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The Utilization of Various Types of Organic Fertilizer and Trichoderma on Increasing The Production and Quality of Chryshone Cut Flowers

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A B S T R A C T

Horticultural commodities, especially ornamental plants, have high economic value in th market. It is necessary to research the introduction of appropriate technology in increasin the intensity of chrysanthemum cultivation such as the use of domestically created organi fertilizers and Trichoderma, which are formulated with local resources in chrysanthemum to improve quality and added value and utilize the potential of agricultural resources that ar easy to apply following the ability of farmers and have a real impact on increasing incom The purpose of this research is to obtain a package of organic matter and Trichoderma tha is suitable for the agro-climate, thus farmers will be interested in adopting the technolog and developing it widely into their production system. The method used is field research i a greenhouse using a factorial randomized block design, with two factors that will be used t achieve the goal, namely the use of various types of organic fertilizers and the administratio of Trichoderma doses. If the single treatment has a significant or very significant effect, the continue with the 5% Least Significant Different (LSD) average value test, whereas if ther is an interaction between the two factors, it is tested with Duncan' t 5%. Based on the resul of the study, all types of organic fertilizers, namely organic cow manure, organic pig manur and organic goat manure combined with Trichoderma were able to suppress rust disease i chrysanthemums and increase the production and quality of chrysanthemums. Goat dun fertilizer and a dose of 5 tons-¹ ha of Trichoderma tended to produce flower stalk heigh flower stalk weight, stem diameter, flower diameter, economical flower fresh weight an resulted in the lowest percentage of leaves affected by rust disease.

1. INTRODUCTION

1.1. Research Background

Chrysanthemum (Dendranthema grandiflora, Tzvelev) or known as the Chrysanthemum flower, is a commodity that has a high enough economic value so that it has the potential to be developed commercially as a basic component in agribusiness, both as cut flowers, ornamental plants in pots, and medicinal plants [1]. Chrysanthemum is one of the leading floriculture products developed in several centers, especially to meet the domestic market. The use of chrysanthemums in each flower arrangement is very dominant, reaching 30-65%. This is quite prospective to continue to be developed in terms of quality, quantity, and development of the chrysanthemum business industry. Chrysanthemum cultivation, which was originally concentrated in Java, has now spread to Bali.

The production of chrysanthemums in Java and Bali has not been able to meet market needs because productivity is still low. The increase in production needs to be continuously increased either through extensification or intensification. Chrysanthemum cultivation in Bali is currently only concentrated in the districts of Buleleng and Tabanan, so it needs to be developed in other potential areas.[2]. All potential areas have been planted with ornamental plants, due to various considerations such as being far from the marketing center, not having adequate infrastructure, and limited knowledge of cultivation, harvesting, and post-harvest handling.[3]. Increased production through intensification is often encountered with problems including pests and diseases, spacing, setting soil moisture with mulch, determining the optimum dose of organic and inorganic fertilizers, and post-harvest (sorting, grading and packaging) and

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management of the production system. These cultivation factors are the cause of the low production and quality of chrysanthemums which affect the selling price of chrysanthemums as cut flowers [4]. Pests and diseases can cause a significant decrease in the quality and quantity of chrysanthemum production. The use of biological agents, one of which is Trichoderma, is a solution to control several diseases caused by fungi without damaging the surrounding environment [5]. The biodiversity of organic farming is higher than in conventional farming. In conventional agriculture which is more intensive using inorganic fertilizers and synthetic pesticides, Trichoderma is not found. In organic farming, Trichoderma growth is faster than in conventional farming [6].

In the in vitro antagonism test Trichoderma atroviride can inhibit the fungus Botryodiplodia theobromae with an inhibition percentage of 94.58% [7]. The intensity of rust disease on chrysanthemum flowers of 19.58% was still relatively low because the application of the biological agent Paenibacillus polymixa with an application time of 1 week after planting was able to suppress the pathogen Puccinia horiana Hen and reduce the number of infected leaves on chrysanthemums.[8]. The highest economic weight of fresh flowers and the lowest intensity of disease occurred in the treatment dose of Trichoderma sp 1.0 ton ha-1, namely 85.97 g and 25.19% [9]. Composting is an alternative way to convert large biomass and can be applied with Trichoderma sp. as a biological control agent [10]. This compost can be made from cow dung, pigs, goats, and others.

Based on the above, it is necessary to research to increase the production and quality of chrysanthemum flowers through the application of the biological agent Trichoderma combined with cow, pig, and goat manure compost. The results of this study can be used by farmers in supporting the production and quality of chrysanthemum flowers which at the same time will be able to increase farmers' income.

2. MATERIAL AND METHOD

2.1. Place and time of research

The research was conducted in Pancasari Village, Sukasada District, Buleleng Regency, with an altitude of 1,247 meters above sea level and an average temperature of 17°C to 20°C. This research will be carried out at partner locations.

2.2. Tools and materials

Research materials and tools include chrysanthemum seeds, inorganic and organic fertilizers (pig, cow, and goat manure), Trichoderma, caliper, electric scales, labels, pesticides, fungicides, PHP mulch, plant enforcement nets, lights, timers, and stakes.

2.3. Research design

The research method used a factorial randomized block design which was carried out in the field in a greenhouse, in this study used two factors, namely factor I is the type of organic matter and factor II is the dose of Trichoderma each consisting of three levels. The data obtained were analyzed by analysis of variance and continued with the LSD 5%..

Factor first is a kind of organic matter (P) that consists of 3 levels, namely organic cow manure (Ps), organic pig manure (Pb), and organic goat manure (Pk). Factor second is Trichoderma Dose (D) which consists of 3 levels, namely 5 tons ha-¹ (D1), 10 tons ha-¹ (D2), and 15 tons ha-¹ (D3). The combination treatment was repeated 3 times, so 27 experimental plots were needed. With a plot size of 1.5 x 1.5 m, the distance between the plots is 30 cm and the distance between replications is 50 cm, with the number of plant samples as many as 10 samples.

2.4. Research procedure

The research begins with a survey of partner locations to identify partner problems. The survey results showed that the attack of pests on chrysanthemum cultivation can have an impact on decreasing the quality and production of chrysanthemum cut flowers which usually also occurs from the soil. Control of pest and disease attacks on chrysanthemum plants uses chemical pesticides, if handling does not comply with integrated pest control rules, it often harms agricultural ecosystems and the environment. The application of integrated pest control carried out with farming norms ensures the health of the community, farmers, consumers, and environmental sustainability.

Implementation of the experiment includes preparation of planting media, fertilization, planting, treatment, plant maintenance (watering, replanting, weeding, pest, and disease control), observation of plant growth and development, and harvest and data analysis. The observed variables include; Number of infected plants, number of infected leaves, the intensity of attack, flower stalk length, flower stalk weight, flower diameter, and economic weight of fresh flowers per plant.

3. RESULTS AND DISCUSSION

3.1. Effect of Trichoderma Dosage and Types of Organic Fertilizers on Chrysanthemum Cut Flower Cultivation

Based on the variance of ANOVA, the Trichoderma dose treatment had a significant to a very significant effect on all variables, while the type of organic fertilizer treatment had a significant to a very significant effect on all variables except the percentage of leaves affected by rust disease. The interaction of Trichoderma dose and types of organic fertilizers had no significant effect on all variables. The significance of the results of the analysis of variance of the effect of Trichoderma Dosage and Types of Organic Fertilizers on Chrysanthemum Cut Flower Cultivation can be seen in Table 1.

3.2. Effect of Trichoderma dose and on all observed variables

The highest plant height is obtained in the treatment of Trichoderma 5 tons ha-¹ of 114.05 cm which was not significantly different from the treatment the dose of Trichoderma 10 tons ha-¹ of 112.34 cm and significantly different from the treatment dose of Trichoderma 15 tons ha-¹ of 110.75 cm. The highest plant height was obtained in the treatment of goat manure with a plant height of 116.75 cm which was significantly different from other treatments (Table 2).

The highest flower stalk weight was obtained in the treatment with a dose of Trichoderma 5 tons ha-¹ of 71.93 grams which is not significantly different from the treatment the dose of Trichoderma 10 tons ha-¹ of 68.53gram and significantly different from the treatment dose of Trichoderma 15 tons ha-¹ of 64.60

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grams. The highest flower stalk weight was obtained in the treatment of goat manure application at 78.73 grams which were significantly different from the other treatments (Table 2). The highest stem diameter was obtained in the treatment with a dose of Trichoderma 5 tons ha-¹ of 3.51 cm which is not significantly different from treatment the dose of Trichoderma 10 tons ha-¹ of 3.28 cm and significantly different from the treatment dose of Trichoderma 15 tons ha-¹ of 3.13 cm. Highest rod diameter obtained in the treatment of goat manure of 3.52 cm which was not significantly different from the treatment of cow manure of 3.48 cm but significantly different from the treatment of pig manure with a stem diameter of 2.92 cm (Table 2).

Table 1. Significance of the results of the analysis of variance of the effect of Trichoderma Dosage and Types of Organic Fertilizers on Chrysanthemum Cut Flower Cultivation

No	Variable	Treatment		
		Trichoderma (D) Dosage	Kinds of Organic Fertilizer (P)	DxP
1	Flower stalk height (cm)	**	**	ns
2	Flower stalk weight (g)	**	**	ns
3	Rod diameter(cm)	*	**	ns
4	Flower Diameter (cm)	**	**	ns
5	Economical flower fresh weight (g)	*	**	ns
6	Percentage of leaves affected by rust disease	**	ns	ns

Note: * = significant effect, ** = very significant effect, ns = not significant.

The highest flower diameter was obtained in the treatment of Trichoderma 5 tons-¹ ha of 6.78 cm which is not significantly different from treatment the dose of Trichoderma 10 tons ha-¹ of 6.61 cm and significantly different from the treatment dose of Trichoderma 15 tons ha-¹ of 6.00 cm. The highest rod diameter obtained in the treatment of goat manure of 7.40 cm which was not significantly different from the other treatments (Table 2). Based on the results of the study, the diameter of the chrysanthemum flowers was in the AA quality class and the A quality class with a flower diameter range of 5.61 cm-7.40 cm. Quality class AA has a kris flower diameter of >6 cm and quality class A has a flower diameter of 5-5.9 cm.

The highest flower stalk weight was obtained in the treatment with a dose of Trichoderma 5 tons ha-¹ of 67.72 gram which is not significantly different from treatment the dose of Trichoderma 10 tons ha-¹ of 63.06 gram and significantly different from the treatment dose of Trichoderma 15 tons-¹ ha of 57.77 grams. The highest flower stalk weight obtained in the treatment of goat manure administration of 76.22 grams which was not significantly different from other treatments (Table 2).

The highest percentage of leaves affected by rust disease was obtained in the treatment with a dose of Trichoderma 15 tons-¹ ha of 1.47% which is not significantly different from the treatment dose of Trichoderma 10 tons ha-¹ of 1.32% and significantly different from treatment dose of Trichoderma 5 tons ha-¹ of 1.24%. The treatment of giving the type of manure did not affect the percentage of leaves affected by rust disease.

Table 2. Average treatment effect of Trichoderma dose and on all observed variables

Treatment	Flower stalk height (cm)	Flower stalk weight (g)	Rod diameter(cm)	Flower Diameter (cm)	Flower stalk weight (g)	% of leaves affected by rust (%)
Trichoderma Dosage						
15 tons-¹ ha	110.75 b	64.60 b	3.13 b	6.00 b	57.77 b	1.47 b
10 tons-¹ ha	112.34 ab	68.53 ab	3.28 ab	6.61 a	63.06 ab	1.32 b
5 tons-¹ ha	114.05 a	71.93 a	3.52 a	6.78 a	67.72 a	1.24 a
LSD 5%	1.74	4.20	0.29	0.31	6.43	0.12
Kinds of Organic Fertilizer						
Pig manure	108.28 c	56.68 c	2.92 b	5.62 c	50.97 c	1.43 a
Cow manure	112.12 b	69.64 b	3.48 a	6.37 b	61.36 b	1.31 a
Goat manure	116.75 a	78.73 a	3.52 a	7.40 a	76.22 a	1.29 a
LSD 5%	1.74	4.20	0.29	0.31	6.43	0.12

Note: The numbers in the same column for each factor followed by the same letter are not significantly different in the 5% LSD test.

Various treatments of organic fertilizers had a significant to a very significant effect on all variables except the percentage of leaves that were attacked by rust disease. Organic fertilizers applied to the soil will increase the chemical, physical and biological fertility of the soil. If different kinds of organic fertilizers are applied, such as pig manure (PK), cow manure, and goat manure, they will contribute different amounts of soil nutrients. This is due to the different nutrient content in these types of organic fertilizers [11]. Based on the research results, goat manure gave the highest plant height, flower stalk weight, stem diameter, flower diameter, and flower stalk weight. This research is following Ref. [12] that the application of goat manure can increase the rate of growth and crop yields. Ref. [13], soil that is given goat manure becomes fertile soil so that it can facilitate the development of plant roots properly. If the roots can absorb the nutrients available in the soil easily then the growth

and development of plants can be optimal. According to Ref. [14], goat manure contains higher potassium than other manure such as cow manure or chicken manure, while nitrogen and phosphorus nutrient levels are almost the same as other manure. Potassium plays a role in enzyme activity in carbohydrate and protein synthesis and increases photosynthetic translocation from leaves to all parts of the plant. Goat manure contains high N nutrients. According to Haryanto [15], High N nutrients can stimulate leaf growth, because nitrogen is a nutrient that forms amino acids and proteins for leaf formation. The role of the element N is to stimulate growth, especially in stems, branches, and leaves.

Dosage of Trichoderma had a significant to a very significant effect on all observed variables. In the percentage of leaves affected by rust at a dose of 5 tons ha-¹, the lowest rust disease was seen at 1.24% which was significantly different from other treatments. At the dose of Trichoderma 5 ton-¹ ha, the highest plant height, flower stalk weight, stem diameter, flower diameter, and flower stalk weight were compared to other treatments. A lower percentage of leaves affected by the disease certainly results in more optimal growth and quality of chrysanthemums. Ref. [16] stated the application of Trichoderma sp. on chrysanthemum plants showed good or effective results. Damage to plants by pests and diseases in an area cannot be considered pests and diseases if the amount can still be controlled by natural enemies. The damage caused economically is not so significant. The economic threshold of pests and diseases is a certain number of plant-disturbing populations that are sufficient to damage crops and can be economically detrimental [17].

Figure 1. Research Photo Documentation

4. CONCLUSION

This study concludes that all types of organic fertilizers, namely organic cow manure, organic pig manure, and organic goat manure combined with Trichoderma can suppress rust disease in chrysanthemums and can increase the production and quality of chrysanthemums. Goat dung fertilizer and a dose of 5 tons-¹ ha of Trichoderma tended to produce flower stalk height, flower stalk weight, stem diameter, flower diameter, economical flower fresh weight and resulted in the lowest percentage of leaves affected by rust disease.

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