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Growth and Production Response of pakcoy (*Brassica rapa* L.) to Natural Growth Regulator Application

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ABSTRACT: Pakcoy (Brassica rapa L.) is a type of vegetable plant that belongs to the Brassicaceae family which has high economic value, but its production is still low so that it cannot meet market demand. To meet market demand, pakcoy plant production needs to be optimized, one of which is by using natural growth regulators. Natural ingredients that can be utilized as growth regulators include bean sprouts and coconut water. The objectives of this study were (1) to determine the effect of natural growth regulators on the growth and production of pakcoy plants, (2) to obtain the best type of natural growth regulators on the growth and production of pakcoy plants. This research was conducted at Kandang Lamo Nursery from June to October 2023. This study used a completely randomized design with 3 treatments and 5 replications, namely A. Control (without growth regulator treatment), B. Bean sprout extract, C. Coconut water. The parameters observed were plant height (cm), number of leaves (strands), root length (cm) and plant wet weight (g). Based on the observations, the plants treated with coconut water growth regulator produced higher plant height, number of leaves, root length, and plant wet weight (g) compared to the other treatments. The lowest growth and production were shown by plants that were not treated with growth regulators (control).

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1.0 INTRODUCTION

Pakcoy (*Brassica rapa* L.) is a vegetable that was first introduced in Japan and is still in the same family as the Chinese vegetable. Today, pakcoy has been developed on a large scale in the Philippines and Malaysia, in Indonesia and Thailand (Setiawan, 2017). Pakcoy was a vegetable crop that has economic value. The prospect of pakcoy vegetable crops has high economic value and is highly favored by many people. This vegetable is not native to Indonesia, but its popularity in the country is quite high. Pakcoy plants are also known as spoon mustard or meat mustard. The shape of the leaves resembles a spoon with a bulging base.

The mineral content of Pakcoy can help maintain bone structure. Bones become stronger and avoid the risk of osteoporosis. Pakcoy also contains vitamin K which will maintain the stability of calcium levels in the bones so that the condition is stronger and healthier. Lisdayani et al, (2019) concluded that the use of doses of NASA liquid organic fertilizer had a significantly different effect on the net weight of pokcay plants. POC with a dose of 2 cc/ltr already gives the best production results with a net weight per plot of 262.92 grams.

Growth regulators are used to optimize the growth and production of Pakcoy plants. Growth regulators are compounds that are given to plants as additional supplements to increase the cell division process to make it more active. Growth regulators in small amounts can stimulate plant growth while large amounts can inhibit plant growth. Growth regulators are divided into two groups, namely synthetic growth regulators and natural growth regulators. Some natural growth regulators used to increase plant growth and production are bean sprout extract, and coconut water.

Bean sprouts contain many phytochemical compounds that are very efficacious (Amilah and Astuti, 2006). Bean sprouts also contain non-essential amino acids. The non-essential amino acid contained in bean sprouts is tryptophan, where this compound acts as a precursor to the biosynthesis of Indol-3-Acetic Acid (IAA). Auxin hormones are useful in spurring growth because they are able to

stimulate cell enlargement, chromosomal DNA synthesis, and stimulate root growth in plants (Setiawati et al., 2018). The results of research by Jayanti et al. (2019) showed that the provision of bean sprout extract had a significant effect on the growth of height, number of leaves, and quality index of seedlings of *A. malaccensis.*

Coconut water can stimulate growth because young coconut water contains growth regulators in the form of hormones gibberellin, auxin and cytokinin which play a role in plant growth. Gardner et al., (2008) stated that auxin is one of the growth regulators that plays a role in encouraging cell elongation, cell division, differentiation of xylem and phloem tissues, root formation, tropism response and inhibiting the shedding of leaves, flowers and fruits. The results of research by Purba et al., (2018) show that the application of coconut water has an effect on plant height, number of leaves, leaf area, canopy width. leaf wet weight, leaf dry weight, root wet weight and root dry weight.Based on the above problems the authors have conducted research with the title: Growth And Production Response Of Pakcoy (*Brassica Rapa* L.) To Natural Growth Regulator Application.

The objectives of this study were (1) to determine the effect of natural growth regulators on the growth and production of Pakcoy plants, (2) to obtain the best type of natural growth regulators on the growth and yield of Pakcoy plants.

2.0 MATERIALS AND METHODS

2.1 Time and Place

This research was conducted from June to October 2023 at Kandang Lamo Nursery, Harau District, Lima Puluh Kota Regency with an altitude of ± 500 meters above sea level.

2.2 Treatments

The study consisted of 3 treatments with 5 replications, the number of samples was 5 Pakcoy plants for each treatment, so the total number of samples for all treatments was 15 pakcoy plants. The treatments consisted of: A. Control (without natural growth regulator treatment); B. Bean sprout extract; C. Coconut water. This study used a completely randomized design (CRD).

To test the effect of treatment on the observed responses, analysis of variance was carried out using the Statistical Analysis System (SAS) program, followed by the Duncan New Multiple Range Test to see treatment differences at α 5%.

2.3 Implementation

Preparation of Planting Media

The planting media used were soil and cow manure in a ratio of 1:1. Planting was done using a polybag measuring 18 x2 5 cm, the soil was put into the polybag until it was full. Planting media was prepared as many as 15 polybags for five different treatments, each treatment consisting of 5 polybags. After filling the polybags, the treatment was placed in the nursery. **Preparation of natural growth regulator treatment**

a. Preparation of bean sprout extract

250 g bean sprouts were cleaned and mashed using a blender by adding 250 ml of water. Taking bean sprout extract is done by filtering the bean sprouts that have been mashed using a filter. The 250 ml bean sprout extract was added with 250 ml of water to obtain 500 ml of bean sprout extract which was applied to 5 replicate plants, each plant was given 100 ml of bean sprout extract.

b. Preparation of coconut water

Coconut water as much as 250 ml was dissolved with water as much as 250 ml so as to obtain 500 ml of coconut water which was applied to 5 replicate plants, each plant was given 100 ml of coconut water.

Pakcoy seed preparation

Pakcoy seedlings used are NAULI F1 varieties. Pakcoy seedlings were purchased directly from Ana's nursery in Lima Puluh Kota Regency. The selected seedlings were of good quality, free from pests and diseases, and normal growth with the need for 25 Pakcoy seedlings.

Planting

Pakcoy seedlings were planted in soil and cow manure in a 1:1 ratio. Planting is done using polybags that have contained media by making planting holes and then planting pakcoy seedlings.

Growth regulator treatment

The treatment using ZPT bean sprout extract and coconut water was carried out by watering as much as 100 ml / plant at intervals of time, 2, 4 and 6 weeks after planting. While the control treatment was watered using water.

2.4 Maintenance

Maintenance includes watering and weed control. Watering is done regularly once a day. Watering is done using a watering can until the planting media is wet. Watering time is in the morning or evening, according to the watering capacity to field capacity. Weed control is carried out by pulling weeds that grow in the polybag area of the plant and collecting them, then throwing the weeds away from the planting area. Weed control is done once a week manually by hand.

2.5 Data Collection

Observations were made when the plants were 6 weeks after planting. The variables measured were (1) Plant Height (cm); done by

measuring from the growing point of the plant to the longest leaf (2) Number of leaves (strands); done by directly counting one by one the number of leaves on the plant (3) Root length (cm); observed by pulling out the plant and measuring the length of the plant roots; and (4) wet weight of plants (g); done by weighing the harvest of each plant according to the treatment.

3.0 RESULTS AND DISCUSSION

3.1 Plant Height and Number of leaves

Based on the results of observations of pakcoy plant growth including plant height (cm) and number of leaves (strands), it was found that the provision of several types of natural growth regulators had an effect on plant growth. which is presented in Table 1.

Table 1. Plant height and number of leaves of pakcoy plants at the age of 6 weeks after planting

Natural growth regulator	observation	
	Plant height (cm)	Number of leaves (strands)
Control	18.20 a	15.60 a
Bean sprout extract	23.40 b	18.60 b
Coconut water	28.60 c	22.40 c

Note: Numbers followed by the same letter in the same column are not significantly different based on the DMRT test at α 5%

Based on Table 1, it can be seen that plants treated with coconut water growth regulator produce higher plant height, number of leaves compared to other treatments. In the coconut water growth regulator treatment, the plant height was 28.60 cm with 22.40 leaves. The lowest growth was shown by plants that were not treated with growth regulators.

Pakcoy plants treated with bean sprout extract, coconut water, and control showed a significantly different effect on plant height and number of leaves. This is because the treatment of growth regulators produces growth regulators that can increase plant growth. Appropriate growth regulators can help plant growth, because growth hormones are one of the components needed in the process of plant growth, in addition to carbohydrates and nitrogen. Growth regulators as compounds given to plants as an additional supplement to increase the process of cell division to be more active. Growth regulators in small amounts can stimulate plant growth while in large amounts can inhibit plant growth.

Plants treated with coconut water produced the highest plant height and number of leaves compared to other treatments because coconut water contains the hormones auxin, cytokinin and gibberellin. Old coconut water has the following composition of growth regulators: cytokinin 5.8 mg/l, auxin 0.07 mg/l, and gibberellin 0.01 mg/L (Muazzinah and Nurbaiti, 2017). The increase in plant height and number of leaves is closely related to the work of the hormones cytokinin and auxin. Growth in parts such as roots and stems is the focus of cytokinin and auxin hormones. Auxin functions in inducing cell elongation, influencing apical dominance, inhibition of axillary and adventitious shoots and root initiation while cytokinin functions to stimulate cell division in tissues and stimulate shoot growth (Salisbury and Ross, 1995 in Setyawati et al., 2020). The results of this study are in line with the results of research by Riny (2014), in his research using coconut water at levels of 250 ml, 200 ml, 150 ml, 100 ml on mustard plants and the results show that coconut water affects the growth of mustard plants (*Brassica juncea* L.), namely on plant height and number of leaves. The results of research by Al Banna et al., (2023) also showed that the utilization of old coconut water waste as a natural growth regulator on mustard growth (*Brassica juncea* L.) showed the highest results in the parameters of plant height, number of leaves, and leaf area.

3.2 Root length

Based on the results of observations of pakcoy plant growth on the length of plant roots (cm), it was found that the provision of several types of natural growth regulators had an effect on plant growth. which is presented in Table 2.

Table 2. Root length of Pakcoy plants at 6 weeks after planting

Natural growth regulator	Observation
	Root length (cm)
Control	5.80 a
Bean sprout extract	9.40 b
Coconut water	11.60 c

Note: Numbers followed by the same letter in the same column are not significantly different based on the DMRT test at α 5%

Based on Table 2, it can be seen that the plants given the coconut water growth regulator treatment produced higher root lengths compared to the bean sprout extract ZPT treatment and the control. The treatment of coconut water growth regulator has a root length of 11.60 cm allegedly because coconut water contains auxin and cytokinin hormones that play a role in the process of cell division so that it is thought to be effective in the process of root elongation. Campbell (2003) states that auxin not only spurs stem

elongation but also spurs the growth of all parts of the plant including roots and leaves. Root length is also influenced by the number of leaves. This is in accordance with the statement of Husain and Khan (2004) that the growth of root length can be influenced by two factors, namely genetic factors and the number of leaves. Genetic factors play a role in coordinating genes that build the root system, while the number of leaves is responsible for increasing root development, because the leaves are a place of food synthesis through the process of photosynthesis, and then the food will be translocated to the roots for root development. According to Goldsworthy and Fisher (1992) root length has been accepted as a measure of the absorption capacity of the root system. Plants that have long roots will have the ability to absorb nutrients and water better when compared to plants with short roots and are able to find water in locations that are difficult to reach water. The longer the roots, the sturdier the plant will be and the water and mineral salts in the growing medium will be easily absorbed to be channeled to the stem and leaves.

3.3 Plant Wet Weight

Based on the observations obtained that the provision of several types of natural growth regulators affects the wet weight of Pakcoy plants. The data is presented in Table 3.

Table 3. Wet weight of Pakcoy plants aged 6 weeks after planting

Natural growth regulator	observation
	Wet Weight (g)
Control	128 a
Bean sprout extract	153 b
Coconut water	212 c

Note: Numbers followed by the same letter in the same column are not significantly different based on the DMRT test at α 5%

Table 3 shows that the treatment given coconut water growth regulator produces higher plant wet weight compared to other treatments. This is because the content of growth regulators in coconut water in the form of gibberellin, auxin and cytokinin hormones that play a role in plant growth is higher than other treatments so that it affects plant growth. According to Nana and Salamah (2014) Coconut water affects plant weight due to the presence of the hormone auxin which encourages cell elongation and enlargement, thus affecting wet weight gain. reinforced by (Tiwery, 2014) which also states that the achievement of higher wet weight and dry weight of plants with coconut watering is due to the availability of nutrients for plants that are very important for the growth process and the presence of growth regulators that spur cell division and enlargement. Coconut water contains a unique chemical composition consisting of minerals, vitamins, sugars, amino acids, and phytohormones that have significant effects on plant growth (Winarto and da Silva, 2015). Growth is cell division (increase in number) and cell enlargement (increase in size) that accumulates in the wet weight and dry weight of plants (Gardner et al., 1991).

CONCLUSION

Based on the results of the study it can be concluded that the use of natural growth regulators affects the growth of pakcoy plants. Coconut water natural growth regulator gives better effect compared to other treatments with plant height 28.60 cm, number of leaves 22.40 strands, root length 11.60 cm and wet weight of Pakcoy plants 212 g.

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