



## THE EFFECT OF AB MIX FERTILIZER CONCENTRATION AND PLANTING MEDIA ON THE GROWTH AND YIELD OF PAKCOY (*Brassica rapa* L.) USING A HYDROPONIC WICK SYSTEM

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### Abstract

Determining the concentration of nutrients and planting media in a hydroponic wick system is necessary to increase the growth and yield of Pakcoy mustard greens (*Brassica rapa* L.). The research used a Completely Randomized Factorial Design consisting of 2 factors. The first factor is the concentration of AB Mix fertilizer, which consists of 4 levels, namely 500 ppm, 1.000 ppm, 1.500 ppm, and 2.000 ppm. The second factor is the planting media, which consists of 2 levels: cocopeat planting media and husk charcoal. If the analysis result shows a significant difference, then continue with the BNT test at the 5% level. The research stated that applying 1.500 ppm AB Mix fertilizer and husk charcoal planting media could provide the best results in all parameters.

**Keywords:** AB Mix concentration, cocopeat, husk charcoal, Pak Choy, wick

### INTRODUCTION

Hydroponics is an agricultural cultivation activity that does not use land but water as a substitute for soil. As population density increases, hydroponic farming is an alternative way to continue cultivating plants on limited land. Hydroponic farming has many advantages, such as not requiring a large area of land to grow crops, guaranteeing the success of plants in growing and producing, and making plant maintenance easier and more practical. One of the plants that can be cultivated hydroponically is the pak choy plant (*Brassica rapa* L.).

The pak choy plant (*Brassica rapa* L.) is a leaf vegetable with high economic value. It can grow in the lowlands and highlands. However, during the dry season, regular watering is necessary. Using this hydroponic system, the lifespan of pakcoy plants is relatively short. A porous medium, good aeration, and adequate nutrition for plant growth support the success of a hydroponic cultivation system.

The problem in hydroponics is the need for the right nutrient concentration and suitable planting media to support the success of hydroponic plants. The nutrients needed in hydroponics are nutrients that contain macronutrients and micronutrients. The nutrients commonly used in hydroponic plant cultivation are AB Mix nutrients with the right concentration. According to Fitriansyah et al. (2018), it is necessary to provide the right nutrient concentration that suits the plant so that the nutrients are more easily absorbed and used optimally. Apart from providing nutrition, the use of appropriate planting media also needs to be considered. The planting medium is where plant roots

attach to absorb the nutrients the plant needs. Husk charcoal and cocopeat are the planting media used in this research. Supporting the success of a hydroponic cultivation system is a porous, well-aerated medium and adequate nutrition for plant growth (Perwtasari et al., 2012). This research aims to determine the nutrient concentration of AB Mix and the selection of appropriate planting media to support the growth and yield of Pakcoy mustard greens in hydroponic cultivation using a wick system.

## METHOD

This factorial research design uses a Completely Randomized Factorial Design (RALF), which consists of 2 factors. The first factor is the difference in nutrient concentration of the AB mix, which consists of 4 levels, namely 500 ppm, 1,000 ppm, 1,500 ppm, and 2,000 ppm. The second factor is the planting media, which consists of 3 levels: husk, charcoal, and cocopeat. Eight treatment combinations were repeated 3 times, resulting in 24 experimental units.

The nutrient solution is given when transplanting, and the AB Mix nutrient solution is replaced every four days. Every day, in the morning and evening, the nutrient concentration (ppm value) is checked using a TDS meter according to each treatment, and the pH value is checked. Data analysis was carried out based on experimental data obtained using analysis of variance of a Randomized Complete Factorial Plan (RALF). If the analysis results show a significant difference, continue with the BNT test at the 5% level.

## RESULTS AND DISCUSSION

### Plant Length

Table 1  
 Average Length of Pakcoy Mustard Plants Age 15, 19, 23, 27, 31, 35, and 39 DAS Planting Media Treatment and Nutrient

	Plant Length (cm) at Various Plant Ages (DAS)						
	15	19	23	27	31	35	39
AB Mix Concentration							
500 ppm	6,39	8,39	9,42	11,28 a	12,44 a	15,61 a	16,89 a
1.000 ppm	6,22	8,44	9,36	11,17 a	12,72 a	15,28 a	16,89 a
1.500 ppm	6,00	8,56	9,42	11,89 b	13,22 b	16,22 b	17,61 b
2.000 ppm	6,28	8,28	9,44	11,17 a	12,39 a	16,17 ab	16,72 a
BNT 5%	tn	tn	tn	0,40	0,48	0,52	0,62
Planting Media							
Cocopeat	6,36	8,44	9,35	11,17 a	12,47 a	15,61 a	16,56 a
Husk Charcoal	6,08	8,39	9,47	11,58 b	12,92 b	16,03 b	17,50 b
BNT 5%	tn	tn	tn	0,28	0,34	0,37	0,44

Note: The average value followed by the same letter at the same age and treatment is not significantly different in the 5% BNT Test; tn=not real; HSS = Day After Sowing

Table 1 shows that giving different AB Mix nutrients produces different plant lengths for each plant. The best pak choy plant length in this study was obtained when a nutrient concentration of

1,500 ppm was given, which gave the highest results and showed a real difference in the size of the pak choy mustard plant. Akasika, Samekto, and Siswadi (2014) stated that AB Mix fertilizer with a concentration of 1,000-1,500 ppm has a high nutrient content. The nutrients will also be higher when administering AB Mix fertilizer with a high concentration. Meanwhile, Mushafi's (2016) research shows that an AB Mix fertilizer concentration of 1,500 ppm is the right concentration for mustard plants.

The husk charcoal planting medium in Table 1 shows that the husk charcoal planting medium gives the highest yields on pak choy mustard greens with a length of 17.50 cm. The husk charcoal planting medium contains potassium and carbon, which can influence plant growth and development. Apart from that, the charcoal husk media does not easily clot, so plants can grow well. So, using husk charcoal as a medium, plant roots can develop freely and absorb nutrients well, supporting the increase in plant length and a maximum increase in the number of leaves. According to Cahyadi and Nur Hayati (2021), husk charcoal is a porous planting medium; light does not easily clump and is rough, so air circulation is high, making it easier for plant roots to absorb oxygen.

### Number Of Leaves

Table 2  
 Average Number of Pakcoy Mustard Leaves Ages 15, 19, 23, 27, 31, 35, and 39 HSS Planting Media Treatment and Nutrient Concentration

Treatment	Number of Leaves (sheet) pada Berbagai Umur Tanaman (HSS)						
	15	19	23	27	31	35	39
AB Mix Concentration							
500 ppm	3,17	4,44	6,83	7,72 a	8,22 a	10,33 a	13,39 b
1.000 ppm	3,00	4,22	6,17	7,56 a	8,83 a	9,89 a	12,56 c
1.500 ppm	3,00	4,28	6,89	9,28 b	9,78 b	11,50 b	14,22 c
2.000 ppm	3,17	3,94	6,06	7,39 a	8,61 a	9,56 a	12,83 ab
BNT 5%	tn	tn	tn	0,80	0,77	1,08	0,71
Planting Media							
Cocopeat	2,97	4,39	6,81	7,58 a	8,42 a	9,69 a	12,97 a
Husk Charcoal	3,19	4,06	6,17	8,39 b	9,31 b	10,94 b	13,81 b
BNT 5%	tn	tn	tn	0,42	0,60	0,76	0,50

Note: The average value followed by the same letter at the same age and treatment is not significantly different in the 5% BNT Test; tn=not real; HSS = Day After Sowing

The research results in Table 2 show that giving a nutrient concentration of 1,500 ppm produced the highest number of leaves compared to giving other concentrations. It is caused by the nutrients filled in the pak choy plant. The higher the concentration, the greater the number of leaves will grow. Leaf production on pak choy plants is of great concern. With a concentration of 1,500 ppm, this is the right concentration for pak choy plants. This was stated by Hidayat, et al. Yane (2017) stated that differences in nutrient concentrations can affect the growth of pagoda mustard plants. Pagoda mustard greens, given a concentration of 1,500 ppm, produced the highest number of leaves

during the vegetative period. The planting medium that influences the growth of the number of leaves is the husk charcoal planting medium. It can be seen in Table 2 that with the charcoal husk planting media treatment, the highest number of leaves was 13.81 leaves. Because husk charcoal has porous properties, making it easy for plants to grow and develop. Research conducted by Mujiono et al. (2021) stated that giving husk charcoal to pakcoy plant media increased leaf length by 26.13 cm.

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### Root Length

Table 3. Average Root Length Due to Planting Media and Nutrient Concentration

Treatment	Root Length (cm)
AB Mix Concentration	
500 ppm	17,83 a
1.000 ppm	20,72 b
1.500 ppm	23,33 c
2.000 ppm	20,78 b
BNT 5%	1,14
Planting Media	
Cocopeat	20,19 a
Husk Charcoal	21,14 b
BNT 5%	0,81

Note: The average value followed by the same letter at the same age and treatment is not significantly different in the 5% BNT Test; tn=not real;

Table 3 shows the root length parameters, showing that nutrition significantly affects plant root growth using a hydroponic wick system. The highest average was obtained by a nutrient concentration of 1,500 ppm for root length parameters. In the treatment of giving a nutrient concentration of 2,000 ppm, there was a decrease in root length parameters. Because giving higher nutrient concentrations will cause poisoning, as explained by Hidayanti and Trimin (2019), providing higher doses of AB Mix nutrients in hydroponics will increase plant growth; however, if the dose is too high and exceeds plant needs, it will cause plant growth to decrease.

Table 3 shows that using charcoal husk media provides the best root length results. Because husk charcoal has good pores for plant root growth, the air circulation in husk charcoal can make plant roots freer to absorb maximum nutrients. According to Cahyadi and Nur Hayati (2021), husk charcoal is a porous planting medium; light does not easily clump and is rough, so air circulation is high, making it easier for plant roots to absorb oxygen. Husk charcoal also contains high carbon, making the planting medium loose and suitable for plant root growth.

### Total Plant Wet Weight

Table 4. Average Wet Weight Due to Planting Media and Nutrient Concentration

Total Plant Wet Weight (g)				
Planting Media	AB Mix Concentration (ppm)			
	500	1.000	1.500	2.000
Cocopeat (M1)	109,89 a	119,83 bcd	122,69 d	114,12 ab
Arang Sekam (M2)	118,90 bcd	121,02 cd	134,94 e	116,20 bc
BNT 5%	6,30			

Note: The average value followed by the same letter at the same age and treatment is not significantly different in the 5% BNT Test; tn=not real;

Combining 1,500 ppm AB Mix fertilizer concentration and husk charcoal planting media gave the best results on total plant wet weight (134.94 g). The combination treatment of 500 ppm AB Mix fertilizer concentration and cocopeat planting media gave the lowest results on total plant wet weight (109.89 g). The results showed that the combination treatment of AB Mix 1,500 ppm fertilizer using charcoal husk planting media produced the best results in this study. Because the AB Mix fertilizer concentration of 1,500 ppm contains sufficient nutrients to increase the total wet weight of the pak choy plant, husk charcoal has porous properties and can store water well. Besides, husk charcoal contains potassium and carbon elements supporting plant growth and development. So, by providing an AB Mix fertilizer concentration of 1,500 ppm using charcoal husk as a medium, you can increase the total wet weight of the plant. It is in line with the opinion of Perwtasari, Tripatmasari, and Wasonowati (2012), in their research concluding that the use of husk charcoal planting media and AB Mix hydroponic nutrients provides the best growth of pakcoy plants.

### Harvest Index (%)

Table 5. Average Harvest Index Due to Planting Media and Nutrient Concentration

Indeks Panen (%)				
Media Tanam	Konsentrasi Pupuk AB Mix (ppm)			
	500	1.000	1.500	2.000
Cocopeat (M1)	67 a	77 b	82 b	77 b
Arang Sekam (M2)	80 b	81 b	89 c	78 b
BNT 5%	6,01			

Note: The average value followed by the same letter at the same age and treatment is not significantly different in the 5% BNT Test; tn=not real;

The combination of AB Mix fertilizer concentration treatment of 1,500 ppm and husk charcoal as a planting medium also gave the best results on the harvest index (89 %) of pak choy plants. Because the AB Mix fertilizer concentration of 1,500 ppm is sufficient for the nutrient requirements needed by pakcoy plants, such as the macronutrients and micronutrients contained in the AB Mix fertilizer, balanced nutrient content in the planting medium can also support plant growth, thereby increasing plant productivity. The harvest index value will also increase with the higher wet weight of pakcoy plant consumption. Apart from that, planting media with good aeration and drainage will facilitate good air circulation and gas exchange in the roots to absorb sufficient water and minerals for plant growth. As stated by Yuhasnita (2007), media with good aeration and drainage have water-holding capacity and can facilitate the exchange of gases in and out through the planting medium. Oxygen in the roots can influence the roots to absorb sufficient water and minerals for plant growth.

### Chlorophyll Levels

Table 6. Average Chlorophyll Levels Due to Planting Media and Nutrient Concentration

	Chlorophyll Levels (mg/l)			
	500	1000	1500	2000
Cocopeat (M1)	4,14 a	6,63 bc	6,67 bc	5,23 ab
Arang Sekam (M2)	8,27 c	7,60 c	10,02 d	6,64 bc
BNT 5%	1,70			

Note: The average value followed by the same letter at the same age and treatment is not significantly different in the 5% BNT Test; tn=not real;

This research shows that the combination treatment of AB Mix fertilizer concentration of 1,500 ppm and husk charcoal as a planting medium gave the highest chlorophyll yield (10.02 mg/l). A high chlorophyll content will speed up the photosynthesis process, so the photosynthate produced is higher. The higher the chlorophyll content, the better the nutrients absorbed by the plant, thus supporting the photosynthesis process and optimizing chlorophyll formation. Apart from that, the quality of vegetables can be seen from their chlorophyll levels. The higher the chlorophyll content in a plant, the better the quality of the plant. Chlorophyll itself has benefits as an antioxidant, encouraging detoxification and being anti-cancer and anti-aging. At a concentration of 1,500 ppm, it can provide sufficient magnesium and nitrogen elements for the formation of chlorophyll. Research conducted by Suarsana et al. (2019) stated that root growth influences leaf growth, which will affect plant leaves. So, good leaf growth will affect the chlorophyll content of the plant. Based on the opinion expressed by Yama and Hendro (2020), sufficient nitrogen is given to plants, which will help the process of optimal chlorophyll formation so that the photosynthesis process runs smoothly.

## CONCLUSION

The use of AB Mix fertilizer at a concentration of 1,500 ppm, coupled with charcoal husk as a planting medium, yielded superior outcomes in pak choy (*Brassica rapa L.*) cultivation using a hydroponic wick system. This combination demonstrated significant advantages, particularly in terms of total plant fresh weight, harvest index, and chlorophyll content. These parameters are crucial indicators of plant health and productivity in hydroponic setups. The effectiveness of this approach underscores the importance of nutrient management and substrate selection in optimizing plant growth and yield in controlled environments. Such findings contribute valuable insights into enhancing agricultural practices, promoting sustainability, and maximizing resource efficiency in modern farming techniques.

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