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Application of Rice Washing Water and Organic NPK To Increase Caisim Mustard Plant (*Brassica juncea* L) Growth and Production

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ABSTRACT

The demand for vegetables in Riau Province remains high, but the current production is insufficient. As a result, vegetables are sourced from other regions, such as West Sumatra and North Sumatra. To address this issue, there is a need to increase vegetable production. The study aimed to investigate the impact of concentrated rice washing water and organic NPK application on the growth and production of caisim mustard greens (Brassica juncea L). The study utilized a completely randomized factorial design with two factors. The first factor was rice washing water, which had four treatment levels: 25%, 50%, 75%, and 100%. The second factor was organic NPK, which had four treatment levels: no organic NPK, 1.5 g/plant, 3.0 g/plant, and 4.5 g/plant. The parameters observed included the number of leaves, wet weight, economic weight, dry weight, net assimilation rate, and relative growth rate. The study's results indicated that the interaction between rice washing water and organic NPK significantly affected all observed parameters. The best treatment was applying 75% rice washing water and 4.5 g organic NPK per plant. The main effect of rice washing water application was also significant on all observed parameters, with the best treatment being 75% rice washing water. Similarly, the main impact of organic NPK was significant on all observed parameters, with the best treatment being 4.5 g per plant.

Keywords: *Rice washing water, Organic NPK, Growth, Production, Mustard Greens.*

1. INTRODUCTION

Caisim, scientifically known as Brassica juncea L., is a vegetable plant with immense promise and opportunities in terms of its commercial, climatological, technical, economic, and social aspects. This makes Caisim a highly viable option for cultivation in Indonesia. Caisim is a crucial ingredient in dishes such as *Lodeh* soup, Capcay, boiled noodles, etc.

The mustard plant production data for the past five years is as follows: In 2018. the production was 1.986 tons. In 2019. the total output was 1.339 tons. In 2020. the production amounted to 1.423 tons. In 2021. there was an increase in production, reaching 1.673 tons. Furthermore, in 2022. there was another increase, with the output reaching 2.249 tons. These figures are provided by the Badan Pusat Statistik Riau (2022). Despite the consistent increase in production over the years, the demand for mustard greens has not been fully met. As a result, the region has to rely on external sources, such as West Sumatra, to fulfill the demand. Therefore, it is necessary to increase production further to meet the growing need for mustard greens.

In Riau, numerous challenges are encountered in the cultivation of plants due to the prevalence of nutrient-deficient agricultural land. Consequently, special measures are necessary to ensure optimal plant growth and maximum productivity.

Fermentation is a viable approach that enhances soil fertility and promotes healthy plant development and high yields. One effective method to improve soil fertility involves reducing inorganic fertilizers and incorporating organic fertilizers into the soil.

The research conducted by Murdaningsih et al. (2020) highlights the potential of rice-washing water as an organic material for plant growth. This readily available waste product serves as a convenient resource and contains many essential nutrients that are beneficial for plants.

According to Himayana et al. (2018), rice washing water can be effectively utilized as a liquid fertilizer to fulfill the nutrient requirements of plants. Furthermore, the analysis conducted by Wulandari et al. (2011) reveals the nutrient composition of white rice washing water, which includes nitrogen (N) at 0.015%, phosphorus (P) at 16.306%, potassium (K) at 0.02%, calcium (Ca) at 2.944%, magnesium (Mg) at 14.252%, sulfur (S) at 0.027%, iron (Fe) at 0.0427%, and vitamin B1 (B1) at 0.043%. These findings emphasize the potential of rice washing water as a valuable nutrient supplement for optimizing plant growth and development.

According to a study conducted by Dewi et al. (2021), it has been found that the waste water obtained from rice washing can enhance the growth of green mustard plants. The research demonstrated that different concentrations of rice washing water, specifically at 1. 20. and 30 DAP, can positively impact these plants' growth. Notably, when green mustard plants were provided with rice washing water at a concentration of 100% and a volume of 200 ml per polybag, there was a significant increase in the number of leaves, stem height, and wet weight of the mustard greens. This concentration and volume combination resulted in the most favorable growth outcomes for green mustard plants.

For plants to grow and develop well, they need nutrients, including N, P, and K, and one fertilizer containing these elements is Organic NPK. The results of research that has carried out the application of organic NPK at a dose of 4.5 g/plant, equivalent to 750 kg/ha, show that it is the best treatment for the growth

and production of Caisim mustard greens. In contrast, the research results of Panjaitan E. (2018) show that the treatment dose of organic NPK fertilizer has a very significant effect on variable plant height, number of leaves, wet weight per plant, dry weight, and root volume of mustard greens with the best dose of 500 kg/ha.

2. MATERIAL AND METHODS

The Faculty of Agriculture, Riau Islamic University's experimental garden served as the location for this research, which spanned three months from August to October 2023.

The study utilized materials such as Caisim var tosakan mustard seeds, rice washing water, Organic NPK, polybags, wood, nails, zinc plates, paint, raffia, and other relevant items. Additionally, a range of tools, including hoes, Gembor, measuring tape, scissors, hand sprayer, camera, digital scales, drums, buckets, scoops, measuring cups, and writing instruments, were employed throughout the research process.

This study employed a Factorial Completely Randomized Design (CRD) with two factors. The first factor, rice washing water (A), consisted of four levels: 25%, 50%, 75%, and 100%. The second factor, Organic NPK (N), had four treatment levels: 0. 1.5. 3.0. and 4.5 g/plant. As a result, 16 treatment combinations were repeated thrice, totaling 48 experimental units. Each replication comprised eight plants, with six plants used as samples. The research process involved land preparation, including weed and rubbish removal, and leveling the land with a hoe for easier polybag arrangement. The polybags were then filled with 3 kg of mineral topsoil and placed in each experimental unit at a distance of 20x30 cm. The Caisim seeds seedling process is conducted ten days before planting using rock wool media. After the seedlings have reached 10 days old, they are transplanted from the nursery to individual polybags, with one seed planted in each polybag. Rice washing water is applied four times, specifically during planting, at 7. 14. and 21 days after planting. Each application consists of 200 ml per plant, with different concentrations. Organic NPK is applied during planting, with varying doses of 0 g/plant, 1.5 g/plant, 3.0 g/plant, and 4.5 g/plant. The Organic NPK is immersed in the soil 10 cm away from the base of the plant.

Plant maintenance involves watering, weeding, and pest and disease control. Several parameters are observed, including the number of leaves, wet weight, economic weight, dry weight, net assimilation rate, and relative growth rate. The data obtained from these observations are analyzed statistically. If the F-count is higher than the F-table value, the Honest Significant Difference Test (BNJ) is conducted at a significance level of 5%.

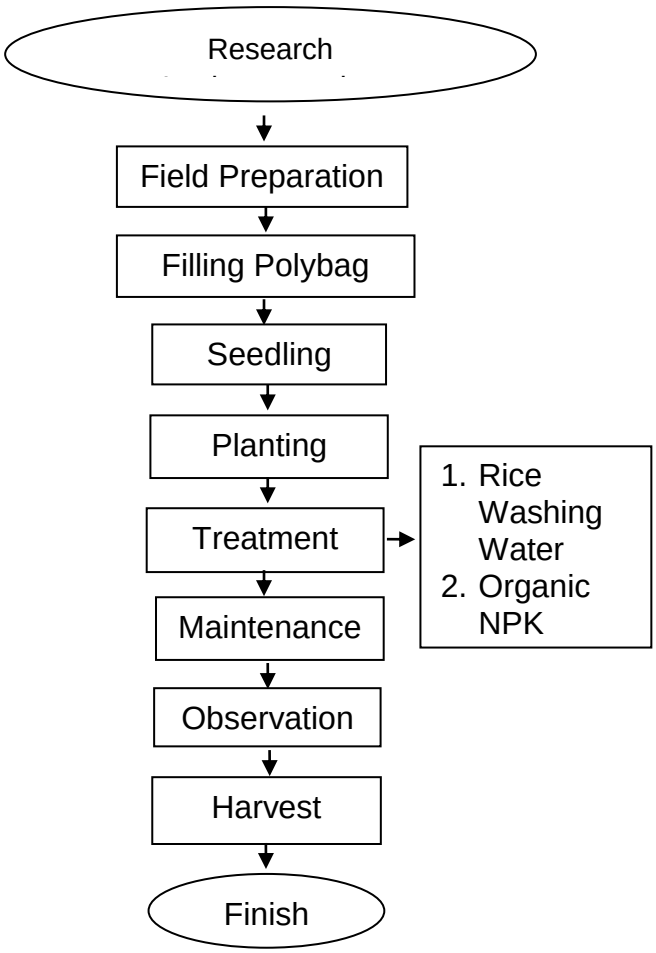

Figure 1. Research Implementation Diagram

3. RESULT AND DISCUSSION

3.1 Number of leaves

The variance analysis showed that the interaction and the main effect of rice washing water and organic NPK were significant on the number of leaves of Caisim mustard plants. The average results of observations of the number of leaves of Caisim mustard plants can be seen in Table 1.

Table 1. Average number of leaves of Caisim mustard plants (strands) treated with rice washing water and Organic NPK.

Rice washing water (%)	Organic NPK (g)				Mean
	0	1.5	3.5	4.5	
25	5.33 ± 1.25 g	6.00 ± 0.50 fg	6.50 ± 0.50 efg	7.17±0.28 c-f	6.25 d
50	6.17 ± 0.28 fg	6.33±0.28 efg	7.00±0.50 c-f	8.33±0.28 bcd	6.96 c
75	6.83±0.28 d-g	8.50±0.50 bc	9.83±0.28 ab	0.17±0.28 a	8.83 a
100	6.50±0.50 efg	7.33±0.28 c-f	7.83± 0.57cde	9.50±0.28 ab	7.79 b
Mean	6.21 d	7.04 c	7.79 b	8.79 a	
CV = 6.77%	Tukey L&G = 0.56		Tukey LG = 1.54		

Numbers in rows and columns followed by the same lower case letter show no significant difference according to the BNJ follow-up test at the 5% level.

Table 1 shows that the highest average number of leaves of Caisim mustard plants was obtained in the treatment of 75% rice washing water +

4.5 g Organic NPK, namely 10.17 pieces. The higher the dose of rice washing water and Organic NPK given, the higher the average number of mustard plant leaves increased. The standard deviation value indicates the variation of individual data towards the average value. The small standard deviation values in this table (0.28 to 1.25) indicate that the observation data for the number of leaves is close to the average value.

The combination of rice washing water and Organic NPK significantly affected the number of leaves, where the best treatment was 75% rice washing water and 4.5 g Organic NPK/plant with an average number of leaves of 10.17 pieces, which was not significantly different from the combination of rice washing water treatment. 75% and organic NPK 3.5 g/plant with an average number of leaves of 9.83 pieces and a combination of 100% rice washing water and organic NPK 4.5 g/plant with an average number of 9.50 pieces, significantly different from other treatments. The treatment that produced the lowest average number of leaves was 25% rice washing water without giving organic NPK, with an average number of leaves of 5.33 pieces.

The research findings indicate that rice-washing water possesses immense potential to enhance plant growth. By utilizing rice washing water, not only does it provides the necessary hydration for Caisim mustard greens, but it also supplies essential nutrients to the plants. According to the analysis conducted by Wulandari et al. (2013), white rice washing water contains N 0.015%, P 16.30%, K 0.02%, Ca 2.94%, Mg 14.25%, S 0.027%, Fe 0.042%, and B1 tires 0.043%. Furthermore, Bahar's (2016) study shows that rice washing water significantly influences groundwater spinach plants' height, leaf count, fresh weight, and dry weight. Similarly, the research findings indicate that rice washing water can augment the number of leaves in Caisim mustard plants.

Organic NPK fertilizer functions in providing macro and micro nutrients in a balanced manner and with a high alkaline pH (alkaline) so that it can increase the decomposition process of soil organic matter, improve soil conditions, increase the availability of nutrients, and the population of good organisms for the soil that can be in obligate symbiosis with plant roots so that they can increase the absorption range of plant roots for nutrients and water.

Organic NPK fertilizer is a type of organic fertilizer that can supply the nutrients N, P, and K effectively and efficiently in the soil so that the decomposition of the elements occurs more effectively and efficiently. Apart from that, it can also improve the chemical and biological properties of the soil so that the availability of soil nutrients increases, which can have a maximum influence on increasing plant growth and production yields Rohmah et al., (2016). This can also be seen from the research results where the provision of Organic NPK can increase the number of leaves produced by Caisim mustard plants.

The combination of treatment with 100% rice washing water and no organic NPK reduced the number of leaves produced, and it is suspected that the administration of 100% rice washing water had exceeded the dose. This is in line with the opinion of Nasir and Jasmi (2022), who state that plants need sufficient nutrients. If the dose given is excessive or low, it will cause the photosynthesis process not to be optimal, and photosynthesis will decrease.

Agustina (2015) stated that if too much nutrition is given to plants, plant growth will be disrupted, or the plant will be poisoned. If the dose given is low, it will not affect the plant.

3.2 Plant Wet Weight

The analysis of variance showed that both the interaction and the main influence of rice washing water and Organic NPK were significant on the fresh weight of Caisim mustard greens. The average results of observations of the wet weight of Caisim mustard plants after further BNJ testing at the 5% level can be seen in Table 2.

Table 2. Average wet weight of plants (g) treated with rice washing water and Organic NPK.

Rice washing water (%)	Organic NPK (g)				Mean
	0	1.5	3.5	4.5	
25	01.19±4.98 j	15.12±5.22 i	27.77±7.35ghi	42.90±4.12 def	121.74 d
50	26.53±4.41 hi	34.03±6.47 fgh	49.58±3.12 cde	56.50±3.01 bc	141.66 c
75	48.61±3.15 cde	57.15±4.52 bc	67.52±4.95 ab	72.41±3.70 a	161.42 a
100	40.85±3.73 efg	48.57±2.65 cde	54.65±3.85 bcd	64.92±1.53 ab	152.25 b
Mean	129.30 d	138.72 c	149.88 b	159.18 a	
CV = 3.05%	Tukey A&N = 4.88		Tukey AN = 13.40		

Numbers in rows and columns followed by the same lower case letter show no significant difference according to the BNJ follow-up test at the 5% level.

Table 2 shows the highest average wet weight of Caisim mustard plants obtained in the treatment of 75% rice washing water + 4.5 g Organic NPK, 172.41 g. The higher the dosage of rice washing water and Organic NPK, the higher the average wet weight of the plants. The standard deviation value ranges from 3.01 to 7.35. this indicates that the variation in plant wet weight observation data is not far from the average value.

The combination of rice washing water and organic NPK significantly affected the wet weight of Caisim mustard greens, where the best treatment was 75% rice washing water combined with 4.5 g organic NPK/plant with an average wet weight of 172.41 g, not significantly different from the treatment 75% rice washing water combined with 3.5 g organic NPK/plant with an average wet weight of 167.52 g and 100% rice washing water combined with 4.5 g organic NPK/plant with an average wet weight of 164.92 g . The lowest wet weight of Caisim mustard greens was produced by a combination of 25% rice washing water treatment and without organic NPK with an average wet weight of 101.19 g.

The better-wet weight of Caisim mustard greens produced by a combination of 75% rice washing water and 4.5 g Organic NPK per plant shows a sound effect from both treatments, where the application of rice washing water can accelerate the decomposition of organic matter. Soil so that the soil becomes more fertile and plant roots can absorb nutrients optimally. The Organic NPK applied has been able to supply the nutrients that plants need for nitrogen, phosphorus, and potassium. By fulfilling these nutrients, plant growth will optimally produce more leaves.

Rice washing water has the potential to be used as fertilizer for plants, especially Caisim mustard plants, where from research that has been carried out, the application of rice washing water can increase plant growth in a better direction so that it can produce maximum plant fresh weight.

Fadilah et al. (2019) state that watering fermented rice washing water for 15 days with a concentration of 100% increases plant height, number of leaves,

leaf area, fresh weight of plants, and dry weight of green mustard plants.

Reducing the concentration of rice washing water reduces the wet weight of Caisim mustard plants, and it is suspected that in this treatment, the plants lack nutrients, which affects the photosynthesis process; the number of leaves produced is less, affecting the wet weight.

Suwardani et al. (2019) explained that applying liquid organic fertilizer from Veras washing water at a low dose cannot supply sufficient macronutrients so plant growth will be slow.

Lingga and Marsono (2013) also emphasized that N, P, and K are macronutrients generally needed by plants, providing a better nutrient balance for plant growth and production. Suhastyo and Raditya (2019) state nitrogen is the main nutrient plants need to grow and form vegetative organs such as stems, leaves, and roots.

The research results show that the application of Organic NPK 4.5 g/plant (750 kg/ha) is a treatment that produces a heavier wet weight in Caisim mustard plants. This shows that this treatment is right for the N, P, and K nutrients. The organic NPK contained has been able to meet the plant's needs. Then, by reducing the dose of organic NPK, there has been a decrease in the wet weight of Caisim mustard greens. It is suspected that the Organic NPK doses of 3.0 and 1.5 g/plant were not fully able to meet the nutrients needed by the plants, thus affecting growth and affecting wet weight.

The results of Panjaitan's research (2018) showed that organic NPK fertilizer dosage treatment had a very significant effect on the variables of plant height, number of leaves, wet weight per plant, dry weight, and root volume of mustard greens with the best dose, namely 500 kg/ha, while the results of Trisnawan's research, (2018) giving organic NPK to lettuce plants had a real influence on all observed parameters.

3.3 Economical Weight

The results of observations of the economic weight of Caisim mustard plants show that both the interaction and the main influence of rice washing water and Organic NPK are significant on the economic weight. The average wet weight observation results after further BNJ testing at the 5% level can be seen in Table 3.

Table 3. Average economic weight (g) of Caisim mustard plants treated with rice washing water and Organic NPK.

Rice washing water (%)	Organic NPK (g)				Mean
	0	1.5	3.5	4.5	
25	0.53±5.01 h	02.12±3.28 gh	115.43±6.24 f	131.57±5.40 de	109.91 d
50	13.53±3.97fg	21.03±6.47 ef	136.58±3.12 cd	144.50±2.04 bc	128.91 c
75	35.94±2.97 cde	46.15±3.55 bc	154.52±4.95 ab	160.41±4.44 a	149.25 a
100	27.85±3.73 de	36.23±1.80 cd	143.98±1.61 bc	151.92±1.53 ab	140.00 b
Mean	116.96 d	126.38 c	137.63 b	147.10 a	
CV = 3.08%	BNJ A&N = 4.50		BNJ AN = 12.38		

Numbers in rows and columns followed by the same lower case letter show no significant difference according to the BNJ follow-up test at the 5% level.

Table 3 shows that the highest average economic weight of Caisim mustard plants was obtained in the treatment of 75% rice washing water + 4.5 g Organic NPK, 160.41 g. The higher the dose of rice washing water and

Organic NPK given, the higher the average economic weight of the plants increases. The standard deviation value in this table is small (1.53 to 6.47), which shows that the variation in economic weight observation data is close to the average value.

Based on the data in Table 3. shows that the combination of rice washing water and organic NPK significantly affects the economic weight of Caisim mustard greens, where the best treatment is produced by a combination of 75% rice washing water and organic NPK 4.5 g/plant, with the average economic weight being 160.41 g. These results were not significantly different from the combination of 75% rice washing water and 3.5 g organic NPK/plant, with an average economic weight of 154.52 g, and the combination of 100% rice washing water and 4.5 g organic NPK/plant. with an average economic weight of 151.92 g and was significantly different from other treatments. Then, the combination of 25% rice washing water treatment and no organic NPK treatment resulted in the lowest economic weight of Caisim mustard greens, namely 90.53 g.

The combined effect of rice washing water and Organic NPK shows that these two treatments can positively influence the better growth of Caisim mustard greens. Apart from containing nutrients, rice washing water also contains many microorganisms so that it can increase soil fertility through more the rapid decomposition of organic matter in the soil so that the roots of mustard plants will more easily absorb the nutrients, then combined with Organic NPK, it can supply the nutrients N, P, and K which Caisim mustard plants need.

The research results by Wulandari et al. (2011) showed that the nutrient content in rice-washing water stimulated the growth of roots, stems, and leaves so that the wet weight value of the mustard greens produced was greater than without the rice washing water. Furthermore, Wardiah et al., (2014) showed that waste water from rice washing had a real influence on the vegetative growth of mustard greens. This effect has been visible since 10 days after planting; with the same volume of rice washing water in each treatment, mustard greens can absorb maximum nutrients, thus providing optimal growth.

Lingga and Marsono (2013) also emphasized that N, P, and K are macronutrients generally needed by plants, providing a better nutrient balance for plant growth and production.

Masblack fertilizer is an organic NPK fertilizer containing macro nutrients (N, P, K, MgO) and HA (Humic Acid) necessary for plant growth. Applying the Masblack organic fertilizer will increase the activity of microorganisms in the soil, such as bacteria and fungi, then decompose the fertilizer granules into nutrients ready to be absorbed by plant roots (Rohmah et al., 2018).

The use of Organic NPK, apart from contributing nutrients, can also improve the soil's physical, chemical, and biological properties. The soil becomes loose, and the roots penetrate more easily, so root growth will be better, positively impacting plant growth. The next advantage is that adding organic material will improve the biological properties of the soil. Organic matter adds the energy needed for the life of soil microorganisms. Purnami (2014) states that plants require optimal amounts of nutrients to support plant growth. Providing sufficient nutrients will increase plants' genetic potential, such as the shape, size, and weight of the organs produced.

3.4 Dry Weight.

The observations of the dry weight of Caisim mustard plants showed that both the interaction and the main influence of rice washing water and organic NPK were

significant on dry weight. The average dry weight observation results after further BNJ testing at the 5% level can be seen in Table 4.

Table 4. Average dry weight (g) of Caisim mustard plants treated with rice washing water and Organic NPK.

Rice washing water (%)	Organic NPK (g)				Mean
	0	1.5	3.5	4.5	
25	5.02±0.24j	6.17±0.24 i	7.24±0.26 hi	8.59±0.31 efg	6.76 d
50	7.25±0.24 h	7.90±0.22 gh	8.19±0.26 fgh	9.59±0.45 de	8.23 c
75	9.26±0.19 def	10.21±0.51 bcd	11.04±0.25 ab	11.67±0.31 a	10.55 a
100	8.13±0.10 gh	8.86±0.45 efg	9.95±0.50 cd	10.99±0.68 abc	9.48 b
Mean	7.41 d	8.29 c	9.10 b	10.21 a	
CV = 4.02%	Tukey A&N = 0.39		Tukey AN = 1.07		

Numbers in rows and columns followed by the same lower case letter show no significant difference according to the BNJ follow-up test at the 5% level.

Table 4 shows the highest average dry weight of Caisim mustard plants obtained in the treatment of 75% rice washing water + 4.5 g Organic NPK, 11.67 g. The higher the dose of rice washing water and Organic NPK, the greater the average dry weight of the plant. Standard deviation values between 0.10 and 0.68 indicate variations in dry weight observation data are not far from the average value.

The combination of rice washing water and organic NPK was significant for dry weight, where the best treatment was 75% rice washing water and organic NPK 4.5 g/plant, with an average dry weight of 11.67 g, not significantly different from the washing water treatment. 75% rice and 3.5 g organic NPK/plant with an average dry weight of 11.04 g and 100% rice washing water and 4.5 g organic NPK/plant with an average dry weight of 10.99 g are significantly different with other treatments. The combination of 25% rice washing water treatment and no organic NPK treatment resulted in the lowest dry weight of Caisim mustard greens, with an average dry weight of 5.02 g.

The research results showed that the concentration of rice washing water combined with organic NPK had a good influence on the growth of Caisim mustard plants; through the application of rice washing water it was able to increase soil fertility through improving physical, chemical and biological properties. Then, this treatment is also coupled with the provision of organic NPK so that it can supply the N, P, and K nutrients needed by the plants so that by fulfilling the required nutrients, it will support the photosynthesis process to run well, which in the end will produce more plants. produces assimilate material, where part of the assimilate will be used for energy in the growth process, and part will be stored in plant organs reflected in the dry matter.

The ability of plants to accumulate organic matter accumulates in plants (biomass), resulting in weight gain. The formation of plant biomass includes all plant materials originating from photosynthesis and uptake of nutrients and water processed in the biosynthesis process. The growth process leads to the accumulation of dry weight of the plant, and this process will occur if sufficient assimilation results are available.

Results of analysis of General Soil Laboratory Tests and Food Ingredient Analysis UGM (2011) in Dewi et al. (2021) the content of rice washing water

includes carbohydrates, nitrogen, phosphorus, calcium, potassium, magnesium, sulfur, iron, and Vitamin B1.

The effect of the application of rice washing water on the dry weight of Caisim mustard plants is that the rice washing water contains enough nutrients so that the nutrients needed by the plants can be adequately fulfilled. The research results of Ratnadi et al. (2014) stated that waste rice washing water can increase the growth of lettuce plant roots in different types and water levels of rice washing. Rice washing water also increases water henna plants' growth and dry weight. Furthermore, the results of research by Wijiyanti et al. (2019) showed that the application of rice-washing water fertilizer without incubation had a significant effect on the number of leaves, leaf area, wet weight and dry weight of green mustard greens.

Agustina et al., (2015) stated that the elements nitrogen, phosphorus, and potassium are very important for plants, including parts related to generative development which causes metabolism in the plant body to be better. This can be seen from the research results through the correct application of Organic NPK, which has increased plant growth. The elements N, P, and K contained in Organic NPK have been able to supply nutrients according to what the Caisim mustard plants need.

Leaf development and sunlight intensity are two factors that affect the dry weight of plants. Plants with wider leaves can absorb sunlight more efficiently, increasing photosynthesis and higher production. According to Simanullang (2019), they can carry out photosynthesis effectively.

In a study conducted by Iqbal (2010), it was found that the application of organic NPK 4.5 g/plant significantly impacted the dry weight of pakcoy plants. Similarly, the combination of rice washing water and organic NPK 4.5 g/plant resulted in the highest dry weight of Caisim mustard plants, as observed in the research findings.

3.5 Net Assimilation Rate/LAB

The observations of the net assimilation rate of Caisim mustard plants show that both the interaction and the main influence of rice washing water and organic NPK are significant on the value of the net assimilation rate of Caisim mustard greens. The average results of observing the net assimilation rate after the BNJ further test at the 5% level can be seen in Table 5.

Table 5. Average net assimilation rate (mg/cm2/day) of Caisim mustard plants treated with rice washing water and organic NPK

DAT	Rice washing water (%)	Organic NPK (g/plant)				Mean
		0	1.5	3.5	4.5	
14-21	25	0.008±0.00 h	0.011±0.00 g	0.014±0.00 def	0.015±0.001 cde	0.012 d
	50	0.011±0.001 g	0.012±0.001fg	0.015±0.001 cde	0.017±0.001 bc	0.014 c
	75	0.015±0.001 cde	0.017±0.001 bc	0.017±0.00 bc	0.020±0.001 a	0.017 a
	100	0.012±0.00 fg	0.013±0.00 efg	0.016±0.001 bcd	0.018±0.001 ab	0.015 b
	Mean	0.012 c	0.013 c	0.016 b	0.018 a	
	CV = 5.43 %		Tukey A&N = 0.001 Tukey AN = 0.002			
21-28	25	0.014±0.002 g	0.019±0.00 f	0.023±0.00 e	0.027±0.001 cd	0.021 d
	50	0.019±0.00 f	0.024±0.00 de	0.027±0.001 cd	0.029±0.001 bc	0.024 c
	75	0.025±0.00 de	0.029±0.00 bc	0.032±0.00 ab	0.034±0.001 a	0.030 a
	100	0.023±0.002 e	0.027±0.00cd	0.029±0.00 bc	0.031±0.001 ab	0.028 b
	Mean	0.020 d	0.025 c	0.028 b	0.030 a	
	CV = 4.01%		Tukey A&N = 0.001 Tukey AN = 0.003			

Numbers in rows and columns followed by the same lower case letter show no significant difference according to the BNJ follow-up test at the 5% level.

Table 5 shows that the highest average net assimilation rate of Caisim mustard plants at 21-28 HST was obtained in the treatment of 75% rice washing water + 4.5 g Organic NPK, 0.034 mg/cm2/day. The higher the dosage of rice washing water and Organic NPK, the greater the average net assimilation rate. The table's standard deviation value of 0.001 shows that the variation in the observation data is very close to the average value.

The combination of rice washing water and organic NPK significantly affected the net assimilation rate (LAB), where the best treatment at the age of 14-21 days after was found in a combination of 75% rice washing water and 4.5 g organic NPK/plant with an average of 0.020 mg/plant. cm2/day, not significantly different from the combination of 100% rice washing water and organic NPK 4.5 g/plant, with an average of 0.018 mg/cm2/day. The lowest net assimilation rate of Caisim plants was found in the combination of 25% rice water washing and without organic NPK, 0.008 mg/cm2/day.

At the age of 21-28 DAT the best treatment was a combination of 75% rice washing water and 4.5 g organic NPK/plant with an average of 0.034 mg/cm2/day, not significantly different from the 75% rice washing water and NPK treatment. Organic 3.5 g/plant with an average of 0.032 mg/cm2/day and 100% rice washing water treatment and organic NPK 4.5 g/plant with an average of 0.032 mg/cm2/day and the lowest net assimilation rate of Caisim plants produced in a combination of 25% rice water washing water and without organic NPK with an average value of 0.014 mg/cm2/day.

The net assimilation rate results from assimilation per unit leaf area and time. From table 5 it can be seen that the net assimilation rate increases with increasing plant age. The good development of the leaves on the plant characterizes plant growth. If the leaves develop optimally, they will produce much energy to support plant growth. Leaf area influences the plant's net assimilation rate and relative growth rate. The wider the leaves of a plant, the greater the net assimilation.

Buntoro, et al. (2014) stated that young leaves can absorb the most light, have a high photosynthesis rate, and translocate most photosynthesis to other parts of the plant. Meanwhile, in the lower leaves, the rate of photosynthesis is slower because the upper leaves shade them. The research results of Permanasari & Sulistyaningsih (2013) state that during the initial generative phase, the growing leaves are still relatively small and do not cover each other's lower leaves and almost all the leaves are still actively carrying out the photosynthesis process and have a big influence on the plant's net assimilation rate. Meanwhile, most of the leaves that have entered the final generative phase or are approaching harvest have covered each other's lower leaves and are not active in photosynthesis, thus reducing the value of the net assimilation rate.

The results of the research on the net assimilation rate of Caisim mustard greens in a combination of 75% rice washing water and organic NPK 4.5 g/plant at 21-28 DAT observations increased, this is because Caisim plants at that age were still in the vegetative phase so that the photosynthesis process in the leaves was still running optimally. In line with the opinion of Gardner et al., (1991) in Mahmudi et al., (2022) that the net assimilation rate of a plant is not constant over time and decreases with increasing plant growth phase.

3.6 Relative growth rate /LPR

The results of observing the relative growth rate of Caisim mustard plants show that both the interaction and the main influence of rice washing water and Organic NPK are significant on the close growth rate of Caisim mustard greens. The average results of observations of relative growth rates after the BNJ further

test at the 5% level can be seen in Table 6.

Table 6. Average relative growth rate (g/day) of Caisim mustard plants treated with rice washing water and Organic NPK.

DAT	Rice washing water (%)	Organic NPK (g/plant)				Mean
		0	1.5	3.5	4.5	
14-21	25	0.08±0.01 j	0.12±0.00 hi	0.14±0.00 gh	0.17±0.00def	0.13 d
	50	0.11±0.00 i	0.15±0.00 fg	0.17±0.00 def	0.19±0.01 bcd	0.16 c
	75	0.16±0.00 efg	0.19±0.01bcd	0.20±0.00 ab	0.22±0.00 a	0.19 a
	100	0.14±0.00 gh	0.16±0.00efg	0.18± cde	0.21±0.00 abc	0.17 b
	Mean	0.12 d	0.15 c	0.17 b	0.20 a	
	CV = 4.20 %	Tukey A&N = 0.007	Tukey AN = 0.02			
21-28	25	0.12±0.00 i	0.16±0.01 h	0.18±0.00 gh	0.22±0.01 def	0.17 d
	50	0.16±0.01 h	0.19±0.00 fgh	0.22±0.00 def	0.23±0.01 cde	0.20 c
	75	0.20±0.00 efg	0.22±0.00 def	0.26±0.00 ab	0.29±0.00 a	0.24 a
	100	0.17±0.01 gh	0.20±0.00 efg	0.24±0.00 bcd	0.27±0.00 abc	0.22 b
	Mean	0.16 d	0.20 c	0.23 b	0.25 a	
	CV = 4.59%	Tukey A&N = 0.010	Tukey AN = 0.03			

Numbers in rows and columns followed by the same lower case letter show no significant difference according to the BNJ follow-up test at the 5% level.

Table 6 shows the highest average relative growth rate of Caisim mustard plants at 21-28 HST obtained in the treatment of 75% rice washing water + 4.5 g Organic NPK, 0.29 g/day. The higher the dose of rice washing water and Organic NPK given, the greater the relative average growth rate. The standard deviation value ranges from 0.00 to 0.01. this indicates that the variation in observational data is not far from the average value.

The combination of rice washing water and organic NPK significantly affected the relative growth rate (LPR), where the best treatment at the age of 14-21 dap was found in the treatment of 75% rice washing water and organic NPK 4.5 g/plant with an average of 0.22 g/day is not significantly different from the treatment of 75% rice washing water and 3.5 g organic NPK/plant with an average of 0.20 g/day and the treatment of 100% rice washing water and organic NPK 4.5 g/plant with an average -average 0.21 g/day and significantly different from other treatments. The treatment with the lowest average was 25% rice washing water without organic NPK with an average value of 0.08 g/day.

The relative growth rate at 28-35 days after the best treatment was found in the 75% rice washing water treatment and organic NPK 4.5 g/plant with an average of 0.29. g/day, not significantly different from the 75% rice washing water treatment. Organic NPK 3.5 g/plant with an average of 0.26 g/day and 100% rice washing water treatment and organic NPK 4.5 g/plant with an average of 0.27 g/day and significantly different from the treatment other. The treatment with the lowest average was 25% rice washing water treatment without giving organic NPK with an average value of 0.12 g/day.

The relative growth rate measures a plant's ability to increase its biomass within a specific timeframe, close to its dry weight. Plant growth is primarily driven by cell elongation and enlargement, which necessitates a significant amount of nutrients. During the vegetative phase, plants require nitrogen fertilizer to enhance the rate of photosynthesis. This increased photosynthetic activity leads to higher photosynthate production, increasing the plant's dry weight. As Sarif et al. (2015) stated, a higher dry weight signifies a more efficient photosynthesis process, leading to improved productivity and faster development of tissue cells, ultimately resulting in better plant growth.

Zivcak et al. (2014) and Bayat et al. (2018) have also documented that a decrease in the photosynthesis status of

plants can lead to a reduction in photoassimilation and the flow of soluble sugars to the stem.

On the other hand, Rahmah et al. (2014) have found that an increase in plant biomass indicates the relative growth rate during different growth phases. This increase in biomass is attributed to the plant's ability to absorb more water and nutrients, which in turn stimulates organ development, particularly roots. Consequently, the enhanced nutrient and water absorption leads to an increase in photosynthetic activity and ultimately influences the wet weight and dry weight of the plant.

The research findings indicate that by utilizing rice washing water at an appropriate concentration and combining it with Organic NPK, it has been feasible to achieve improved growth of Caisim mustard greens. Furthermore, this approach has resulted in higher relative plant growth rate values when compared to alternative treatment combinations.

4. CONCLUSION

1. The combination of rice washing water and Organic NPK significantly influenced all observed parameters. The most effective treatment involved using 75% rice washing water and applying 4.5 g of Organic NPK per plant.
2. The application of rice-washing water significantly impacted all observed parameters, with the best treatment being the use of 75% rice-washing water.

3. The application of Organic NPK significantly affected all observed parameters, and the most effective treatment involved applying 4.5 g of Organic NPK per plant.

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