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Research Article

The influence of various fertilizing methods on two new superior varieties of rice (*Oryza sativa* L.) in monsoon agroecosystem of Sulawesi

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Abstract: A research on the adaptation test of new superior varieties of rice and fertilization methods in monsoon agroecosystem in Sulawesi has been conducted in Baramamase Village, Walenrang subdistrict, Luwu Regency, South Sulawesi from February to, May 2016. The research location is located at an altitude of 13 m above sea level. The research aimed to find out the combination of treatments of new superior varieties of rice and location-specific fertilization methods to be developed. The experiment used completely randomized block design with four repetitions. The treatments use two varieties of rice consist of Ciherang and Inpari 30 each with fertilization methods of PUTS, Katam, Laboratory test and farmer pattern (as a comparison). Research result showed that treatment combination of Ciherang variety + fertilization method (PUTS, KATAM and laboratory test) increased the yield of harvested dry rice grain (PUTS of 171%, KATAM of 108%, and laboratory test 137%) compare to those of farmer pattern of 58%. Treatment of Inpari30 variety + fertilization method using PUTS, KATAM and laboratory test increased harvested dry grain yield of 85%, 72% and 100%, respectively, compare to those of farmer pattern of 46%. Ciherang variety is a superior rice variety and adaptive to specific environment thus it could be developed in the area of Luwu Regency, South Sulawesi.

Keywords: *fertilization recommendation, KATAM, new superior variety, PUTS, rice*

Introduction

Rice (*Oryza sativa* L.) commodity is still a strategic commodity. This food crop is in the top among other food crop commodities, such as corn and soybean (Mahmud et al., 2014).It is not only a staple food for the people but also the economic source for most farmers in rural areas. In addition, it plays role in various aspects of social, economy, national politics and security (Mulyati et al., 2006; Suhendrata, 2008).

The need for rice as one of the main food sources for people of Indonesia continues to increase in rate of 2% per year along with the increase in population; in addition, the change in dietary habit from non-rice to rice increases the consumption of rice (Azwir and Ridwan, 2009). It threats the stability of economy and politics (Baharsyah et al., 1998). Therefore, an effort in increasing the productivity of rice is a high priority in agricultural development in Indonesia. On the other hand, biophysical and technical obstacles in the increasing of rice productivity require a comprehensive and holistic approach. South Sulawesi is a national food buffer area. It is the first for eastern region of Indonesia and the third for national on the production of rice after West Java and East Java.

In 2013, rice area in South Sulawesi is 613,580 ha or an average of production of 4.9 t/ha (BPS Sulawesi Selatan, 2013; Sahardi and Dewi, 2013), which is lower than the average of national production in a range of 5-6 t/ha. Factors causing the low productivity of rice are, among others: (1) the use of low quality rice variety from previous harvest with continues planting, and (2) fertilizationthat is not in accordance with the recommendation and unbalanced.

There are many new superior rice varieties produced by such research institutes as Agricultural Research and Development Agency, universities, and private research institutions, and BATAN. Those varieties, however, are unknown by local farmers regarding their superiority. In addition, fertilization conducted by farmers is not in accordance with recommendation of location specific. Las et al. (2004) stated that the contribution of superior varieties on the increase in national production is 56%. Research and Development Agency has produced 233 superior varieties consist of 144 Inbrida superior rice varieties, 35 hybrid superior rice varieties, 30 superior upland rice varieties, and 24 wet rice varieties. In 2014, Agricultural Research and Development Agency has launched new superior varieties (VUB) in irrigated land (Inpari 1 – Inpari 33), superior upland rice varieties (Inpago 4-10), and for marsh ecosystem of Inpara 1-7 varieties (Mejaya et al., 2014).

Balanced fertilizer is based on soil nutrient status and crop requirement to achieve effective and efficient fertilization. Some fertilization methods are fertilization based on paddy soil test device (PUTS) and Planting Calendar (KATAM). Both fertilization methods have their own advantages, i.e.: (1) the recommendation of N, P and K fertilizer application for rice is more precise and efficient to achieve fertilizer saving, and (2) the amount of fertilizer applied to each different classes of soil nutrient status is in accordance with crop requirement. For planting calendar (KATAM) the fertilization recommendation is based on the map of soil nutrient status in scale of 1 : 50,000 and it can be used as a base to make fertilization recommendation in sub-district level based on location specific (Sofyan et al., 2004).

Based on the above description, this research was aimed to elucidate the influence of various fertilization methods on two new superior varieties of rice (*Oryza sativa* L.) in monsoon agroecosystem of Sulawesi.

Materials and Methods

The research was conducted on farm in Baramamase village, Walenrang subdistrict, Luwu Regency, South Sulawesi in February to, May 2016. The research location located at the altitude of 13 m above sea level. The research used a completely randomized block design with four repetitions.

The treatments consisted of (A) Ciherang + fertilization method based on farmer pattern, (B) Ciherang + fertilization method based on PUTS device, (C)Ciherang + fertilization method based on planting calendar (Katam), (D) Ciherang + fertilization method based on laboratory test, (E) Inpari 30 + fertilization method based on farmer pattern, (F) Inpari 30 + fertilization method based on PUTS device, (G) Inpari 30 + fertilization method based on planting calendar (KATAM), (H) Inpari 30 + fertilization method based on laboratory test. Components of basic technology of rice applied were: (1) Ciherang and Inpari 30 varieties; (2) Petroganic fertilizer (450 g/plot)); (3) *Tegel* planting system (25 cm x 25 cm), (4) Fertilization of N, P and K was based on farmer pattern (67.5 kg Urea/ha, 108 kg SP36/ha, 48 kg KCl/ha), paddy soil test device (300 kg Urea/ha; 50 kg SP-36/ha, and 100 kg KCl/ha), planting calendar (250 kg Urea/ha, 75 kg SP36/ha, 50 kg KCl/ha) and laboratory test (164 kg Urea/ha, 209 kg SP36/ha, and 102 kg KCl/ha).

The fertilization stages applied were as follow: (a) basic fertilization was conducted at the age of 10-14 days after planting (DAP) when the rice crop started to form tiller with entire dose of SP 36 and KCl added with 30% of Urea dose, (b) the first supplementary fertilization was conducted at the age of 21-25 DAP when the crop was in the phase of active tiller with dose of 40% of Urea, (c) the second supplementary fertilization was conducted at the age of 40-45 DAP during primordial flower phase with dose of 30% of Urea. When the seedling reached the age of 17 DAS (day after seeding), integrated pest control was conducted according to the field condition.

Observations were conducted on number of tiller, growth rate per crop, number of panicle per clump, number of filled grain, harvest index, harvested dry rice grain yield, and weight of 1,000 grains. Data was analyzed statistically using Anova test and Least Significant Difference Test at the 5% level was conducted to see differences across treatments.

Results and Discussion

The suitability of climate is one of factors influencing crop growth process and yield since it is related to crop growth requirements. The suitability of agroecosystem in Baramamase Village consisted of various criteria. Those criteria were rainfall pattern classification is Monsoon with average rainfall of 2233 mm per year; daily temperature during research period is around 25.8 – 26.3^{0}C and humidity temperature of 88.1 – 90.60 C. Based on suitability criteria of rice, those criteria are within the suitable criteria. Good temperature for rice productivity is 24-26^{0}C. Whereas, the result of post-harvest soil analysis was low with criteria of N = 0.13% (low), P P_2O_5 = 9.89 ppm (low), and K = 0.26 (low). Appraisal criteria of soil analysis result was toward to medium where N = 0.21-0.5%, P_2O_5 Olsen = 11-15 ppm, and K_2O = 0.3-0.5 me/100 g.

Components of crop growth

Number of tiller (panicle) is one of determinants for rice yield and it influences the potential of rice yield. The greater the number of tiller produced by rice crop, the potential of grain yield will also increase. The more rice grain produced, the higher the production since it will increase the weight of rice grain (Iqbal and Faozi, 2010). Treatment combination of variety and fertilizer dose in all observation had significant influence on the number of tiller (Table 1).

At the age of 30-75 DAP, parameter of number of tiller was increased in every observation and fertilizer was applied as dose. At the age of 30 DAP, treatment of Ciherang variety with fertilizer dose based on PTUS (300 kg Urea/ha, 50 kg SP36/ ha, 100 kg KCl/ha) produced number of tiller of 11.50. Inpari 30 variety with fertilizer dose based on PUTS produced number of tiller of 19.30 higher than those of farmer pattern (67.5 kg Urea/ ha, 108 kg SP36/ha, 48 kg KCl/ha). N element is important in supporting crop growth as well as number of tiller (Gardner et al., 2008). On the other hand, the application of lower dose of N, P and K fertilizer caused soil unable to provide sufficient nutrients to fulfill the need of growing crop. According to Baligar et al. (2001), recovery of nutrients from inorganic fertilizers is low in most types of soil thus the potential of nutrient loss due to leaching process and evaporation is relatively high. Therefore, plant will experience nutrient deficiency and unable to grow optimally. Sufficient nutrients supply supports the growth of plant and result in higher production. Nutrient of N, P and K are primary macro nutrients needed more by plants than other nutrients. Generally, plant contains organic compounds. However, plant is unable to do metabolism with lack of nutrient to form essential substances (Tufaila et al., 2014). Whereas, in last observation at the age of 90 DAP, Ciherang variety with fertilizer dose based on PUTS produced number of tiller of 25.23 and Inpari variety with fertilizer dose based on laboratory test produced number of tiller of 22.10. Rice crops need optimal macro nutrient of NPK, especially phosphor, to increase the number of tiller (Sennang et al., 2012).

Number of productive tiller is influenced by NPK fertilization. It is known that low application of N fertilizer will reduce the number of tiller, causes dwarf in crop, and significantly different compared to the application of N based on the recommendation dose as well as for P and K (Abdulrahman et al., 2012; Bobihoe, 2007; Syahri and Somantri, 2013). In addition, sufficient water availability also influences the number of tiller. Water availability can be conducted through intermittent irrigation by alternating the condition of land within dry and flooded condition. The irrigation system will give opportunity for roots to develop better and reduces the number of unproductive tiller (unable to produce panicle or grain).

Table 1.Number of tiller at the age of 30, 45, 60, 75 and 90 days after planting (DAP)

Treatment	Number of tiller at the age of (DAP)							
	30		**45**		**60**		**75**	
Ciherang + ppk farmer pattern	11.50	a	16.35	a	18.75	a	19.10	a
Ciherang + ppk PUTS	19.20	c	25.35	c	25.50	c	25.23	b
Ciherang + ppk Katam	16.20	bc	20.75	b	22.70	bc	23.45	b
Ciherang + ppk Lab test	16.15	bc	19.50	ab	24.45	c	24.16	b
Inpari 30 + ppk farmer pattern	13.85	bc	20.20	b	21.50	b	22.00	ab
Inpari 30 + ppk PUTS	19.30	bc	20.25	b	21.67	b	22.10	ab
Inpari 30 + ppk Katam	18.55	bc	19.70	ab	20.15	ab	21.14	ab
Inpari 30 + ppk Lab test	16.15	b	17.10	ab	19.70	ab	21.90	ab
LSD 5%	3.4		3.71		2.71		3.23	
CV %	10.07		11.65		10.59		11.68	

Note: Numbers followed by the same letter in the same column indicates not significantly different at the level of α 5%. LSD: Least Significant Difference Test. CV: Coefficient of Variation, Ppk: Fertilizer; PUTS: Paddy Soil Test Device; Katam: Planting Calendar

Crop growth rate is the increase in plant biomass at certain age and area. Through its calculation, it can be known which treatment gives the best result in plant growth. Table 2 indicates that crop growth rate in vegetative phase increased with the application of optimal N, P and K dose. Observation at the age of 30-90 DAP shows significant response in all treatment combinations. Treatment of fertilizer dose based on farmer pattern resulted in the lowest growth rate per crop. It was due to the low available N in soil. Nitrogen plays role in the formation of chlorophyll. The increase in chlorophyll will increase photosynthesis process and produce more carbohydrate. The carbohydrate will be changed into organic compounds that in turn increase plant dry weight. Maximum growth rate is achieved when leaf growth is perfectly developed thus producing potential dry weight. In the beginning of crop growth, organic fertilizers were given as a starter and NPK fertilization dose was based on crop nutrient need. Therefore, plant biomass from various ages shows an increased in crop biomass at the age of 30-75 DAP. At 90 DAP, however, crop dry weight started to decrease. N element plays important role in generative phase development of a crop. P and K elements play important role in transportation process of metabolism energy (ATP and ADP) and as activator of enzymes played important role in plant biosynthesis. The need for phosphorus element in cereal crops to support optimal growth of crop is in the range of 0.3% - 0.5% of crop dry weight during vegetative growth period. K element, on the other hand, is a regulator of osmotic pressure and cell turgor, especially in the opening and closing of stomata thus influencing the transpiration pull of the crop that has direct effect on photosynthesis rate. The application of optimal dose of fertilizers along with organic fertilizers and NPK has fulfilled the need of crops so that crop could grow optimally. It can be seen from the average of CGR at every age when grow rate per crop is increasing. A research conducted by Amilia (2011) showed that the application of organic liquid fertilizers in combination with NP fertilizersshowed no significant value; however, there was a tendency of increase in growth components and crop yield of 22-34%. The application of appropriate fertilization dose of N, P and K fertilizers is effective to increase crop growth.

Table 2. Crop growth rate at the age of 30, 45, 60 and 75 days after planting (DAP)

Treatment	Crop growth rate (g m^2 /day) at the age of (DAP)			
	30-45	45-60	60-75	75-90
Ciherang + ppk farmer pattern	0.097 a	0.341 a	0.320 a	0.13 a
Ciherang + ppk PUTS	0.138 ab	0.460 b	0.572 c	0.19 ab
Ciherang + ppk Katam	0.135 ab	0.450 b	0.397 ab	0.21 b
Ciherang + ppk Lab test	0.161 b	0.492 b	0.401 ab	0.44 c
Inpari 30 + ppk farmer pattern	0.172 b	0.527 bc	0.408 ab	0.14 ab
Inpari 30 + ppk PUTS	0.265 c	0.690 d	0.435 b	0.24 b
Inpari 30 + ppk Katam	0.231 c	0.356 a	0.430 b	0.21 b
Inpari 30 + ppk Lab test	0.284 c	0.597 c	0.431 b	0.40 c
LSD 5%	0.06	0.08	0.11	0.08
CV %	21.85	10.83	17.53	21.34

Note: Numbers followed by the same letter in the same column indicates not significantly different at the level of α 5%. LSD: Least Significant Difference Test. CV: Coefficient of Variation, Ppk: Fertilizer; PUTS: Paddy Soil Test Device; Katam: Planting Calendar

Crop yield components

Data in Table 3 indicate that treatment combination of variety and fertilizer dose influenced the number of panicle. Basically, number of panicle is related to the number of tiller. The increasing number of tiller will increase the number of panicle per clump. However, not all panicles produced productive tiller. It is assumed to be related with competition in nutrient and solar energy. If there is no productive tiller, photosynthesis will result in many rice grains. In the end of observation, the highest number of panicle was gained in combination treatment of Ciherang variety with fertilizer dose based on KATAM (250 kg Urea/ha, 75 kg SP36/ha, 50 kg KCl/ha), which was 22.25 per clump. Treatment of Inpari 30 variety and fertilizer dose based on PUTS (300 kg Urea/ha, 50 kg SP36/ha, 100 kg KCl/ha) produced number of panicle of 22.13 per clump. When crop blooms, almost all photosynthesis result is allocated to the generative parts of the crop (panicle) in form of flour. In addition, mobilization of carbohydrate, protein and mineral in leaf, stem and root to panicle is occurred. Number of panicle per clump is followed by total rice grain yielded per panicle. The greater the number of panicle per clump, the higher the rice grain weight (Faozi and Wijanarko, 2010). According to Abdulrahman (2004), the least number of panicle per clump will be followed by the increase in the number of rice grain per panicle. The difference in the number of rice grain per panicle resulted by the two varieties was due to genetic factor of each variety based on the description of the varieties. The number of rice grain per panicle is influenced by genetic factor. Another influencing factor is environment. Clear weather will increase photosynthesis rate thus solar energy used to process water and acid gas is turned into food. The resulted photosynthate will be stored in stem and leaf tissues that later will be translocated to grain to the maturity level.

Table 3.Number of panicle per clump at the age of 60, 75 and 90 days after planting (DAP)

Treatment	Number of panicle per clump at the age of (DAP)					
	60		75		90	
Ciherang + ppk farmer pattern	12.75	a	14.88	a	14.97	a
Ciherang + ppk PUTS	16.25	ab	20.25	b	20.45	b
Ciherang + ppk Katam	22.25	c	22.13	b	22.25	b
Ciherang + ppk Lab test	20.38	bc	21.13	b	21.33	b
Inpari 30 + ppk farmer pattern	18.25	b	20.38	b	20.00	b
Inpari 30 + ppk PUTS	21.05	c	21.15	b	22.13	b
Inpari 30 + ppk Katam	20.10	c	20.25	b	21.50	b
Inpari 30 + ppk Lab test	19.88	bc	19.88	b	19.88	b
LSD 5%	3.53		3.75		3.94	
CV %	12.35		12.11		13.73	

Note: Numbers followed by the same letter in the same column indicates not significantly different at the level of α 5%. LSD: Least Significant Difference Test. CV: Coefficient of Variation, Ppk: Fertilizer; PUTS: Paddy Soil Test Device; Katam: Planting Calendar

The number of filled grain is one of crop productivity indicators. The higher number of filled grain yielded by a variety is an indicator for high productivity. The use of Ciherang variety with fertilizer dose based on laboratory test (167.42 kg Urea/ha, 215 kg SP36/ha, 102 kg KCl/ha) yielded filled grain of 77.40 g compared to those of farmer pattern as much as 61.82 g (Table 4). Whereas, Inpari 30 variety with fertilizer dose based on PUTS (300 kg Urea/ha, 50 kg SP36/ha, 100 kg KCl/ha) yielded the highest number of filled grain of 100.32 grains per clump compare to those of Ciherang variety with fertilizer dose based on farmer pattern (67.5 kg Urea/ha, 108 kg SP36/ha, 48 kg KCl/ha) of 61.82 grains per clump. K element is needed to transfer the photosynthesis product in crop and plays important role in increasing the number of filled grain (Abdulrahman, 2004; Fairhurst et al., 2007). The deficiency of K, on the other hand, could impede photosynthesis process that causes a decrease in rice grain (Tufaila et al., 2014). It is related to the use of well adapted superior variety.

Table 4. Filled grain, harvest index, harvested dry rice grain yield, and weight of 1000 grains

Treatment	Filled grain (g)		Harvest index		Harvested dry rice grain yield (t/ha) GKP		Weight of 1000 grain (g)
Ciherang + ppk farmer pattern	61.82	a	0.27	a	4.23	a	23.49
Ciherang + ppk PUTS	69.28	ab	0.50	c	11.45	c	25.44
Ciherang + ppk Katam	71.03	ab	0.38	b	8.83	b	26.31
Ciherang + ppk Lab test	77.40	b	0.37	b	10.03	bc	30.32
Inpari 30 + ppk farmer pattern	65.08	a	0.41	b	5.48	a	25.16
Inpari 30 + ppk PUTS	100.32	c	0.44	bc	10.13	bc	31.02
Inpari 30 + ppk Katam	91.69	c	0.42	bc	9.40	bc	31.18
Inpari 30 + ppk Lab test	99.83	c	0.38	b	10.93	bc	30.57
LSD 5%	11.88		0.09		2.53		4.42
CV (%)	10.15		15.47		19.5		10.78

Note: Numbers followed by the same letter in the same column indicates not significantly different at the level of α 5%. LSD: Least Significant Difference Test. CV: Coefficient of Variation, Ppk: Fertilizer; PUTS: Paddy Soil Test Device; Katam: Planting Calendar

The number of filled grain is influenced by genetic factor of each rice variety. The higher number of filled grain per panicle is greatly influenced by the number of productive tiller produced as well as the optimal availability of nutrient. In addition, the suitable condition of growing environment tends to stimulate initiation process of panicle into perfect stage. Therefore, the opportunity for the formation of prospective grain is higher.

The increase in the number of filled grain influences the increase in the value of harvest index. Harvest index value indicates how much of photosynthesis products are translocated to the formation of seed compare to other plant organs growth. Higher harvest index shows higher quantity of photosynthesis products and assimilate translocated to the formation of seed (Faozi and Wijanarko, 2010). Combination treatment of variety and fertilizer dose had significant influence on harvest index value. The highest harvest index value was obtained in treatment of Ciherang variety with fertilizer dose based on PUTS (300 kg Urea/ha, 50 kg SP36/ha, 100 kg KCl/ha) of 0.50. Whereas, the lowest value was obtained in combination treatment of Ciherang with fertilizer dose of 67.5 kg Urea/ha, 108 kg SP36/ha, and 48 kg KCl/ha as much as 0.27. It is assumed that in optimal condition of inorganic fertilization, nutrient supply into soil is higher thus the addition of organic fertilizers will support optimal absorption of the nutrient by crops.

The addition of optimal dose of N, P and K fertilizers based on PUTS caused the creation of ideal growing environment for rice crop development thus physiological processes can take place. The availability of nutrient in roots media will be transported into plant body to ensure the photosynthesis process forming assimilate to be translocated to seed parts (grain). The more assimilate translocated to seed the higher the dry rice grain yield. Sugito (2009) stated that the measurement of harvest index indicates the domination of vegetative growth of a crop against the generative growth since production yielded by a crop is basically the result of the work of both growth phases with different domination of balance for every type of plant, cultivation technique as well as environmental condition. The value of harvest index contributes to harvested dry rice grain yield.

Treatment of Ciherang variety with fertilizer dose based on PUTS device gave the highest harvest index of 0.50 compare to those of farm pattern of 0.27. It was due to the application of optimal dose of N, P and K fertilizers that made physiological process takes place. The availability of nutrient in roots zone will be transported to plant body so that photosynthesis process could perform well to form assimilate that will be translocated to seed part (rice grain). Research of Sennang *et al*. (2012) indicated that the index value of rice of 0.68 in treatment of organic and bio-fertilizer dose was the highest compare to other treatments. It was assumed that the application of bio fertilizers produced hormone-producing rhizobacteria thus the result of harvest index was higher than those without the application of rhizobacteria inoculation.

The result of harvested dry rice grain (t/ha) in treatment combination of Ciherang variety and fertilization dose based on farmer pattern, PUTS and KATAM indicated different influence; however, fertilization dose based on KATAM was not significantly different to fertilization dose of laboratory test.Harvested dry rice grain yield (t/ha) in treatment combination of Ciherang variety with fertilization dose based on PUTS was increased by 171% (11.45 t/ha) compare to those of farmer pattern of 63% (4.23 t/ha), KATAM 108% (8.83 t/ha) and laboratory test of 137% (10.03 t/ha). Whereas, treatment of Inpari 30 variety with fertilization dose based on PUTS, KATAM and laboratory test had no significant influence but significantly different than those of farmer pattern. Variety of Inpari 30 with fertilization dose based on laboratory test experienced an increase by 99.45% (10.93 t/ha) compared to those of farmer pattern of 49.86% (5.48 t/ha). Abdulrahman (2004) stated that N, P and K nutrients, especially N and P, are needed by crop until seed filling phase.

The appropriate dose of fertilizer will determine the amount of rice yield. The available nutrients can be used by crop to increase the intended yield. Nutrient balance should be achieved to optimize crop productivity (Ciampitti et al., 2013). The application of fertilizer dose based on recommendation of PUTS device had the highest result. It was assumed to be related to the availability of N, P and K in soil. Treatment of Inpari 30 variety with fertilization dose based on PUTS, KATAM and laboratory test were not significantly different; however, it was significantly different with farmer pattern. Treatment of Inpari 30 variety with fertilization dose based on PUTS, KATAM and laboratory test compare to those of farmer pattern showed an increase in yield by 99.45%. The application of optimal NPK dose could increase yield productivity than those of farmer pattern. According to Arafah and Najmah (2012) N, P and K fertilization could increase rice growth and yield. A research by Sirappa et al. (2007) found that the role of superior variety followed by appropriate fertilization and irrigation techniques gave contribution to the increase in rice productivity. Rice yield will increase along with the increase of fertilizer dose applied; however, it will decrease when the dose reached optimal level. Fertilization dose based on recommendation indicated that recommendation packaged produced by Balitbangtan (Agricultural Research and Development Agency), which was PUTS and KATAM, had the best result in term of harvested dry grain parameter compare to those of farmer pattern. PUTS device can be used in determining status of soil nutrient and gives recommendation on fertilizer for rice. In addition, PUTS can be done easily and relatively accurate as well as simple.

Good fertilization is by applying balanced fertilizer based on the need of crop and nutrient status of the planted land. In addition, the support from organic fertilizers could provide more balanced nutrients for plant especially nutrients containing micro nutrients that play role in supporting plant growth even in small amounts (Kanokkanjana and Garivait, 2013). Component of weight of 1000 dry rice grain is one of important indicators in identifying the potential yield of a variety. The weight of 1000 rice grains is positively correlated to the prediction of achieved productivity level. The weight of 1000 rice grain between research result and description is not relatively different. The weight of 1000 rice grain of Ciherang variety based on the description was around 27-28 g and based on research result was 23.49 – 30.32 g. Whereas, Inpari 30 variety, the weight based on description was around 27 g and based on research result was 25.16 g – 31.18 g.

Observation result on the weight of 1000 grain (g) with water level of 14% in treatment combination of Ciherang and Inpari 30 varieties with fertilization dose indicated a significant influence based on the result of statistical analysis. Variety of Inpari 30 with fertilization dose based on KATAM (164 kg Urea/ha, 215 kg SP36/ha, 103 kg KCl/ha) resulted in weight of 1000 grains of 31.18 g compared to those of Ciherang variety of 23.49-25.44 g (Table 4). The application of P fertilizer of 215 kg/ha was able to yield weight of 1000 grains of 31.18 g. Inpari 30 variety was able to yield higher weight of 1000 grains compare to Ciherang variety (Table 4). It is supported by Puspitawati (2013) that during the filling of grain phase, plant needs P as the energy source for grain filling and maturation.

The weight of 1000 grains depends on the size and shape of grain, thickness of grain hull and time of harvest. The quality of grain content is also influenced by growing environment, soil fertility, and water availability especially during panicle initiation and plant maintenance system during growth (Suriany and Arman, 2009). The application of organic materials and inorganic fertilizer (N, P, K) is an effort to fulfill nutrient needs of plant. It is aimed to improve nutrient balance in soil. Saha et al. (2013) added that the application of inorganic fertilizers combined with organic fertilizers could save the use of inorganic fertilizers, prevent environmental pollution risk, increase soil fertility as well as increase rice yield.

Conclusion

Results of research on the combination treatment between Ciherang and Inpari 30 varieties and fertilization methods using tools of PUTS, KATAM and laboratory test resulted in the same influence on the fertilization method used. Combination of Ciherang variety + fertilization methods (PUTS, KATAM and laboratory test) increased the yield of harvested dry rice grain (PUTS 171%, KATAM 108%, and laboratory test 137%) compare to those of farmer pattern (58%). Treatment of Inpari 30 variety + fertilization method using tools of PUTS, KATAM and laboratory test gave the same result as farmer pattern. Fertilization methods using tools of PUTS, KATAM and laboratory test gave an increase of 85%, 72%, and 100%, respectively, than those of farmer (46%).

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