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Growth and Production Response of Hydroponic Melon (*Cucumis Melo L.*) Using DFT System with Ab Mix and Gandasil B

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KEYWORDS
Melon, Hydroponics, Gandasil B

ABSTRACT
Hydroponic cultivation represents an innovative approach to enhancing agricultural productivity, with melon (*Cucumis melo* L.) showing excellent adaptability to *Deep Flow Technique* (DFT) systems. Optimal nutrient management remains crucial for maximizing yield in hydroponic melon production. This study aims to evaluate the growth and production response of hydroponic melon to *Gandasil B* foliar fertilizer supplementation in DFT systems and to determine its optimal dosage. The research was conducted at UKI Toraja's Screen House using a Randomized Block Design with four *Gandasil B* concentrations: 0, 1, 2, and 3 cc/liter. Results demonstrated that *Gandasil B* application significantly improved all growth parameters, with 3 cc/liter yielding optimal results: plant height (117.08 cm), leaf count (16.25 strands), branches (3.67 stems), and fruit weight per plot (7,091.33 g). The research implications indicate that *Gandasil B* supplementation at 3 cc/liter can significantly enhance hydroponic melon productivity, providing farmers with an effective protocol to improve yield and economic returns. These findings contribute to sustainable agricultural practices through efficient nutrient management and support the development of precision horticulture techniques for optimal crop production.

Introduction

Melon (Cucumis melo L.) is a fruit crop belonging to the Cucurbitaceae family, with a domestication history that spans multiple regions (Chomicki et al., 2020). Recent genomic and archaeological studies suggest that melon was domesticated at least twice independently, once in Africa and once in Asia, with wild relatives such as C. trigonus in India contributing to its genetic diversity (Endl et al., 2018). Although some historical accounts trace its origin to the Persian Valley in present-day Iran and Syria, phylogenetic and archaeobotanical evidence indicates a broader domestication center extending across West Asia and Central Asia (Chomicki et al., 2020). Archaeological findings from Iran and China further support the long history of melon cultivation, dating back several millennia, before its diffusion into the Mediterranean basin through ancient trade networks (Paris, 2016). Molecular breeding studies confirm that the species later diversified and adapted to various agroecological zones, enabling successful cultivation in Europe, including Denmark, the Netherlands, and Germany (Komala et al., 2023). From Europe, melon was introduced to the Americas during the 14th century and became widely cultivated in regions such as California, Colorado, and Texas, facilitated by European colonization and transatlantic trade (Liu et al., 2020). Today, resequencing of diverse accessions shows strong genetic links among melons grown in Asia, Africa, Europe, and the Americas, highlighting a complex post-domestication dispersal that eventually reached tropical and subtropical countries, including Indonesia, Japan, China, and Australia (Zhang et al., 2024).

Melon is one of the most widely cultivated fruit crops in Indonesia. The *melon* market serves various segments, ranging from traditional markets and modern markets to hotels and restaurants (Widianarko et al., 2025). *Melons* are popular because of their sweet and refreshing taste, making them ideal as a dessert fruit.

In Indonesia, there are various types of *melons*, and one of the superior quality varieties is the premium *melon* (Kumalasari et al., 2024; Nor et al., 2022). Premium *melons* are derived from superior seeds, usually characterized by a very sweet taste and relatively uniform fruit shape compared to common *melons*. These *melons* also have a higher market value than regular ones.

The cultivation of premium *melons* can be supported by hydroponic systems. Hydroponic cultivation in greenhouses allows for relatively faster harvest times. Additionally, nutrient requirements can be controlled and adjusted to the plant's growth stages. Pest attacks in greenhouse cultivation are also easier to manage compared to open-field cultivation (Mangaras et al., 2022).

AB Mix nutrients and Gandasil B are among the fertilizers that support the growth of *melons* in the DFT (Deep Flow Technique) hydroponic system. AB Mix provides both macro and micronutrients, while Gandasil B is a compound fertilizer containing more than two essential elements. Its composition includes nitrogen (15%) in the form of NH4+, phosphorus (15%) as P2O5, and potassium (15%) as K2O. A key advantage of Gandasil B is its quick absorption and direct utilization by plants, without causing damage when applied properly. The concentration of Gandasil B refers to the weight of fertilizer dissolved in a given volume of water, typically expressed in grams per liter (Delpita, 2020).

AB Mix is considered the best nutrient solution for hydroponic plants, providing a balanced supply of nutrients to enhance plant growth and yield. Part A generally contains macronutrients such as calcium and nitrogen, while Part B contains micronutrients such as magnesium, phosphorus, and potassium. Gandasil B is optimized for the vegetative phase as it contains nitrogen, phosphorus, potassium, and magnesium (Bulan et al., 2016; Surtinah, 2004).

Previous research has explored various aspects of hydroponic *melon* cultivation. Afza et al. (2022) examined the marketing mix of hydroponic *melon* products and its impact on customer loyalty, highlighting the commercial potential of quality hydroponic *melons*. Bambang et al. (2021) conducted research on premium hydroponic *melons*, demonstrating their superior quality and market value. Darwiyah & Rochman (2021) investigated the production and quality of hydroponic *melons* with different potassium nutrition, showing that nutrient variations significantly affect *melon* quality. Furthermore, Furoidah (2018) studied the effectiveness of AB Mix nutrition on the yield of two *melon* varieties, confirming the importance of proper nutrient management in hydroponic systems.

This research aims to determine the optimal dosage of Gandasil B foliar fertilizer that provides the most effective impact on the growth and production of hydroponic *melons* cultivated with a DFT system. The results of this study are expected to provide practical recommendations for farmers to increase the efficiency, yield, and quality of hydroponic *melon* cultivation, ultimately contributing to enhanced profitability and the development of more sustainable agricultural practices.

Materials and Method

This research project was conducted from March to June 2024 at the Screen House, Faculty of Agriculture, UKI Toraja, Tallunglipu District, North Toraja Regency. The tools used included drilling machines, rulers, saws, cutters, markers, PVC pipes, hoses, nutrient tanks, flannel cloth, and water pumps, while the materials consisted of premium melon seeds, water, cocopeat, AB Mix, and Gandasil B. The research employed a Randomized Block Design (RBD) with four treatments (G0 = control, G1 = 1 cc/L, G2 = 2 cc/L, G3 = 3 cc/L of Gandasil B) and three replications, totaling 15 plots with 105 planting holes in the treatment pipes and 130 in the production pipes. The research, carried out by a group of two students, lasted approximately 2–3 months with about 100 melon plants. The work stages included greenhouse preparation, construction of the DFT hydroponic system, postharvest handling and marketing, data collection, and business analysis. Data were collected through observation of growth and yield, while economic feasibility was analyzed using quantitative methods to assess the viability of hydroponic melon production.

Results and Discussions

Economic Analysis of Hydroponic Melon Plants

Table 1. Economic analysis of hydroponic melon plants

No	Description	Total sales	Selling price	Total receipts
1	Hydroponic melon	235 pieces	IDR 30,000	IDR 7,050,000

Component	Value
Total expenses	IDR 3,286,500
Total sales	IDR 7,050,000

Net profit = Total Expenditure – Total Income
Net Profit = IDR 3,286,500 – IDR 7,050,000
= Rp. 3,763,350

Hydroponic Melon Plant Data Analysis

a. Plant Height

Table 2. Plant height at age 21 HST and 28 HST (cm)

Gandasil B & AB mix	Plant height (cm)	
	21 HST	28 HST
G0= 100% AB mix	98.83a	114.50a
G1= 1 cc/ L water	100.25a	115.58ab
G2= 2 cc/L water	100.92b	115.83ab
G3= 3 cc/L water	101.67bc	117.08b
NP BNT 0.05	1,63	2,15

Remarks*: The average value followed by the same letter is not real at the BNT test level of 0.05.*

Based on the results of the BNT 0.05 test in table 2 on plant height at the age of 21 HST, it shows that the administration of 3 cc of Gandasil B/liter of water results in the highest plant height (101.67 cm), which is not real with the treatment of 2 cc of Gandasil B/liter of water (G2), but is significantly different from the treatment of 1 cc of Gandasil B/liter of water (G1) and without treatment (G0)

Based on the results of the BNT 0.05 test in table 2 on plant height at the age of 28 HST, it was shown that the administration of 3 cc of Gandasil B / liter of water produced the highest plant height (117.08 cm) which was significantly different from without Gandasil B (G0) treatment but not real difference with the treatment of 1 cc of Gandasil B / liter of water (G1) and 2 cc of Gandasil B/liter of water (G2)

b. Number of Leaves

Table 3. Number of Leaves at Age 21 HST and 28 HST (Strands)

Gandasil B & AB mix	Number of leaves (leaves)	
	21 HST	28 HST
G0= 100% AB mix	9.58a	13.42a
G1= 1 cc/L water	10.42a	14.58ab
G2= 2 cc/L water	11.67b	15.50bc
G3= 3 cc/L water	12.42b	16.25c
NP BNT 0.05	1,16	1,45

Remarks*: The average value followed by the same letter is not real at the BNT test level of **0.05**.*

Based on the results of the BNT 0.05 test in table 2 on the number of leaves at the age of 21 HST, it shows that the administration of 3 cc of Gandasil B / liter of water results in the highest number of leaves (12.42 sheets) which is not real with the treatment of 2 cc of Gandasil B / liter of water (G2) but is significantly different from other treatments.

Based on the results of the BNT 0.05 test in table 2 on the number of leaves at the age of 28 HST, it shows that the administration of 3 cc of Gandasil B / liter of water produces the highest number of leaves (16.25) of different strands that are not real with the treatment of 2 cc of Gandasil B / liter of water (G2) but are significantly different from other treatments.

c. Number of Branches

Table 4. Number of Branches Age 21 and 28 HST

Gandasil B & AB mix	Number of leaves (leaves)	
	21 HST	28 HST
G0= 100% AB mix	1.42a	2.33a
G1 = 1 cc/ Birth	1.83b	3.17b
G2= 2 cc/L water	1.75ab	3.33b
G3= 3 cc/L water	2.00b	3.67b
NP BNT 0.05	0,35	0,6

Remarks*: The average value followed by the same letter is not real at the BNT test level of 0.05.*

Based on the results of the BNT 0.05 test in table 2 on the number of branches at the age of 21 HST, it shows that the administration of 3 cc of Gandasil B / liter of water produces the highest number of branches (2 stems) that are significantly different from those without Gandasil B (G0) treatment but are not real from other treatments. Based on the results of the BNT 0.05 test in table 2 on the number of leaves at the age of 28 HST, it shows that the administration of 3 cc of Gandasyl B / liter of water results in the highest number of branches (3.67 stems) which is significantly different from without Gandasyl B (G0) treatment but is not real from other treatments.

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d. Interest Amount

Table 5 Number of Interest Ages 21 and 28 HST

Gandasil B & AB mix	Number of Flowers (fruit)	
	21 HST	28 HST
G0= 100% AB mix	3.33a	5.67a
G1= 1 cc/L water	3.75b	6.25a
G2= 2 cc/L water	3.75b	7.17b
G3= 3 cc/L water	4.08b	7.42b
NP BNT 0.05	0,32	0,77

Remarks*: The average value followed by the same letter is not real at the BNT test level of 0.05.*

Based on the results of the BNT 0.05 test in table 5 on the amount of flowers at the age of 21 HST, it was shown that the administration of 3 cc of Gandasil B / liter of water produced the highest amount of flowers (4.08 pieces) which was significantly different from the one without Gandasil B (G0) treatment but was not real from other treatments.

Based on the results of the BNT 0.05 test in table 5 on the amount of flowers at the age of 28 HST, it shows that the administration of 3 cc of Gandasil B / liter of water produces the highest amount of flowers (7.42 pieces) which is significantly different from the absence of Gandasil B (G0) treatment and the treatment of 1 cc of Gandasil B/liter of water but significantly different from other treatments.

e. Number of Fallen Flowers

Table 6. Number of Flower Drops

Gandasil B & AB mix	Rata – Rata	NP BNT 0.05
G0=100% AB mix	1.83a	
G1=1 cc/L water	1.50b	
G2=2 cc/L water	1.42b	0,25
G3=3 cc/L water	1.33b	

Remarks*: The average value followed by the same letter is not real at the BNT test level of 0.05.*

Based on the results of the BNT 0.05 test in table 6 on the number of fall flowers, it shows that the administration of 3 cc of Gandasil B / liter of water produces the least number of fall flowers (1.33 pieces) which is significantly different from without Gandasil B (G0) treatment but is not real from other treatments.

The results of the research on the BNT test showed that the administration of Gandasil B can reduce the number of deciduous flowers in hydroponic melon plants. The dose of 3 cc/L produced the least number of deciduous flowers, which was 1.33 fruits, and was significantly different from the control (G0), but not significantly different from the treatment of 1 cc/L (G1) or 2 cc/L (G2). This indicates that the application of Gandasil B in adequate doses is able to minimize flower drops, but the reduction effect has been achieved at lower doses, so that an increase in dose to 3 cc/L does not make a significant difference compared to 1–2 cc/L.

Physiologically, flower fall can be caused by nutrient imbalances, photosynthate deficiencies, and disruption of nutrient transport to the reproductive organs. The elements potassium, boron, and calcium contained in Gandasyl B play an important role in strengthening the tissues of flower stalks, increasing the distribution of assimilates, and maintaining the stability of growth hormones (auxin, gibberelin) that regulate the abscission (gugur) process. At sufficient doses (≥ 1 cc/L), these needs have been met so that the miscarriage rate decreases.

f. Fruit Diameter

Table 7. Fruit Diameter

Gandasil B & AB mix	Rata – Rata	NP BNT 0.05
G0=100% AB mix	11,33a	
G1=1 cc/L water	12,33a	
G2=2 cc/L water	13.43b	1,53
G3=3 cc/L water	12.79ab	

Remarks*: The average value followed by the same letter is not real at the BNT test level of 0.05.*

Based on the results of the BNT 0.05 test in table 7 on the fruit diameter, it shows that the administration of 2 cc of Gandasil B / liter of water produces the largest fruit diameter (13.43 cm) which is significantly different from without Gandasil B (G0) treatment and 1 cc Gandasil B treatment / liter of water (G1) but is not real difference with 3 cc of Gandasil B / liter of water (G3).

g. Fruit Weight

Table 8. Fruit Weight

Gandasil B & AB mix	Rata – Rata	NP BNT 0.05
G0=100% AB mix	1,021.58a	
G1=1 cc/L water	1,250.58ab	
G2=2 cc/L water	1,585.25b	550.91
G3=3 cc/L water	1,489.52ab	

Remarks*: The average value followed by the same letter is not real at the BNT test level of 0.05.*

Based on the results of the BNT 0.05 test in table 8 on the weight of the fruit, it shows that the administration of 2 cc of Gandasil B / liter of water produces the largest fruit weight (1,585.25 g) which is significantly different from without Gandasil B (G0) treatment but not real difference with the treatment of 1 cc of Gandasil B / liter of water (G1) and the treatment of 3 cc of Gandasil B / liter of water (G3).

h. Weight of Fruit Plot

Table 9. Weight of Fruit Plot

Gandasil B & AB mix	Rata – Rata	NP BNT 0.05
G0=100% AB mix	3,636.00a	
G1=1 cc/L water	4,333.00a	
G2=2 cc/L water	5,426.33b	550.91
G3=3 cc/L water	7,091.33c	

Remarks*: The average value followed by the same letter is not real at the BNT test level of 0.05.*

Based on the results of the BNT 0.05 test in table 8 on the weight of the fruit, it shows that the administration of 3 cc of Gandasil B / liter of water results in the largest weight of the fruit per plot (7,091.33 gr) which is significantly different from other treatments.

Observation of Plant Variables

Based on the results of the fingerprint analysis, the treatment of Gandasil B can be responded to well by all observation parameters, namely plant height, number of leaves, number of branches, number of flowers, number of falls, fruit diameter, weight of fruit, and weight of fruit per plot.

a. Plant Height

The plant height graph (Graph 1) shows that Gandasil B with a concentration of 3 cc/liter of water produces the best plant height than any other concentration. The results of further tests using orthogonal polynomial (Graph 2) showed that the concentration of Gandasyl B showed a linear relationship with the height of the melon plant at the age of 21 and 28 HST.

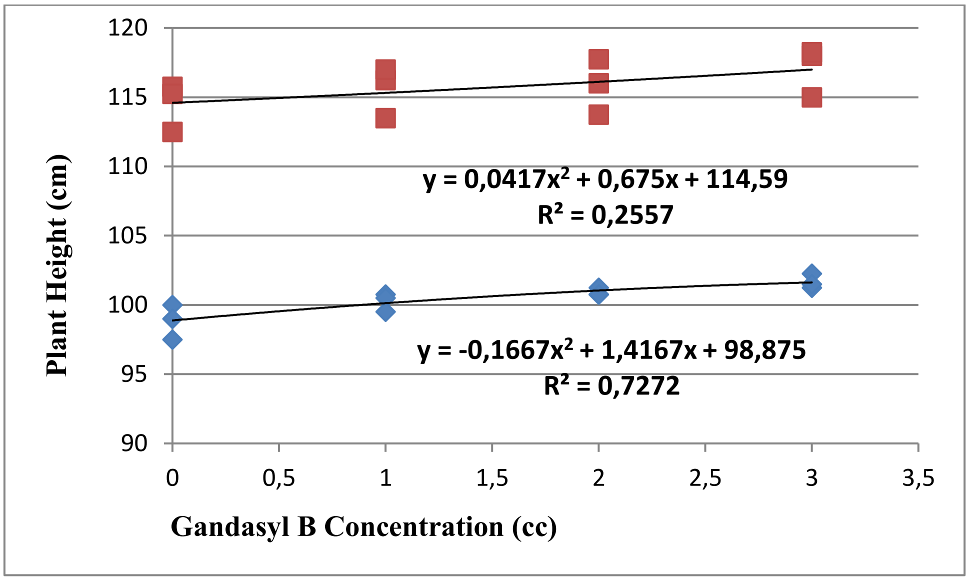

Figure 1. Crop Height Graph

The graph above shows the high R2 value of plants at the age of 21 Hst of 0.7272 which means that the provision of Gandasil B concentration to melon plants contributes 72.72% and the remaining 27.28% is influenced by other factors. Meanwhile, at the age of 28 Hst with an R2 of 0.2557, which means that the administration of Gandasil B concentration to melon plants contributed 25.57% and the remaining 74.43% was influenced by other factors.

At the age of 21 HST, plants are still in the active vegetative growth phase, where the need for macronutrients, especially nitrogen (N), is very high. Nitrogen plays a role in the formation of chlorophyll, protein synthesis, and cell division, thus spurring stem elongation. Higher doses of Gandasyl B (3 cc/liter) provide optimal amounts of nitrogen, phosphorus, and potassium, resulting in maximum growth (101.67 cm).

Meanwhile, at the age of 28 HST, although plants with a dose of 3 cc still produce the highest height (117.08 cm), the difference with doses of 1 cc and 2 cc is no longer significant. This is likely due to the transition phase of growth, in which the plant begins to allocate energy and nutrients for the formation of generative organs (flowers and fruits). In addition, hydroponic systems that use AB mix solutions already provide complete nutrients through the roots, so that the difference in Gandasil B supplementation through leaves becomes less dominant in this phase. Other physiological factors that play a role are the limited capacity to absorb nutrients through the leaves;

Once nutrient needs are met, excess nutrients do not promote further growth and can even lead to nutrient utilization saturation points.

b. Number of Leaves (Strands)

The plant height graph (Graph 1) shows Gandasil B with a concentration of 3 cc/liter of water produces the highest number of leaves than any other concentration. The results of further tests using orthogonal polynomial (Graph 2) showed that the concentration of Gandasyl B showed a linear relationship with the leaf mass of the Melon plant at the age of 21 and 28 HST.

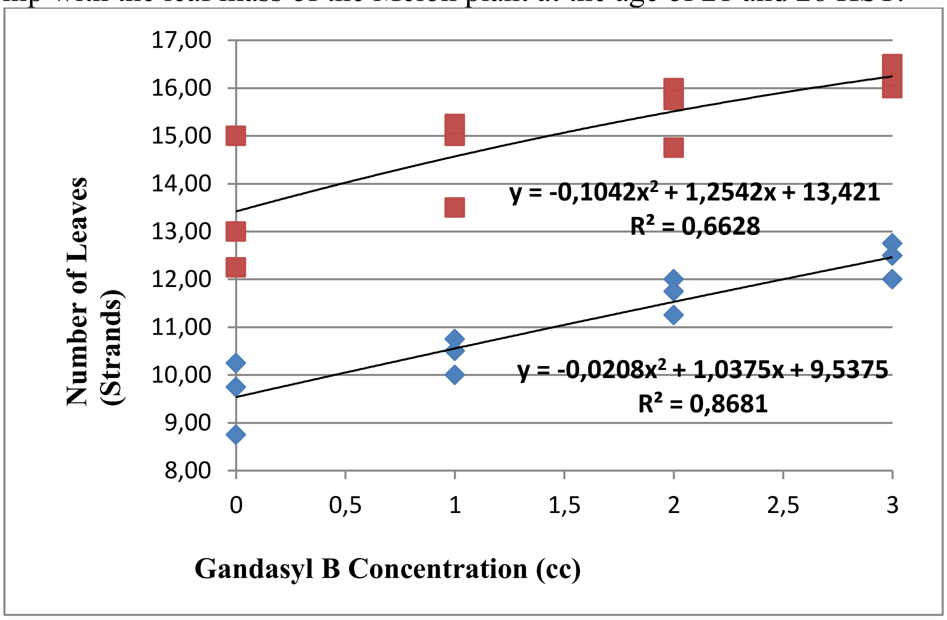

Figure 2. Leaf Count Graph

The graph above shows the R2 value of plant height at the age of 21 Hst of 0.8681 which means that the provision of Gandasyl B concentration to melon plants contributes 86.81% and the remaining 13.19% is influenced by other factors. Meanwhile, at the age of 28 Hst with an R2 of 0.6628 which means that the administration of Gandasil B concentration to melon plants contributed 66.28% and the remaining 33.72% was influenced by other factors.

. The results of the research on the BNT test showed that the administration of Gandasil B had a significant effect on the number of leaves of hydroponic melon plants, where a dose of 3 cc/L produced the highest number of leaves at the age of both 21 HST (12.42 sheets) and 28 HST (16.25 sheets). However, the difference between the 3 cc/L (G3) and 2 cc/L (G2) doses was not significant, while the two differed markedly with the 1 cc/L (G1) and control (G0) doses. This indicates that the dose of 2 cc/L has met the optimal needs of the plant for leaf formation, so the addition to 3 cc/L does not provide a significant increase.

Physiologically, the nitrogen, phosphorus, potassium, and microelement content in Gandasyl B plays an important role in stimulating cell division in the apical meristem, the formation of leaf primordia, and extending the functional life of the leaves. In the vegetative phase, adequate doses encourage maximum leaf formation, but once the nutritional needs are met, the increased dose does not accelerate the process due to the limitations of foliar absorption, physiological saturation points, and the distribution of resources to generative organs. These findings suggest that a dose of 2 cc/L may be an efficient option to optimally increase leaf count.

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c. Number of Branches (Trunks)

The number of branches graph (Graph 3) shows that Gandasil B with a concentration of 3 cc/liter of water produces the highest number of branches than any other concentration. The results of further tests using orthogonal polynomial (Graph 2) showed that the concentration of Gandasyl B showed a linear relationship with the leaf mass of the Melon plant at the age of 21 and 28 HST.

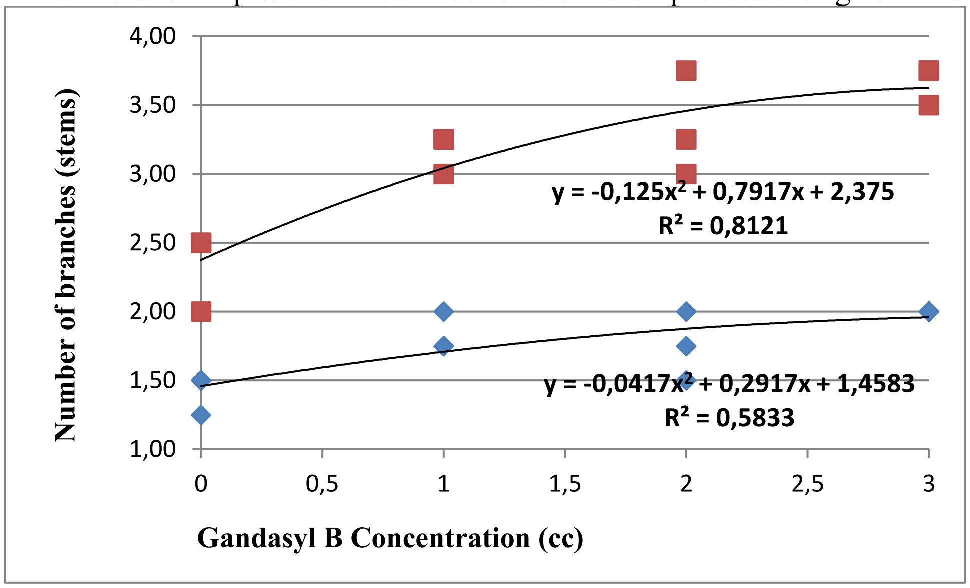

Figure 3. Graph Number of Branches

The graph above shows the R2 value of the number of branches at the age of 21 Hst is 0.5833 which means that the administration of Gandasil B concentration to melon plants contributes 58.33% and the remaining 41.67% is influenced by other factors. Meanwhile, at the age of 28 Hst with an R2 of 0.8121, which means that the provision of Gandasil B concentration to melon plants contributed 81.21% and the remaining 18.79% was influenced by other factors.

The results of the research on the BNT test showed that the administration of Gandasil B could increase the number of branches of hydroponic melon plants, where a dose of 3 cc/L produced the highest number of branches, namely 2 stems at the age of 21 HST and 3.67 stems at the age of 28 HST. At both observation times, the 3 cc/L treatment was significantly different from the control (G0), but not significantly different from the 1 cc/L (G1) and 2 cc/L (G2) dose treatments. This suggests that although high doses are able to spur branch formation, even lower doses can provide comparable results, so increasing doses above 2 cc/L does not provide statistically significant additional effects.

Physiologically, branch formation is strongly influenced by the availability of nitrogen, phosphorus, potassium, and microelements that favor the growth of lateral shoots. Nitrogen promotes the formation of vegetative tissue, phosphorus supports cell division and differentiation, while potassium plays a role in regulating turgor pressure which affects the elongation of shoots. The administration of Gandasyl B through the leaves allows the nutrients to be absorbed directly by the photosynthetic tissue, so that it is quickly utilized for lateral shoots growth. However, once optimal nutritional requirements are achieved, overdoses no longer significantly increase the number of branches due to physiological mechanisms such as apical dominance, limited foliar absorption capacity, and resource allocation to generative organs.

d. Amount of Interest (fruit)

The chart of the number of flowers (Graph 5) shows that Gandasil B with a concentration of 3 cc/liter of water produces the highest number of leaves than any other concentration. The results of further tests using orthogonal polynomial (Graph 2) showed that the concentration of Gandasyl B showed a linear relationship with the leaf mass of the Melon plant at the age of 21 and 28 HST.

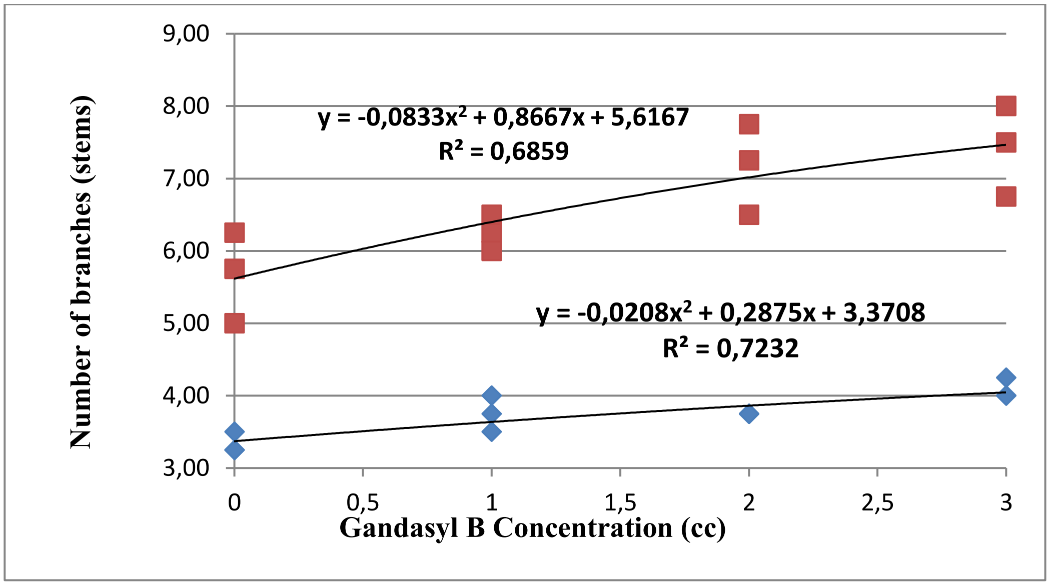

Figure 4. Interest Amount Chart

The graph above shows the R2 value of the amount of flowers at the age of 21 Hst is 0.7232 which means that the provision of Gandasil B concentration to melon plants contributes 72.32% and the remaining 27.68% is influenced by other factors. Meanwhile, at the age of 28 Hst with an R2 of 0.6859, which means that the provision of Gandasil B concentration to melon plants contributed 68.59% and the remaining 31.41% was influenced by other factors.

The results of the research on the BNT test showed that the administration of Gandasil B had an effect on the number of flowers of hydroponic melon plants, where a dose of 3 cc/L produced the highest number of flowers at both observation times. At age 21 HST, the 3 cc/L (4.08 flowers) treatment was significantly different from the control (G0), but not significantly different from the 1 cc/L (G1) or 2 cc/L (G2) dose treatments. At age 28 HST, a dose of 3 cc/L yielded 7.42 flowers and was significantly different from controls (G0) and G1, but not significantly different from G2. This pattern suggests that an increase in dose above 2 cc/L tends to give an additional amount of interest, but its significance is only evident in the later generative phase (28 HST).

Physiologically, flower formation is strongly influenced by the balance of macro and micro nutrients. Phosphorus plays a role in the formation of reproductive tissue and flowering, potassium aids in the transport of photosynthates to the flower organs, while microelements such as boron and zinc are important for the development of healthy reproductive organs. The administration of Gandasyl B in adequate doses accelerates the transition from the vegetative to the generative phase, so that the number of flowers increases. However, once optimal nutrient needs are met (about 2 cc/L), the plant's response to additional doses becomes limited, except in the active flowering phase where energy and nutrient requirements increase rapidly.

e. Number of Flower Drops (Fruit)

The graph of the number of deciduous flowers (Graph 8) shows that Gandasil B with a concentration of 3 cc/liter of water produces the least number of deciduous flowers than any other concentration.

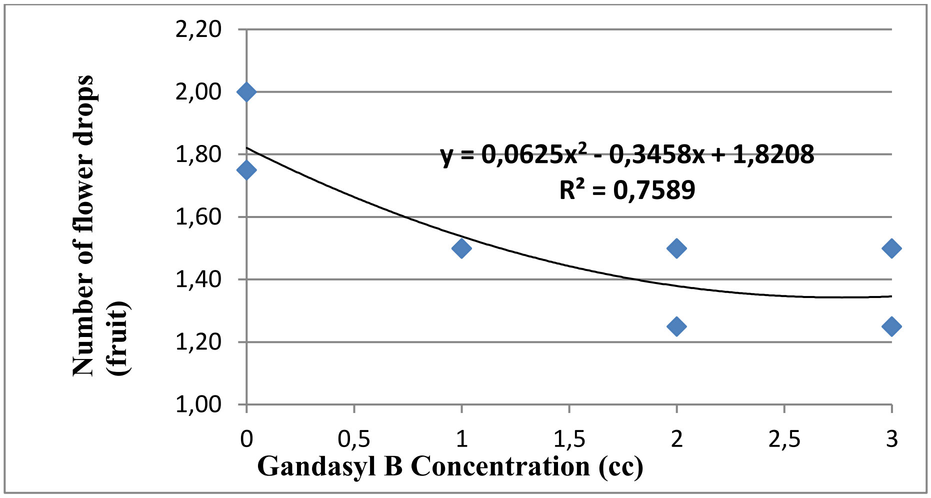

Figure 5. Graph of the Number of Fallen Flowers

The graph above shows the R2 value of the number of fall flowers is 0.7589 which means that the application of Gandasil B concentration to the number of fall flowers of melon plants contributes 75.89% and the remaining 24.11% is influenced by other factors.

The results of the research on the BNT test showed that the administration of Gandasil B can reduce the number of deciduous flowers in hydroponic melon plants. The dose of 3 cc/L produced the least number of deciduous flowers, which was 1.33 fruits, and was significantly different from the control (G0), but not significantly different from the treatment of 1 cc/L (G1) or 2 cc/L (G2). This indicates that the application of Gandasil B in adequate doses is able to minimize flower drops, but the reduction effect has been achieved at lower doses, so that an increase in dose to 3 cc/L does not make a significant difference compared to 1–2 cc/L.

Physiologically, flower fall can be caused by nutrient imbalances, photosynthate deficiencies, and disruption of nutrient transport to the reproductive organs. The elements potassium, boron, and calcium contained in Gandasyl B play an important role in strengthening the tissues of flower stalks, increasing the distribution of assimilates, and maintaining the stability of growth hormones (auxin, gibberelin) that regulate the abscission (gugur) process. At sufficient doses (≥ 1 cc/L), these needs have been met so that the miscarriage rate decreases.

f. Fruit diameter

In the graph in gamabr 6 below, the R2 value of fruit dimater is 0.5949 which means that the provision of Gandasil B concentration to the fruit dimater of melon plants contributes 59.49% and the remaining 41.51% is influenced by other factors).

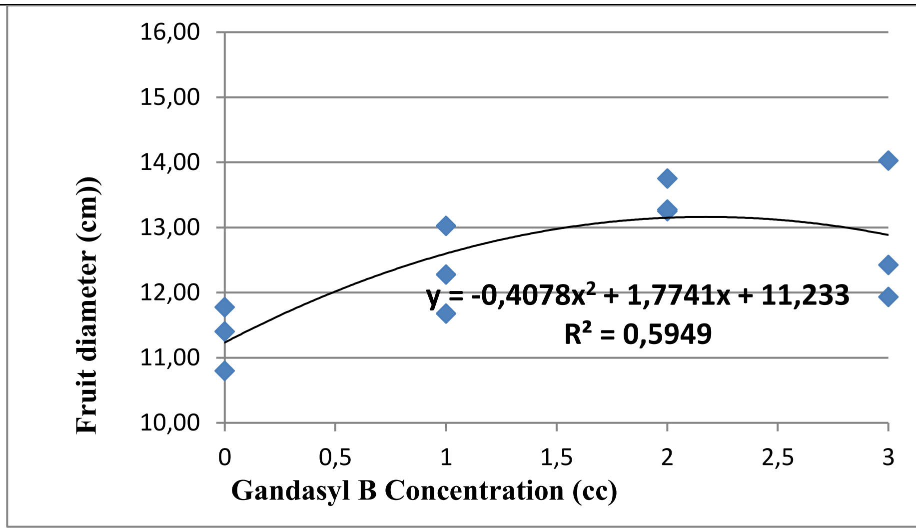

Figure 6. Fruit Diameter Chart

The results of the BNT test research showed that the administration of Gandasil B had an effect on the diameter of hydroponic melons, with the largest diameter obtained at a dose of 2 cc/L, which was 13.43 cm. This treatment was markedly different from the control (G0) and the 1 cc/L (G1) dose, but not significantly different from the 3 cc/L (G3) dose. This indicates that the dose of 2 cc/L is quite optimal in meeting the nutritional needs of plants for fruit growth, so increasing the dose to 3 cc/L does not provide a statistically significant increase.

Physiologically, fruit enlargement is greatly influenced by the availability of potassium, phosphorus, and microelements that support cell division and enlargement. Potassium plays an important role in regulating the osmotic pressure of cells, maximizing the filling of fruits with water and assimilating photosynthesis, while phosphorus supports the metabolism of energy (ATP) needed during the growth process. The administration of Gandasyl B through the leaves accelerates the supply of nutrients to the fruit through the phloem tissue, thereby increasing the rate of filling of the fruit.

g. Fruit weight

In the graph in figure 7 below, the R2 value of fruit weight is 0.515, which means that the application of Gandasil B concentration to the weight of melon plants contributes 51.5% and the remaining 48.5% is influenced by other factors.

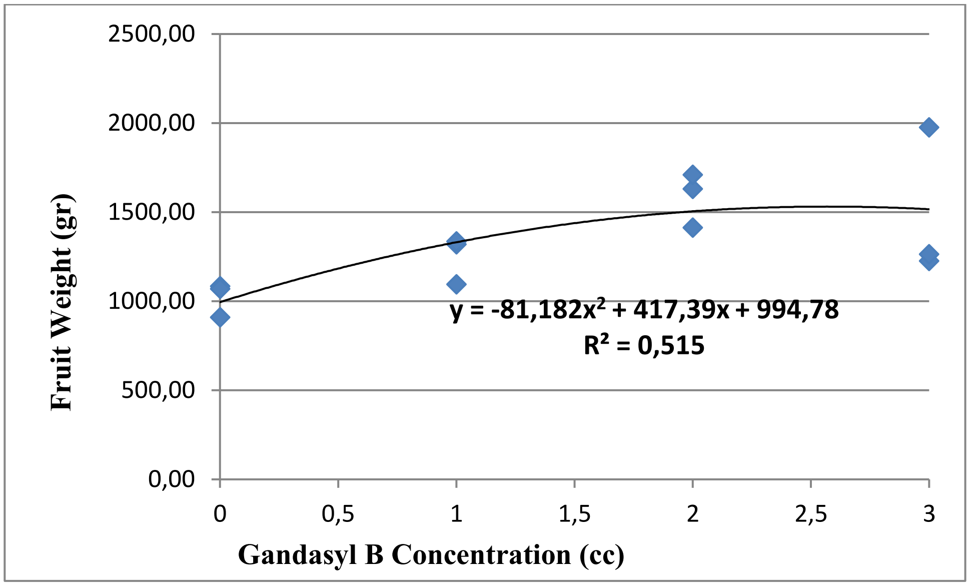

Figure 7. Fruit Weight Graph

The results of the research in the BNT test showed that the administration of Gandasil B had an effect on the weight of hydroponic melons, where the highest weight was obtained at a dose of 2 cc/L, which was 1,585.25 grams. This treatment was significantly different from the control (G0), but not significantly different from the doses of 1 cc/L (G1) or 3 cc/L (G3). This suggests that although the administration of Gandasil B can increase the weight of the fruit, a dose of 2 cc/L is sufficient to meet the nutritional needs of the plant, so adding or decreasing the dose of this value does not make a statistically significant difference.

Physiologically, the increase in fruit weight is closely related to the optimal availability of potassium, phosphorus, and nitrogen elements. Potassium facilitates the translocation of photosynthetic results (assimilates) from leaves to fruits, phosphorus supports the process of energy metabolism required in fruit filling, while nitrogen plays a role in the formation of proteins and organic compounds that affect the growth of fruit tissue. With the fulfillment of these three elements, the formation and enlargement of fruits can take place optimally so that the weight of the fruit increases.

h. Weight of fruit per plot

In the graph in figure 8 below, the R2 value of the weight of the fruit plot is 0.9455 which means that the provision of the concentration of Gandasil B to the weight of the fruit of the melon plant gives a significant contribution of 94.55% and the remaining 5.5% is influenced by other factors.

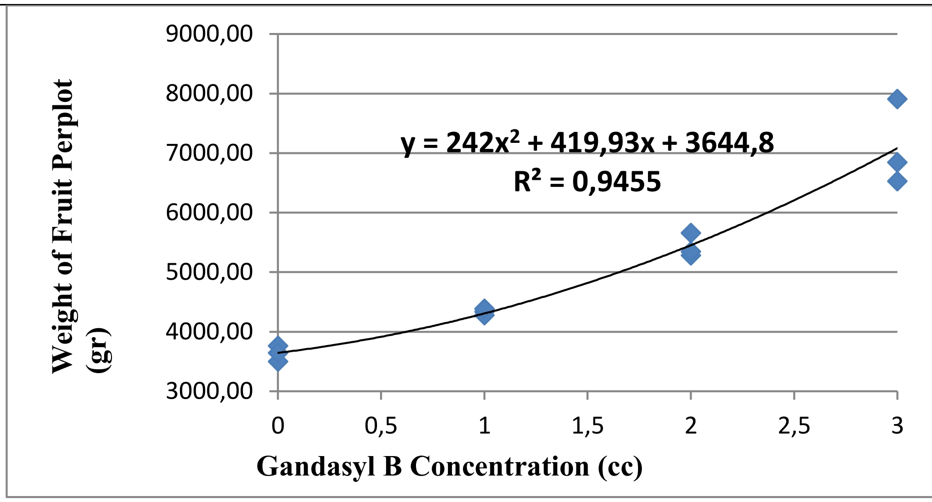

Figure 8. Fruit Weight Chart per Plot

The results of the research on the BNT test showed that the administration of Gandasil B had a significant effect on the weight of fruit per plot of hydroponic melon plants, where a dose of 3 cc/L resulted in the highest weight, which was 7,091.33 grams, and was significantly different from all other treatments. This indicates that on the scale of the total harvest per plot, an increase in dose of up to 3 cc/L provides a real advantage over a lower dose, either due to the effect of increasing weight per fruit, the number of fruits, or a combination of both.

Physiologically, high doses of Gandasil B provide a more abundant supply of macro (N, P, K) and micronutrients, thus supporting both flower and fruit formation (generative phase) and fruit filling. A sizable amount of potassium maximizes the translocation of photosynthates from the leaves to all the fruits that form, phosphorus supports energy metabolism for the growth of fruit tissues, while nitrogen remains required to maintain photosynthetic activity during the filling period. This combination can increase productivity per plot overall.

Analysis of the Cost of Farming Melon Madesta F1

a. Fixed costs

Table 10. Fixed cost component in hydroponic melon farming F1

Component	Per three years (Rp)	Per month (Rp)
Depreciation cost of screen house depreciation	IDR 5,715,000	IDR 158,750
Depreciation cost of DFT installation tools and materials	IDR 5,838,000	IDR 162,166
Total	IDR 11,553,000	IDR 320,916

In the business of cultivating Madesta F1 melons using a hydroponic system, there are several fixed cost components that must be taken into account. Fixed costs are costs that do not change regardless of the amount of production produced. These costs include initial investments in means of production that have a certain economic lifespan and depreciate over time. From the table presented, there are two main components in the fixed cost, namely: Screen House Depreciation Cost.Screen house is an important facility in the hydroponic system to protect plants from pests, extreme weather, and maintain an optimal growing environment. The cost of screen house depreciation is calculated at Rp. 5,715,000 per three years, or if averaged per month, it becomes Rp. 158,750.Cost of Depreciation of DFT (Deep Flow Technique) Installation Tools and Materials The DFT installation is a hydroponic system used in the cultivation of Madesta F1 melons. This system includes a variety of tools and materials such as water pumps, hydroponic gutters, nutrient solution reservoirs, as well as circulation systems. The depreciation cost for DFT installation tools and materials for three years is Rp. 5,838,000, with an average monthly cost of Rp. 162,166. So, the total fixed cost if added up, the total depreciation cost for the two components for three years is Rp. 11,553,000, or around Rp. 320,916 per month.

b. Variable (variable) costs

Table 12. Components of non-fixed costs in hydroponic madesta melon farming F1

Component	Average cost/ 3 years (Rp)	Average cost/month (Rp)
Ab mix goodplant fruit 5 L	IDR 5,175,000	IDR 143,750
Rockwool	IDR 756,000	IDR 21,000
Electricity	IDR 1,350,000	IDR 37,500
Wire Tape	IDR 472,500	IDR 13,125
Product labels	IDR 2,700	IDR 75,000
Plastic (packaging)	IDR 108,000	IDR 3,000
Gandasil B	IDR 100,000	IDR 2,700
Total	IDR 12,449,710	Rp.296.075

In the Madesta F1 melon farming business using a hydroponic system, there are various variable cost components that affect the sustainability of production. Variable costs are costs that change according to the level of production and use of materials. Based on the table presented, here are the details and discussion: AB Mix Goodplant Fruit 5 L AB mix is the main nutrient in the hydroponic system that functions to meet the nutrient needs of plants. The cost incurred for AB mix for three years is Rp. 5,175,000, or around Rp. 143,750 per month. Rockwool is used as a planting medium for rooting hydroponic plants because it has high water absorption and a structure that supports root growth. The cost incurred for three years is Rp. 756,000, or around Rp. 21,000 per month. Electricity needs in hydroponic systems include water pump operations, circulation systems, and additional lighting if needed. The electricity cost for three years is Rp. 1,350,000, or around Rp. 37,500 per month. Wire tape is used as a plant support so that it grows upright and does not collapse, especially during fruiting. The cost incurred for three years is Rp. 472,500, or Rp. 13,125 per month. Product labels serve as product identity and branding that can increase market appeal. The cost for three years reaches Rp. 2,700,000, or around Rp. 75,000 per month. Plastic (packaging) is used as product packaging to maintain the quality and appearance of melons so that they remain attractive when marketed. The cost incurred for three years is Rp. 108,000, or Rp. 3,000 per month. Gandasyl B is used to increase plant fertility. So, the cost for three years is Rp. 100,000, or around Rp. 2,700 per month. If all components are added up, then the total variable cost in three years is Rp. 12,449,710, or around Rp. 296,075 per month.

c. Classification of production costs

Table 13. Classification of the production cost of melon madesta F1

Component	Cost/ 3 years (Rp)	Cost /month (Rp)
Fixed costs	IDR 11,553,000	IDR 320,916
Variable costs	IDR 12,449,710	IDR 296,075
Total production cost	IDR 24,002,710	IDR 616,991

In running Madesta F1 melon farming with a hydroponic system, the total production cost consists of two main components, namely fixed costs and variable costs. The following is a discussion of each component and the total cost of production produced Fixed costs are unchanged expenses regardless of the amount of production produced. These costs include initial investments that have depreciated over a period of time. In this business, the fixed cost for three years reaches Rp. 11,553,000, or if calculated per month it is Rp. 320,916. This cost includes the shrinkage of the screen house and hydroponic installation equipment of the Deep Flow Technique (DFT) system. Variable costs are expenses that fluctuate depending on the volume of production and the use of materials. The total variable costs incurred over three years are Rp. 12,449,710, with an average monthly cost of Rp. 296,075. This cost component includes AB mix nutrition, rockwool growing media, electricity, wire tape, packaging, product labels, and double B. Total Production Costs By adding fixed costs and variable costs, the total production cost for three years reaches Rp. 24,004,500, or around Rp. 668,791 per month. This figure reflects the overall cost required to run a hydroponic Madesta F1 melon farm in that period.

d. Analysis of the reception of melon madesta F1

Table 14. Sales and receipts data of hydroponic F1 madesta melon

Description	Total sales (fruit / 3 years)	Selling price (Rp)	Total revenue (Rp)	Average / day (Rp)
Melon madesta F1	2.115	IDR 30,000	IDR 63,450,000	IDR 58,000

Based on the available data, the Madesta F1 Melon cultivation business using the hydroponic method has produced the following sales and receipts: Total sales over a three-year period, the number of melons sold reached 2,115 pieces. This figure reflects the harvest and distribution of melons during that period. The selling price per fruit of each melon is sold at a price of IDR 30,000. This price shows the selling value of the product in the market which can be influenced by quality factors, market demand, and production costs. Total receipts with total sales of 2,115 pieces and selling price of IDR 30,000 per piece, the total revenue obtained in three years is as follows: 2,115 pieces × IDR 30,000 = IDR 63,450,000. This figure is the gross income obtained from sales without taking into account production and operational costs. Average daily receipts to find out the average receipts per day, total receipts divided by the number of days in three years (3 × 365 days = 1,095 days): IDR 63,450,000 ÷ 1,095 days = IDR 58,000 per day. This means that on average, the hydroponic Madesta F1 Melon cultivation business provides an income of Rp 58,000 per day.

e. Analysis of the income of melon madesta F1

Table 15. Hydroponic F1 madesta melon business income

Component	Quantity / 3 years	Average/month
Total revenue (Rp)	IDR 63,450,000	IDR 1,762,500
Total cost (Rp)	IDR 24,002,710	IDR 616,991
Operating income (Rp)	IDR 39,447,290	Rp. 1,145,509

In the cultivation business of melon Madesta F1 with a hydroponic system, the income obtained is calculated based on the total revenue from sales minus the total production costs. Here is the revenue analysis based on the available data:

This farming produced 2,115 melons in a three-year period. With a selling price of Rp. 30,000 per piece, the total revenue obtained for three years reached Rp. 63,450.00. If averaged, the daily income from this sale is Rp. 58,000, while the average monthly income is Rp. 1,762,500.

The total production cost that includes fixed and variable costs for three years is Rp. 24,004,500, with an average monthly cost of Rp. 616,991.

Venture income is calculated by subtracting the total cost from the total revenue. In three years, the net income obtained was Rp. 39,447,290, or an average of Rp. 1,145,509 per month.

f. Feasibility analysis of the F1 madesta melon venture

- R/C Analysis of Hydroponic F1 madesta melon business ratio

Table 16. R/C Analysis of Hydroponic F1 madesta melon business ratio

Component	Quantity / 3 years
Total cost (Rp)	IDR 24,002,710
Business Revenue (Rp)	IDR 63,450,000
R/C Ratio	2.64

R/C Ratio (Revenue to Cost Ratio) is an economic indicator used to measure the level of efficiency of farming by comparing total revenue to total costs incurred. The R/C Ratio value shows the extent to which farming can generate profits from every rupiah invested.

The R/C Ratio is calculated by the following formula:

$$\text{R/C Ratio} = \frac{total\ penerimaan}{total\ biaya\ produksi}$$

Based on available data:
Total business revenue in 3 years = Rp. 63,450,000
Total production cost in 3 years = Rp. 24,002,710
So that:

$$\text{R/C Ratio} = \frac{63.450.000}{24.002.710} = 2{,}64$$

The R/C Ratio value of 2.64 shows that every Rp. 1 spent in this business produces a revenue of Rp. 2.64 Because the R/C Ratio value is more than 1 (R/C Ratio > 1), the Madesta F1 melon cultivation business with a hydroponic system can be said to be feasible and profitable. The higher the R/C Ratio value, the more efficient the business will be in generating profits.

g. Analysis of B/C Hydroponic Melon F1 Hydroponic Business Ratio

Table 17. Analysis of B/C Hydroponic Melon F1 Hydroponic Business Ratio

Component	Quantity / 3 years
Total cost (Rp)	IDR 24,002,710
Operating income (Rp)	IDR 39,447,290
B/C Ratio	1.64

The total production cost for 3 years is Rp. 24,002,710. This cost includes initial investment, maintenance, operation, and other costs required in running a Madesta F1 melon hydroponic business during the period.

Operating income obtained in 3 years reached Rp. 39,447,290 This income is calculated based on the yield and selling price of melons during the business period.

B/C Ratio is calculated by the formula:

$$\mathrm{B/C\ Ratio} = \frac{total\ tendapatan}{total\ biaya}$$

$$\mathrm{B/C\ Ratio} = \frac{39.447.290}{24.002.710} = 1.64$$

Based on the calculation results, a B/C Ratio of 1.64 was obtained. This value is greater than 1, which means that the Madesta F1 melon hydroponic business is feasible and profitable.

h. BEP analysis of hydroponic melon madesta F1 business

Table 18. BEP analysis of hydroponic melon madesta F1 business

Component	Value
Total cost (Rp)	IDR 24,002,710
Selling price (Rp/piece)	IDR 30,000
Quantity of production (fruit)	2.115
BEP Volume (fruit)	235
BEP production price	30.000

The total production cost of the Madesta F1 melon business with a hydroponic system during the business period is Rp. 24,002,710. This cost covers all expenses, such as investment, operational, maintenance, and labor costs. Melon Madesta F1 is sold at a price of Rp. 30,000 per piece. This price is an important factor in the calculation of BEP because it determines the break-even point of the business. So, the number of melon production produced during the business period is 2,115 pieces. The Break Even Point (BEP) in production volume indicates the minimum number of products that must be sold so that the business does not suffer losses. In this analysis, the BEP volume was 235 pieces. This means that this business will break even after successfully selling 235 melons, where the income obtained has covered the total production costs. The production price BEP shows the minimum selling price per piece so that the business does not suffer losses. In this calculation, the BEP production price is Rp. 30,000 per piece, which means that with the selling price, the business is already at break-even. Interpretation of the results of BEP with a total production of 2,115 pieces and a volume of BEP of 235 pieces, this business has a considerable profit margin because production far exceeds the break-even point. The selling price of Rp. 30,000 per piece is in accordance with the BEP production price, so that with maximum production, this business has the potential to generate significant profits. If production or selling price falls below the BEP point, the business can suffer losses. Therefore, maintaining production efficiency and maintaining selling prices is essential for business sustainability

Conclusion

The research concludes that nutrients, pH, and air circulation significantly affect melon growth and yield in the DFT hydroponic system, with Gandasil B applied at 3 cc/L delivering the best results across growth parameters. The economic analysis shows melon cultivation to be profitable, with a break-even point of 235 fruits at Rp 30,000 each, total costs of Rp 11,950,000, and annual income of Rp 21,150,000 from three harvests, yielding an R/C ratio above 1. Future research should not only optimize nutrient management but also investigate integrated pest and disease control strategies to further enhance hydroponic melon production.

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