Effect of Bioactivator Dosage Trichoderma Spp. and Phonska NPK Fertilizer on Growth and Yield of Onion (Allium Ascalonicum L.) in Dry Land

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DOI: 10.22178/pos.98-12

LCC Subject Category: S1-(972)

Received 30.10.2023
Accepted 28.11.2023
Published online 30.11.2023

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Abstract. This study aims to determine the effect of the *Trichoderma* spp bioactivator dose and NPK Phonska fertiliser on the growth and yield of shallots (Allium ascalonicum L) in dry land. This research used an experimental method with pot trials at the Screen House. The experiment will be designed using a Completely Randomised Design with two factors: bioactivator and NPK fertiliser. The activator dosage factor (B) consists of 3 levels, namely: b1 (1.25 t/ha equivalent to 5 g/plant); b2 (2.50 t/ha - 10 g/plant); b3 (3.75 t/ha - 15 g/plant). The NPK (P) fertiliser factor consists of 4 levels, namely P1 (25% recommended dose), P2 (50% recommended dose), P3 (75% recommended dose), P4 (100% recommended dose). The results showed that administration of *Trichoderma* spp bioactivator significantly affects shallots' growth and production parameters with the best 15 gr/plant dose. Likewise, the application of NPK fertiliser has a real influence on the growth parameters and production of shallots with the best dose of 1.6 g/plant. Statistically, there was no interaction between the administration of *Trichoderma* spp bioactivators and the giving NPK fertiliser to various observation variables: plant height, number of leaves, number of tillers (tubers), wet tuber weight, dry tuber weight, and number of *Trichoderma* spp bioactivator populations.

Keywords: Organic Fertilizer; Chemical Fertilizer; Corn Plant; Vertisol Soil.

INTRODUCTION

According to the Ministry of Agriculture, imports of shallots are still high, as seen from data for the last four years (2012-2015), namely 122,190 t, 96,139 t, 74,019 t and 17,492 t. Therefore, efforts to increase shallot production must be expanded to cope with growing demand. Increasing the harvested area is one of the efforts that can be taken to increase shallot production, especially in shallot production centre areas such as West Nusa Tenggara (NTB) Province. Based on the Ministry of Agriculture, there has been a fluctuation in the harvest area and production of shallots for five consecutive years (2011-2015), namely: 9,988 ha (78,300 t), 12,333 ha (100,989 t), 9,277 ha (101,628 t), 11,518 ha (117,515 t) and 14,524 ha (160,201 t).

In West Nusa Tenggara (NTB), one of the problems in increasing the harvest area, especially for shallots, is the decreasing area of productive land. This is due to the transfer of the function of agriculturally productive land to non-agricultural land. Relatively large dry land is an alternative that can be used as agricultural land. According to [1], the area of dry land in NTB that has been used, including for shallots, has only reached 6.32%, whereas we already know, in NTB, the area of dry land is around 1,814,340 ha (84.19%) of the area, and there is around 330,069 ha that has the potential for food crops [2].

Increasing shallot production also faces the problem of the availability of quality seeds, which causes shallot productivity to be lower than its potential. So far, shallots have been propagated using vegetative seeds in the form of tubers from several generations [3]. However, there are several disadvantages of vegetative tuber seeds, namely low shelf life and required in vast quantities [4], and use from generation to generation causes plant productivity and quality to decrease [3].

One of the seed problems faced by farmers can be overcome by using botanical seeds or TSS (True Seed of Shallot) as planting material. According to [3], using TSS as seeds can increase productivity because the seeds used are healthier compared to seed tubers, which carry degenerative diseases such as Fusarium sp., anthracnose, bacteria and viruses. Other advantages of TSS seeds are volume, shelf life, dormancy, storage location and price. The need for TSS seeds in terms of volume is lower, so they can be stored in smaller storage areas such as refrigerators so that they can maintain the quality of the seeds during storage.

Several research results show that using Trichoderma spp as a bioactivator can increase plant growth and flowering. The research results [5] showed that *Trichoderma* harzanium treatment effectively overcame fusarium wilt attacks and tomato plant growth. Research [6] results demonstrate that the use of the endophytic fungus *Trichoderma* polysporum isolate ENDO-04 and the saprophytic fungus T. Harzanium isolate SAPRO-07 as bioactivators can stimulate vegetative growth and earlier flower formation.

Efforts to accelerate the flowering and production of shallots will certainly not be effective and efficient if they only use bioactivators. Other cultivation technology factors or components, such as fertilisation, are needed to optimise quantity and quality production [7]. Fertilisation is necessary as a source of energy for growth, flowering and seed production. Nutrients, especially N, P, and K, are essential for plants, including shallots, because they greatly influence plant growth and production [7].

Based on the background and previous research, research was carried out on the effect of applying *Trichoderma* spp as a bioactivator. It is hoped that it can reduce the use of chemical fertilisers and pesticides, which can leave residues that can lower the quality of the soil and the shallot plants.

METHOD

Place and time. This research will be carried out from January 2023 to March 2023 in a screen house on UD land. Kelun Tani is located in Kumbang Village, Masbagik District, East Lombok Regency.

Experimental design. The experiment will be designed using a Completely Randomised Design with two factors: bioactivator and NPK fertiliser. The bioactivator dosage factor (B) consists of 3 levels, namely:

b1: 1.25 t/ha equivalent to 5 g/plant

b2: 2.50 t/ha equivalent to 10 g/plant

b3: 3.75 t/ha equivalent to 15 g/plant

Meanwhile, the NPK (P) fertiliser factor consists of 4 levels, namely:

p1: 25% recommended dose

p2: 50% recommended dose

p3: 75% recommended dose

p4: 100% recommended dose

The treatment combined five repetitions of bioactivator dose factors and NPK fertiliser so that 60 experimental units were obtained.

Experiment Implementation. *Planting preparation*. Initial analysis will be carried out to determine the condition and characteristics of the soil used for the experiment. Composite soil samples will be taken in the tilled layer (0-20 cm) using a hoe using the Latin square method. A 1 ha land area was divided into five rows and two columns to obtain ten sub-sampling areas. After all the sub-samples are taken, they are mixed and brought to the laboratory. Soil analysis includes pH, 3C-Organic, N-Total (%), available P (ppm), available K (ppm), and CEC.

Cultivation Material *Trichoderma* spp Provision of T. Harzianum fungal culture isolate SAPRO-07, collection of Prof. Dr. Ir. I Made Sudantha, MS., which is stored in the Agricultural Microbiology Laboratory, Faculty of Agriculture, Mataram University [2]. Cultivation uses PDA (Potato Dextrose Agar) growth medium with an incubation period of 14 days.

Making Bioactivators. Prepare the coffee leaf litter, dry it in an oven at 60 °C for 14 days, crush it using a coffee grinder, and sift it using a sieve with a diameter of 2 mm. The prepared ingredients are moistened with sterile water to obtain a homogeneous mixture and then cooked for 60 minutes. This mature substrate is sterilised in an autoclave. This sterile substrate is then inoculated with a suspension of the fungus T. Harzianum isolate SAPRO-07 (spore density 106 /ml suspension). Clay is added and put into a tablet maker (tablets weighing 5 g), then incubated at room temperature for two weeks [2].

Planting Media Preparation. The planting medium used is air-dried soil sieved with a sieve diameter of 2 mm. Each polybag measuring 40 cm x 40 cm was then filled with 8.8 kg of soil, watered and left for a week.

Seed Preparation. The shallot seeds that will be used in this research are the Bali rubber variety. The condition of the tubers that will be utilised as seeds is that they are still fresh, without defects, and clean from dry skin or dirt, pests and diseases.

Experiment Implementation. *Bioactivator Application*. The bioactivator application will be carried out at planting time according to the treatment dose by planting it next to the plant to a depth of around 3 cm.

NPK Fertilizer Application. Phonska NPK fertiliser (15-15-15) recommended dose (400 kg/ha) will be given two times, namely 14 days after planting and 28 days after each, half the treatment dose.

Planting. The seed tubers will be planted in 40 cm x 40 cm polybags. Planting will be done by digging to a depth of 3 cm. Shallots with their ends cut off and dried will be placed in the hole with the top end flush with the soil's surface. After planting, water will be carried out until saturated and left until it stops dripping. After that, the polybag is weighed to determine the initial weight when planting.

Maintenance. Maintenance that will be carried out includes irrigation, weeding and pest control. Maintenance procedures will follow the Technical Instructions for Shallot Cultivation:

1. Irrigation will occur every morning and evening to maintain moisture levels in the planting medium. The amount of water to be added is the difference between the weight of the polybag at the beginning of planting and the weight of the polybag at the time of observation.

2. Weeding will remove grass/weeds around the plant-growing environment to reduce competition for nutrients during the plant-growth phase. Weeding intensity will be adjusted to conditions in the field.

3. Pest control using chemical pesticides will only be carried out as a last resort. Some of the actions that will be taken against pests that attack shallots include:

a) Manual picking and discard. This condition will be carried out if eggs and leeks show symptoms of attack. If the number of eggs exceeds the limit, spraying will be carried out using the insecticide Curacron 500 EC at a dose of 2 ml/l;

b) Trips attacks will be controlled using the insecticide 0.5 ml/l Agrimec 18 EC;

c) If symptoms of purple spot/trotol disease are found, spraying will be carried out using fungicide 2 g/l Antracol 70 WP or 2 g/l Dithane M-45 80 WP

4. If fusarium wilt is found, it will be removed and destroyed to prevent it from spreading.

Observation Parameters. *Plant height*. Observations will be made by measuring the height of the shallot plant from the top of the ground/base of the stem to the top of the shallot leaves. Plant height measurements were performed five times during the vegetative period, namely at 7, 14, 21, 28 and 35 HST (days after planting).

Number of Leaves. Observations were made by counting the number of leaves present during growth to calculate the reaction of *Trichoderma* spp and NPK fertiliser as a growth promoter. Measurements were also carried out during the vegetative period, namely at 7, 14, 21, 28 and 35 HST (days after planting).

Number of Saplings per Polybag (Tubers). The number of saplings or fresh tubers will be observed directly after the tubers are harvested and cleaned from soil residue.

Wet tuber weight per polybag (g). The wet weight of shallot bulbs per polybag will be observed immediately after harvest using a digital scale.

Dry Tuber Weight per polybag (g). The weight of dry onion bulbs per polybag is first done by air-drying the onions harvested for three days within 3 hours because, at this stage, it is the rainy season, then weighing them using a digital scale.

The population of Trichoderma spp in the soil is calculated after harvest using an indirect method and selective *Trichoderma* spp media. The analysis will be carried out at LPHP Narmada BPTP NTB Province.

Data analysis. All observational data will be analysed using Random Analysis Analysis (ANOVA) with the SPSS Program. If the ANOVA results are significantly different, it will be continued with the honest significant difference (BNJ) test at the 5% level.

RESULTS AND DISCUSSION

Soil characteristics before and after treatment with adding Trichoderma spp Bioactivator (B) and NPK Fertilizer (P). The results of soil tests before the research showed that the soil conditions at the research site in North Pringgabaya Village, Pringgabaya District, East Lombok Regency were as follows: The pH-H2O content was 6.84 with neutral status, had a total N content of 0.05% with deficient status, Organic C content is 0.53% with deficient status, C/N Ratio content is 10.60 with low status. The organic material content has a mollisol status, and the CEC content is 19 mol/kg with medium status. The P content is 81.39 ppm, with a very high status, and the K content is available with high status.

After planting shallots with Trichoderma spp bioactivator and NPK fertiliser, soil test results can increase available K by up to 52.98%. If the soil contains higher levels of available K after treatment, the soil is more fertile and can support plant growth better. This is because available K is an essential nutrient for plants. Available K plays a role in various plant physiological processes, including photosynthesis, respiration, and nutrient transport. Meanwhile, the available P content is still of a very high status, although statistically, it has decreased slightly.

Plant height. *Trichoderma* bioactivator dose treatment significantly affected plant height from 7 days of observation to 35 days of planting. B3 treatment, namely the application of *Trichoderma* bioactivator at a dose of 15 g/plant, had the best effect on increasing the height of shallot plants from 7 days to 35 days after planting. The highest average plant height at 35 daps was found in treatment B3, namely 46.75 cm, followed by B2, with a height of 43.88 cm, and the lowest was treatment B1, with a height of 42.08 cm. This can be seen in the following table.

The increase in plant height in shallots is thought to be due to the bioactivator *Trichoderma* spp has cellulase, chitinase and lipase enzymes, which can degrade complex organic compounds into simple compounds that plants more easily absorb. These complex organic compounds include cellulose, chitin and fat. Cellulose is the main component of plant cell walls, chitin is the main component of fungal cell walls, and fat is the main component of cell membranes. By degrading these complex organic compounds, *Trichoderma* can increase the availability of nutrients for plants so plants can grow better. This is by the opinion [7], who reported that the fungus *Trichoderma* spp can stimulate plants to produce the hormones gibberellin acid (GA3), Indolacetic Acid (IAA), and benzylaminopurine (BAP) so that plant growth such as plant height and number of leaves is more significant and healthier, more robust and has an effect on plant resistance to disease. Authors [6] said that shallot plants treated with a biostimulant mixture of the fungi T. Harzianum Sapro-07 and T. Koningii Endo-02, either with or without ZPT BAP could increase plant height, number of leaves, root length, and increase the number of tillers and weight of harvested dry shallots.

Table 1 – Average Height of Shallot Plants for Each *Trichoderma* spp Bioactivator Dose Treatment at the age of 7 HST to 35 HST

Bioactivator Dosage for *Trichoderma* spp (g/plant)	Plant Height (cm)				
	7 hst	14 hst	21 hst	28 hst	35 hst
B1 (5)	1.68	12.65	31.05	39.30	42.08
B2 (10)	1.81	13.53	33.35	40.63	43.88
B3 (15)	2.15	15.68	35.08	42.58	46.75
BNJ 5%	0.34	1.81	1.66	1.03	1.30

Notes: Numbers followed by the same letter in the same column are not different from those in the 5% BNJ test.

The treatment dose of NPK fertiliser at the age of 7 to 35 DAT showed the following results for plant height. The NPK fertiliser dose treatment significantly increased plant height at 7, 21, 28, and 35 dap, but it was not significantly different at 14 dap. The best treatment effect of NPK fertiliser dose on increasing the height of shallot plants at 35 DAT was the P4 treatment at a dose of 1.6 g/plant with a plant height of 45.57 cm, while the lowest shallot plant height was the P1 treatment, namely fertiliser application. NPK at a dose of 0.4 g/plant with a height of 43.33 cm. This can be seen in Table 2 below.

Table 2 – Average Height of Shallot Plants for Each NPK Fertiliser Dose Treatment at Age 7 DAP to 35 DAP

NPK Fertilizer Dosage (g/plant)	Plant Height (cm)				
	7 hst	14 hst	21 hst	28 hst	35 hst
P1	1.64	13.8	31.43	40.00	43.33
P2	1.69	14.0	33.27	40.60	43.63
P3	1.95	13.9	33.87	41.00	44.40
P4	2.22	14.1	34.07	41.73	45.57
BNJ 5%	0.47	2.52	2.31	1.43	1.81

Notes: Numbers followed by the same letter in the same column do not differ really in the 5% BNJ test

Providing NPK fertiliser at a dose of 0.4 g/plant is thought to have increased the availability of N elements in the soil, thereby increasing the vegetative growth of shallot plants. The availability of N elements in the soil increased after applying Trichoderma spp bioactivator and NPK fertiliser. This can be seen in the increase in total N compared to conditions before the research. This is supported by [8] that the element N can increase protein synthesis and chlorophyll formation. The availability of N elements in sufficient quantities can facilitate plant metabolic processes that will influence plant organs' growth, such as stems, leaves and roots. The research results [9] show that administering NPK fertiliser at 75 g/m2 (N3) provides the best results for all plant growth parameters. Treatment with various doses of NPK fertiliser significantly affected plant height at 6 WAP. NPK, with a dose of 75 g/m2, produced the highest plant height, namely 38.48 cm.

Number of Leaves. The ANOVA results showed that the effect of treatment doses of *Trichoderma* spp Bioactivator and NPK fertiliser on the number of leaves showed that there was a significant effect from the application of each dose of *Trichoderma* spp Bioactivator. and NPK fertiliser dosage. The results of further tests on the number of shallot plant leaves can be seen in Table 3 and Table 4.

Based on Table 3, the treatment dose of Trichoderma spp bioactivator at various doses significantly affected the number of shallot plant leaves. *Trichoderma* spp bioactivator dose treatment is directly proportional to the number of leaves; the higher the dose of bioactivator, the more leaves are produced. The B3 treatment gave the best effect: a dose of 15 g/plant with more leaves compared to a dose of 5 g/plant or 10 g/plant from 7 days to 35 days after planting.

Table 3 – Average Number of Leaves of Shallot Plants in Each *Trichoderma* spp Bioactivator Dose Treatment at the age of 7 HST to 35 HST

Bioactivator Dosage for *Trichoderma* spp (g/plant)	Number of Leaves (pieces)				
	7 hst	14 hst	21 hst	28 hst	35 hst
B1 (5)	3.05	8.55	16.95	24.50	30.75
B2 (10)	3.35	9.30	18.15	26.60	32.75
B3 (15)	3.95	10.40	21.75	31.15	37.95
BNJ 5%	0.55	1.35	2.11	2.08	2.88

Notes: Numbers followed by the same letter in the same column do not differ really in the 5% BNJ test

Table 4 – Average Number of Leaves of Shallot Plants for Each NPK Fertiliser Dose Treatment at Age 7 to 35 DAI

NPK Fertilizer Dosage (g/plant)	Number of Leaves (pieces)				
	7 hst	14 hst	21 hst	28 hst	35 hst
P1	3.33	8.87	17.33	25.73	30.60
P2	3.53	9.40	18.27	26.87	32.93
P3	3.47	9.00	19.53	28.00	34.73
P4	3.47	10.40	20.67	29.07	37.00
BNJ 5%	0.77	1.89	2.93	2.90	4.01

Notes: Numbers followed by the same letter in the same column do not differ really in the 5% BNJ test

Plants given *Trichoderma* spp can increase the number of leaves on plants because *Trichoderma* spp contains various enzymes that can improve the number of leaves on shallot plants, such as cellulase, hemicellulase, protease and lipase enzymes, which can break down organic matter in the soil into nutrients that plants can absorb. These enzymes can also increase the production of phytohormones, such as auxin and cytokinin. Auxin and cytokinin play a role in stimulating plant growth, including leaf growth. This is supported by [2], that the presence of the fungus *Trichoderma* spp can stimulate the formation of leaf buds/vines. The presence of *Trichoderma* spp in plant tissue and the population in the soil dramatically influences plant growth.

The population of *Trichoderma* spp contained in the bioactivator *Trichoderma* spp used in this study was 1.34×10^{-7} cfu/ml. A good *Trichoderma* population density for application is around 10^{-6}-10^{-7} spores per gram of soil. This population density can provide optimal results in increasing plant growth and yield. A population density of Trichoderma spp that is too low may not have a significant effect on plants.

Based on Table 4, it can be seen that the fertiliser dose treatment did not have a significant effect on the number of leaves of shallot plants at the age of 7 daps and 14 daps. This was because fertiliser was given when the plants were 14 dap and 28 dap, so the effect would be visible in subsequent observations. A significant impact due to the application of NPK fertiliser only appeared at 21 dap, 28 dap and 35 dap. The P1 treatment was not significantly different from the P2 and P3 treatments. Still, it was substantially different from the P4 treatment, while the P2 and P3 treatments were not significantly different from the P4 treatment at the ages of 21 DAP, 28 DAP and 35 DAP.

Author [5] reported that an adequate supply of N can expand the leaf blades and increase the chlorophyll in the leaves so that plants can produce sufficient amounts of carbohydrates or assimilate them for growth. Furthermore, the author [10] stated that the nutrient N is necessary for plants to form and grow vegetative parts such as roots, stems, and leaves.

Production result. The ANOVA results showed that the effect of Trichoderma spp bioactivator dose treatment and NPK fertiliser significantly influences shallot production results, such as the number of tillers, wet bulb weight, and dry bulb weight. The results of further tests on the number of tillers, wet bulb weight and dry bulb weight of shallot plants can be seen in Tables 5 and 6.

Table 5 – Average Number of Tillers, Wet Bulb Weight, Dry Bulb Weight, Shallot Plants for Each *Trichoderma* Bioactivator Dose Treatment spp at 63 DAP

Dosage of *Trichoderma* spp (g/plant)	Number of Cubs (tubers / polybag)	Wet Tuber Weight (g/polybag)	Dry Tuber Weight (g/polybag)
B1 (5)	9.50	115.55	93.20
B2 (10)	10.05	128.50	102.70
B3 (15)	10.60	138.30	112.65
BNJ 5%	0.85	10.84	9.55

Notes: Numbers followed by the same letter in the same column do not differ significantly in the 5% BNJ test.

Table 6 – Average Number of Saplings, Wet Bulb Weight and Dry Bulb Weight of Shallot Plants for Each NPK Fertilizer Dose Treatment at Age 63 DAP

NPK Fertilizer Dosage (g/plant)	Number of Cubs (tubers / clumps)	Wet Tuber Weight (g/polybag)	Dry Tuber Weight (g/polybag)
P1	9.33	119.40	95.67
P2	9.80	124.47	100.60
P3	10.27	128.87	104.33
P4	10.80	137.07	110.80
BNJ 5%	1.18	15.24	13.31

Notes: Numbers followed by the same letter in the same column are not different from the actual in the 5% BNJ test

Based on Table 5, it can be seen that the treatment with various doses of *Trichoderma* spp had a significant effect on the number of tillers, wet bulb weight and dry bulb weight of shallot plants. The highest number of tillers was found in treatment B3, namely inoculation of *Trichoderma* spp with a dose of 15 g/plant producing 10.60 tubers/polybag, and the lowest yield was in treatment B1 with a total of 9.50 tubers/polybag. Treatment B1 was not significantly different from treatment B2, yielding 10.05 tubers/polybag.

The presence of *Trichoderma* spp in plant tissue has a vital role in increasing body weight because *Trichoderma* spp can stimulate plants to produce growth hormones. As the author [11], stated, the fungus T. Harzianum can stimulate plants to produce certain hormones such as gibberellin acid (GA3), indolacetic acid (IAA), and benzylaminopurine (BAP) in large quantities. The gibberellin hormone and auxin hormone in plants play a role in elongating roots and stems, stimulating flowering and fruit growth and increasing plant growth.

Apart from producing growth hormones, *Trichoderma* spp produces several enzymes that can decompose organic matter in the soil to increase soil fertility - one of the enzymes of *Trichoderma* spp. The cellulose enzyme is thought to decompose organic matter in the soil. Author [2] reported that cellulose in organic materials can be separated by the cellulose enzyme produced by the fungus T. Harzianum into lignin-cellulose, then breaking down into simpler compounds that can dissolve in water so that can be used directly by plants for growth and development.

Increased tuber weight in plants given *Trichoderma* spp bioactivator. This is thought to be due to the absorption of P nutrients into plant tissue. Based on the results of soil sample analysis, the amount of available P before the research had a very high status of 81.39 ppm. The soil test results after the study showed a reduction in the available P value due to its absorption into plant tissue. Available P in the soil is P that plants can absorb. Available P can come from P from fertiliser, P from weathering organic material, and P that previous plants did not absorb. The P absorbed by plants will be used for various physiological processes, such as photosynthesis, respiration and nutrient transport. P that plants do not absorb will be fixed in the soil or leached by water.

The nutrient P is essential in forming plants' vegetative and generative parts. The nutrient P plays a role in forming flowers, fruit, seeds and roots, especially the origins of seeds and young plants. The nutrient that plays a vital role in the formation of shallot bulbs is phosphorus (P).

Table 6 shows that the P4 treatment had the most significant influence on the number of tillers, wet bulb weight and dry bulb weight of shallot plants. This can be caught in the number of tillers, wet tuber weight, and dry tuber weight resulting from the treatment given a higher dose of 1.6 g/plant than the 0.4 g/plant treatment. The dose of NPK fertiliser that gave the highest value for all variables was a dose of 1.6 g/plant, namely the number of tillers (10.80 tubers/polybag), wet tuber weight (137.07 g/polybag), dry tuber weight (110.80 g/polybag). Meanwhile, 0.4 g NPK fertiliser/plant gave the lowest results for the number of tillers (9.33 tubers/polybag), wet tuber weight (119.40 g/plant) and dry tuber weight (95.67 g/polybag).

The higher the NPK dose given, the higher the weight of the tubers produced. This can be seen from the high number of tubers produced by the P4 treatment, which significantly differs from the P1 treatment. The highest wet tuber weight was produced by treatment P4 with an NPK dose of 1.6 gr/plant-producing tubers of 137.07 gr/polybag, and the lowest wet tuber weight was produced by treatment P1 with an NPK dose of 0.4 gr/plant-producing tubers as much as 119.40 g/plant. The author [12] stated that the wet weight of plants has increased due to the increased growth of plant organs, so the water content in the tissues increases.

Authors [6] stated that the availability of sufficient N elements during plant vegetative growth allows amino acids to be formed into protein. The proteins formed are used in photosynthesis and then quickly form vegetative parts. Meristem tissue will undergo cell division, enlargement and elongation of new cells so that plant growth continues. Authors [13] also stated that shallot plants actively divide to form seedlings after reaching the vegetative growth phase. This is supported by [14], who states that the development of the number of onion seedlings is determined by the number of leaves formed, so the number of leaves formed will produce many onion seedlings, which is related to the development of the number of bulbs that will form on the shallot plant.

Effect of Bioactivators *Trichoderma* spp and NPK Fertilizer on the Total Population of *Trichoderma* spp. Results of observations and analysis of various impacts of bioactivator dosing *Trichoderma* spp and the dose of NPK fertiliser show that there is no known interaction between bioactivators of *Trichoderma* spp and boron on the population of *Trichoderma* spp. Further test results mean the population of *Trichoderma* spp using a BNJ level of 5% can be seen in Table 7.

Table 7 – Effect of dosing of bioactivator *Trichoderma* spp on the population number parameters of *Trichoderma* spp

Bioactivator Dosage for *Trichoderma* spp (g/plant)	Population Number (10-4 cfu/g soil)
B1 (5)	17.17
B2 (10)	24.33
B3 (15)	32.75
BNJ 5%	1.71

Notes: The numbers in each column are followed by the same letter in each

The treatments were not significantly different in the 5% BNJ test.

Based on Table 7, it can be seen that the bioactivator treatment of *Trichoderma* spp at various doses had a significant effect on the population of *Trichoderma* spp in the soil, the higher the dose of bioactivator *Trichoderma* spp given, the higher the population of *Trichoderma* spp contained in the soil. This can be seen from the differences in population numbers resulting from various doses of *Trichoderma* spp bioactivators, which are applied. The highest total population of Trichoderma spp was found in the B3 treatment, which was given *Trichoderma* spp bioactivator. with a dose of 15 g/plant produces a population of *Trichoderma* spp as much as 32.75 x 10-4 cfu/g soil, followed by B2 treatment given *Trichoderma* spp bioactivator. with a dose of 10 g/plant produces a population of *Trichoderma* spp as much as 24.33 x 10^{-4} cfu/g, and the lowest population number was in treatment B1, which was given the bioactivator *Trichoderma* spp with a dose of 5 g/plant produces a population of *Trichoderma* spp as much as 17.17 x 10-4 cfu/g.

CONCLUSIONS

Administration of *Trichoderma* spp bioactivators significantly affects shallots' growth and production parameters with the best dose of 15 gr/plant. Likewise, the application of NPK fertiliser has a real influence on the growth parameters and production of shallots with the best dose of 1.6 g/plant. Statistically, there was no interaction between administration of *Trichoderma* spp bioactivators and giving NPK fertiliser to various observation variables: plant height, number of leaves, number of tillers (tubers), wet tuber weight, dry tuber weight, and number of *Trichoderma* spp bioactivator populations.

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