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The Influence Of Cow Urine Fertilizer, Leaf Bokashi, And AB Mix For The Growth Of Water Spinach Plant (Ipomoea Reptans Var.Poir) With The DFT (Deep Flow Technique) Hydroponic System At Adventist University Of Indonesia

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ABSTRACT

Urine cow is livestock waste that can be used as liquid fertilizer. Urine has a high N and K content and there is enough P content for plant development. Besides being able to work quickly, urine turns out to contain certain hormones that can stimulate plant development. Urine in cattle consists of 92% water, nitrogen 1.00%, 0.2% phosphorus, and 0.35% potassium. Water spinach is a vegetable commodity that is liked by many people, its nutritional content is high, and its cultivation is very simple and easy. The nutritional content of kale is quite high, especially vitamin A, vitamin C, iron, calcium, potassium, and phosphorus. Hydroponic system cultivation can be done in a backyard. The purpose of this study was to determine growth by using leaf Bokashi, cow urine, and AB Mix (control). One-way ANOVA and Duncan data analysis with a significant level of $\alpha = 0.05$. The results obtained showed that the urine urine nutrition affected the growth of plant height, leaf number, leaf width, and root length, giving significance to the testing of descriptive analysis.

Keywords: Cow urine, Hydroponics, Kale (Ipomoea reptans var.poir)

INTRODUCTION

The development of industrial sector has caused agricultural land to be shifted which causes agricultural land to become narrower. On the other hand, community needs for agricultural products have increased along with the increasing population (Sutrisno et al, 2014). Agricultural land is decreasing in fertility. This is due to the continuous exploitation and use of land without efforts to restore fertility. Cultivation of land that continues to reduce the content of organic matter because organic matter in the soil is absorbed by plants (Yanuarismah, 2012).

Plant cultivation systems carried out by the community, especially farmers generally use conventional cultivation systems. However, efforts to increase the productivity and quality of

conventional vegetables are less satisfying. One way to produce high-quality vegetable products in a sustainable manner with large quantities per plant is cultivation with a hydroponic system. Hydroponics is one of the cultivation systems used to improve the quality of vegetables produced (Nugraha and Susila, 2015).

Food availability is a must condition for achieving food security status in a country. To obtain sufficient food availability, it is necessary to use all of the available land resources properly and in a planned manner, including the plot of land. In the community, the use of yard to fulfill family needs has been going on for a long time (Ashari, et al, 2012).

Hydroponics is a cultivation system without using soil as a medium for growing plants with additional nutrients for growth. The advantages of growing with the hydroponic system are that plant cleanliness is easier to maintain, no need to do land management and weed control, sterile planting media, water use and fertilizer are very efficient, plants can be cultivated continuously regardless of the season, can be done on narrow land, and protected from rain and direct sun. Hydroponic system plant cultivation can be done in a narrow room, outside or inside the house, such as in the yard of the house, kitchen and garage (Silvina and Syafrinal, 2008).

How to grow hydroponically is actually already widely used by some communities to utilize land that is not too broad. Many advantages and benefits can be obtained from the system. This system can benefit from the quality and quantity of agricultural products, and can maximize existing agricultural land because it does not require a lot of land. All types of plants can be planted with a hydroponic farming system, but usually many people plant annual crops (Roidah, 2014).

Water spinach is a vegetable commodity that many people like, it has a high nutritional content, and its cultivation is very simple and easy. Nutritional content of water spinach is quite high, especially vitamin A, vitamin C, iron, calcium, potassium, and phosphorus (Sofiari, 2009).

One obstacle in the nursery process is the lack of nutrients available in the nursery growing media, especially in the wean media, therefore to meet the nutrient requirements for plants is done by applying fertilizer to the media so that healthy plant seedling growth is expected to be achieved (Desiana et al, 2013).

Cow urine is livestock waste that can be used as liquid fertilizer. Urine has a high N and K content and there is enough P content for plant development. Besides being able to work quickly, urine turns out to contain certain hormones that can stimulate plant development.

Urine in cattle consists of 92% water, 1.00% nitrogen, 0.2% phosphorus, and 0.35% potassium (Sutedjo, 2010). According to Hanafiah (2005), phosphorus functions in accelerating plant development, while Potassium functions to increase cell wall thickness and stem strength so that plants do not easily fall and be attacked by diseases.

Based on the background description, the research problem was determined, namely the Influence of Cow Urine Fertilizer, Leaf Bokashi, and AB Mix for the Growth of Water Spinach Plant (Ipomoea reptans var.Poir) with the DFT (Deep Flow Technique) Hydroponic System at Adventist University of Indonesia.

LITERATURE REVIEW

This study used a randomized block design method with 3 treatments and 3 replications so that there were 9 experimental units consisting of 2 factors. The first factor is nutritional treatment (N), namely: N1 = AB mix nutrition, N2 = cow urine fertilizer and N3 = leaves Bokashi. The second factor is the treatment of planting media (M), namely M1 = AB mix, M2 = cow urine fertilizer M3 = leaf Bokashi (1: 1: 1). From these two factors, 9 treatment combinations were obtained with 3 replications to obtain 9 units of experiment and each unit of experiment used spinach plants, so that a total of 90 plants were used.

The data obtained were analyzed with One Way ANOVA, Descriptive and Duncan Test statistics.

Tools

The tools used in this research are electric socket, water pump, electric cable, stationery, notebook, ruler, pipe, bucket, measuring cup, mild steel, plastic tub, TDS meter, and netpot.

Materials

The materials used in this study were water, seeds, nutrient A B mix, cow urine, leaf bokashi fertilizer, and rock wool.

Object of Research

In this research the object of research is the effect of bokashi liquid cow urine in the development of water spinach plants when compared with other organic fertilizers namely AB mix and see the fertility of water spinach which will be carried out on the DFT (Deep

Flow Tehnique) Hydroponic system in the Green House experimental garden at the Adventist University of Indonesia.

Research Design

The technique used in crops planting is the DFT (Deep Flow Technique) system, water is flowed into the roots of the plants with plenty of water, as a planting medium we use Rockwool, because Rockwool is able to hold water well, easily adapted to users, can store water well and free of bacteria.

Making of DFT (Deep Flow Technique) Hydroponic System

In the making of a hydroponic system the first step is making lightweight steel racks for supporting the pipe is made in advance with a height of 200 cm above the ground. By making 10 paralon pipes, 4 meters in size and 2.5 cm in diameter and each pipe will be given 16 holes in each paralon pipe. Joining the pipe paralon from one another using glue pipe. After the pipe is connected to another pipe, then the pipe is connected to the water source using electricity and pumped using a water pump so that water can be flowed to all pipes.

Cow Urine Collection

Cow urine collection is obtained from the village of Mokla cattle. The technique of taking the cow urine is done by putting a bucket under the urinary tract of a cow. In this case the cow is placed in a safer place so that the cow doesn't move and walk around. When the cow is passing urine, the urine will easily enters the bucket. Cow urine comes from a female cows with green feed, tofu pulp, and grass.

Cow Urine Fermentation

Utilization of cow urine as liquid organic fertilizer must pass the fermentation stage first, by following the steps as follows:

1. Insert the 8-liter cow urine fermented into a bucket.
2. Add 1 kg of brown sugar and EM4 50 ml slowly and pour, then stir until the sugar dissolves in cow urine.
3. The bucket is closed tightly and left for 14 days and after sufficient time the bucket is opened.

4. Successful fermentation results if it no longer smells of urine. Organic liquid cow urine fertilizer is ready to be put in a storage bucket and ready for use.

Bokashi Fermentation

Making bokashi using vegetable leaves that will be fermented in solid form is converted into liquid form by means of manure mixed with vegetable leaves, then mixed with EM4 as much as 50 mL with 5 liters of soaked water and drained until getting leaf bokashi takes four weeks and applied to the DFT (Deep Flow Technique) system.

Seedling Water Spinach

Seeding hydroponic water spinach started from water spinach seeds then the seeds are soaked, after that, the rockwool will be cut into cubes with a size of 2 × 2 cm, after being cut then the rockwool will be given a hole to insert the water spinach seeds, and put into a container, then covered with black plastic so that the seeds germinate quickly and will be avoided from direct sunlight.

Making of Hydroponic Nutrition Solutions

This research used three types of nutrients, which is cow urine, AB mix nutrition, organic liquid fertilizer (bokashi), AB mix nutrient solution is done by dissolving AB mix A (83 grams) and AB mix B (83 grams) each into 500 mL of water, then the two solutions are mixed into 100 mL of water and then stirred until thoroughly mixed, these nutrients are stored in a plastic bucket.

Adjustment of pH and Concentration of Nutrition

The pH of the water can be measured using a pH meter. For hydroponic plants, the ideal pH range is between 5, 5-6, 5. pH water that is less or more than the above range causes nutrients to not be absorbed by plants properly. The density of hydroponic nutrition and clean water can be measured by a device called a TDS Meter. The TDS Meter unit is ppm (parts per million). So TDS or PPM (Part Per Million) Meter can be interpreted as a tool to measure the number of solids or particles. The only way to measure it is to dip the tip into the nutrient mixed with the water that has been stirred, then it is read on the screen display, in units of PPM, PPM needed for the type and age of the plant.

Planting Water Spinach

Planting water spinach is done by moving the plant into a netpot that has been filled with planting media in the form of the available rockwool there are several things that must be done so that the transplanted plants grow well and fertile preparations that must be done include:

1. Ensure that the DFT (Deep Flow Technique) system is functioning properly and does not leak.
2. Make sure the irrigation is not blocked.
3. If clogged use hard objects to open waterways.
4. Make sure the water in the DFT (Deep Flow Technique) tank has been filled.
5. Make sure the water reservoir is not mossy.
6. Make sure the pipe is clean and not mossy.
7. Make sure the water in the DFT (Deep Flow Technique) tank has been filled.
8. Water flow in the DFT (Deep Flow Tecnique) tub.
9. Water flow in DFT hydroponics with the speed of water flowing from the first pipe to the last one is as much as one liter in one minute.
10. Make sure the plants are transplanted into healthy plant plots.

Plantations that have more than one root under the policap or have come out about 1 cm are placed into holes in the pallets. The roots that have come out are used to absorb water. The netpot in the pipe must touch the ground floor of the pipe so that plant roots can get water that flows under the pipe in addition for the roots of plants get water. The purpose of laying the netpot in the bottom of the pipe is so that the planting media can get water and always moist, planting is best done in the afternoon.

Maintenance

After the plant is planted into the pipe there are several things that must be done so that the planted crop can be successfully harvested.

1. The flow of water must always be seen so it will not be clogged.
2. Make sure the nutrient water in the tub is always full.
3. If the water has been reduced to the minimum limit, immediately refill the water until it is full and then give the nutrition.
4. Do not let the tub dry because it can cause the pump to break.
5. If there are plants that die take it immediately because it can transmit the disease.

6. If the plants die immediately replace with new ones.

METHODS

1. Plant Height (cm)

   Plant height measurements were carried out one week after all treatments were given, at intervals once a week. Measurements using the meter start from the base of the plant to the highest leaf blade, until the 6th week.

2. Number of Leaves (strands)

   For observations, total leaf counts were counted in sample plants starting 3 weeks after planting at one week intervals after observation. Leaves that are counted are leaves that have been formed or fully opened at the time of observation until the 6th week.

3. Leaves width (cm)

   Measurement of the leaf width is done by measuring the widest leaf at the time of observation, measurement starts from the left edge of the leaf to the right edge of the leaf and perpendicular to the mother's leaf bone. Observation of leaf width was carried out from the third week to the 6th week of each plant. The measuring instrument used is a ruler. Leaves that are used as samples are the longest and widest sizes. Observations were averaged.

4. Root Length (cm)

   Observation of root length is done by taking water spinach plants and measuring root length with a gauge / ruler from the tip of the stem to the root end of the water spinach plant, carried out every week after planting in the DFT hydroponic system, until the 6th week.

Statistic Analysis

Observation Variable

1. Number of Leaves, are the leaves that are formed perfectly calculated when the plant is 6 MST (Weeks After Planting).
2. Leaf width, measurements are taken when the plant is 6 MST. Where the selection of water spinach leaves are seen most widely in water spinach plants.
3. Plant Height is calculated from the base of the stem to the tip of the longest leaf when the plant is 6 MST.

4. Root length, measured from the root of the longest root at the end of the observation (harvest).

The procedure for calculating the statistical variations with a completely randomized design of patterns in one way Anova factorial, Descriptive Test, and Duncan Test.

RESULTS

Amount of Height Measurement of Water Spinach (Ipomoea reptans var.Poir)

1. Descriptive Data of Height Measurement of Water Spinach (Ipomoea reptans var.Poir)

In this research 3 variations were used, which are leaf bokashi, cow urine and AB Mix. Table 1 is a descriptive analysis of the effect of cow urine on kale plant height.

Table 1. **Descriptive Results of Height Measurement of Water Apinach (Ipomoea reptans var.Poir)**

Nutrition	N	Average (unit)	Std. Deviation	Std. Error	Bottom Border
Bokashi Leaf	30	52.4933	6.81499	1.24424	49.9686
Cow Urine	30	26.6467	3.56300	.65051	25.3162
AB Mix	30	21.1200	2.09291	38211	20.3385
Total	90	33.4200	14.48396	1.52674	30.3864

From the results of Table 1 it can be seen that the nutrition that has the highest average number is Bokashi leaves with a mean of 52.4933, nutrients that have the second mean is cow urine with an average number of 26.6467, AB Mix with the lowest average number of 21.1200.

2. Anova One-way Statistical Data Number of Height Measurement of Water Spinach (Ipomoea reptans var.Poir)

Table 2. **Anova One-Way Statistical Test Results Amount Measurements of Water Spinach (*Ipomoea reptans* var.Poir)**

	Sum of	*df*	Average	*F*	*Sig*

	Squares		**Square**		
Between Groups	16828.803	2	8414.401	397.41	,000
In Groups	1846.061	87	21.173		
Total	18670.864	89			

Based on the results of ANOVA statistical analysis addressed in table 2 that the height between variables with the sum of squares is 16828,803, df 2, and the average square is 8414,401 with F 397.41 with Sig 0,000. For fertilizer variable which is explained in the first hypothesis, "Giving liquid cow urine bokashi, AB Mix, and leaf bokashi can not give a difference in effect on height of growth of water spinach plants" is rejected with a value of p = .000 (smaller than α = 0.05 , so it can be concluded that the administration of liquid cow urine bokashi, AB Mix, and leaf bokashi can provide a different effect on the height of growth of water spinach, followed by Duncan's multiple distance test to see which nutrients most influence the rejection of the hypothesis.

3. Duncan Test on the Amount of Height Measurement of Water Spinach (*Ipomoea reptans* var.Poir)

Table 3. **Duncan Results Amount of Height Measurement of Water Spinach (*Ipomoea reptans* var.Poir)**

Nutrition	**N**	***Subset for Alpha = 0.05***		
		1	**2**	**3**
AB Mix	30	21.1200		
Cow Urine	30		26.6467	
Bokashi Leaf	30			52.4933
Sig.		1.000	1.000	1.000

From the table above shows that Bokashi Leaves with the number of measurements of plant water spinach as much as 52.4933, is the main contributor variable to the significance of the test and statistical analysis.

Calculation of Number of Water Spinach Leaves (*Ipomoea reptans* var.Poir)

1. **Descriptive Data Calculation on Number of Water Spinach Leaves (*Ipomoea reptans* var. Poir)**

   Descriptive calculation results obtained in this study can be seen in table 4 with the highest average results is Bokashi Leaf which is 3.4733, the width of the second leaf is AB Mix 2.1267 and the third average is Cow urine 2.1233.

Table 4. **Descriptive Results of Number of Water Spinach Leaves (*Ipomoea reptans* var.Poir)**

Nutrition	N	Average (unit)	Std. Deviation	Std. Error	Bottom Border
Bokashi Leaf	30	21.0667	3.37264	.61576	19.8073
Cow Urine	30	14.7333	1.31131	.23941	14.2437
AB Mix	30	19.1000	3.68922	.67356	17.7224
Total	90	18.3000	3.97308	.41880	17.4679

2. **ANOVA One-Way Test on Number of Water Spinach Leaves (*Ipomoea reptans* var.Poir)**

   Based on the results of ANOVA statistical analysis addressed in table 5 that the root length between variables with the sum of squares is 28879,783, df 87, and the mean square is 1263.727 with F 3.807 with Sig 0.026. For fertilizer variable which is described in the third hypothesis, namely "Giving Bokashi leaves, cow urine, AB Mix can not provide growth influence on height of spinach (*Ipomoea reptans* var.Poir)" shows that the penokan with a value of p = .000 (smaller of α = 0.05), so it can be concluded that there is an effect of cow urine nutrition on the growth of kale (Ipomoea reptans var.Poir). After having found significant results, this test was continued with Duncan's multiple range test to see which nutrients most influenced the rejection of the hypothesis.

Table 5. **Anova One-Way Statistical Test Results Number of Measurements of Leaves of Water Spinach (*Ipomoea reptans* var.Poir)**

	Sum of Squares	*df*	Average Square	*F*	*Sig*
Between	630.467	2	315.233	35.4	.000

Groups				13	
In Group	774.433	87	8.902		
Total	1404.900	89			

3. Duncan Test on the Calculation of the Number of Water Spinach Leaves (*Ipomoea reptans* var.Poir)

Table 6 shows that Bokashi leaves with the number of measurements of water spinach plant roots as much as 21.0667, are the main contributing variables to the significance of the test and statistical analysis.

Table 6. **Duncan Results on Measurement Amount of Water Spinach Leaves (*Ipomoea reptans* var.Poir)**

Nutrition	**N**	***Subset for Alpha = 0.05***		
		1	**2**	**3**
Cow Urine	30	14.7333		
AB Mix	30		19.1000	
Bokashi Leaf	30			21.0677
Sig.		1.000	1.000	1.000

Calculation of Water Spinach Leaf Width (*Ipomoea reptans* var.Poir)

1. Descriptive Data Calculation of Water Spinach Leaf Width (*Ipomoea reptans* var.Poir)

Descriptive calculation results obtained in this study can be seen in table 7 with the highest average leaf width results is Bokashi Leaf which is 3.4733, the width of the second leaf AB Mix 2.1267 and the third mean that is Cow urine 2.1233.

Table 7. **Descriptive Results of Water Spinach Leaf Width *(Ipomoea reptans* var.Poir)**

Nutrition	**N**	**Average (unit)**	**Std. Deviation**	**Std. Error**	**Bottom Border**

Bokashi Leaf	30	3.4733	.59823	.10922	3.2499
Cow Nutrition	30	2.1233	.26088	.04763	2.0259
AB Mix	30	2.1267	.29470	.05381	2.0166
Total	90	2.5744	.75870	.07997	2.4155

2. ANOVA One-Way Test on Calculation of Water Spinach Leaf Width (*Ipomoea reptans* var.Poir)

Based on the ANOVA statistical analysis addressed in table 8 that the height between variables with the sum of squares is 16828,803, df 2, and the mean square is 8414,401 with F 397.41 with Sig 0,000. For fertilizer variable which is described in the third hypothesis, namely "Giving Bokashi leaves, cow urine, AB Mix can not provide growth influence on height of spinach (Ipomoea reptans var.Poir)" shows that the rejection with a value of p = .000 (smaller of α = 0.05), so it can be concluded that there is an effect of cow urine nutrition on the growth of kale (Ipomoea reptans var.Poir). After having found significant results, this test was continued with Duncan's multiple range test to see which nutrients most influenced the rejection of the hypothesis.

Table 8. **Anova One-Way Statistical Test Results Leaf Width Measurement of water spinach (*Ipomoea reptans* var.Poir)**

	Sum of Squares	***df***	**Average Square**	***F***	***Sig***
Between Groups	16828.803	2	8414.401	397.41	,000
In Group	1846.061	87	21.173		
Total	18670.864	89			

3. Duncan Test on Calculation of Water Spinach Leaf Width (*Ipomoea reptans* var.Poir)

Table 9 shows that Bokashi Leaves with the height number of water spinach plant measurements is 3.4733, is the main contributor variable to the significance of the test and statistical analysis.

Table 9. **Duncan Results Amount of Water Spinach Leaf Width (*Ipomoea reptans* var.Poir)**

Nutrisi	**N**	***Subset for Alpha = 0.05***	
		1	**2**
Cow Urine	30	2.1233	
AB Mix	30	2.1267	
Bokashi Leaf	30		3.4733
Sig.		.975	1.000

Total Length Measurement of Water Spinach Root (*Ipomoea reptans* var.Poir)

1. **Descriptive Data Number Measurements of Water Spinach Plant Root Length (Ipomoea reptans var.Poir)**

   From the results of table 10 it can be seen that the nutrient that has the highest average number is AB Mix with an average of 26.4967, nutrition that has the second mean is Bokashi leaves with the average number of 19.1733, Cow urine with the lowest average number is 13.5533.

Table 10. **Descriptive Results Measurement of Water Spinach Root Length (*Ipomoea reptans* var.Poir**

Nutrition	**N**	**Average (unit)**	**Std. Deviation**	**Std. Error**	**Bottom Border**
Bokashi Laef	30	19.1733	3.03053	.55330	18.0417
Cow Urine	30	13.5533	3.36101	.61363	12.2983
AB Mix	30	26.4967	31.78537	5.70197	14.8348
Total	90	19.7411	18.78537	1.98015	15.8066

2. ANOVA One-Way Test on Root Length of Water Spinach (Ipomoea reptans var.Poir)

Based on the results of ANOVA statistical analysis addressed in table 11 that the length of the roots between variables with the sum of squares is 28879,783, df 87, and the mean square is 1263.727 with F 3.807 with Sig 0.026. For fertilizer variable which is described in the third hypothesis, namely "Giving Bokashi leaves, cow urine, AB Mix cannot provide growth influence on height of spinach (Ipomoea reptans var.Poir) " indicates that the rejection with a value of p = .000 (more smaller than α = 0.05), so it can be concluded that there is an influence on the administration of cow urine nutrition on the growth of water spinach plants (Ipomoea reptans var.Poir). After having found significant results, this test was continued with Duncan's multiple range test to see which nutrients most influenced the rejection of the hypothesis.

Table 11. **Anova One-Way Statistical Test Results Amount Measurement of Water Spinach Root Length (Ipomoea reptans var.Poir)**

	Sum of Squares	***df***	**Average Square**	***F***	***Sig***
Between Group	2527.455	2	1263.727	3.807	.026
In Group	28879.783	87	331.952		
Total	31407.238	89			

3. Duncan Test on Calculation of Water Spinach Root Length (*Ipomoea reptans* var.Poir)

Table 12 shows that AB Mix with the number of measurements of the root length of kale as much as 26.4967, is the main contributing variable to the significance of the test and statistical analysis.

Table 12. **Duncan Results Total Measurements of Water Spinach Root (*Ipomoea reptans* var.Poir)**

Nutrition	**N**	***Subset for Alpha = 0.05***	
		1	**2**
Cow Urine	30	13,5533	
Bokashi Leaf	30	19,1733	19,1733
AB Mix	30		26,4967
Sig.		,235	,123

DISCUSSION

Based on the results of the analysis of research data, it was found that there were differences in the effect of giving cow urine liquid fertilizer, AB Mix nutrition, and leaf bokashi on growth height, number of leaves, leaf width, and root length of spinach. Giving Bokashi leaves proven to provide the best results. This is influenced by the nutrient content needed for plant growth found in leaf bokashi fertilizer. Bokashi fertilizer in this study was made from straw, vegetable waste, and manure, namely chicken manure. To this bokashi fertilizer also added Effective microorganisms-4 (EM-4) which is a mixed culture of various organisms that are beneficial for plant growth and production. (leaf bokashi content). Vegetable waste consists of various vegetables with certain nutritional contents that are important for plant growth such as organic vegetable waste mustard greens that can be used as ingredients for making liquid compost (Setyawati et al. 2012).

The material has a high water content, carbohydrate, protein, and fat (Latifah, et al. 2012). Added by Ongkowijoyo (2011) the material also contains fiber, phosphorus, iron, potassium, calcium, vitamin A, vitamin C, and Vitamin K. All of these elements have functions that can help in the process of growth and breeding of plants so it is very good to be used as an ingredient raw organic liquid compost making. Besides being easily decomposed, this material is also rich in nutrients needed by plants (Purwendro and Nurhidayat 2006).

The results of this study are also supported by the results of research Annisava, et al (2014) that the administration of leaf bokashi has an influence on increasing plant height, number of leaves, leaf length and leaf width. Provision of homemade nutrition and rockwool growing media proven to provide the best results for growth and yield of water spinach plants is characterized by an increase in the number of leaves, plant height, root length, leaf area, canopy fresh weight and canopy dry weight. This is likely due to the nutrients the plants obtain from homemade nutrients that have met the needs of the plant (the zone of adequacy).

According to Lakitan (2004), that if plant tissues contain certain nutrients with concentrations higher than the concentration needed for maximum growth, then in this condition the plants are said to be in a state of fancy consumption.

One very significant difference between the three nutrients is that homemade nutrients contain high calcium (Ca) compared to other nutrients, according to (Sutiyoso, 2004), that calcium affects the meristem or the point of growth at the tip of the root so that the root volume increases and can eventually stimulate the growth of water spinach plants.

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