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# GROWTH AND PRODUCTION RESPONSE OF PAKCOY (BRASSICA RAPA L.) ON DIFFERENT CONCENTRATIONS OF ECO ENZYME APPLICATIONS UNDER AQUAPONIC SYSTEM

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## ABSTRACT

Pakcoy (Brassica rappa L) is one of the most popular vegetable commodities, but the growth and production of this plant cannot meet the demand. The purpose of this study was to determine the effect of giving eco enzyme in aquaponics system on the growth and production of Pakcoy. This research was conducted in Patemon, Gunung Pati, Central Java, Indonesia. The method used is a 3x3 Completely Randomized Design (CRD). The treatments used were: P0 (control), P1 (addition of eco enzyme 1 mL/1 L water), P2 (addition of eco enzyme 1.5 mL/1 L water). Parameters observed were leaf length, leaf width, number of leaves, and plant wet weight. Data analysis used ANOVA by comparing Fcount with Ftable at the 5% level. The results showed that the treatment with eco-enzyme affected the growth and production of Pakcoy in the addition of length (20.17 cm), width (10.16 cm), number of leaves (24 strands) and plant wet weight (225.66 grams). The results of this study can be concluded that the application of eco-enzyme in aquaponics system affects the growth and production of Pakcoy. Excessive use of eco-enzyme will cause stunted plant growth due to acidic pH conditions.

**Keywords:** Aquaponics, Eco Enzyme, Growth, Production

## 1. INTRODUCTION

Vegetables are plant commodities that people really need because they contain nutrients and vitamins that are good for the human body, besides that they don't grow too long so people can regularly consume these vegetables. Because public interest is very high, many farmers grow vegetables for sale. Vegetables that are currently in high demand among the public include mustard greens, although there are many types of mustard greens on the market, one type of mustard greens is pakcoy Ardiana and Lasmini (2021). Pakchoy has its own characteristics from other types of mustard greens, namely: pakchoy has wide leaves and stems, while the leaves themselves are slightly curved like a spoon. Therefore, pakchoy is often referred to by local people as spoon mustard greens Zidni et al. (2013). This vegetable is one of the vegetables that is very popular with the public because its contents are beneficial for the body, including: they contain protein, fat, Ca, P, Fe, Vitamins A, B, C, E, and K. These contents are very good for health, have high nutritional content, and are a high commodity value.

To increase the value of existing commodities, farmers must change the way they grow vegetables from conventional methods using soil to using an aquaponic system that uses water as a medium Rokhmah et al. (2014). This method can really help farmers to increase the production of pak choy commodities. Aquaponics itself is a combination of fish cultivation and the growth process, this is very helpful because farmers can utilize narrow land by combining agricultural methods and fish cultivation. Meanwhile, with the problem of fertilizer and plant diseases, farmers can use natural ingredients, namely eco enzyme. According to Larasati (2020), the goal of eco enzyme is to determine the quality of the eco enzyme, the effect it has after being given to the water in the aquaponics tank so that it can be absorbed by the pak choy. Based on existing research, it is known that eco enzyme is an organic substance that can be used as organic fertilizer, pest repellent, etc.

## 2. METHOD

This research was conducted in in Patemon, Gunung Pati, Central Java, Indonesia. The experiment was carried out in Aquaponic System and Greenhouse controlled environment. This research used the research method used was a Completely Randomized Design (CRD) with 3 ocean concentration treatments eco enzyme namely: P0 (without addition eco enzyme), P1 (addition eco enzyme 1mL / 1 L water), P2 (addition eco enzyme 1.5 mL /1 L water). In this research, the tools and materials used included 3 aquaponic tubs measuring 1x1.2 meter, 3 pieces of 1x1M styrofoam, 60 net pots, 60 rockwoolls, 60 pak choy seeds, 15 L of water in each tub, 1 liter of eco enzyme solution, and 2 spray equipment. The method used in qualitative descriptive, observations made in this research are as follows: the pest population that attacks pakcoy plants is seen every 7 days at the age of pakcoy 15, 22, 29, and 36 days after being transferred to the aquaponic system. Data analysis uses the F test, if it is significantly different, it is continued with the Duncan Test at the 5% level.

## 3. RESULTS AND DISCUSSION

The research results obtained 36 days after planting and the Duncan test results showed that the solution was given eco enzyme as a fertilizer it affects the growth in length, width and number of leaves as well as production in increasing the pakchoy wet weight. The optimal dose for increasing plant height is obtained by adding a eco enzyme of 1.5 mL/1 L of water.

### 1) Pakchoy Leaf Length

The results of Duncan's test analysis show that the addition of the eco enzyme as a fertilizer with different treatments it affects pakchoy leaf length at the age of 36 days after planting. The average pakchoy leaf length is presented in Table 1.

**Table 1**

**Table 1 The Average Pakchoy Leaf Length**

| Treatment | Repetition | | | Average | Standard (cm) |
|---|---|---|---|---|---|
| | I | II | III | | |
| P0 | 16,00 | 18,30 | 16,00 | 16,76 | 14-17 |
| P1 | 18,90 | 20,90 | 19,50 | 19,76 | |
| P2 | 20,10 | 20,16 | 20,26 | 20,17 | |

Administration of eco enzyme affects the growth of pakchoy leaf length. This is due to the compound content in the eco enzyme, the compounds contained include N, P and K. These compounds are needed for plant growth. According to Lingga and Marsono (2003), nitrogen in sufficient quantities plays a role in accelerating overall plant growth, especially stems and leaves. Lakitan (2011) increased plant height is a physiological process in which cells divide. In the process of division, plants require essential nutrients in sufficient quantities which are absorbed by the plant through the roots. Another element that helps increase plant growth is the content in the aquaponic tank itself, such as ammonia, nitrite and nitrate. Brahmana et al. (2010) stated that many ammonium and nitrate compounds are absorbed by plants in the growth process. Ingredients in the aquaponics system are also needed for the growth process, such as ammonia, ammonia is waste from leftover feed and the results of fish metabolism (feces and urine) which will be converted by bacteria in plant growth media and fish rearing media into nitrites and nitrates Mullen (2003). Average results of solution addition analysis eco enzyme, pakchoy leaf length is presented in Figure 1.

**Figure 1**

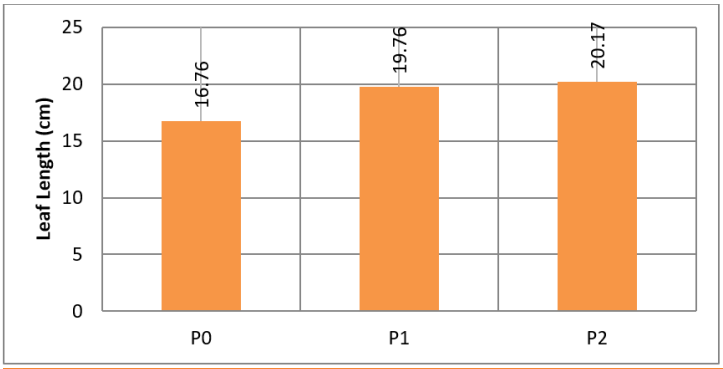


**Figure 1** Graphic of the Growth of Pakchoy Leaf Length

Based on Figure 1, the average growth of pakchoy leaf length, it was obtained that the addition of the eco enzyme at P2 as much as eco enzyme 1.5 mL / 1 L water affects pakchoy leaf length. This shows that the nitrogen content and additional compounds produced from fish feces influence the increase in pakchoy leaf length.

### 2) Pakchoy Leaf Width

The results of Duncan's test analysis show that the addition of the eco enzyme as a fertilizer with different treatments it affects the pakchoy leaf width at the age of 36 days after planting. The average pakchoy leaf width is presented in Table 2.

**Table 2**

**Table 2 The Average Pakchoy Leaf Width**

| Treatment | Repetition | | | Average |
|---|---|---|---|---|
| | I | II | III | |
| P0 | 8,0 | 9,0 | 8,0 | 8,33 |
| P1 | 8,7 | 9,7 | 9,0 | 9,13 |
| P2 | 10,5 | 9,5 | 10,5 | 10,16 |

Based on Table 2, it is known that the effect of changes in the pakchoy width leaves is influenced by substances absorbed through the plant roots and distributed by the stem, the leaves synthesize organic material using light as an energy source through the process of photosynthesis. This is in accordance with Rais (2021) that leaves function as receivers and tools for photosynthesis, the greater the leaf area, the optimal sunlight can be absorbed to increase the rate of photosynthesis. According to Brahmana et al. (2010) in Sitompul et al. (2017), plants that lack nutrients will appear to have a darker leaf color, the tips of the old leaves will dry out.

**Figure 2**

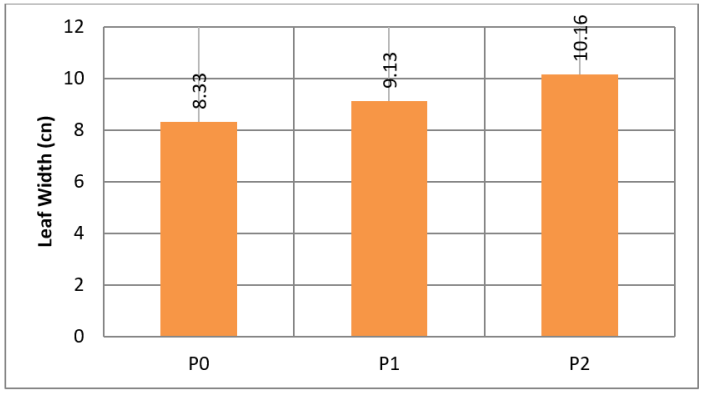


**Figure 2** The Growth of Pakchoy Leaf Width

Based on Figure 2, the average pakchoy leaf width, it can be seen that apart from adding the eco enzyme, external factors such as sunlight also influence the increase in pakchoy leaf width plants and it can be seen in Figure 2 that in treatment P2 the increase in pakchoy leaf width is more significant.

### 3) The Number of Pakchoy Leaves

The results of the Duncan test analysis show that the addition of the *eco enzyme* as fertilizer with different treatments it affects the number of pakchoy leaves at the age of 36 days after planting. The number of pakchoy leaves is presented in Table 3.

**Table 3**

**Table 3 The Number of Pakchoy Leaves**

| **Treatment** | **Repetition** | | | **Average** |
|---|---|---|---|---|
| | I | II | III | |

| | | | | |
|---|---|---|---|---|
| P0 | 21 | 20 | 21 | 20,66 |
| P1 | 22 | 22 | 21 | 21,66 |
| P2 | 23 | 23 | 26 | 24 |

Based on Table 3, it is known that the addition of the solution *eco enzyme* can affect the number of pakchoy leaves. According to Junia (2017) providing sufficient N and P elements can help convert carbohydrates produced in the photosynthesis process into protein which will help increase the number of pakchoy leaves. Meanwhile, according to Roidi (2016), the nutrient element nitrogen is one of the forms of chlorophyll. Chlorophyll is a pigment used in the photosynthesis. If nitrogen increases, chlorophyll also increases so that the number of pakchoy leaves also increases. Phosphorus plays a role in encouraging the ripening of chlorophyll and the transport of metabolic energy in plants (Liferdi, et al. 2008 in Damanik (2020).

**Figure 3**

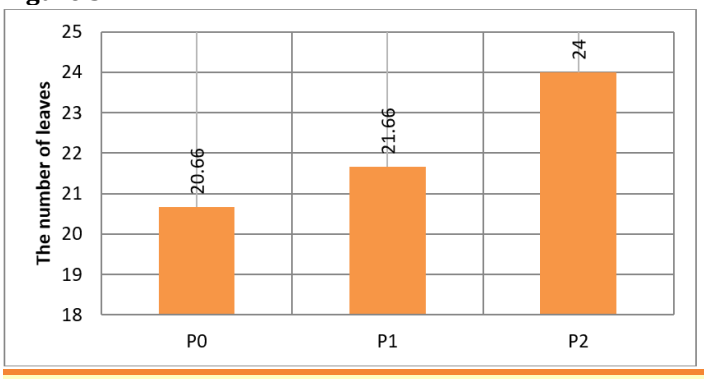


**Figure 3** The Number of Pakchoy Leaves

Based on Figure 3, the number of pakchoy leaves with the addition of the eco enzyme. It is known that treatment P2 showed that the number of pakchoy leaves with the addition of eco enzyme 1.5 mL / 1 L water had a significantly high yield of 24 leaves.

### 4) Pakchoy Wet Weight

The results of the Duncan test analysis show that the addition of the eco enzyme as a fertilizer with different treatments it affects the pakchoy wet weight at the age of 36 days after planting. The pakchoy wet weight is presented in Table 4.

**Table 4**

**Table 4 Pakchoy Wet Weight**

| Treatment | Repetition | | | Average |
|---|---|---|---|---|
| | I | II | III | |
| P0 | 127 | 148 | 157 | 144 |
| P1 | 189 | 196 | 178 | 187,66 |
| P2 | 243 | 242 | 192 | 225,66 |

Based on Table 4, pakchoy wet weight increases as plant size increases, such as leaf length, leaf width and number of leaves Ardiana and Lasmini (2021). In the opinion of Ernanda (2017) that the nutrient nitrogen is very much needed in the process of forming vegetative parts of plants such as stems, leaves and roots because

nitrogen is a building block for essential amino acids for the process of cell division and enlargement. Apart from being influenced by nutrients, the plant's wet weight is also influenced by temperature and dissolved oxygen. This is in accordance with the opinion of Paramita & Yuliani (2021) that the concentration of nutrients in the planting media, dissolved oxygen content and temperature influence changes in the pakchoy wet weight.

**Figure 4**

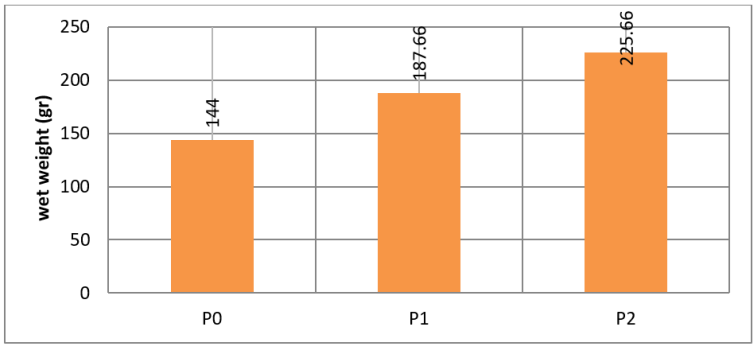


**Figure 4** Pakchoy Wet Weight

Based on Figure 4, the pakchoy wet weight with the addition of the eco enzyme. It is known that treatment P2 showed that the pakchoy wet weight with the addition of eco enzyme 1.5 mL / 1 L water had a significantly high yield of 225,66 grams.

## 4. CONCLUSION

Eco enzyme has an effect on supporting the growth and production of pakchoy with the N, P and K content which is used to break down ammonia into nitrites and nitrates which function as plant growth nutrients with the highest treatment average being P2 (addition eco enzyme1.5 mL/ 1 L water) with leaf length being 20.17 cm, leaf width being 10.16 cm, number of leaves being 24 and pakchoy wet weight being 225.66 grams.

## CONFLICT OF INTERESTS

None.

## ACKNOWLEDGMENTS

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