Growth and Production of Three Varieties of Melon (*Cucumis melo* L.) under Various Composition of Planting Media and Concentration of Liquid Organic Fertilizer (LOF)

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Abstract

The study aimed to determine the interaction between the composition of planting media, varieties and concentration of liquid organic fertilizer (LOF) that affects the growth and production of melon plants. The research was conducted at the Experimental Farm, Faculty of Agriculture, Hasanuddin University, under greenhouse conditions. This study used a split-split plot design and there were 27 treatment combinations that were repeated 3 times. Each replication consisted of 3 experimental units, so there were 243 experimental units. The treatment used in the main plot was the planting media, which consisted of 3 compositions of planting media, soil : trichocompost = 1:1, soil : trichocompost = 1:2, soil : trichocompost = 2:1, and sub plots were 3 types of melon varieties, namely: Glamour F1, Rio F, Noni F1, while sub-sub plots the concentration of LOF, that are : without LOF (control), 5 $mL.L^{-1}$, and 10 $mL.L^{-1}$. The results of this study brought the conclusion that the combination of planting media treatment with a ratio of 1 soil : 2 trichocompost, on Noni F1 variety with an additional concentration of LOF 5 $mL.L^{-1}$ produced the best average yield on production which is 0.9 kg $plant^{-1}$

Keywords: Liquid organic fertilizer; melon; trichocompost; variety

Introduction

Melon fruits are extensively enjoyed by Indonesians due to their sweet flavor and high moisture content, providing a refreshing experience when consumed (23). According to (4), melon production in Indonesia exhibited growth from 2021 to 2022, from 129.147 tons to 118.696 tons. Despite this, the current production is only capable of satisfying approximately 40% of the nation's demand for melons. To address this shortfall, there is a critical need for the development of melon cultivation practices to enhance production and meet domestic requirements (24).

One of the efforts to increase the yield of melon plants is by utilising organic materials to improve nutrients in the planting media, selecting seeds of superior varieties and proper fertilisation (22). The use of *Trichoderma* sp. for composting only takes one month (6). *Trichoderma* sp. can break down organic materials such as carbohydrates, especially cellulose with the help of the enzyme cellulase (20).

In addition, low melon production is also influenced by the use of inappropriate varieties. The selection of melon seeds must consider environmental factors and growth and production factors. The next issue causing a lack of melon production is the difficulty in obtaining higher quality crops due to melons' insignificant use of nutrients. Nitrogen (N), phosphorus (P), and potassium (K) fertilizers are the most important nutrients for melon plants (11).

An alternative fertilization method involves the utilization of liquid organic fertilizer (LOF). The liquid composition of organic fertilizer facilitates better nutrient absorption by plants compared to solid fertilizers (1). One potential source of organic fertilizer is Eco Farming, comprised of highly active organic components containing a comprehensive range of nutrients tailored to plant requirements (26).

The primary goal of this research was to determine how the composition of planting media, varieties, and concentrations of liquid organic fertilizer affect the growth and production of melon plants.

Material and Methods

Study Area and Experimental Design

The research was conducted at the Teaching Farm, Faculty of Agriculture, Hasanuddin University, Makassar, with coordinates 5° 7'40.07" E 119° 28'48.94" East at an altitude of 9 m above sea level, under greenhouse condition. This research was conducted from November 2022 to February 2023.

The main plot was the planting media (m) which consists of 3 ratio of soil and trichocompost planting media, namely, m1 = 1:1, m2 = 1:2, m3 = 2:1. Sub plot were 3 types of melon varieties (v), namely, v1 = Glamour F1, v2 = Rio F1, v3 = Noni F1. Sub-sub plot was LOF concentrations (k), namely: k0 = without LOF (control), k1 = 5 $mL.L^{-1}$, k2 = 10 $mL.L^{-1}$. Thus, there were 27 treatment combinations that were repeated 3 times. Each replicate consisted of 3 units, so there were 243 experimental units.

Trichocompost Preparation

The preparation of trichocompost involves mixing 50 kg of chicken manure with 40 kg of rice husks, then spreading them

evenly on the ground/floor to a thickness of 20 cm. Meanwhile, combine 1 liter of fruit molasses with 5 liters of water, then add molasses, and stir until all ingredients are thoroughly mixed. Next, pour the solution onto the previously mixed materials, then cover with a tarpaulin. After 12 days, add 10 kg of *Trichoderma* sp. isolate and mix again. Let it sit for 30 days, and the trichocompost is ready for use.

Liquid Organic Fertilizer Preparation

The production of liquid organic fertilizer using Eco Farming fertilizer involves obtaining 1 tube of starter and mixing it with one liter of water (to make 1000 mL stock), then allowing it to sit for 24 hours. Afterward, it is diluted according to the desired concentration of the liquid organic fertilizer treatment.

Cultivation Process

Field research included: seed sowing, making trichocompost, preparing the green house, preparing polybag planting media, transplanting melon seedlings 14 days after planting, maintenance consisting of (watering, insertion, staking and propagation, fertilisation, application of eco farming, pollination, and fruit selection, and pruning the top shoots), pest and disease control, and harvesting.

Data Collection and Analysis

Parameters observed include plant height (cm), leaf area (cm^2), number of male and female flowers per plant, number of fruits per plant, fruit diameter (cm), fruit weight per fruit (kg), fruit flesh thickness (cm), sweetness level (brix), fruit weight per plant (kg), stomata density (stomata per μm^2), stomata opening area (μm^2), and light absorption (%) A two-way analysis of variance (ANOVA) was used to perform statistical analysis, with a p-value of 0.05 considered significant. The difference in effect on each type of priming agent was then evaluated using duncan multiple range test.

Table 1. Chemical Properties of Each Media

Analysis	Soil + Trichocompost (1:1)	Soil + Trichocompost (1:2)	Soil + Trichocompost (2:1)
pH	6.55	6.38	6.67
C (%0	1.49	1.90	2.63
N (%)	0.09	0.12	0.11
C/N	17	16	24
P_2O_5 (ppm)	14.72	17.60	15.62
Ca (cmol/kg)	6.15	6.12	7.12
Mg (cmol/kg)	1.22	1.29	0.87
K (cmol/kg)	0.13	0.13	0.28
Na (cmol/kg)	0.21	0.28	0.32
CEC (cmol/kg)	21.18	22.81	22.77

Result and Discussion

Plant Height, Leaf Area, and Number of Female Flower per Plant

The interaction between variety, planting medium, and application of liquid organic fertilizer significantly influenced plant height, leaf area, and number of female flowers in melon plants (Table 2). The combination treatment of soil + Trichocompost media composition (2:1), Glamor F1 variety, and liquid organic fertilizer concentration of 5 $mL.L^{-1}$ had the highest average plant height. The treatment combination with the largest leaf area is soil + Trichocompost media composition (1:1), Glamor F1 variety, and liquid organic fertilizer concentration of 5 $mL.L^{-1}$. Then, the combination of soil media composition + Trichocompost (1:2), Glamor F1 variety, and liquid organic fertilizer concentration of 5 $mL.L^{-1}$ recorded the highest number of female flowers.

These three observations indicate that the ability of each melon variety is different in the growth process. The Glamor F1 variety consistently shows more significant growth than other varieties. Likewise, applying liquid organic fertilizer with a concentration of 5 $mL.L^{-1}$ always has a more substantial influence on the growth of melon plants. On the other hand, the composition of the growing media has different results. However, the addition of Trichocompost to the media had a significant effect. Trichocompost planting medium produces nutrients such as N, P, and K, which can support the growth phase of melon plants (12) believes that plants can utilize the nutrients absorbed to increase plant growth, such as root growth, stem growth, and leaf and flower formation.

When observing the number of male flowers, the interaction of the three treatment factors did not have a significant effect. However, the variety factor alone significantly influenced (Table 3). The Glamour F1 variety recorded the highest average number of male flowers. Genetic factors directly influence this difference in the ability to form flowers. This follows the opinion of (10) that the three types observed have genetic and physiological differences in the formation and development of flowers into fruit until they are ready for harvest.

Table 2. Plant Height, Leaf Area, and Number of Female Flowers

Treatment	Plant Height (cm)	Leaf Area (cm^2)	Number of Female Flowers per Plant
m1v1k0	95.47h-k	57.44c-g	2.35d-g
m1v1k1	109.34a-d	**73.87a**	2.37d-g
m1v1k2	108.55a-d	64.52a-e	2.51c-f
m1v2k0	107.09a-e	56.13d-g	2.85a-c
m1v2k1	93.751i-k	45.25g	2.41d-g
m1v2k2	98.38f-j	61.71a-f	2.31fg
m1v3k0	100.08e-j	57.86b-g	2.53c-f
m1v3k1	103.33d-h	48.61fg	2.55c-f
m1v3k2	98.644e-j	70.51a-d	2.39d-g
m2v1k0	111.94a-c	57.36c-g	2.30fg
m2v1k1	112.51a-c	72.17abc	**3.08a**

m2v1k2	104.39c-g	66.52a-e	2.713b-d
m2v2k0	92.57jk	63.64a-e	2.72b-d
m2v2k1	96.87f-k	71.60a-c	2.96ab
m2v2k2	101.98d-i	70.38a-d	2.35d-g
m2v3k0	88.78k	58.23b-g	2.84a-c
m2v3k1	100.08e-j	58.18b-g	2.58c-f
m2v3k2	96.09 g-k	67.52a-e	2.58c-f
m3v1k0	115.344a	64.39a-e	2.12g
m3v1k1	**115.43a**	63.10a-f	2.21fg
m3v1k2	114.29ab	73.55a	2.33e-g
m3v2k0	106.90b-e	71.53a-c	2.27fg
m3v2k1	104.65c-f	72.06a-c	2.69b-e
m3v2k2	103.35d-h	63.90a-e	2.50c-f
m3v3k0	111.76a-c	72.65ab	2.71b-d
m3v3k1	105.03c-f	60.58a-f	2.49c-f
m3v3k2	104.89c-f	55.05d-g	2.51c-f

Means followed by an identical letter are not significantly distict at $p \leq 0.05$ according to duncan multiple range test.

Table 3. Number of Male Flowers per Plant

Variety	Number of Male Flowers per Plant
Glamour F1	**7.57a**
Rio F1	6.79b
Noni F1	6.29c

Means followed by an identical letter are not significantly distinct at $p \leq 0.05$ according to duncan multiple range test.

Number of Fruit per Plant, Fruit Diameter, and Flesh Thick

The interaction between variety, planting medium, and application of liquid organic fertilizer significantly influenced the number of fruits per plant, fruit diameter, and fruit flesh thickness (Table 4). The combination treatment of soil + Trichocompost media composition (2:1), Noni F1 variety, and liquid organic fertilizer concentration of 5 mL/L recorded the highest average number of fruits per plant. The treatment combination with the broadest fruit diameter is soil + Trichocompost media composition (1:1), Noni F1 variety, and liquid organic fertilizer concentration of 5 $mL.L^{-1}$. Then, the combination of soil media composition + Trichocompost (1:1), Noni F1 variety, and liquid organic fertilizer concentration of 10 $mL.L^{-1}$ recorded the thickest fruit flesh.

The Noni F1 variety recorded the highest number of fruits successfully formed on each plant. Plant genetic factors also influence this in developing flowers. Apart from that, other factors that can affect the formation of fruit on melon plants are environmental factors. Then, the Noni F1 variety recorded the widest fruit diameter and the thickest fruit flesh, with soil + Trichocompost (2:1) growing media. Research by (8) also discovered differences in the ability of different melon varieties to form fruit. Fruit size and yield quality differed between cultivars. Application of liquid organic fertilizer with concentrations of 5 $mL.L^{-1}$ and 10 $mL.L^{-1}$ recorded the formation of larger fruit and

thicker fruit flesh. Nutrient intake from organic fertilizer also contributes to plant nutrient needs. At least 4.84% P_2O_5 and 1.47% K_2O are contained in the applied liquid organic fertilizer.

Table 4. Number of Fruit per Plant, Fruit Diameter and Flesh Thick

Treatment	Number of Fruit per Plant	Fruit Diameter (cm)	Flesh Thick (cm)
m1v1k0	1,0 b	10.190c-i	3.046a-d
m1v1k1	1,0 b	9.66hi	2.71a-e
m1v1k2	1,3 a	9.536i	3.07a-d
m1v2k0	1,0 b	10.84a-c	3.11a-d
m1v2k1	1,0 b	10.28c-i	2.68a-e
m1v2k2	1,0 b	10.20c-i	2.62b-e
m1v3k0	1,0 b	10.26c-i	2.80a-e
m1v3k1	1,0 b	**11.46a**	3.15a-c
m1v3k2	1,0 b	10.47c-g	**3.34a**
m2v1k0	1,0 b	10.38c-h	2.64a-e
m2v1k1	1,0 b	10.28b-f	2.90a-e
m2v1k2	1,0 b	9.69g-i	2.43de
m2v2k0	1,0 b	10.87a-c	3.15a-c
m2v2k1	1,0 b	11.32ab	2.84a-e
m2v2k2	1,7 a	10.95a-c	3.14a-c
m2v3k0	1,0 b	10.42c-h	3.01a-d
m2v3k1	1,0 b	10.40c-h	3.07a-d
m2v3k2	1,0 b	10.77a-d	2.59b-e
m3v1k0	1,0 b	9.94e-i	2.47c-e
m3v1k1	1,0 b	10.37c-h	2.24e
m3v1k2	1,0 b	9.84f-i	1.61f
m3v2k0	1,0 b	10.68b-e	2.93a-e
m3v2k1	1,0 b	10.26c-i	3.02a-d
m3v2k2	1,0 b	10.62b-f	2.72a-e
m3v3k0	1,0 b	10.01d-i	2.90a-e
m3v3k1	**1,7 a**	10.39c-h	2.92a-e
m3v3k2	1,0 b	10.68b-e	3.29ab

Means followed by an identical letter are not significantly distinct at $p \leq 0.05$ according to duncan multiple range test.

Weight per Fruit, Weight Fruit per Plant, and Sweet Index

The interaction between variety, planting medium, and application of liquid organic fertilizer significantly influenced weight per fruit, fruit weight per plant, and level of fruit sweetness (Table 5). The combination treatment of soil + Trichocompost media composition (2:1), Noni F1 variety, and liquid organic fertilizer concentration of 5 $mL.L^{-1}$ recorded the heaviest average weight per fruit, also the heaviest average fruit weight per plant Then, the combination of soil media composition + Trichocompost (1:2), Glamor F1 variety, and liquid organic fertilizer concentration of 0 mL/L recorded the highest level of sweetness.

The Rio F1 variety with soil + Trichocompost (1:2) media sprayed with 5 mL/L liquid organic fertilizer also had the highest weight per fruit and fruit weight per plant. This is, of course, related to the number of fruits formed in this treatment combination. However, the Glamor F1 variety recorded the highest level of

sweetness compared to other varieties. The planting medium in the form of soil with a more significant proportion of Trichocompost (1:2) can increase the sweetness of the fruit. However, the application of liquid organic fertilizer did not affect this parameter. This planting medium has a higher P_2O_5 content than other media. As we know, the phosphate element has a vital role in the quality of plant fruit. Research conducted by Martuscelli et al. (19) also found that phosphate fertigation in melon plants during the growth process increased melon fruit production and quality, especially fruit brix. However, external factors influencing melon fruit quality include fruit arrangement during development and ripening, physiological factors, genotypic, and the major agro-environmental factors at work (17).

Table 5. Weight per Fruit, Weight Fruit per Plant, and Sweet Index

Treatment	Weight per Fruit (g)	Weight Fruit per Plant (kg)	Sweet Index (Brix)
m1v1k0	706,5 bc	0,7 bcd	11.56a-c
m1v1k1	697,9 bc	0,7 bcd	11.96ab
m1v1k2	525,4 cde	0,6 bcde	11.16a-d
m1v2k0	556,7 cde	0,6 de	10.03a-f
m1v2k1	467,8 e	0,5 e	10.66a-e
m1v2k2	537,7 cde	0,5 de	8.96c-g
m1v3k0	508,6 de	0,5 de	9.50b-g
m1v3k1	634,6 bcde	0,6 bcde	8.96c-g
m1v3k2	624,4 bcde	0,6 bcde	9.03c-g
m2v1k0	527,8 cde	0,5 de	**12.26a**
m2v1k1	548,6 cde	0,5 de	8.76d-g
m2v1k2	499,1 de	0,5 de	7.90e-h
m2v2k0	561,7 cde	0,6 de	8.26e-g
m2v2k1	794,0 ab	0,8 abc	7.66f-h
m2v2k2	649,7 bcde	0,8 ab	9.00c-g
m2v3k0	541,4 cde	0,5 de	8.400e-g
m2v3k1	600,6 cde	0,6 bcde	7.03gh
m2v3k2	555,1 cde	0,6 de	7.80f-h
m3v1k0	484,7 de	0,5 de	10.66a-e
m3v1k1	523,2 cde	0,5 de	12.16ab
m3v1k2	573,7 cde	0,6 de	10.40a-f
m3v2k0	669,8 bcd	0,7 bcde	9.60a-g
m3v2k1	**929,4 a**	**0,9 a**	10.40a-f
m3v2k2	585,4 cde	0,6 cde	5.66h
m3v3k0	700,1 bc	0,7 bcd	9.10c-g
m3v3k1	592,1 cde	0,6 cde	8.16e-h
m3v3k2	587,0 cde	0,6 cde	8.53d-g

Means followed by an identical letter are not significantly distinct at $p \leq 0.05$ according to duncan multiple range test.

Stomata Density, Stomata Opening Area, and Light Absorption

The interaction between varieties, planting media, and application of liquid organic fertilizer significantly influenced stomata density, stomatal opening area, and percentage of light absorbed (Table 6). The combination treatment of soil + Trichocompost media composition (1:2), Glamor F1 variety, and liquid organic fertilizer concentration of 0 $mL.L^{-1}$ recorded the densest average stomata

density. The treatment combination with the largest stomatal opening area was soil + Trichocompost media composition (1:2), Rio F1 variety, and liquid organic fertilizer concentration of 10 mL/L. Then, the combination of soil media composition + Trichocompost (1:2), Rio F1 variety, and liquid organic fertilizer concentration of 5 $mL.L^{-1}$ recorded the highest average percentage of light absorption. It can be seen that each, melon variety tested has different stomata and light absorption characteristics. The Glamor F1 variety has a high density of stomata, while Rio F1 has a larger opening area. The diverse characteristics of stomata are indeed influenced by variety, and even environmental factors have a significant influence (7) found that grape plants have different stomata sizes and densities depending on the plant variety. The density and size of stomata are things that are not related to each other. Likewise, with the plant's ability to absorb light, each variety shows different abilities. Leaf pigments, such as chlorophyll and anthocyanins greatly influence this light absorption (25).

Table 6. Stomata density, stomata opening area and light absorption

Treatment	Stomata Density	Stomata Opening Area	Light Absorption (%)
m1v1k0	130.78a-d	7.52k	0.081de
m1v1k1	101.06f	13.54b-j	0.07de
m1v1k2	113.80c-f	14.39a-j	0.08c-e
m1v2k0	141.82ab	15.37a-g	0.09b-e
m1v2k1	133.33a-c	15.56a-f	0.08c-e
m1v2k2	104.45ef	11.77g-j	0.08c-e
m1v3k0	102.76ef	16.35a-c	0.09b-d
m1v3k1	117.38c-f	12.95c-j	0.07de
m1v3k2	124.84a-e	11.51h-j	0.07de
m2v1k0	**145.22a**	11.77g-j	0.08b-e
m2v1k1	128.23a-d	14.91a-h	0.08de
m2v1k2	118.89b-f	16.16a-d	0.08de
m2v2k0	118.89b-f	11.06j	0.07de
m2v2k1	124.90a-e	16.61ab	0.08c-e
m2v2k2	129.93a-d	**17.40a**	0.10b
m2v3k0	124.84a-e	12.62d-j	0.07de
m2v3k1	108.70d-f	11.77g-j	**0.14a**
m2v3k2	118.89b-f	11.12ij	0.07de
m3v1k0	132.48a-c	14.71a-i	0.08c-e
m3v1k1	125.69a-e	14.91a-h	0.08c-e
m3v1k2	130.78a-d	12.16e-j	0.10bc
m3v2k0	122.29a-f	16.41a-c	0.09b-d
m3v2k1	145.22a	13.99a-j	0.07de
m3v2k2	130.78a-d	14.64a-j	0.07de
m3v3k0	119.74b-f	11.97f-j	0.08c-e
m3v3k1	141.82ab	14.91a-h	0.08c-e
m3v3k2	131.63a-d	15.64a-e	0.07e

Means followed by an identical letter are not significantly distinct at $p \leq 0.05$ according to duncan multiple range test.

Conclusion

The conclusion of this research is that the interaction between the composition of the planting medium, variety and concentration of liquid organic fertilizer has an influence on the parameters of plant height (115.4 cm), leaf area (73.87 cm^2), number of female flowers (3.10 flowers), fruit diameter (11.33 cm), weight per fruit (929.40 gr) and fruit weight per plant (0.9 kg), number of fruits per plant (1.7 fruit), sweetness level (12.3 brix), thickness of fruit flesh (3.35 cm), while the single influence, namely variety, has an influence on the parameter number of male flowers (7.57 flowers).

Authors Contribution

Muhlizha Azhari Nur: preparing the research site, conducting the research, collecting data, statistical analysis, and writing the article. Elkawakib Syam'un: coordinating and responsible for the overall direction and planning of the research, writing and interpretation of the results. Muh.Farid BDR: analysed the data, write and reviewed the draft article.

Conflict of interest

The authors declare no conflict of interest.

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