

Effectiveness of AB Mix and Liquid Organic Fertilizer from Coconut Water and Eggshells on Hydroponic Pakcoy Growth

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SYNOPSIS

Pakcoy (*Brassica rapa* L.) is cultivated hydroponically with AB Mix nutrients that have the potential to pollute the environment. This study aims to analyze the efficiency and determine the best formulation for reducing AB Mix through the addition of liquid organic fertilizer, coconut water and eggshells to the growth of pakcoy. The study used a complete randomized design with four treatments and a test. The results showed that treatment one provided optimal growth, treatment two had a noticeable effect on plant height, stem diameter, and leaf area, Treatments three and four had no effect. The best formulation to reduce AB Mix is the two-dose treatment. Farmers can reduce the risk of environmental pollution and make pakcoy crispier.

Keyword: Pakcoy; *Brassica rapa* L.; AB Mix; liquid organic fertilizer; coconut water; eggshell; hydroponic cultivation.



INTRODUCTION

Pakcoy (*Brassica rapa* L.) is a type of vegetable that belongs to the Brassicaceae family. This vegetable is rich in nutrients, such as vitamins A, C, K, B6, folic acid, protein, carbohydrates, fiber, as well as essential minerals such as potassium, magnesium, and iron (Cahyadi & Nurhayati, 2021).

Pakcoy is cultivated with a hydroponic system. In a hydroponic system, nutrients are met through a solution containing both macro and micronutrients. The nutrients used are generally inorganic fertilizers, such as AB Mix (Lestari & Putri, 2022). However, the long-term use of chemical fertilizers can cause a variety of serious problems, including soil pollution and farmers' economic and social dependence. One of the solutions to increase the yield of pakcoy plants while reducing the use of inorganic fertilizers is to utilize liquid organic fertilizers (Handayani & Elfarisna, 2021).

One of the materials that has the potential to be used as liquid organic fertilizer is coconut water (Hidayanti, *et al.* 2022). As a mixed ingredient in the manufacture of organic liquid fertilizer, coconut water contains two natural hormones, namely auxin and cytokinin, which

play an important role in the process of cell division (Royani *et al.*, 2021). Eggshells are another material that can be used to make liquid organic fertilizers. Eggshells have a high nutrient content, with 97% calcium. This high calcium content is excellent for making liquid organic fertilizers and increasing the pH of soil and water media (Hasibuan, *et al.* 2021).

Several previous studies researched by Mangesa, *et al.* 2021 examined the growth response and yield of pakcoy mustard greens to the combination of AB Mix nutrients and coconut water, as well as research conducted by Fuadi, *et al.* 2022 which discussed the growth response of purple long bean plants to liquid organic fertilizer from rice washing water and egg shells. However, research focusing on the efficiency of using ab mix with liquid organic fertilizer from coconut water and eggshells hydroponically is still very limited. In addition, existing research generally focuses on height parameters and leaf count, without examining other aspects.

Based on this, it is necessary to conduct research on the efficiency of using AB Mix with liquid organic fertilizer from coconut water and eggshells on the growth of pakcoy (*Brassica rapa* L.) hydroponically.

ARTICLE CONTENTS

The research was carried out in May-July 2025 at the greenhouse of SEAMEO BIOTROP. The tools used are trays, impraboard, netpots, tds meters, ph meters, thermometers, rulers, scales, stationery, mobile phones, jerry cans, hacksaws, hydroponic tubs, calipers, spray bottles and materials such as pakcoy seeds, rockwool, ab mix nutrition, water, em4, flannel fabric, coconut water, molasses, egg shells. Using the RAL method of 4 treatments and 4 replicates, namely: P1: (control): 100% ab mix, P2: 50% ab mix + 100 ml/l poc coconut water + 100 ml/l poc eggshell, P3: 50% ab mix + 200 ml/l poc coconut water + 200 ml/l poc eggshell, P4: 50% ab mix + 300 ml/l poc coconut water + 300 ml/l poc eggshell. The research stages include installation preparation, POC manufacturing, making ab mix solution, seedlings, seedlings, nutrient provision, maintenance and harvesting. The observation parameters are plant height, number of leaves, root length, stem diameter, wet weight, and leaf area. The data was analyzed using SPSS 26.



Table 1 Annova Test and Advanced Test of Pakcoy Plant (*Brassica rapa* L.)

Treatment	7 HST	14 HST	21 HST	28 HST	35 HST
P1	7.56 a	12.59 a	14,13 b	18.03 c	19.13 c
P2	7.44 a	13.00 a	13.75 b	16.06 b	17,31 b
P3	7.34 a	9.94 b	10.69 a	11.69 a	13.19 a
P4	7.16 a	9.31 b	10,13 a	11.31 a	12.63 a
F Calculate	0,515	48,664	78,237	166,358	196,573
F Table (0.05)	0,673	0,000	0,000	0,000	0,000
Remarks	NS	**	**	**	**

Table 2 Annova and Advanced Test of the Number of Leaves of Pakcoy Plant (*Brassica rapa* L.)

Treatment	7 HST	14 HST	21 HST	28 HST	35 HST
P1	5.69 a	7.25 b	10.44 b	13.94 c	18.19 c
P2	5.69 a	7.00 b	10.13 b	13.19 c	15.63 b
P3	5.63 a	6.38 a	8.31 a	10.63 b	13.38 a
P4	5.63 a	6.19 a	8.00 a	10.25 a	13.13 a
F Calculate	0,087	21,760	63,838	123,923	246,153
F Table (0.05)	0,967	0,000	0,000	0,000	0,000
Remarks	NS	**	**	**	**

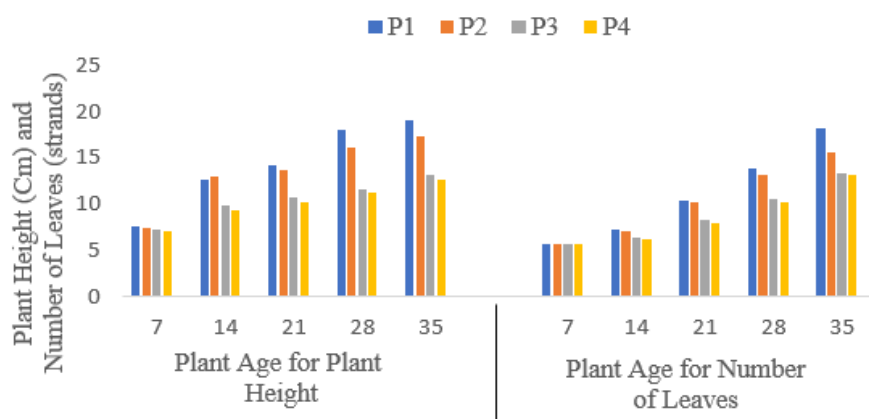


Figure 1 Plant Height and Number of Leaves of Pakcoy Plant (*Brassica rapa* L.)

Source: Author's Undergraduate Thesis



The highest growth in treatment 1 was 19.13 cm. The concentration of 100% Ab Mix is able to increase the height of the plant. According to Oktavian, et al (2024) AB Mix produces better growth than organic nutrients.

The high efficiency of the plant at 35 HST is calculated using the formula Efficiency =.

$$\text{High Efficiency of Plants 35 HST} = \frac{\text{Output Aktual}}{\text{Output Maksimal}} \times 100\% = \frac{17,31}{19,13} \times 100\% = 90\%$$

The number of leaves treatment 1 is the most optimal. According to Purnamasari (2023), the number of leaves is influenced by the availability of water, nutrients, and light for photosynthesis.

$$\text{At 35 HST, the nutrient efficiency of the number of leaves} = \frac{15,63}{18,19} \times 100\% = 85\%.$$

The number of leaves has a close relationship with the area of the leaves. The formed leaves increase the surface area of the plant.

Table 3 Annova Test and Advanced Root Length Test of Pakcoy Plant (*Brassica rapa* L.)

Treatment	7 HST	14 HST	21 HST	28 HST	35 HST
P1	5.66 a	12.94 c	21.06 c	26.66 c	31.06 c
P2	5.63 a	9.25 b	12.81 b	15.81 b	19.38 b
P3	4.88 a	7.06 a	9.31 a	11.69 a	14.94 a
P4	5.25 a	6.25 a	8.63 a	11.38 a	14.69 a
F Calculate	1,224	36,463	54,075	63,173	169,693
F Table (0.05)	0,309	0,000	0,000	0,000	0,000
Remarks	NS	**	**	**	**

Table 4 Annova Test and Advanced Test of Leaf Area of Pakcoy Plant (*Brassica rapa* L.)

Treatment	7 HST	14 HST	21 HST	28 HST	35 HST
P1	3.48500 a	13.27889 d	26.11202 d	33.45615 p	41.32111 c
P2	3.96191 a	9.26238 c	13.52800 c	17.05397 c	22.27509 b
P3	3.59464 a	7.24218 b	10.47339 b	14.15420 b	20.97152 b
P4	3, 70256 a	6.09856 a	8.33844 a	10.95242 a	15.30933 a
F Calculate	0,702	70,185	154,561	204,700	96,076
F Table (0.05)	0,554	0,000	0,000	0,000	0,000
Remarks	NS	**	**	**	**

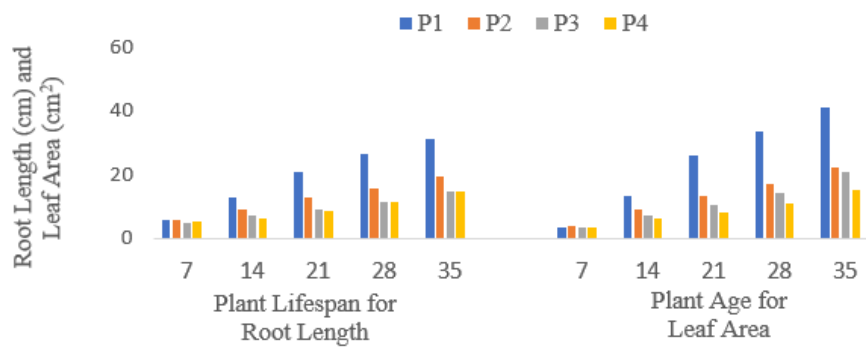


Figure 2 The root length and leaf area of the pakcoy plant (*Brassica rapa* L.)

Source: Author's Undergraduate Thesis

Treatment 1 was the highest average at 35 HST, which was 31.06 cm. Root growth is influenced by elements N, P, and K as well as IAA which stimulate root elongation (Sari, 2025).

Root length plays a role in supporting an increase in wet weight.

$$\text{Root length efficiency at 35 HST} = \frac{19,38}{31,06} \times 100\% = 62\%.$$

At 7 HST, the highest leaf area of treatment 2 was 3.96 cm². The macro and micronutrient content expands the width of the leaves. Meriaty, *et al.* (2021) said that as AB Mix increases, nutrition becomes optimal.

$$\text{Leaf area efficiency at 35 HST} = \frac{22,27509}{41,32111} \times 100\% = 53\%.$$

It shows an effect, but it is not optimal because fertilizer application and high temperatures affect plants (Hutapea *et al.*, 2023).



Source: <https://www.degrocery.com/product/fresh-siew-pek-chai-350g/>

Table 5 Annova Test and Advanced Test of Stem Diameter of Pakcoy Plant (*Brassica rapa* L.)

Treatment	7 HST	14 HST	21 HST	28 HST	35 HST
P1	1,841 a	2,563 b	3,400 b	4,125 c	5,094 c
P2	1,881 a	2,569 b	3,412 b	3,581 b	4,206 b
P3	1,875 a	2,425 a	2,950 a	3,181 a	4,050 a
P4	1,875 a	2,356 a	2,906 a	3,113 a	3,950 a
F Calculate	1,307	6,765	86,771	208,457	208,798
F Table (0.05)	0,281	0,001	0,000	0,000	0,000
Remarks	NS	**	**	**	**

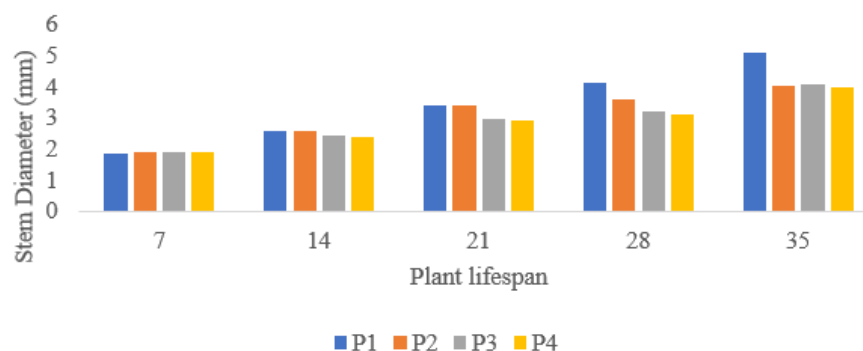


Figure 3 Diameter of Pakcoy Stem (*Brassica rapa* L.)

Source: Author's Undergraduate Thesis

Rod diameter at 7-21 HST, treatment 2 highest with an average of 2.569 mm. The growth of the diameter of the stem is affected by water. According to Nugroho & Setiawan, (2022) water helps dissolve nutrients, thus contributing to the enlargement of the stem diameter.

Egg shells contain calcium carbonate which plays a role in strengthening the cell wall, increasing cell division, improving ph and increasing the diameter of the stem (Renfiyeni, *et al.* 2025).

$$\text{At 35 HST, the stem diameter efficiency} = \frac{4,206}{5,094} \times 100\% = 82\%$$

Showing liquid organic fertilizer favors the accumulation of water and biomass thereby increasing wet weight.

Table 6 Average Wet Weight of Pakcoy Plant (*Brassica rapa* L.)

Treatment	Friendly
1	47.625 c
2	32.75 b
3	22.8125 a
4	21.625 a

Source: Author's Undergraduate Thesis

The optimal wet weight, treatment 1, is 47,625. Research by Meliza, et al (2024) the content of AB Mix provides optimal production results.

Coconut water contains auxin, gibberelin, and cytokinins that play a role in cell division and lengthening, thus supporting wet weight (Ramli, *et al.* 2023).

$$\text{The administration of POC resulted in a wet weight efficiency} = \frac{32,75}{47,625} \times 100\% = 68\%$$

indicating that POC has an effect although it is not optimal.

Based on the results of the study, Treatment 1 is the optimal treatment, Treatment 2 affects the height of the plant on the 14th day, the diameter of the trunk on the 7th-21st day and the leaf area on the 7th day. Treatments 3 and 4 had no real effect. The best AB Mix formulation with the addition of POC is treatment 2.

FUTURE DIRECTION

Further research needs to be conducted by comparing the treatment of replacing the nutrient solution once a week and the treatment without nutrient replacement during the study period, in order to obtain a more optimal concentration of liquid organic fertilizer from coconut water and eggshells to increase the growth of hydroponically cultivated pakcoy plants. So it is worthy of being recommended to be applied by practitioners and the general public.

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Muhammad Aftahudin, S.Si., is a graduate of the Biology Study Program at Pakuan University, Bogor. His research interests are in the field of agriculture, specifically hydroponics. In this study, the issue of reducing the use of ab mix with the addition of poc coconut water and eggshells was raised. Researchers began to be interested in the field of hydroponics since receiving a funding grant from PPK Ormawa Dikti, then developed into current research. This article is his first publication, prepared as part of his graduation requirements, and serves as the first step to contributing to the field of sustainable agriculture research.

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