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Suriani, N. L., & Darmadi, A. A. K. (2019). Utilization of biotechnology stater to improve quality and production of clove plant (*Syzygium aromaticum* L). *International Journal of Life Sciences & Earth Sciences*, 2(1), 38-43.
<https://doi.org/10.31295/ijle.v2n1.92>

Utilization of Biotechnology Staters to Improve Quality and Production of Clove Plant (*Syzygium aromaticum* L)

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Abstract---*Clove plant is a commercial plant that has a lot of potentials. Gitgit Sukasada Village, Buleleng is one of the clove plantation centers, but lately, its production has decreased due to a large number of clove plants that have been attacked by the disease. For this reason, it is necessary to research how to increase production. The purpose of this research is to get organic fertilizer products that are environmentally friendly that can improve the quality and production of clove plants. The design used is a randomized group design. The results showed that biostaters could accelerate the maturity of organic fertilizer, within 30 days organic fertilizer was ready to be used and the quality of the fertilizer could be improved. The results of research on clove plants at the age of 20 years showed that the treatment of organic fertilizer 2 tons/ ha and 3 tons/ha had a significant effect on the number of flowers /stems and dry weight /trees, and so were not found sick plants. Whereas in the control and treatment of 1 ton /ha organic fertilizer, sick clove plants were found. Adapted compost fertilizer also increases the brightness of the leaf's color, and can increase the size of the clove fruit.*

Keywords---*biostater, clove, organic fertilizer.*

Introduction

Clove plants in Indonesia are considered plantations, besides cocoa, coffee and rubber. Clove plants to be able to grow and produce require specific growing environmental requirements. Environmental factors that influence clove plants include climate, height, and type of soil. Optimal rainfall for the development of clove plants is 1,500 - 2,500 mm/year or 2,500 - 3,500 mm/year with a dry month of fewer than 2 months. The intensity of irradiation is 61 - 60% and the temperature is 22 - 28 ° C and there are no strong winds throughout the year. Clove plants can be planted and still produce at an altitude of 0 - 900 m above sea level (asl) (Ireng, 2017; Yadnya *et al.*, 2016; Partama *et al.*, 2018).

Clove is a commodity for domestic and export. In Bali, many spas use clove oil as therapeutic aroma oil, which is very liked by guests. Besides that, the clove plant is one of the natural attractions which is liked by the guests. In the world of agriculture, cloves are widely used as plant-based pesticides. Clove plants are also used as herbs for spices (Ristiansyah *et al.*, 2018). In Bali, one of the centers of clove plants is in the district of Buleleng, namely in the village of Gitgit, sub-district of Sukasada. From the survey results found that the development of cloves there is quite good but there are deficiencies in treatment. Especially the fertility of the soil begins to decline so that many clove plants that die due to pests and diseases and thin clove plants and yellow leaves tend to turn yellow. From the results of interviews that clove farmers in the village tended from year to year to always use synthetic fertilizers. The impact arising in long-term use is a decrease in soil fertility, pests and disease increases (Hartatik & Widowati, 2015). So that gradually the production decreases, the welfare of farmers decreases.

This village is also a center of rice farming and each resident owns cattle and pigs. Rice waste in the form of abundant straw, mostly processed by burning. Likewise, there is an abundance of livestock waste without treatment that spreads foul odors that pollute the environment. If this is used and treated as organic fertilizer, farmers will not

lack fertilizer, besides that the costs are also low, welfare will increase. But because the knowledge/technology about it is not so well known by farmers, farmers have objections in buying fertilizer. As a result, the production of cloves is not optimal. The purpose of this research is to get organic fertilizer products that are environmentally friendly and improve the quality and production of clove plants through the application of compost organic fertilizer on clove plants.

Research Methods

The research is in the village Amertasari, Sukasada Buleleng. This research is field research consisting of 2 stages, stage I making organic fertilizer using biostater (*Trichoderma sp.*, and *Aspergillus niger*). Phase II is the application of organic fertilizer to clove plants by the randomized block design method, with 4 treatments and 4 replications. These treatments are treatment without fertilizer (F0), treatment with organic fertilizer 1 ton/ha (F1), treatment with organic fertilizer 2 tons/ha (F2), treatment of organic fertilizer 3 tons/ha (F3). The parameters observed were fertilizer quality parameters (odor, color, and appearance of fertilizer) and production parameters and clove quality (leaf color, flower length and width, number of flowers/stems, flower color and flower/tree weight). Data analysis used quantitative analysis using analysis of variance (ANOVA), if the treatments were significantly different, followed by the multiple range test (DMRT) at the 5% level (Gomez, 2007; Yuliana *et al.*, 2018; Zambrano *et al.*, 2019).

Results and Discussion

Quality of Compost Fertilizer

The quality of organic fertilizer is presented in Table 1. Inorganic fertilizers with biostater, it shows that the texture is a crumb, odorless, ripe and brownish in color. Whereas organic fertilizer without biostater shows a rather dense texture, smelly, undercooked and brownish color. Antonious (1997), states that biostater is a microbe that functions to accelerate the process of degradation, can suppress pathogenic microbes and stimulate the growth of decomposing microbes. This can accelerate the maturity of organic fertilizer. Suriani *et al.*, (2015), states that biostater can accelerate the maturity of organic fertilizer, within 30 days organic fertilizer is ready to use. Organisms found in biostater such as *Aspergillus niger* and *Trichoderma sp.* *Trichoderma* organism is a remodel organism and can also suppress plant pathogens, function as biocontrol and can increase plant growth and production. *Trichoderma sp.* can also suppress blast disease in rice plants (Gomathinayagam *et al.*, 2009; Kumar *et al.*, 2017; Yadav *et al.*, 2018; Eiham *et al.*, 2012; Yutida *et al.*, 2014; Ram & Norman, 2018; Zee & Vu, 2018).

Table 1
Compost quality organic fertilizers at each treatment

No.	Parameters	Organic fertilizer without biostater	Organic fertilizer with biostater
F0	Smell	Smelling pungent	-
F1	Color	Brownish black	Brownish black
F2	Texture	Solid crumbs	crumbs
F3	Maturity	Less mature	Maturity

Production

Results of research on clove plants aged 20 years (Figure 3) showed that the treatment of organic fertilizer 2 tons/ ha and 3 tons/ ha significantly affected the number of flowers/stems and the dry weight of flowers/trees (Figure 2; tables 2, 2) Figure 2 shows the higher concentration of organic fertilizer, the number of flowers and flower weight increases. No diseased plants were found in the treatment F2 and F4, while in control and F1 found. In the control and treatment of organic fertilizer 1 ton/ha found a clove plant that is sick with the characteristics of leaves and branches to dry out gradually.

Table 2
Number of clove plant flowers

Treatment	Number of clove plant flowers/stalk				Everage
	Replication				
	1	2	3	4	
F0	17	18	16	16	16.75 a*
F1	18	17	18	17	17.50b
F2	19	18	18	19	18.50c
F3	19	19	18	19	18.75c

Table 3
Weight of dried flowers per tree

Treatment	Weight of dried flowers per tree (kg)				Everage
	Replication				
	1	2	3	4	
F0	6.0	5.90	6.10	6.21	6.10 a*
F1	6.25	6.10	6.05	6.30	6.18a
F2	7.0	7.0	7.10	7.0	7.03b
F3	7.9	7.9	7.70	7.70	7.80b

The use of synthetic fertilizers and pesticides continuously can damage the land, many decomposing microbes in the soil die so that the availability of nutrients is reduced. [Hartatik & Widowati \(2015\)](#), states that organic fertilizers contain microbes that can suppress pathogenic microbes in the soil so that plants avoid disease. [Suriani et al., \(2019\)](#), that organic fertilizer with biostater can increase the yield of Bali local dry rice. Likewise, the results of [Santi \(2006\)](#), show that compost fertilizer has a significant effect on tomato plant height. The number of cabbage leaves increased due to the use of liquid organic fertilizer R11 at a concentration of 2 ml / 0.5 L.% ([Nandissa et al., 2012](#)). The content of nutrients P and K in organic fertilizer stimulates flowering ([Hartatik & Widowati, 2015](#)). Anthurium flowers are brighter in color after the application of organic fertilizer with starter biotechnology ([Suriani et al., 2016](#)). Compost also has a significant effect on the growth of ornamental plants and can function as bioremediation ([Parwanayoni et al., 2015](#)). Various types of organic fertilizer tried on clove plants can increase the diameter of clove plants by 29.9% for 12 weeks ([Ratih & Ade, 2015](#)). Clove crop production is strongly influenced by several factors including how to cultivate such as fertilization ([Ireng, 2017](#)). [Yudi & Ridwan \(2016\)](#), that organic fertilizer responds to increasing clove plant height and increasing soil moisture.

Organic fertilizers are also effective in increasing P uptake and increasing soybean yields ([Supriyadi et al., 2016](#)). Organic fertilizer combined with 30% compost can increase the yield of red Balinese rice ([Suriani et al., 2019](#)).



Figure 1. Clove plant

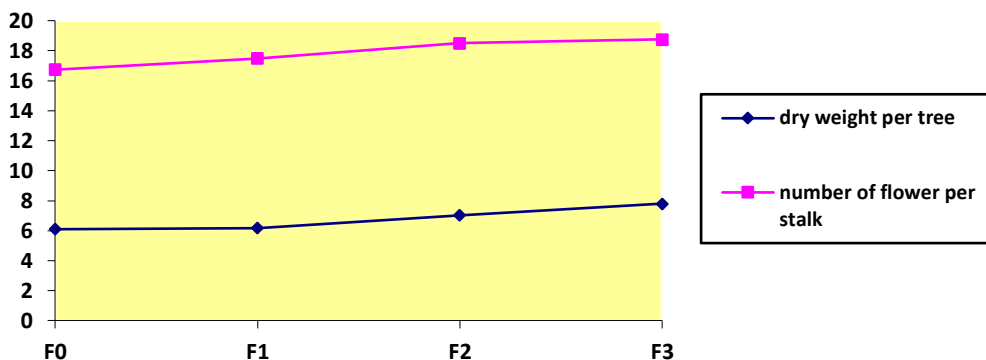


Figure 2. Clove production

Quality of Clove Flowers

Table 4 shows the colors in different treatments and controls, the green leaf control while the shiny green treatments. The application of compost organic fertilizer also significantly affected the treatment ($P < 0.05$). The higher the compost concentration, the higher the flower length and width. High nutrient P and k nutrients in the media affect the flowering of a plant. [Suriani et al., \(2019\)](#), that the use of nutrients can increase the size of hortensia flower diameter, and can brighten the color of the flower. Figure 3 shows the higher the compost concentration, the greater the flower size. Nutrients contained in compost are sources of nutrients for plants and can increase production.

Table 4
The Quality of clove

Treatment	Color of leaf	Flower length (cm)	Flower width (cm)
F0	Green	1.5 a*	0.7 a*
F1	Shiny green	1.55a	0.72a
F2	Shiny green	1.7b	0.79b
F3	Shiny green	1.99c	0.80b



Figure 3. Dry clove flowers from left to right F0, F1, F2, F4

Conclusion

The conclusion of this research is the biotechnology of the starter added when making organic fertilizer can improve the quality of fertilizers such as odor and texture to be better. Application of organic fertilizer to clove plants can improve the quality and production of cloves.

Acknowledgments

Thank you to LPPM UNUD and DIKTI as funders, and we thank the clove farmer group of Gitgit Village for providing land/gardens for the ongoing research.

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