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Response of Growth and Yield of Shallot (Allium ascalonicum L.) to Application of Biofertilizer and Fungicide

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Abstract

Allium ascalonicum L. (shallot) cultivar Bima is one of the leading horticultural commodities in Brebes region, which has high economic value. Shallots have excellent development prospects in terms of various fields, but there is a decreasing rate in shallot yields and it caused by several factors, including low levels of soil fertility and high intensity of disease attacks. The application of biofertilizers and fungicides is expected to be one solution for increasing shallot yields. The purpose of this study was to analyze the growth response and yield of shallots as a result of the application of biofertilizers and fungicides. This research was conducted at Baros Village, Ketanggungan District, Brebes, Central Java. The experimental design used was a randomized complete block design with 16 treatments and 2 repetition. The treatment that given is a combination of biofertilizer concentration (0 ml/l, 4 ml/l, 8 ml/l, 12 ml/l) and fungicide concentration (0 g/l, 0.25 g/l, 0.50 g/l, 0.75 g/l). Observational data were analyzed using ANOVA and followed by Duncan's Multiple Range Test at 5% level. The application of 8 ml/l biofertilizer and 0.75 g/l fungicide showed significant results on the variables of disease attack intensity, plant height, number of leaves, plant growth rate, bulb diameter, fresh weight of bulbs and dry weight of bulbs, and resulted in a dry weight value of 5.03 kg / plot or equivalent to a productivity value of 11.66 tons / hectare.

Keywords: *Biofertilizer, Bima Brebes, Fungicide, Shallot.*

1. INTRODUCTION

Allium ascalonicum L. or shallot is one of the leading horticultural commodities that have high economic value. Shallots have excellent development prospects as seen from the increasing demand along with the increasing population and the need for shallots (Istina, 2016). Shallots are one of the most consumed vegetable commodities in Indonesia. Based on data from the Socio-Economic Survey (Susenas) September 2021, the average per capita consumption of shallots in Indonesia for a month reached 2.49 kilograms (Central Bureau of Statistic Indonesia, 2021).

As much as 80% of shallot production in Indonesia comes from Java Island and almost 50% is concentrated in Central Java. Brebes Regency is the center of shallot production in Central Java (Aldila et al., 2017). The development of the area of shallot harvest and yield in Central Java Province in 2017-2021 tends to increase every year. However, in 2020 shallot yields decreased by 0.71 tons/ha (7.06%) from 2019. While the development of the area of shallot harvest and yield in 2017-2020 in Brebes Regency which is the

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center of shallots in Central Java also tends to increase every year, but in 2020 the yield of shallots decreased quite large, namely as much as 2.59 tons / ha (24.93%) from 2019.

The decrease rate in shallot yield can be caused by plant disease attacks and low levels of soil fertility. Yield loss due to disease attacks on shallot ranges from 20-100% (Putrasamedja et al., 2016). Fusarium wilt disease is a disease that often attacks shallots caused by Fusarium oxysporum fungus which can cause yield losses of up to 50% (Syarifudin et al., 2021). Fusarium wilt disease is one of the main diseases of shallots (Sintayehu et al., 2014) and on high attacks can result in yield losses of up to 50% (Juwanda et al., 2016). In research of Prakoso et al. (2016), yield loss due to fusarium wilt disease can occur very high, which exceeds 50%.

Increasing shallot yields and preventing disease attacks on shallots can be done by applying biofertilizers. According to Beneduzi et al. (2012) in Nuryani et al (2020), biofertilizer is reported to suppress disease attacks by producing antibiotic compounds and inducing plant resistance to pathogens. The role of biofertilizers made from active microbes is also expected to control wilt disease in shallots caused by Fusarium oxysporum f. sp. cepae (Hikmahwati et al., 2020).

The composition that contained in biofertilizers includes, the first is phosphate solvent bacteria. The use of P solvent microbes as biofertilizer has advantages, including energy saving, not polluting the environment, being able to help increase the solubility of absorbed P, blocking the absorption of P fertilizer for trapping elements and reducing the toxicity of Al^{3+}, Fe^{3+} and Mn^{2+} to plants on acidic soils. In certain types, P solvent microbes can spur plant growth because they produce growth regulators, and resist the penetration of root pathogens (Elfiati, 2005 in Rizky, 2018). The composition of the second is nitrogen-fixing bacteria. N-fixing bacteria in the root area such as azotobacter which are able to produce substances that promote the growth of gibberellin, cytokinins and indole acetic acid so that their utilization can spur root growth (Alexander,1977 in Rizky, 2018). Azotobater populations in the soil are affected by fertilization and plant type. Then, another composition of biofertilizer is decomposer / organic matter. Organic matter is a loose grain adhesive and the main source of nitrogen, phosphorus and sulfur. Organic matter tends to increase the amount of water that can be retained in the soil and the amount of water available to plants. In the end, organic matter is the source of energy for micro-bodies. (Adnan, 2022)

Disease control of purple spot and fusarium wilt usually uses fungicides made from chlorothalonil, copper oxychloride, mancozeb, iprodin, propineb and others (Chetana et al., 2012 in Pratiwi, 2018). Among the uses of those fungicides, fungicides with the active ingredient propineb 70% to control fusarium wilt disease are still widely used. Propineb is the active ingredient of dithiocarbamate fungicides which are widely used as fungicides in agriculture because of their high chemical and biological activity, as well as low production costs. Propineb contains organic sulfur components which are the main group of fungicides to control approximately 400 pathogens in more than 70 plants (European Comission, 2002 in Pratiwi, 2018).

Antracol which is made from 70% propineb has several advantages, including working preventively, not easily resistant, can deliver zinc nutrients to plants that lack zinc, and can be used during the rainy and dry seasons (Siti Nur Aeni, 2022). Based on how it works, antracol is a type of contact fungicide, which is a type of fungicide that only works on parts affected by the spray or parts directly touched by the fungicide, so as to avoid the death of non-target organisms. Its application is carried out by direct spraying to plants, injection of stems, casting on the roots, soaking seeds and fumigants (Azzamy, 2020).

This study aims to analyze the growth and yield response of shallots (Allium ascalonicum L) to the concentration treatment of biological fertilizers and fungicides. It is hoped that the best concentration can be obtained that can be recommended to farmers.

2. METHOD

The research was conducted at Baros Village, Ketanggungan District, Brebes, Central Java. The research took place at location with altitude of ±22 meters above sea level (asl), with soil types including the Alluvial soil category. The time for this research is carried out from May 25th, 2023 to August 20th, 2023. The experimental design used was Randomized Complete Block Design. The research consists of 16 (sixteen) combinations treatment of biofertilizer concentration (0, 4, 8, 12 ml/l) and fungicides concentration (0, 0.25, 0.50, 0.75 g/l). All treatments were repeated twice, bringing the total to 32 trial plots. Each treatment was applied to plots measuring 2 meters x 1.2 meters, trench width 0.5 meters and planting distance 20 cm x 15 cm. The number of plants is 84 clumps/plot and there are 2320 plots/ha.

Basic fertilizer that contain nitrogen, phosphor, and potassium were applied 7 days before planting, biological fertilizer with a concentration of 10 ml/l and a spray dose of 60 ml solution/plot also applied. As a biofertilizer treatment is given with a concentration of 0 ml/l, 4 ml/l, 8 ml/l and 12 ml/l applied out at the age of 7, 21 and 35 days after plant (DAP). Application is carried out by spraying onto the soil surface and a spray dose of 60 ml of solution/plot. Fungicides are applied weekly from 7 to 42 DAP with concentrations of 0 g/l, 0.25 g/l, 0.5 g/l and 0.75 g/l. The application of biofertilizers and fungicides is each carried out by spraying on the soil surface with a spray dose of 60 ml of solution/plot.

The variables observed include the intensity of disease attacks at the age of 21, 28, 35 and 49 DAP using the non-absolute damage method with the formula from the Directorate General of Food Crops, Indonesia Ministry of Agriculture (2018), namely Intensity of Attack (IS) $= [(\sum n \times v) \div (Z \times N)] \times 100\%$ where IS: intensity of attack (%), n: number of plants or plant parts on a scale of v, v: crop damage scale value, N: number of observed sample plants or plant parts, Z: the highest damage scale value. Growth variables are plant height, root volume, number of leaves and plant growth rate using the formula Plant Growth Rate $=[(w2 - w1).1/GA] \div (t2\text{-}t1)$ where w1: initial dry weight, w2: final dry weight, t1: observation start time, t2: observation end time, GA: specific planting area, observed at the age of 14, 21, 28, and 35 DAP, while the yield variables observed were the number of bulbs per clump, the diameter of the bulbs per clump, the fresh weight of the bulbs and the dry weight of the bulbs, observed after harvesting.

The observational data were analyzed using Analysis of Variance (ANOVA) and if the results of the analysis of variance showed a significant rate, it continued with Duncan's Multiple Range Test (DMRT) with a level of 5% (Smith, 2021).

3. RESULT AND DISCUSSION

The soil condition at this research location had a pH of 5.57 with nutrient content at that time such as C-organic of 0.66%, N-total of 0.07%, Phosphorus of 309 ppm, and Potassium of 0.33 cmol / kg. In addition, the average temperature in the research environment was 32^{o} Celsius with an average humidity of 67%. During the research, the weather conditions is tended to be dry.

3.1 Intensity of Disease Attacks

Analysis of variance shows that the treatment of biofertilizers and fungicides has a significant effect on the intensity of disease attacks at age 21, 28, 35 dan 45 days after plant (DAP) (Table 1)

Table 1. The effect of the concentration of biofertilizers and fungicides on the intensity of disease attacks at the age of 21, 28, 35 and 49 DAP

Treatment	The intensity of the disease attack (%)							
	21 DAP		28 DAP		35 DAP		49 DAP	
A (Control)	19,37	f	26,37	f	34,00	g	41,70	e
B (PH 0 ml/l dan F 0,25 g/l)	9,68	de	9,93	cd	13,12	e	16,64	cd
C (PH 0 ml/l dan F 0,50 g/l)	8,24	bcd	8,50	bcd	10,83	bcde	16,83	cd
D (PH 0 ml/l dan F 0,75 g/l)	0	a	0	a	7,86	bcd	7,94	b
E (PH 4 ml/l dan F 0 g/l)	12,52	e	21,35	e	21,39	f	21,40	d
F (PH 4 ml/l dan F 0,25 g/l)	7,74	bcd	7,77	bcd	11,82	cde	11,86	bc
G (PH 4 ml/l dan F 0,50 g/l)	8,12	bcd	8,17	bcd	11,17	bcde	11,37	bc
H (PH 4 ml/l dan F 0,75 g/l)	0	a	0	a	7,22	bc	7,33	b
I (PH 8 ml/l dan F 0 g/l)	9,85	de	11,91	d	11,94	de	11,94	bc
J (PH 8 ml/l dan F 0,25 g/l)	6,84	bcd	6,86	bc	6,89	b	6,94	b
K (PH 8 ml/l dan F 0,50 g/l)	5,53	b	5,56	b	6,92	b	6,95	b
L (PH 8 ml/l dan F 0,75 g/l)	0	a	0	a	0	a	0	a
M (PH 12 ml/l dan F 0 g/l)	9,56	cde	11,90	d	12,12	de	12,13	bc
N (PH 12 ml/l dan F 0,25 g/l)	6,02	bc	6,08	bc	7,01	b	7,03	b
O (PH 12 ml/l dan F 0,50 g/l)	5,08	b	5,15	b	7,16	bc	7,19	b
P (PH 12 ml/l dan F 0,75 g/l)	0	a	0	a	7,20	bc	7,22	b

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

The results showed an increasing rate in the intensity of fusarium wilt disease from the age of 21 to 49 DAP. This suggests that the pathogen fusarium oxysporum continues to develop as plants age. The highest intensity of disease attacks occurred in treatment A (control) with the highest value of 41.70% (severe category) at the age of 49 DAP, while the lowest intensity of attack occurred in treatment L (biofertilizer 8 ml/l and fungicide 0.75 g/l) at the age of 21 to 49 DAP. The results showed that the increasing concentration of fungicides, the smaller the intensity of fusarium wilt disease, this is in line with the research of Pratiwi (2018) which stated that Fusarium sp., Penicillium sp., Nigrospora sp., Phylosphere 1 and 2 fungi will begin to be inhibited at concentrations of 0.25 g/l and at concentrations of 1.00 g/l. will experience the highest growth inhibition. The percentage of inhibition of fusarium sp fungus with fungicide concentration treatment of 0.75 g/l reached 94.44%.

3.2 Plant Height

Analysis of variance showed that the treatment of biofertilizers and fungicides had a significant effect on plant height at the age of 28 and 35 DAP. While at the age of 14 and 21 DAP did not have a significant effect (Table 2).

Table 2. The effect of biofertilizer and fungicide concentrations on plant height at the age of 14, 21, 28 and 35 DAP

Treatment	Plant Height (cm)							
	14 DAP		21 DAP		28 DAP		35 DAP	
A (Control)	15,37	a	17,59	a	20,23	abc	23,87	a
B (PH 0 ml/l dan F 0,25 g/l)	15,48	a	17,07	a	19,18	a	24,41	a
C (PH 0 ml/l dan F 0,50 g/l)	14,39	a	17,16	a	19,09	a	23,91	a
D (PH 0 ml/l dan F 0,75 g/l)	16,77	a	19,46	a	21,73	bcd	24,91	a
E (PH 4 ml/l dan F 0 g/l)	14,98	a	19,09	a	21,95	bcd	26,09	a
F (PH 4 ml/l dan F 0,25 g/l)	15,27	a	18,96	a	21,91	bcd	25,64	a
G (PH 4 ml/l dan F 0,50 g/l)	16,00	a	18,96	a	20,27	abc	25,00	a
H (PH 4 ml/l dan F 0,75 g/l)	14,36	a	17,37	a	19,82	ab	25,46	a
I (PH 8 ml/l dan F 0 g/l)	13,84	a	17,82	a	22,54	cd	26,91	a
J (PH 8 ml/l dan F 0,25 g/l)	16,59	a	19,87	a	22,50	cd	26,96	a
K (PH 8 ml/l dan F 0,50 g/l)	15,96	a	19,18	a	21,18	abcd	27,32	a
L (PH 8 ml/l dan F 0,75 g/l)	13,96	a	17,46	a	22,91	d	36,96	b
M (PH 12 ml/l dan F 0 g/l)	15,91	a	17,96	a	21,36	abcd	25,96	a
N (PH 12 ml/l dan F 0,25 g/l)	14,73	a	17,41	a	20,59	abcd	25,50	a
O (PH 12 ml/l dan F 0,50 g/l)	15,64	a	18,16	a	20,57	abcd	25,00	a
P (PH 12 ml/l dan F 0,75 g/l)	15,64	a	17,78	a	19,68	ab	25,21	a

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

At the age of 14 and 21 DAP, the treatment of biofertilizers and fungicides had no significant effect on plant height, this is suspected because in the early growth phase of plants, the nutrients in the soil are still available enough and ready to be absorbed by plants so that the treatment of biofertilizers and fungicides does not have a significant effect, this is in line with Tampinongkol's research (2021) that soil is a place to grow and provide nutrients to plants, Soil is able to provide water and various nutrients both macro and micro that are needed by plants. While at the age of 28 and 35 DAP, combination of L treatment (biofertilizer 8 ml/l and fungicide 0.75 g/l) has a significant effect on plant height, this is suspected because at the time of further growth phase of plants, nutrients in the soil tend to decrease and the treatment of biofertilizer application can make nutrients in the soil that were previously not available in the soil become available for plants to be absorbed for example by phosphate solvent processes and others, this is in line with Afrilanda's research (2018), one that affects plant height is phosphorus (P), therefore, biofertilizer is a preparation containing cells of nitrogen-fixing microbial organisms (N), solvents and mobilization of phosphorus (P) elements which aim to increase organic carbon content, and increase nutrient nutrition for plants (Afrilanda, 2018).

The application of biofertilizers to the soil can increase the solubility of mineral-phosphate and mineralization of organic phosphate compounds, so that the availability of phosphates that can be absorbed by plants increases and in turn will affect plant growth (Alori et al., 2017). While the application of fungicides has an effect on suppressing the intensity of disease attacks, this is in accordance with observations on the intensity of disease attacks that have been analyzed previously, treatment L (biofertilizer 8 ml / l and fungicide 0.75 g / l) from the age of 21 to 49 DAP has the lowest intensity of fusarium wilt disease. Therefore, in growth variables such as plant height it produces significant values as well. The lower the level of intensity of the existing disease attack, the more significant the results of the analysis of growth variables.

3.3 Number of leaves

Analysis of variance showed that the treatment of biofertilizers and fungicides had a significant effect on the number of leaves aged 28 DAP. While at the age of 14, 21 and 35 DAP did not have a significant effect (Table 3)

Table 3. The effect of the concentration of biofertilizers and fungicides on the number of leaves at the age of 14, 21, 28 and 35 DAP

Treatment	Number of Leaves (strands)							
	14 DAP		21 DAP		28 DAP		35 DAP	
A (Control)	7,23	a	9,64	a	11,60	a	13,69	a
B (PH 0 ml/l dan F 0,25 g/l)	7,05	a	9,23	a	12,09	abc	14,05	a
C (PH 0 ml/l dan F 0,50 g/l)	7,91	a	9,64	a	11,64	ab	14,23	a
D (PH 0 ml/l dan F 0,75 g/l)	6,78	a	9,41	a	14,37	d	14,73	a
E (PH 4 ml/l dan F 0 g/l)	6,82	a	9,46	a	12,91	abcd	14,73	a
F (PH 4 ml/l dan F 0,25 g/l)	7,23	a	10,05	a	13,59	cd	15,55	a
G (PH 4 ml/l dan F 0,50 g/l)	7,19	a	10,05	a	13,10	abcd	15,50	a
H (PH 4 ml/l dan F 0,75 g/l)	7,68	a	10,18	a	13,73	cd	16,37	a
I (PH 8 ml/l dan F 0 g/l)	7,64	a	10,64	a	13,73	cd	16,46	a
J (PH 8 ml/l dan F 0,25 g/l)	8,00	a	10,50	a	13,91	cd	17,10	a
K (PH 8 ml/l dan F 0,50 g/l)	5,91	a	10,32	a	14,32	d	17,41	a
L (PH 8 ml/l dan F 0,75 g/l)	9,05	a	12,18	a	14,30	d	17,50	a
M (PH 12 ml/l dan F 0 g/l)	6,64	a	9,19	a	13,41	bcd	16,27	a
N (PH 12 ml/l dan F 0,25 g/l)	6,91	a	8,96	a	13,32	abcd	15,64	a
O (PH 12 ml/l dan F 0,50 g/l)	6,77	a	9,42	a	12,55	abcd	16,23	a
P (PH 12 ml/l dan F 0,75 g/l)	8,23	a	10,87	a	13,14	abcd	15,73	a

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

At the age of 14, 21 and 35 DAP the treatment of biofertilizers and fungicides had no significant effect on number of leaves. This is suspected because in the early growth phases the soil still provides enough nutrients for the initial needs of plant growth so that the treatment of biological fertilizers and fungicides has an insignificant effect, this is in line with Tampinongkol's research (2021), soil is the most fundamental natural resource on earth because soil is the main medium where plants obtain food. While at the age of 28 DAP treatment L (biofertilizer 8 ml / l and fungicide 0.75 g / l) has a significant effect on the number of leaves. This is thought to be because in a further growth phase, biofertilizer is able to provide nutrients needed by plants to be available in the soil and can be absorbed by plants, one of which is nitrogen. This is in line with Haryadi's research (2015) which stated that nitrogen in sufficient quantities will play a role in accelerating overall plant growth, especially stems and leaves. The element nitrogen plays a role in the formation of plant cells, tissues, and organs. Elements phosphorus, nitrogen are used to regulate the growth of plants as a whole.

Nazimah (2020) stated that biofertilizer is a fertilizer made from microbes that has the ability to provide nutrients and hormones for plant growth. Microbes contained in biofertilizers applied to plants will be able to bind nitrogen from the air, dissolve phosphates bound in soil, break down complex organic compounds into simpler compounds, and spur plant growth. While the impact of fungicide application can be seen from the results of analysis on the observation of the intensity of previous disease attacks which showed that L treatment (biofertilizer 8 ml/l and fungicide 0.75 g/l) from the age of 21 to 49 DAP has the lowest intensity of fusarium wilt disease. Therefore, on the growth variable, one of which is the number of leaves and produces significant values. The lower the level of intensity of disease attacks that exist, the more significant the results of the analysis of growth variables because the growth processes that take place in plants are not hampered by anything including disease attacks.

3.4 Root Volume

Analysis of variance showed that the treatment of biofertilizers and fungicides had no significant effect on root volume in all observations at the age of 14, 21, 28 and 35 DAP (Table 4).

Table 4. The effect of the concentration of biofertilizers and fungicides on root volume at the age of 14, 21, 28 and 35 DAP

Treatment	Root Volume (ml)			
	14 DAP	21 DAP	28 DAP	35 DAP
A (Control)	0,24 a	0,44 a	0,54 a	0,77 a
B (PH 0 ml/l dan F 0,25 g/l)	0,26 a	0,46 a	0,56 a	0,83 a
C (PH 0 ml/l dan F 0,50 g/l)	0,24 a	0,43 a	0,53 a	0,81 a
D (PH 0 ml/l dan F 0,75 g/l)	0,23 a	0,42 a	0,52 a	0,79 a
E (PH 4 ml/l dan F 0 g/l)	0,25 a	0,44 a	0,55 a	0,84 a
F (PH 4 ml/l dan F 0,25 g/l)	0,26 a	0,46 a	0,56 a	0,84 a
G (PH 4 ml/l dan F 0,50 g/l)	0,24 a	0,44 a	0,54 a	0,81 a
H (PH 4 ml/l dan F 0,75 g/l)	0,25 a	0,43 a	0,53 a	0,81 a
I (PH 8 ml/l dan F 0 g/l)	0,21 a	0,43 a	0,53 a	0,80 a
J (PH 8 ml/l dan F 0,25 g/l)	0,26 a	0,43 a	0,53 a	0,80 a
K (PH 8 ml/l dan F 0,50 g/l)	0,33 a	0,46 a	0,56 a	0,82 a
L (PH 8 ml/l dan F 0,75 g/l)	0,26 a	0,46 a	0,54 a	0,85 a
M (PH 12 ml/l dan F 0 g/l)	0,28 a	0,43 a	0,52 a	0,78 a
N (PH 12 ml/l dan F 0,25 g/l)	0,26 a	0,44 a	0,55 a	0,82 a
O (PH 12 ml/l dan F 0,50 g/l)	0,23 a	0,45 a	0,52 a	0,82 a
P (PH 12 ml/l dan F 0,75 g/l)	0,29 a	0,44 a	0,53 a	0,80 a

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

The treatment of biofertilizers and fungicides has no significant effect on root volume in all observations, this is suspected due to suboptimal root growth, one of those suboptimal growth problem is the lack of microorganism that helps provide nutrients for plant roots, this is in line with Wei at al's research (2018), there are several factors that can affect the occurrence of insignificant results on root volume, biological agents whose population development is hampered have an impact on the limited amount of variety and concentration of organic acids they produce, resulting in a delay in the process of dissolving P minerals in the soil. This has an impact on suppressing plant growth such as roots.

3.5 Plant Growth Rate

Analysis of variance shows that the treatment of biofertilizers and fungicides has a significant effect on the growth rate of plants at the age of 28-35 DAP. However, at ages 14-21 and 21-28 DAP did not have a significant effect (Table 5).

Table 5. Effect of biofertilizer and fungicide concentrations on plant growth rate at age 14-21, 21-28 and 28-35 DAP

Treatment	Plant Growth Rate (g/m^2/day)					
	14-21 DAP		21-28 DAP		28-35 DAP	
A (Control)	0,08	a	0,09	a	0,17	a
B (PH 0 ml/l dan F 0,25 g/l)	0,09	a	0,13	a	0,18	a
C (PH 0 ml/l dan F 0,50 g/l)	0,09	a	0,11	a	0,18	a
D (PH 0 ml/l dan F 0,75 g/l)	0,10	a	0,11	a	0,30	ab
E (PH 4 ml/l dan F 0 g/l)	0,08	a	0,10	a	0,30	ab
F (PH 4 ml/l dan F 0,25 g/l)	0,09	a	0,11	a	0,34	ab
G (PH 4 ml/l dan F 0,50 g/l)	0,08	a	0,10	a	0,36	ab
H (PH 4 ml/l dan F 0,75 g/l)	0,10	a	0,11	a	0,43	b
I (PH 8 ml/l dan F 0 g/l)	0,09	a	0,11	a	0,45	b
J (PH 8 ml/l dan F 0,25 g/l)	0,09	a	0,20	a	0,48	b
K (PH 8 ml/l dan F 0,50 g/l)	0,07	a	0,22	a	0,81	c
L (PH 8 ml/l dan F 0,75 g/l)	0,11	a	0,24	a	0,83	c
M (PH 12 ml/l dan F 0 g/l)	0,08	a	0,10	a	0,45	b
N (PH 12 ml/l dan F 0,25 g/l)	0,08	a	0,09	a	0,36	ab
O (PH 12 ml/l dan F 0,50 g/l)	0,10	a	0,11	a	0,43	b
P (PH 12 ml/l dan F 0,75 g/l)	0,09	a	0,13	a	0,31	ab

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

At the age of 14-21 DAP and 21-28 DAP the treatment of biological fertilizers and fungicides has no significant effect on the growth rate of plants, this is suspected because in the initial growth phase of plants, the nutrients in the soil are still available enough and ready to be absorbed by plants so that the treatment of biological fertilizers and fungicides does not have a significant effect, this is in line with Tampinongkol's research (2021) that the soil is a place to grow and provide nutrients to plants, Soil is able to provide water and various nutrients both macro and micro that are needed by plants. While at the age of 28-35 DAP treatment of biofertilizers and fungicides has a significant influence on the growth rate of plants. It's all assumed due to the role of biofertilizers that can make some nutrients in the soil that previously could not be absorbed by plants become available and can be utilized by plants, this is in line with Nugraha's research (2018) that the application of biofertilizers can also help optimize plant growth. The benefits of biofertilizers include as a nutrient catalyst that is useful for plant growth, can increase and encourage the formation of leaf chlorophyll so that the process of plant photosynthesis and nitrogen absorption from the air increases, can increase plant vigor to make plants sturdy and strong, increase plant resistance to weather stress, drought and disease-causing pathogen attacks, stimulate the growth of production branches, increase the formation of flowers and fruits, and reduce the fall of leaves, flowers and fruits.

The combination of L treatment (application of biofertilizer and fungicide at concentrations of 8 ml/l and 0.75 g/l) produced significant data on plant growth rates. Referring to the results of observations of disease attack intensity that have been analyzed previously, the combination of treatment L has the lowest intensity of disease attacks, resulting in significant results on variable plant growth rates because with the low level of disease attack intensity, plant growth can be more optimal and produce a good growth rate.

3.6 Number and Diameter of Bulb per Clump

Analysis of variance showed that the treatment of biofertilizers and fungicides had a significant effect on the diameter of bulb per clump, while the number of bulbs per clump did not have a significant effect (Table 6). The combination of treatment L (biofertilizer concentration of 8 ml/l and fungicide 0.75 g/l) gave the best results with a bulb diameter of 3.54 cm.

Table 6. The effect of the concentration of biofertilizers and fungicides on the number of bulb and the diameter of bulb per clump

Treatment	Number of Bulbs Per Clump (piece)		Bulb Diameter Per Clump (cm)	
A (Control)	5,46	a	2,51	a
B (PH 0 ml/l dan F 0,25 g/l)	5,05	a	2,49	a
C (PH 0 ml/l dan F 0,50 g/l)	5,14	a	2,49	a
D (PH 0 ml/l dan F 0,75 g/l)	5,59	a	2,60	a
E (PH 4 ml/l dan F 0 g/l)	5,91	a	3,13	abcde
F (PH 4 ml/l dan F 0,25 g/l)	5,14	a	2,88	abcde
G (PH 4 ml/l dan F 0,50 g/l)	6,50	a	3,33	bcde
H (PH 4 ml/l dan F 0,75 g/l)	6,46	a	2,81	abcd
I (PH 8 ml/l dan F 0 g/l)	5,14	a	2,70	abc
J (PH 8 ml/l dan F 0,25 g/l)	5,14	a	3,39	cde
K (PH 8 ml/l dan F 0,50 g/l)	5,69	a	3,48	de
L (PH 8 ml/l dan F 0,75 g/l)	5,96	a	3,54	e
M (PH 12 ml/l dan F 0 g/l)	6,18	a	2,64	ab
N (PH 12 ml/l dan F 0,25 g/l)	5,55	a	2,90	abcde
O (PH 12 ml/l dan F 0,50 g/l)	5,59	a	2,93	abcde
P (PH 12 ml/l dan F 0,75 g/l)	6,32	a	2,63	ab

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

The treatment of biofertilizers and fungicides has no significant effect on the number of bulbs per clump, this is suspected due to the genetic nature of the shallot of the cultivar bima brebes itself, this is in line with the description of the various Shallots cultivar that put forward by The Agricultural Instrument Standardization Agency of Vegetable Crops that the average number of bulbs of the shallot cultivar Bima Brebes is 4 to 6 bulbs per clump, In addition, according to research by Cokrosudibyo (2023), the average number of bulbs in shallot cultivar Bima Brebes is 4 to 5 bulbs per clump. Meanwhile, on the diameter of the bulb, the results of further DMRT tests showed that the combination of L treatment, namely the application of biological fertilizers and fungicides with concentrations of 8 ml/l and 0.75 g/l produced significant values. It is suspected that there is the availability of micronutrients from biofertilizers that can optimize the photosynthesis process which is then distributed to the plant bulb so that they have larger internodes and diameters, this is in line with Anisya's research (2022) stated that micronutrients can optimize the photosynthesis process in plants where the results of the photosynthesis process will form bulb so that the diameter of the bulb is greatly influenced by micronutrients.

3.7 Fresh Weight of Bulb

Analysis of variance shows that the treatment of biofertilizers and fungicides has a significant effect on the fresh weight of bulb per clump and per plot (Table 7). The combination of treatment L (biofertilizer concentration of 8 ml/l and fungicide 0.75 g/l) gives the highest rate for fresh weight of bulb, reaching a weight of 6.25 kg/plot.

Table 7. The effect of the concentration of biofertilizers and fungicides on the fresh weight of bulb

Treatment	Fresh Weight			
	Per Clump (g)		Per Plot (kg)	
A (Control)	38,27	ab	3,21	ab
B (PH 0 ml/l dan F 0,25 g/l)	40,52	ab	3,40	ab
C (PH 0 ml/l dan F 0,50 g/l)	34,90	a	2,93	a
D (PH 0 ml/l dan F 0,75 g/l)	43,92	bc	3,69	bc
E (PH 4 ml/l dan F 0 g/l)	59,84	ef	5,03	ef
F (PH 4 ml/l dan F 0,25 g/l)	50,00	cd	4,20	cd
G (PH 4 ml/l dan F 0,50 g/l)	51,83	cde	4,35	cde
H (PH 4 ml/l dan F 0,75 g/l)	55,68	def	4,68	def
I (PH 8 ml/l dan F 0 g/l)	63,80	fg	5,36	fg
J (PH 8 ml/l dan F 0,25 g/l)	68,63	gh	5,76	gh
K (PH 8 ml/l dan F 0,50 g/l)	68,77	gh	5,78	gh
L (PH 8 ml/l dan F 0,75 g/l)	74,40	h	6,25	h
M (PH 12 ml/l dan F 0 g/l)	62,22	fg	5,23	fg
N (PH 12 ml/l dan F 0,25 g/l)	59,71	ef	5,02	ef
O (PH 12 ml/l dan F 0,50 g/l)	57,14	def	4,80	def
P (PH 12 ml/l dan F 0,75 g/l)	63,10	fg	5,30	fg

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

Analysis of variance showed that the combination of L treatment (biofertilizer 8 ml/l and fungicide 0.75 grams) gave significant results with a fresh weight value of bulb of 6.25 kg/plot equivalent to productivity of 14.5 tons/ha. It is suspected that referring to the results of the analysis of the intensity of disease attacks which show that the combination of treatment L has the lowest attack intensity so that shallot with thus treatment have optimal growth and yield and produce significant values on the variable fresh weight of bulbs, this is in line with Mugiastuti's research (2019) antagonistic microbes in biofertilizers can spur plant growth through mechanisms Among them produce indole acetic acid (IAA) growth hormone, increase the solubility of certain nutrients such as phosphates, produce vitamins for plants, improve plant roots, increase mineral uptake, affect nitrogen uptake and metabolism. This will increase the growth rate and yield of the plant.

3.8 Dry Weight of Bulb

Analysis of variance shows that the treatment of biofertilizers and fungicides has a significant effect on dry weight per clump, per plot and per hectare (Table 8). The combination of treatment L (biofertilizer concentration of 8 ml/l and fungicide 0.75 g/l) gives the highest dry weight yield of 5.03 kg/plot equivalent to productivity of 11.66 tons/ha.

Table 8. The effect of the concentration of biofertilizers and fungicides on the dry weight of bulb

Treatment	Dry Weight					
	Per Clump (g)		Per Plot (kg)		Productivity (ton/ha)	
A (Control)	23,91	a	2,01	a	4,66	a
B (PH 0 ml/l dan F 0,25 g/l)	28,20	ab	2,37	ab	5,50	ab
C (PH 0 ml/l dan F 0,50 g/l)	24,97	a	2,10	a	4,87	a
D (PH 0 ml/l dan F 0,75 g/l)	33,58	abc	2,82	abc	6,54	abc
E (PH 4 ml/l dan F 0 g/l)	48,41	def	4,07	def	9,43	def
F (PH 4 ml/l dan F 0,25 g/l)	38,95	bcd	3,27	bcd	7,59	bcd
G (PH 4 ml/l dan F 0,50 g/l)	41,63	cde	3,50	cde	8,11	cde
H (PH 4 ml/l dan F 0,75 g/l)	42,51	cde	3,57	cde	8,28	cde
I (PH 8 ml/l dan F 0 g/l)	49,82	def	4,18	def	9,71	def
J (PH 8 ml/l dan F 0,25 g/l)	53,45	ef	4,49	ef	10,42	ef
K (PH 8 ml/l dan F 0,50 g/l)	52,28	ef	4,39	ef	10,19	ef
L (PH 8 ml/l dan F 0,75 g/l)	59,83	f	5,03	f	11,66	f
M (PH 12 ml/l dan F 0 g/l)	45,17	de	3,79	de	8,80	de
N (PH 12 ml/l dan F 0,25 g/l)	46,72	de	3,92	de	9,10	de
O (PH 12 ml/l dan F 0,50 g/l)	44,58	cde	3,74	cde	8,69	cde
P (PH 12 ml/l dan F 0,75 g/l)	49,61	def	4,17	def	9,67	def

Note : Numbers followed by different letters in the same column showed significantly different according to Duncan's Multiple Range Test of 5%. PH: Biofertilizer, F: Fungicide

The combination of L treatment has a significant effect on the dry weight of bulb per plot with a decrease rate of moisture content of 1.22 kg (19.52%), it is suspected that the application of biofertilizers and fungicides can increase the dry weight of plants because it is related to the mechanism of nutrient absorption into the plant tissue itself, this is in line with Pratiwi's research (2018) that the dry weight of plants is strongly influenced by root absorption of nutrients available in the soil. Biofertilizers containing phosphate solvent bacteria can increase the dry weight of plants. The combination of L treatment (application of biofertilizer 8 ml/l and fungicide 0.75 g/l) has a productivity of 11.66

tons/hectare, an increase of 15.7% when compared to the average value of national shallot productivity at 10.08 tons/hectare.

4. CONCLUSION

The combination treatment of biofertilizer and fungicide concentrations has a significant influence on the variable intensity of disease attack on plants aged 21, 28, 35 and 49 DAP, plant height aged 28 and 35 DAP, number of leaves aged 28 DAP, plant growth rate at the age of 28-35 DAP, diameter of bulb per clump, fresh weight of bulb per clump and dry weight of bulb per clump. However, it did not have a significant influence on the variables of plant height aged 14 and 21 DAP, number of leaves aged 14, 21 and 35 DAP, root volume, plant growth rate at the age of 14-21 DAP and 21-28 DAP and the number of bulbs per clump.

The combination of biofertilizer concentration treatment of 8 ml/l and fungicide 0.75 gram/l has the best effect on the yield of shallot plants with the highest dry weight value of bulbs is 5.03 kg/plot or equivalent to 11.66 tons/ha and this can increase productivity by 15.7% compared to the national average productivity of shallot (Allium ascalonicum L.) which is at 10.08 tons/ha.

5. SUGGESTION

We recommend that further research be carried out to support the results of this study, especially the use of concentrations of biofertilizers and fungicides and each comparison to obtain optimal concentrations for the growth and yield of shallots.

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