RICE PLANT RESPONSES TO ADDITIONAL INGREDIENTS MICRO NUTRIENTS TO ORGANIC FERTILIZER PLUS TITONIA

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ABSTRACT

Synthetic fertilizer use during this time can increase rice yields, but by simply using any synthetic fertilizer to farmland will lead to land being loud. No crumbs and loose soil, soil fertility will be reduced because the soil becomes solid. Therefore, fertilizer alternatives must be found. Based on previous research turns micro elements required in the manufacture Organic Fertilizer Plus Titonia Plus (OFPT) is Mn and Zn. The purpose of this study is: to equip OFPT formula with micro-nutrients Mn and Zn to reduce the application of synthetic fertilizers by 50% to paddy intensification. Pot experiment using a factorial 4 x 4 with 3 groups by randomized block design. The first factor Mn consisted of 4 levels (0kg / ha, 1.5 kg / ha, 3,0kg / ha and 4.5 kg / ha). The second factor Zn consists of 4 levels (0 kg / ha, 3kg / h, 6kg / ha, 9kg / ha). The result showed that doses of micro nutrients is 3kg / ha Mn without Zn, 4.5 kg / ha Mn + 6kg / ha Zn, and 4.5kg / ha Mn + 9kg / ha Zn.

KEYWORDS

Keywords: micro nutrients, rice land.

INTRODUCTION

One cause of the decline in rice production increase was due to disruption of the balance of nutrients in the soil due to the use of synthetic fertilizers is 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). Fertilizers organic, contain all the nutrients that plants need, not only 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.

In addition to the problem of nutrient that is not balanced on the use of synthetic fertilizers, synthetic fertilizer prices are more expensive, due to the termination of fertilizer subsidies by the government, it 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 (BPT, 2006). In this connection, Nurhajati Hakim et al., (2009, 2010, and 2011) tried to solve the problem by gathering and using organic fertilizers Plus Titonia (OFPT), 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 OFPT contains macro nutrients (N, P, K, Ca, Mg and S) are relatively high. 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. N, P, and K, Titonia also has a nutrient content of 0.59% Ca and 0.27% Mg.

Titonia (*Tithonia diversifola*) or sunflower Mexico (*Mexican sunflower*) is a countryman of weeds that can grow well all the ordo to soil, containing nutrients are high, especially N and K, which is about 3.5% N, 0.38% P, and 4 , 1% K (Jama et al., 2000). Titonia also contains 0.59% Ca; and 0.27% Mg (Rutunga et al., 1999). Nurhajati Hakim (2002) reported that crop weed Titonia (stems and leaves as

long as 50 cm from the tip) that were collected from several locations in West Sumatera, on average contains nutrients as much as 3.16% N; 0.38% P; and 3.45% K.

Gusnidar (2007) reported the use of 2.5 tons Titonia + 150 kg of urea in paddy intensification can provide higher rice yield 8 tonnes/ha. The paddy soil is already rich with P and K for an intensification of rice fields since 20 years ago, so the addition of Titonia alone can save the application of N, P and K in paddy intensification of 50 to 75%.

Although the rice straw is the main source of organic matter in paddy soil, but the habits of farmers prefer to burn straw, with consideration easily implemented. Since the adoption of SRI methods, utilization of straw began to attract attention (Adimihardja, 2004). In order to accelerate the weathering straw composting is done with biological agents such as Trichoderma harzianum. Nurhajati Hakim, Agustian and Mala (2012) the formula which has been published OFPT need to be equipped with micro elements such as Fe, Mn, Zn, Cu, B, Cl, or Mo. Next will be explained the role of micronutrients.

Nurhajati Hakim, Nalwida Rozen, and Yanti Mala (2010 and 2011) reported that the use OFPT to paddy intensification SRI method is able to reduce the use of synthetic fertilizer N and K up to 50%, with results slightly higher than the 100% synthetic fertilizers. Gusnidar (2007) made titona as fertilizer on land rice intensification in Sicincin Padang Pariaman district. She is reported titonia dryweight 5 tones.ha^{-1} reduce fertilizer Urea or N 50% (100 kg Urea), 80% pupuk P (162 kg SP36), dan 100% pupuk K (75 kg KCl), with yield 6 tons.ha^{-1}. Utilization OFPT crimped the SRI method can produce grain amounting to 4.6 to 5.0 tons / ha in the Air Pacah, the city of Padang, as much as 3.6 to 4.6 tons / ha in Jawi-Jawi, Solok regency, and as much as 6 , 8 to 7.0 tons / ha in propagation, Tanah Datar district. However, they stated that the results obtained in the fields of rice intensification, not optimal as expected (about 8 tons / ha). Nurhajati Hakim, Nalwida Rozen, and Yanti Mala (2010) suspect that one of the possible causes micro nutrient deficiencies indicated by symptoms brownish yellow spots (browning) on the leaves.

Based on this information, the problem can be formulated that seem OFPT existing formula, have not been able to provide sufficient micro-nutrients for plants to produce optimal paddy to paddy intensification. Nurhajati Hakim, Nalwida Rozen, and Jamilah (2014) states that the Mn and Zn micro elements need to be added in the manufacture of OFPT.

Research purposes

The purpose of this research is: OFPT supplement formula with micro nutrient (Mn and Zn) to reduce the application of synthetic fertilizers by up to 50% of practicing SRI in paddy intensification target grain yield equal to or greater than 8 tons / ha.

MATERIALSAND METHODS

Time And Place

This study consisted of pot experiments have been carried out in 2014, at the Greenhouse Faculty of Agriculture, University of Andalas, Padang, West Sumatera. Analysis of soil and plants do in the laboratory Utilization of Nuclear Science and Technology Research Center and the laboratory Soil

Department, Faculty of Agriculture, specifically for the measurement of micro nutrient the Laboratory of Environmental engineering Andalas University in Padang.

Materials And Implement

Synthetic fertilizers used are Urea, SP36, KCl and Kieserite. Fertilizer micro elements as treatments sourced from MnSO4 and ZnSO4. Rice seeds to be used is the IR-42 variety. For the control of pests and plant diseases will be used insecticides Ripcord 5 EC and Dithane M-45. Materials for the manufacture OFPT is Titonia crop, rice straw, lime, and biological agents stardec, Trichoderma, Azotobacter, Azospirillum, and bacterial solvent phosphate.

The implement that will be used are black plastic and black plastic sacks for the manufacture and storage containers OFPT, hoes, machetes, knives, tape measure, stakes, grinder, plastic sacks for harvest.

Experimental Design

Experimental design to determine the dose of micro elements Mn and Zn is needed, have used a randomized block design (RAK) with factorial form of 4 x 4 with 3 groups. The treatments were as follows: The first factor is the micro-elements Mn consists of four levels ie (0kg / ha, 1.5 kg / ha, 3.0 kg / ha and 4.5 kg / ha. The second factor is the micro-elements Zn consists of 4 levels (0 kg / ha, 3 kg / ha, 6 kg / ha, and 9 kg / ha). There are 16 combination and 3 groups made 48 experimental unit. When the F count larger than F table then continued with advanced test HSD level of 5%. in this case OFTP dosed to provide N and K 50% of the rice crop needs. Therefore, accompanied by synthetic fertilizer N and K as much as 50% more.the results of previous trials concluded that micro elements needed to accompany OFPT is Mn and Zn. Cunclution is based of haghly grain as OFPT only and 100% syntetic fertilizer.

Observations were made for OFPT and plant nutrients content, soil sample analysis of early and after incubation with OFPT, plant height measurements carried out on five samples clumps of plants per plot. total number of tillers per clump together with observations made height. Dry weights Hay and Grain and analysis of plant nutrient content.

RESULTSAND DISCUSSION

The results of the analysis of the chemical characteristics of the soil by OFPT and without being given OFPT presented in Table 1 below. Treatment betwen without OFPT and giving OFPT as showed different nutrient content (N, P, K, Ca, and Mg), treatment by with giving OFPTshowed pH higly than without OFPT.

Table 1. Effect OFPT against pH and micro elements paddy land intensification

Treatment	pH H2O	C-org .....(%).....	N	P $mg.kg^{-1}$	K	Ca .....$cmol.kg^{-1}$.....	Mg
Without OFPT	5,73	0,42	0,17	35,16	0,39	0,99	0,55
Giving OFPT	6,32	0,44	0,19	60,10	0,89	1,08	0,60

In Table 1 shows that soil pH and nutrient levels increases with OFPT the intensification of rice land. The increase in pH clearly due to the addition of lime in the making OFPT. Increased P about 25 mg.kg-1 is equivalent to 250 mg P.pot-1, are due to fertilizer P into OFPT manufacture, thus reducing the cost of N fertilizer application P. Increased by 0.02%, equivalent to 2 g N .pot-1 caused by the content of N OFPT fairly high (1.05%) which aimed to provide 50% of the rice crop N needs. Improved K-1 as much as 0.50 cmol.kg equivalent to 1.95 g K.pot-1 also caused by high K content in OFPT to provide 50% of the rice crop K needs. With the increase in soil nutrient levels are expected to improve the growth and yield of rice. 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. N, P, and K, Titonia also has a nutrient content of 0.59% Ca and 0.27% Mg. Titonia (*Tithonia diversifola*) or sunflower Mexico (*Mexican sunflower*) is a countryman of weeds that can grow well all the ordo to soil, containing nutrients are high, especially N and K, which is about 3.5% N, 0.38% P, and 4 , 1% K (Jama et al., 2000). Titonia also contains 0.59% Ca; and 0.27% Mg (Rutunga et al., 1999). Nurhajati Hakim, Agustian and Mala (2012) the formula which has been published OFPT need to be equipped with micro elements such as Fe, Mn, Zn, Cu, B, Cl, or Mo. Next will be explained the role of micronutrients.

Results of analysis of variance showed that the effect of real interaction between micro elements Mn and Zn only to the dry weight of grain per panicle, while others affect not real, are presented in Table 2 and Table 3.

Table 2.Effect of the main and the interaction between Mn and Zn to the dry weight of straw varieties IR42 by OFPT on paddy soil intesification.

Treatment	0kgMn/ha	1,5kgMn/ha	3,0kgMn/ha	4,5kgMn/ha	Zn
		----------(g/clum)----------			
0kgZn/ha	70,86	69,80	**79,77**	70,97	72,85
3kgZn/ha	68,05	**76,36**	74,27	**78,22**	74,23
6kgZn/ha	65,99	73,85	69,31	69,52	69,67
9kgZn/ha	**75,33**	73,45	70,09	66,97	71,46

Note: the numbers in the same column and the same row significant unreal According to the F test 5% significance level.

Although the effect of the interaction between Mn and Zn no significant effect on the dry weight of straw (Table 2), but there is a tendency to interact. From these data it appears that without Mn, the highest straw weight obtained on granting 9 kg / ha Zn, where as the provision of 1.5 kg / ha Mn, the highest yield was obtained at 3 kg / ha Zn. On giving 3 kg / ha Mn highest yield obtained in without giving Zn, while the provision of 4.5 kg / ha Mn highest yield was obtained at 3 kg / ha Zn. That is the response of plants to increased doses of Zn is not the same at all levels or doses of Mn. 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. N, P, and K, Titonia also has a nutrient content of 0.59% Ca and 0.27% Mg. Nurhajati Hakim et al., (2009, 2010, and 2011) tried to solve the problem by gathering and using organic fertilizers Plus Titonia (OFPT), 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 OFPT contains macro nutrients (N, P, K, Ca, Mg and S) are relatively high. Titonia also contains 0.59% Ca; and 0.27% Mg (Rutunga et al., 1999). Gusnidar (2007) made titona as fertilizer on land rice intensification in Sicincin Padang Pariaman district. She is reported titonia dryweight 5 tones.ha^{-1} reduce fertilizer Urea or N 50% (100 kg Urea), 80% pupuk P (162 kg SP36), dan 100% pupuk K (75 kg KCl), with yield 6 tons.ha^{-1}.

Table 3.Effect of the main plot and the interaction between Mn and Zn to the dry weight of IR 42 rice varieties by OFPT on paddy soil intesification.

Treatment	0kgMn/ha	1,5kgMn/ha	3,0kgMn/ha	4,5kgMn/ha	The main plot (Zn)
		----------(g/clum)----------			
0kgZn/ha	38,00 aB	**47,29 aAB**	**51,06 aA**	43,48 aAB	44,96
3kgZn/ha	34,13 aB	45,90 aA	33,69 bB	42,41 aAB	39,03
6kgZn/ha	42,64 aAB	46,24aAB	39,59 abB	48,77 aA	44,31
9kgZn/ha	**43,76 aAB**	**44**,85aAB	42,59 abB	49,55 aA	45,19
Mn	39,63	46,07	41,73	46,05	

Note: figures are followed by different small letters in the same column, and by different capital letters in the same row are significantly different according to BNJ 5%.

In Table 3, it appears that no Mn, the highest grain yield obtained in the provision of 9 kg Zn / ha, while the provision of 1.5 kg Mn / ha, the highest yield at without giving Zn. On giving 3 kg Mn / ha, the highest yield obtained in without giving Zn, while the provision of 4.5 kg Mn / ha, the highest yield at 9 kg Zn / ha. However, the increase in rice yield significantly only in the delivery of 3 kg Mn / ha, without giving Zn.

The treatment of grain yield between Mn and Zn were recommended in the manufacture OFTP to be tested in the field is the provision of 3 kg Mn / ha, without additional Zn with results of 51.06 g / clump (equivalent to 8.17 tonnes / ha). In addition, it also suggested a combination of 4.5 kg Mn / ha and 6kg Zn / ha with the results 48,77g / clump (equivalent to 7.80 tonnes / ha), or 4.5 kg Mn / ha and Zn 9kg / ha with results of 49.55 g / clump (equivalent to 7.93 tonnes / ha). Compared to without Mn and Zn with the results of only 38 g / pot (equivalent to 6.08 tonnes / ha) results of 3 combination of Mn and Zn are successively higher by 2.09 tonnes / ha (34%), 1.72 tons / ha (28%) and 1.85 tonnes / ha (30%). The increase in grain yield of 6.08 tonnes / ha to 8.17 tons, 7.80 tons and 7.93 tons / ha, or 34, 28 and 30% is quite bearti in order to increase the productivity of rice land. Nutrient analysis of varieties of IR 42 by OFTP with the addition of micronutrients Mn and Zn in paddy land intensification are presented in Table 3. Gusnidar (2007) reported the use of 2.5 tons Titonia + 150 kg of urea in paddy intensification can provide higher rice yield 8 tonnes/ha. The paddy soil is already rich with P and K for an intensification of rice fields since 20 years ago, so the addition of Titonia alone can save the application of N, P and K in paddy intensification of 50 to 75%. Titonia (*Tithonia diversifola*) or sunflower Mexico (*Mexican sunflower*) is a countryman of weeds that can grow well all the ordo to soil, containing nutrients are high, especially N and K, which is about 3.5% N, 0.38% P, and 4 , 1% K (Jama et al., 2000). Nurhajati Hakim, Nalwida Rozen, and Yanti Mala (2010 and 2011) reported that the use OFPT to paddy intensification SRI method is able to reduce the use of synthetic fertilizer N and K up to 50%, with results slightly higher than the 100% synthetic fertilizers.

Than, effect of micro-nutrients Mn and Zn on levels of nutrient variety IR42 by OFPT on paddy land Intensification are presented in Table 4 below. Observation by straw and grain on paddy showed grain higly than straw on the level content nutrient (N, P, K, Ca, and Mg).

Table 4.Effect of micro-nutrients Mn and Zn on levels of nutrient variety IR42 by OFTP on paddy land intensification.

Treatment Mn+Zn ($kg.ha^{-1}$)	% N		% P		% K		% Ca		% Mg	
	straw	grain	straw	grain	straw	grain	straw	grain	straw	grain
Mn 0+Zn 0	1,01	1,91	0,20	0,63	1,28	0,64	0,30	0,30	0,23	0,24
Mn 0+Zn3	1,18	1,93	0,22	0,56	0,72	0,36	0,24	0,33	0,25	0,27
Mn 0+Zn 6	1,00	1,10	0,17	0,54	0,92	0,46	0,26	0,35	0,26	0,26
Mn 0+Zn 9	0,93	1,93	0,20	0,50	1,08	0,54	0,32	0,26	0,27	0,28
Mn 1,5+Zn 0	1,01	1,64	0,21	0,47	0,82	0,41	0,27	0,27	0,30	0,25
Mn 1,5+Zn 3	0,88	1,78	0,20	0,45	0,60	0,30	0,22	0,26	0,27	0,29
Mn 1,5+Zn 6	1,10	1,82	0,22	0,61	0,70	0,35	0,33	0,31	0,25	0,31
Mn 1,5+Zn 9	1,09	1,94	0,22	0,58	1,34	0,67	0,22	0,20	0,24	0,34
Mn 3,0+Zn 0	0,92	2,06	0,20	0,50	1,42	0,71	0,30	0,24	0,29	0,29
Mn ,03+Zn 3	1,21	2,32	0,20	0,55	1,02	0,51	0,38	0,21	0,25	0,28
Mn 3,0+Zn 6	1,08	2,38	0,22	0,43	1,48	0,72	0,24	0,26	0,21	0,25
Mn 3,0+Zn 9	1,94	2,42	0,23	0,52	1,12	0,56	0,26	0,29	0,22	0,30
Mn 4,5+Zn 0	0,97	1,78	0,21	0,52	1,20	0,60	0,29	0,25	0,24	0,33
Mn 4,5+Zn 3	1,13	2,31	0,21	0,53	1,38	0,69	0,27	0,28	0,31	0,31
Mn 4,5+Zn 6	1,15	1,66	0,21	0,53	0,96	0,48	0,22	0,31	0,23	0,28
Mn 4,5+Zn 9	1,09	2,10	0,20	0,50	0,82	0,41	0,30	0,27	0,29	0,30

Based on the criteria proposed by the nutrient adequacy and Firhust Doberman (2000) can be stated that the N content in the straw which vary from 0.88 to 1.94% and the N content of grain from 1.10 to 2.42% pertained to the optimum height. In Table 3 it appears that the levels of N and P in the grain higher than the grain. K content in straw classified optimum, while the K content in the grain is high. Furthermore, the levels of Ca and Mg classified as optimum and relatively equally well in hay and grain. Such nutrient content, seems to have given the relative growth of rice plants is as good as the results of the straw which is also not significant. It is quite interesting to note is the amount of N and K were transported harvest high enough. Nurhajati Hakim, Agustian and Mala (2012) the formula which has been published OFPT need to be equipped with micro elements such as Fe, Mn, Zn, Cu, B, Cl, or Mo. Next will be explained the role of micronutrients.

Analysis of nutrient content of hay and grain were transported harvest are presented in Table 5 below. Since the focus of the study is due to the saving of synthetic fertilizer N and K with OFPT, the analysis focused on the transport of nutrients N and K only.

Table 5. Effect of micro-nutrients Mn and Zn to carrier N and K varieties IR42 by OFPT to paddy intensification.

Treatment Mn+Zn ($kg.ha^{-1}$)	straw ($g.rpn^{-1}$)	grain ($g.rpn^{-1}$)	carrier N ($g.rpn^{-1}$)	carrier N ($kg.ha^{-1}$)	straw ($g.rpn^{-1}$)	grain ($g.rpn^{-1}$)	carrier K ($g.rpn^{-1}$)	carrier K ($kg.ha^{-1}$)
Mn 0+Zn 0	0,716	0,726	1,442	230,7	0,907	0,319	1,226	196,2
Mn 0+Zn 3	0,803	0,659	1,462	233,9	0,490	0,382	0,872	139,5

Mn 0+Zn 6	0,660	0,469	1,129	180,6	0,607	0,333	0,940	150,4
Mn 0+Zn 9	0,682	0,845	1,527	244,3	0,792	0,656	1,448	231,7
	51%	**49%**		**222,4**	**62%**	**38%**		**179,5**
Mn 1,5+Zn 0	0,706	0,776	1,482	237,1	0,573	0,539	1,112	177,9
Mn 1,5+Zn 3	0,672	0,817	1,489	238,2	0,458	0,450	0,908	145,3
Mn 1,5+Zn 6	0,812	0,842	1,654	264,6	0,517	0,490	1,007	161,1
Mn 1,5+Zn 9	0,801	0,870	1,671	267,4	0,984	0,377	1,361	217,8
	48%	**52%**		**251,8**	**58%**	**42%**		**175,5**
Mn 3+Zn 0	0,734	1,052	1,786	285,8	1,133	0,623	1,756	281,0
Mn 3+Zn 3	0,899	0,782	1,681	269,0	0,758	0,317	1,075	172,0
Mn 3+Zn 6	0,749	0,942	1,691	270,6	1,026	0,309	1,335	213,6
Mn 3+Zn 9	1,360	1,031	2,391	382,6	0,785	0,298	1,083	173,3
	50%	**50%**		**302,0**	**70%**	**30%**		**210,0**
Mn 4,5+Zn 0	0,688	0,774	1,462	233,9	0,852	0,365	1,217	194,7
Mn 4,5+Zn 3	0,884	0,479	1,363	218,1	1,079	0,399	1,478	236,5
Mn 4,5+Zn 6	0,799	0,810	1,609	257,4	0,667	0,517	1,184	189,4
Mn 4,5+Zn 9	0,730	1,041	1,771	283,4	0,549	0,436	0,985	157,6
	50%	**50%**		**248,2**	**65%**	**35%**		**194,6**

Note: Estimated transport of nutrients per hectare assuming a spacing of 25 cm x 25 cm in order to obtain 160,000 clumps.ha^{-1}.

In Table 5 above it appears that transport of N by impartial straw and grain, while the K nutrient transport about 60-70% are in a straw. Means the return of straw to the wetland will be able to restore about 50% N and 60-70% K were transported harvest. Increasing doses of up to 3 kg Mn.ha Mn-1 tends to increase the transport of N and K, but tends to fall with increased Mn from 3 kg to 4.5 kg Mn.ha^{-1}. The reality may be a reason why the grain yield was higher in the provision of 3 kg.ha^{-1} Mn. As stated by Hanafi (2007) that the nutrient Mn serves as a catalyst for some of the reduction process-oksodasi, activators of enzymes, breaking water molecules in photosynthesis. Ultimately produce higher grain.

From Table 5 it can also be seen that whenever the harvest will be transported approximately 200 to 300 kg.ha^{-1} N and approximately 180-210 kg.ha^{-1} K. If only rely synthetic fertilizers only as a source of N and K, then obviously it it is a sizable expense for farmers. Therefore, the use of OFPT is capable of providing 50% of N and K needed rice plants, is the perfect solution to save farmers. Nurhajati Hakim, Nalwida Rozen, and Yanti Mala (2010 and 2011) reported that the use OFPT to paddy intensification SRI method is able to reduce the use of synthetic fertilizer N and K up to 50%, with results slightly higher than the 100% synthetic fertilizers. Nurhajati Hakim, Nalwida Rozen, and Jamilah (2014) states that the Mn and Zn micro elements need to be added in the manufacture of OFPT.

Load paddy crop nutrient in Table 5 above, seems to be larger than reported Doberman and Fairhust (2000) that element N takes about 9-12 kg per ton of grain and about 6-8 kg N per ton of straw. When the desired optimum rice yield as much as 8 ton.ha^{-1}, it will be transported as many as 72 - 96kg.ha^{-1} N by grain, and about 48-64 kg N.ha^{-1} by straw, or a total of 120-160kg N .ha^{-1}.

The difference is understandable because in this study nutrient transport calibrated on the yield hectare^{-1} pot into by a factor of 160,000 clumps. However, transport of nutrients calculated from the pot experiment can be used as a guideline for fertilizer recommendations and as the basis of return on the straw to the field after each harvest.

CONCLUSIONS and SUGGESTION

Conclusions

The addition of micronutrients to complete the formula OFTP to paddy intensification is 3 kg Mn / ha without Zn, 4.5 kg Mn/ha + 6 kg/ha Zn, and 4.5 kg Mn/ha + 9 kg/ha Zn.

SUGGESTION

The OFTP formula needs to be added with 3 kg Mn/ha without Zn, 4.5 kg Mn/ha + 6 kg Zn/ha, and 4.5 kg Mn/ha + 9 kg Zn/ha.

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