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The Effect of Nutrition Supply Duration and KNO3 Concentration on Melon Growth and Yield

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ABSTRACT

This study aimed to evaluate the effect of the interaction between the duration of AB-Mix nutrient solution application and the concentration of Potassium Nitrate (KNO3) on the growth and yield of melon plants. The decrease in the sweetness of melon fruit is often associated with the use of low potassium NPK fertilizers. KNO3 is known to play an important role in improving fruit quality, especially sweetness. This study used a split-plot design with four levels of nutrient application duration (D1, D2, D3, D4) as the main plot and three levels of KNO3 concentration (K0=control, K1=850 ppm, K2=1000 ppm) as subplots, replicated four times to produce 48 experimental units. The results showed that the treatment of nutrient solution application interval (D) significantly affected plant height at 2 and 3 WAP and the number of leaves at 2, 3, 4, and 7 WAP, and the number of female flowers. The application of KNO3 (K) fertilizer significantly affected plant height at 2, 3, and 5 WAP, as well as the level of fruit sweetness (Brix). The interaction between the two treatments showed no significant effect on growth parameters and yield. Treatment D4 (the longest watering duration) resulted in a significant increase in plant height, while D3 produced the highest number of leaves and female flowers. A concentration of 1000 ppm KNO3 (K2) alone increased fruit sweetness.

Keywords: Melon, KNO3 Nutrient Solution, Growth, Yield, Fruit Sweetness.

INTRODUCTION

Melon (Cucumis melo L.) is a horticultural commodity that is popular with the public because of its sweet taste and crunchy texture. Melon production in Indonesia continues to increase, reaching 138,177 tonnes/ha in 2020 (Central Statistics Agency, 2020). However, the quality of melons, especially the sweetness content, often decreases. One of the contributing factors is the use of NPK fertilizer with low potassium content. Potassium (K) is essential for increasing sweet taste and fruit quality in the generative phase of the plant (Kamaratih and Ritawati, 2020). Potassium Nitrate (KNO3) is a fertilizer containing 13% nitrogen (N) and 46% potassium (K2O). KNO 3 plays a

role in encouraging flower growth and stimulating the formation of new flowers, as well as increasing nitrate reductase (NRA) in leaves which is important for nitrogen metabolism and the formation of ethylene, the hormone that triggers flowering (Nurlela & Anshar, 2021). The use of potassium in the form of nitrate (KNO3) has proven to be more effective because nitrate is easily absorbed by plants (Ramadani et al., 2022).

Apart from fertilization, proper irrigation is also crucial for melon growth. Water functions as a raw material for photosynthesis, a component of protoplasm, a transpiration medium, as well as a solvent and transporter of nutrients (Nurlela & Anshar, 2021). Optimal water availability at each growth phase is very important for cell division and enlargement, which has an impact on plant height, number of leaves and root growth.

Melon plants can adapt to various climates, but cannot withstand strong winds, because the leaf stalks, stems and fruit will break easily. If the melon plant experiences a lack of water during flowering, it will cause the flowers to fall so that fertilization cannot occur. In dry climates and land that does not have water sources, melon plants can be planted at the end of the dry season or the beginning of the rainy season (Soedarya, 2015)

Melon flowers consist of three types, namely female flowers, male flowers and perfect flowers. A perfect flower has a fruit ovary, female genitalia (pistil), and organs male genitalia (stamens) (Setiadi, 2016)

In cultivating hydroponic melon plants using AB mix nutrients. Hydroponic nutrition usually uses the AB mix formulation concept. Namely calcium in group A and not meeting sulfate and phosphate in group B. These main nutrients include dissolved cations (positively charged ions), namely Ca2+ (calcium), Mg2+ (magnesium), and K+ (potassium); The main nutrient solutions in anion form are NO3- (nitrate), SO42- (sulfate), and H2PO4- (dihydrogen phosphate). Many formulas can be used as hydroponic nutrients. Most of these formulas use various combinations of ingredients that are commonly used as sources of macro and micro nutrients. Macro elements include potassium nitrate, calcium nitrate, potassium phosphate, and magnesium sulfate. Micro nutrients are usually added to hydroponic nutrients to supply important micro elements, including Fe (iron), Mn (manganese), Cu (copper), Zn (zinc), B (boron), and Mo (molybdenum) (Sastro and Rokhmah, 2016)

This study aims to compare the effect of watering intervals at various concentrations of KNO 3 on the growth and yield of melon plants, as well as to obtain watering intervals and concentrationsKNO 3 which is optimal for increasing the growth and yield of melon plants.

RESEARCH METHODS

This research was carried out at *Green House* Academic Gardens, Faculty of Agriculture, Tadulako University, Palu, Central Sulawesi, from May to September 2024 .

The tools used in this research include an IOT (Internet of Things) time control system, push machine, timer, pH meter, TDS meter, sprayer, scissors, camera, stationery, vernier caliper, pipe, hose, electric cable, battery, control panel, IOT sensor. The materials used are premium melon seeds, KNO 3, Meroke fertilizer (Kalinitar, Calnit, Micro Fe 6%, MAG-S, MKP, MAP, SOP, VITAFLEX), distilled water, rockwool, polybag, cocopeat, shallots.

The research used a split plot design with four replications, resulting in 48 experimental units. Main Plot (AB-Mix Nutrient Solution Administration Interval,

D):
D1: 1.5, 2.3, 3.0, 4.0 minutes,
D2: 2.0, 2.5, 4.0, 4.5 minutes,
D3: 2.3, 3.8,5.1, 5.3 minutes,
D4: 3.0, 4.0, 5.0, 6.0 minute. Subplots (KNO Concentration 3)
K0: Control (0 ppm),
K1: 850 ppm, K2: 1000 ppm

Research Implementation

Preparation of Planting Media Polybag filled with cocopeat, watered 7 times to wash out other elements.

Seeding Melon seeds are soaked in AQUA water with crushed shallots for 24 hours, drained, spread on wet paper towels for 48 hours until they germinate. Seeds are sown 1-2 cm into the planting medium.

Planting 3 day old seedlings (7-10 cm tall, 2 leaves) are planted in rockwool holes and covered with cocopeat.

Preparation of Hydroponic Nutrient Solutions Meroke fertilizer is grouped into stock A (KNO 3 Calnitrate, Fe) and stock B (MAG-S, MKP, MAP, SOP, VITAFLEX). Stocks A and B were dissolved in 5 liters of water each. Then, mix it into 500 liters of water until it reaches a concentration of 1500 ppm.

Preparation of KNO Solution 3 Treatment KNO3 dissolved in distilled water to a concentration of 850 ppm (0.85 g/L) and 1000 ppm (1.0 g/L).

Application of Nutrient Solution and KNO 3 AB-Mix nutrient solution is applied according to the duration of the treatment using IOT technology. The time interval between the duration of D1, D2, D3 is 1 week. Nutrient solution with the same concentration was given in the 3rd week for 3 minutes for 3 weeks. Application KNO3 is carried out at 70 Days Apter Planting (DAP) and every week until 90 DAP.

Maintenance Includes watering, installing stakes, replanting, tying stems and fruit, pruning, fertilizing, pollinating, and controlling pests and diseases.

Harvesting Done when the fruit shows cracks in the skin, yellow color, and a fragrant aroma. The fruit is cut with a stalk of at least 2 cm. Two fruits per plant are harvested.

RESULTS AND DISCUSSION

Based on the results of the research that has been carried out, the following results wereobtained:

Table 1. Height of melon plants (*cucumis melo* L) (cm)

Age (MST)		D1	D2	D3	D4	Average	HSD 0.05
	K0	14.25	13.83	15.63	16.58	15.07	
	K1	15.59	15.15	17.69	18.20	16.65	
2	K2	13.98	13.76	16.56	18.14	15.61	
	Average	14.60a	14.25a	16.63ab	17.64b		
	BNJ			3,03			
	K0	37.04	39.81	41.38	41.94	x40.04	
	K1	43.55	40.80	46.56	62.75	xy48.41	8,49
	K2	40.20	44.95	49.94	60.81	y48.97	
3	Average	40.26a	41.85a	45.96ab	55.15b		
	BNJ			10,52			

Note: Values followed by the same letter are not significantly different at the 0.5% test level

Table 2. Number of Melon Leaves

Age (MST)		D1	D2	D3	D4	Average	HSD 0.05
	K0	3.88	4.25	4.63	4.38	4.28	
	K1	4.13	4.13	4.75	4.00	4.25	
2MST	K2	4.13	4.13	4.75	4.25	4.31	
	Average	4.04a	4.17a	4.71b	4.21a		
BNJ 0.05			0,38				
	K0	7.38	9.38	9.75	9.38	8.97	
3MST	K1	8.63	9.13	10.50	10.00	9.56	
	K2	8.13	8.75	10.38	10.25	9.37	
	Average	8.04a	9.08ab	10.21b	10.04b		
	BNJ 0.05			1,57			
	K0	17.75	17.50	17.00	19.8818.03		
	K1	16.63	17.25	18.38	28.6320.22		
4MST	K2	16.50	20.13	19.50	28.0021.03		
	Average	16.96a	18.29a	18.29a	25.50b		
	BNJ 0.05			3.48			
	K0	32.63	36.00	39.38	38.38	36.59	
7MST	K1	34.38	34.88	42.63	36.25	37.03	
	K2	34.25	39.50	39.50	41.63	38.72	
	Average	33.75a	36.79ab	40.50c	38.75bc		
	BNJ 0.05			3,01			

Note: Values followed by the same letter are not significantly different at the 0.5% test level

Table 3. Number of Female Flowers

Treatment	D1	D2	D3	D4	Average
K0	13.63	18.88	33.75	31.25	24.37
K1	11.00	14.50	32.25	27.25	21.25
K2	12.25	15.88	35.38	31.38	23.72
Average	12.29a	16.42a	33.79b	29.96b	
BNJ 0.05		7,99			

Note: Values followed by the same letter are not significantly different at the 0.5% test level

Table 4. Brix of Melon Fruit

Perlakuan	Rata-rata	LSD
K0	14.625a	
K1	15.875b	1.15
K2	15.925b	

Note: Values followed by the same letter are not significantly different at the 0.5% test level.

Discussion

Growth Components. The absence of a real interaction between the duration of nutrient solution application (D) and the concentration of KNO 3 (K) on the growth and yield of melon plants is probably caused by the antagonistic effect between the nutrients of AB-Mix and KNO 3 or nutrient availability from each treatment that is sufficient for individual plant needs. The AB-Mix solution contains sufficient essential nutrients, so that the plant's physiological response to each treatment occurs separately. This is in line with the findings of Putra et al. (2020) and Hermawan et al. (2018) who reported that the interaction of nutrient frequency and fertilizer concentration does not always have a significant effect if nutrient needs have been met.

The nutrient solution interval treatment (D) showed a real influence on plant height and number of leaves. Water is very important for plant physiological processes such as nutrient absorption, photosynthesis, and maintaining cell turgor. The availability of sufficient and consistent water, especially in the vegetative phase, supports the dissolution and distribution of nutrients, as well as the photosynthesis process. Providing AB-Mix nutrition which contains macro elements (N, P, K) and micronutrients optimally supports vegetative growth, such as increasing height and number of leaves (Wulandari et al., 2022). Correct watering intervals prevent media saturation or dryness, which can inhibit nutrient absorption (Ismail and Rahman, 2021).

Melon plants can adapt to various climates, but cannot withstand strong winds, because the leaf stalks, stems and fruit will break easily. If the melon plant experiences a lack of water during flowering, it will cause the flowers to fall so that fertilization cannot occur. In dry climate areas and land that does not have water sources, melon plants can be planted at the end of the dry season or the beginning of the rainy season (Soedarya, 2015).Future agriculture cannot be separated from the integration of digital technology, especially in the management of horticultural crops such as melons. The smart farming system allows real-time analysis of environmental data which is very important for the plant growth phase. With this data, such as temperature, air humidity, and soil nutritional content, farmers can make decisions quickly and accurately. This technology contributes directly to preventing plant stress and speeding up the harvest period (Putri, R. M 2023)

The effect of KNO 3 on vegetative growth (plant height, number of leaves, leaf area) is not significant because the application is carried out in the final phase of growth (70 DAT), after the main vegetative stage has passed. However, on plant height aged 3 WAP,

KNO 3 showed a real effect even though no single treatment was given. This is possibly because the elements potassium (K) and nitrate (N) from KNO 3 are already contained in the AB-Mix solution which is given regularly since the beginning of growth. Nitrogen in the form of nitrate is easily absorbed and promotes the formation of new cells and tissues, contributing to an increase in plant height in the initial phase.

Yield Components. Giving KNO 3 only had a significant effect on the level of fruit sweetness (Brix), but not significantly on fruit diameter and weight. This shows that the application of KNO 3 in the final phase plays a more important role in increasing fruit quality (sugar content) than quantity. The AB-Mix nutrient solution given from the start of growth is likely to have met the nutritional needs for vegetative growth and yield formation.

Potassium in KNO 3 plays an important role in the translocation of sugar from leaves to fruit, thereby increasing the soluble sugar content without significantly increasing fruit size. This finding is consistent with previous research which shows that potassium is more effective in improving the organoleptic quality of fruit than increasing the quantity of harvest (Balitbangtan, 2020; Sulastri et al., 2021). The insignificance of the effect of KNO 3 on fruit diameter and weight can also be caused by the application time being carried out in the final phase of growth, when the fruit enlargement process has mostly been completed (Rostami et al., 2020). Apart from that, the presence of nutrients from a balanced AB-Mix solution also plays a role, making the addition of KNO 3 in the final generative phase more of a complement than the main determinant (Setiawan dkk., 2021; Putra & Rahardjo, 2022).

If you want a sweet melon, avoid using N-ammonium. When given a lot of ammonium, plants will absorb this light anion very easily. Cells will be filled with ammonium, and water acts as a protective layer for each ammonium ion, helping to enlarge the fruit. As a result, the melon will be large but taste bland. To sweeten melons, it is necessary to increase the nutrients Mg, P, and K. In addition, it is also important to pay attention to dissolved oxygen. If levels are high and the plant can easily breathe to produce abundant energy, then heavy nutrients will be absorbed by the roots, indirectly increasing the formation of carbohydrates that make melons sweet (Sutiyoso, 2018).

CONCLUSION AND SUGGESTIONS

Conclusions

A concentration of 1000 ppm KNO3 produces sweeter melons, as shown by the Brix value reaching 15,925 Brix, compared to without KNO3 treatment, the Brix value is 14,625.

Suggestions

The duration of nutrient solution administration (2.3, 3.8, 5.1, 5.3, Minutes) (D3) resulted in the best growth and yield.

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