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Application Various Sources of Organic Matter in the Cultivation of Chrysanthemum Plants as Cut Flowers

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A B S T R A C T

To enhance the intensity of chrysanthemum cultivation across different regions, further investigation is required regarding implementing suitable technology. This technology should be developed using local resources specific to chrysanthemum flowers to enhance their quality and value. Additionally, it should leverage readily applicable resources that align with farmers' capabilities, ultimately leading to a substantial increase in income. This study aims to acquire diverse organic materials suitable for chrysanthemum production in specific locations to examine the impact of different dosages on enhancing quality outcomes. The research methodology employed in this study is a Nested Experiments approach with a Random Design of Factorial Groups. Three types of organic sources are commonly utilized, namely: 1. organic matter derived from rasamala leaf litter (S), and 2. Chrysanthemum harvest residue (P). The study focuses on the effects of Chrysanthemums (P) and hydroponic media residue (H) on different types of organic matter with varying doses. The doses are nested within the different sources of organic matter. The findings indicated that the application of different sources of organic matter did not have statistically significant effects on the investigated variables, except the blossom diameter (cm), which exhibited a significant impact. The impact of different doses on the organic matter of various types of leaf litter had a notable influence on all observed variables. Specifically, a dose of 15 tons ha-1 resulted in the highest yield of economic flowers, with a fresh weight of 89.93 g. This represented a 17.01% increase compared to the lowest yield observed at a dose of 5 tons ha-1, which yielded 74.63 g. The relationship between different doses of organic matter remaining from chrysanthemum harvest and various observed variables was statistically significant. Specifically, a dose of 6 tons ha-1 resulted in the highest fresh weight yield of economically valuable flowers, measuring 94.89 g. This yield was 19.89% higher than the lowest yield observed with a dose of 2 tons ha-1, which measured 76.02 g. The impact of different doses on various types of organic matter in hydroponic media does not substantially influence all observable variables except for blossom diameter, which demonstrates a notable effect.

1. INTRODUCTION

1.1. Research Background

The production of chrysanthemums in Java and Bali has not been able to meet market needs because productivity is still low. Increased production needs to be continuously increased both through extensification and intensification. Chrysanthemum planting in Bali until now has only been concentrated in the Buleleng and Tabanan areas so it needs to be developed in other potential areas. Not all potential areas have been planted with ornamental plants, due to various considerations such as its location far from the marketing center, lack of adequate infrastructure, limited knowledge of cultivation, harvesting, and post-harvest handling. Increasing production through intensification often encounters problems, including the provision of planting material (cuttings), spacing arrangements, regulating soil moisture with mulch, determining the appropriate types of organic fertilizer sources and optimal doses, pre-and post-harvest (sorting, grading, and packaging) and managing production systems. These cultivation factors are the cause of low production and quality of chrysanthemums which affect the selling price of chrysanthemums as cut flowers [1]. During the process of growth and development, plants are affected and stressed by various environmental factors, such as high temperatures (low), strong light (weak), drought (floods), high salt content, heavy metals, and pathogenic bacteria (or viruses)[2].

Chrysanthemum 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 [3]. Chrysanthemum morifolium is one of the four major cut flowers in the world and has important ornamental and economic value. The fragrance of flowers is an important ornamental character of chrysanthemums, especially for tea and edible chrysanthemums, and their excellent fragrance determines their commercial value. Today, chrysanthemums are widely used as fragrances and medicines [4].

The rapid development of tourism also has an impact on the variety of horticultural products needed to meet the demands of a quality market and the continuity of guaranteed products, related to Bali is a tourism area so the potential of the chrysanthemum market is very promising for individual consumers such as: florist, wedding events and holidays. As well as institutional consumers (hotels, banks government offices, and private). Thus, the development of ornamental plants is directed to refer to market needs, as well as comparative benefits and economic value. In addition, its development is in accordance with the potential of resources, agro-climatic conditions, agroecosystems of an area, supporting facilities and infrastructure, and market prospects.

The main obstacle in the cultivation of chrysanthemums in new centers is limited knowledge of cultivation technology (preharvest and post-harvest). Therefore, efforts to introduce cultivation technology need to be made so that farmers are interested in adopting the technology and developing it into the chrysanthemum cultivation production system.

1.2. Literature Review

Various sources of organic fertilizer can come from animal manure, plant material, and waste. Plant material can come from the fall leaves of forest plants, plant waste in the form of rice straw, harvest residues of chrysanthemum plants, corn stalks, and others, as well as hydroponic cultivation waste such as husk charcoal and cocopeats. Soil fed with organic fertilizer has a greater water-binding ability than soil with low organic matter content [5][6]. Organic fertilizer is the best and most natural soil improvement material than artificial soil improvement materials. Organic matter is needed in addition to improving the physical structure of the rhizosphere, it can also provide additional microelements for plants [7] [8]. Good media also plays a role in stimulating root growth, easily holding nutrients and easily releasing them to be absorbed by plant roots [9].

The results showed that the decomposition of teak leaf litter and the release of its chemical composition and nutrients can fertilize the soil in dry tropical deciduous forest areas with the content of higher element N is about 1.02-1.36% [10]. Compost results of chrysanthemum cut flower waste The advantages of this compost are that it is environmentally friendly, can increase income, and can increase soil fertility by repairing physical damage to the soil due to excessive use of inorganic (chemical) fertilizers. In addition, compost can also be used to increase the carrying capacity of the environment, increase crop production, increase farmers' income, and reduce pollution to the environment [11]. Various studies that have been carried out show the application of biochar has real agronomic benefits [12] [13]. In general, organic fertilizers contain low macronutrients but contain sufficient amounts of micronutrients that are needed for plant growth. Nitrogen and other nutrients are released by organic fertilizers slowly through the mineralization process. Thus, if given on an ongoing basis, it will help a lot in building soil fertility.

Based on the above, the following problems can be formulated: 1). How does the influence of various sources of organic matter on the growth and yield of chrysanthemum plants? 2). Can the dose of organic matter increase the yield of chrysanthemum plants as cut flowers?

1.3. Objective

The purpose of the study was to determine the effect of the application of various sources of organic matter and doses in sources of various organic materials on the growth and yield of chrysanthemum plants as cut flowers. The urgency of this research is that in the introduction of new businesses, especially chrysanthemums in Bali, more persistence and patience are needed so that increased production, productivity, and quality of chrysanthemum products can be realized, it is necessary to carry out strategies so that obstacles and problems in the cultivation of chrysanthemum plants that often occur in the development of new commodities to farmers can be minimized so that improving the welfare of farmers through the development of chrysanthemum farming can be realized. The application of cultivation technology findings is expected to have a real impact on increasing the income or welfare of local farmers so that farmers will be interested in adopting the technology and developing it into the production system on their farms

2. MATERIALS AND METHODS

The method used is an experiment in the field in a greenhouse using a Nested Experiment with Random Design Factorial pattern groups, namely: the type of organic material source (M) used consists of 3 types, namely: 1. From Rasamala Leaf Litter (S), 2. Waste Harvest residues of Chrysanthemum Plants (P) and 3. Hydroponic Media Waste (H), and each type of organic matter with certain doses. Where the dose is nested in various sources of organic matter. The treatments tried: Rasamala Leaf Litter (S) with doses: 5 tons ha^{-1}, 10 tons $ha^{-1,}$ and 15 tons ha^{-1}, Chrysanthemum Harvest Residues (P) with doses of 2 tons ha^{-1}, 4 tons $ha^{-1,}$ and 6 tons ha^{-1}, Remaining Hydroponic Media (H) with doses of 150 kg ha-1, 300 kg ha-1 and 450 kg ha^{-1}.

The materials used in the study include Gompi variety chrysanthemum seeds, inorganic fertilizers and rasamala leaf litter, chrysanthemum crop residues, hydroponic planting media (husk charcoal), pesticides, and fungicides. The implementation of experiments includes preparation of planting media, fertilization, provision of treatment, planting, plant maintenance (watering, diving, weeding, pest and disease control), observation of plant growth and development, and harvesting.

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Figure 1. Organic fertilizer from rasamala leaf litter source (a), chrysanthemum harvest residue (b), and hydroponic media residue (c)

Figure 2. Observation of flower stalk length, flower diameter, economical fresh weight of flowers, and post-harvest

The variable observed was the length of the flower stalk (cm). Measurement before harvest, by measuring the length of the flower stalk from ground level to the tip of the highest flower. Measured from the base of the stem to the tip of the highest flower. Flower stalk weight (g), Measured by weighing all plant samples with electric scales at harvest time. Trunk diameter (cm). By measuring the diameter of the stem with a caliper before harvest, by measuring the stem of the plant between the maximum height. Flower diameter (cm). Measured using calipers of flowers that have been in full bloom on each floret. Economical fresh weight of flowers (g). Measured by weighing the fresh weight of economical flowers along 80 cm after harvest with electric scales.

Figure 3. Observation of flower stalk length, flower diameter, economical fresh weight of flowers, and post-harvest

Observational data were analyzed using variance analysis if the treatment had a real or very real effect followed by the smallest real difference test at the level of 5%[14] [15].

3. RESULT AND DISCUSSION

The significance of the application of organic matter sources and the interdose effect on each type of organic matter source on all observed variables are presented in Table 1.

Table 1. The significance of the results of the analysis of variance of application of various sources of organic matter in the cultivation of plants as cut flowers on all variables observed in chrysanthemum plants

Variable	Various sources of organic matter	Effects between doses		
		Rasamala leaf litter	Chrysanthemum harvest residue	Hydroponic media residue
Flower stalk length (cm)	Not significant	Significant	Very Significant	Not significant
Flower stalk weight (g)	Not significant	Significant	Significant	Not significant
Chrysanthemum stem diameter (cm)	Not significant	Significant	Significant	Not significant
Flower diameter (cm)	Significant	Significant	Significant	Significant

The results of statistical analysis showed that the influence of various sources of organic matter had an intangible effect ($P<0.05$) on all variables observed except for the diameter of the flower (cm) had a real effect ($P>0.05$). Various sources of organic matter as organic fertilizers play a role in improving the physical properties of the soil, it turns out that the provision to Andisol soil is not so significant. This is because Andisol soil has quite good soil physical properties [16]. This opinion is reinforced that the role of organic matter does not apply significantly to soils that interact well [17]. The highest average value of flower diameter is found in the source of organic matter left over from chrysanthemum harvest by 8.78 cm and the lowest in the remaining hydroponic media by 6.81 cm Table 3.

The effect between sources of organic matter and between doses on each type of organic material source on the average of all variables observed is presented in Tables 2 and 3.

The effect between doses on each type of leaf litter organic matter had a significant effect ($P>0.05$) on all variables observed in Table 1. The dose of 15 tons ha^{-1} gave the highest yield at the fresh weight of economic interest which was 89.93 g and there was an increase in yield of 17.01% when compared to the lowest yield at a dose of 5 tons ha-1 of 74.63 g . There is a significant effect on all variables inseparable from the content of N-total (1.26%), P-available (679.32 ppm), and K-available (568.18 ppm) leaf litter is very high [18]. Thus plants get adequate nutritional intake to support the process of plant growth and development.

Figure 4. The effect of plant growth between doses on each kind of leaf litter organic matter (S), chrysanthemum harvest residues (P), and hydroponic media residues (H)

The effect between doses on each type of organic matter left over from chrysanthemum harvest has a real ($P>0.05$) to very real ($P>0.01$) effect on all variables observed in Table 1. The dose of 6 tons ha-1 gave the highest yield at the fresh weight of economical flowers of 94.89 g and there was an increase in yield of 19.89% when compared to the lowest yield at a dose of 2 tons ha-1 of 76.02 g. Plant growth and development due to the treatment of chrysanthemum plant residues are able to give a real response to chrysanthemum plants because chrysanthemum leaf extract contains elements such as N, P, K, Mg, Ca with N content of 1.421%, P of 0.2262%, K of 4.819%, Mg of 0.1883%, and Ca of 0.419% [19]. Nitrogen is important in the formation of chlorophyll, protoplasm, proteins, and nucleic acids. This element has an important role in the growth and development of all living tissues [20]. Phosphorus is an important component of compounds for energy transfer (ATP and other nucleoproteins), genetic information systems (DNA and RNA), cell membranes (phospholipids), and phosphoproteins [21]. While potassium balances the contents of anions and affects the uptake and transport of anions, potassium can also reduce the outbreak of certain diseases. The role of calcium is as a binding between phospholipid molecules or between phospholipids and membrane proteins, causing membranes to function normally in all cells. Calcium can also spur the activity of some enzymes, as well as inhibit enzyme activity [22].

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Table. 2. The effect between sources of organic matter and between doses on each type of organic matter source on the average length of flower stalks (cm), the weight of flower stalks (g), and stem diameter (cm)

Influence between various sources of organic material			
Traetment	Flower stalk length (cm)	Flower stalk weight (g)	Stem Diameter (cm)
Rasamala Leaf litter (S)	128.38 a	98.81 a	1.95 a
Chrysanthemum harvest residue (P)	136.60 a	100.93 a	2.26 a
Remaining hydroponic media (H)	121.10 a	91.00 a	1.91 a
LSD 5%	**ns**	ns	ns
The effect of dosage on each type of organic material source			
Rasamala leaf litter (S)			
5 ton ha^{-1}	122.33 c	91.60c	1.42 b
10 ton ha^{-1}	127.50 b	98.67 b	2.10 a
15 ton ha^{-1}	135.30 a	106.17 a	2.31 a
Chrysan harvest residue (P)			
2 ton ha^{-1}	128.17 c	92.20 c	1.73 b
4 ton ha^{-1}	136.20 b	101.48 b	2.50 a
6 ton ha^{-1}	145.43 a	109.10 a	2.55 a
Hydroponic media Residue (H)			
150 kg ha^{-1}	118.10 a	87.23 a	1.53 a
300 kg ha^{-1}	118.40 a	92.93 a	2.00 a
450 kg ha^{-1}	126.80 a	92.83 a	2.21 a
LSD 5%	4.98	6.57	0.34

Table 3. The effect between sources of organic matter and between doses of each type of organic material source on the average flower diameter (cm) and economical fresh weight of flowers (g)

Influence between different sources of organic matter		
Treatment	Flower Diameter (cm)	Fresh Weight of Flower (g)
Rasamala Leaf litter (S)	7.48 ab	82.05 a
Chrysanthemum harvest residue (P)	8.78 a	85.69 a
Remaining hydroponic media (H)	6.81 b	80.95 a
LSD 5%	1.49	ns
The effect of dosage on each type of organic material source		
Rasamala leaf litter (S)		
5 ton ha^{-1}	6.63 b	74.63 c
10 ton ha^{-1}	7.70 a	81.58 b
15 ton ha^{-1}	8.10 a	89.93 a
Chrysan harvest residue (P)		
2 ton ha^{-1}	8.17 b	76.02 c
4 ton ha^{-1}	8.53 b	86.15 b
6 ton ha^{-1}	9.63 a	94.89 a
Hydroponic media residue (H)		
150 kg ha^{-1}	6.23 b	75.19 a
300 kg ha^{-1}	6.57 b	83.00 a
450 kg ha^{-1}	7.62 a	84.65 a
LSD 5%	0.65	6.43

While the effect between doses on each type of organic matter remaining hydroponic media has an intangible influence (P<0.05) on all variables observed except for the variable diameter of interest has a real effect (P<0.05) Table 1. The dose of 450 kg ha-1 gave the highest result in flower diameter of 7.62 cm and was significantly different from the dose of 150 kg ha-1 and 300 kg ha-1 Table 3. There is an unreal influence on the rest of the hydroponic media because the media material comes from husk charcoal which has difficult weathering, so it requires a long time in the weathering process, causing the nutrients released to be unavailable to plants for the growth of vegetative and generative organs. Rice husk biochar has an organic C- content of 30.76%, so biochar has a long residence time in the soil [23].

The effect between doses on each type of organic matter left over from chrysanthemum harvest has a real (P>0.05) to very real (P>0.01) effect on all variables observed in Table 1. The dose of 6 tons ha-1 gave the highest yield at the fresh weight of economical flowers of 94.89 g and there was an increase in yield of 19.89% when compared to the lowest yield at a dose of 2 tons ha-1 of 76.02 g. Plant growth and development due to the treatment of chrysanthemum plant residues are able to give a real response to chrysanthemum plants because chrysanthemum leaf extract contains elements such as N, P, K, Mg, Ca with N content of 1.421%, P of 0.2262%, K of 4.819%, Mg of 0.1883%, and Ca of 0.419% [19]. Nitrogen is important in the formation of chlorophyll, protoplasm, proteins, and nucleic acids. This element has an important role in the growth and development of all living tissues [20]. Phosphorus is an important component of compounds for energy transfer (ATP and other nucleoproteins), for genetic information systems (DNA and RNA), for cell membranes (phospholipids), and phosphoproteins [21]. While potassium balances the contents of anions and affects the uptake and transport of anions, potassium can also reduce the outbreak of certain diseases. The role of calcium is as a binding between phospholipid molecules or between phospholipids and membrane proteins, causing membranes to function normally in all cells. Calcium can also spur the activity of some enzymes, as well as inhibit enzyme activity [22] .

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4. CONCLUSION

The results of the study can be concluded as follows: The effect of application of various sources of organic matter has an intangible influence (P<0.05) on all variables observed except for the diameter of the flower (cm) has a real effect (P>0.05). The effect between doses on each type of leaf litter organic matter had a noticeable effect (P>0.05) on all observed variables, a dose of 15 tons ha-1 gave the highest yield on the fresh weight of economical interest of 89.93 g and their was an increase in yield of 17.01% when compared to the lowest yield at a dose of 5 tons ha-1 of 74.63 g. The effect between doses on each type of organic matter left over from chrysanthemum harvest had a real effect (P>0.05) to very real (P>0.01) on the observed variables, the dose of 6 tons ha-1 gave the highest yield at the fresh weight of economic interest of 94.89 g and there was an increase in yield of 19.89% when compared to the lowest yield at a dose of 2 tons ha-1 of 76.02 g. The effect between doses on each type of organic matter remaining hydroponic media had an intangible effect (P<0.05) on all variables observed except for the diameter of the flower with a real effect (P<0.05).

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