



Composition of Growing Media and Concentration of Foliar Fertilizer Affected Yield and Quality of Purple Eggplant (*Solanum melongena* L.)

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ABSTRACT

The study aimed to obtain the best combination of growing media composition and the concentration of foliar fertilizer (Gandasil B) on the yield quality of eggplant. The research was conducted from December 2022 to February 2023 in Nganjuk Regency, using a completely randomized design of two factors. The first factor was composition of the growing media, which comprised of soil:husk charcoal:cow manure with ratios of (1:1:1), (1:1:2), (1:2:1), and (2:1:1), and the second factor was the concentration of foliar fertilizer (0, 2, 4, 6 g/L). The results exhibited that the combination of (1:2:1) medium growing composition and the 2 g/L concentration of foliar fertilizer produced the best fruit diameter with an increase of 22.35% compared to the combination of growing media (1:1:1) and concentration of foliar fertilizer of 2 g/L. The composition of the soil growing medium 1:2:1 gave the best results on fruit length and diameter, average fruit weight, and total fruit weight per plant. A quadratic regression analysis of the concentration of foliar fertilizer and the number of purple eggplant fruits showed that the highest concentration of foliar fertilizer was 5.78 g/L.

Keywords: foliar fertilizer, fruit diameter, growing medium, purple eggplant

INTRODUCTION

Purple eggplant (*Solanum melongena* L.) is a horticultural plant that Indonesian people widely consume. The attractive purple color on the skin also has various properties, including higher antioxidant content, which can be used to reduce blood cholesterol levels, prevent strokes and tumor growth, and be beneficial for diabetics (Wijayanti 2019). Eggplant production in Indonesia has increased from year to year. Based on data from the Central Statistics Agency, eggplant production in Indonesia in 2019 was 575,392 tons, while in 2020 production was 676,339 tons (BPS 2021). On the other hand, the demand for eggplant is increasing along with the increasing population and public awareness about the importance of consuming vegetables.

Development in urban areas and massive urbanization have impacted the narrowing of agricultural land in cities, so urban farming in narrow urban areas is the best choice. However, urban farming is also constrained by land damage (low soil pH, dense soil structure, and lower nutrient availability) that occurs in urban areas, so plant cultivation is carried out using

polybags as cultivation containers and growing media. Cultivating plants in polybags requires an ideal growing medium. A mixture of several materials for growing medium must produce an appropriate structure because each media type has a different effect on plants (Syahputra *et al.* 2014). A good growing medium is a porous and fertile growing medium derived from organic materials such as husk charcoal and cow manure. Applying organic matter, husk charcoal, and manure can create conditions for a crumbly and fertile growing medium with good drainage and aeration and can maintain moisture in the root area (Sari *et al.* 2022). Husk charcoal has a chemical composition of SiO₂ (52%) and C (31%), while the other contents consist of small amounts of Fe₂O₃, K₂O, MgO, CaO, MnO, and Cu as well as several other organic materials (Wuryan 2008). A previous experiment displayed that the composition of the media (soil + cow manure) produced the highest number of eggplant fruits and fruit weight and was not significantly different from other treatments using only cow manure (Hali and Telan 2018).

Efforts to increase eggplant productivity can also be made by improving cultivation techniques. The high miscarriage of eggplant flowers and fruit is caused by the unavailability of P and K nutrients at the flowering and fertilization stages. Gandasil B foliar fertilizer is a type of foliar fertilizer that contains macro- and micronutrients to improve plant growth and development, primarily to support the formation of flowers and fruit. Gandasil B as

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foliar fertilizer is an inorganic fertilizer in powder form and contains growth regulators to stimulate plant growth in the generative phase (Ervin *et al.* 2016). Using Gandasil B foliar fertilizer with a concentration of 4 g/L increased eggplant fruit weight per plant by up to 2 times or around 200% than the control (without Gandasil B fertilizer) (Satriyo and Aini 2018). The research objective was to determine the combination of the treatment of the composition of the growing media and the concentration of Gandasil B fertilizer that gave the best growth and yield of the purple eggplant.

METHODS

Time and Place of Research

The research was conducted in Sanggrahan Village, Gondang District, Nganjuk Regency, from December 2022 to February 2023. The site was a lowland with an altitude of ± 60 m above sea level.

Equipment and Materials

The tools used were shovels, sprayers, buckets, cloth for background, ruler, caliper, scissors, digital scale, stationery, plastic, and camera for documentation. The materials included purple eggplant seeds of the Mustang F1 variety, 10 cm x 12 cm polybags, 40 cm x 40 cm polybags, labels, lanyards, Gandasil B leaf fertilizer, NPK Mutiara fertilizer 16:16:16, ZA fertilizer, ZK fertilizer, soil, rice husk charcoal, cow manure, and water.

Statistical Methods

The experiment used a factorial Completely Randomized Design (CRD) consisting of two factors. The first factor was the composition of the growing medium consisting of 4 levels of soil:husk charcoal:cow manure, i.e. K1 (1:1:1), K2 (1:1:2), K3 (1:2:1), and K4 (2:1:1). The second factor was concentration of Gandasil B as a foliar fertilizer, consisting of 4 levels: D0 (0 g/L as control), D1 (2 g/L), D2 (4 g/L), and D3 (6 g/L). Each combination treatment was repeated 3 times so that there were 48 experimental plots. Furthermore, the number of experimental plots was tripled, so there were 144 experimental samples.

Plant Media Preparation

The growing medium consisted of a mixture of soil, husk charcoal, and cow manure in a ratio determined by the treatments. The polybag used was 40 cm x 40 cm in size and filled up to 4/5 of the polybag volume.

Growing and Treatments

Firstly, eggplant seeds were planted in a small tray pot for up to 3 weeks. After 25 days, when the seedlings had

3-5 leaves, the plants were transferred to the treatment polybags according to the previous media composition.

Caring for Plants

Plant maintenance was carried out during the treatment, including daily watering, weekly weeding and pruning, setting stakes at 14 days after planting (DAP), and pest control using insecticide Curacron 500EC, Lannate 40 SP, and Dithane M-45 fungicide with a concentration of 3 g/L water. Fertilization was using NPK at a dose of 15 g/plant, 4.5 g ZA/plant, and 4.5 g ZK/plant. Fertilization began 7 DAP and was applied gradually according to the plant age.

Application of Gandasil B Foliar Fertilizer

Gandasil B foliar fertilizer was given when the plants were 15 DAP. The foliar fertilizers were applied using a hand sprayer, and the concentrations used were by the predetermined treatment: 0, 2, 4, and 6 g/L. The interval for fertilizer spraying was once every 7 days until 42 DAP.

Harvest and Parameter Observation

Eggplants were harvested at 45 DAP, with fruits having an even purple color and a fruit length of about 15–20 cm. The harvesting interval was every 3 days, and the fruit stalk was cut 2 cm from the base of the stem using pruning shears. Observations were made on the yield and quality of purple eggplant, including the number of fruits per plant, fruit weight per plant, fruit length and diameter, and average fruit weight.

Data Analysis

The data were analyzed using a two-way ANOVA at the 1% and 5% test levels. If the effect was significant, the analysis proceeded with the Honest Significant Difference (HSD) test at a significance level of 5%.

RESULTS AND DISCUSSION

Number of Fruits

The results indicated that the growing media's composition and the foliar fertilizer concentration significantly affected the number of fruits formed by purple eggplant. The composition factor of the K2 growing medium, a combination of soil, husk charcoal, and cow manure (1:1:2), produced the highest number of fruits formed than the other growing media composition treatments (Table 1). The application of stable manure not only provided nutrients but also improved the soil's physical, chemical, and biological features so that it could increase the efficient absorption of nutrients. Improvements in soil features and the available nutrients have produced a higher net assimilation rate for the eggplant (Gulshan *et al.* 2013). Manure application is a

good soil amendment because it can increase beneficial biota in soil and will improve the water holding capacity while slowing down the loss of water content in the soil and moister the soil, which can provide nutrients to plants (Mahamad *et al.* 2022). Meanwhile, 6 g/L foliar fertilizer concentration resulted in the highest number of fruits formed, significantly different from the control. The formation of flowers and fruit in plants is influenced by the availability of nutrients, including potassium (K) and phosphorus (P). It states that the nutrient phosphorus plays a role in the photosynthesis process, and the photosynthesis results can be used to form flowers and fruit (Rismunandar 2000). The nutrient potassium helps the process of stomatal opening, which influences the

entry of CO₂ into the leaves. The more CO₂ that enters the stomata, the more photosynthesis results will be distributed to the fruit (Ervin *et al.* 2016).

Based on the results of the quadratic regression analysis between the concentration of Gandasil B fertilizer and the number of fruits formed by the purple eggplant plant (Figure 1), the line equation was $Y = -0.0731x^2 + 0.8453x + 6.3655$ ($R^2 = 0.99$). Based on the equation, the highest concentration of Gandasil B fertilizer ($Y_1 = 0$), which affected the increase in the number of fruits formed by the highest purple eggplant plant, was 5.78 g/L. Thus, if the concentration of Gandasil B fertilizer is increased, the number of fruits formed will decrease.

Table 1 Effect of composition of growing media and concentration of foliar fertilizer on the number of fruits formed in purple eggplant plants

Treatment	Number of fruit
Composition of growing media (soil:husk charcoal:cow manure)	
K1 (1:1:1)	8.36 ab
K2 (1:1:2)	8.39 b
K3 (1:2:1)	7.67 ab
K4 (2:1:1)	7.09 a
HSD 5%	1.32
Concentration of foliar fertilizer	
D0 (0 g/l)	6.36 a
D1 (2 g/l)	7.78 ab
D2 (4 g/l)	8.56 b
D3 (6 g/l)	8.81 b
HSD 5%	1.32

Note: Numbers followed by the same letter in the same column and the same treatment show insignificant difference in the HSD test $p = 0.05$.

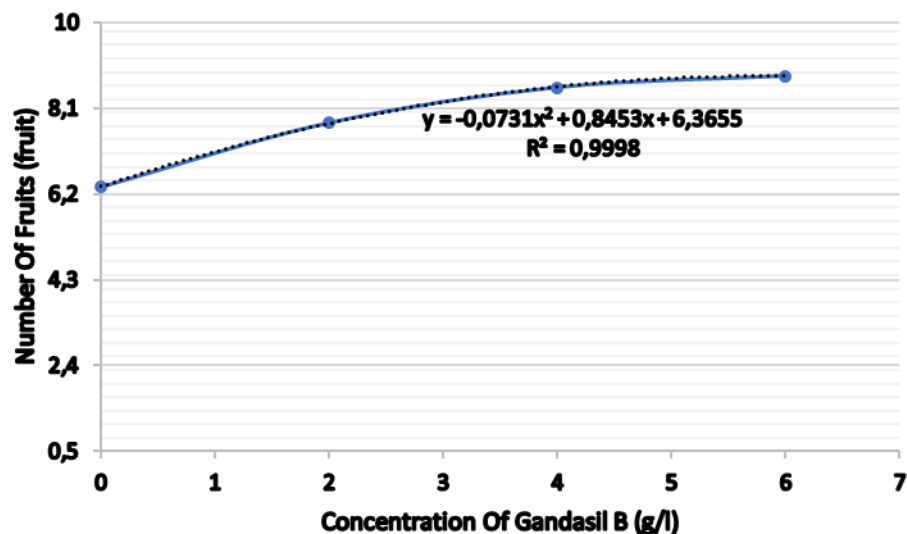


Figure 1 Quadratic regression graph of the relationship between concentration of foliar fertilizer and number of fruits formed by purple eggplant.

Fruit Length

The growing media's composition and the foliar fertilizer concentration showed a significant effect. The composition of the growing medium 1:2:1 produced the best average length of fruit. It increased by 10.10% compared to the 1:1:1 composition (Table 2). It happened because the composition of husk charcoal was more than soil and cow manure treatment. Adding husk charcoal resulted in the growing medium having an excellent ability to store nutrients (Musthafa 2022). Husk charcoal contains high silica (87–97%) and 1% N and 2% K nutrients (Kiswondo 2011). The availability of nutrients for plants has a positive effect on increasing the rate of photosynthesis. The amount of photosynthates produced will be translocated to plant organs such as fruit so that the length of the fruit will increase.

In addition to media, the foliar fertilizer concentration factor also significantly affected the average fruit length. A foliar fertilizer concentration of 6 g/L produced the best average length of fruit, which increased by 12.58% from the control. This may be because foliar fertilizer contains 30% of the nutrient K that plants need to facilitate the entry of CO₂ through the stomata. The more CO₂ is absorbed through stomata, the more photosynthetic

yields will be obtained, which will then be channeled to parts of plant organs such as fruit (Ervina *et al.* 2016).

Fruit Diameter

The results presented a significant interaction between the composition of the growing media and the concentration of foliar fertilizer on the average diameter of the purple fruit. The combination of treatments for the composition of the soil growing medium (1:2:1) and the concentration of foliar fertilizer 2 g/L (K3D1) produced the best average fruit diameter and was significantly different from other treatments except for K1D2, K2D3, and K3D0, K3D3, K4D2, and K4D3 (Table 3). There was an average increase in fruit diameter because of the K3D1 treatment combination of 22.35% compared to the K1D1 treatment combination.

This happened because the composition of husk charcoal was more in the K3D1 treatment combination. Applying husk charcoal to the growing medium can improve the porosity and aeration properties of the soil so that fertilization can be effective (Fadhilah and Harahap 2020). Under such media, the application of Gandasil B fertilizer with a concentration of 2 g/L could be adequately absorbed by purple eggplant plants so that the combination of these treatments produced the best

Table 2 Effect of composition of growing media and concentration of foliar fertilizer on fruit length

Treatment	Average fruit length (cm)
Composition of growing media (soil:husk charcoal: cow manure)	
K1 (1:1:1)	17.40a
K2 (1:1:2)	17.88 ab
K3 (1:2:1)	19.31 b
K4 (2:1:1)	17.63 ab
HSD 5%	1.84
Concentration of foliar fertilizer	
D0 (0 g/L)	17.42 a
D1 (2 g/L)	17.45 ab
D2 (4 g/L)	17.74 ab
D3 (6 g/L)	19.61 b
HSD 5%	1.84

Note: Numbers followed by the same letter in the same column and the same treatment gave insignificant difference in the HSD test $p = 0.05$.

Table 3 Effect of combination of treatment composition of growing media and concentration of foliar fertilizer on average fruit diameter

Concentration of foliar fertilizer	Average fruit diameter (mm)			
	Composition of growing media (soil:charcoal husk:cow manure)			
	K1 (1:1:1)	K2 (1:1:2)	K3 (1:2:1)	K4 (2:1:1)
D0 (0 g/L)	35.80 ab	37.57 ab	39.75 bc	36.53 ab
D1 (2 g/L)	35.34 a	36.59 ab	43.24 c	36.35 ab
D2 (4 g/L)	41.69 bc	36.82 ab	37.73 ab	39.24 bc
D3 (6 g/L)	38.24 ab	40.58 bc	40.99 bc	38.83 bc
HSD 5%	6.59			

Note: Numbers followed by the same letter in the same column and the same treatment show no significant difference in the HSD test $p=0.05$.

average fruit diameter. Gandasil B fertilizer contains 30% potassium (K) and 20% phosphorus (P). The potassium plays a role in speeding up the flowering process (Anisa and Gustia 2017). Meanwhile, phosphorus nutrients play a role in protein formation, accelerating the formation of flowers and fruit (Lingga and Marsono 2003).

Average Weight per Fruit

The growing medium's composition factor and the foliar fertilizer's concentration factor did not show a significant effect on fruit weight. Even though not significantly different, the composition factor of the K3 growing medium (1:2:1) produced the best average fruit weight of the purple eggplant plant compared to the other growing media composition treatments with an increase of 15.74% (Table 4.). Adding husk charcoal resulted in the growing medium having a better ability to store nutrients (Musthafa 2022). Rice husk charcoal is a growing medium that has gone through the combustion process so that it has high carbon content and is easily decomposed and high absorption because it has larger pores so that it can absorb the nutrients that are around it to be stored in these pores (Agustin *et al.* 2014). The availability of nutrients for plants may increase the photosynthesis rate. The amount of photosynthates formed will increase the weight and number of eggplants (Ridho and Yuliana 2007). The amount of photosynthesis that is formed will cause the fruit length to increase as well. The greater the photosynthate that is translocated to the fruit, the greater the weight of the fruit produced.

Total Fruit Weight per Plant

The growing media composition factors did not significantly affect total fruit weight, but K3 growing media composition factors (1:2:1) produced the best total plant fruit weight and increased by 8.72% than the composition of the K1 growing medium. This happened due to the composition of husk charcoal, which was more in the composition of the K3 growing medium. Husk charcoal can influence the availability of phosphorus, which is an important part that plays a role in photosynthetic reactions that affect the net assimilation rate and turn out affects the total fresh weight of plants (Akasiska *et al.* 2014). Husk charcoal has relatively high silica nutrients and plays a role in improving the fruit quality. Silica compounds play a role in the structure of the tissue cells that make up the fruit during the fruit enlargement process (Djajadi *et al.* 2016). Silica is needed in cell growth and enlargement and determines the size of the fruit produced (Falk *et al.* 2007).

The concentration of foliar fertilizer caused a significant difference in total fruit weight, and a concentration of 6 g/L was able to produce the best total

fruit weight and was significantly different from the control (D0). There was an increase in the total fruit weight of the plant due to foliar fertilizer of 6 g/L up to 36.11% compared to the control (D0) (Table 5). The nutrient potassium influences the quantity and quality of plant production (Ambarwati *et al.* 2020). Another experiment recorded that applying Gardasil D 3 g/L as foliar fertilizer can increase eggplant fruit weight by 50% compared to the control (Widiwurjani *et al.* 2021).

CONCLUSION

The combination of growing media and foliar fertilizer affected eggplant production. The composition of the soil growing medium:husk charcoal:cow manure (1:2:1) gave the best results on average fruit length and diameter, average fruit weight, and total fruit weight per plant. The composition of soil:rice husk charcoal:cow manure (1:2:1) in combination with Gandasil B fertilizer of 2 g/L produced the best eggplant yield indicated by longer fruit and higher total fruit production.

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Table 4 Effect of composition of growing media and concentration of foliar fertilizer on average fruit weight

Treatment	Average fruit weight (g)
Composition of growing media (soil: husk charcoal: cow manure)	
K1 (1:1:1)	85.17
K2 (1:1:2)	83.55
K3 (1:2:1)	98.58
K4 (2:1:1)	87.75
HSD 5%	ns
Concentration of foliar fertilizer	
D0 (0 g/L)	95.42
D1 (2 g/L)	85.66
D2 (4 g/L)	80.90
D3 (6 g/L)	93.07
HSD 5%	ns

Note: Numbers followed by the same letter in the same column and the same treatment show no significant difference in the 5% HSD test, ns = not significant.

Table 5 Effect of composition of growing media and concentration of foliar fertilizer on total fruit weight per plant

Treatment	Total Plant Fruit Weight (g)
Composition of growing media (soil: husk charcoal: cow manure)	
K1 (1:1:1)	688.17
K2 (1:1:2)	694.30
K3 (1:2:1)	748.22
K4 (2:1:1)	616.88
HSD 5%	ns
Concentration of Gandasil B fertilizer	
D0 (0 g/L)	593.51 a
D1 (2 g/L)	666.43 ab
D2 (4 g/L)	676.32 ab
D3 (6 g/L)	804.12 b
HSD 5%	185.33

Note: ns = not significantly different; The numbers followed by the same letters in the same column and the same treatment showed no significant difference in the 5% HSD test.

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