GRANT OF ORGANIC FERTILIZER PLUS AT TITONIA WITH MICRO FERTILIZER TO IMPROVE METHODS OF SRI

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Abstract

The experiments were conducted in 2015 in the fields of farmers in order Inseptisol two location in Padang, Koto Panjang Ikur Koto, Koto Tangah and Koto Tingga Kuranji. Purpose of the experiment to establish the ingredients of organic fertilizer plus titonia artificial fertilization (POTP) with micro fertilizar Zn and Mn in order to reduce the 50% in rice results about 7 tons. ha^{-1}. The experiments were conducted at two locations with Randomized Block Design with 6 treatments and 3 replications. The treatment A = POTP + 3,0 kg Mn/ha + 0 kg Zn/ha, B = POTP + 3,0 kg Mn + 3,0 kg Zn/ha, C = POTP + 4,5 kg Mn + 6,0 kg Zn, D= POTP + 4,5 kg Mn/ha + 9,0 kg Zn/ha, E = only POTP without artificial fertilizers and F = 100% syntethic fertilizers alone. IR42 varieties grown two location in Padang. The experimental results show that the composition of POTP plus Zn and Mn micro fertilizer to reduce the application of artificial fertilizers by 50% is increase quantity of pedicle of paddy until 45 days after planting from mean 20 pedicle (conventional) to 54 pedicle (SRI). Yield to paddy increase to 7 tons.ha^{-1}.
Keywords: POTP, micro fertilizer, paddy, SRI

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PRELIMINARY

One cause smoothing increasing rice production is due to the disruption of the balance of nutrients in the soil due to the use of synthetic fertilizers are limited to nitrogen (N), phosphorus (P) and potassium (K) only. In the case, 13 kinds of plants need nutrients from the soil (Nyakpa *et al*., 1988). Natural fertilizer / organic, contain all the nutrients the plants, not only the N, P and K, but also calsium (Ca), magnesium (Mg) and sulfur (S), as well as elements Micro which include iron (Fe), zinc (Zn), manganese (Mn), copper (Cu), boron (B), chlorine (Cl), and molybdenum (Mo), but has long been abandoned by farmers. Besides, the problem of nutrient that is not balanced on the use of synthetic fertilizers, synthetic fertilizer prices are more expensive, is also a major problem for farmers. Therefore, the use of synthetic fertilizers should be reduced without lowering production. One way is the use of organic fertilizer (Soil Reseach Institute, 2006).

In this connection, Nurhajati Hakim *et al*., (2009, 2010, and 2011) tried to solve the problem by gathering and using Titonia organic fertilizer plus (POTP), which is an organic fertilizer made with raw materials Titonia (*Tithonia diversifolia*), plus rice straw and / or manure, lime, fertilizer P, and microorganisms (biological agents). Basic usage is because Titonia POTP contains macro nutrients (N, P, K, Ca, Mg and S) are relatively high. Nurhajati Hakim (2002), Nurhajati Hakim and Agustian (2003) reported that the average nutrient content Titonia located in West Sumatera around 3.16% N, 0.38% P, and 3.45% K. The addition of N, P, and K, Titonia also has the nutrient content of 0.59% Ca and 0.27% Mg.

Nurhajati Hakim, Nalwida Rozen, and Yanti Mala (2010 and 2011) reported that the use POTP the SRI method of rice intensification can reduce the use of synthetic fertilizer N and K up to 50%, with results slightly higher than the 100% synthetic

fertilizers. Utilization POTP demgan the SRI method can produce a grain of 4.6 - 5,0 ton ha^{-1} in Air Pacah, the city of Padang, 3.6 - 4.6 ton ha^{-1} in Jawi-Jawi, Solok regency, and as many as 6, 8 to 7.0 tons ha^{-1} in propagation, Tanah Datar. However, they stated that the results obtained in paddy rice intensification, not optimal as expected (about 8 tons.ha^{-1}). Nurhajati Hakim *et al*., (2010) suspect that one reason may be a lack of micro elements indicated by symptoms brownish yellow spots (browning) on the leaves.

Based on this information, the problem can be formulated that seem POTP existing formula, has not been able to provide sufficient micro elements for rice plants to produce optimal on rice intensification. Micro elements what is lacking among the essential micro elements (Fe, Mn, Zn, Cu, B, Cl and Mo), is not known, so it needs to be investigated further fundamental and applied. Assessment of the micro elements are relatively underdeveloped. In the case of micro elements are needed, although in small quantities.

Based on the background and issues that have been raised, Nurhajati Hakim, Nalwida Rozen, and Jamilah (2014) has continued the research that had been applied in the field, returned to the greenhouse with pot experiment treatment of 6 kinds of micro elements (Fe, Mn, Cu, Zn, B, Mo) on paddy rice by POTP + 50% synthetic fertilizer N and K, plus POTP treatment alone, and 100% synthetic fertilizers alone. Results of that study concluded that micro elements required by the rice crop POTP is Mn with an increase of 21% and Zn results with a 17% increase in results.

Research purposes

The purpose of this study is: POTP complete formula with micro elements (Mn and Zn) to reduce the application of synthetic fertilizers by 50% in the application of SRI method in rice intensification target grain yield equal to or greater than 8 tons / ha. Long-term goal is to reduce the dependence of farmers on synthetic fertilizers and accelerate the realization of self-sufficiency in rice, towards resilience and national food security. Outcomes and benefits of research results. Outcomes of this study is the formula POTP equipped micro elements to be transferred to the farmers and patented. Benefits for partners, namely the Department of Agriculture (Ministry of Agriculture) are (1) the availability of the technology package of organic fertilizer plus the raw materials of local resources (Titonia, straw, lime, biological agents) to be applied at the farm level in order to reduce the application of synthetic fertilizers 50%, the rice yield higher than 100% synthetic fertilizers, (2) for farmers to reduce dependence on synthetic fertilizers, and (3) for employers organic fertilizer is the availability of formula and method of manufacture of organic fertilizer plus (POTP) has to be produced (after patented).

MATERIALS AND METHODS

Time and place

This research is a field experiment on rice intensification in the city of Padang on the three new POTP formula with the addition of Mn and Zn combined treatment chosen from the results of previous research studies lasted for 8 months, from February to September 2015. Analysis of soil and plants carried out in the laboratory P3IN (Utilization of Nuclear Science and Technology Research Center) and laboratory Soil Department, Faculty of Agriculture, specifically for the measurement of micro elements conducted at the Laboratory of Environmental engineering Andalas University in Padang.

Materials and tools

Synthetic fertilizer used is urea, SP36, KCl and Kieserite. Fertilizer micro elements as treatments sourced from MnSO4 and ZnSO4. Rice seed varieties used are IR-42.

For the control of pests and diseases of plants used insecticide Ripcord 5 EC and Dithane M-45. Materials for the manufacture POTP is clipping Titonia, rice straw, lime, and biological agents stardec, Trichoderma, Azotobacter, Azospirillum, and bacterial phosphate solvent.

A number of chemicals used for soil analysis, POTP and plant analysis in the laboratory. The tools used are black plastic and black plastic sacks for the manufacture and storage containers POTP, hoes, machetes, knives, meter, marker, grinder, plastic sacks for harvest.

Design of Experiments

Based on the results of previous experiments, the experiment design used was a randomized block design consisting of 6 treatments and 3 groups, as follows:

P = POTP + 3,0kg Mn / ha + 0kg Zn / ha

Q = POTP + 3,0kg Mn / ha + 3,0kg Zn / ha

R = POTP + 4.5kg Mn / ha + 6kg Zn / ha

S = POTP + 4.5kg Mn / ha + 9kg Zn / ha

T = POTP only

U = 100% synthetic fertilizer alone

All treatments received POTP formula plus 50% of synthetic fertilizer N and K needed rice plants at a local trial site. Data obtained plants tested F (Sidik Variety), and if the real effect of treatment followed by a test of least significant difference (LSD) at 5%. Conclusions drawn by the higher grain yield than treatment only POTP or 100% synthetic fertilizer.

Observations Plants

The observations made is the analysis of soil nutrient levels and POTP, plant height, number of tillers total number of productive tillers, dry weight of straw and grain, content analysis and nutrient uptake straw and grain.

RESULTS AND DISCUSSION

Analysis of Soil Nutrient Levels

Table 1. Analysis of soil nutrient in two pilot sites

pH	N	C-orgk	P	Ca	K	Mg	Mn	Zn	Location
5,64	0,14	1,65	20,90	0,734	0,89	1,66	0,59	0,199	Koto Tingga
6,34	0,22	2,40	9,52	0,780	0,96	0,91	0,78	0,220	Koto Panjang

From the above data shows that the very high P content in rice fields while in Koto Panjang and Koto Tingga is moderate. This is because the rice in Koto Tingga a relatively high porosity and P soil is very high but it is bound, so that P can not be absorbed by plants. Farmers always provide macro elements N, P, and K only in the form of Urea, TSP, and KCl, without considering the micro fertilizer. While in Koto Panjang, farmers have already started applying compost hay to their land, so that the P that despite the level being more available to plants.

Analysis of nutrient content POTP

Table 2. Analysis of the nutrient content in both locations POTP trial

NA	N	P	C-orgk	Mg	K
0,2882%	0,95%	1,503%	0,6788%	0,3534%	0,3538%

POTP of nutrient analysis indicates that, the element P is high so POTP can help P bound in the soil becomes available to plants. One of the benefits of organic fertilizers is to provide nutrients for the soil and plants.

Height Plant of Rice

Results of analysis of variance showed that the height of rice plants at different locations unreal second neighbor. This can be seen in Table 3 below.

Table 3. High-crop rice paddies in Koto Panjang and Koto Tingga age 56 days

Treatment	Height Plant (cm)	
	Koto Panjang	Koto Tingga
POTP+3,0kgMn/ha+0kgZn/ha	92,93	82,20
POTP+3,0kgMn/ha+3,0kg/ha	88,20	80,13
POTP+4,5kgMn/ha+6,0kgZn/ha	89,27	79,40
POTP+4,5kgMn/ha+9,0kgZn/ha	92,27	78,67
POTP only	91,93	79,93
100% Synhetic fertilizers	92,07	84,80

The numbers on the same lane not significant according to the BNT on the real level of 5%

From the table above, it appears that the second plant height at different locations show differences in plant height of rice varieties IR42 different. This is because the locations used different the terrain, where the area of Koto Panjang have the type of soil porosity is moderate while in Koto Tingga has a high porosity, so that water can not be held longer by land, with rapid occurrence of run-off in the soil so it needs the addition POTP into the soil so that the soil can hold water. Organic fertilizer in this case can also add jerab POTP groundwater.

Total number Tillers

Total number of tillers after analyzed by analysis of variance showed no significant results in the two pilot sites, as shown in Table 4 below.

Table 4. Number of tillers total in Koto Panjang and Koto Tingga age 56 days

Treatment	The number of total tillers (stem)	
	Koto Panjang	Koto Tingga
POTP+3,0kgMn/ha+0kgZn/ha	45,87	42,67 b
POTP+3,0kgMn/ha+3,0kg/ha	43,40	43,80 b
POTP+4,5kgMn/ha+6,0kgZn/ha	40,80	42,33 b
POTP+4,5kgMn/ha+9,0kgZn/ha	41,93	48,00 a
POTP only	44,73	53,93 a
Synhetic fertilizers 100%	41,93	53,53 a

The figures in the same column followed by the same lowercase not significant according to the BNT on the real level of 5%.

In the above table can be seen that the total number of seedlings at the two locations is much more than the conventional way. SRI method can increase the number of tillers of rice plants because of the rapid transplanting (12-15 HSS) makes the rice plants formed after transplanting seedlings in the nursery instead of (conventional).

Productive tiller number

The number of productive tillers after analyzed by analysis of variance showed no significant results in the two pilot sites. This can be seen in Table 5 below.

Table 5. The number of productive tillers in Koto Panjang and Koto Tingga age 105 days

Treatment	The number of productive tillers (stem)	
	Koto Panjang	Koto Tingga
POTP+3,0kgMn/ha+0kgZn/ha	25,53	22,07
POTP+3,0kgMn/ha+3,0kg/ha	24,40	20,80
POTP+4,5kgMn/ha+6,0kgZn/ha	25,87	21,87
POTP+4,5kgMn/ha+9,0kgZn/ha	21,33	22,47
POTP only	24,80	24,53
Synhetic fertilizers 100%	28,53	24,80

The numbers on the same lane not significant according to the BNT on the real level of 5%

The table above shows that the number of productive tillers varieties IR42 rice plants at both locations more than conventional (20 stems). This is because the rice plants grown with SRI method. This method can improve productive tillers.

Net Weight of Clean Grain

Weight of clean rice varieties IR42 rice plants at both locations showed no significant results. Data from ragmnya fingerprints can be seen in Table 6 below.

Table 6. Net weight of clean grain in Koto Panjang and Koto Tingga age 105 days

Treatment	Weight of clean grain (kg)	
	Koto Panjang	Koto Tingga
POTP+3,0kgMn/ha+0kgZn/ha	2,57	3,23
POTP+3,0kgMn/ha+3,0kg/ha	2,23	2,90
POTP+4,5kgMn/ha+6,0kgZn/ha	2,27	3,00
POTP+4,5kgMn/ha+9,0kgZn/ha	2,67	2,50
POTP only	2,57	2,93
Synhetic fertilizers 100%	2,40	2,57

The numbers on the same lane not significant according to the BNT on the real level of 5%.

Weights Dry Clean

Grain dry weight showed significantly different results on the paddy fields while in Koto Koto Panjang Tingga showed no significant results. This can be seen in Table 7 below.

Table 7. Dry weight of grain in Koto Panjang and Koto Tingga age 105 days

Treatment	Dry weight of grain (kg)	
	Koto Panjang	Koto Tingga
POTP+3,0kgMn/ha+0kgZn/ha	71,87 b	83,60
POTP+3,0kgMn/ha+3,0kg/ha	71,87 b	85,13
POTP+4,5kgMn/ha+6,0kgZn/ha	73,10 b	84,20
POTP+4,5kgMn/ha+9,0kgZn/ha	73,47 b	83,73
POTP only	72,97 b	82,90
Synhetic fertilizers 100%	80,27 a	84,43

The figures in the same column followed by the same lowercase not significant according to the BNT on the real level of 5%.

From the table above shows that the dry weight of paddy rice crop varieties IR42 showed significantly different results on the paddy in Koto Panjang, but in Koto Tingga showed no significant results.

Dry weights Straw

Straw dry weight berbde show tangible results on the paddy in Koto Panjang, whereas in Koto Tingga shows the results of the dry weight of straw were not significant. Data variance results can be seen in the following table.

Table 8. Weight of dry straw in Koto Panjang and Koto Tingga

Treatment	Weight of dry straw (kg)	
	Koto Panjang	Koto Tingga
POTP+3,0kgMn/ha+0kgZn/ha	39,47 a	34,36
POTP+3,0kgMn/ha+3,0kg/ha	36,83 b	34,23
POTP+4,5kgMn/ha+6,0kgZn/ha	36,87 b	33,23
POTP+4,5kgMn/ha+9,0kgZn/ha	34,90 b	37,03
POTP only	34,83 b	32,97
Synhetic fertilizers 100%	42,50 a	36,47

The figures in the same column followed by the same lowercase not significant according to the BNT on the real level of 5%.

In the table above shows that, the dry weight of straw is higher in comparison to Koto Koto Panjang Tingga. Dry weight of straw on synthetic fertilizer treatment was higher than other treatments in Koto Panjang. While in Koto Tingga higher in treatment POTP + 4,5 kg Mn / ha + 6.0 kg Zn / ha.

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