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Application of Defoliated Chrysanthemum Leaves and Combination of Organic Fertilizer to the Yield and Quality of Chrysanthemum Flowers

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A B S T R A C T

The market value of horticultural products, particularly ornamental plants, is quite high. It is necessary to conduct research on the introduction of appropriate technology for increasing the intensity of chrysanthemum cultivation, such as the use of chrysanthemum leaf messenger and a combination of manure, which is formulated with local resources in chrysanthemum flowers to improve quality and add value and utilize the potential of agricultural resources that are easy to apply based on the capacity of farmers and have a real impact on increasing income. This study's objective was to determine the optimal concentration of chrysanthemum leaves and the optimal combination of manure for enhancing the production and quality of chrysanthemums. Using a Factorial Randomized Block Design, field research is conducted in a greenhouse using two factors: the dosage of defoliated chrysanthemum leaves and a mixture of manure. The obtained data were statistically analyzed using the ANOVA test. If the effect of a single treatment is genuine or very real, the average value test is continued. Least significant difference (LSD) is 5%, whereas Duncan's 5% indicates an interaction between the two factors tested. The treatment of defoliated leaves had a real to very real effect on all variables, with the exception of stem diameter, whereas the combination treatment of organic fertilizers had a real to very real effect on all variables. The interaction between the quantity of defoliated leaves and the combination of organic fertilizer has no significant effect on all variables. The administration of a dose of 5 tons/ha and the combined use of goat manure and pig manure increased the length of the flower stalk, the weight of the flower stalk, the diameter of the stem, the diameter of the flower, the fresh weight of the most cost-effective flowers, and the proportion of leaves infected with rust. According to SNI 01-4478-88, the chrysanthemums produced in this investigation are of quality class A.

1. INTRODUCTION

1.1 Research Background

Although chrysanthemum plants are not indigenous to Indonesia, they have been known in this country for decades and are a staple product in the horticultural sector, which has quite promising market prospects. The flower, known as one of the "Kings of cut flowers", is gaining more and more fans. Shapes, types, and colors are diverse and so beautiful, increasingly making domestic and foreign demand increase from year to year [1]. The increasing demand for ornamental plants parallels the rising community standard of living and prosperity. There is an increase in market demand, particularly for chrysanthemum plants, which has a favourable effect on farmers, namely the creation of new business opportunities. This situation has arisen in recent years as a result of the pervasive small- and large-scale cultivation of chrysanthemums. In addition, the elevational range of chrysanthemum plants is expanding from 600 to 1,200 metres above sea level [2].

The quality of chrysanthemums and other cut flowers is a major factor that determines consumer preferences, although there are other factors such as differences in taste and trends. One of the obstacles that determine the quality of cut flowers is damage to leaves and/or flowers both physical and biotic. According to Ref. [3] the presence of rust attacks, thrips or spots on chrysanthemum leaves/flowers reduce their freshness, until the phase-of life is only 5 days, whereas, for healthy flowers without defects, the phase of life can reach 12 days.

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 is currently only concentrated in Buleleng and Tabanan districts so it needs to be developed in other potential areas [4]. 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, and limited knowledge of cultivation, harvesting, and post-harvest handling [5]. Increasing production through intensification often encounters problems, including pest and disease attacks, spacing planting, regulating soil moisture by mulch, determining the optimum dose of organic and inorganic fertilizers, 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 [6].

One of the special maintenance carried out in the cultivation of chrysanthemums is the defoliation of the leaves, which aims to reduce leaf damage both physically and biotically. The results of defoliated leaves will produce enough leaf residue so that it has the potential to be used as organic fertilizer. The use of chrysanthemum leaves as organic fertilizer can reduce environmental pollution due to chrysanthemum leaf waste. In addition, chrysanthemum leaves contain several macro and microelements that are good for the growth of chrysanthemum plants. Ref. [7] reported chrysanthemum leaf extract contains elements N, P, K, Mg, and Ca with N content of 1.421%, P of 0.2262%, K of 4.819%, Mg of 0.1883%, and Ca of 0.419%.

Planting media is a growing place for plants that provide nutrients for plant growth, either from the planting media itself or deliberately added to the planting media. The planting media that plants like is loose textured media, loose media facilitates the development of plant roots. Loose textured planting media is usually a medium derived from organic materials such as compost, humus, or manure. The use of manure is one of the priorities in the development of cut chrysanthemum cultivation systems, where the application of organic fertilizers as well as can act as soil improvement materials. Ref. [8], states that the application of organic fertilizers to cultivated plants can increase soil productivity and improve the chemical, physical and biological properties of the soil.

Manure that can be used as a mixture of planting media chrysanthemums between goat manure, pig dung, and cow dung. Fertilizer from the manure of these types of animals has a fairly good nutrient content. However, these three types of fertilizers have different nutrient content. The difference in nutrient content in this type of manure causes each manure to have advantages and disadvantages, so it is necessary to research the combination of the use of these three types of manure to produce optimal plant growth. The nutrients found in cow manure are N 2.33%, P2O5 0.61%, K_2O 1.58%, Ca 1.04%, Mg 0.33%, Mn 179 ppm, and Zn 70.5 ppm. In pig manure the nutrients are N 3.21%, P2O5 3.21%, K_2O 1.57%, Ca 1.57%, Mg 1.44%, Mn 250 ppm, and Zn 315 ppm [9]. Nutrients in goat manure N 2.10%, P2O5 0.66%, K2O 1.97%, Ca 1.64%, Mg 0.60%, Mn 233 ppm and Zn 90.8 ppm [10].

Based on the foregoing, it is necessary to research increasing the production and quality of chrysanthemum flowers through the application of the dose of chrysanthemum flower leaves and the combination treatment of cow, pig, and goat dung fertilizers. The results of this research can be used by farmers in supporting the production and quality of chrysanthemum flowers which will also increase farmers' income.

2. MATERIALS AND METHODS

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.

2.1 Research Materials and Tools

Chrysanthemum seeds, inorganic and organic fertilizers (pig, cow, and goat manure), chrysanthemum defoliated leaf, calipers, electric scales, labels, pesticides, fungicides, PHP mulch, plant enforcement nets, lamps, timers, and pegs.

2.2 Research Methodology

The research method uses a Factorial Randomized Block Design conducted in the field of the greenhouse, this study uses two factors, namely factor I is a combination of organic fertilizer and factor II is the dose of chrysanthemum leaves, each consisting of three levels. The production data obtained were analyzed by Variant analysis and continued with the test The least significant difference (LSD) or Duncan 5%, while the quality data of chrysanthemum flowers were compared with SNI 01-4478- 1988.

Factor I, a Combination of Organic Fertilizer (P) with a dose of 5 tons/ha consists of 3 levels, namely:

P1 = Organic Fertilizer Goat Manure + Pig Manure
P2 = Organic Fertilizer Goat Manure + Cow Manure
P3 = Organic Fertilizer Pig Manure + Cow Manure

Factor II, Dose of Defoliated Chrysanthemum Leaves (D) consists of 3 levels, namely:

D1= 1 ton-¹ ha
D2= 3 ton-¹ ha
D3= 5 ton-¹ ha

The combination treatment was repeated 3 times, so 27 trial plots were required. With a plot size of 1.5 x 1.5 m, the distance between plots is 30 cm and the distance between repetitions is 50 cm, with a total of 10 plant samples.

2.3 Research Implementation

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

3. RESULT AND DISCUSSION

Based on the ANOVA, defoliated leaves dose treatment has a real to very real effect on all variables except stem diameter, while organic fertilizer combination treatment has a real to very real effect on all variables. The interaction of defoliated leaves dose and organic fertilizer combination has no real effect on all variables. The significance of the results of the variance analysis of the effect of defoliated leaves dose and organic fertilizer combination on Chrysanthemum Cut Flower Cultivation can be seen in Table 1.

Table 1. Analysis of variance of the effect of defoliated leaves dose and combination of organic fertilizers on Chrysanthemum Cut Flower Cultivation

No	Variable	Treatment		
		Dosage (D)	Fertilizer (bs, Ks, Kp) (P)	Dosage x Fertilizer, bs, ks, Kp (DP)
1	The length of the flower stalk (cm)	**	*	ns
2	The weight of the flower stalk (g)	**	*	ns
3	Diameter of the stem (cm)	Ns	**	ns
4	Diameter of flower (cm)	**	**	ns
5	the economical fresh weight (g)	*	*	ns
6	Percentage of leaves attacked by leaf rust desease	*	**	ns

The length of the flower stalk, the weight of the flower stalk, the diameter of the stem, the diameter of the flower, the economical fresh weight and the percentage of leaves attacked by leaf rust desease in chrysanthemums due to the treatment of the dose of defoliated leaved and the combination of fertilizers can be seen in Table 2 and Table 3.

Table 2. The average value of Flower stalk length, flower stalk weight, and stem diameter in Chrysanthemum

Treatment	Flower stalk length, (cm)		flower stalk weight (g)		Stem diameter (cm)	
D1	120.32	B	120.32	b	1.06	a
D2	123.19	Ab	123.37	a	1.14	a
D3	125.94	a	125.94	a	1.39	a
LSD 0.05	3.09		3.00		0.29	
Pbs	121.04	b	121.04	b	0.84	c
Pks	122.88	ab	122.88	ab	1.18	b
Pkb	125.53	a	125.71	a	1.57	a
LSD 005	3.09		3.00		0.29	

Remarks: The average value followed by the same letter in the same column shows no real difference in the 5% LSD test

The highest flower stalk length was obtained in the treatment of giving a 5 ton/ha defoliated leaves dose of 125.94 cm which was not real from the administration of a 3 ton/ha Defoliated Leaves dose with a stalk length of 123.19 cm and was significantly different from the dosing of 1 ton/ha with a stalk length of 120.32 cm. Giving Defoliated Leaves with higher doses increases the length of flower stalks because Defoliation is one of the organic fertilizers that contain many important nutrients needed by the body. The leaves of chrysanthemum flowers contain nitrogen, phosphorus, potassium and microorganisms. Nitrogen is an essential nutrient needed by plants for optimal growth and development. Organic fertilizer from the leaves of chrysanthemum flowers contains enough nitrogen to meet the needs of plants. Phosphorus is also an essential nutrient needed by plants for root growth and flower formation. Organic fertilizer from the leaves of chrysanthemum flowers contains enough phosphorus to meet the needs of plants. Potassium is an essential nutrient needed by plants to increase resistance to environmental stress and disease. Organic fertilizer from chrysanthemum leaves contains enough potassium to meet the needs of plants [11]. In addition to macronutrients, organic fertilizer from chrysanthemum leaves also contains microorganisms that are beneficial for improving soil fertility and plant health[12].

The highest flower stalk length of 125.53 cm differs is not real from the treatment of a combination of goat manure and cow manure with a stalk length of 122.88 cm but differs markedly from the treatment of a combination of pig manure and cow manure with a stalk length of 121.04 cm. Chrysanthemum plants given a combination of goat manure provide a higher stalk length because goat manure is an organic fertilizer that contains N 0.97%, P 0.69%, and K 1.66% where the nutrient content can improve the physical, chemical, and biological properties of the soil [13]. Then Semekto (2006) [14] added that in addition to having macro elements, manure also has microelements such as Ca 1.64%, Mg 0.60%, Mn 233 ppm, and Zn 90.8 ppm. The length of chrysanthemum flower stalks produced in this study in all treatments is categorized as AA quality class because it has a length of more than 76 following SNI 01-4478- 1988.

The highest flower stalk weight was obtained in the treatment of applying a 5 ton/ha defoliated leaves of 125.94 g which was not real from the administration of a 3 ton / ha defoliated leaves with a stalk weight of 123.37 g and significantly different from the dosing of 1 ton / ha with a stalk weight of 120.32 g. The weight of the flower stalk is directly proportional to the length of the flower stalk, where the longer the flower stalk results in a greater weight of the flower stalk. The combination treatment of goat manure and pig manure resulted in the highest flower stalk weight of 125.71 g which was not real from the treatment of a combination of goat manure and cow manure with a stalk weight of 122.88 g, but significantly different from the treatment of a combination of pig manure and cow manure with a stalk weight of 121.04 g. Goat manure application results in a higher flower stalk length resulting in a greater flower stalk weight.

Defoliated leaves dose treatment does not affect the diameter of the stem of chrysanthemums. The diameter of chrysanthemum flower stems at the treatment of 1 ton/ha, 3 ton/ha and 5 ton/ha

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respectively was 1.39 cm, 1.13 cm and 1.06 cm which was statistically not significantly different. The combination treatment of goat manure and pig manure produced the highest flower stem diameter of 1.57 cm, which was not real from the treatment of a combination of goat manure and cow manure with a trunk diameter of 1.18 cm, but significantly different from the treatment of a combination of pig manure and cow manure with a stalk weight of 0.84 cm. Some studies show that the application of organic fertilizers including goat and cow manure can improve the growth and quality of chrysanthemum flowers, including the diameter of the stem [11][15]. The diameter of the rod in this study ranged from 0.84-1.57 cm which was in quality class C according to SNI 01-4478- 1988.

Table 3. The average value of flower diameter, economical fresh weight, and percentage of leaves infected by leaf rust disease in chrysanthemums

Treatment	The Flower Diameter (cm)		Economical Fresh Weight (g)		Percentage of leaves infected by leaf rust desease	
D1	7.07	b	86.28	B	0.30	a
D2	7.97	a	86.84	B	0.25	ab
D3	8.28	a	95.12	A	0.18	b
BNT 0.05	0.67		7.57		7.57	
Pbs	7.18	b	84.77	B	0.34	a
Pks	7.83	ab	88.28	Ab	0.26	a
Pkb	8.30	a	95.21	A	0.14	b
BNT 0.05	0.67		7.57		7.57	

The highest flower diameter was obtained in the treatment of giving a 5 ton/ha defoliated leaves dose of 8.30 cm which was not real with the administration of a 3 ton / ha defoliated leaves dose with a flower diameter of 7.97 cm and significantly different from giving a dose of 1 ton / ha with a flower diameter of 7.07 cm. The combination treatment of goat manure and pig manure resulted in the highest flower diameter of 8.30 cm, which was not real from the treatment of a combination of goat manure and cow manure with a flower diameter of 7.83 cm, but significantly different from the treatment of a combination of pig manure and cow manure with a flower diameter of 7.18 cm. The highest flower diameter was obtained in the treatment of giving a 5 ton / ha r defoliated leaves dose of 8.30 cm which was not real with the administration of a 3 ton / ha defoliated leaves dose with a flower diameter of 7.97 cm and significantly different from giving a dose of 1 ton / ha with a flower diameter of 7.07 cm. The combination treatment of goat manure and pig manure resulted in the highest flower diameter of 8.30 cm, which was not real from the treatment of a combination of goat manure and cow manure with a flower diameter of 7.83 cm, but significantly different from the treatment of a combination of pig manure and cow manure with a flower diameter of 7.18 cm. The diameter of chrysanthemum flowers can be influenced by several factors, namely the application of organic fertilizers such as goat and cow manure can improve the growth and quality of chrysanthemum flowers, including the diameter of the stem[11][16][17]. In addition, planting density can affect stem diameter, number of flowers, and width of chrysanthemum plant header [16][18]. Nutrient concentration also affects chrysanthemum flower diameter whereas NPK fertilizer concentration and organic liquid waste can affect chrysanthemum growth and quality, including stem diameter [18][19]. The diameter of the flowers in this study ranged from 7.07-8.30 cm which was in quality class A according to SNI 01-4478- 1988.

The highest economical fresh weight of chrysanthemum flowers was obtained in the treatment by giving a dose of 5 tons/ha of 95.12 grams which was significantly different from other treatments. The greater the dose of defoliation, resulting in a higher economic fresh weight because of defoliation, the chrysanthemum leaves contain nutrients that can increase the growth of chrysanthemum flower plants and produce a high economic fresh weight. While in the combination treatment of manure, the highest fresh weight was obtained in the combination treatment of goat manure and pig manure at 95.21 g, which was not real from the treatment of goat and cow manure with an economical fresh weight of 88.28 g, but was significantly different from the combination treatment of cow manure and pig manure with an economical fresh weight of 84.77 g. Manure contains nutrients that are good for the growth of chrysanthemum plants to increase the economical fresh weight of chrysanthemum flowers. The economical fresh weight of chrysanthemum flowers is directly proportional to the length of the flower stalk, stem diameter, and flower diameter so the economic weight of chrysanthemum flowers is high because the length of the flower stalk, stem diameter and flower diameter are also high.

Figure 1. Chrysanthemums due to defoliated leaves treatment and combination of organic fertilizers

The lowest percentage of leaves affected by leaf rust was obtained in the treatment of giving a dose of 5 tons / ha of 0.18%. The application of a combination of goat manure and pig manure gives the smallest percentage of leaves affected by leaf rust, which is 0.14%. Based on this research, the application of

organic fertilizer can reduce the risk of leaf rust (Figure 1). Organic fertilizers can help increase plant resistance to disease and extreme weather [20][21].

4. CONCLUSION

This study concludes that the treatment of the dose of defoliated leaves has a real to very real effect on all variables except stem diameter, while the combination treatment of organic fertilizers has a very significant effect on all variables. The interaction of defoliated leaves dose and organic fertilizer combination has no significant effect on all variables. The administration of a dose of 5 tons/ha and the combined use of goat manure and pig manure resulted in the length of the flower stalk, the weight of the flower stalk, the diameter of the stem, the diameter of the flower, the fresh weight of the highest economical flowers and resulted in the lowest percentage of leaves attacked by rust disease. The quality of chrysanthemums produced in this study is in quality class A according to SNI 01-4478- 1988.

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