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Red Rice (Oryza Nivara) Growth and Yield are Impacted by Seedling Age and the Concentration of Liquid Organic Fertilizer

Ade Yanvar Bestari[1], **Amran Jaenudin**[2], **Ida Setya Wahyu Atmaja**[3]
[1]Universitas Swadaya Gunung Jati Cirebon, Indonesia, email: bestariadeyanvar@gmail.com
[2]Universitas Swadaya Gunung Jati Cirebon, Indonesia, email: amranjaenudin57@gmail.com
[3]Universitas Swadaya Gunung Jati Cirebon, Indonesia, email: iedasetya@gmail.com

Abstract. This study aims to ascertain how seedling age and liquid organic fertilizer content interact and correlate with red rice growth and production. This study was conducted in Karya Mulya village, Kesambi district, Cirebon, West Java, from December 2020 to April 2021. The factorial randomized block design (RBD) research methodology was used. Plant height, tiller count, leaf color, number of active tillers, number of panicles per clump, panicle length, number of grains per panicle, weight of 1000 grains, dry weight of grain harvested per plot, and dry weight of grain milled per plot were the key observations. The findings indicate that at 35 days following planting, there was an interaction between seedling age and liquid organic fertilizer concentration on leaf greenness. While the number of tillers 35 days after planting was affected by seedling age independently. When applied 42 days after planting, liquid organic fertilizer had an impact on the number of productive tillers, the number of panicles per clump, the length of the panicle, the number of grains per panicle, the weight of 1000 grains, the dry weight of the grain harvested per plot, and the dry weight of the grain ground per plot.

Keywords: Liquid, Organic, Fertilizer, Red Rice, Seedling Age

INTRODUCTION

Rice is the staple food of most Indonesian people. National rice needs have increased every year in line with the rapid population growth and the difficult to replace the role of rice as a fulfillment of people's carbohydrate needs. Rice is estimated to contribute calories by 60-80% and protein 45-55% (Haryadi, 2008). West Java is one of the rice production centers in Indonesia that contributes to national rice production. From 2014 to 2018 West Java experienced an increase in rice crop area (Table 1.). Although there was an increase in harvest area, it was not balanced with fluctuating rice crop production and productivity. This shows that the productivity of rice plants still needs attention.

Table of Production and Harvest Area of Rice Crops in West Java 2014-2018

No	Year	Production (tonnes)	Harvest Area (ha)	Productivity (ton/ha)
1	2014	11.644	1.97	58.82

2	2015	11.373	1.85	61.22
3	2016	12.540	2.07	60.49
4	2017	12.299	2.08	58.87
5	2018	12.499	2.12	58.91

Source: Ministry of Agriculture (2018)

Brown rice has advantages over white rice, but red rice cultivation is less desirable by most farmers. This is because red rice has low productivity and a long harvest age of 136 days. The longevity of the harvest is a consideration for farmers to cultivate brown rice because the longer the harvest life, the costs needed for maintenance will increase. However, efforts to improve brown rice cultivation techniques need to be carried out in order to increase production. Efforts to improve cultivation techniques that can be done include setting the age of moving seedlings and fertilizing.

The moving age of seedlings is one of the technologies that can determine rice production. The use of the appropriate transfer age of seedlings will also determine the number of saplings per clump and the number of productive saplings. In addition to the number of saplings, nutrient uptake is also influenced by the age of seedlings. Young seedlings are better at nutrient absorption than old age seedlings. Abdullah et al., (2000) reported that the use of rice seedlings that are more than 30 HSS old and with a larger number of seedlings will give poor results. The use of relatively old seedlings will reduce the adaptability of seedlings after transplanting, the number of saplings is not uniform, and has shallow roots so it is difficult to utilize deeper nutrients.

Research conducted by Anggraini et al., (2013) showed that the treatment of seedlings aged 14 days was able to increase the number of panicles per clump, grain weight per clump (28.13 g), GKG production 6.72 tons / ha. The use of young seeds can increase the development potential of saplings, the older the age of seedlings transferred to the field, the less time available for the growth of saplings (Muyassir, 2012). According to Kasim (2004), young seedlings that are moved to the field will avoid stagnation of seedlings in the field due to transplanting and optimization efforts of rice plants in order to achieve maximum growth.

In addition to regulating the moving age of seedlings, other efforts that can be made in order to increase rice production are fertilization. Fertilization is one of the efforts to provide nutrients needed by plants to increase the supply of nutrients in the soil (Irwan &; Wicaksono, 2016). Research conducted by Lestari et al., (2014) showed that giving banana weevil POC to rice plants can increase plant height and the number of rice saplings. This is because POC contains the element Nitrogen which plays an important role in the formation of chlorophyll. Chlorophyll is a pigment needed as an

absorbent of sunlight used in the process of photosynthesis. When N increases, chlorophyll also increases so that photosynthetes produced and accumulated to plant height growth also increase.

METHOD

Place and Time of Trial

The research was conducted in Karya Mulya village, Kesambi District, Cirebon. The research will be conducted from December 2020 to April 2021.

Bahan and Alat Experiment

The materials used in this experiment were brown rice seeds of the Pamelen variety, liquid organic fertilizers, manure, inorganic fertilizers (Urea, KCl, SP-36) and pesticides. The POC used is POC Agro Mol Plus which is made from banana weevils. The tools used are tractors, tarpaulins, scales, moisture meters, measuring cups, plastics, pegs, sprayer tanks, and stationery.

Experiment Design

The method used in this experiment is factorial Group Randomized Design (RAK), the first factor is the age of seedlings (U) which consists of three levels, namely 7, 14, and 21 HSS and the second factor is the concentration of liquid organic fertilizer (P) consisting of three levels, namely 5, 15, and 25 ml / l of water. The trials are:

Factor I is the age of seedlings (U) consisting of 3 treatments, namely:

U_1 = 7 Days after seedling (HSS)

U_2 = 14 Days after seedling (HSS)

U_3 = 21 Days after seedling (HSS)

Factor II is the concentration of liquid organic fertilizer (P) consisting of 3 treatments, namely:

P_1 = POC concentration 5 ml/l

P_2 = POC concentration 15 ml/l

P_3 = POC concentration 25 ml/l

There are nine treatment combinations that will be repeated three times for 27 experimental units. Each experimental unit will select five sample plants to be observed.

DISCUSSION

Plant Height

Based on the results of fingerprint analysis, there is no interaction and independent influence between seedling age and POC concentration on plant height aged 28, 35 and 42 HST. The effect of

the difference in treatment was tested with the 5% Duncan Multiple Distance Test presented in table 3.

Table 3. Effect of Seedling Age and Liquid Organic Fertilizer Concentration Against Plant Age Height 28, 35, and 42 HST.

Treatment	Plant height (cm)				
	28 HST	35 HST		42 HST	
Age of seedlings					
U_1 (7 HSS)	64.84 a	76,04	a	86,18	a
U2 (14 HSS)	62.04 a	75,20	a	85,22	a
U_3 (21 HSS)	64.41 a	81,26	a	90,64	a
POC Concentration					
P_1 (5 ml/l)	63.16 a	77,91	a	86,00	a
P_2 (15 ml/l)	63.04 a	77,18	a	87,58	a
P_3 (25 ml/l)	65.09 a	77,41	a	88,47	a

Remarks: Numbers followed by the same letter in the same column mean no real difference according to Duncan's Multiple Distance Test 5% level

Based on the results of the analysis in Table 3 shows that the age of seedlings and the concentration of liquid organic fertilizer do not have a noticeable effect on plant height at the age of 28, 35 and 42 HST. This shows that the height of red rice plants is not influenced by the age of seedlings and POC concentration. Seedling age and POC concentration have the same influence on red rice plant height. In accordance with the research of Jalil *et al*., (2018) which said that plant height is not influenced by the age of seedlings.

Number of saplings

Based on the results of fingerprint analysis, it shows that there is no interaction between the age of seedlings and the concentration of POC on the number of saplings, but there is an independent influence of the age of seedlings on the number of saplings. The effect of the difference in treatment was tested with the 5% Duncan Multiple Distance Test presented in table 4.

Table 4. The Effect of Seedling Age and Liquid Organic Fertilizer Concentration on the Number of Saplings Age 28, 35, and 42 HST.

Treatment	Number of saplings				
	28 HST	35 HST		42 HST	
Age of seedlings					
U_1 (7 HSS)	15.11 a	28,22	b	23,71	a
U2 (14 HSS)	15.60 a	23,78	a	23,24	a
U_3 (21 HSS)	18.02 a	18,40	a	20,18	a
POC Concentration					
P_1 (5 ml/l)	15.47 a	23,38	a	21,60	a
P_2 (15 ml/l)	17.33 a	23,27	a	21,51	a
P_3 (25 ml/l)	15.93 a	23,76	a	24,02	a

Description: Numbers followed by the same letter in the same column mean no real difference according to Duncan's LSR Test at the level of 5%

Based on the results of the analysis in Table 4 shows that the concentration treatment of liquid organic fertilizer does not have a noticeable effect on the number of saplings at the age of 28, 35 and 42 HST, but the treatment of the age of seedlings has a real effect on the age of 35 HST. It is suspected that the age of rice seedlings that are still young in cultivation, does not experience stagnation so that seedlings can adapt to the new environment. In accordance with Kasim's opinion (2004) said the age of seedlings is very influential on rice production. The sooner the seedlings are moved, the more adequate the period of the seedlings adapts to the new environment, so the more adequate the period for the development of saplings and roots.

Greenness grade of leaves

Based on the results of fingerprint analysis, it shows that there is an influence of interaction between seedling age and liquid organic fertilizer concentration on leaf greenness at the age of 35 HST, and the independent influence of POC concentration on leaf greenness at the age of 42 HST. The effect of the difference in treatment was tested with the 5% Duncan Multiple Distance Test presented in tables 5 and 6.

Table 5. The Effect of Seedling Age and Liquid Organic Fertilizer Concentration on the Greenness of Leaves Age 28 and 42 HST.

Treatment	Greenness grade of leaves			
	28 HST		42 HST	
Age of seedlings				
U_1 (7 HSS)	3,64	a	3,51	a
U2 (14 HSS)	3,78	a	3,53	a
U_3 (21 HSS)	3,80	a	3,49	a
POC Concentration				
P_1 (5 ml/l)	3,58	a	3,31	a
P_2 (15 ml/l)	3,84	a	3,58	Ab
P_3 (25 ml/l)	3,80	a	3,64	b

Remarks : Numbers followed by the same letter in the same column show no real difference based on the LSR Test at a real level of 5%.

Based on the results of the analysis in Table 5 shows that there is no independent effect of seedling age treatment on leaf greenness, but there is an independent influence on POC concentration treatment on leaf greenness at the age of 42 HST. POC concentration treatment of 25 ml/l gave the highest level of leaf greenness of 3.64.

Based on the results of laboratory analysis, the research land has an N content of 0.17 (low category). Through the addition of POC is thought to be able to increase the N nutrient content needed

by plants. POC contains N elements needed by plants to enhance photosynthesis. The higher the amount of N given, the greenness of the leaves will also increase. Padmanabha et al., (2014) said that nitrogen is an important component of chlorophyll which gives green color to leaves which is necessary in the process of photosynthesis.

LSR 5% test results have an interaction effect between seedling age treatment and POC concentration on the greenness level of leaves aged 35 HST. The results of the analysis are presented in table 6.

Table 6. Effect of Seedling Age and Liquid Organic Fertilizer Concentration Against the degree of greenness of the leaves 35 HST

Treatment		Age of seedlings		
		U_1 (7 HSS)	U2 (14 HSS)	U_3 (21 HSS)
POC Concentration	P_1 (5 ml/l)	3.53 A	3.73 ab	3.67 a
		A	A	A
	P_2 (15 ml/l)	3.47 a	3.93 b	3.60 a
		A	B	A
	P_3 (25 ml/l)	3.67 a	3.40 a	3.60 a
		A	A	A

Description: Numbers followed by the same letter in the same column mean no real difference according to Duncan's LSR Test at the level of 5%

Based on Table 6 on the age condition of seedlings 14 HSS, the application of POC concentration has a significant effect on the level of leaf greenness. While at a POC concentration of 15 ml / l seedling age treatment also has a significant effect on the level of leaf greenness. Based on Table 7 shows that the treatment of seedling age of 14 HSS and POC 15 ml / l has the best effect on the level of leaf greenness at the age of 35 HST, which is 3.93.

Based on Marlina's research (2018), the age of 14 HSS seedlings is the right time to move planting because seedlings quickly adapt to the growing environment so that they can absorb POC optimally. While the provision of POC 15 ml / l is considered able to meet the needs of plants. This is evidenced when the concentration of POC is increased at the age condition of seedlings 14 HSS, the level of greenness of the leaves decreases.

Number of productive saplings

Based on the results of fingerprint analysis, there is no influence of interaction between seedling age and POC concentration on the number of productive saplings, but there is an independent influence of POC concentration on the number of productive saplings. The effect of the difference in treatment was tested with the 5% Duncan Multiple Distance Test presented in table 7.

Table 7. Effect of Seedling Age and Liquid Organic Fertilizer Concentration Against the number of productive saplings

Treatment	Number of productive saplings
Age of seedlings	
U_1 (7 HSS)	19,40 a
U2 (14 HSS)	22,09 a
U_3 (21 HSS)	22,71 a
POC Concentration	
P_1 (5 ml/l)	18,49 a
P_2 (15 ml/l)	22,76 a
P_3 (25 ml/l)	22,96 b

Description: Numbers followed by the same letter in the same column mean no real difference according to Duncan's LSR Test at the level of 5%

Based on the results of the analysis in Table 7, it shows that the age treatment of seedlings has no real effect on the number of productive saplings, while the treatment of liquid organic fertilizer has a real effect on the number of productive saplings of red rice plants. P_3 treatment gave the highest number of productive saplings at 22.96. POC contains elements N, P and K where element N is important in increasing the amount of leaf chlorophyll needed in photosynthesis. The higher the nitrogen, the more optimal photosynthesis and the results of photosynthesis or photosynthetes can be utilized by plants. While element P functions for root development and strengthens the root system, then element K functions in circulating the results of photosynthesis to plant tissues. These elements are interrelated and work together so as to produce maximum productive saplings. This is in line with the opinion of Widiatmika et al., (2017) which states that nitrogen elements can stimulate plant vegetative growth, while the addition of P nutrients will strengthen the plant root system so that many productive saplings are produced.

Number of panicles per clump

Based on the results of fingerprint analysis, there is no interaction between seedling age and POC concentration on the number of panicles per clump, but there is an independent influence of POC concentration on the number of panicles per clump. The effect of the difference in treatment was tested with the 5% Duncan Multiple Distance Test presented in table 8.

Table 8. Effect of Seedling Age and Liquid Organic Fertilizer Concentration Against the number of panicles per clump

Treatment	Number of panicles per clump
Age of seedlings	
U_1 (7 HSS)	22,93 a
U2 (14 HSS)	22,56 a
U_3 (21 HSS)	23,27 a

POC Concentration	
P_1 (5 ml/l)	20,42 a
P_2 (15 ml/l)	22,71 a
P_3 (25 ml/l)	25,62 b

Description: Numbers followed by the same letter in the same column mean no real difference according to Duncan's LSR Test at the level of 5%

Based on the results of the analysis in Table 8 shows that the age treatment of seedlings does not have a noticeable effect on the number of panicles per clump, but the concentration of POC has an independent influence on the number of panicles per clump. The treatment of P_3 differs markedly from P_2 and P_1. The P_3 treatment gave the highest number of panicles per clump at 25.62.

According to Azis (2015) the effect of fertilizers that contain N elements shows that the higher the dose given will produce the highest length and number of panicles, this can be explained that the application of fertilizers that contain N elements will affect the growth phase. Giving POC containing N elements further spurs the development of growth components in preparing for the generative phase, resulting in an optimal number of panicles.

In the treatment of the age of seedlings has no noticeable effect on the number of panicles per clump. This means that the age of seedlings 7, 14 and 21 hss has the same impact on these three parameters. The successful growth of a plant is controlled by growth factors. There are two important factors that influence the growth of a plant, namely genetic factors and environmental factors. Genetic factors are related to the inheritance of traits / behavior of the plant itself, while environmental factors are related to the environmental conditions in which the plant grows. Each plant variety has different abilities in terms of utilizing growing facilities and the ability to adapt to the surrounding environment, thus affecting the potential yield of plants.

Table 14. Height Correlation Analysis of Plant Age 28 HST, 35 HST, and 42 HST with Dry Grain Weights Harvest Perpetak

Variable	Correlation of Dry Grain Weight of Harvest per Plot		
	Coefficient r	Test t	Conclusion
Plant Height 28 HST	0,213	1,093	Unreal
Plant Height 35 HST	0,121	0,613	Unreal
Plant Height 42 HST	0,169	0,857	Unreal
Number of Leaves 28 HST	0,426	2,356	Real
Number of Leaves 35 HST	0,437	2,431	Real
Number of Leaves 42 HST	0,098	0,494	Unreal
Leaf Greenness Rate 28 HST	0,153	0,776	Unreal
Leaf Greenness Rate 35 HST	-0,290	-1,515	Unreal
Leaf Greenness Rate 42 HST	0,358	1,290	Unreal

Based on Table 14, it can be seen that between the number of saplings and the weight of harvested dry grain per plot shows a positive correlation, although not all of these correlation values show a real relationship. The ability of plants to produce saplings is closely related to the yield component of rice plants. The more saplings formed, the greater the chance of saplings forming that produce panicles. The more panicles, the more grain contained in it so that it can increase the weight of dry grain harvested per plot.

CONCLUSION

Based on the results of the research and discussion, the following conclusions can be drawn:

1. There is an effect of interaction between seedling age and POC concentration on the greenness level of leaves aged 35 HST.
2. The age of seedlings has a significant influence on the number of saplings and POC concentration of 25 ml/l has a significant influence on the degree of leaf greenness, number of productive tillers, panicle length, weight of 1000 grains, weight of harvested dry grain per plot, weight of milled dry grain per plot
3. There is a real correlation between the variable number of saplings and the yield of harvested dry grain, but the variable of plant height and the degree of greenness of leaves with the yield of harvested dry grain is not real.

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