RESPONS OF THREE VARIETIES AT UPLAND RICE (*Oryza sativa* L.) TO THE RATIO OF VERMICOMPOST AND CHEMICAL FERTILIZERS

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Abstract. *Rice is the staple food for most of the world's population. Increasing rice production still very depends on the use of chemical fertilizers very much. The use of organic fertilizer is needed to replace the role of chemical fertilizers, preserving the environment and for sustainable agriculture. The research used a randomized block design with two factors. The first factor is about varieties (V), which include Situ Patenggang (V1), Situ Bagendit (V2), and Limboto (V3). The second factor is the ratio of vermicompost and chemical fertilizers, which include : vermicompost 100% (K1), vermicompost 75% + chemical fertilizer 25% (K2), vermicompost 50% + chemical fertilizer 50% (K3), vermicompost 25% + chemical fertilizer 75% (K4) and chemical fertilizers 100% (K5). The result obtained that varieties significantly affected the parameters of plant height 8 weeks after planting, the number of tillers are 8 weeks after planting, the number of productive tillers, length of panicle, the number of grains per hill, number of grains contain per cluster, the percentage of grains contain per clump, and 1000 grain weight. The ratio of vermicompost and chemical fertilizers significantly affected the parameters of plant height 8 week after planting, the number of tiller week after planting, number of productive tillers, number of grains per hill, percentage of grains contain per clump, and 1000 grain weight. The interaction between varieties and the ratio of vermicompost and chemical fertilizers only affect the parameters of grain content per hill and the percentage of grain contains per clump. The best variety is Situ Patenggang and the ratio of vermicompost and chemical fertilizers are vermicompost 75% + 25% chemical fertilizers.*

Keywords: Upland rice, Varieties, vermicompost, chemical fertilizers.

1. Introduction

As a food, rice and other staple food is a source for carbohydrates and fats. Digestion of carbohydrates produce energy. Compared with other food, rice is the most complete food and nutritional content is very high in carbohydrates, fat and protein. It is makes rice as the most important food crop in Indonesia and led to the need for rice growing. Rice production in 2009 amounted to 64.33 million tons of dry milled grain, increased by 4 million tons (6.64%) from 2008. 2010 production was estimated at 64.9 million tons of dry milled grain, which showed an increase of 568.37 thousand tonnes (0.88%) (www.bps.com, 2010).

To increase national rice production need rehabilitation and construction of new irrigation, and it includes intensification of agriculture, the way is with rice cultivation system of rice intensification (SRI). SRI system more efficient water use and farmers' income increased because can saving seeds, lower cost and higher production. Although only one seed are planted but the root is longer and can produced more tillers. The recommended fertilizer on SRI is organic fertilizer, because it can improving soil structure, and saving the water (www.pu.go.id, 2010).

The use of chemical fertilizers continuously cause environmental pollution, reduced land productivity, the occurrence of residues of chemicals that are harmful to health. Organic fertilizer is a solution to sustainable agriculture. Organic fertilizers is expected to replace chemical fertilizers.

Vermicompost are organic fertilizer, that contains microbes, phytohormone and the elements necessary for plant growth. Vermicompost has several advantages, it can improve the physical, biological and chemical properties of the soil (Prasetyo, 2010). Earthworms can eat the organic material size within of the body in 24 hours. Earthworms able to describe the organic waste 2 to 5 times faster than spoilage microorganisms. Organic material described her weight may shrink 40-60%. Organic fertilizer produced from the process of composting using earthworms microorganisms is called vermicompost (Nick, 2010).

Based on the description above studies will be needed to determine the extent of the use of organic fertilizers can replace chemical fertilizer in upland rice cultivation efforts.

2. Materials And Methods

The research was conducted in the village Marindal of Medan Johor district with a height of 25 m above sea level. The research was conducted in November 2010 to March 2011.

Materials used in this study include upland rice seed varieties Situ Patenggang, Situ Bagendit and Limboto, chemical fertilizers (NPK), vermicompost with raw material mixture empty fruit bunches of oil palm, rice straw and grass (2: 1: 1), organic pesticides (dippel nordox 56 wp and wp), top soil and nets to protect rice from birds. This experiment used randomized block design (RAK) factorial with two factors, namely Factor I: upland rice varieties comprising: Situ Patenggang, Situ Bagendit, Limboto and Factor II: vermicompost with 5 level; vermicompost 100% (8 tonnes / ha), kascing 75% (6 tonnes / ha) + 25% chemical fertilizer (50, 18.75, 25 kg / ha), vermicompost 50% (4 tonnes / ha) + 50% of chemical fertilizers (100, 37.5, 50 kg / ha), vermicompost 25% (2 tonnes / ha) + 75% of chemical fertilizers (150, 56.25, 75 kg / ha), 100% chemical fertilizer (200, 75, 100 kg / ha). To obtain 15 combinations of treatments with 3 replications, plot the number of all 45 plots, plot length 100 cm, width 100 cm plot, the distance between blocks of 50 cm, distance between plots of 30 cm, 4 polybag / plot, 3 samples / plot, so that the number whole plant 180 plants.

Land research first cleared of weeds and the remnants of plant roots, then flattened using a hoe. After the area flattened made 3 blocks with 50 cm spacing between blocks, each block is divided into 15 plots, with distances between 30 cm and plot size 100 cm x 100 cm. Planting medium used in this study is top soil. Before planting, the soil first cleaned of trash and remnants of the roots. Then the soil included in the polybag and added vermicompost accordance with the treatment.

Before planting the seeds soaked in water for 60 minutes. Then planted in polybags of one seed per polybag as deep as two centimeters. Fertilization vermicompost done before planting with mixed manner on the top of the planting medium with the appropriate dose of treatment. TSP and KCL fertilizer is given at 2 weeks after planting (WAP) with appropriate doses of treatment, whereas urea is administered twice at 2 and 8 WAP, respectively - half of each treatment dose.

Maintenance includes watering plants adapted to field conditions. Weeding is done once a month. Control of pests and diseases carried by spraying organic pesticide (insecticide and fungicide). Harvesting is done when the grain is ripe or has reached the stage with characteristic morphological old tawny-colored leaves or 33-36 days after flowering.

Observation variables include plant height, number of tillers per plant, number of productive tillers per plant, panicle length per plant, grain number per hill, number of grain containing a clump, the percentage of grain containing per hill, weight of 1000 grains, dry grain production per clump and production dry grain per hectare. Research data were analyzed using analysis of variance. If the results of analysis of variance showed significant effect, then continued with the different test average based on Duncan's Multiple Range Test (DMRT) at 5% level (Steel and Torrie, 1989).

3. Result And Discussion

3.1 Growth of some varieties of upland rice in comparison between vermicompost and chemical fertilizers

Varieties produce tangible effects on all parameters of growth of upland rice. Comparison between vermicompost and chemical fertilizer also affects the growth of upland rice. While the interaction between varieties and comparison between vermicompost and chemical fertilizers had no effect on the growth of upland rice (Table 1).

Table 1. Rice growth (plant height, number of tillers and productive tillers) aged 8 weeks after planting on varieties and comparison between vermicompost and chemical fertilizers

Treatment	Plant Height (cm)	Number of Tillers (stems)	Productive Tillers (stems)
Varieties			
V1 (Situ Patenggang)	63,89 a	12,20 b	10,24 b
V2 (Situ Bagendit)	50,81 b	21,90 a	17,56 a
V3 (Limboto)	66,28 a	11,07 b	10,86 b
vermicompost :Chemical Fertilizers			
K1 (Kascing 100%)	56,83 c	10,17 c	8,96 c
K2 (Vermicompost 75% + Chemical 25%)	59,87 b	13,28 bc	12,55 b
K3 (Vermicompost 50% + Chemical 50%)	60,94 b	16,67 ab	14,51 a
K4 (Vermicompost 25% + Chemical 75%)	59,18 bc	16,22 ab	13,74 ab
K5 (Chemical 100%)	64,82 a	17,28 a	14,68 a
Interaksi V x K			
V1K1	60,00	7,50	7,56
V1K2	67,13	9,33	9,44
V1K3	63,45	11,50	11,66
V1K4	62,43	14,33	11,22
V1K5	66,41	13,33	11,33
V2K1	48,35	15,00	12,00
V2K2	50,33	19,50	17,22
V2K3	51,81	28,00	20,44
V2K4	47,86	22,17	18,55
V2K5	55,70	24,83	19,61
V3K1	62,13	8,00	7,33
V3K2	62,13	11,00	10,99
V3K3	67,55	10,50	11,44
V3K4	67,25	12,67	11,44
V3K5	72,33	13,67	13,11

Note: the numbers followed by different letters in same column significantly different according to Duncan test at level 5%

Variety V2 (Situ Bagendit) provide plant growth is lower than the treatment of V1 (Situ Patenggang) and V3 (Limboto). But V2 varieties produce tillers much higher than the treatment of V1 and V3. Observational data and analysis of variance of productive tillers and panicle length also showed that the varieties have real impact on rice growth. Differences between the growth of upland rice varieties are thought to be caused by differences in genetic characters carried by the individual - each variety. Between varieties of one another there are always differences, although the difference was small. The apparent differences between the varieties is caused by differences in the nature varieties (Siregar, 1981).

Increased plant growth is strongly influenced by the content and availability of nutrients in the soil, such as nitrogen, phosphorus and potassium. Nitrogen is useful to promote growth and stimulate bud growth, phosphorus is useful for stimulating root growth and seedling establishment. In the treatment of K5 (100% chemical fertilizer) showed an increase better plant growth, on the plant height and number of tillers parameters compared with other treatments. This is because treatment K5 contain more nutrients than other treatments. The availability of nutrients for plant growth will

lead to more optimal plant growth. The provision of fertilizer to the soil will increase the nutrients in the soil that will be absorbed by plant roots to grow.

Variety V1 (Situ Patenggang) generating plants with the longest panicle compared to varieties of 19.24 cm (Table 2) this is due to the different sensitivity factors of each variety environmental factors. At the same environment each variety can show different respo depending on the nature of genetics. Each species in the community shows a certain toleran habitats, both physical, chemical or biological. Changes in these physical conditions can changes in species phenotypes. At some stage in their life cycle and in particular the conditions, each species or variety has a temperature range of minimum, optimum and ma are different (Salisbury and Ross, 1992).

Table 2. Components of rice production on varieties and comparison between vermicompost chemical fertilizers.

Treatment	Tassel length (cm)	Number of Grain per Clumps (grain)	Grain number per Clumps Contains (item)	Percentage of Total Grain Containing (%)
Varieties				
V1 (Situ Patenggang)	19,24 a	956,24 a	546,13 ab	55,71 a
V2 (Situ Bagendit)	17,33 b	1141,18 a	551,42 a	48,70 ab
V3 (Limboto)	18,57 a	1072,99 a	413,94 bc	40,09 b
Vermicompost: ChemicalFertilizers				
K1 (vermicompost 100%)	18,15	699,61 c	467,64	69,39 a
K2 (vermicompost 75% + Chemical 25%)	18,93	1032,48 b	581,85	55,32 b
K3 (Vermicompost 50% + Chemical 50%)	17,43	1293,26 a	524,85	42,06 c
K4 (Vermicompost 25% + Chemical 75%)	18,92	1089,65 b	497,68	37,58 c
K5 (Chemical 100%)	18,97	1169,02 ab	447,13	36,49 c
Interaction V x K				
V1K1	17,50	634,88	422,44 fgh	69,77 a
V1K2	20,84	1098,43	751,43 a	68,34 a
V1K3	18,71	1132,66	691,77 ab	62,20 a
V1K4	19,74	744,83	380,00 fgh	37,00 cd
V1K5	19,41	1170,89	485,00 cdef	41,23 bcd
V2K1	18,39	790,39	532,16 cde	67,77 a
V2K2	17,24	1030,11	494,67 cdef	46,83 bc
V2K3	17,14	1485,44	597,11 bc	39,90 cd
V2K4	18,02	1270,55	571,44 bcd	43,97 bc
V2K5	17,35	1129,39	561,72 bcde	45,03 bc
V3K1	18,57	673,55	448,33 defg	70,62 a
V3K2	18,70	968,89	499,44 cdef	50,79 b
V3K3	16.45	1261,66	285,66 h	24,07 e
V3K4	18,99	1254,05	541,61 cde	31,77 de
V3K5	20.14	1206,77	294,66 h	23,20 e

Note: the numbers followed by different letters in same column significantly different according to Duncan 5%

3.2 Component production and the production of several varieties of up land comparation between vermicompost and chemical fertilizers

Varieties produce real effects on production parameters, the number of grain per clump grain containing a clump, the percentage of grain containing a clump and 1000 grain whereas no significant effect on production parameters and production per clump and per Vermicompost treatment also significantly affect the parameters of upland rice production in the parameter number of grain per clump, the percentage of grain containing a clump grain weight, whereas no significant effect on the parameter contains the number of grain yield per clump and production per hectare. The interaction between varieties and between kascing and chemical fertilizer only affects the amount of grain per clump and percentage of the amount of grain containing per clump.

K3 treatment (50% vermicompost + 50% chemical fertilizer) produce more grans per clump other treatment that is 1293.65, grains (Table 2) productive tillers produced K3 treatment quite a lot compared with other treatments. This is because good comparison between chemical fertilizers. Organic matter content in kascing can improve physical and

properties of the soil. Condition of the soil structure becomes more crumbs and loose, so that soil aeration and drainage better. This condition causes the roots to work more optimally so that it can absorb the nutrients provided by chemical fertilizers that are useful for the formation of the rice grain. Compost or organic materials can improve the productivity of soil physical, chemical and biological soil.

On the parameter contains the number of grain per clump treatment comparison between vermicompost and chemical fertilizers K2 produces the largest number of 581.85 grains (Table 3), although the largest amount of grain produced K3 treatment, but more vermicompost on K2 treatment produces more organic. Vermicompost are organic materials that contain organic acids that can improve soil chemical properties. Besides needing nutrients, to form the grain rice also requires a variety of enzymes and hormones. Hormones are organic compounds that are synthesized at the plants and then transferred to other parts of the very low concentration (Salisbury and Ross, 1992) hormones have an important role in the process of metabolism and catabolism of plants that help transport the organic material from roots to the leaf to process of photosynthesis. Vermicompost and other organic materials containing a variety of hormones and enzymes that are needed to assist the process of plant metabolism in the body of the plant. Overhaul of organic material will produce organic acids such as humic and fulvic acids which important to caught Fe and Al (Mezuan, et al, 2002). This makes the chemical properties of soil is better so that more optimal absorption by the roots. The roots can absorb the elements nitrogen, phosphorus and potassium are administered through chemical fertilizers. Protein component in the organs of rice plants is particularly phosfor nutrients are absorbed during the vegetative growth which then translocated vegetative tissue to seeds after flowering process for filling seeds (Mezuan, et al, 2002). Translocation of substances which cause the charging rate better seed in the K2 treatment is also better.

Table 3. Production of rice on varieties and comparison between vermicompost and chemical fertilizers.

Treatment	Production per Clumps (g)	Production per Hectare (tonnes)
Varieties		
V1 (Situ Patenggang)	12,60	1,13
V2 (Situ Bagendit)	11,84	1,06
V3 (Limboto)	10,51	0,88
Vermicompost : Chemical Fertilizers		
K1 (Vermicompost 100%)	11,65	1,04
K2 (Vermicompost 75% + Chemical 25%)	14,02	1,26
K3 (Vermicompost 50% + Chemical 50%)	11,78	1,05
K4 (Vermicompost 25% + Chemical 75%)	10,04	0,90
K5 (Chemical 100%)	10,76	0,86
Interaction V x K		
V1K1	10,07	0,90
V1K2	17,51	1,57
V1K3	15,85	1,42
V1K4	8,94	0,80
V1K5	10,61	0,95
V2K1	12,80	1,15
V2K2	11,10	1,00
V2K3	12,05	1,08
V2K4	11,84	1,06
V2K5	11,42	1,02
V3K1	12,08	1,08
V3K2	13,45	1,20
V3K3	7,44	0,64
V3K4	9,33	0,84
V3K5	10,24	0,62

On the parameter contains a percentage of the amount of grain per hill showed that the treatment K1 (vermicompost 100%) percentage of the amount of grain produced per clump which contains the largest is 69.39% (Table 3). Number vermicompost which contains more organic material that much more. Organic material is food for a variety of soil microorganisms. Soil microorganisms

able to describe the organic material so easily absorbed by plants and facilitate the transport of nutrients and water (Sari, 2011).

On production parameters production per clump per hectare both treatments showed no significant effect, but the treatment produced the highest production of K2 (vermicompost 75% + 25% chemical fertilizers), this is because the amount of grain produced containing these treatments are also more than the treatment other. Weather is the most important factor that can regulate the water needs of plants, water loss due to transpiration and evaporation from the soil. Plants that are high not always indicate a good production. Plants are shorter as a whole can receive more sunlight than in higher plants. Higher plants have a crop canopy to the bottom of the cause not all plant parts can be exposed to the sun (Siregar, 1981).

K5 treatment (100% chemical fertilizer) did not show a prominent production may be due to biological properties of soil that is not good because there is little organic material in it. This resulted in rice roots is not optimal for a given absorbing nutrients, organic material shortages also led to weak ground for water absorption. This suggests that in addition to genetic, technical culture and environmental factors also determine the production plant. Treatment comparisons between vermicompost and chemical fertilizer also showed that the use of chemical fertilizers can be substituted by vermicompost fertilizer. This proves that the use of organic fertilizers can reduce farmers' dependence on chemical fertilizers that cost will be relatively more expensive compared to organic fertilizers. Organic rice production under the yield potential of hybrid rice due to the possibility of organically grown less suitable for breeding laboratories acquired through the process. Although it is a high yielding varieties resistant to pests and diseases, but generally hybrid rice can only grow and produce optimal when accompanied by an application of chemical fertilizers in large quantities. Without chemical fertilizer, rice will not grow fast and produce optimal. Suitable rice varieties grown organically or just a kind of natural varieties. In order to produce the optimal type of rice does not require the use of chemical fertilizers in large quantities.

4. Conclusion

The best varieties is Situ Patenggang and comparison between vermicompost and chemical fertilizers are most suitable is 75% vermicompost + 25% chemical fertilizers with grain yield 1.57 t / ha..

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