



Cultivation of Water Spinach Using A Hydroponic Systems at Different AB Mix Concentrations

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ABSTRACT

Water spinach is one of the most popular vegetable commodities in Indonesia. Currently, limited land due to plastic waste and uncertain climate change are inhibiting factors for plant cultivators. Efforts that can be done is to carry out cultivation activities to water spinach hydroponically. Hydroponic cultivation can use the wick system because it is easy to apply and does not require expensive costs. To support optimal growth of water spinach and reduce plastic waste in Indonesia, presenting AB Mix nutrition and the use of plastic bottles as a nutrient container in hydroponic cultivation are efforts to obtain quality water spinach production. This study aims to determine the response of water spinach plants to the use of hydroponic growing systems, as well as to obtain information regarding the best concentration of AB Mix. The experimental method used was a completely randomized design, which consisted of 3 levels, namely the nutrient concentration of 800 ppm, 1000 ppm and 1200 ppm. The results of the various concentrations of mixed AB showed significantly different effects on the parameters of plant height, number of leaves and weight of fresh plants. AB Mix concentration treatment of 1200 ppm was the best treatment for all observed parameters.

INTRODUCTION

Water spinach is one of the most popular vegetable commodities in Indonesia. In addition to the properties contained in it such as vitamin A, vitamin C, iron, and calcium, this plant has an economical price so that it is in great demand by various groups. Water spinach plants can grow well in tropical areas such as Indonesia with an altitude of 500-2000 mdpl at an optimum temperature of 25-30°C and an average rainfall of 500-5000mm/year (Sholihat et al., 2018). If the environmental conditions are not extreme, water spinach can grow adaptively and adjust to environmental conditions. In general, water spinach can be harvested four weeks after planting with the water spinach still not showing flowers.

Currently, plant cultivation activities are hampered and limited due to many environmental problems such as reduced active agricultural land and increased plastic waste which has an impact on environmental pollution. Hydroponic cultivation of water spinach is one of the solutions and efforts to

continue to carry out plant cultivation activities. Hydroponics is a farming technique that does not use soil as a growing medium, but can be replaced by other growing media such as rockwool, burnt husks, sand, sponges and so on. Nutrient containers can also be replaced using plastic bottle waste, so it can reduce costs and be more environmentally friendly.

One of the methods to get quality water spinach production results, it is necessary to provide nutrients that are in accordance with the needs of the plant. According to (Hidayati et al., 2017) fertilization is an external input activity with the aim of improving nutrients and complementing plant needs in order to grow well. To meet public demand for water spinach plants, information on how to cultivate and nutritional needs of water spinach hydroponically is very necessary. This study uses a hydroponic wick system and AB Mix solution as the nutrients given. AB mix is a nutrient concentration in which it contains macro and micro nutrients needed by plants. Hydroponics with a wick system helps roots in absorption of nutrients through a wick made of flannel. Furthermore, the concentration given can affect the growth, development and production of water spinach. Therefore, the provision of nutrients with the right concentration needs to be applied to support the growth and development of water spinach.

This study aims to determine differences in the concentration of AB Mix on the growth, development and production of water spinach plants hydroponically. Precisely the provision of nutrition and the appropriate concentration given will produce a good water spinach. Testing some of these concentrations is expected to help determine recommendations for the right nutrition, especially for hydroponic cultivators of water spinach.

METHODS

Location and Time

This research was conducted in Maron Village, Maron District, Probolinggo Regency, East Java (112°50' - 113°30' East Longitude and 7°40' - 8°10' South Latitude) with an elevation level of 0-2500 masl. Implementation time is carried out in March - May 2022.

Method of Collecting Data

This hydroponic water spinach cultivation research method uses a Completely Randomized Design (CRD) with 1 factor, namely the difference in AB Mix concentration with 3 levels including 800 ppm, 1000 ppm and 1200 ppm. Each was repeated 4 times, so that 12 experimental units were obtained with a total of 120 plants. This research stage begins with seeding, after 7 days the plants are transplanted into hydroponic wick system media according to their respective treatments.

Data Analysis

The data were analyzed qualitatively and quantitatively. Quantitative data were obtained from the growth data of water spinach every week and at the end of the observation, such as plant height, number of leaves and fresh weight of the plant. Qualitative data obtained from the development of water spinach over time. Comparative analysis was conducted to test the hypothesis and to compare each treatment with various concentrations of AB Mix in the study. If there is data that has a significant effect on the observed parameters, further HSD testing will be carried out with a 95% confidence level.

RESULTS AND DISCUSSIONS

Effect on Agronomy Parameters

The effect of different concentrations of AB Mix given to plants shows a significant effect which can be seen from the results of analysis of variance (ANOVA) in the table below (Table 1).

Table 1. Results of Research Analysis of Variance

No.	Parameter	K
1.	Plant Height (cm)	995,59**
2.	Number of Leaves (strands)	87,316**
3.	Fresh Weight (g)	121,98**

Information: (**) = Very significant effect; K = Concentration of AB Mix



Figure 1. The view of water spinach growth in the various concentrations treatment using AB Mix

Based on the results of the ANOVA test in Table 1 and Figure 1, it shows that the concentration treatment has a very significant effect on the parameters of plant height, number of leaves and plant fresh weight. In an effort to obtain optimal yields of water spinach, the nutritional needs of plants must be met and according to what is needed by the plant. In accordance with the opinion of (Suarsana et al., 2020) macro nutrients have a very important role in the growth and development of water spinach plants that are cultivated hydroponically. The non-fulfillment of macro and micro nutrients can inhibit root development which causes nutrients cannot be absorbed optimally, so that the results obtained also have poor quality. This can be seen in the treatment using AB Mix concentration of 800 ppm. According to Sari et al. (2020), plants with sufficient availability of nutrients through the provision of basic fertilizers before planting, and continued to provide supplementary fertilizers will show their potential results. The results of the HSD further test at the 95% confidence level on the parameters of plant height, number of leaves and plant fresh weight are as follows.

Plant Height

The results of the HSD test with a 95% confidence level on the hydroponic water spinach plant height growth parameters are as follows (Figure 2).

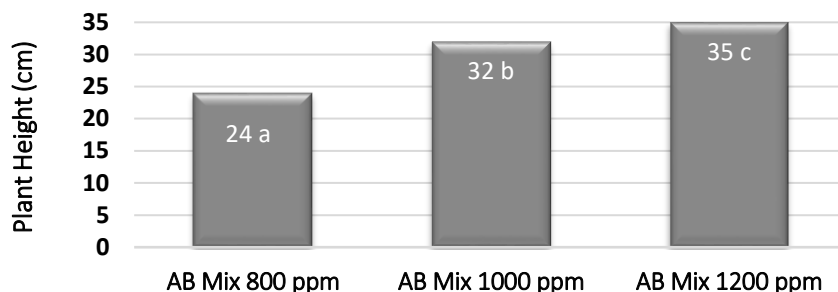


Figure 2. The effect of various concentrations of AB Mix on Plant Height

Based on the graph in Fig.1 shows that the application of different nutrient concentrations will produce different plant heights as well. The results of the HSD test with a 95% confidence level showed that all treatments were significantly different from other treatments. The concentration of AB Mix 1200 ppm is the recommendation as well as the best treatment for plant height yields. The parameter that shows growth is plant height which can be affected depending on internal and external factors (Avivi et al., 2018). According to (Julyana & Meidy, 2018) the nutritional content of AB Mix can support plant vegetative growth. Stem and root growth is a determining factor for plant height. Nutrients absorbed by the roots will be distributed to all parts of the plant which will produce optimal plant height. Giving the right concentration of AB Mix will produce a good plant height as in the K3 treatment with a plant height of 35 cm, while the low plant height appears in the K1 treatment with a height of 24 cm and the K2 treatment having 32 cm.

Number of Leaves (strands)

The results of the HSD test with a 95% confidence level on the number of leaves of water spinach plants hydroponically are as follows (Table 2).

Table 2. The effect of various concentrations of AB Mix on the number of leaves parameters

No.	Treatment	Number of Leaves (strands)
1.	800 ppm (K1)	18 a
2.	1000 ppm (K2)	23 b
3.	1200 ppm (K3)	25 c

Description : Numbers followed by different letters in the columns of each treatment show significant differences according to the 95% confidence level HSD test.

The data in table 2 above shows that giving different concentrations of AB Mix will produce an unequal response to the number of water spinach leaves. The results of the HSD test and tabulated data in table 2 show that the difference in the concentration of AB Mix has a significant effect on the number of leaves. The application of AB Mix nutrients with a concentration of 1200 ppm showed the best results for the parameters of the number of leaves of the water spinach. The K3 treatment produced 25 leaves, while the K1 treatment only produced 18 leaves and K2 with 23 leaves. Giving the right concentration of nutrients and receiving sufficient sunlight will support the metabolic processes of plants in the photosynthesis process, this will affect the quality and quantity of plant leaves (Afrahmiryano, 2019). According to the opinion of (Sholihat et al., 2018) although the sunlight absorbed by plants is sufficient, but if the nutrients needed are not met then the plant's growth will be stunted. This can be seen in the 800 ppm AB Mix concentration treatment which showed the lowest number of leaves followed by 1000 ppm treatment, and the K3 treatment became the treatment with the highest number of leaves.

Fresh Weight

The results of the HSD test with a 95% confidence level are shown in the graph of the effect of giving various concentrations of AB Mix on the parameters of fresh weight of water spinach plants hydroponically as follows (Figure 3).

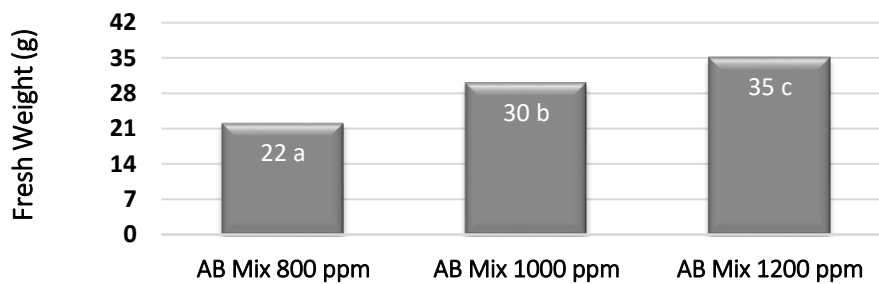


Figure 3. The effect of various concentrations of AB Mix on Plant Fresh Weight

The graph in Figure 2 shows that the difference in the concentration of AB Mix has a significant effect on plant fresh weight parameters. In line with the results of the parameters of plant height and number of leaves, it shows that the higher the concentration of AB Mix produces a good increase in yield, so that the increase in the concentration of AB Mix will be directly proportional to the parameters of plant height, number of leaves and fresh weight of plants. (Suarsana et al., 2020) said that if the ideal macro and micro nutrients and according to the needs of plants will produce plants with maximum quality and quantity of yields. According to research that has been done by (Khozin et al., 2022). External inputs, both fertilizers and ZPT, can be provided to support the quality of plant growth and development. In the nutritional content of AB Mix, there are complex macro and micro nutrients needed by plants. Optimal AB Mix nutrition will result in maximum growth and development. However, too much nutrition will also cause the plant to die. According to (Hidayati et al., 2017) that the solution used in hydroponic cultivation must have an ideal pH. In general, the ideal level of acidity is in the range of 5.5 – 6.5 pH. Less than pH 5.5 will cause nutrients to settle so that they cannot be absorbed by plant roots. Therefore, in addition to the right type and concentration of nutrients, giving the right concentration of nutrients also needs to be done in order to obtain optimal hydroponic kangsung plant yields.

CONCLUSIONS

The results showed that there were significant differences in the results of each treatment. Provision of nutrients with different concentrations produces plants with different growth. In the parameters of plant height growth, number of leaves and fresh weight, K1 treatment was the lowest among other treatments, while K3 treatment, namely the use of 1200 ppm AB Mix concentration, was the best treatment among other treatments. The higher the concentration of AB Mix produces an increase in good yields, so that the increase in the concentration of AB Mix will be directly proportional to the parameters of plant height, number of leaves and plant fresh weight.

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