RESEARCH FINAL REPORT
DIPA BIOTROP 2021

FORMULATION OF LIQUID ORGANIC WASTE TO INCREASED THE RESISTANCE OF SHALLOTS (*Allium ascalanicum* L.) FROM FUSARIUM WILD DISEASE

Mariani
Sugiarta
Siti Aminah

MINISTRY OF EDUCATION AND CULTURE
SECRETARIAT GENERAL
SEAMEO SEAMOLEC
SOUTHEAST ASIAN REGIONAL CENTRE FOR TROPICAL BIOLOGY
(SEAMEO BIOTROP)
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APPROVAL SHEET

1. Research Title : Formulation of Liquit Organic Waste to Increased the Resistance of Shallots (*Allium ascalanicum* L.) from Fusarium Wild Desease .

2. Research Coordinator
   a. Name : Mariani
   b. Genjer : Ladis
   c. Occupation : Teacher

3. Institution
   a. Name of Institution : SMKPPN Mataram
   b. Address : Jalan TGH Lopan No. X Labuapi
   c. Telepon : (0370) 622380
   d. Fax : (0370) 622780
   e. Email Address : marianiharamain@gamil.com

4. Research Schedule : 9 Months
5. Research Badget :

Mataram, 4 Agustus 2021

Endorsed by,
Acting Manager of Research
Hub Inovation Departement

Research Coordinator

Ir. Sri Widayanti, M.Si.
NIP. 19670822 200701 2 001

Mariani, SP., M.Si.

Approved by,
Director of SEAMEO BIOTROP

Dr. Zulhamsyah Imran, S.Pi, M.Si
NIP 19700731 199702 1 001

INTRODUCTION

1.1 Background

Shallots (Allium ascalonicum L.) are one of the horticultural crops. In addition, red onions can be consumed by the public as a mixture of cooking spices. In addition to cooking mixtures, onions are sold in processed forms such as shallot extract, powder, essential oil, fried onions and other preparations (Mariani and Sugiarta, 2016). Shallots as a medicinal ingredient to lower cholesterol, blood sugar, prevent blood clots, lower blood pressure and improve blood flow (Santas et al., 2010 and Lu et al., 2011). Therefore, red onion is a vegetable commodity that has an important meaning for society, both from its high economic value and nutritional content (Widyantara dan Yasa, 2013).

Indonesia has tremendous potential as a center for shallot cultivation. Agricultural land from Aceh to Merauke can be planted with shallots throughout the year, including the West Nusa Tenggara (NTB) Region. In 2015, NTB has been designated as one of the national shallot centers to meet domestic and export needs, with an export volume of 18 thousand tons to 30 thousand tons per year. Shallots exported to a number of countries such as Malaysia, Singapore, Vietnam and several other countries are red onions from NTB (Maharani, E., 2015.

. Furthermore, in 2018 the Ministry of Agriculture issued a Decree of the Minister of Agriculture No. 472 / Kpts / Rc.040 / 6/2018 concerning the location of shallot National Agricultural Areas in 32 Provinces. One of them is NTB Province with a harvest area of 19,275 hectares of shallots. The distribution of National shallot planting areas in NTB is in Bima, Dompu, Bima City, Sumbawa, West Sumbawa, East Lombok, Central Lombok, Mataram City, West Lombok, and North Lombok (Minister of Agriculture, 2018).

Wilt disease caused by Fusarium sp. is a disease that is commonly found in shallot plants that grow around the world (Cramer, 2006). According to Yulis (2009), Fusarium wilt disease in 1997 was not the main disease in shallots, but in the last five years there has been an increase in disease attacks, so that it has become the main disease in various shallot production centers in Indonesia. The ability of Fusarium sp. to cause wilt disease in shallot plants is widely scattered in the soil and is widely available in agricultural land in tropical and sub-tropical regions (Cramer, 2006).

Fusarium wilt disease is the main disease affecting shallots (Lager, 2011; Ilhe et al., 2013, and Futane et al., 2018). Incidence of disease caused by Fusarium sp. in the field reached more than 50% (Lacy and Roberts, 1982; Wiyatiningsih, 2003). Shrestha (2007), also reported that the fungus Fusarium sp. can cause up to 90% damage. Furthermore Sudantha (2015), said that Fusarium wilt disease caused by Fusarium sp. also occurred in shallot cultivation centers in NTB namely in West Lombok, East Lombok, Sumbawa, and Bima which caused damage and reduced shallot yields by more than 45%.

Attack of Fusarium sp. generally attacks the base of the tubers, resulting in disturbed growth of roots, tubers, and leeks, which in turn can cause tubers to rot (Hadisoeganda et al., 1995; Rahayu et al., 2018). Mushroom Fusarium sp. is a soil-borne fungus that forms chlamydispores so that it lasts a long time in the soil and can infect plant tissue through direct penetration and can infect plant tissue through wounds in the root tissue and at the base of the onion-coated tubers (Cramer, 2006)

One of the technologies that can be developed to increase the resistance of shallots to Fusarium wilt is the application of liquid organic waste. According to Yuliprianto (1996), organic waste is rich in macro and micro nutrients for plants, and can function to improve soil biological life (Dasiswaah, 2015), especially the quality of soil biological agents. This is also in accordance with the statement of Setyowati (2008), that composted organic waste can increase soil fertility by improving soil chemical and biological properties and can prevent plant root infections by plant pests such as soil-borne pathogens. Based on the description above, it is necessary to conduct a study entitled "liquid organic waste formulation to increase the resistance of shallots (Allium ascalanicum L.) from Fusarium wilt disease".

1.2 Objectives

The purpose of this study was to determine the formulation of liquid organic waste which can increase the resistance of shallots (Allium ascalanicum L.) from Fusarium wilt disease.

1.3 Expected Output

The expected results from this study are found formulation of liquid organic waste that can increase the resistance of shallots (Allium ascalanicum L.) from Fusarium wilt disease.

2. State of the Art of the Research

From this research, a technology package from liquid organic waste will be found that can increase the resistance of shallots (Allium ascalanicum L.) to Fusarium wilt disease which can be useful: (1) as a reference to enrich scientific repertoire on the use of organic waste to increase the resistance of onions. red against Fusarium wilt disease, (2) as a reference to develop further research on liquid organic waste formulations that can increase the resistance of shallots to Fusarium wilt disease (scientific journal publication), (3) as information for shallot farmers to utilize organic waste liquid to increase the resistance of shallots to Fusarium wilt disease, and (4) as information for organic waste managers to utilize organic waste into products of economic value. Based on these benefits, this research is very important to carry out because this research will be able to solve the problem of waste, namely organic waste which has always been a national issue, so as to produce a clean and healthy environment and free from pollution. In addition, this research will be able to increase the income of shallot farmers because it can streamline agricultural input in the form of fungicide use by utilizing waste and this research will also produce quality agricultural output, namely healthy shallot products that have high selling value and storage power so that they can survive. for a long time and can become superior seeds that are resistant to Fusarium wilt disease.

3. Methods

This study was designed using experimental research methods conducted in the greenhouse of SMKPPN Mataram. This research was conducted from April 2021 to December 2021. The materials used in this study were isolates of the pathogenic Fusarium solani, Saccharomyces cereviciae (Permifan), organic waste, water, and shallot seeds. Furthermore, the tools that will be used are: Petridishes, Erlenmeyer, Test Tubes, Chemical Glasses, Measuring Glasses, Polybags, rulers, pH meters, TDS, and writing instruments. The organic waste formulation was made in the liquid formulation, namely

in the form of a suspension with the following components (in 1 liter): 20 grams of corn flour, 60 grams of bran, 20 grams of sugar, 100 grams of potatoes, 300 grams of household solid organic waste compost, and 500 ml of water was blended until it became a suspension, then pure inoculant of the Saccharomyces cereviciae of Permifan brand was added as a biological stimulant to accelerate the fermentation process of organic waste. Liquid organic waste is fermented within three days, then added with one liter of sterile water per 500 ml of liquid organic waste suspension. The organic waste suspension is ready to be applied and stored until the time of application on shallot plants.

Furthermore, the application dose test of the organic waste formulation was carried out in the greenhouse of SMKPPN Mataram. The experiment was designed with a randomized block design (CRD) with 5 treatment dosages of the formulation, namely 50 ml/polybag (d1), 100 ml/polybag (d2), 150 ml/polybag (d3), 200 ml/polybag (d4), and control (d0 = without liquid organic waste formulation). Each treatment was repeated 5 times so that there were 25 experimental units, each consisting of 4 polybags of shallot plants, so that in this experiment 100 polybags of shallot plants were prepared. The shallot seeds used are the Bali rubber varieties of shallots. Planting is done by planting one tuber per polybag. Furthermore, pathogen inoculation was carried out before planting by soaking the shallot seeds in a suspension of Fusarium solani fungus for 30 minutes before planting. Furthermore, the application of liquid organic waste is carried out shortly after planting shallots. Observations were made by recording the growth of shallot plant height, the day the symptoms of Fusarium wilt appeared on shallot plants and the number of shallot plants showing symptoms of Fusarium wilt until the shallot plants were 30 days old. All observational data will be analyzed using analysis of variance (ANOVA) at a 5% significance level, if there is a significant difference then proceed with the Least Significant Difference (LSD) test at the same significant level. Data analysis was carried out using data analysis software, Co.Stat.

4. Results and Discussion

The results of observations on the height of the shallot, the day the symptoms of Fusarium wilt appear and the quantity of sick shallots at the age of 9 weeks after planting are presented in Table 1, Table 2, and Table 3.

Table 1. Height of Shallots at 9 week after planting

Dosage of Formulation (ml/ polybag)	Height of Plant (cm)					
	Repeat					Average
	1	2	3	4	5	
100	38	42	47	41	39	41,4 a*)
150	46	50	41	45	42	44,8 a
200	35	44	40	45	46	42,0 a
250	58	36	34	44	45	43,4 a
0	37	35	38	42	36	37,6 a

Note: *the numbers followed by the same letter are not significantly different based on the LSD test at a 5% significance level.

Based on Table 1, it is known that the dosage of the formulation had a significant effect on the growth of shallot height at the age of 2 week after planting. Plant height were 37,6 cm (control without organic waste formulation); 41,4 cm (formulation dose 100 ml/ polybag); 44,8 cm (formulation dose 150 ml/ polybag); 42,0 cm (formulation dose 200 ml/ polybag); and 43,4 cm (formulation dose of 250 ml/polybag). This shows that the different dosages of liquid organic waste formulation applied to shallot plants gave the same shallot plant height. Based on these results, the difference in the dose of organic liquid fertilizer application from 100 ml/polybag to 250 ml/polybag did not have an effect on increasing plant height, but when compared to the control plant height tended to be lower, namely in onion plants that were not fertilized with organic liquid fertilizer. This may indicate that the dose of organic fertilizer application still needs to be increased in order to significantly increase the shallot plant height compared to the shallot plant height in the control.

Table 2. The Day of symptoms of Fusarium wilt disease (period of incubation) on shallot

Dosage of Formulation (ml/ polybag)	Period of Incubation (the day after isolation)					
	Repeat					Average
	1	2	3	4	5	
100	14	-	-	-	-	14
150	15	-	-	-	-	15
200	-	-	-	-	-	-
250	-	-	-	-	-	-
0	11	12	13	14	10	12

Table 2 shows that the dosage of the formulation has an effect on the incubation period of shallots against Fusarium wilt disease. In the treatment with a formulation dose of 100 ml/polybag, the incubation period of shallots was 14 day after isolation in the 1st replication, and in the 2nd, 3rd, 4th, and 5th replications, the shallot plants did not show any symptoms of illness; at a dosage of 150 ml/polybag formulation, the incubation period of shallot plants against Fusarium wilt disease was 15 day after isolation in the 1st replication and in the 2nd, 3rd, 4th, and 5th replicates the shallot plants did not show any symptoms. sick; at a dosage of 200 ml/polybag and 250 ml/polybag of shallots, none of them showed symptoms of illness; while in the control treatment without treatment the dosage of liquid organic waste formulations the incubation period of shallots against Fusarium wilt disease in a row at the 1st, 2nd, 3rd, 4th, 5th replicates were 11 day after isolation, 12 day after isolation, 13 day after isolation, 14 day after isolation, 10 day after isolation with an average of 12 day after isolation. This indicates that the higher the dosage of liquid organic waste formulation applied to shallots, the longer the incubation period of shallots against Fusarium wilt disease. Based on these results, it is known that the higher the dosage of liquid organic waste formulation, the shallots will be more resistant to Fusarium solani attack so that the symptoms of Fusarium wilt disease in shallots will be lower.

Table 3. Quantity of sick shallot at the age of 3 weeks after planting

Dosage of Formulation (ml/ polybag)	Quantity of Sick Shallots					
	Repeat					Average
	1	2	3	4	5	
100	1	0	0	0	0	1
150	1	0	0	0	0	1
200	0	0	0	0	0	0
250	0	0	0	0	0	0
0	1	2	2	1	1	1,4

Table 3 show that the dosage of the formulation has an effect on the number of diseased shallot plants. In the treatment with a formulation dose of 100 ml/polybag, the number of diseased shallot was 1 tree in the 1st replication, and in the 2nd, 3rd, 4th, and 5th repetitions there were no sick shallot plants; at a dosage of 150 ml/polybag formulation, the number of diseased shallot was 1 tree in the 1st replication and in the 2nd, 3rd, 4th, and 5th repetitions there were no sick shallot; at a dosage of 200 ml/polybag and 250 ml/polybag formulation there were no sick shallot; while in the control treatment without the dosage treatment of liquid organic waste formulation the number of sick shallot plants in the 1st, 2nd, 3rd, 4th, 5th replicates was 1 tree, 2 trees, 2 trees, 1 tree, 1 tree with an average of 1.4 trees. This indicates that the higher the dosage of liquid organic waste formulation applied to shallot, the lower the number of sick shallot. Based on these results, it is known that the higher the dosage of liquid organic waste formulation, the shallot will be more resistant to Fusarium solani attack so that the number of sick shallot will be less.

5. Conclution

Based on the results of research, data analysis, and discussion, it can be concluded several things as follows: (1) The difference in the dose of organic liquid fertilizer application from 100 ml/polybag to 250 ml/polybag did not have an effect on increasing plant height, but when compared with the control plant height tends to look lower, namely in shallot plants that are not fertilized with organic liquid fertilizer; (2) The higher the dosage of liquid organic waste formulation, the shallot plants will be more resistant to

Fusarium solani pathogen attack so that the incidence of Fusarium wilt disease in shallot plants will be lower and the incubation period of Fusarium wilt disease on shallot plants will be longer even some treatments showed no infection until the end of the observation.

6. Recommendation

Based on the results of the discussion and conclusions, it can be suggested as follows: the application dose of organic liquid fertilizer from 100 ml/polybag to 250 ml/polybag did not have an effect on increasing plant height, but when compared to the control plant height, it tends to look lower. Based on this, the application dose of liquid organic fertilizer needs to be increased to above 250 ml/polybag in order to significantly increase the shallot plant height compared to the shallot plant height in the control. In addition, with a higher dose of liquid organic fertilizer application, it can also reduce the incidence of disease and slow down the incubation period of Fusarim wilt disease in shallot plants.

7. Refrences

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Attachment:

Attachment 1. Data on shallot plant height at 2 weeks after planting

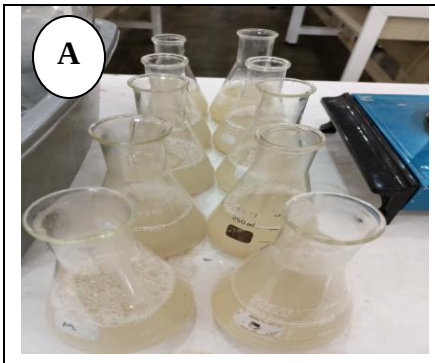
Perlakuan	Ulangan	Tinggi Tanaman (cm)
d1	1	38
d1	2	42
d1	3	47
d1	4	41
d1	5	39
d2	1	46
d2	2	50
d2	3	41
d2	4	45
d2	5	42
d3	1	35
d3	2	44
d3	3	40
d3	4	45
d3	5	46
d4	1	58
d4	2	36
d4	3	34
d4	4	44
d4	5	45
d0	1	37
d0	2	35
d0	3	38
d0	4	42
d0	5	36

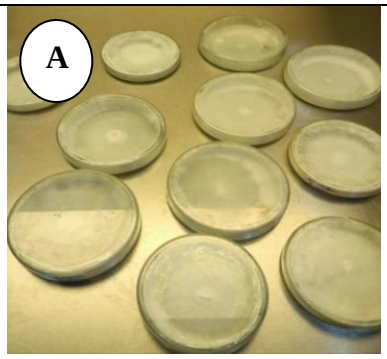
Attachment **2.** Results of Analysis of Variance (ANOVA) and BNT Test of Shallot Plant Height 9 weeks after planting

HOMOGENEITY OF VARIANCES - RAW DATA

Source	df	Type I SS	MS	F	P
Main Effects					
Perlakuan	4	146.96	36.74	1.29	.3080 ns
Error	20	570.4	28.52		
Total	24	717.36			

Attachment 3. Documentation





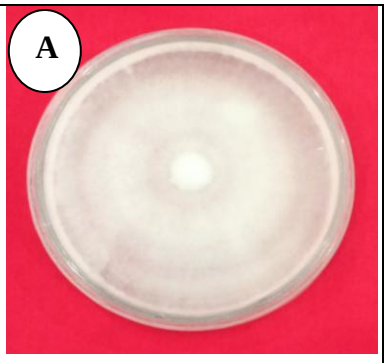
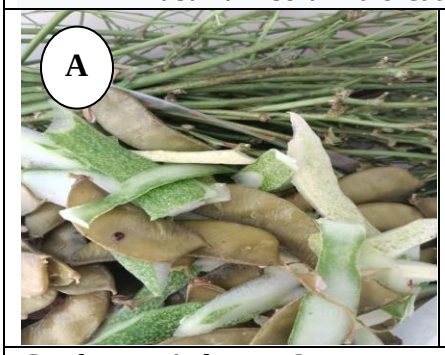
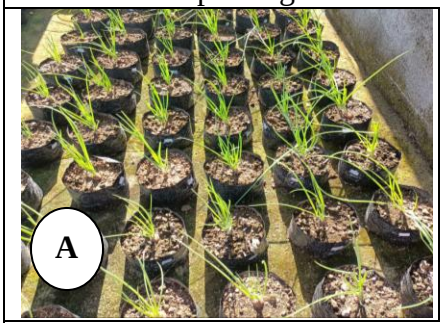


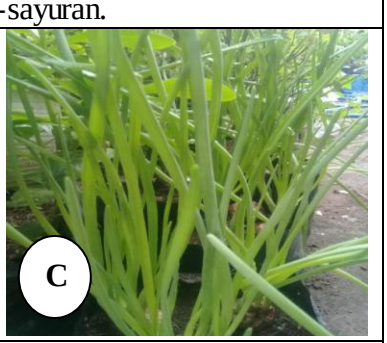
Figure 1. A. Propagation media of *Fusarium solani*; B. Multiplication of *Fusarium solani*; C. *Fusarium solani* the cause of Fusarium wilt disease of shallots



Gambar 2. A dan B. Organic waste; C. Dekompocer (permifan).


Gambar 3. Pupuk organik cair hasil fermentasi dari limbah sayur-sayuran.





.Liquid organic fertilizer fermented from vegetable waste