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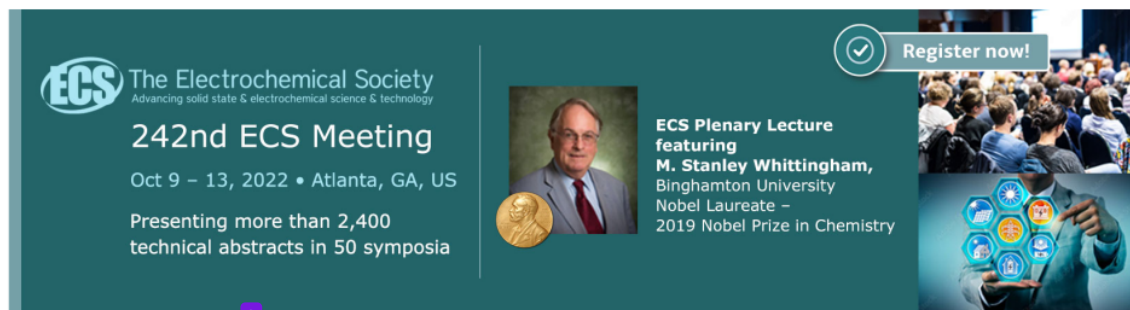
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Growth and production of lowland rice (*Oryza sativa* L.) with water management systems on the application of various combination of fertilizers and planting systems

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Abstract. This study aimed to determine the growth and production of rice in various water management systems, the application of a combination of fertilization and planting systems. The research was carried out from June to September 2016 in Ponrangae Village, Sidrap Regency. The trial used a split-split plot design with water management system set as main plot, a combination of nitrogen fertilizer as subplot and planting system as sub-sub plot. Two water management system applied were stagnant and intermittent management systems. Three fertilization packages were used by applying different combination of inorganic and organic fertilizers. The sub-subplot consisted of three planting system namely tiled planting system, 2:1 and 4:1 legowo planting systems, respectively. The results show that the interaction of intermittent water management system with the application of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 L ha⁻¹ liquid organic fertilizer resulted in the highest number of productive tillers. Interaction of intermittent water management with the application of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 L ha⁻¹ liquid organic fertilizer and 4:1 legowo planting system produced highest weight of 1,000 grains. Application of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 L ha⁻¹ organic fertilizer with the 4:1 legowo planting system showed the highest harvested and milled dry grain.

1. Introduction

Indonesia is the third largest country that produces the most rice ⁸ the world and rice is an essential food item used by almost all Indonesian people [1]. However, Indonesia still needs to import rice almost every year (although usually only to maintain the level of rice reserves). This situation is caused by farmers using sub-optimal farming techniques coupled with large rice consumption per capita. In an effort to realize the availability of rice production, the government, in this case, the Indonesian Ministry of Agriculture through the National Rice Production Enhancement program (P2BN) has implemented 4 (four) main strategies, are as follows: (1) Increasing productivity; (2) Expanding the planting area; (3) Securing production; and (4) Diversification of food consumption. To achieve these targets, the supports of appropriate technologies is necessary [2]. Therefore, the government through the Agricultural Technology Assessment Center (BTP) has issued several recommendations including sup³ or varieties, planting systems, fertilization, optimum pest and disease control, and post-harvest [3].



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Sidrap Regency has been known as the city of rice which has enormous potential in developing technology, especially in agriculture, as an effort to increase rice production in South Sulawesi. However, there are several problems faced by farmers, especially in South Sulawesi, in the water management system, fertilization and planting systems used. There are still many farmers who still rely on their focused experience to get large yields but often forget to pay attention to the environmental impacts caused. Local farmers, in general, have a concern about the water condition that will cause the plants to short of water, therefore many farmers will flood their fields constantly. Even though rice plants are not a water plant but plants that only need water at certain phases. Rice cultivation does not have to be inundated continuously so that the availability of water for agriculture can be managed and utilized as needed [4].

Waterlogging is the paddy mainly intended to reduce weed pressure and control certain types of pests, but in fact, the paddy rice plants do not require stagnant water for all phases of their growth. Inundation of water (above 15 cm) and over a long period of time can create increasingly acidic soil conditions, extremely reductive, reduced availability of micronutrients, increased disease infections and infestation of pests, stem extension, percolation rate and seepage (lateral water movement) in paddy fields increases and the root system of plants is easily damaged so that nutrient absorption capacity decreases. Irrigation systems are constantly inundation in lowland rice causing a lot of waste of water. Intermittent irrigation by keeping water in a muddy condition and sometimes even dry can increase the efficiency of water use [5]. Several studies have been conducted to determine the suitable water management system in rice plants. A continuous irrigation system used on the paddy rice resulted in better results in the observed parameters such as the maximum number of tillers, the number of productive tillers, and harvest age [6]. On the contrary, Sukristiyonubowo [7] showed the best results for rice growth and production was obtained by the use of intermittent water management systems on the parameters fresh weight of the straw, grain weight at harvest and dry weight of milled rice.

In addition to the right water management system choices for the efforts to increase rice production, fertilization also becomes a matter that needs substantial attention. Fertilization is an activity that aims to add nutrients to the soil and plants so that the production and quality of crop yields can increase. But the facts found in the field, there are still many farmers who do not fertilize as recommended for example giving urea to rice plants exceeds the recommended dose. This will initially cause the leaves to appear much greener and fresher, but their impact will easily collapse and be vulnerable to disease. [8].

To obtain high grain yields while maintaining soil fertility, it is necessary to combine fertilization between inorganic fertilizers and organic fertilizers. The advantage of the application of the combination of the two types of fertilizers is that the two types of fertilizers can cover each other weakness. In addition, using organic matter can increase the yield of rice. The addition of organic liquid organic fertilizer is an alternative to reduce the negative impact of inorganic fertilizer use, because it provides balanced nutrition for plants, improves soil structure, acts as an energy source for soil microorganisms, and increases the ability of the soil to retain water, and increases the cation exchange capacity [9], and can increase the level of plant resistance to pest attacks [10].

Several studies have been conducted to evaluate the use of inorganic fertilizers combined with organic fertilizers in rice plants. Sahardi et al. [11] showed the best results for rice growth obtained with a combination of organic and organic fertilizer (Organic fertilizer 5 t ha⁻¹ + Bio Urine 20 l ha⁻¹) + (inorganic fertilizers Urea 200 kg ha⁻¹ + NPK 300 kg ha⁻¹) on the observed parameters of plant height, number of productive tillers, number of grain per panicle, and production of harvested dry grain. Other studies conducted by Amilia [12] showed that the application of liquid organic fertilizer applied to the leaves combined with 75% to 100% dose of recommended dose of NPK tended to increase the number of productive tillers, the number of grains per panicles, and 1000 grain weight, production per plant and yield ton per hectare.

The issue of distance and planting systems is also one of the determining factors for increasing rice production. Despite the recommendation of the government to use "jajar legowo" planting system,

farmers are often tiled planting systems (a planting system using the same size of planting distance). Jajar legowo is one of Integrated Crop Management (ICM) technologies for paddy rice by adjusting spacing and planting populations in a certain pattern. Generally, farmers found difficulties in implementing the planting system due to lacking understanding. The legowo distance is wide enough for the tillers to develop. The yield of rice in the legowo planting method is higher than that of the farmers (the tiled system). This is caused by an increase in plant isolation and border effects which tend to produce higher tillers, hence yield per hectare [13]. The previous study found the best results for rice growth using a tiled planting system on the parameters of the maximum number of tillers, productive tillers, number of grains per panicle, panicle density, and production per plant [14]. G amdani and Murtiani's research [15] showed that the best results for rice growth were by the use of 2:1 legowo planting system on the parameters of weight of 1,000 grains, the percentage of filled grain and harvested dry grain. Other studies conducted by Ricardo et al. [16] showed the best results on dry weight per plot and 1000 grain weight parameters resulted from the use of 4:1 legowo planting system.

2. Methodology

This research was carried out on a new paddy field in Ponrangae Subdistrict Pituriawa District, Sidrap Regency from June to September 2016. The trial was set using split-split plot design with water management system (w) as main plot, combination of fertilizer (p) as subplot, and planting system (s) as sub-subplot. The combination of treatments carried out in this experiment is shown in table 1. Two water management systems applied were stagnant and intermittent management systems, respectively. Three combinations of nitrogen fertilization were used by applying different doses of Urea, NPK, and ZA. The sub-subplot consisted of three planting system namely tiled planting system, 2:1 and 4:1 legowo planting system.

Table 1. Treatments used in the trial

Factors	Treatments
Main Plots:	w1: Stagnant;
Water management system (w)	w2: Intermittent.
Subplots:	p1: 100 kg ha ⁻¹ Urea + 150 kg ha ⁻¹ NPK + 50 kg ha ⁻¹ ZA + 3.5 l ha ⁻¹ Liquid organic fertilizers (LOF);
Package of fertilization (p)	p2: 50 kg ha ⁻¹ Urea + 200 kg ha ⁻¹ NPK + 50 kg ha ⁻¹ ZA + 3 l ha ⁻¹ LOF
	p3: 50 kg ha ⁻¹ Urea + 250 kg ha ⁻¹ NPK + 2.5 l ha ⁻¹ LOF
Sub Subplots:	s1: Tiled systems (20 x 20 cm);
Planting system (s)	s2: Legowo 2:1 (40 x 20 x 10 cm);
	s3: Legowo 4:1 (40 x 20 x 10 cm).

Watering in the experimental field was carried out 5 days after planting (DAP), where the water supply was adjusted to the treatment given. In the stagnant water management system, water was flown into the field until the height reaches 5 cm then the water level was maintained during the experiment. Whereas in the intermittent water management system, intermittent water intake was carried out where irrigation water was administered when the soil was dry enough to a flood as high as 5 above the surface.

Components of growth and production observed and measured in this study, namely: number of productive tillers per plant, panicle length, percentage of filled and empty grain per panicle, grain weight of 1,000 grains, production per plant, and harvested dry grain. Data were analyzed using analysis of variance (ANOVA). If the f test has a significant or very significant effect then a further test with LSD 0.05% was conducted.

3. Results

3.1. Number of productive tiller.

Water management system and the combination of inorganic and organic fertilizers significantly affected the number of productive tillers of the rice. No significant interaction found between the three factors. The average number of productive tillers on different water management systems and the combination of fertilizers used are shown in Table 2.

Table 2. Average number of productive tillers (stems plant⁻¹) in different water management systems and fertilizer combinations.

Water management system	Fertilization packages			LSD _{0.05} (w)
	Package 1 (p1)	Package 2 (p2)	Package 3 (p3)	
Stagnant (w1)	18.48 ^x _p	18.57 ^x _p	16.98 ^x _p	3.22
Intermittent (w2)	20.33 ^x _q	21.48 ^x _{pq}	23.17 ^y _p	

LSD_{0.05} (p) 1.80

The numbers followed by the same letters in the same column (p, q) and the same row (x, y) mean are not significant different at LSD_{0.05} test. p1 = 100 kg ha⁻¹ Urea + 150 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ liquid organic fertilizer (LOF); p2 = 50 kg ha⁻¹ Urea + 200 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3 l ha⁻¹ LOF; p3 = 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF.

LSD test in Table 2 shows that the treatment of the intermittent water management system and the application of fertilizer combination of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF (w2p3) showed the highest number of productive tillers, namely 23.17 stems th⁻¹ was not significantly different with other treatments except for the treatment of 100 kg ha⁻¹ Urea + 150 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ LOF (w2p1) and application of Urea fertilizer 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF (w1p3) in the intermittent water management system.

3.2. Length of panicle

The treatment of the water management system and the interaction of three factors had a significant to a highly significant effect on the length of the panicle parameter. While the application of the fertilization packages, the interaction between the water management system and the application of a fertilizer combination, the planting system, the interaction between the water management system with the planting system and the interaction between the applications of the fertilization package with the planting system had no significant effect on panicle length. Average of length of a panicle of the rice plants as response to all factors tested in the study are shown in Table 3.

Table 3. Average length of rice panicle (cm) in water management systems with different combinations of fertilizers and planting systems.

Water management system	Fertilization packages	Planting system			LSD _{0.05} (w)
		Tiled (s1)	2:1 Legowo	4:1 Legowo	
Stagnant (w1)	Package 1 (p1)	a24.05 ^x _p	a23.81 ^x _p	a22.97 ^x _p	3.81
	Package 2 (p2)	a23.10 ^x _p	a24.42 ^x _p	a24.02 ^x _p	
	Package 3 (p3)	a23.38 ^x _p	a23.96 ^x _p	a24.40 ^x _p	
Intermittent (w2)	Package 1 (p1)	a24.58 ^x _q	a25.07 ^x _{pq}	a26.04 ^x _p	
	Package 2 (p2)	a26.25 ^x _{pq}	a23.88 ^x _q	b23.40 ^x _q	
	Package 3 (p3)	a26.85 ^x _p	a25.79 ^x _p	a25.36 ^x _p	

LSD _{0.05} (p)	1.82
LSD _{0.05} (s)	1.67

The numbers followed by the same letters in the same column (p, q) and the same row (x, y) mean are not significant different at LSD_{0.05} test. LSD_{0.05} (w) is w factor test at the same p and s (x, y), LSD_{0.05} (p) is p factor test at the same w and s (p, q), LSD_{0.05} (s) is s factor test at the same w and p (a, b). p1 = 100 kg ha⁻¹ Urea + 50 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ liquid organic fertilizer (LOF); p2 = 50 kg ha⁻¹ Urea + 200 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3 l ha⁻¹ LOF; p3 = 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF.

LSD test in Table 3 shows that the treatment of intermittent water management system with the application of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF and tiled planting system (w2p3s1) resulted the longest panicle (26.85 cm) and significantly different from the application 100 kg ha⁻¹ Urea + 150 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ LOF with the tiled planting system (w2p1s1), application of 50 kg ha⁻¹ Urea + 200 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3 l ha⁻¹ LOF in the 2:1 legowo planting system and the 4:1 legowo planting system (w2p2s3).

3.3. Number of grain per panicle.

The treatment of the water management system and the interaction of three factors have a significant to highly significant effect on the parameter of the number of grain per panicle of the rice plant. No significant effect found both for the single effect of other treatments and interaction between the factors. Average values of the parameter are shown in Table 4.

Table 4. Average number of grains per panicle of rice (grains panicle⁻¹) in water management systems with different combinations of fertilizers and planting systems.

Water management system	Fertilization packages	Planting system			LSD _{0.05} (w)
		Tiled (s1)	2:1 Legowo	4:1 Legowo	
Stagnant (w1)	Package 1 (p1)	a128.41 _p ^x	a127.13 _p ^x	a122.63 _p ^x	20.37
	Package 2 (p2)	a123.34 _p ^x	a130.37 _p ^x	a128.23 _{pq} ^x	
	Package 3 (p3)	a124.85 _p ^x	a127.91 _p ^x	a131.90 _p ^x	
Intermittent (w2)	Package 1 (p1)	a131.24 _q ^x	a133.87 _{pq} ^x	a139.03 _p ^x	
	Package 2 (p2)	a140.16 _p ^x	b127.50 _q ^x	b124.94 _q ^x	
	Package 3 (p3)	a143.38 _p ^x	a137.72 _p ^x	a135.40 _p ^x	
LSD _{0.05} (p)		9.70			
LSD _{0.05} (s)		8.92			

The numbers followed by the same letters in the same column (p, q) and the same row (x, y) mean are not significant different at LSD_{0.05} test. LSD_{0.05} (w) is w factor test at the same p and s (x, y), LSD_{0.05} (p) is p factor test at the same w and s (p, q), LSD_{0.05} (s) is s factor test at the same w and p (a, b). p1 = 100 kg ha⁻¹ Urea + 150 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ liquid organic fertilizer (LOF); p2 = 50 kg ha⁻¹ Urea + 200 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3 l ha⁻¹ LOF; p3 = 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF.

LSD test in table 4 shows that implementation of intermittent water condition with the application of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF in the tiled planting system (w2p3s1) showed the biggest number of grain per panicle (143.38 grains) and not significantly different from other treatment interactions but significantly different from the application 100 kg ha⁻¹ Urea + 150 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ LOF in the tiled planting system (w2p1s1) and the application of 50 kg ha⁻¹ Urea + 200 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3 l ha⁻¹ LOF in 2:1 (w2p2s2) and 4:1 legowo planting system (w2p2s3).

3.4. Weight of 1,000 grains.

The water management system, fertilizer combination, and application of different planting systems interacted significantly in affecting the weight of 1000 grains of the rice plant. Average weight of 1000 grains as affected by the three factors is shown in Table 5. LSD test results in table 5 shows that the treatment of intermittent water management with the application of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF in the 4:1 legowo planting system (w2p3s3) resulted in the highest weight 1000 grains of the rice plants with an average value of 26.97 g significantly different from other treatment combination.

Table 5. Average weights of 1,000 grains (g) in water management systems with different combinations of fertilizers and planting systems.

Water management system	Fertilization packages	Planting system			LSD _{0.05} (w)
		Tiled (s1)	2:1 Legowo	4:1 Legowo	
Stagnant (w1)	Package 1 (p1)	a24.55 ^x _p	a26.22 ^x _p	a24.22 ^x _p	4.06
	Package 2 (p2)	a19.89 ^x _p	a23.47 ^x _p	a22.14 ^x _{pq}	
	Package 3 (p3)	a23.89 ^x _p	a22.97 ^x _p	a22.22 ^x _p	
Intermittent (w2)	Package 1 (p1)	a23.89 ^x _q	a22.55 ^x _p	a24.22 ^x _p	
	Package 2 (p2)	a22.55 ^x _p	b21.89 ^x _q	b16.89 ^x _q	
	Package 3 (p3)	a24.55 ^x _p	a25.74 ^x _p	a26.97 ^x _p	
LSD _{0.05} (p)		2.56			
LSD _{0.05} (s)		2.43			

The numbers followed by the same letters in the same column (p, q) and the same row (x, y) mean are not significant different at LSD_{0.05} test. LSD_{0.05} (w) is w factor test at the same p and s (x, y), LSD_{0.05} (p) is p factor test at the same w and s (p, q), LSD_{0.05} (s) is s factor test at the same w and p (a, b). p1 = 100 kg ha⁻¹ Urea + 50 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ liquid organic fertilizer (LOF); p2 = 50 kg ha⁻¹ Urea + 200 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3 l ha⁻¹ LOF; p3 = 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF.

3.5. Production

The variance analysis shows that the treatment of fertilizer combination, planting system and the interaction between both factors had a significant effect on the parameter of harvested dry grain and milled dry grain. Average of these production parameter values are shown in Table 6.

Table 6. Average of production of harvested dry grain and milled dry grain (ton ha⁻¹) in different water management systems and fertilizer combination.

Fertilization packages	Planting system			LSD _{0.05} (p)
	Tiled (s1)	2:1 Legowo	4:1 Legowo	
Production of harvested dry grain (ton ha ⁻¹)				
Package 1 (p1)	4.43 ^x _p	4.43 ^x _p	4.43 ^x _{pq}	0.65
Package 2 (p2)	3.52 ^y _q	4.48 ^x _p	4.08 ^x _q	
Package 3 (p3)	4.48 ^y _p	4.72 ^{xy} _p	5.04 ^x _p	
LSD _{0.05} (s)		0.49		
Production of milled dry grain (ton ha ⁻¹)				
Package 1 (p1)	4.12 ^x _p	4.12 ^x _p	4.12 ^x _{pq}	0.60
Package 2 (p2)	3.27 ^y _q	4.17 ^x _p	3.80 ^x _q	
Package 3 (p3)	4.17 ^y _p	4.39 ^{xy} _p	4.69 ^x _p	
LSD _{0.05} (s)		0.46		

The numbers followed by the same letters in the same column (p, q) and the same row (x, y) mean are not significant different at LSD_{0.05} test. p1 = 100 kg ha⁻¹ Urea + 150 kg ha⁻¹

NPK + 50 kg ha⁻¹ ZA + 3.5 l ha⁻¹ liquid organic fertilizer (LOF); p2 = 50 kg ha⁻¹ Urea + 200 kg ha⁻¹ NPK + 50 kg ha⁻¹ ZA + 3 l ha⁻¹ LOF; p3 = 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ LOF.

4. Discussion

In this study, analysis of variance shows that the interaction between the water management systems with the application of fertilizer combination had a significant to a very significant effect on the character of the number of productive tillers. On the other hand, the interaction between the fertilizer combinations with the planting system had a significant to a very significant effect on the production characters of harvested and milled dry grain. The interaction of three factors had a significant to very significant effect on panicle length, number of grains per panicle, and weight of 1,000 grains parameters.

The results indicate that growth and production of the rice is greatly influenced by the availability of water and the macronutrients such as N, P and K. The availability of excess elements in the plant will help dissolve the nutrients provided so that it can be available for plant needs, the availability of water will help the plant to carry out metabolic processes and produce energy for plant growth and development. This is in line with the opinion of Sugiyanta [17], P and K nutrient requirements are highly dependent on the supply of N nutrients.

Number of productive tillers produced also very much depends water management and the composition of fertilizer used. Excess water during the growth phase will affect the number of tillers produced. In this recent study, the number of productive tillers found to be higher in the intermittent water condition while other previous studies reported a higher value of this parameter in continuous water conditions [6]. Despite this, the results of Shi et al. [18] showed that maximum growth stage of tillers, hence the highest number of tillers occurred in intermittent water management treatment compared to continuous flooding treatment. High figures found in this study could be related to the use of a different combination of fertilizer used. The number of productive tillers is the character of the yield that determines the yields of each crop produced. The number of productive tillers is greatly influenced by the physiological activity of plants. Plants with strong rooting will help the rice plant to absorb nutrients and distribute them to organs that need especially the leaves which will carry out physiological processes that produce energy for plant growth and development. This condition is strengthened by the presence of sufficient nutrients in the soil. According to Mishra and Salokhe [19], plants grown in conditions of intermittent water management are thought to have a better root system than plants in continuous flooding.

Characters that support the yield produced in rice plantations are the length of the panicle and number of grain per panicle. This parameter in rice plantations is influenced by the growing environment conditions such as the distance of plants to other plants and the availability of water and nutrients provided. Plant spacing that is too narrow will produce a short panicle length and accumulate to a small amount of grain. This will affect the amount of grain that will produce a crop. Similarly, the production of 1000 seeds and crop production is greatly influenced by the availability of sufficient water so that the needs of plants in the metabolic process to produce assimilates as an energy source for more optimal grain fill. The amount of grain per panicle is more influenced by genetic factors, namely by the length of panicle and the number of grains from each panicle [20,21]. Nevertheless, land conditions affect the number of panicles, panicle densities, efficient use of light, as well as competition among the plants in the use of water, nutrients, which ultimately affects plant growth and yield [22-24]. In this recent study, the highest grain production resulted from the use of 4:1 legowo planting system which confirmed the results of Ricardo et al., [16]. In addition, narrow planting distance will inhibit the absorption of sunlight on plants so that the amount of energy to fill the grain is low and positively correlated to the production produced [6].

5. Conclusions

From the results obtained, the conclusions can be drawn as follows:

- a) The intermittent water management system gives the best results on the number of productive tillers, length of panicle, and number of grains per panicle.
- b) The application of 50 kg ha⁻¹ Urea + 250 kg ha⁻¹ NPK + 2.5 l ha⁻¹ liquid organic fertilizers gives the best results on the number of productive tillers, weight of 1000 grains, and grain production.
- c) The 4:1 legowo planting system provides the best results on production of harvested and milled dry grain.

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