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The Effect of Nutrients Solution Application Frequency on The Growth and Yield of Two Cherry Tomato (Lycopersicon Esculentum Miller.) Varieties With Drip Irrigation Hydroponic System

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ABSTRACT

Increasing growth and production of cherry tomatoes, especially in the lowlands, is influenced by the availability of water, humidity, and crop cultivation technology, so that a drip irrigation hydroponic system is needed to realize the growth and production of cherry tomatoes. This research aim was to identify the frequency of the appropriate nutrient solution application on the growth and production of two cherry tomato varieties with drip irrigation hydroponic systems. This research was conducted at Perumahan Royal Sumatra's Screenhouse, Medan Tuntungan (± 32 m above sea level), from March to August 2017. The research used Completely Randomized Factorial Design, namely the frequency of nutrient solutions application (P1: 4 times, P2: 5 times and P3: 6 times) and varieties (V1: First Love and V2: Tropical Ruby). The results showed that the frequency of nutrient solutions application significantly affected the flowering age speed. The interaction of the frequency of nutrient solutions application with cherry tomato varieties significantly affected the diameter of the stems aged 4, 6, 7, 8, 9, 10, 11 and 12 weeks after transplanting and the plants flowering age speed.

Keywords: frequency of nutrient solutions application, varieties and cherry tomatoes

INTRODUCTION

Tomato is a plant from the Solanaceae family which has many types, one of which is cherry tomatoes. Public awareness of the health value has made tomatoes as a source of vitamin C / antioxidants needed by them. Cherry tomatoes are in great demand because they contain higher vitamin C and sweeter and fresher than ordinary tomatoes, their shape and size are unique with an average weight of only 15-22 grams/fruit and a diameter of 2-3 cm/fruit. Cherry tomatoes can be consumed fresh as table fruit, or in processed form such as canned cherry tomatoes, salads, ice cream, juice, pasta, sauces, and can be processed into various other high-nutritious food ingredients. Cherry tomatoes have a high economic value; the price ranged from Rp. 20,000- 30,0000 / kg (Sri et al, 2014).

Cherry tomatoes are currently one of the horticultural commodities with high economic value and still need serious handling, especially in terms of increasing the yield and quality of the fruit. According to data from the Central Bureau of Statistics in 2015, tomato production in West Java reached 296,217 tons/year. Whereas in 2014,

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tomato production in West Java reached 304,687 tons/year.

The low production of cherry tomatoes in Indonesia is probably caused by varieties that are not suitable, technical culture is not good or eradication of pests/diseases that are less efficient. There are several superior varieties of cherry tomatoes including Golden Sweet, Rojita, First Love F1, Tropical Ruby, Gem F1, Lumina F1, Tymoti F1, Sweet Million F1 (Wijayani and Widodo, 2005).

Another factor that causes the low production of cherry tomatoes is the use of fertilizers that have not been optimal as well as improper cropping patterns. Efforts to overcome these obstacles are by improving cultivation techniques. One of the cultivation techniques that is expected to improve the yield and quality of cherry tomatoes is hydroponic drip irrigation. Cultivation of cherry tomatoes with hydroponic systems can be regulated in environmental conditions such as temperature, relative humidity and light intensity, even rainfall factors can be eliminated altogether and pest attacks can be minimized. The results showed that drip irrigation had been able to significantly increase agricultural yields and save water consumption between 50-70% and the quality of tomato products was also increased (Merit and Narka 2007).

Drip irrigation is the application of nutrients along with irrigation in hydroponic systems and is a way of giving water to plants directly (Jones, 2008). Nutrient solution application with drip irrigation is an open system, i.e. the nutrient solution that is flowed to the plant is not recirculated. The nutrient is AB Mix solution which contains macro and micronutrient solutions.

In order to get a better growth and production of tomato plants with drip irrigation hydroponics, it is necessary to regulate the concentration of nutrient solutions, the volume of nutrients and the frequency of applicating the right nutrients. In general, the effect of the frequency of nutrient solutions application affects the yield of plants and peppers which are cultivated hydroponically for drip irrigation. The amount of water and nutrients will always change according to age and plant growth. The plant needs for nutrients continue to increase since the nursery until the plants produce. Susila's research results (2008) stated that watering as much as 250 ml 4 or 5 times a day according to the schedule gives the best results for pepper plants. With the research on the pepper plants, the authors are interested in doing research on cherry tomatoes that focus on the frequency of nutrient solutions application to plants.

Based on the description above, the authors are interested in conducting a research entitled: "The effect of Nutrients Solution application frequency on the growth and yield of two cherry tomato (Lycopersicon esculentum Miller.) varieties with drip irrigation hydroponic system"

MATERIALS AND METHOD

This research was conducted at Perumahan Royal Sumatera's Screenhouse, Medan Tuntungan-Medan, at an altitude of ± 32 meters above sea level, started in March 2017 to August 2017.

The materials used were First Love F1 cherry tomato seeds, Tropical Ruby varieties of cherry tomato seeds, husk

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charcoal, cocopeat, AB mix nutrients, insecticides, label paper and water.

The tools used were the seedling tray, TDS and EC meter, timer, tank, measuring cup, hoe, clear plastic, bucket, ruler/meter, handspray, callipers, analytic scales, stakes, screen house buildings and drip irrigation devices, and polybags.

This research used Completely Randomized Factorial Design (CRD) with 2 treatment factors, namely, Factor 1: Frequency of nutrient solution application (P) with 3 levels of treatment with volume of each 250 ml watering, namely: P1: Four times a day (07.30 WIB; 09.30 WIB ; 13.30 WIB; 16.30 WIB), P2: Five times a day (07.30 WIB; 09.30 WIB; 11.00 WIB; 13.30 WIB; 16.30 WIB), P3: Six times a day (07.30 WIB; 09.30 WIB; 11.00 WIB; 13.30 WIB; 14.30 WIB ; 16.30 WIB). Factor 2: Plant Varieties (V) with 2 levels, namely: V1: First Love F1, V2: Tropical Ruby.

The research began with growing media preparation, the ingredients needed such as husk charcoal and cocopeat were used as planting media, seedbed, cherry tomato seeds were sown on the seedling tray filled with planting media in the form of husk charcoal, preparation of Nutrient Solution, hydroponic nutrition or nutrition AB mix Haileys's Farm used is a solid (powder) seedling plant, 35-day-old cherry tomato seedlings were selected using uniform cherry tomato seedling criteria. Mounting, providing nutrition, was carried out by flowing nutrients from the tank which was arranged by the watering schedule by using the drip irrigation timer. Control of 'Plant Disturbing Organisms', and Harvest.

The observation variables were length, stem diameter, the age of flowering, number of branches, number of sections, number of fruit and weight of fruit per plant.

RESULTS AND DISCUSSION

The Rate of Plants Flowering Age

Observation data and variance of the plant flowering age (days) can be seen in Appendix 30 and Appendix 31. Based on variance, it can be seen that the frequency treatment of nutrient solutions and their interactions have a significant effect on the flowering age parameters of cherry tomato plants, while the treatment of influential varieties had no significant effect to the flowering age parameters. The results of average difference test on treatment varieties and the frequency of nutrient solution application on cherry tomato plants can be seen in Table 3.

Table 3 showed that the frequency of nutrient solutions application resulted in the fastest flowering age of cherry tomato plants in P2 (23.50 days) and the lowest in treatment P1 (24.67 days).

Table 3 showed that the interaction effect of varieties and frequency of nutrient solutions application resulted in the fastest flowering age of cherry tomato plants found in the combination of P3V1 (22.50 days) treatment and the lowest in combination treatment P1V1 (24.83 days).

Based on the research results, it showed that the frequency of nutrient solutions application had a significant effect on the plant flowering age. The fastest age for flowering of cherry tomato plants in P2 (23.50 days) and the lowest at the level of treatment P1 (24.67 days). It was presumably that the level of low nutrient solutions application over a long period of time causes

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a low flowering age. Decreased of photosynthetic activity means reduced the photosynthate which tends to result in a decrease in the amount of flowering.

Based on the results of observations and variance of cherry tomato plants on the rate of flowering age parameters, the interaction of nutrient solution application frequency treatment as much as 6 times with the First Love variety (P3V1) was significantly different from other treatment interactions. The lowest treatment combination average was P1V1. The frequency of nutritional solutions application as much as 6 times can accelerate vegetative and generative growth and development of varieties of First Love cherry tomatoes.

The appearance of the first flower was in this combination treatment. It was suspected that the nutrient content contained for flowering and the amount of water provided was appropriate. This was consistent with the statement of Kurnia (2004) stated the appropriate amount of water accelerates vegetative growth, flowering, and fruit formation.

Table 3.The average of flowering age in cherry tomato plants on the frequency of nutrient solutions application and varieties

Varieties (V)	frequency of nutrient solutions application (P)			Average
	4 Times (P_1)	5 Times (P_2)	6 Times (P_3)	
	----------(day)----------			
First Love (V_1)	24,83b	24,17ab	22,50a	23,83
Tropical Ruby (V_2)	24,50ab	22,83ab	24,83b	24,06
Average	24,67a	23,50c	23,67b	23,94

Description: The numbers followed by different letters in the same column and row showed significant difference from Duncan's Multiple Distanc Test at the level of 5%.

Number of Fruits per Plant

Table 6.The average number of fruits per cherry tomato plant aged 12 weeks after transplanting on the treatment of nutrient solution application frequency and variety

frequency of nutrient solutions application (P)	Varieties (V)		Average
	First Love (V1)	Tropical Ruby (V2)	
	----------(fruit)----------		
4 Times (P1)	6,42	19,25	12,83
5 Times (P2)	19,08	39,75	29,42
6 Times (P3)	16,92	14,67	15,79
Average	14,14	24,56	19,35

Observation data and variance of the number of fruits per plant can be seen in Appendix 36 and Appendix 37. Based on variance, it can be seen that the treatment of frequency of nutrient solutions application, varieties and interactions of the two treatments had no significant effect on the parameters of fruit per cherry tomato plant.

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The results of average difference test on the treatment of frequency of nutrient solutions application and cherry tomato plant varieties can be seen in Table 6.

Although it has no significant effect, there was a tendency that the average number of fruits per cherry tomato plant was highest in the frequency treatment of nutrient solution with 5 times nutrient solution application (P2) which was 29.42, and the highest number of fruits per plant of cherry tomatoes was in Tropical Ruby varieties (V2) which were 24.56.

Observation data and variance of fruit weight per plant can be seen in Appendix 40-41. Based on variance, it can be seen that the variety treatment, frequency of nutrient solution application, and interaction between the two treatments have no significant effect on the parameters of fruit weight per cherry tomato plant. The results of average difference test on treatment frequency of nutrient solutions application and cherry tomato plant varieties can be seen in Table 7.

Although it has no significant effect, there was a tendency that the highest fruit weight per cherry tomato plant was in Tropical Ruby (V2) variety treatment, i.e. 109.01 g and the frequency of nutrient solutions application was in 5 nutrient solutions (P2) that were 116.48 g.

In the research results, it was found that the frequency of nutrient solutions application did not significantly increase the number of fruits and fruit weight. This was presumed if water shortages occur at the stage of formation of results and

cause loss of flower if water shortages occur during the flowering period.

This was also supported by Kurnia's statement (2004) that the more water is given, the excess water becomes useless or inefficient. This causes the volume and frequency of watering to be considered to produce optimal watering methods, where the critical phase of plant growth is the flowering phase.

Based on the results of observations and variance, it was known that the interaction between varieties treatment and frequency of nutrient solutions application did not significantly affect plant length, number of branches, number of segments, number of fruits and fruit weight. This showed that the two treatment factors respond respectively to the observed parameters without interaction. This was in accordance with Winten's statement (2009) stated that if simple effects of a different factor are greater than what can be caused by coincidence, this response difference is called the interaction between the two factors. If the interactions are not significant, then it is concluded that the factors act independently of each other, the simple effect of a factor is the same at all other levels of factors within the limits of random diversity.

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Fruit Weight per Plant

Table 7. The average of fruit weight per cherry tomato plant aged 12 weeks after transplanting on the frequency of nutrient solutions application and varieties

frequency of nutrient solutions application (P)	Varieties (V)		Average
	First Love (V1)	Tropical Ruby (V2)	
	----------(g)----------		
4 Times (P1)	14,24	78,73	46,48
5 Times (P2)	50,96	182,00	116,48
6 Times (P3)	77,07	66,30	71,68
Average	47,42	109,01	78,22

CONCLUSION

The treatment of cherry tomato varieties did not significantly affect all observed parameters. The frequency treatment of cherry tomato nutrient solution application significantly affected flowering age speed parameters, namely P2 treatment and did not significantly affect the parameters of plant length, number of plant branches, number of plant segments, number of fruits per plant and fruit weight per plant. The interaction of frequency of nutrient solution application with cherry tomato varieties had a significant effect on stem diameter at 4, 6, 7, 8, 9, 10,11, and 12 weeks after transplanting at the combination of P2V1 treatment and flowering age at P3V1 treatment combination.

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