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## **CULTIVATION OF WATER SPINACH (*IPOMOEA REPTANS POIR*) PRODUCTION BY USING DFT AND NFT**

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### **Abstract**

Water spinach (*Ipomoea reptans* Poir) is one of the horticultural crops known for its very easy cultivation and fast harvest cycle and high nutritional value. This plant can be produced or cultivated hydroponically using NFT (Nutrient Film Technique) and DFT (Deep Flow Technique) systems. Cultivation of plants in the NFT system uses a sloping circuit with shallow nutritious water that circulates for 24 hours at a fast flow. The DFT system uses a closed-circuit insulated with stagnant water that circulates for 24 hours at a slow flow. Thus, this research was conducted to determine the differences in the production of water spinach in two hydroponic systems, namely NFT and DFT. The research was conducted using a Randomized Block Design (RAK) and observation method by observing plant height, number of leaves, wet weight, and root length. Data were analyzed using independent samples T-test with a prerequisite test in the form of the Shapiro-Wilk normality test. The results of this research showed that the cultivation of water spinach using NFT and DFT hydroponic systems had significant differences in plant height, number of leaves, root length, and wet weight. Water spinach production can be increased by using DFT compared to NFT.

**Keyword :** Cultivation; Production; Dft; Nft

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### **INTRODUCTION**

Indonesia is an agricultural country that has abundant natural resources. One of these natural resources is the agricultural sector. The agricultural sector in Indonesia has various kinds of commodities, including food commodities, plantations, horticulture, ornamental plants, and industrial plants (Wibowo, 2013). (Andana, 2015) stated that horticulture is the cultivation of fruit, vegetable, and ornamental plants. One of the horticultural crops with good prospects and commercial value is water spinach (*Ipomoea reptans* Poir). (Nasichin, Fajarsukoco, Satria, Sebastian, & Yulia, 2020) stated that this vegetable plant is known by the public because of its very easy cultivation and fast harvest cycle. In addition, this vegetable plant has a fairly high nutritional value. In 100 grams of water spinach, it contains 29 calories, 3 grams of protein, 0.3 grams of fat, 5.4

grams of carbohydrates, 1 gram of fiber, 73 mg of calcium, 50 mg of phosphorus, 2.5 mg of iron, 6300 SI of vitamin A, 0.07 mg vitamin B, 32 mg vitamin C, 25 mg/l chlorophyll, and 89.7 g water (Astawan, 2009). Water spinach as a food ingredient can be consumed fresh with other foods. Water spinach can grow in areas with hot and cold climates (Rahmat, n.d.).

This research uses NFT (Nutrient Film Technique) and DFT (Deep Flow Technique) hydroponic systems. (Maulido, Tobing, & Adimihardja, 2016) stated that NFT is a hydroponic system in plant cultivation by placing the roots of a plant in nutritious shallow water. This nutrient-dense water will circulate for 24 hours quickly on an inclined circuit. So, the roots can grow in the nutrient solution and get abundant oxygen for plant growth. The DFT hydroponic system is a cultivation system using water and nutrient supplies by circulating it for 24 hours at a continuous slow flow in a closed circuit (Ningrum, Triyono, & Tusi, 2014). Research on NFT (Nutrient Film Technique) and DFT (Deep Flow Technique) hydroponic systems on water spinach has been carried out. The research was conducted by (Sholihat, Kirom, & Fathonah, 2018) the result is that water spinach has an average plant height of 53.08 cm, root length of 24.7 cm, and leaf length of 17.6 cm using the NFT (Nutrient Film Technique) hydroponic system. (Girsang & Sulastrri, 2019) using the DFT hydroponic system (Deep Flow Technique) has an average plant height of 33.4 cm, number of leaves 18.3, leaf width of 2.6 cm, and root length of 19.7 cm on water spinach. This research was conducted to determine the differences in the production of water spinach in two hydroponic systems, namely DFT (Deep Flow Technique) and NFT (Nutrient Film Technique).

## RESEARCH METHODS

This research used a Randomized Block Design with two treatment groups, namely DFT and NFT. Both treatment groups were carried out with 8 replications in every three net pots. The research was carried out by preparing tools and materials, namely TDS/EC, drill, net pot, paralon pipe, 7 mm and 16 mm PE hose, YAMANO WP-3800 water pump, ruler, mild steel frame for paralon pipe support, datasheet, scales, bucket, AB mix, water spinach (*Ipomoea reptans* Poir) seeds, and water. The construction of a paralon pipe supporting framework with mild steel for the NFT and DFT hydroponic systems was carried out. Paralon pipe is drilled and placed in the support. 7 mm and 16 mm PE hoses are installed on the paralon pipe.

Place a bucket containing a YAMANO WP-3800 water pump on both hydroponic systems. Water spinach seeds were sown up to 9 DAP (Days After Planting). Fill the bucket with water up to the top of the water pump so that the pump is not damaged and the kale plants are transferred to the NFT and DFT systems. AB mix nutrition was made by dissolving 1 kg of stock nutrients A and B with a dose of 5000 ml. Filled with AB mix nutrients with ppm 1050-1400 into buckets on NFT and DFT systems. Plant height, number of leaves, wet weight, and root length were observed every four days. Plant height and root length were measured with a ruler from the base to the apical (tip). Wet weight was measured at harvest. The data were analyzed using independent samples T-test with a prerequisite test in the form of the Shapiro-Wilk normality test to determine whether the data obtained had a normal distribution or not with  $\alpha = 0.05$ .

## RESULTS AND DISCUSSION

Plant height, number of leaves, wet weight, and root length of water spinach (*Ipomoea reptans* Poir) in the normality test showed normal data distribution which can be

seen in table 1. Plant height showed significant differences in DFT and NFT periods 13 and 21 DAP which can be seen in table 2. The histogram shows that DFT is better at producing plant height than NFT which can be seen in Figure 1a. This is because the nutrients absorbed by plants in the DFT hydroponic system can increase the growth of water spinach plant height. The results of this research are different from (Nofal et al., 2021) which stated that plant height in NFT gave a large significant difference compared to DFT in crop production. Because it gets a continuous supply of water, oxygen, and nutrients with a fast flow without the constraints of equipment, such as pumps and water hoses. In this study, there was a problem with the water pump which caused a decrease in plant height in NFT. Thus, when experiencing wilting will inhibit plant production. Therefore, the water pump must always be observed and maintained.

Table 1

Normality test of plant height, number of leaves, wet weight, and root length on DFT and NFT

Observation	Observation Period	Treatment	Statistics	Sig.
Plant height	13 DAP	NFT	0,916	0,398
		DFT	0,912	0,368
	17 DAP	NFT	0,955	0,765
		DFT	0,892	0,245
	21 DAP	NFT	0,918	0,411
		DFT	0,889	0,228
Number of leaves	13 DAP	NFT	0,930	0,516
		DFT	0,860	0,120
	17 DAP	NFT	0,865	0,135
		DFT	0,847	0,088
	21 DAP	NFT	0,887	0,220
		DFT	0,908	0,341
Wet weight	13 DAP	NFT	0,897	0,274
		DFT	0,930	0,512
	17 DAP	NFT	0,959	0,801
		DFT	0,925	0,470
	21 DAP	NFT	0,903	0,308
		DFT	0,848	0,091
Root length	13 DAP	NFT	0,959	0,801
		DFT	0,860	0,120
	17 DAP	NFT	0,855	0,106
		DFT	0,926	0,476
	21 DAP	NFT	0,916	0,395
		DFT	0,918	0,418

If the value of sig. < 0.05, then the data distribution is not normal and if the value of sig. > 0.05, then the data distribution is normal, DAP: Days After Planting

The number of leaves in DFT and NFT showed significant differences in the production of water spinach (*Ipomoea reptans* Poir) at periods 13 and 17 DAP which can be seen in table 2. This was because the flow of AB mix nutrients in slow-moving DFT could stimulate faster and faster leaf growth. much of the fast-moving nutrient flow in NFT. This leaf growth can produce the number of leaves on the plant. The number of leaves on DFT produced better leaves than NFT which can be seen in Figure 1b. (Ardha & Omar, n.d.) stated that the number of leaves on DFT gave a result of 38 leaves. While NFT gives the number of leaves of 36 leaves. The difference from the results of this study showed that DFT was better at producing a large number of leaves than NFT.

Table 2

Independent T test of plant height, number of leaves, wet weight, and root length on DFT and NFT

Observation	Treatment	Observation Period		
		13 DAP	17 DAP	21 DAP
Plant height	NFT	0,001*	0,303	0,000*

	DFT			
Number of leaves	NFT	0,049*	0,038*	0,414
	DFT			
Wet weight	NFT	0,567	0,000*	0,000*
	DFT			
Root length	NFT	0,000*	0,002*	0,052
	DFT			

Sign (\*) indicates a significant difference with sig. < 0.05, DAP: Days After Planting

Wet weight on DFT and NFT showed significant differences in the production of water spinach (*Ipomoea reptans* Poir) in the period 17 and 21 DAP which can be seen in table 2. The histogram shows that DFT is better than NFT in increasing the wet weight of water spinach, which can be seen in Figure 1c. This is because the AB mix nutrients absorbed by plants can increase plant weight growth. In the DFT hydroponic system with slow water flow, plants absorb more AB mix nutrients than NFT. Thus, the absorption of these nutrients stimulates an increase in the weight of the water spinach.

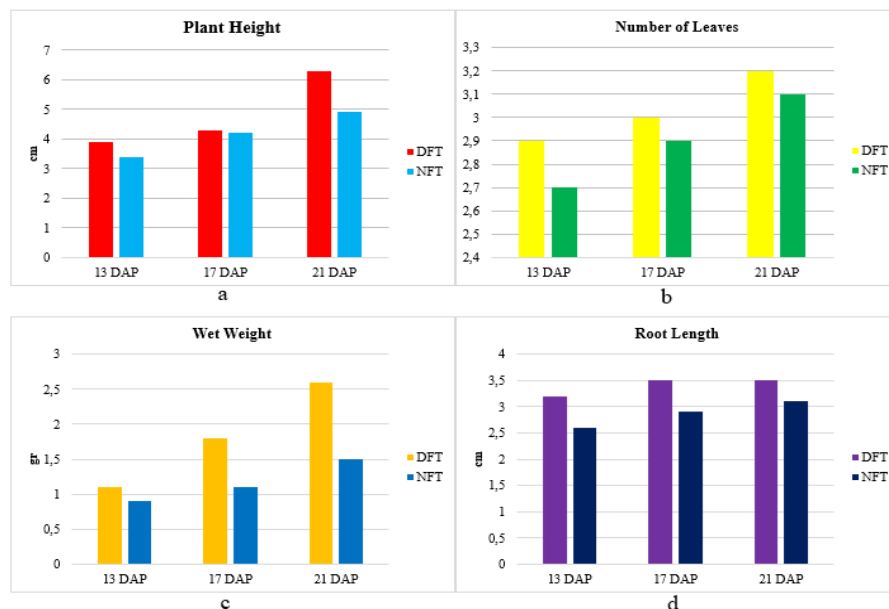


Figure 1

Histogram of differences in a) plant height, b) number of leaves, c) wet weight, and d) root length on DFT and NFT

(Maneeply, Sujipuli, & Kunpratun, 2018) stated that there was a significant difference in the wet weight of plants using the DFT and NFT hydroponic systems. DFT provides a flow of nutrient solution at a depth of 4 cm with a flow rate of 1.5 L/min. While the NFT system has a solution depth of 1 to 3 mm with a flow rate of 1.0 L/min. Thus, the flow rate of the nutrient solution can affect the wet weight of the plant. The wet weight of the plant is strongly influenced by the water content contained in the plant tissue. In addition to water content, nutrients absorbed are in the form of macroelements (Nitrogen (N), Phosphate (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S)) and microelements (Iron (Fe), Boron (B), Manganese (Mn), Copper (Cu), Molybdenum (Mo), and Zinc (Zn)) can increase the results of photosynthesis in the form of photosynthate. The results of photosynthesis can increase plant weight to be larger and heavier wet (Lakitan, 2010).

Root length on DFT and NFT showed significant differences in the production of water spinach (*Ipomoea reptans* Poir) at periods 13 and 17 DAP which can be seen in table 2. This was because the nutrients absorbed by the roots supported root growth in

increasing the ability to absorb nutrients. The root length produced by DFT is better than that of NFT, which can be seen in Figure 1d. Due to the ability of the roots of this plant in the DFT hydroponic system, it can support the growth of more and longer roots in absorbing nutrients compared to NFT. (Cova et al., 2017) stated that DFT has a different recirculation frequency because plant roots are maintained to continuously absorb nutrient solutions. As for NFT, plant roots survive for some time (the interval between two consecutive recirculations) without nutrient solution which increases the possibility of plants experiencing water deficit, especially during the hottest time of day.

## CONCLUSION

Cultivation of water spinach (*Ipomoea reptans* Poir) with DFT and NFT hydroponic systems has differences in production in plant height, number of leaves, root length, and wet weight. DFT can increase water spinach production better than NFT. The author would like to thank Assessment Institute for Agricultural Technology Jakarta for supporting and providing the tools, materials, and places to conduct this research.

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