Journal of Advanced Zoology

ISSN: 0253-7214

Volume 44 Issue 03 Year 2023 Page 10:17

The Effect of Planting Media and Time of Application of Nutrients on Melon (*Cucumis Melo L.*) Using Drip Irrigation Hydroponics

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Article History

Received: 06 June 2023
Revised: 15 August 2023
Accepted:21August 2023

Abstract

The cultivation of melon plants began to develop hydroponically. A good planting medium for hydroponics is porous, able to retain moisture, and serves to absorb nutrient solutions. The planting media that are widely used are husk charcoal, compost, and cocopeat. This study aims to determine the effect of planting media and time of application of nutrients on melon using drip irrigation hydroponics. This research method uses two independent variables, namely the time of application of nutrients (T) and the planting medium (M). The treatment times for the application of nutrients were one day (T1) and two days (T2). While the treatment of planting media was husk charcoal (M1), husk charcoal and compost with a ratio of 1:1 (M2), as well as husk charcoal and cocopeat with a ratio of 1:1 (M3), The results of measurements of plant height, number of leaves, number of segments, and fruit weight were compared to determine differences using a two-way ANOVA with a significance level of 5%. The results showed that the time of application of nutrients (T) and the planting media (M) affected plant height, number of leaves, number of segments, and weight of melon fruit. T1 had a better effect on melon plants when compared to T2, and M3 had a better effect on melon plants when compared to M1 and M2.

Keywords: *Surgical Planting media, Melon, Time of application of nutrients*

1. Introduction

Chronic Initially, melon plants were cultivated conventionally in the field, and until now, this method is still being used. With the development of science, the cultivation of melon plants began to be developed in hydroponic greenhouses. According to AgroMedia (2010) that "melon plants belong to the Cucurbitaceae family, which is a type of pumpkin plant, and is in the same family as cucumber, pumpkin, watermelon, and cantaloupe. This plant grows vines and includes annual crops, and leaves and shoots grow on its segments".

Margianasari et al. (2012) states that "melon (*Cucumis melo* L.) is a plant originating from the Persian Valley, the Mediterranean, which belongs to the Cucurbitaceae family and is an annual fruit plant. This fruit is loved by the public because it is affordable, tastes sweet, smells fresh, and is available throughout the season. Melon plants began to be developed in Indonesia since 1980 so that at this time it is a fruit that is familiar to Indonesia. Furthermore, according to Wibowo (2021a) that "hydroponics is the cultivation of plants using a planting media other than soil". While Prihmantoro & Indriani (2005) stated that "a good planting media for hydroponics is porous and able to retain moisture". Furthermore Hartus (2018) states that "the planting media has the function of absorbing the nutrient solution when it is dripped or sprinkled and a place to hold the roots of the planted hydroponic plant roots".

Dalimoenthe (2013) states that "a good planting media is able to provide sufficient air and be able to maintain the availability of nutrients". Furthermore, Dalimoenthe (2013) reported that "manure, humus, compost, moss, charcoal, chopped fern, and coconut coir are several types of organic matter that can be used as planting media".

One method of providing nutrition in hydroponics is drip irrigation. According to Idrus (2013) that "the use of drip irrigation systems can increase productivity by up to 30% in hydroponic businesses in Pamulang Integrated Farming". While Simonne et al. (2012) stated that "drip irrigation is the provision of water where the area to be moistened is limited, and is the most efficient irrigation compared to overhead irrigation and seepage irrigation with an efficiency value of 80-95%". The disadvantage of applying drip irrigation for hydroponics is that the nutrient solution is not given continuously for 24 hours, so the timing of the nutrient solution must be right for optimal plant growth.

According to Sobari (2020) that "drip irrigation is a method of providing water or nutrients to plants by using containers and drippers, with the working principle of pushing nutrient solutions to plant roots using low pressure so that the efficiency and effectiveness of water use is up to 95%". Furthermore, Sobari (2020) states that "fertilization is a factor that influences plant growth and productivity, and one of the applications must be timely".

Several studies on melon plants have been carried out, including by Nursayuti, (2019), Nainggolan et al. (2019), Triadiati et al. (2019), Amir & Abdillah (2019), and Palmasari et al. (2022). However, to the authors' knowledge, studies comparing the growth and production of hydroponically cultivated melon plants with drip irrigation using planting media treatment and the time of application of nutrients have never been carried out. Therefore, this study used three treatments of planting media, namely husk charcoal (M1), husk charcoal and compost with a ratio of 1:1 (M2), and charcoal husk and cocopeat with a ratio of 1:1 (M3), with time treatment. one day (T1) and two days (T2) nutrition. This study aims to determine the effect of planting media and time of application of nutrients to melon (*Cucumis melo* L.) with hydroponic drip irrigation.

2. Materials And Methods

The research was conducted at the Banjarnegara Polytechnic in a greenhouse, with research time ranging from October 2022 to March 2023. The tools used were pots, a simple drip irrigation system, a TDS meter, a three-way soil meter, and digital scales. The materials used were melon seeds of variety P 4529, husk charcoal, compost, cocopeat, melon AB mix, and water.

In this study, six rows of potting columns were used for the treatment of planting media (M) and the time of application of nutrients (T), as well as five rows of replications for each treatment. "The pot is made of a plastic bucket with a top diameter of 31 cm, a bottom diameter of 25 cm, and a height of 24 cm, with a hole perforated at the bottom for drainage" Margianasari et al. (2012). Based on the truncated cone formula, the volume of the pot is 14,827 cm3. The distance between the pots was 60 cm x 60 cm, and each pot was filled with planting media according to the treatment M1, M2, and M3 and a simple drip irrigation system was installed using used plastic bottles and a small emitter hose with an inside diameter of 3 mm. The amount of drip irrigation discharge is 1.125 L/h.

The data measured in this study were plant height (cm), number of leaves (leaf), number of segments (segment), and fruit weight (g). In addition, measurements of the concentration and pH of the nutrient solution were also carried out, as were measurements of the humidity and pH of the planting media. The results of measurements of plant height, number of leaves, number of segments, and fruit weight in the treatment of planting media and the time of application of nutrients were compared to determine differences using a two-way ANOVA with a significance level of 5%. If the results are significantly different, then proceed with the Tukey's HSD test at a significant level of 5% Hartono (2012). The hypothesis used is the null hypothesis (Ho) and the alternative hypothesis (Ha) for the planting media factor (M), the nutrition time factor (T), and the interaction of the planting media and the time of nutrition (MT) Nurgiyantoro et al. (2009).

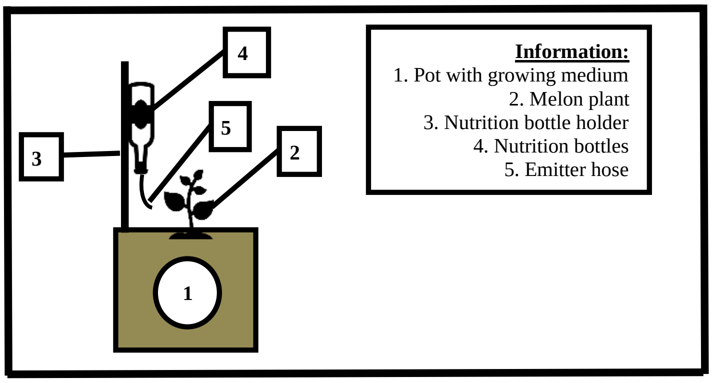

Figure 1. Desain simple hydroponic drip irrigation

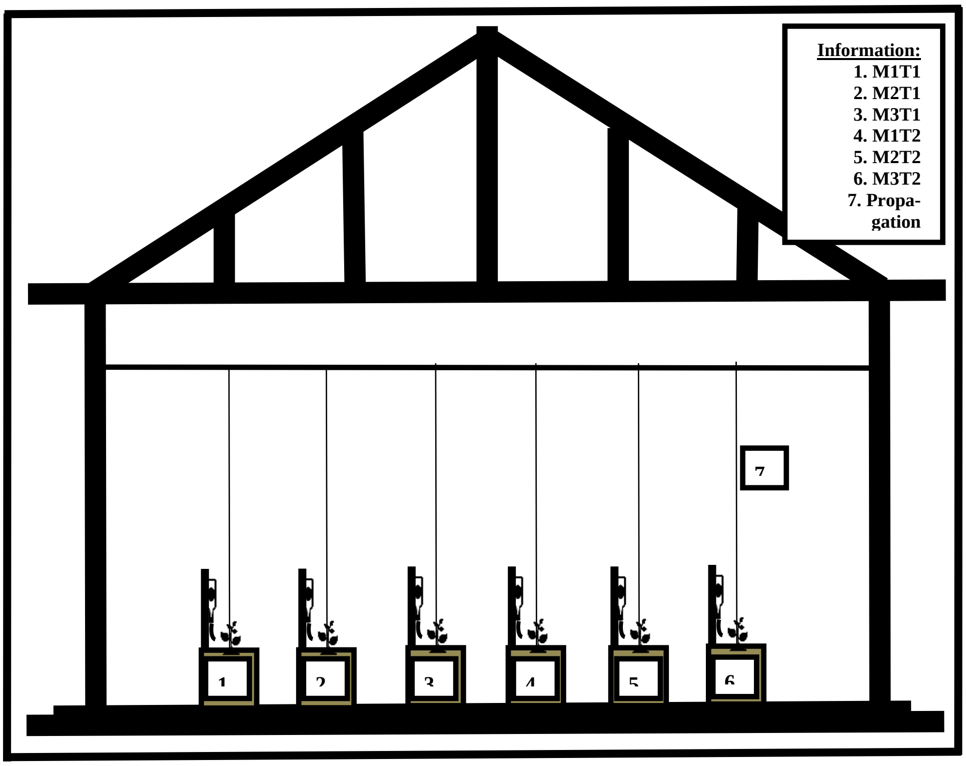

Figure 2. Desain layout of a drip irrigation hydroponic installation

3. Results and Discussion

Plant

Plant measurements including plant height, number of leaves, and number of segments were carried out once a week after transplanting the plants until the plant height was around 200 cm. At this height, which is at the age of 5 WAP, topping is done by cutting the top of the plant. According to Margianasari et al. (2012) "the purpose of topping is so that the development of plants in the vertical direction stops and the plants concentrate on the fertilization process".

In addition, at the age of the plant after 5 WAP, pewiwilan is started. “Pewiwilan is carried out on the first to the 11th segments and on the above the 15th segments, by cutting the shoots, branches or tendrils in the leaf axils that are detrimental, and by leaving one leaf on each segment. This aims to maximize plant growth and produce optimal fruit” Margianasari et al. (2012). The average results of plant measurements at 10 WAP which include plant height, number of leaves, and number of segments are presented in Table 1.

Plant height, number of leaves, and number of segments, both at T1 and T2, were the best at M3 (Table 1). According to Agriculture (2022a) that "a good planting media for hydroponics uses a mixture of husk charcoal and cocopeat in a ratio of 1:1. This mixture has the advantage that it can increase the level of porosity so that plant roots are more flexible to develop. Before use, cocopeat is washed or rinsed first so that the tannins are lost. Tannins are substances that inhibit plant growth".

Table 1. Average crop measurement results

Parameter	Treatment					
	M1T1	M2T1	M3T1	M1T2	M2T2	M3T2
Plant height (cm)	183.0	186.8	194.2	171.0	177.2	185.0
Number of leaves (leaf)	23.0	23.6	24.4	22.0	22.6	23.2
Number of segments (segment)	20.8	21.0	21.8	19.4	20.4	21.2

Nutrient Solution

The nutrient solution is given through a simple drip irrigation system, with the nutrient solution given once a day for T1 and once every two days for T2. Measurement of nutrient solution is carried out once a week after transplanting, which includes nutrient concentration and nutrient pH. This measurement is carried out for 10 WAP in the nutrient solution reservoir before being given to the plants so that the conditions are the same for all plants.

The results of nutrient solution measurements showed that the concentration of the nutrient solution was 1,360-1,520 ppm with an average of 1,414 ppm and the pH of the nutrient solution was 5.7-6.2 with an average of 6.0. According to Bayu (2016) that "the concentration of nutrients for melons is 1,400-1,750 ppm, while the pH for melons is 5.5-6.0". Thus, the average concentration and pH of the nutrient solution given is ideal for melon plants.

Planting Media

Measurement of the planting media is carried out once a week after transplanting for 10 WAP, which includes the moisture and pH of the planting media. Wibowo (2021b) states that "a three-way soil meter is used to measure the humidity of the planting media, with three criteria, namely dry 10-30%, moist 30-75%, and wet 75- 100%". The average moisture measurement results for the planting media during the study were 64.8-73.4% with an average of 69.3% for T1 and 56.1-64.5% with an average of 60.3% for T2. This shows that the humidity of the planting media, for both T1 and T2, is included in the moist criteria, and this condition is good for plant growth.

According to Prihmantoro & Indriani (2005) that "a good hydroponic media has a neutral acidity of around 5.8-7.2, must be porous and can retain moisture". The results of measurements of the pH of the planting media were 5.8-6.4 with an average of 6.1 for T1 and 6.1-6.8 with an average of 6.4 for T2. Thus, the degree of acidity (pH) of the planting media is ideal for plant growth. The results of measurements of moisture and pH of the planting media are presented in Table 2.

Table 2. The average results of measurements of the planting media

Parameter	Treatment					
	M1T1	M2T1	M3T1	M1T2	M2T2	M3T2
Planting media humidity (%)	64.8	69.7	73.4	56.1	60.2	64.5
The pH of the planting media	6.4	6.1	5.8	6.8	6.5	6.1

Melon

Measurements of melon quality include diameter, length, weight, and fruit sweetness. Fruit diameter and length were measured at 5-10 WAP. The average fruit diameter and length measurement results at 10 WAP (at harvest) are presented in Table 3, the weight and fruit sweetness in Table 4. The best average melon fruit diameter and length is in M3T1, while the one that is not good is on M1T2 (Table 3). Likewise with the average fruit weight of melons, the best was on M3T1 and the poorest was on M1T2 (Table 4). Meanwhile, the fruit sweetness of the melon is inversely proportional to the weight of the melon (Table 4).

Table 3. Average fruit diameter and length

Parameter	Treatment					
	M1T1	M2T1	M3T1	M1T2	M2T2	M3T2
Fruit diameter (cm)	11.8	12.6	13.0	8.4	11.8	11.9
Fruit length (cm)	18.1	19.2	19.6	13.1	17.5	18.3

Table 4. Average fruit weight and fruit sweetness

	Fruit weight (g)					
	T1			T2		
	M1T1	M2T1	M3T1	M1T2	M2T2	M3T2
Average	959	980	1,105	816	904	1,090
Average (on T)		1,014			937	
Total average			976			
	Fruit sweetness (brix)					
	T1			T2		
	M1T1	M2T1	M3T1	M1T2	M2T2	M3T2
Average	7.0	6.2	6.1	9.0	8.2	7.0
Average (on T)		6.4			8.1	
Total average			7.3			

Table 5. Average comparison of hydroponic and field melons

Parameter	**Hydroponic**	**On land**
Diameter (cm)	11.6	17.8
Length (cm)	17.6	19.0
Fruit weight (g)	976	2,600
Fruit sweetness (brix)	7.3	10.0

The average comparison of hydroponic melons and those cultivated in the field is presented in Table 5. The average sweetness level of hydroponic melons is 7.3. According to Tanigras (2021) that "the melon variety P. 4529 has a fruit weight of 2.2-2.6 kg and a sweetness level of 11-12". This shows the level of sweetness of the fruit is smaller. The average weight of the fruit produced by hydroponics was 976 g, while the weight of the fruit grown on conventional land was 2,600 g (Table 5). This shows that the weight yield of hydroponic fruit is lower than the quality of fruit cultivated conventionally in the field. The reason is that the volume of planting media used in hydroponic pots is small. According to Agriculture (2022a) that "ideally the pot used is 40 cm in diameter and 40 cm high, so that the volume of the planting media becomes 50,240 cm^3". Thus, the ratio of the volume of the research hydroponic pot to the ideal volume of the pot is 1:3.4. The small volume of planting media in hydroponics makes it difficult for roots to develop so that fruit production is not optimal.

Another cause is the small volume of hydroponic nutrients given every day. At 1-6 WAP the volume of hydroponic nutrition given is 300 ml/day for T1 and 300 ml//2 days for T2. At 7-8 WAP the volume of hydroponic nutrition given is 800 ml/day for T1 and 800 ml/2 days for T2. At 9 wp-harvest the volume of hydroponic nutrients given was 650 ml/day for T1 and 650 ml/2 days for T2. According to Agriculture (2022b) that "the volume of hydroponic nutrients at 1-6 WAP (45 days) is 4 x 400 = 1,600 ml/day. At > 6 weeks (45 days) is 6 x 400 = 2,400 ml/day". Thus, the plant lacks nutrients because the nutrient solution given is small so that the fruit produced is not optimal.

ANOVA Test

The results of plant measurements on M1, M2, and M3 planting media, as well as at the time of T1 and T2 nutrition, on plant height, number of leaves, number of segments, and fruit weight were compared using the two-way ANOVA test at 5% level, and continued with Tukey's HSD (*Honest Significantly Difference*) test if the results are significantly different. This is to determine the effect of these three variables. The results of the ANOVA test (Table 6) show that the time of application of nutrients (T) and the planting media (M) affect plant height, number of leaves, number of segments, and fruit weight so that post-ANOVA calculations are continued. While the interaction between the two (TM) has no effect.

Table 6. Two-way ANOVA test results at the 5% level

	Time of application of nutrients (T)	Planting media (M)	Interaction of time of application of nutrients and planting media (TM)
Plant height			
F grade	F_A = 10.25 F_{table} = 4.26 $F_A > F_{table}$ Ha accepted	F_B = 5.22 F_{table} = 3.40 $F_B > F_{table}$ Ha accepted	F_{AB} = 0.07 F_{table} = 3.40 $F_{AB} < F_{table}$ Ho accepted
Number of leaves			
F grade	F_A = 11.13 F_{table} = 4.26 $F_A > F_{table}$ Ha accepted	F_B = 5.52 F_{table} = 3.,40 $F_B > F_{table}$ Ha accepted	F_{AB} = 0.04 F_{table} = 3.40 $F_{AB} < F_{table}$ Ho accepted
Number of segments			
F grade	F_A = 6.50 F_{table} = 4.26 $F_A > F_{table}$ Ha accepted	F_B = 5.69 F_{table} = 3.40 $F_B > F_{table}$ Ha accepted	F_{AB} = 0.62 F_{table} = 3.40 $F_{AB} < F_{table}$ Ho accepted
Fruit weight			
F grade	F_A = 8.80 F_{table} = 4.26 $F_A > F_{table}$ Ha accepted	F_B = 23.03 F_{table} = 3.40 $F_B > F_{table}$ Ha accepted	F_{AB} = 1.99 F_{table} = 3.40 $F_{AB} < F_{table}$ Ho accepted

Post-ANOVA Analysis

Post-ANOVA analysis was carried out using the Turkey's HSD formula Hartono (2012), with the aim of knowing which growing media uses differ and affect plant height, number of leaves, number of segments, or fruit weight, and the results are presented in Table 7.

Table 7. The average difference between the use of planting media for plants

	M1	M2	M3
Plant height (HSD = 12,13)			
M1	-	5	12.6
M2	5	-	7.6
M3	12.6	7.6	-
Number of leaves (HSD = 1,21)			
M1	-	0.6	1.3
M2	0.6	-	0.7
M3	1.3	0.7	-
Number of segments (HSD = 1,29)			
M1	-	0.6	1.4
M2	0.6	-	0.8
M3	1.4	0.8	-
Fruit weight (HSD = 99,41)			
M1	-	54.3	210.3
M2	54.3	-	156
M3	210.3	156	-

Note: There is a significant difference if the average difference > HSD.

The results of the post-ANOVA analysis showed that there were significant differences in the use of M1, M2 and M3 planting media on the average plant height, number of leaves, number of segments, and fruit weight. Thus, the use of a mixture of rice husk charcoal and cocopeat with a ratio of 1:1 (M3) is the best planting media when compared to the planting media of charcoal husk (M1) and a mixture of charcoal husk and compost with a ratio of 1:1 (M2).

According to Rokhmadiani (2020) that "the most widely used and most popular planting media is husk charcoal because it is easy to obtain, the price is cheap, elements that have the potential to disturb plants have been lost due to burning so that it is sterile, it is efficient to use because it is easy to make, lighter in weight, and easy to clean. used". Prihmantoro & Indriani (2005) stated that "one of the planting media that can be used for hydroponics is husk charcoal". Ginanjar et al. (2021) stated that "husk charcoal, cocopeat, and rockwool are the most widely used hydroponic media".

Kuntardina et al. (2022) states that "cocopeat is coconut powder produced when coconut fiber is separated, and can be used as a planting media in hydroponic cultivation, and its quality is not inferior to soil planting media. Cocopeat has pores that facilitate the entry of sunlight and air exchange, and has properties that easily absorb and store water. There is Trichoderma mold in cocopeat, a type of fungus enzyme, which can reduce disease in the planting media. Cocopeat pH is between 5.0-6.8 so it is very good for plant growth. According to Abad et al (as cited in Nasution & Tammin (2022) that "cocopeat is a good planting media with acceptable chemicals, electrical conductivity, and pH".

4. Conclusion

The results showed that the time of application of nutrients (T) and the planting media (M) affected plant height, number of leaves, number of segments, and weight of melon fruit. The timing of T1 nutrition (one day) had a better effect on melon plants when compared to T2, and the planting media M3 (chaff charcoal and cocopeat with a ratio of 1:1) had a better effect on melon plants when compared to M1 (chaff charcoal) and M2 (chaff charcoal and compost with a ratio of 1:1).

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