

Effect of rice wastewater poc and planting distance on growth and yield of green Mung Beans (*Vigna Radiata L.*)

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ABSTRACT

Keywords:

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This study aims to determine the effect of the combination of POC concentration, rice washing water and planting distance on the growth and yield of mung bean plants (*Vigna radiata L.*) of the Vima 1 cultivar. The research was carried out in the Kedung Dadap block, Serang Village, Palimanan District, Cirebon Regency from May 2024 to August 2024. The experimental method used was using an experimental method with a group random design (RAK), consisting of 9 treatment combinations that were repeated 3 times. Data analysis was carried out using various fingerprints and further tests with the Duncan Brganda Distance Test at the level of 5%. The results showed that there was a real influence between the POC concentration of rice washing water and planting distance on the variables of plant height, number of leaves, flowering age, total number of pods, weight of dry seeds per plant, and weight of dry seeds per plot. The POC concentration of 50 ml/l rice washing water with a planting distance of 20 cm x 30 cm had the best effect on the weight of dry seeds per plot which resulted in a production of 1.65 kg/plot or equivalent to 1.83 tons/ha.

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INTRODUCTION

Green beans (*Vigna radiata L.*) is one of the plants from the legume family that has a high protein content. This is due to the high lysine content which can be a complement to the main food nutrition such as rice which has a low lysine content. In Indonesia, mung beans are in third place among legumes, after peanuts and soybeans (INDIATI et al., 2017; Kuntastyuti & Lestari, 2016; Santari & Dewi, 2024; Taher et al., 2022; Wijaya et al., 2015). According to Hijria & Syarni (2019) the content of substances in mung beans is able to overcome several diseases such as anemia, hemorrhoid, liver disorders, and others.

However, from the perspective of mung bean cultivation, it receives less attention from farmers so that the yield per hectare is still much lower than the yield capability. Optimal fertilization is a cultivation technique that aims to provide nutrients for plants so that plants can produce optimally. Generally, farmers use inorganic fertilizers such as NPK compound fertilizers to increase the growth and yield of mung beans. However, this is the cause of the increase in farmers' production costs. One of them is the increasing price of inorganic fertilizers, so a solution is needed to overcome this problem.

POC Rice washing water is an organic fertilizer that comes from environmental waste and then ferments into POC which can be used as an alternative to plant fertilization other than inorganic fertilizers. So that the costs incurred by farmers can be reduced. POC Rice washing water has many benefits for plants, such as: environmental friendliness. It is easy for farmers to obtain, and has a low price so that it can be affordable for farmers. The results of the study by Octavia & Wahidah (2020) reported that liquid organic fertilizer combined with rice washing water had a significant effect on the leaf height and area of mung bean plants. This combination can also improve the physical properties of mossy soils as their nitrogen availability becomes higher as a result of the decomposition process of microorganisms in the fertilizer. So that its use can be a recommended alternative choice in an effort to improve soil quality.

POC Rice laundry water contains many components in the form of carbohydrates, nitrogen, phosphorus, potassium, magnesium, sulfur, iron and vitamin B1 (Rajasimman et al., 2021; Sulisetijono et al., 2024; Verma et al., 2018). POC Rice washing water has many benefits on plants. One of them is an increase in fruit weight.

increase in plant height and increase in the number of leaves (Astiari et al., 2024; Nabayi et al., 2021; Samad et al., 2024; Sulfianti et al., 2022; Sulistiani et al., 2023). In addition to fertilization techniques, to support maximum growth and results. Plants also need intensification in maximizing mung bean production, including planting distance treatment to increase the number of plants on a land to the optimal limit. At a planting distance of 15 cm x 30 cm, it is able to produce the highest per plot, which is 663.34g plot-1 (Trisnarningsih et al., 2020).

A high population in general will lead to high production per unit area. Because the more plants, the higher the production will be so that the water, Sunlight, and nutrients in the soil can be absorbed optimally by plants (Chaniago et al., 2017). The results of Taher et al. (2022) showed that the best POC administration of rice washing water in his study was a 60 ml/l treatment with a planting distance of 15 cm x 15 cm. That is, it produces an average weight of 100 mung bean plants of 6.68 grams. Meanwhile, the 90 ml/l treatment actually produced a lower average seed weight than the less treatment, which was 60 ml/l. Thus, It can be concluded that an optimal concentration of POC is needed to get optimal results as well. Based on the results of these studies, it can be concluded that the optimal planting distance will be different for various fertilizer concentrations and different environments.

This study aims to determine the best planting distance for the three concentrations of POC of rice washing water on mung bean plants which are tested in the rainy season in dry land. The research contribution of this study lies in identifying the optimal planting distance in conjunction with different concentrations of liquid organic fertilizer (POC) from rice washing water for mung bean cultivation on dry land during the rainy season. This research advances agricultural knowledge by providing insights into how planting strategies and organic fertilization practices can be tailored to enhance crop performance under specific environmental conditions, particularly in challenging dry land environments. The findings may contribute to more sustainable and efficient farming practices for mung beans and similar crops.

METHOD

The experiment was carried out on dry land located in the Kedung Dadap block, Serang Village, Palimanan District, Cirebon Regency, Indonesia. The land used has a soil texture of 42% sand, 34% dust, and 24% clay with an altitude of 13 m above sea level (above sea level). The trial period will be carried out from June 2024 to August 2024.

The research was carried out experimentally which was prepared with a factorial Group Random Design (RAK). The first factor is the POC concentration of rice washing water consisting of P1 = 40 ml/l, P2 = 50 ml/l, and P3 = 60 ml/l, The second factor is the planting distance regulation consisting of J1 = 20 cm x 30 cm, J2 = 30 cm x 30 cm, and J3 = 40 cm x 30 cm. From the two factors (P and J), nine treatment combinations were obtained as described in (table 1). Each of these combinations was repeated three times at the same time, resulting in 27 trials.

Tillage is carried out 7 days before planting. After that, a map is made - a map according to the predetermined layout. Plots - plots are made of 27 plots. Each replicate consists of 9 plots with a size that is suitable for the planting distance treatment. the distance between the treatment plots is 0.3 m and the distance between replicates is 0.5 m which functions for waterways and plant control. The observed parameter is the height of the plant, number of leaves, number of productive branches, flowering age, diameter of the cob is petted, and the weight of the skewed cobs per plant and per plot.

The observation data was processed using a statistical test of the Random Group Design (RAK) linear model of factorial patterns. To find out if the treatment has an effect on the observed variables, then it is carried out by the F test. If the F value is greater than the F table at the level of 5%, shows that there is a real difference, then the test continued with the Duncan multiple distance test (DMRT) at the level of 5%.

RESULTS AND DISCUSSION

Plant Height

Based on the 5% DMRT test varietal fingerprints, it shows that the POC concentration treatment of rice water and planting spacing have a significant influence on the height parameters of mung bean plants at the age of 28 hst and at the age of 35 hst shown in (Table 1).

Table 1. The average height of mung bean plants (cm) relative to POC concentration and planting distance at the age of 21, 28, and 35 hst.

Treatment	Average Plant Height		
	21 HST	28 HST	35 HST
POC Rice Washing Water			
40 ml/l	18.90 A	26.85 A	38.32 A
50 ml/l	17.99 A	28.29 a	40.02 from

60 ml/l	18.46 A	30.86 b	45.71 b
Planting Distance			
20 cm x 30 cm	18.87 a	28.11 a	39.73 a
30 cm x 30 cm	18.20 a	29.03 a	41.52 a
40 cm x 30 cm	18.28 a	28.85 a	42.79 a

Description: The average number followed by the same letter in the same column shows no significant difference according to the DMRT Test at the level of 5%

The average observation results of the high observation of mung bean plants with a POC concentration of 60 ml/l at the age of 35 hst gave the highest average. Meanwhile, at the age of the plant is 21 hst. POC concentration treatment and planting distance did not have a significant effect on the observation of plant height. So no significant differences were found.

The absence of the effect of planting distance on POC concentration in mung bean plants indicates that the applied planting distance is still adequate to support the growth of mung bean plants with different POC concentrations. The results of this study are similar to the results of a study conducted by Kuntastuti & Lestari, (2017), whose results showed that the planting density did not show a real flow of the height parameters of the Vima 1 cultivar mung bean plant.

Number of Leaves

Based on the fingerprints of the 5% DMRT test, the POC concentration treatment and planting spacing regulation showed a real effect on the observation parameters of the number of mung bean leaves at the age of 21 hst and 28 hst described in (Table 2).

The average observation of the number of mung bean leaves treated with a POC concentration of 60 ml/l at the age of 21 hst and 28 hst plants gave the highest average. Meanwhile, at the age of 35 hst. POC concentration treatment and planting distance did not have a significant effect on the observation of plant height. So no significant differences were found.

The average observation of the number of mung bean leaves treated with a POC concentration of 60 ml/l at the age of 21 hst and 28 hst plants gave the highest average. Meanwhile, at the age of 35 hst, the treatment of POC concentration and planting distance did not have a significant effect on the observation of plant height. So no significant differences were found.

Table 2. The average number of leaves of mung bean plants to POC concentration and planting distance at the age of 21, 28, and 35 hst.

Treatment	Average Number of Leaves		
	21 HST	28 HST	35 HST
POC Rice Washing Water			
40 ml/l	10.10 a	18.76 ab	33.02 a
50 ml/l	10.52 ab	18.32 a	32.51 a
60 ml/l	11.67 b	20.54 b	32.89 a
Planting Distance			
20 cm x 30 cm	10.40 a	19.19 a	33.69 a
30 cm x 30 cm	10.53 a	18.97 a	33.33 a
40 cm x 30 cm	11.36 a	19.47 a	31.40 a

Description: The average number followed by the same letter in the same column shows no significant difference according to the DMRT Test at the level of 5%

The average observation of the number of mung bean leaves treated with a POC concentration of 60 ml/l at the age of 21 hst and 28 hst plants gave the highest average. Meanwhile, at the age of 35 hst, the treatment of POC concentration and planting distance did not have a significant effect on the observation of plant height. So no significant differences were found.

Number of Productive Branches

Based on the fingerprints of the 5% DMRT test, it shows that the POC concentration treatment and planting spacing regulation show an unreal influence on the parameter of the number of productive branches of mung bean plants. The average number of productive branches can be seen in Table 3.

Table 3. The average number of productive branches of mung bean plants to the concentration of POC and planting spacing regulation

POC concentration (ml/l)	Planting Distance (cm)			
	20 x 30	30 x 30	40 x 30	Average POC
40	4.85 a	5.42 a	5.31 a	5.19 a
50	4.60 a	5.29 a	5.54 a	5.14 a
60	4.34 a	5.55 a	5.45 a	5.11 a
Average Planting Distance	4.60 a	5.42 a	5.43 a	

Description: The average number followed by the same letter in the same column shows no significant difference according to the DMRT Test at the level of 5%

Table 3 shows that the interaction of POC with various planting distances. The main factors of POC and planting distance resulted in a different number of productive branches were not real. The results of this study are similar to the results of the research of Kurnia et al., (2019), which show that planting distance and POC have no real effect on the parameter of the number of productive branches.

Flowering Age (HST)

Based on the 5% DMRT test varietal fingerprints, the POC concentration treatment and planting spacing regulation showed an insignificant effect on the flowering age parameters of mung bean plants. However, the main influence of POC concentration has an effect on the life of the flower. The average flowering age can be seen in Table 4.

Table 4. Average flowering age (HST) of mung bean plants on POC concentration and planting spacing regulation

POC concentration (ml/l)	Planting Distance (cm)			Average POC
	20 x 30	30 x 30	40 x 30	
40	36.55 b	35.43 b	34.78 b	35.59 b
50	35.20 b	34.56 b	35.34 b	35.03 b
60	33.43 a	32.40 a	33.67 a	33.17 a
Average Planting Distance	35.06 a	34.13 a	34.60 a	

Description: The average number followed by the same letter in the same column shows no significant difference according to the DMRT Test at the level of 5%

The data of table 4 shows that the application of POC of rice washing water has an effect on the flowering age parameters. The fastest flowering age occurred in the 60 ml/l treatment, which was 33.17 days, which was significantly different from the 50 ml/l treatment with a flowering age of 35.03 days and the 40 ml/l treatment, which was 35.59 days. In the POC concentration treatment of 50 ml/l, the longest flowering life time is 35.03 days after planting.

Total Number of Pods and Hollow Pods Per plant (fruit)

Based on the fingerprints of the 5% DMRT test, the combination of POC concentration treatment and planting spacing regulation has a real effect on the total number of pods (fruits) parameters. Meanwhile, it does not have a real effect on the parameter of the number of hollow pods (fruits). The results of the analysis of the total number of pods and the number of hollow pods can be seen in table 5.

Table 5. The average number of total pods (fruit) and the number of hollow pods (fruit) of mung bean plants against POC concentration and planting spacing regulation

Treatment	Total number of pods (pieces)	Number of Hollow Pods (fruit)
P1J1		
Concentration 40 ml/l + planting distance 20 cm x 30 cm	58,30 a	15,12 a
P2J1		
Concentration 50 ml/l + planting distance 20 cm x 30 cm	66,21 b	16,32 a
P3J1		

Concentration 60 ml/l + planting distance 20 cm x 30 cm	77,43 c	18,07 a
P1J2		
Concentration 40 ml/l + planting distance 30 cm x 30 cm	57,89 a	18,12 a
P2J2		
Concentration 50 ml/l + planting distance 30 cm x 30 cm	68,43 b	18,16 a
P3J2		
Concentration 60 ml/l + planting distance 30 cm x 30 cm	75,34 c	18,67 a
P1J3		
Concentration 40 ml/l + planting distance 40 cm x 30 cm	59,32 a	18,34 a
P2J3		
Concentration 50 ml/l + planting distance 40 cm x 30 cm	65,66 b	19,65 a
P3J3		
Concentration 60 ml/l + planting distance 40 cm x 30 cm	76,88 c	19,09 a

Description: The average number followed by the same letter in the same column shows no significant difference according to the DMRT Test at the level of 5%

Based on Table 5, it can be seen that the combination of POC concentration treatment of rice washing water and planting spacing regulation shows a significantly different effect on the total number of pods parameter. The treatments of P3J1, P3J2, and P3J3 showed markedly different effects from the treatments of P1J1, P2J1, P1J2, P2J2, P1J3, and P2J3. In the parameter of the total number of pods, the concentration treatment of 60 ml/l with a planting distance of 40 cm x 30 cm gave the highest number, namely with an average figure of 76.88 pieces.

Dry Seed Weight Per plant (g) and Per plot (kg)

Based on the fingerprints of the 5% DMRT test, the combination of POC concentration treatment and planting spacing regulation had a real effect on the dry seed weight parameters per plant and per plot. The results of the analysis of dry seed weight per plant and dry seed weight per plot can be seen in table 6.

Table 6. The average weight of dry seeds per plant (g) and the weight of dry seeds per plot (kg) of mung bean plants against POC concentration and planting spacing regulation

Treatment	Dry seed weight per plant (g)	Dry seed weight per plot (kg)
P1J1		
Concentration 40 ml/l + planting distance 20 cm x 30 cm	46.22 a	1.50 c
P2J1		
Concentration 50 ml/L + planting distance 20 cm x 30 cm	47.78 from	1.65 d
P3J1		
Concentration 60 ml/L + planting distance 20 cm x 30 cm	48.52 from	1.62 cd
P1J2		
Concentration 40 ml/L + planting distance 30 cm x 30 cm	47.14 from	0.86 b
P2J2		
Concentration 50 ml/L + planting distance 30 cm x 30 cm	46.90 from	0.96 b
P3J2		

Concentration 60 ml/l + planting distance 30 cm x 30 cm P1J3	50.41 c	0.93 b
Concentration 40 ml/l + planting distance 40 cm x 30 cm P2J3	47.10 from	0.69 a
Concentration 50 ml/l + planting distance 40 cm x 30 cm P3J3	47.71 from	0.72 a
Concentration 60 ml/L + planting distance 40 cm x 30 cm	51.67 c	0.69 a

Description: The average number followed by the same letter in the same column shows no significant difference according to the DMRT Test at the level of 5%

The data of table 6 showed that the combination of POC concentration treatment and planting distance had a significant effect on the weight of dry seeds per plant and per plot. Where the highest seed weight per plant lies in the treatment of a concentration of 60 ml/l with a planting distance of 40 cm x 30 cm, which is with a value of 51.67 grams. On the other hand, the highest seed weight per plot lies in the treatment of a concentration of 50 ml/l with a planting distance of 20 cm x 30 cm, which is with a value of 1.65 kg. At a concentration of 40 ml/l with a planting distance of 20 cm x 30 cm, the yield of dry seed weight per plant was the lowest with a figure of 4622 grams.

Weight of 100 Dry Grains (g)

Based on the fingerprints of the 5% DMRT test, the combination of POC concentration treatment and planting distance adjustment did not have a real effect on the weight parameters of 100 dried seeds. The results of the analysis of dry seed weight data per plant and dry seed weight per plot can be seen in table 7.

Table 7. Average weight of 100 dry seeds (g) of mung bean plants to POC concentration and planting spacing regulation

Treatment	Weight 100 dry grains (g)
P1J1	
Concentration 40 ml/l + planting distance 20 cm x 30 cm	10.12 a
P2J1	
Concentration 50 ml/l + planting distance 20 cm x 30 cm	9.50 a
P3J1	
Concentration 60 ml/l + planting distance 20 cm x 30 cm	9.74 a
P1J2	
Concentration 40 ml/l + planting distance 30 cm x 30 cm	9.55 a
P2J2	
Concentration 50 ml/l + planting distance 30 cm x 30 cm	9.66 a
P3J2	
Concentration 60 ml/l + planting distance 30 cm x 30 cm	9.97 a
P1J3	
Concentration 40 ml/l + planting distance 40 cm x 30 cm	9.45 a
P2J3	
Concentration 50 ml/l + planting distance 40 cm x 30 cm	9.76 A
P3J3	
Concentration 60 ml/l + planting distance 40 cm x 30 cm	10.32 a

Description: The average number followed by the same letter in the same column shows no significant difference according to the DMRT Test at the level of 5%

CONCLUSION

A study found that the concentration of polychlorinated phosphate (PCP) in rice washing water significantly influenced plant growth and yield. The concentration of 50 ml/l with a planting distance of 20 cm x 30 cm had the most significant effect on seed weight, resulting in 1.65 kg/plot or 1.83 tons/ha of mung bean crop production. This suggests that the recommended POC concentration of 50 ml/l and planting distance of 20 cm x 30 cm can be recommended for farmers to increase mung bean crop yield. However, further research is needed to validate these findings across different environmental conditions and to explore the interaction of

POC with other fertilizers. Additionally, research into the long-term effects on soil health and crop sustainability when using POC from rice washing water could provide valuable insights for sustainable agricultural practices.

REFERENCES

- Astiari, N. K. A., Sulistiawati, N. P. A., Sutapa, I. G., Rai, I. N., & Landra, I. W. (2024). Application of liquid organic fertilizer rice water waste and magnesium sulfate on flowering and fruiting of Siamese citrus in the off-season. *Magna Scientia Advanced Biology and Pharmacy*, 12(1), 084–091. <https://doi.org/10.30574/msabp.2024.12.1.0042>
- Chaniago, N., Wahyudin Purba, D., & Utama, A. (2017). Respon Pemberian Pupuk Organik Cair (POC) Bonggol Pisang dan Sistem Jarak Tanam Terhadap Pertumbuhan Dan Produksi Kacang Hijau (*Vigna radiata* L. Willczek). *Jurnal Penelitian Pertanian BERNAS*, 13(1).
- Hijria, H., & Syarni, P. (2019). PENGARUH PEMBERIAN PUPUK ORGANIK TERHADAP PERTUMBUHAN DAN HASIL BEBERAPA VARIETAS KACANG HIJAU (*Vigna radiata* L.). *Journal TABARO Agriculture Science*, 2(2). <https://doi.org/10.35914/tabaro.v2i2.131>
- INDIATI, S. W., BEJO, B., & RAHAYU, M. (2017). Diversity of mung bean insect pests and their natural enemies in farmers fields in East Java, Indonesia. *Biodiversitas Journal of Biological Diversity*, 18(4), 1300–1307. <https://doi.org/10.13057/biodiv/d180403>
- Kuntyastuti, H., & Lestari, S. A. D. (2016). Pengaruh interaksi antara dosis pupuk dan populasi tanaman terhadap pertumbuhan dan hasil kacang hijau pada lahan kering beriklim kering. *Jurnal Penelitian Pertanian Tanaman Pangan*, 35(3).
- Nabayi, A., Sung, C. T. B., Zuan, A. T. K., Paing, T. N., & Akhir, N. I. M. (2021). Chemical and microbial characterization of washed rice water waste to assess its potential as plant fertilizer and for increasing soil health. *Agronomy*, 11(12). <https://doi.org/10.3390/agronomy11122391>
- Octavia, D., & Wahidah, B. F. (2020). Modifikasi pupuk organik cair dari air cucian beras sebagai biofertilizer tanah pratanam pada kacang hijau (*Vigna radiata* L.). *Prosiding Seminar Nasional Biologi*.
- Rajasimman, M., Suganya, A., Manivannan, P., & Pandian, A. M. K. (2021). Utilization of agroindustrial wastes with a high content of protein, carbohydrates, and fatty acid used for mass production of biosurfactant. In *Green Sustainable Process for Chemical and Environmental Engineering and Science: Microbially-Derived Biosurfactants for Improving Sustainability in Industry*. <https://doi.org/10.1016/B978-0-12-823380-1.00007-1>
- Samad, S., Mahmud, S. A., & Sabban, H. (2024). PROVIDING LIQUID TOFU WASTE, RICE WASH, FRUIT AND EGG SHELLS CAN INCREASE TOMATO PLANT PRODUCTION IN DRY LANDS. *Proceeding International Conference Khairun University*.
- Santari, P. T., & Dewi, D. O. (2024). Increasing Productivity and Cropping Intensity with Intercropping of Maize, Soybean, and Mung Bean in Rainfed Lands. *AIP Conference Proceedings*, 2957(1). <https://doi.org/10.1063/5.0183915>
- Sulfianti, S., Priyantono, E., & Risman, R. (2022). CONTENT OF NPK HARA INGREDIENTS IN LIQUID ORGANIC FERTILIZER FROM VARIOUS TYPES OF RICE WASHING. *AGROLAND The Agricultural Sciences Journal (e-Journal)*, 8(2), 121–131. <https://doi.org/10.22487/agroland.v8i2.693>
- Sulisetijono, S., Muhdhar, M. H. I. Al, Putri, Z. A., Amalia, F. N., & Abdillah, R. R. (2024). *The effect of washed rice water on the growth of Pakcoy plants (Brassica rapa chinensis)*. 020006. <https://doi.org/10.1063/5.0215550>
- Sulistiani, L., P. Negara, Z., Adriansyah, F., Gustiar, F., Halimi, E. S., Sodikin, E., & Ali Muda, S. (2023). The Effects of Shading and Organic Domestic Waste on Brazilian Spinach Growth. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands*, 12(1). <https://doi.org/10.36706/jlso.12.1.2023.623>
- Taher, Y. A., Fitri, A., Desi, D. Y., & Eka, U. (2022). Jurnal Ekonomi dan Bisnis Dharma Andalas Pengaruh Konsentrasi POC Air Cucian Beras dan Kulit Kentang Terhadap Pertumbuhan dan Hasil Kacang Hijau (*Phaseolus radiatus* L.) untuk Pengurangan Biaya Produksi. *Jurnal Ekonomi Dan Bisnis Dharma Andalas*, 24(1).
- Trisnaningsih, U., Wahyuni, S., & Prasetyo, M. (2020). PERTUMBUHAN DAN HASIL TIGA KULTIVAR KACANG HIJAU PADA JARAK TANAM YANG BERBEDA. *Jurnal Agrotek Tropika*, 8(1). <https://doi.org/10.23960/jat.v8i1.3083>
- Verma, D. K., Srivastav, P. P., & Mohan, M. (2018). Nutritional quality evaluation of different rice cultivars. In *Agronomic rice practices and postharvest processing*. Apple Academic Press.
- Wijaya, H., Zakaria, F. R., Syah, D., & Prangdimutri, E. (2015). Isolation of Mung bean (*Vigna radiata* (L.) R. Wilczek proteins to create a skin prick test reagent to the diagnosis of mung bean allergy. *IOSR Journal of Pharmacy*, 5(1).