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POTENTIAL OF RICE WASTE WATER AND GOOD-PLANT NUTRITION TOINCREASE HYDROPONIC GROWTH AND PRODUCTION OF PAKCOY (Brassica rapa L.)

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ABSTRACT

This study aims to determine the effectiveness of the application of good-plant nutrients and rice washingwater waste on the growth and yield of hydroponic pakcoy (Brassica rapa L.) plants. This research was carried out at the Half Shadow House made in the experimental garden of the Faculty of Agriculture, Jabal Ghafur Sigli University, starting on April 30 until the end of May 27, 2021. This study used a completely randomized design (CRD) with a factorial pattern consisting of two factors, namely the concentration factor of Good PlantNutrition. and factor of Rice Wash Water Waste. The Good plant Nutrient concentration factor consists of 600 ppm (N1), 800 ppm (N2), 1000 ppm (N3) and the Rice Wash Water Waste Factor consists of 500 ml with 500ml water (L1), 700 ml with 300 ml water (L2) and 900 ml with 100 ml of water (L3). Each treatment was repeated 3 times, so there were 9 treatment combinations and 27 experimental units. Parameters observed were plant height, number of leaves, weight of wet stover, Initial pH of water and final pH of water. The results showed that good plant nutrition had a significant effect on the number of leaves aged 20 DAP, no significant effect on plant height, number of leaves aged 10 and 30 DAP, weight of wet stove, initial pH of water and final pH of water. Rice washing water waste had no significant effect on plant height, number of leaves, weight ofwet stove, initial pH of water and final pH of water. There was no significant interaction between good plant nutrition and rice washing water waste on plant height, number of leaves, weight of wet stove, initial pH of water and final pH of water.

Keywords: *good plant nutrition, rice and pakcoy washing water waste*

INTRODUCTION

Pakcoy (Brassica rapa L.) is one of the most popular vegetables in Indonesia. This vegetable belongs to the Brassicaceae family which is resistant to rainwater, so it can be harvested throughout the year because it does not depend on the season [1]. Pakcoy is also classified as a short-lived vegetable crop that can be planted in the highlands and lowlands [2]. Therefore, pakcoy can be usedas a model plant in testing liquid organic fertilizers as alternative nutrients for hydroponics.

Hydroponics is a way of growing crops without using soil media but using water or porous materials [3]. One of the existing hydroponic systems is the Floating System Hydroponic Technology (TDAP). This system is able to provide good dissolved oxygen for plants [4]. Hydroponics is the future of agriculture because hydroponics can be cultivated in various places, both in villages, in cities, in open land, or even above apartments. The quality of hydroponic plants is also better than conventional yields and has a higher selling price. This happens because the environment is clean and the supply of nutrients is met in accordance with the needs of plants.

This study also uses rice washing water that is no longer used during the rice washing process. Rice washing water can be used in watering because rice washing water is thought to accelerate plant growth. The milky white washing water is rich in protein and vitamin B1 which is widely contained inrice which is also eroded. Vitamin B_1 is a group of vitamins that have a role in plant metabolism, which is useful for converting carbohydrates into energy that drives the activities of a plant [5].

Rice washing water is the residual water from the rice washing process which is generally rarely used so that it is only thrown away. This is because people do not know the benefits of rice washing water. Rice washing water has not been used optimally even though it still contains

many

vitamins, minerals and other elements. Rice washing water contains elements of N, P, K, C and other elements [6].

Organic fertilizers are fertilizers that come from the fermentation process or decomposition of organic materials such as from animals, plants, kitchen waste, and others. Liquid organic fertilizer (LOF) is one type of organic fertilizer with basic ingredients from animals or plants or selected from soft leaves and kitchen waste such as leftover spinach, mustard greens, cabbage, fruit peels, and other easily decomposed materials by adding a bioactivator. liquid and adequate amount of water [7].

The use of inorganic fertilizers in addition to having a positive impact. The negative impacts that are often encountered are poisoning and damage to the local ecology, besides the purchase priceof inorganic fertilizers from year to year is getting more expensive, besides the dose used must also beincreased [8]. Therefore, to reduce the excessive use of inorganic fertilizers, a combination of organic fertilizers with inorganic fertilizers is carried out.

This study aims to determine the effectiveness of the application of good-plant nutrients and rice washing water waste on the growth and yield of hydroponic pakcoy (Brassica rapa L.) plants.

RESEARCH METHODOLOGY

This research was carried out at the Half Shadow House made in the experimental garden of theFaculty of Agriculture, Jabal Ghafur Sigli University, starting from April 30 to May 30, 2021.

The materials used in hydroponic research include Good-plant nutrition, rice washing water waste, pakcoy seeds, water, up-down, cocopeat and flannel.

The tools used in hydroponic research include TDS meter, pH meter, traisemai, solder, netpot, styrofoam, measuring cup, bamboo, paranet, information board, camera, stationery and plastic mulch as styrofoam coating.

This study used a completely randomized design (CRD) with a factorial pattern consisting of two factors, namely the Good-plant Nutrition concentration factor (N) with 3 levels and the Rice Washing Water Waste factor (L) consisting of 3 levels.

Good plant nutrient concentration factor (N), consists of 3 levels,
namely:N_1 = 600 ppm
N_2 = 800 ppm N_3 = 1000 ppm

Rice Wash Water Waste Factor (L), consists of 3 levels,
namely:L_1 = 500 ml with 500 ml of water
L_2 = 700 ml with 300 ml of waterL_3 = 900 ml with 100 ml of water

Thus there were 9 treatment combinations with 3 replications so that a total of 27 experimental units were obtained, each experimental unit was planted with 6 plants so that 162 experimental units were obtained.

Research Implementation

1. Land Preparation and Plot Making

Land preparation in this study was by clearing the land, making half-shadowed houses, making shelves, making shade and then making experimental plots on styrofoam boxes with a size of 6 planting holes per plot of 27 plots.

2. Making a plastic house

The plastic house is made of bamboo and is covered with transparent plastic. Rectangular plastic house with a height of 250 cm, width 170 cm, length 300 cm.

3. Seed Preparation

Seeds to be planted must be made in nurseries first during the 14-day nursery. Seeds are germinated directly in glass packaging so that they are easy to move so as not to interfere with seed

roots. Then the seeds are covered with clear plastic for 2 days to speed up the germination process.

4. Transfer of Seeds or Planting

Transfer of seeds is done directly by moving the seeds that grow directly into the glass packaging and then put into the styrofoam box that has been prepared, with 6 holes in each styrofoam box.

5. Good-Plant Nutrition App

Good-plant nutrition preparation begins by dissolving both nutrients with water because theyare in powder form, then dissolve them with 5 liters of water each. Good-plant nutrition is a mixtureof fertilizer A and fertilizer B. Fertilizer A contains potassium, while fertilizer B contains sulfate and phosphate. After dissolving, each fertilizer (A and B) was put into a water conductor and tightlyclosed to avoid contamination with other objects.

Nutrition is given at the time of transplanting by entering the nutrients that have been prepared into Styrofoam with a concentration according to the treatment being tested and checked by using a TDS meter to measure the number of particles or the concentration of the solution. The addition of nutrients needs to be done if the nutrients are reduced.

6. Rice Wash Water Waste Application

Rice washing water that has been soaked for 1 week will be applied to the plant when it is transferred from the nursery at an interval of 1 week and applied 2 times a week. Each rice washing water waste is dissolved in water, after being dissolved then put into styrofoam in each plant with treatment according to their respective doses. The application of rice washing water waste is carried out in the morning starting at 08.00-10.00 WIB.

7. Maintenance

Hydroponic maintenance of pakcoy plants includes:

1. Plants that die immediately embroidered. Embroidery is done when the plant is 1 week old when the seedlings are removed.
2. Checking the concentration of nutrients with a TDS meter, if it is not appropriate with the treatment, it is necessary to make adjustments according to the treatment of nutritional needs, the concentration of nutrients is checked every day starting from the first transplanting.
3. Check the pH using a pH meter.

8. Harvesting

Harvesting is done by lifting the plant from the styrofoam of the plant and done after the plantis 30 days after planting (DAT).

Observation

Parameters observed include:

1. Plant Height
   Calculated from the base of the plant to the tip of the longest leaf at the age of 10, 20 and 30DAP in cm.
2. Number of Leaves
   Completely formed leaf blades were counted when the plants were 10, 20 and 30 DAP.
3. Wet Safe Weight
   It was carried out at the end of the observation by harvesting the plants and then weighing themin grams.
4. Initial pH of Water
   The initial pH of the water was measured before transplanting and before applying good plantnutrients using a pH meter.
5. Final pH of Water
   Measured at the time of observation before harvest using a pH meter.

RESULTS AND DISCUSSION

Good Plant Nutrition

EffectPlant Height

The results of the analysis of variance showed that good plant nutrition had no significant

effecton the height of pakcoy plants aged 10, 20 and 30 DAP. The average plant height of pakcoy at the ageof 10, 20 and 30 DAP due to good plant nutrition can be seen in Table 1.

Table 1. Average Plant Height of Pakcoy Age 10, 20 and 30 Days After Planting Due to Good Plant Nutrition

Good Plant Nutrition	Plant Height (cm)		
	10 DAP	20 DAP	30 DAP
N_1	12,39	17,83	24,94
N_2	13,01	18,16	25,22
N_3	12,53	19,01	25,27

Table 1 can be explained that, the average height of pakcoy plants aged 10 DAP due to good plant nutrition was highest in treatment (N_2) which was 13,01 cm, age 20 and 30 DAP were found in treatment (N_3) which was 19,01 cm and 25 ,27 cm, the lowest age 10, 20 and 30 DAP were found in treatment (N_1), which were 12,39 cm, 17,83 cm and 24,94 cm, respectively.

The availability of nutrients that can be absorbed by plants is one of the factors that can affect the level of plant growth and development [9]. State that the growth of a plant will be optimal if the required nutrients are available in quantities and forms in accordance with the plant's needs [10].

This is in line with the opinion of [11] which states that increasing water nutrient levels can increase plant growth and development, the higher the concentration of the solution means the more concentrated the mineral salt content in the solution so as to increase plant growth.

Number of Leaves

The results of the analysis of variance showed that good plant nutrition had a significant effect onthe number of leaves of pakcoy plants aged 20 DAP, not significantly affected at 10 and 30 DAP. Theaverage number of leaves of pakcoy plants at the age of 10, 20 and 30 DAP due to good plantnutrition can be seen in Table 2.

Table 2. Average Number of Leaves of Pakcoy Plants Ages 10, 20 and 30 DAP Due to Good Plant Nutrition

Good Plant Nutrition	Number of leaves (strands)		
	10 DAP	20 DAP	30 DAP
N_1	7,85	12,40[a]	19,05
N_2	7,89	13,11[b]	18,77
N_3	7,70	13,07[ab]	19,18
BNJ 0,05	-	0,67	-

Explanation : Numbers followed by the same letter in the same column are not significantly different at the level = 5% (BNJ test)

Table 2 can be explained that, the average number of leaves aged 20 DAP was mostly found in treatment (N_2), namely 13,11 strands, not significantly different from treatment (N_3) but significantly different from treatment (N_1), the lowest was found in treatment (N_1). ie 12,40 strands but not significantly different from the treatment (N_3).

Based on research conducted by [12] the high content of nitrogen (N) in nutrients stimulates an increase in the number of leaves and height of lettuce plants. This is in accordance with the opinion of
[3] which states that high N nutrients not only affect plant height but also affect the number of plant leaves.

According to the results of [13] which states that the influence of nutrients on the growth and yield of pakcoy plants with a hydroponic system that the best treatment is found in the nutrients usedis Goodplant as evidenced by the highest average yield on the parameters of plant length, number of leaves, leaf area, wet weight and dry weight.

The use of the hydroponic wick system method is the simplest system in which the nutrient solution is drawn into the wick media, usually the wick using flannel cloth that easily absorbs water. One of the weaknesses of the wick hydroponic system is that the nutrient solution is not circulated, so it is prone to moss growth, plant growth is slightly slower.

Wet Safe Weight

The results of the analysis of variance showed that the nutritional factor of good plant had no significant effect on the weight of the wet stove. The average weight of the wet stover for pakcoy due to good plant nutrition can be seen in Table 3.

Table 3. Average Wet Weight of Pakcoy Plants Due to Good Plant Nutrition

Good Plant Nutrition	Wet Cooker Weight (gr)
N_1	538,89
N_2	605,56
N_3	600,00

Table 3 can be explained that, the average weight of the heaviest wet stover was found in treatment (N_2), which was 605,56 gr. The lowest was found in treatment (N_1), which was 538,89 gr.

Maximum plant growth and production will be achieved if the supply of nutrients to plants is inoptimal conditions because a deficiency or excess of one nutrient will reduce the efficiency of other elements and can reduce the quantity and quality of plants [14]. This is in accordance with the opinionof [15] stated that, an important factor that needs to be considered in increasing lettuce production is sufficient availability of nutrients [16] adding that wet weight is the total weight of the plant which shows the results of plant metabolic activity. Macro nutrients are very important to help plant growth and development, while micro nutrients are very important in improving plant quality and production[17].

Initial pH of Water

The results of the analysis of variance showed that the nutritional factors of good plant had no significant effect on the initial pH of the water. The average initial pH of water due to good plant nutrition can be seen in Table 4.

Table 4. Average Initial pH of Pakcoy Plant Water due to Good Plant Nutrition

Good Plant Nutrition	Initial pH of water
N_1	8,37
N_2	8,39
N_3	8,39

Table 4 can be explained that, the highest average initial pH of water was found in treatments (N_2) and (N_3) which was 8,39, the lowest was found in treatment (N_1) which was 8,37.

pH is also an important factor to control. Different nutrient concentration factors will result in different water pH, because the nutrients in the nutrients will affect the pH of the water as themedium. Which states that pH is an important factor because it affects the availability of minerals needed by plants. One of the factors that affect the activity of microorganisms in the media for the decomposition of organic matter is pH. Optimum pH for the decomposition of organic matter [18].

Final pH of Water

The results of the analysis of variance showed that the nutritional factors of good plant had no significant effect on the final pH of the water. The average final pH of water due to good plant nutrition can be seen in Table 5.

Table 5. Average Final pH of Pakcoy Plant Water due to Good Plant Nutrition

Good Plant Nutrition	Final pH of Water
N_1	6,79
N_2	6,82
N_3	6,81

Table 5 can be explained that, the highest average final pH of water was found in treatment (N_2) which was 6,82, the lowest was found in treatment (N_1) which was 6,79. The decrease in the

finalpH of the water was due to the fact that it had been absorbed by the pakcoy plant.

The degree of acidity (pH) ranges from 0-14. At 7, pH is considered neutral because the electriccharge of the H+ cation is balanced with the electric charge of the OH- anion. The lower the pH, the more acidic the solution is. The greater the pH, the greater the alkaline condition of the solution. The pH range that plants prefer is 5.5-6.5. In this range, the solubility of nutrients in optimal conditions [19].

Effect of Rice Wash Water WastePlant height

The results of the analysis of variance showed that the factor of rice washing water waste hadno significant effect on the height of pakcoy plants aged 10, 20 and 30 DAP. The average height of pakcoy plants at the age of 10, 20 and 30 DAP due to rice washing water waste can be seen in Table6.

Table 6. Average Plant Height of Pakcoy Ages 10, 20 and 30 DAP due to Rice Washing Water

WasteRice Wash Water Waste	Plant Height (cm)		
	10 DAP	20 DAP	30 DAP
L_1	12,63	18,35	25,11
L_2	12,59	18,55	25,11
L_3	12,72	18,11	25,22

Table 6 can be explained that, the highest average plant height of pakcoy aged 10 and 30 DAP was found in treatment (L_3) which was 12,72 cm and 25,22 cm, age 20 DAP was found in treatment (L_2) which was 18,55 cm, the lowest age of 10 DAP was found in treatment (L2), which was 12,59cm, age 20 DAP was found in treatment (L_3), which was 18,11 cm, age 30 DAP was found in treatment (L_1) and (L_2), which was 25,11 cm. This is due to the lack of dose of rice washing water.

Rice washing water contains Nitrogen (N) 0.015 %, Phosphorus (P) 16.306%, Potassium (K) 0.02% and Calcium (Ca) 2.944% which are very necessary for pakcoy plants and development. However, if the dose of rice washing water given to plants is less than what is needed, the supply of plant nutrients will also decrease, so that it will affect their growth and production [20]. This is in line with the statement of [21] that the provision of rice washing water has no effect on the plant crown including plant height and number of leaves.

Number of Leaves

The results of analysis of variance showed that rice washing water had no significant effect on the number of leaves of pakcoy plants aged 10, 20 and 30 DAP. The average number of leaves of pakcoy plants at the age of 10, 20 and 30 DAP due to rice washing water waste can be seen in Table7.

Table 7. Average number of leaves of Pakcoy plants aged 10, 20 and 30 DAP due to rice washing water

waste Rice Wash Water Waste	Number of Leaves (Strand)		
	10 DAP	20 DAP	30 DAP
L_1	7,75	12,53	18,89
L_2	7,76	13,18	19,15
L_3	7,92	12,87	18,98

Table 7 can be explained that, the highest average number of leaves aged 10 DAP was found in treatment (L_3) which was 7,92 strands, ages 20 and 30 DAP were found in treatment (L_2), namely 13,18 strands and 19,15 strands, the lowest ages 10, 20 and 30 DAP were found in treatment (L_1), namely 57,75 strands, 12,53 strands and 18,89 strands. This is because the rice washing water provides the nitrogen needed by the pakcoy plant for the growth of the number of leaves.

Nitrogen plays an important role in the formation of amino acids and proteins as basic ingredients in making leaves [22]. According to [22]. pakcoy really needs Nitrogen, Phosphorus and Potassium in large quantities for its growth. Nitrogen functions to stimulate leaf growth and Phosphorus is an important element in early plant growth and is absorbed in the form of phosphate.

Potassium serves to strengthen plants and magnesium functions in the formation of leaf green matter and helps spread phosphorus throughout the plant [23]. According to [19], the function of phosphorusfor plants is to form cell nuclei and improve the mobility of nutrients in plants.

Wet Safe Weight

The results of the analysis of variance showed that the factor of rice washing water waste hadno significant effect on the weight of the wet stover of pakcoy plants. The average weight of wet stover for pakcoy plants due to rice washing water waste can be seen in Table 8.

Table 8. Average Wet Weight of Pakcoy Plants Due to Rice Washing Water Waste

Rice Wash Water Waste	Wet Cooker Weight (gr)
L_1	561,11
L_2	572,22
L_3	611,11

Table 8 can be explained that, on average, the heaviest wet stove was found in treatment (L_3) which was 611,11 g, the lightest found in treatment (L_1) was 561,11 gr.

According to [24], the heavier a plant, the better the metabolic processes in the plant. Furthermore, according to [25] plant fresh weight shows plant metabolic activity and plant fresh weight value is influenced by tissue water content, nutrients and metabolic products.

According to [26] the availability of sufficient nutrients in liquid organic fertilizer will increasethe photosynthesis process that occurs in plants, with the increase in the photosynthesis process, it willalso increase the results of photosynthesis which then affects the wet weight produced by plants. Wet weight indicates the ability of plants to take up nutrients to support growth and metabolic activities. Thus the greater the wet weight indicates the photosynthesis process takes place more efficiently. The greater the wet weight, the more efficient the photosynthesis process that occurs and the productivity and development of tissue cells are higher and faster, so that plant growth is better [27].

According to [28] the nutrient content contained in rice washing water is able to stimulate root growth so as to increase the value of the fresh weight of the resulting plant to be greater.

Initial pH of Water

The results of the analysis of variance showed that the factor of rice washing water waste hadno significant effect on the initial pH of the water. The average initial pH of water due to rice washingwater waste can be seen in Table 9.

Table 9. Average Initial pH of Water Due to Rice Washing Water Waste

Rice Wash Water Waste	Initial pH of water
L_1	8,39
L_2	8,33
L_3	8,42

Table 9 can be explained that, the highest average initial pH of water was found in treatment (L_3) which was 8,42, the lowest was found in treatment (L_2), which was 8,33.

The pH meter shows a number above 7 means the solution is alkaline because in alkaline nutrient solutions the number of OH- ions is higher in solution than H+ ions. In conditions like this, macro nutrients or nutrients that are needed in plants which include copper, manganese, zinc and iron will be chemically bound, this makes the roots unable to absorb and can lead to nutrient deficiency or stunting of plants and can not produce maximally then the plant can die [29].

Final pH of Water

The results of the analysis of variance showed that the factor of rice washing water waste hadno significant effect on the final pH of the water. The average final pH of water due to rice washing water waste can be seen in Table 10.

Table 10. Average Final pH of Water Due to Rice Washing Water Waste

Rice Wash Water Waste	Final pH of Water
L_1	6,81
L_2	6,78
L_3	6,83

Table 10 can be explained that, the highest average final pH of water was found in treatment (L_3) which was 6,83, the lowest was found in treatment (L_2), which was 6,78.

Which states that in the process of plant growth there will be changes in pH or pH values that will experience ups and downs. The difference in pH values in all treatments was still in the range between 6.5-7, so it could still support plant growth[30].

Interaction Effect

The results of the analysis of variance (Appendix show that there is no interaction betweengood plant nutrition and rice washing water waste on all parameters observed.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. Good plant nutrition had a significant effect on the number of leaves aged 20 DAP, no significant effect on plant height, number of leaves aged 10 and 30 DAP, weight of wet stove, initial pH of water and final pH of water.
2. Rice washing water waste had no significant effect on plant height, number of leaves, weight of wet stove, initial pH of water and final pH of water.
3. There was no significant interaction between good plant nutrients and rice washing water waste on plant height, number of leaves, weight of wet stove, initial pH of water and final pH of water.

Suggestions

1. It is necessary to do further testing on the effectiveness of the good plant nutrient concentration treatment on the hydroponic wick system.
2. Further research is conducted on rice washing water waste by increasing the concentration. Should be done using other hydroponic systems, because the wick system is less effective in cultivating pakcoy plants.

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