ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT117

Effects of Trichoderma Fermented Biourine Dosage on the Growth of Two Shallot Varieties

Wahyu Astiko[1]; I Made Sudantha[2]
Faculty of Agriculture, University of Mataram, Indonesia

Abstract:- This study aims to determine the effect of Trichoderma harzianum fermented biourine dosage on the growth of two shallot (Allium ascolonicum L.) varieties. The research employed an experimental method with a Factorial Completely Randomized Design (CRD) consisting of two factors: biourine dosage and shallot variety. The biourine dosage levels were: q0 = Without biourine application, q1 = 5 ml/plant, q2 = 15 ml/plant, q3 = 25 ml/plant, and q4 = 35 ml/plant. The shallot varieties tested were v1 = Keta Monca and v2 = Bali Karet. In total, 10 treatment combinations of biourine dosage and variety were evaluated. The results showed that the most effective biourine dosage for promoting shallot growth was 35 ml (q4). This dosage significantly increased plant height, number of leaves, number of tillers, fresh stover, dry stover, fresh tuber weight, and dry tuber weight. The Keta Monca variety outperformed in terms of number of tillers, fresh tuber weight, and dry tuber weight, while the Bali Karet variety exhibited greater plant height, number of leaves, fresh stover, and dry stover. Significant interactions between biourine dosage and variety were observed in parameters such as plant height at 3 and 4 weeks after planting (WAP), number of leaves at 1, 4, and 5 WAP, number of tillers at 6 and 7 WAP, fresh tuber weight, and dry tuber weight.

Keywords:- *Trichoderma Harzianum, Fermented Biourine, Shallot Growth.*

I. INTRODUCTION

Shallots are an essential horticultural commodity, widely used as a food seasoning and in traditional medicine. The increasing demand for shallots in cooking has led to a continual rise in consumption each year [1]. While the government imports shallots to meet demand, local varieties are preferred for their superior aroma and taste compared to imported ones [2].

According to the Central Statistics Agency (2022), national shallot production reached 2,004,590 tons. West Nusa Tenggara (NTB) is the third largest shallot-producing region in Indonesia, with its production increasing by 17.9% from 188,740 tons in 2020 to 222,536 tons in 2021. The total harvested area of shallots in NTB also grew by 15.56%, from 17,570 hectares in 2020 to 20,305 hectares in 2021 [3]. However, shallot productivity in NTB remains relatively low, at around 10.9 tons per hectare, even though the potential yield of local varieties can reach up to 15 tons per hectare [4].

Improving shallot productivity through sustainable agricultural practices is crucial to meet the increasing demand and reduce reliance on imports [5]. One promising approach is the use of organic fertilizers, such as biourine, which is produced through the anaerobic fermentation of livestock urine with the addition of beneficial microorganisms [6]. *Trichoderma harzianum*, a fungus known for its growth-promoting properties, has been shown to improve crop growth when used in conjunction with biourine [7].

Studies have demonstrated that the application of Trichoderma-fermented biourine can enhance plant growth and yield. Research by [8] showed that the interaction between biourine and inorganic fertilizer doses significantly improved the growth and yield of shallot plants. Similarly, Yusrinawati et al. (2017) found that using *T. harzianum* as a bioactivator at a dose of 20 g/plant increased wet bulb yield by 34.43% and dry bulb yield by 40.21% [9]. These findings suggest that *T. harzianum* can serve as a sustainable and environmentally friendly alternative to chemical inputs, promoting better growth and higher yields [10].

In this study, we investigate the effects of various dosages of *T. harzianum*-fermented biourine on the growth of two shallot varieties, Keta Monca and Bali Karet. By examining growth parameters such as plant height, number of leaves, number of tillers, and tuber yield, we aim to determine the optimal biourine dosage for maximizing the growth and productivity of these shallot varieties.

II. MATERIALS AND METHODS

- *Time and Place of Research*

Experiments were carried out from March to June 2024 at the Microbiology Laboratory and Green House Faculty of Agriculture, University of Mataram.

- *Research Methods*

The method used in this research was an experimental approach with a Completely Randomized Factorial Design (CRD), consisting of two factors: biourine dosage and shallot variety. The biourine dosage factor included the following levels: q0 = No biourine application, q1 = 5 ml/plant, q2 = 15 ml/plant, q3 = 25 ml/plant, and q4 = 35 ml/plant. The variety factor consisted of two shallot varieties: v1 = Keta Monca and v2 = Bali Karet.

In total, there were 10 treatment combinations from the interaction between biourine doses and shallot varieties, and each treatment was repeated 4 times, resulting in 40 experimental units.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT117

➢ *Research Tools and Materials*

The tools used include stationery, autoclave, hoe, oven, ruler, tape measure, analytical balance, analog scale, and jerry can container. Meanwhile, the materials used include polybags, manure, NPK 16-16-16 fertilizer, garden soil, shallot seed bulbs of Keta Monca, Bali Karet varieties, and aerated cow urine.

➢ *Research Implementation*

Making fermented biourine *T. harzianum* carried out following the method described by Sudantha (2019) [11]. The steps begin by mixing 200 g of coffee leaf powder into 2 l of urine which has undergone an aeration process in a fermentation bucket. To make the material homogeneous, coffee leaf powder and urine are mixed by stirring. The next process *T. harzianum* (with a spore density of 10^6 per liter) is inoculated into the material, then stirred until homogeneous again. To improve nutrition for *T. harzianum*, added 20 g of glucose as a carbohydrate source. The material is then fermented anaerobically (covered) for 7 days. After the fermentation period ends, the biourine is filtered using a filter to separate the dregs and extract. The resulting biourine liquid is then put into a jerry can.

After this stage, the next step is preparing the planting medium using garden soil that has been filtered, solarized and mixed with manure in a ratio of 3:1. When making planting media, fertilize using manure at a ratio of 3:1 between soil and fertilizer. Additional basic fertilization using inorganic fertilizer is carried out by providing NPK 16:16:16 fertilizer from the INFARM brand and SP-26 from the PETRO brand. This fertilization process is carried out 4 days before planting, with a basic fertilizer dose of NPK 16-16-16 of 0.8 g per plant and SP-26 of 1.2 g per plant. Additional fertilizer is given at the tuber formation phase (36 DAT) and the tuber ripening phase (51-56 DAT) using MKP fertilizer from the PAK TANI brand at a dose of 4 g/l of water. Red onion seeds (Bali Karet and Keta Monca varieties) are prepared by cutting the bulbs before planting. Next, each polybag is coded according to the specified treatment. The process of planting shallots is done by planting the bulbs 3 cm deep into the soil, with a spacing of 20 cm x 20 cm. The application of biourin after planting is done by injecting it using a syringe around the base of the plant stem or into the soil around the plant at a dose according to the treatment.

Plant height is measured from the base of the stem to the highest tip using a ruler and meter. The number of leaves was calculated based on the clumps of each sample plant. Observation of the number of tillers was carried out by counting the number of each tiller that grew from the base of the roots of the shallot plants. The weight of fresh bushes and tubers per bushel is weighed on a scale at harvest. The weight of the bushes and dry tubers per bush was weighed using an analytical balance after being harvested and dried at a temperature of 70^0C for 72 hours to reach a constant weight using an oven and weighed using analytical scales at the Physiology and Biotechnology Laboratory, Faculty of Agriculture, Mataram University.

III. RESULTS AND DISCUSSION

Based on the results depicted in Figure 1, dose of 35 ml (q4) showed a significant difference in the average fresh stover weight of shallot plants, reaching 641.5 g. This is thought to be because the nutritional content in biourine can increase fresh fruit in plants. This finding is supported by research by Neno (2020) on white mustard plants, which states that the application of biourine can increase overall plant production, including increasing crop diameter, fresh weight per plant, and total fresh weight of the plant [12]. This increase in yield is thought to be due to the efficient absorption of the nutrients contained in biourine fertilizer by plants. By providing more nutrients through the soil, plants can absorb more nutrients, promoting optimal growth. The absorption of macro nutrients such as nitrogen (N), phosphorus (P), and potassium (K) by chicory plants, which are provided by biourine fertilizer, can produce wider leaves and a larger leaf surface for the photosynthesis process. Increased photosynthesis can also produce more carbohydrates, cause an increase in plant fresh weight, and speed up the process of cell division and enlargement [13].

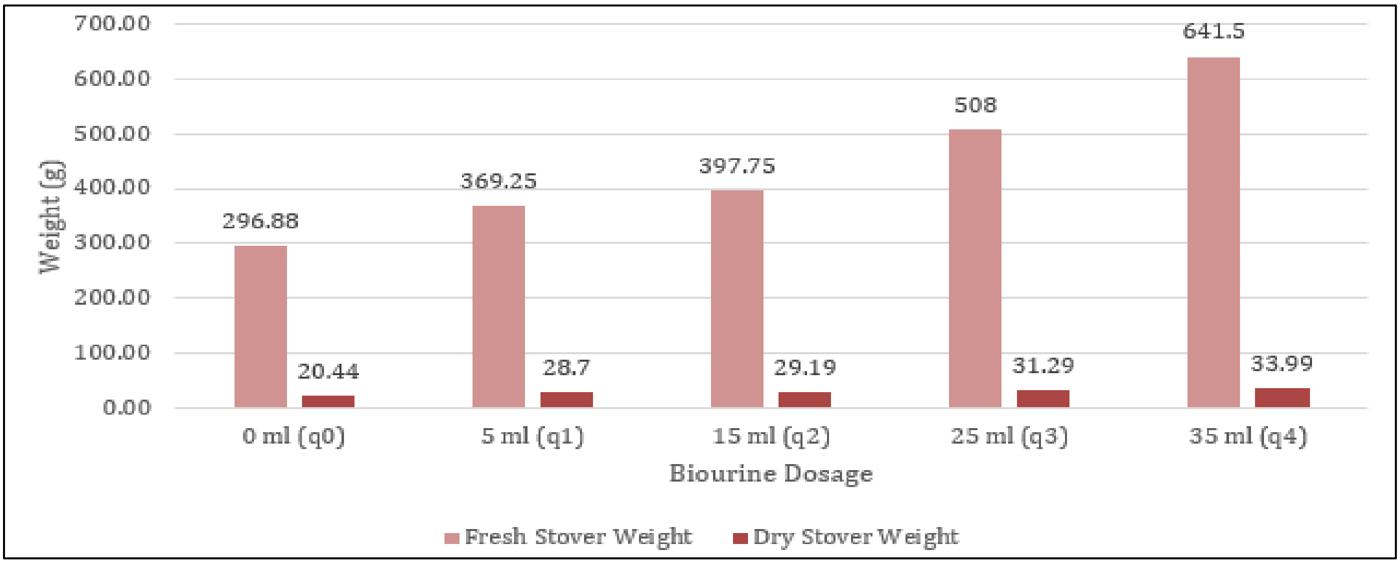

Fig 1 Results of Further Tests of Biourin Dosage Treatment on the Average Weight of Fresh and Dry Fruit

Meanwhile, in terms of dry stover weight parameters, the treatment dose of 0 ml biourin (q0) as a control showed the lowest dry fruit weight, namely 20.44 g. Even though the 35 ml biourin dose treatment showed the highest average, namely 33.99 g, the difference was not significantly different. Therefore, in these parameters, all doses of biourin have the potential to increase dry fruit weight. It is possible that this is caused by the use of high doses of nitrogen (N) fertilizer in fertilization before planting, which can increase plant biomass. However, it should be remembered that using excessive doses of N fertilizer can make plants become succulent, which can result in a drastic reduction in oven-dried fruit weight [14].

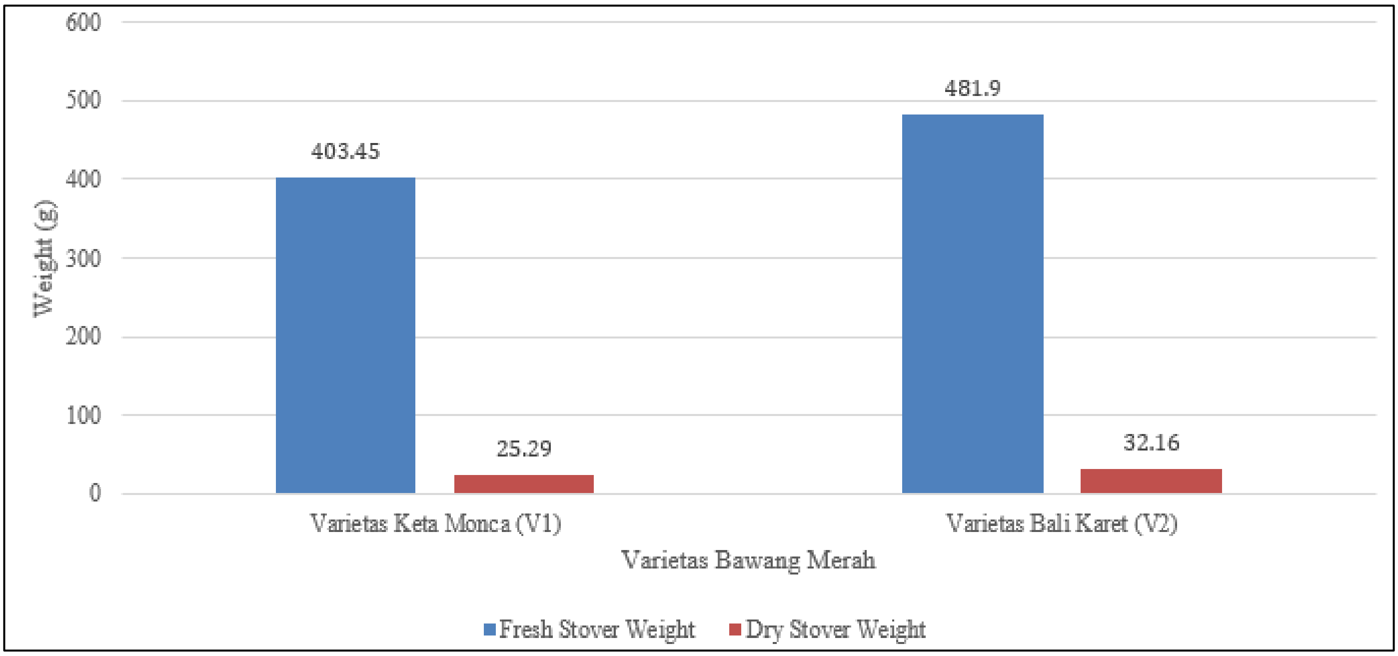

Fig 2 Results of Further Tests for Average Varietal Treatments on Average Weight of Fresh and Dry Fruits

Based on the results shown in Figure 2, it can be seen that the Bali Karet variety shows the highest average weight of fresh and dry stover, namely 481.9 g and 32.16 g respectively. There is a significant difference between the Bali Karet variety and other varieties in terms of fresh and dry fruit parameters in shallot plants. This finding is consistent with previous research conducted by Sudantha and his colleagues in 2018, where the average weight of dry harvested onion bulbs for the Bali Karet variety reached 14-16 tons/ha, higher than the Ampenan variety (12 tons/ha ha) and the Keta Monca variety (11 tons/ha) [15]. This difference in results is believed to be caused by genetic factors for each variety and the influence of environmental conditions where it is planted [16].

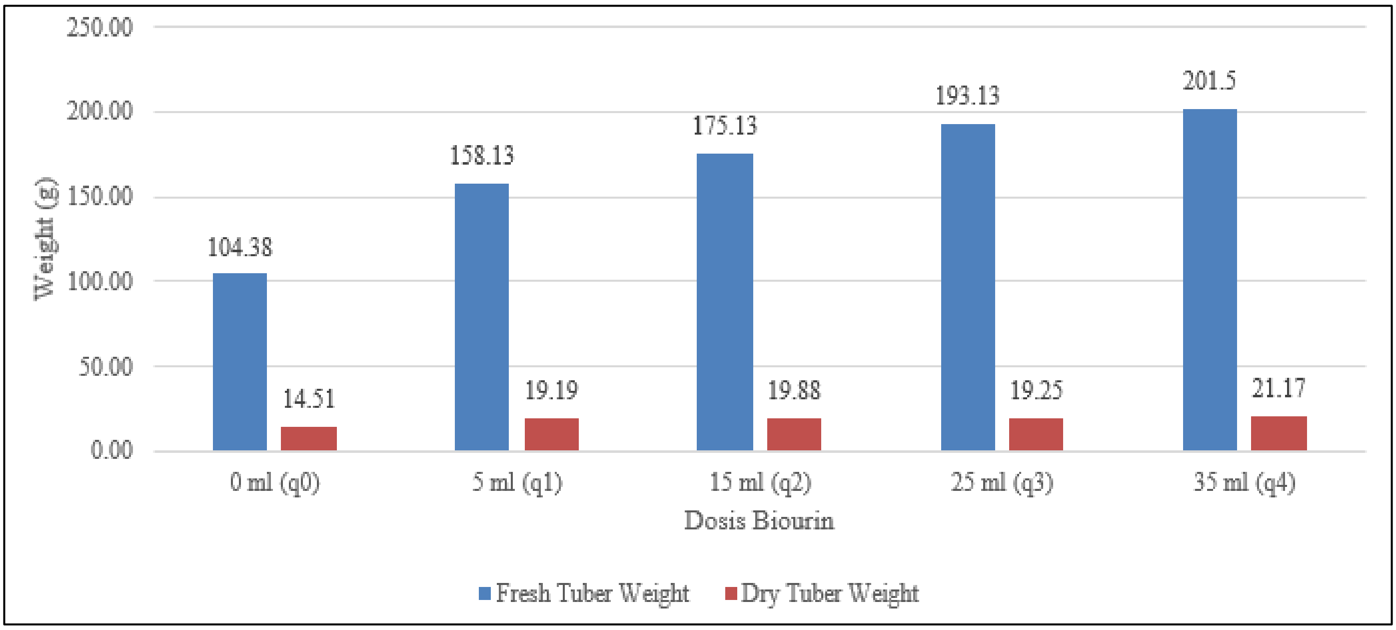

Fig 3 Results of Further Tests of Biourin Dose Treatment on the average Weight of Fresh and Dry Tubers

Based on the results depicted in Figure 3, it can be seen that the lowest fresh and dry tuber weights were found in the 0 ml biourin dose treatment as a control. These findings indicate that the application of biourine fermentation *T. harzianum*. It is thought to have the potential to increase the weight of shallot bulbs. The biourin treatment dose of 35 ml (q4) showed the highest fresh and dry tuber weight when compared with all other treatment doses. This finding is consistent with the results of research conducted by Santoso et al (2015), which showed an increase in shallot bulb production due to the use of biourine [17]. According to Sanuwaliya and Murniati (2020), increasing the biourine concentration and NPK dose can result in a reduction in the weight of the tubers produced, and vice versa if the biourine concentration is low even though the NPK dose is increased. This has an impact on the availability of nutrients for plants, especially microelements contributed by biourine [18].

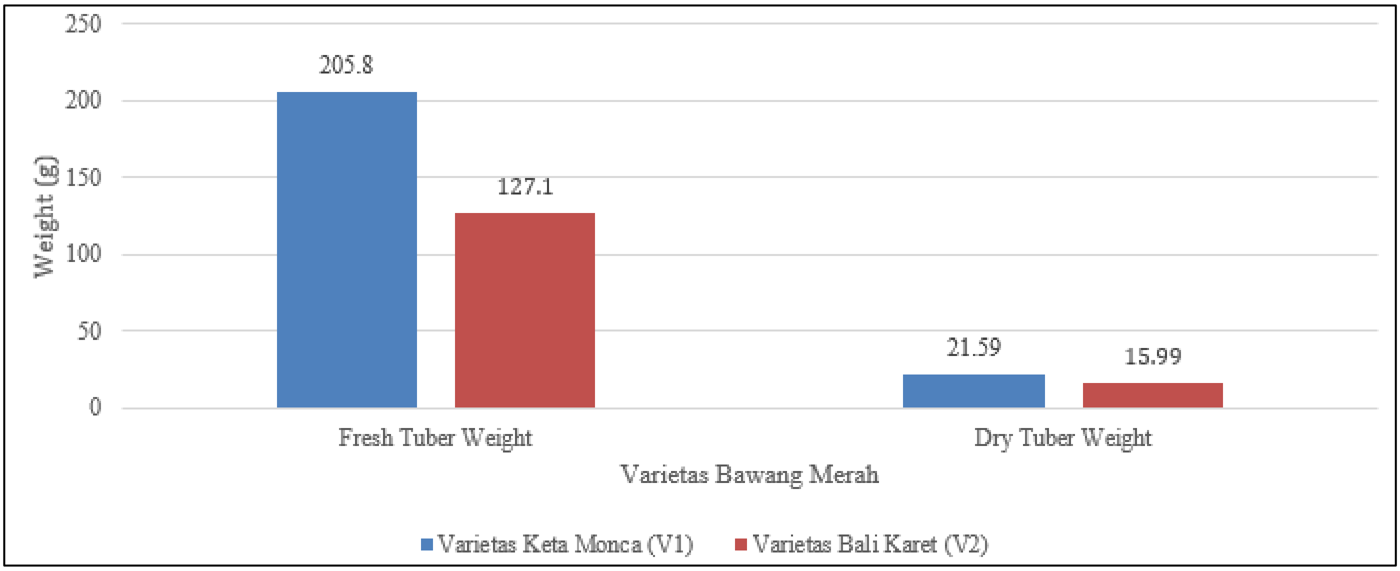

Fig 4 Results of Further Tests of Variety Treatment on the average Weight of Fresh and Dry Tubers

From the results of further analysis in Figure 4, the Keta Monca variety shows a higher fresh tuber weight and dry tuber weight when compared to the Bali Karet variety. Providing plant nutrients can influence the number of saplings that grow on plants [19]. Based on the variety description, Keta Monca has the potential to produce 3-6 tubers per hill [20].

IV. CONCLUSION

The application of *Trichoderma harzianum* fermented biourine at a dosage of 35 ml was the most effective in enhancing the growth of shallots. This dosage significantly improved growth parameters, including fresh stover weight, dry stover weight, fresh tuber weight, and dry tuber weight. The Keta Monca variety exhibited superior performance in terms of fresh tuber weight and dry tuber weight, while the Bali Karet variety also demonstrated strong results in fresh and dry tuber weights, with notable improvements in overall plant growth.

REFERENCES

[1]. Arafah, S.N., Lubis, Y. and Saragih, F.H. 2019. Factors that Influence the Demand for Shallots in Medan City. *Jurnal Penelitian Agrisamudra*. *6*(2): 124-132.

[2]. Fajjriyah, N. 2017. *Tips for Successful Shallot Cultivation*. Bio Genesis. Yogyakarta.

[3]. Central Statistics Agency, Horticultural Agriculture Statistics SPH-SBS (2022) Shallot Production in Nusa Tenggara Barat.

[4]. Sudantha IM, Aryana IGPM, Suwardji, Jayadi IS. dan Pramadya, IMA. 2021. Growth and Yield Response of Shallots Applied with Growth Regulators Benzyl *Amino* Purine (GR BAP) and Liquid Bioactivator of *Trichoderma harzianum* Fungus. *Proceeding International Conference on Science (ICST)* (2):149-60.

[5]. Amiri, Z., Asgharipour, M. R., Campbell, D. E., Azizi, K., Kakolvand, E., & Moghadam, E. H. (2021). Conservation agriculture, a selective model based on emergy analysis for sustainable production of shallot as a medicinal-industrial plant. *Journal of Cleaner Production*, *292*, 126000.

[6]. Said, M. I., Asriany, A., Sirajuddin, S. N., Abustam, E., Rasyid, R., & Al-Tawaha, A. R. M. (2018). Evaluation of quality of liquid organic fertilizer from rabbit's urine waste fermented using local microorganisms as decomposers. *The Iraqi Journal of Agricultural Science*, *49*(6), 990.

[7]. Wati, Y.T., Nurlaelih E. E., dan Santosa, M. 2014. Effect of Biourin Application on Growth and Yield of Shallot Plants (*Allium ascalonicum* L.). *Jurnal Produksi Tanaman*. 2(8): 613-619.

[8]. Widyaswari, E., Herlina, N. dan Santosa, M. 2017. The Effect of Cows Biourine And Anorganic Fertilizer on Shallot (*Allium ascalonicum* L.). *Jurnal Produksi Tanaman*. 5(10): 1700-1707.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT117

[9]. Yusrinawati, Y., Sudantha, I. dan Astiko, W. 2017. 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. *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*. 10(9): 42-49.
[10]. Woo, S. L., Hermosa, R., Lorito, M., & Monte, E. (2023). Trichoderma: a multipurpose, plant-beneficial microorganism for eco-sustainable agriculture. *Nature Reviews Microbiology*, *21*(5), 312-326.
[11]. Sudantha, IM. 2019. Formulation of Biofuncional and Bioactivator Active Ingredients of Fungus *Trichoderma koningii* Isolate Endo-02 and *T. harzianum* Isolate Sapro-07. *Paten Greanted*.
[12]. Neno, A.A. 2020. The Effect of Dosing Biourin Fertilizer on the Growth and Yield of White Mustard Plants (*Brassica chinensis* L.). *Agrica: Journal of Sustainable Dryland Agriculture*. 13(2): 199-211.
[13]. Das, P. P., Singh, K. R., Nagpure, G., Mansoori, A., Singh, R. P., Ghazi, I. A., & Singh, J. (2022). Plant-soil-microbes: A tripartite interaction for nutrient acquisition and better plant growth for sustainable agricultural practices. *Environmental Research, 214*, 113821.
[14]. Khaerana, K. dan Gunawan, A. 2019. Effect of silica fertilizer application in controlling tungro. *Jurnal Pertanian*. 10(1): 1-7.
[15]. Sudantha, I. M., Suwardji, I. G. P. M. Aryana, I. M. A. Pramadya dan I. Jayadi. 2018. Improving the Quality of G0 Seeds/Shallot Seeds Using Biological Technology to Support NTB as a Center for Certified G0 Seeds/Shallot Seeds. [National Strategic Flagship Research Report. Directorate of Community Service Research and Institute for Research and Community Service]. Mataram University. Mataram.
[16]. Sudantha, I.M., Suwardji, S., Aryana, I.G.P.M., Pramadya, I.M.A. dan Jayadi, I. 2020. The effect of liquid bio fungicides dosage *Trichoderma* spp. against fusarium wilt diseases, growth and yield of onion. In *Journal of Physics: Conference Series*. 1594(1): 012013. IOP Publishing.
[17]. Santosa, M., Suryanto, A., & Maghfoer, M. D. (2015). Application of biourine on growth and yield of shallot fertilized with inorganic and organic fertilizer in Batu, East Java. *AGRIVITA Journal of Agricultural Science*, *37*(3), 290-295.
[18]. Sanuwaliya, S. dan Murniati, M. 2020. The Effect of Giving Cow Biourine and NPK Fertilizer on the Growth and Production of Shallots (*Allium ascalonicum* L.). *Jurnal Agroteknologi Tropika*. 9(1): 11-19.
[19]. Askari-Khorasgani, O., & Pessarakli, M. (2020). Evaluation of cultivation methods and sustainable agricultural practices for improving shallot bulb production–a review. *Journal of Plant Nutrition*, *43*(1), 148-163.
[20]. Sudantha, I. M., & Suwardji, S. (2021). Trichoderma biofungicides formulations on shallot growth, yield and fusarium wilt disease resistance. In *IOP Conference Series: Earth and Environmental Science* (Vol. 824, No. 1, p. 012032). IOP Publishing.