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Effect of various doses of nitrogen based on organic fertilizer enriched with *Leucaena leucocephala* leaves on the growth and yield of three rice varieties

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Abstract
The field experiment was conducted from December 2021 to April 2022 at the organic rice field plantation belong to the organic farmers group "Al-Barokhah" located at Ketapang Village, Susukan sub-district, Semarang district (7º26'56" S and 110º33'58" E) Central Java Province, Indonesia. Meanwhile, laboratory analysis was carried out at the Ecology and Plant Production Laboratory, Department of Agriculture, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, Central Java, Indonesia (6º50'-7º10' S and 109º35'-110º50' E). The experiment was aimed to evaluate the application of organic fertilizer enriched with *Leucaena leucocephala* leaves on the growth and yield of three varieties of rice. Factorial experiment with a completely randomized design were used throughout the experiment. The first factor consisted of 3 different levels Nitrogen based organic fertilizer (OF) as D0: no added-fertilizer; D1: 188 kg N/ha, D2: 376 kg N/ha and D3: 564 kg N/ha, respectively, equivalent to 10, 20 and 30 tonnes OF/ha. The second factor was different varieties of rice V1: white rice cv. *Cisokan*, V2: black rice cv. *Arang*, and V3: red rice cv. *Mawar*. The results showed that there was differences in morphological appearance and rice yields occur among the three varieties included cv. *Cisokan*, cv. *Arang* and cv. *Mawar* on the parameters observed included plant height, number of tillers, number of panicles and yield of rice. On the basis of the results, it may be concluded that the genetic characteristics of the three varieties were dominant in determining the performance of the three varieties. However, increasing the dose of Nitrogen based on *L. leucocephala*-enriched organic fertilizer significantly increased rice yields. Further research needs to be carried out taking into account the increase in the number of *L. leucocephala* used to enrich organic fertilizer and the dose of Nitrogen so that the right dose may be found to support the performance of rice both superior and local varieties of rice.

Keywords: Black rice cv. Arang, *L. leucocephala*, organic fertilizer, red rice cv. Mawar, white rice cv. Cisokan

Introduction
Agricultural sector is one of the main contributors to high economic growth of Indonesia. However, there were many agricultural products that have not been able to meet national needs because most of the agricultural land is dominated by "narrow land". Therefore, increasing crop productivity through genetic improvement and environmental factors that affect crop productivity should be the main options that should be applied. Rice production in Indonesia currently reaches 80 million tons with the average national rice productivity level is around 5.35 tons ha^{-1} [1].

It has been widely evaluated and proven that organic matter (OM) supports the availability of soil nutrients, improves the physical, biological and chemical quality of soil OM also allows microorganisms to live and develop. Therefore, OM is expected to be able to improve the impact of implementing intensive agriculture which in the last few decades has been implemented in various countries with rice as a staple food, including Indonesia. Organic materials such as animal manure both feces and urine, leaves of leguminous plants such as *Leucaena leucocephala* leaves can be used as organic fertilizer [2, 3, 4, 5]. In addition, OM such as rotten fruit and vegetables, can be used as a medium for the growth of microorganisms and as an activator in the process of organic fertilizer [6].

Application of OM such as plant residues, green manure, manure, and compost on agricultural land may increase soil fertility. The implementation of OM as bio slurry on rice growth and production has been evaluated. Improving soil quality directly due to the application of OM was thought to affect the performance of agricultural soils in producing rice [7, 8, 9, 10, 11, 12].

Superior varieties of rice (SVR) have many advantages over local varieties of rice (LVR), and vice versa. The advantages of SVR over LVR include high production, short harvest time, resistance to pests and plant diseases and some SVRs are able to acclimatize to various land conditions such as marginal soil. Meanwhile, LVR has weaknesses compared to SVR such as longevity and low average yield (4-5 tons ha^{-1}), meanwhile SVR rice is short lived or early maturing, and high yield (7-10 tons ha^{-1}). One of the SVR is rice cv. *Cisokan* with harvesting age ranged between 110-120 DAP, height reaching 90-100 cm and number of tillers between 20-25 tillers [13].

The superiority of SVR over LVR is one of the farmers reasons in cultivating SVR compared to LVR. Even so, in some areas there were still many farmers cultivate LVR for various reasons such as LVR has been cultivated for generations, has a fluffier and tastier taste. Some of LVR such as cv. *Mentik Susu*, cv. *Pandan Wangi*, black and red rice were still cultivated and as the main choice of most farmers, especially groups of organic rice farmers [14, 15].

Rice cv. *Cisokan* is one of the SVRs which is characterized by early maturing varieties aged 100-110 days, plant heights aged at 21 and 28 DAP were 46.4 cm and 87.8 cm respectively [16], with a yield potential of 4.5-5.0 tons of dry milled grain ha^{-1}. Meanwhile, black rice cv. *Arang* and red rice cv. *Mawar* were both included as the LVR.

The performance of 18 local Acehnese red rice varieties has been evaluated and the results showed that the number of tillers varies between 19.7-30.0 DAP, plant height at the 30 DAP, 60 DAP and at harvest time ranges from 19.7-30.0 cm, 41.0-63.7 cm and 95.0-216.3 cm respectively, number of panicles 15.0-47.7, the weight of grain ranges from 41.7-102.1 g, the weight of 1000-grain ranges from 18.3-47.7 g with a potential yield of 3.0-6.8 tons ha^{-1} [17].

A study was conducted to evaluate the effect of Nitrogen besed on organic fertilizer enriched with *L. leucocephala* leaves on various rice varieties, white rice *cv. Cisokan* (SVR), black rice *cv. Arang*, and red rice *cv. Mawar* (LVR).

Materials and Methods

Experimental Site and Material Used

Field trials were carried out from December 2021 to April 2022 in the organic paddy fields belonging to the organic farmer group “Al-Barokah” located at Ketapang Village, Susukan Sub-district, Semarang District (7º26'56” S and 110º33'58 E) Central Java Province, Indonesia. Meanwhile, labpratory analysis were conducted at the Ecology and Plant Production Laboratory, Department of Agriculture, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, Central Java Province, Indonesia (6º50'-7º10' S and 109º35'-110º50' E), about 90 km from the experimental site.

All materials used such as rice seeds, effective microorganisms (EM4) and molasses were prepared. Organic fertilizer enriched with *L. leucocephala* leaves was made with a composition consisting of cow dung (85%), rice bran (5%), roasted husks (5%), *L. leucocephala* leaves (5%). All of these substances were then mixed evenly, and then a certain amount of molasses and EM4 was added to the mixture. The mixture of these ingredients was then fermented for 21 days. After the fermentation completed, samples were taken and analyzed for macro nutrients (N, P and K) and C-Organic.

The soil used was taken from organic rice fields and then brought to the laboratory and crushed into small sizes. The soil was then air-dried and sieved to 20 mesh. The samples were then analyzed to determine the content of macro nutrients such as N, P and K as well as C-organic content and pH. Organic fertilizer enriched with *L. leucocephala* leaves was added to the soil in a certain amount and mixed homogeneously. The mixture was put into an experimental plastic pot and placed in an organic rice field according to the experimental design and layout that had been determined. The media was then allowed to stand for about a week before the seeds were transplanted into it.

Procedure of Experiment

Rice seeds such as white rice (*Oryza sativa* cv. *Cisokan*), black rice (*Oryza sativa* L. cv. *Arang*), red rice (*Oryza rufipogon* cv. *Mawar*) were obtained from local farmers "Al-barokah organic rice farming group". The seeds were soaked in water at room temperature for approximately 24 hours before the seeds were germinated in organic rice paddy soil. Seeds aged 14 days were then transplanted into experimental plastic pots.

Rice growth parameters such as plant height, number of tillers and panicles were collected weekly during the growth periods. At harvest shoots, roots and grains were separated. Fresh samples were taken, weight and ovened at 70ºC for about 72 hours in order to determined the dry weight of shoots, roots, grains and the 100-grain weight. The N and C content were determined by using Kjeldahl method and Gravimetric method respectively.

Experimental Design and Data Analysis

Factorial experiment with a completely randomized design were used throughout the experiment. The first factor consisted of 3 different levels of Nitrogen as D0: no added-fertilizer; D1: 188 kgN ha^{-1}, D2: 376 kgN ha^{-1} and D3: 564 kgN ha^{-1}, respectively, equivalent to 10, 20 and 30 tonnes of organic fertilizer ha^{-1}. The second factor was different varieties of rice V1: white rice cv. *Cisokan*, V2: black rice cv. *Arang*, and V3: red rice cv. *Mawar*. Parameters observed were number of tillers and panicles, dry weight of shoots, roots and grains, and the 1000-grain weight. The obtained data were analyzed using analysis of variance and Duncan test was employed for further analysis at a significance level of 5%.

Results

Characteristics of soil and manure used in the study

The chemical properties of the initial soil and the enriched organic fertilizers used in the study were presented at Table 1. The soil texture may be categorized as a clay texture which consisting of 9.6% sand, 34.3% silt and 56.1% clay.

Table 1: Chemical properties of soil and organic fertilizer used

Nutrient	Value	Criteria *)	Methods
Soil			
Total N (%)	0.21	Moderate	Micro-Kjedahl
Available P (mg/100g)	25.1	Moderate	Olsen
Available K (mg/100g)	294.6	Very high	Morgan-Wolf
C-Organic (%)	1.63	Low	Spectrophotometry
C/N Rasio	8	Low	
pH H_2O	6.2	Slightly acidic	Glass Electrode pH Meter
pH KCl	5.1	Acidic	Glass Electrode pH Meter
Enriched-organic fertilizer			
Total N (%)	1.88	Very high	Micro-Kjedahl
Total P (%)	0.55	Very high	Spectrophotometry
Total K (%)	4.58	Very high	Spectrophotometry
C-Organic (%)	25.6	Very high	Spectrophotometry
C/N Rasio	14	Moderate	

*) [18]

Morphological performance and yield of rice

Plant height

Plant height was collected at 28, 43, 57 and 72 days after planting (DAP). There was no interaction effect of fertilizer doses and rice varieties on plant height at all time observed. There was no significant effect of fertilizer doses on plant height at 28 and 43 DAP, but there was a significant effect of fertilizer doses on plant height at 57 and 72 DAP. Meanwhile, there was a significant effect of the treatment of rice varieties on plant height at all observation times.

The data at Table 2 shows that cv. *Arang* achieved the highest plant height performance in all observations. Meanwhile, cv. *Cisokan* and *Mawar* showed the same performance at observations of 28, 56 and 70 DAP, but at observation of 42 DAP cv. *Mawar* showed a higher plant height than cv. *Cisokan*. Plant height at 28 and 42 DAP observations was not affected by various doses of organic fertilizer (10, 20 and 30 tons ha^{-1}), all three were not significantly different from the control. Meanwhile, plant height at 56 and 72 DAP observations was significantly higher than the control, but the three treatments showed the same performance. Duncan's test results were presented at Table 2.

Table 2: Plant height of rice varieties

Rice varieties	Dose of enriched organic fertilizer (ton/ha)				Average
	0	10	20	30	
	----------cm----------				
	----------28 DAP----------				
Cisokan	28.5±7.2	38,5±2.3	39,6±3.5	47,6±15.5	38.5±7.8^{b}
Arang	58.8±4.4	57.8±9.8	65.8±5.0	54.8±11.0	59.3±4.7^{a}
Mawar	36.4±3.2	39.2±3.3	40.7±14.0	49.8±104	41.5±5.8^{b}
Average	41.2±15.7	45.2±10.9	48.7±14.8	50.7±3.7	
	----------42 DAP----------				
Cisokan	33.9±22.6	54.5±2.2	51.7±7.1	62.2±17.4	50.5±11.9^{b}
Arang	70.4±15.0	78.8±4.3	79.1±4.0	61.5±16.6	72.4±8,3^{a}
Mawar	50.5±1.6	57.4±4.3	55.9±16.9	67.0±15.2	57.7±6.9^{a}
Average	51.6±18.3	63.5±13.2	62.2±14.7	63.5±3.0	
	----------56 DAP----------				
Cisokan	41.2±13.6	64.1±1.6	60.0±7.0	69.0±16.0	58.5±12.0^{b}
Arang	77.1±16.2	80.8±3.4	85.3±5.1	76.1±5.0	79.8±4.2^{a}
Mawar	55.7±3.0	64.8±4.8	65.1±15.1	78.0±12.9	65.9±9.2^{b}
Average	58.0±18.0^{b}	69.9±9.4^{a}	70.1±13.4^{a}	74.2±3.05^{a}	
	----------70 DAP----------				
Cisokan	54.8±6.7	75.1±1.0	70.2±10.5	74.1±21.8	68.5±9.4^{b}
Arang	88.9±10.9	88.9±2.7	95.8±4.0	81.0±4.1	88.7±6.0^{a}
Mawar	61.0±6.3	72.9±8.9	74.±10.7	91.1±15.4	74.9±12.4^{b}
Average	68.2±18.1^{b}	79.0±8.7^{a}	80.2±13.6^{a}	82.1±8.5^{a}	

Number of tillers

The number of tillers was collected at 28, 42, 56 and 70 DAP. There was no interaction effect of rice varieties and fertilizer doses on the number of tillers at 28, 43 and 57 DAP, but at 72 DAP there was a significant interaction effect between the two treatments on the number of tillers. Meanwhile, at all times of observation there was a significant effect of rice varieties and fertilizer doses on the number of tillers. Duncan's test results were presented at Table 3.

The number of tillers at 28 and 42 DAP observations showed that cv. *Cisokan* was significantly higher than cv. *Mawar* and cv. *Arang*, and cv. *Mawar* was higher than cv. *Arang*. In addition, the number of tillers at 56 DAP showed that cv. *Cisokan* was no significantly different to cv. *Mawar*, but both were significantly higher than the cv. *Arang*. Meanwhile the number of tillers at 30 ton ha^{-1} treatment was significantly higher than 20 ton ha^{-1}, 10 ton ha^{-1} and 0 ton ha^{-1}, respectively. The number of tillers at 70 DAP observations showed that cv. *Mawar* was significantly higher than the number of tillers of cv. *Cisokan* and cv. *Arang*, meanwhile cv. *Cisokan* was higher than cv. *Arang*. The number of tillers at 20 ton ha^{-1} treatment was significantly higher than 30 ton ha^{-1}, 10 ton ha^{-1} and 0 ton ha^{-1}. In the observation at 70 DAP, there was interaction effect of rice varieties and doses of fertilizer on the number of tillers where the highest and lowest number of tillers was achieved at cv. *Mawar*-20 ton ha^{-1} (30.7±1.2) and cv. *Arang*-0 ton ha^{-1} (10.3±2.5) treatments, respectively.

Table 3: Number of tillers of rice varieties

Rice varieties	Dose of enriched organic fertilizer (ton/ha)				Average
	0	10	20	30	
	----------Tillers----------				
	----------28 DAP----------				
Cisokan	7.7±3.1	17.0±2.5	19.0±1.7	21.0±5.8	16.3±6.0[a]
Arang	10.7±0.6	6.7±3.1	10.7±0.6	7.0±4.0	8.8±2.1[c]
Mawar	10.7±4.5	12.7±3.2	14.7±1.2	21.7±9.1	14.9±4.8[b]
Average	9.7±1.7d	12.2±5.3c	14.8±4.2b	16.8±8.2[a]	
	----------42 DAP----------				
Cisokan	10.3±3.8	24.3±5.9	26.3±4.7	29.7±14.2	22.7±8.5[a]
Arang	10.3±5.0	10.7±3.2	14.7±1.2	9.7±4.6	11.3±8.5 c
Mawar	16.0±4.4	19.0±4.0	23.7±9.3	26.7±14.2	21.3±4.8 b
Average	12.2±3.3c	18.0±6.9b	21.6±6.1[a]	22.0±10.8[a]	
	----------56 DAP----------				
Cisokan	11.3±2.9	24.7±5.5	29.3±4.2	30.0±14.7	23.8±8.7[a]
Arang	11.0±4.0	12.0±2.0	16.0±1.7	15.3±0.6	13.6±2.5 b
Mawar	16.0±4.4	19.7±4.0	26.0±8.2	33.0±12.8	23.7±7.5[a]
Average	12.8±2.8d	18.8±6.4c	23.8±6.9b	26.1±9.5[a]	
	----------70 DAP----------				
Cisokan	11.3±2.9 h	24.7±3.2 c	24.7±1.5 c	24.3±12.9c	21.3±6.6 b
Arang	10.3±2.5 i	12.0±2.6 g	15.7±2.1 e	14.7±3.5 f	13.2±2.4 c
Mawar	14.3±3.1 f	20.0±4.4 d	30.7±1.2 a	29.7±9.0 b	23.7±7.9 a
Average	12.0±2.1d	18.9±6.4c	23.7±7.5[a]	22.9±7.6b	

Number and length of panicles

Number and lenght of panicles were collected at 86 and 100 DAP, respectively. There was no interaction effect between rice varieties and doses of fertilizer treatments, as well as the single effect of rice varieties and fertilizer doses on panicle length at 86 DAP observations. Meanwhile, at the 100 DAP observation there was an effect of rice varieties and there was no effect of fertilizer doses and the interaction between the two treatments on panicle length (Table 4.).

The data at Table 4 showed that the rice varieties between cv. *Cisokan*, cv. *Arang* and cv. *Mawar* did not show a difference in the number of panicles at 86 and 100 DAP observations, respectively. Meanwhile, in the observation of 86 DAP, fertilizer doses of 30 ton ha^{-1} treatment were significantly higher than 20 ton ha^{-1}, 10 ton ha^{-1} and 0 ton ha^{-1} treatments, respectively. In contrast, in the observation of 100 DAP, the number of panicles at 30 ton ha^{-1} and 20 ton ha^{-1} treatments were not significantly different, but both were significantly higher than those at 10 ton ha^{-1} and 0 ton ha^{-1} treatments. On the other hand, panicle length at the 86 DAP observations between rice varieties (cv. *Cisokan*, cv. *Arang* and cv. *Mawar*) showed no difference in panicle length. However, at the observation of 100 DAP, panicle length of cv. *Mawar* and cv. *Arang* were not significantly different but panicle length in both varieties was significantly higher than cv. *Cisokan*.

Tabel 4: Number and length of panicles of rice varieties

Rice varieties	Dose of enriched organic fertilizer (ton/ha)				
	0	10	20	30	Average
	----------Number of panicles----------				
	----------86 DAP----------				
Cisokan	1.7±2.1	13.7±3.2	12.3±5.9	12.3±7.1	10.0±5.6
Arang	7.0±5.3	9.0±4.0	10.0±2.6	7.7±1.5	8.4±1.3
Mawar	4.3±2.3	8.0±2.0	7.0±6.2	16.7±5.1	9.0±5.3
Average	4.3±2.7 c	10.2±3.0 b	9.8±2.7 b	12.2±4.5 a	
	----------100 DAP----------				
Cisokan	8.0±6.2	20.0±3.6	15.7±4.7	17.7±7.2	15.3±5.2
Arang	9.7±2.5	10.7±2.1	14.7±1.5	11.3±4.7	11.6±2.2
Mawar	10.0±4.0	13.7±2.3	18.0±8.2	20.3±3.8	15.5±4.6
Average	9.2±1.1 c	14.8±4.8 b	16.1±1.7 a	16.4±4.6 a	
	----------Length of panicles (cm)----------				
	----------86 DAP----------				
Cisokan	51.8±44.9	92.1±0.5	85.5±8.9	83.7±30.2	78.3±18.0
Arang	93.1±17.2	100.3±3.8	101.5±4.4	87.7±15.5	95.6±6.5
Mawar	84.0±11.1	94.8±4.6	71.0±61.8	97.7±6.7	86.9±12.1
Average	76.3±21.7	95.7±4.2	86.0±15.3	89.7±7.2	
	----------100 DAP----------				
Cisokan	75.7±22.8	92.6±1.0	85.6±8.8	93.1±14.1	86.7±8.1 b
Arang	101.1±3.2	101.6±2.3	102.5±4.0	88.2±15.2	98.3±6.8 a
Mawar	92.3±0.8	99.0±7.0	102.0±10.8	98.4±5.6	98.0±4.1 a
Average	89.7±12.9	97.7±4.6	96.7±9.6	93.2±5.1	

Rice yield and weight of 1000-grain

There was no interaction effect between rice varieties and fertilization doses on rice yield. Likewise, there was no effect of rice varieties on rice yield, but there was a significant effect of fertilizer doses on rice yield. There was no interaction between the effect of rice varieties and fertilizer dose on 1000-grain weight. The treatment of rice varieties and fertilizer doses also showed no significant effect on the 1000-grain weight (Table 5.).

The data at Table 5 showed that the rice varieties between cv. *Cisokan*, cv. *Arang* and cv. *Mawar* did not show a difference in the yield of rice. Meanwhile, fertilizer doses of 30 ton ha^{-1} reached the highest yield and followed, respectively, by 20 ton ha^{-1}, 10 ton ha^{-1} and 0 ton ha^{-1}. The rice varieties between cv. *Cisokan*, cv. *Arang* and cv. *Mawar* did not show a difference in the weight of 1000-grain. In addition, fertilizer doses of 30 ton ha^{-1} reached the same result to the treatments of 20 ton ha^{-1}, 10 ton ha^{-1} and 0 ton ha^{-1}, respectively.

Tabel 5: Rice yield and 1000-grain weight of rice varieties

Rice varieties	Dose of enriched organic fertilizer (ton/ha)				
	0	**10**	**20**	**30**	**Average**
	----------Yield of rice (ton ha^{-1}) ----------				
Cisokan	2.1±1.5	7.3±0.7	5.5±2.2	6.1±5.4	5.2±2.2
Arang	4.1±1.8	1.7±1.1	2.4±1.4	1.8±2.0	2.5±1.1
Mawar	3.8±1.6	5.1±0.9	7.0±2.6	8.8±1.4	6.1±2.2
Average	$3.3±1.1^{d}$	$4.7±2.8^{c}$	$5.0±2.4^{b}$	$5.6±3.5^{a}$	
	----------Weight of 1000-grain (g)----------				
Cisokan	12±8	21±1	20±1	18±5	18±4
Arang	18±5	24±1	23±2	17±8	20±3
Mawar	20±6	23±3	21±2	23±1	22±2
Average	17±4	23±1	21±1	19±4	17±4

Discussion

Differences in morphological appearance and rice yields that occur between cv. *Cisokan*, cv. *Arang* and cv. *Mawar* on the parameters observed included plant height, number of tillers, number of panicles and yield of rice suspected due to differences in genetic traits among the three varieties which were more dominant in determining the appearance of the three varieties compared to the N dose factor applied in the form of organic fertilizer. This was in accordance with [19] who found that genetic characteristic influenced the appearance of seven hybrid rice in both qualitative and quantitative parameters. In addition, the experience of the "Al-Barokah organic rice farmer group" of Semarang, Indonesia in LVR cultivation shows that the appearance of various LVRs such as cv. *Mentik Susu*, cv. *Pandan Wangi*, and cv. *Anoman* is dominantly influenced by genetic characteristics than the use of organic fertilizers [15].

Observation of plant height at 28 DAP, showed that plant height of rice cv. *Arang* was higher than cv. *Cisokan* and cv. *Mawar*. Meanwhile, plant height of cv. *Mawar* was not significantly different from plant height of cv. *Cisokan*. In the observation of 42 DAP, plant height of cv. *Arang* was higher than cv. *Cisokan* but not significantly different on plant height of cv. *Mawar*. In the observation of 56 DAP, showed that the plant height of cv. *Arang* was higher than cv. *Cisokan* and cv. *Mawar*. On the other hand, plant height of cv. *Mawar* was not significantly different from cv. *Cisokan*. In the observation of 70 DAP, found that the plant height of cv. *Arang* was higher than cv. *Cisokan* and cv. *Mawar*, meanwhile, plant height of cv. *Mawar* was not significantly different from plant height of cv. *Cisokan*. The results were in accordance with the results of previous studies conducted by [20]. The comparison of morphological and agronomic characteristics of red rice cv. *Vermelho pequeno* and cv. *Vermelho virginia* and white rice cv. BRS *Primavera* and cv. *Caiapó* under upland management were evaluated. The results showed that red rice cv. *Vermelho virgínia* showed higher plant height and lower grain length/width ratio, whereas cv. *Vermelho pequeno* showed the lowest of the 1000-grain weight. Red rice genotypes showed higher panicle yields and there was no significant difference with white rice cultivars, regarding the percentage of fertile grain per panicle and grain yield, revealing the agronomic potential of brown rice genotypes suitable for planting in upland conditions.

Treatment of organic fertilizer enriched with *L. leucocephala* leaves at 28 and 42 DAP observations did not show significant differences in plant height between treatments. While at 56 and 70 DAP observations, plant height at 10 ton ha^{-1}, 20 ton ha^{-1} and 30 ton ha^{-1} was significantly higher than the control (0 ton ha^{-1}). However, there was no difference in plant height between treatments 10 ton ha^{-1}, 20 ton ha^{-1} and 30 ton ha^{-1}. These results were in accordance with the previous studies that compost made from rice straw and cow dung [7] and the application of water hyacinth residue [8] into soil-rice systems had an effect on the appearance of rice. However, the amount of organic matter applied was not significantly different between treatments. This may be due to the application of organic matter into the soil-plant system causing in the process of mineralization-immobilization turnover to occur and resulting in the availability of nutrients for plants to increase if the net mineralization is higher than the net immobilization or vice versa. Therefore, a certain amount of organic matter added to the system may produce a balanced status between mineralization and immobilization so that there was not show significant difference between treatments on the performance of crops. In addition, the application of various doses of organic fertilizer made from cow dung had no significant effect on the height and number tillers of rice cv. Kuriak Kusuik [21].

The data at Table 5 showed that rice varieties between cv. *Cisokan*, cv. *Arang* and cv. *Mawar* did not show a difference in the yield of rice and 1000-grain weight. Meanwhile, yield of rice at 30 ton ha^{-1} was higher than it at 0 ton ha^{-1}, 10 ton ha^{-1} and 30 ton ha^{-1} treatments, respectively. In contrast, there was no differences of the 1000-grain weight among all treatmens. A positive relationship between the appearance of organic rice and the application of organic fertilizers was reported that to achieve the potential yield of rice cv. Kuriak Kusuik about 5.50 tons ha^{-1}, amount of 13.7 tons ha^{-1} of organic fertilizer from cow manure was recommended to be applied [21]. Meanwhile, it was reported that simultaneous treatment of organic fertilizers and inorganic fertilizers and the addition of cellulolytic microbes to peat soil significantly increased the growth and yield of rice including the

number of panicles and the number of grains per panicle as well as the yield of rice compared to the treatment of either inorganic fertilizers or organic fertilizer alone even with the treatment of organic fertilizers plus cellulolytic microbes without inorganic fertilizers [22].

Conclusions

On the basis of the results, it may be concluded that the genetic characteristics of the three varieties were dominant in determining the performance of the three varieties. However, increasing the dose of Nitrogen based on *L. leucocephala*-enriched organic fertilizer significantly increased rice yields. Further research needs to be carried out taking into account the increase in the number of *L. leucocephala* used to enrich organic fertilizer and the dose of Nitrogen so that the right dose may be found to support the performance of rice both superior and local varieties of rice.

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