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Analysis of Pakcoy Mustard (*Brassica rapa*) Growth using Hydroponic System with AB Mix Nutrition

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Abstract. This study aimed to determine the growth of leaves and roots in the pakcoymustard (*Brassica rapa*) using hydroponic system with the AB Mix nutrition fertilizer. The data analysis used was to measure the number of leaves (Jd), leaf width (Ld), leaf length (Pd), number of roots (Ba), root length (Pa), and plant weight (Bt). Plant tools and media used were pipes, net pots, panel cloth, rockwool, TDS/EC, and water. The results of the analysis showed that the treatment of AB Mix nutrition gave a significant effect on the meter observing the number of leaves, leaf width, leaf length, number of roots, and root length. At the age of one week the number of leaves consists of three, leaf width: 0.5 cm, leaf length: 1.5 cm, there are 3 roots with the root length: 1 cm. At the age of two weeks, the number of leaves consists of 6, wide: 2 cm, long: 5 cm, there are 5 roots with the long: 3.5 cm. At the age of three weeks the number of leaves consists of 9 leaves, wide: 4 cm, long: 8 cm, there are 9 roots with the long root: 7.5 cm. At the age of four weeks the number of leaves consists of 11 leaves, leaf width: 8 cm, leaf length: 12 cm, there are 13 roots with the root length is 12 cm and a weight plant is 100 gram/ plants to use AB Mix nutrients. It is showed that the growth and development of mustard pakcoy (*Brassica rapa*) hydroponic system with AB Mix nutrition has a significant effect on the growth of leaf number (Jd), leaf width (Ld), leaf length (Pd), number of roots (Ba), root length (Pa) and plant weight (Bt).

Keywords: Growth, Pakcoy Mustard, AB Mix Nutrition, Hydroponics

1. Introduction

Hydroponic cultivation develops well because it has many advantages, namely: on narrow land can be planted with more plants than it should be, the success of plants to grow and produce is more guaranteed, maintenance for plants is more practical, use of water and fertilizers is more efficient because it can be used re, dead plants are easily replaced with new plants, do not require a lot of labor, several types of plants can be cultivated out of season, and there is no risk of flooding due to not being planted in the land, drought or dependence on natural conditions. While the weaknesses of hydroponics are: the initial investment costs are more expensive and are greatly influenced by the concentration and composition of fertilizers, pH and fertilizers [1].

Hydroponics is a type of viticulture growing media that is used to overcome land shortages, especially in urban areas where there is very little land for farming. The popularity of Hydroponics increasing in during the Covid 19 pandemic, where many people returned to trying to grow crops to



fill their spare time while working from home. Narrow lands that were previously unmanaged are used for farming or just trying hydroponics.

Hydroponics has several planting systems that can be used in planting crops. The hydroponic system also has its advantages and disadvantages. The first is the axis system where this system is a very simple hydroponic system, it is enough to use an old bottle and then make a hole in it and give it a water axis and on top of it given a planting medium such as Rockwool or cotton. Both of these NFT (Net Film Technique) systems are very good because they have water circulation that continues to flow so that plant needs can be met, such as nutrients and oxygen. But the drawback is that when the electricity goes out, the plants do not get fertilizer water, so the plants will wither if the electricity goes out for too long. The next system is the DFT (Deep Flow Technique) system. This system has the advantage that the water in the hydroponic kit is still available if the electricity goes out for a long time, so the plants can stay alive. But the weakness of this system is a large amount of moss that grows in the hydroponic kit and the large number of mosquito larvae caused by stagnant water in the hydroponic kit. The hydroponic system that is widely used for entrepreneurship is a floating raft system where this system uses a large enough tub/pond that contains AB mix fertilizer water and above which some plants float with styrofoam, this system is very efficient because it can contain many plants. The system used to grow fruit crops such as tomatoes, watermelons, melons, etc. It is a dutch bucket system where this system uses a bucket in each plant, the roots of the fruit plants will tie in the bucket so that it is not easy to fall.

However, this system needs special attention because nutrient requirements will increase as the plants grow. The hydroponic system can use various types of planting media, such as perlite, vermiculite, gravel, sand, roasted husks, and cocopeat [2]. One of the plants that are often planted in hydroponic growing media is pakcoy mustard (*Brassica rapa*) where the mustard plant itself is very easy to grow, maintenance is quite easy and does not take long to harvest. The Pakcoy mustard plant is quite attractive to the public because the mustard pakcoy plant has rich benefits, such as containing vitamins and minerals. Mustard plants also function as cancer prevention so that if consumed it is good for maintaining endurance. Also, Pakcoy mustard has benefits during menopause, because it protects women from heart disease and breast cancer. Nutrients such as calcium, folic acid, and magnesium can also support bone health [3].

Pakcoy mustard is an annual crop that only harvests once. Pakcoy mustard is harvested at the age of 40-60 days after planting. Pakcoy mustard plant can grow in the lowlands and highlands with an altitude of 5-1200 masl (meters above sea level). However, pakcoy mustard plants grow well in the highlands with cool air [4]. The climate is good for pakcoy growth, namely areas that have a temperature of 15-30°C, have rainfall of ± 200 mm/month, and sunlight between 10-13 hours. The humidity needed for pakcoy mustard is between 80-90%. The ideal soil for planting pakcoy mustard is loose soil that contains humus and has a pH between 6-7, pakcoy mustard plants do not like standing water so they must

have good drainage [5]. Seeing the many benefits and enthusiasts of pakcoy mustard, especially in Indonesia, the researcher would like to report the results of the research entitled Analysis of the Growth of Pakcoy Mustard (*Brassica rapa*) Hydroponic System with AB Mix Fertilizer.

2. Methodology

2.1 Research Procedure

This research was conducted purposively, where this research was conducted at the Faculty of Agriculture, Universitas Muslim Nusantara Al-Washliyah. The parameters measured were the number of leaves (Jd), leaf width (Ld), leaf length (Pd), number of roots (Ba), root length (Pa), and plant weight (Bt). The plant tools and media used were pipes, net pots, panel cloth, tray seedlings, rockwool, pH calibration and TDS, EC (hold), water, pakcoy mustard seeds, and AB mix fertilizer.

2.2 Experimental Design

Pakcoy mustard seeds are sown using tray seedlings, then when the plants begin to grow, measurement begins. When the plant has 3-4 leaves, the pakcoy mustard plant can be moved to the hydroponic kit. The hydroponic system used in this study uses the DFT system. Measurements are made every day until the pakcoy mustard is harvested. The results of the study were then analyzed using descriptive analysis to obtain a systematic, factual, and accurate description.

2.2.1 Making Hydroponic Installation

The steps to make a hydroponic installation:

- a. Providing a 2.5 inch paralon pipe with a length of 100 cm.
- b. Making 6 planting holes 15 cm apart using PVC pipe
- c. Making Basic Hydroponic Fertilizer
- d. Preparing an AB mix formula weighing 380 grams
- e. Preparing 2 buckets, fill each bucket with 5 liters of well water that has been deposited for 2 days 2 nights.
- f. Pouring the AB mix formula into each of the buckets, stirring until the formula dissolves completely.
- g. Taking 5mL from each solution A and B, and prepare 1 liter of clean water. e. Enter or mix A (5 mL) and B (5 mL) into the 1 liter of water earlier, stirring until the solution is mixed. Solution ready for use.

2.2.2 Seeding

The steps of seeding:

- a. Rockwool is cut into squares (2 cm) first, then soaked in plain water.
- b. Making a small hole in the soaked rockwool.
- c. Then entering the 2 cm sized pakcoy kerockwool seeds using a toothpick.
- d. Wrapping the seeding in plastic for 1 day and 1 night. Then transfer the germinated seeds to the seeding to get enough sunlight.
- e. Flush the seeding with enough water until the seeding age is 14 days.
- f. Provide a netpot or aqua glass with holes in the sides and bottom.
- g. Take the seeds that have 4-5 leaves, then place them in the aqua glass that has been provided earlier
- h. Then move the glass aqua containing the hydroponic installation hole seeds whose water has been dissolved with hydroponic nutrients.

3. Result and Discussion

The first stage in this research is to select superior seeds to get good results. The method used is to soak the mustard seeds in water, if there is mustard seeds floating on the water it mean the seeds are not good and should be thrown away. In the next stage, the seeding stage is carried out in tray seedlings and given a little water to moisten the mustard seedlings. Mustard greens must be kept moist to break the seeds and grow well. When the mustard seed grows, it will have the first 2 leaves, where the seed has become a seed and can be measured the number of leaves, leaf width, leaf length, number of roots, and root length. At the age of 1 week or the plants already have 3-4 leaves, mustard plants can be transferred to the hydroponic kit.

The treatment in this research is to give AB Mix fertilizer when transplanting the hydroponic kit. The dosage of AB Mix fertilizer used in the first week was 600 ppm, and in the second week, it increased to 800 ppm, in the third week it was 1000 ppm and on the fourth and fifth weeks the dose increased to 1200 ppm. Growth of Pakcoy Mustard using AB Mix fertilizer in Table 1.

Table 1. Growth of Pakcoy Mustard using AB Mix fertilizer

Parameter	Week			
	1	2	3	4
Number of Leaves	3 leaves	6 leaves	9 leaves	11 leaves
Leaf Width	0.5 cm	2 cm	4 cm	8 cm
Leaf Length	1.5 cm	5 cm	8 cm	12 cm
Number of Roots	3 roots	5 roots	9 roots	13 roots
Root Length	1 cm	3.5 cm	7.5 cm	12 cm

Based on the Table 1 showed that the treatment of AB Mix nutrition gave a significant effect on the parameters of the observation of the number of leaves, leaf width, leaf length, number of roots, and root length. At the age of one week, the number of leaves consists of three, 0.5 cm wide, 1.5 cm long, 3 roots, and 1 cm long. At the age of two weeks, the number of leaves consists of 6, 2 cm wide, 5 cm long, 5 roots, and 3.5 cm long. At the age of three weeks, the number of leaves consists of 9 leaves, 4 cm wide, 8 cm long, 9 roots, and 7.5 cm long. At the age of four weeks, the number of leaves consisted of 11 leaves, 8 cm wide, 12 cm long, 13 roots, 12 cm long, and 100 grams of plant weight using AB Mix nutrients.

From the results of these studies, the development of plant tissue was influenced by macro and micro nutrients contained in AB Mix fertilizer. The micro nutrient Ca is needed by plants to activate a number of enzymes that function in mitosis, division and elongation of cells, cell division, protein synthesis and carbohydrate translocation [6]. The growth rate (stems, branches, etc.) is basically physiologically balanced, so that the supply of nutrients is in accordance with the needs needed by plants [7]. Plants that are fulfilled with their nutrient needs will be able to stimulate the growth of new leaves. The plants that get enough nitrogen in the soil will grow greener [8].

The plant growth and development apart from seeing the availability of nutrients available in the soil, the need for macro and micro nutrients must also be available in a balanced state [9]. The initial growth of plants need nutrients quite a lot, it is in harmony with the opinion [10] and that to provided an nutrients in sufficient quantities and impartial in the process of plant growth, the division process, the process of photosynthesis, and the process cell elongation will take place quickly which causes several plant organs to grow rapidly, especially in the vegetative phase [11].

Temperature is also an important factor in growth. Temperature affects growth and production in plants. Plants in an environment where the temperature exceeds the optimum temperature will affect their growth resulting in low production. This is due to the lack of balance between photosynthesis and reduced carbohydrates caused by respiration. Along with increasing temperature in the environment will accelerate these two processes, but in the atmosphere above the optimum limit, the respiration process is greater than photosynthesis, so that increasing temperature will result in reduced production.

From these results, it can be seen that the leaf growth is quite fast, where the leaves of the pakcoy mustard plant can develop three leaves per week. Then the width of the leaves every week can be doubled. While the length of the leaves grows 3 cm every week. For many roots every week add 3 roots. Each week the root length was increased by 1.5 times the previous root length.

4. Conclusion

The results of research on the growth of pakcoymustard (*Brassica rapa*) hydroponic system with AB Mix nutrition had a significant effect on the growth of leaf number (Jd), leaf width (Ld), leaf length (Pd), number of roots (Ba), root length (Pa) and plant weight (Bt).

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