The Effect of Organic Stimulant and Inorganic Fertilizer on Two Rice Varieties (*Oryza sativa* L.)

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Abstract
Increased the yield of rice could be done by organic stimulant application and inorganic fertilizer, as well as the used of appropriate variety. The field experiment was aimed to study the interaction of fertilizer application and the using of variety on rice. The research was conducted at April until July 2016 in Sekarputih Hamlet, Pendem Village, Junrejo District, Batu City. This research used the Randomized Complete Block Design (RCBD) Factorial methods with 2 factors are Rice Variety (V) and Fertlizers Doses (P) with 3 replications. Cows Biourine application by dissolved 1 L biourine with 10 L water sprayed on soil and plants. EM-4 application was doing by dissolved 100 cc EM-4 with 10 L water sprayed on soil. The result of research showed that interaction of Mapan-P.05 hybrid variety (V_2) added with fertilizer doses 100 kg phonska+100 kg urea+cows biourine+EM-4 (P_6) can increase yield on rice in parameter 1000 grain weight to 15.29% against which added fertilizer doses 200 kg phonska+200 kg urea (P_1).

Keywords: Inorganic Fertilizer, Organic Stimulant, Rice, Variety.

INTRODUCTION

Rice is the crop plants which produced the rice as the staple food for Indonesian people. Population density increased 1.36% year by year assumed in 2020, total rice needed are 35.97 million ton with consume assumption is 137 kg capita^{-1}[1]. Two approached for increasing yield of rice are by used hybrid variety and improved cultivation [2]. Hybrid technology reached by heterosis utilization causing a more vigour F1 plant, which can increased to 1 ton ha^{-1}; higher than inbreed rice [3].

The balanced fertilization can stimulate the-optimization on the growth of plant [4]. Biourine are plant fertile organic matter made from cow urine and cow faeces with addition of nutrition which used microorganism [5]. Biourine applica-tion can enhanced plant height, number of leaves per plant, leaf area and leaf area index as 5.1%, 6.8%, 11.9% and 10.2% respectively, higher than without biourine application [6].

To enhance the yield and land productivity, EM-4 (*Effective Microorganisme*) can be used. It utilize microorganism technology to repair land fertility and soil physics characters [7]. Thus, this study aims to study the interaction between va-riety of rice and fertilizer to increased the growth and yield of rice.

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MATERIALS AND METHODS

The research was conducted in April to July 2016, in the Sekarputih Hamlet, Pendem Village, Junrejo District, Batu City. The area elevation is 600 m above sea level. Soil types is Andisol with N 0.13% (low), C Organic 1.22% (low), C/N ratio 10 (low), P 6.87 ppm (low), K 0.33 (low) and pH 5.7. Materials used in this study are the seeds of rice variety Ciherang and Mapan-P.05, cow biourine, EM-4, Urea (46% N), Phonska (15:15:15 NPK) and chemical pesticides. The method used was a Randomized Complete Block Design (RCBD) factorial with 2 factors repeated 3 times.

Table 1. Treatment Methods

Factor 1	V_1: Ciherangrice variety
	V_2: Mapan-P.05 rice variety
Factor 2	P_1: 200 kg Phonska+200 kg urea ha^{-1}
	P_2: Cow Biourine
	P_3: EM-4
	P_4: 100 kg Phonska+100 kg urea ha^{-1} + Cow Biourine
	P_5: 100 kg Phonska+100 kg urea ha^{-1} + EM-4
	P_6: 100 kg Phonska+100 kg urea ha^{-1} + Cow Biourine + EM-4

Land preparation was doing by ploughed with tractor. Land area was 295 m^2 made into 36 par-tition with 3 x 2 m^2 dimension. Manual planting with one seed per hole. Seedlings used rice aged 20 dap (day after planting) or has 3-4 leaves and stem was look bigger.

Inorganic Fertilizer Application

Fertilizer application was doing at 0 dap with doses of urea are ¼ doses from total doses. Next

fertilizing of urea was doing at 20, 40, 60 dap with each doses is ¼ doses of the total dose. Phonska application was done at 10 dap.

Biourine Application

Biourine made from fresh urine and feces of cows in the morning. Cows urine were putted on the bottle with dosage 1 L urine, cows feces were putted on the receptacle with dosage about 5 kg feces and then added 30 L water, stirred in earlier morning for 7 days. Biourine ready to be used when it scentless and colder than before, and there is a wax layer on the surface of biourine.

Biourine application was doing by dissolved 1 L biourine with 10 L water sprayed on soil and plants. Recommendation doses of cow's biourine are 2000 L ha^{-1} for three times: at 20 dap as 400 L ha^{-1}, at 40 dap as 600 L ha^{-1}, and at 60 dap as 1000 L ha^{-1}.

EM-4 Application

EM-4 application was doing by dissolved 100 cc EM-4 with 10 L water sprayed on soil. Recommendation doses of EM-4 are 600 L ha^{-1} giving by 34 times: at 14 dap as 100 L ha^{-1}, at 28 dap as 125 L ha^{-1}, at 42 dap as 175 L ha^{-1} and 56 dap as 200 L ha^{-1}.

Observations made on the growth and the yield of rice plants. For non-destructive observation variables include the high of the plant, number of leaves and number of tillers per plant. Destructive observations include leaf area, leaf area index, dry weight of total plant, crop growth rate and net assimilation rate. The observations were performed at 49, 63, 77 and 91 days after planting. Harvest observations include the number of panicles on the harvested crop, percentage of grain, 1000 grain weight, dry weight of total solar plants, grain weight harvest, and harvest index.

Data Analysis

Data obtained from observations then analyzed using analysis of variance (F test) with level of 5%. If there is a significant difference, then followed by HSD (Honest Significant Difference) test with a level of 5%.

RESULT AND DISCUSSION

Interaction Influences between Variety Treatment and Adding Fertilizer on Growth and Yield of Rice

There is an interaction on plant height result of Ciherang variety (V_1) respond to a higher plant height with adding fertilizer doses 100 kg phonska+100 kg urea+cow biourine+EM-4 (P_6) against cow biourine treatment (P_2). Mapan-P.05 variety (V_2) gave respons to fertilizer doses 100 kg phonska+100 kg urea+cowbiourine (P_4) and fertilizer doses 100 kg phonska+100 kg urea+cow biourine+EM-4 (P_6) by produced higher plant height than fertilizer doses 200 kg phonska+200 kg urea treatment (P_1) (Table 2). Organic matter combination and inorganic fertilizer caused plant growth and yield more higher to 91% for Ciherang variety and increased 78% for hybrid variety than control treatment [8]. Yield of Mapan-P.05 hybrid variety higher than Ciherang variety are no needed higher measurement and frequency, means higher fertilizer efficiency on hybrid variety [9].

There is an interaction on dry weight total plant result Mapan-P.05 variety (V_2) respons to fertilizer application with doses 100 kg phonska+100 kg urea+cow biourine+EM-4 (P_6) produce dry weight total plant higher than EM-4 treatment (P_3) (Table 3). Mapan-P.05 variety if giving organic stimulant and inorganic fertilizer, can produced higher dry weight total plant than just giving EM-4 only. Just Mapan-P.05 hybrid variety from 13 other hybrid variety resulted higher dry weight total plant consistently against which Ciherang variety on some locations at wet or dry season [9].

There is an interaction on 1000 grain weight parameter on Mapan-P.05 variety (V_2) giving respons to fertilization doses 100 kg phonska+100 kg urea+cow biourine+EM-4 (P_6) produced higher 1000 grain weight than fertilizer doses 200 kg phonska+200 kg urea (P_1) and 100 kg phonska+100 kg urea+EM-4 treatment (P_5) (Table 4). Total 1000 grain weight influences by environment factors, especially at grain maturity phase. Total 1000 grain weight is the number of biomass consist on grain [10]. Mapan-P.05 variety produce higher 1000 grain weight when added organic stimulant like cow biourine and EM-4, recommend to obtained higher yield of hybrid rice needed to combine inorganic fertilizer (75%) with organic fertilizer (25%) on spacing at 20 cm x 20 cm [11]. Combination of inorganic fertilizer and organic fertilizer can stablished the sustainability of growth, yield and nutrient uptake hybrid rice [12].

Effect of Variety Treatment to Growth and Yield of Rice

In the yield of rice, Mapan-P.05 variety produced grain harvest weight and harvest index higher than Ciherang variety (V_1) (Table 5). Grain harvest weight from this research on Ciherang variety reach 9.54 ton ha^{-1}, whereas on previous study, Ciherang variety resulted higher to 9.90

ton ha^{-1}[9]. For Mapan-P.05 variety in this research, the grain harvest weight reached 13.30 ton ha^{-1}, while previous study for Mapan-P.05 hibryd variety just resulted 10.52 ton ha^{-1} [9]. Thus it can be said that result of this research were higher in hybrid variety Mapan-P.05 than previous study [9].

Effect of Organic Stimulant and Inorganic Fertilizer on Growth and Yield of Rice

Addition of doses fertilizer 100 kg phonska+100 kg urea+cows biourine (P$_4$) resulted higher amount of penicles than EM-4 treatment (P$_3$) (Table 5). Organic matter such as EM-4 can not produce maximal when apply without adding inorganic fertilizer. The organic matter in the area of study has very low nutrient soil thus less supported to the growth and yield of rice. However, we can repair the physical and biological characteristics of the soil properties [13].

Giving fertilizer with doses 100 kg phonska+100 kg urea+cows biourine (P$_4$) resulted higher grain harvest weight than cows biourine treatment (P$_2$) (Table 5). Combination of biourine concentration 1 L urine + 5 kg feces + 15 L water ha^{-1} and inorganic fertilizer with doses 50 kg N, 12.5 kg P$_2$O$_5$, 17.5 kg K$_2$O resulting amount of tuber on shallot increased to 27.33% than without biourine concentration and inorganic fertilizer doses [4]. Giving organic fertilizer 50% and inorganic fertilizer 50% produced optimal growth and yield on rice [14]. Organic fertilizer can reduce the inorganic fertilizer uses as 25% on rice field, by not decreasing the growth and yield on rice. It also can repairs the physical, biological and chemical soil properties [15].

Table 2. Average Plant Height per plant on rice result due to interaction Variety Different and Adding Fertilizer at 35 DAP

Rice Variety	Plant Height (cm)					
	P$_1$	P$_2$	P$_3$	P$_4$	P$_5$	P$_6$
Ciherang (V$_1$)	40.83 abcd	37.33 a	38.91 ab	38.91 ab	39.58 abc	44.92 bcde
Mapan-P.05 (V$_2$)	43.25 abcd	48 de	46.75 cde	51.25 e	47.67 de	50.83 e
HSD 5%	7.27					
CV (%)	5.56					

Notes: Numbers with same letters are not significantly different at 5% level using HSD test, CV= Coefficient of Variation
P$_1$ = 200 kg Phonska+200 kg urea   P$_4$ = 100 kg Phonska+100 kg urea + Cow Biourine
P$_2$ = Cow Biourine   P$_5$ = 100 kg Phonska+100 kg urea + EM-4
P$_3$ = EM-4   P$_6$ = 100 kg Phonska+100 kg urea + Cow Biourine + EM-4

Table 3. Average Dry Weight Total Plant per plant on rice result due to Variety Different and Adding Fertilizer at 91 DAP

Rice Variety	Dry Weight Total Plant (g)					
	P$_1$	P$_2$	P$_3$	P$_4$	P$_5$	P$_6$
Ciherang (V$_1$)	121.23 abc	102.78 a	108.51 ab	126.08 abcd	137.23 abcde	152.29 abcde
Mapan-P.05 (V$_2$)	133.08 abcde	177.44 de	116.38 abc	166.65 cde	154.57 bcde	179.81 e
HSD 5%	51.37					
CV (%)	12.38					

Notes: Numbers with same letters are not significantly different at 5% level using HSD test, CV= Coefficient of Variation
P$_1$ = 200 kg Phonska+200 kg urea   P$_4$ = 100 kg Phonska+100 kg urea + Cow Biourine
P$_2$ = Cow Biourine   P$_5$ = 100 kg Phonska+100 kg urea + EM-4
P$_3$ = EM-4   P$_6$ = 100 kg Phonska+100 kg urea + Cow Biourine + EM-4

Table 4. Average 1000 grain Weight per plant on rice result due to Variety Different and Adding Fertilizer at 115 DAP

Rice Variety	1000 Grain Weight (g)					
	P$_1$	P$_2$	P$_3$	P$_4$	P$_5$	P$_6$
Ciherang (V$_1$)	27.52 ab	27.14 a	26.68 abc	27.67 abc	29.12 abc	28.42 abc
Mapan-P.05 (V$_2$)	29.82 abcd	33.05 de	31.15 bcde	31.40 cde	29.58 abcd	34.38 e
HSD 5%	3.87					
CV (%)	4.39					

Notes: Numbers with same letters are not significantly different at 5% level using HSD test, CV= Coefficient of Variation
P$_1$ = 200 kg Phonska+200 kg urea   P$_4$ = 100 kg Phonska+100 kg urea + Cow Biourine
P$_2$ = Cow Biourine   P$_5$ = 100 kg Phonska+100 kg urea + EM-4
P$_3$ = EM-4   P$_6$ = 100 kg Phonska+100 kg urea + Cow Biourine + EM-4

Soil conditions

C-Organic and N-total increased at all fertilizer treatment (Table 6). Higher C-Organic available on treatment fertilizer doses 100 kg phonska+100 kg urea+cows biourine (P$_4$) increased to 37.70% compared with before treatment. Higher N-total available on treatment fertilizer doses 100 kg phonska+100 kg urea+cows biourine+EM-

4 (P_6) increased 61.54% compared with before treatment. It is caused by the addition of N fertilizer with high dosages which provide higher N-total on soil [16].

Table 5. Average Yield of Rice for each treatment Variety Different and Adding Fertilizer

Treatments	Average Yield of Rice			
	Amount of Panicles	Grain Percentage (%)	Grain Harvest Weight (t ha^{-1})	Harvest Index (%)
Rice Variety				
Ciherang (V_1)	17.1	83.5	9.54 a	27.83 a
Mapan-P.05 (V_2)	17.08	79.8	13.30 b	33.17 b
HSD 5%	ns	ns	2.38	4.74
Adding Fertilizer (ha^{-1})				
200 kg Phonska+200 kg urea (P_1)	17.94 ab	85.31	12.51 ab	29.5
Cows Biourine (P_2)	15.44 ab	78.98	8.92 a	27.45
EM-4 (P_3)	14.36 a	83.13	10.01 ab	29.29
100 kg Phonska+100 kg urea + Cows Biourine (P_4)	19.81 b	83.76	13.12 b	32.84
100 kg Phonska+100 kg urea + EM-4 (P_5)	17.47 ab	75.11	12.46 ab	29.6
100 kg Phonska+100 kg urea + Cows Biourine + EM-4 (P_6)	17.53 ab	83.6	11.51 ab	34.33
HSD 5%	4.52	ns	4.12	tn
CV (%)	12.58	7.26	17.21	12.83

Note : Numeral within columns followed by same letters are not significantly different at 5% level using HSD test; ns:non significant; CV=Coeffiecient of Variation

Table 6. Soil Analysis Before and After Treatments

Parameters	pH	C-Organic (%)	N-Total (%)	C/N	P(mg kg^{-1})	K(me 100 g^{-1})
Before treatment	5.7	1.22	0.13	10	6.87	0.33
After treatment						
V_1P_1	5.3	1.35	0.17	8	3.03	0.23
V_1P_2	5.3	1.36	0.14	9	7.63	0.35
V_1P_3	5.4	1.36	0.15	9	1.53	0.42
V_1P_4	5.9	1.68	0.17	10	11.33	0.41
V_1P_5	5.5	1.27	0.15	8	3.81	0.29
V_1P_6	5.4	1.53	0.16	10	2.29	0.44
V_2P_1	5.6	1.28	0.15	8	1.53	0.22
V_2P_2	5.6	1.44	0.16	9	2.28	0.41
V_2P_3	5.9	1.34	0.17	8	1.51	0.43
V_2P_4	5.6	1.27	0.15	8	1.52	0.32
V_2P_5	6.0	1.51	0.17	9	2.27	0.51
V_2P_6	5.6	1.66	0.21	8	3.14	0.36

CONCLUSION

There is an interaction on Mapan-P.05 hybrid variety with fertilizer doses 100 kg phonska+100 kg urea+cows biourine+EM-4 on yield parameters are 1000 grain weight with percentage of increase as 15.29% compare with fertilizer doses 200 kg phonska+200 kg urea. Mapan-P.05 hybrid variety gives the significant influences on grain harvest weight and harvest index; each increase percentage as 39.41% and 27.83% compared with Ciherang variety. Fertilizer doses 100 kg phonska+100 kg urea+cows biourine increasing amount of panicles and grain harvest weight with increase percentage as 37.95% and 47.08% compare with EM-4 and cows biourine treatment.

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