BIOCHEMICAL (*Buffalo)* FERTILIZER FOR RICE

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ABSTRACT

The experiment entitled "Biochemical (Buffalo) fertilizer on rice" was conducted at the Western Mindanao State University,Zamboanga City, on June to October 2011. Efficacy test of this fertilizer was evaluated at farmer's field singly or in combination with inorganic fertilizer on lowland rice. This biochemical fertilizer is a Taiwan technology produced by Natural Active organic fertilizer factory based at Sabah, Malaysia and utilized as an effective fertilizer for African oil palm. The study was laid-out using a Randomized Complete Block Design (RCBD) with six treatments replicated three times. The following were the treatments: T1- control (no application), T2- full recommendation of inorganic fertilizer based on soil analysis, T3- 50% of the recommendation of inorganic fertilizer, T4- 50% of the recommended inorganic fertilizer + 50% Biochemical (buffalo) fertilizer, T5– full recommendation of Biochemical (buffalo) fertilizer and T6- full recommendation of biochemical (buffalo) fertilizer + full recommendation of inorganic fertilizer. Results revealed that application of biochemical *(buffalo*) fertilizer significantly increased the yield of rice comparable to that of inorganic fertilizer. The rest of the treatments obtained similar yield as that of the control when compared using Least Significant Difference (LSD). Plant height in cm, tiller count and average number of panicles per plant were not significantly affected by the application. The significant effect on rice yield is attributed to nutrient components (NPK, trace elements amino acids and other organic materials added with beneficial soil microorganisms) of the biochemical fertilizer. This product appeared to have sufficient nutrient components for crop growth. It is recommended that this fertilizer be further evaluated to other industrial and high value crops to maximize its utilization.

Keywords: biochemical (buffalo) fertilize, rice, inorganic fertilizer

1 INTRODUCTION

Modern agriculture utilized inorganic fertilizers and chemical residues contaminate our food and water. Specifically the excessive utilization of thesecommercial synthetic fertilizers destroys the natural properties of soil and the environment (PCAARRD 2000).

Organic-based agriculture is a fast emerging farming system designed to improve soil structure, prevent soil degradation and minimize environmental hazards. Reduction on dependence on mineral fertilizer can lead towards more natural and healthier methods of food production (FAO 2004). The inputs utilized from organic farming strengthen plant's resistance to pests and diseases, and safe because they are derived from living things and their by-products.

Organic fertilizer sustained use and management of natural resources (FAO2004) andmaterials such as farm manure, compost, green manure and use of crop residues open up expanded opportunities for indigenous productionand use at a minimal costs (Venkataraman 1984). In developing countries, where chemical fertilizers often are scarce

and expensive and where foreign exchange to purchase them is often short, the use of organic fertilizers appeared to be the only logical alternative (Cosico 1993).

While organic fertilizer improved soil structure and with many advantages and available sources, it must be applied in large amounts because of lower N, P, and K than the inorganic fertilizer (PhilRice 1993). It is also necessary to combine this with inorganic fertilizer so as to maximize its use in supplying the nutrients needed by the crop. The combination of these fertilizers plays an important role in crop production (Mann & Garrity 1994). For instance, in a survey, Asian farmers integrate green manuring with inorganic fertilizer for rice because they view the two sources as complementary and their effect is synergistic (Garrity & Flinn 1988). The Balanced Fertilization Strategy (BFS) composed of five bags of commercial organic fertilizer with six bags of inorganic fertilizers and or 20 bags of chicken manures mixed with six bags of inorganic fertilizers, was found at par with and even better than the pure inorganic fertilizer recommended for rice. This fertilization strategy is capable of rehabilitating degraded rice soils, maintain a healthy balance of soil nutrients and enhance the availability of nutrients from the soil (BSWM 1999).

Biochemical fertilization is found to be effective in crop production. This is composed of effective organic and inorganic fertilizers and quantity of beneficial microorganisms sufficient to further enhance plant growth when applied to soil or to control pathogens in soil (Mehta 2001).The addition of microorganisms in the soil particularly bacteria helps in enhancing decomposition of organic matter and thereby promote healthy plant roots and development. Numerous biochemical fertilizers were produced but need to be evaluated at farmers' field in a variety of economically important agricultural commodities. Biochemical (*buffalo*) fertilizer in particular was effective on oil palm in Malaysia but needs to be proven on rice being an important food crop of the country. Research outputs and technologies shared help improve agricultural production in the Asean Region.

2 OBJECTIVES

1. To assess the performance of Biochemical (Buffalo) fertilizer on Lowland rice
2. To determine which of the fertilizer combination (both biochemical and inorganic fertilizer) will give better yield.

3 METHODOLOGY

3.1 Site

The experiment was conducted in lowland rice field at Talisayan, Zamboanga City during the wet season of June to October 2011.

3.2 Statistical Design and Field Lay-out

An area of 672.75 sq m. was laid-out in Randomized Complete Block Design (RCBD) with 6 treatments replicated 3 times. The area had a distance of 0.5 m between treatmentsand a1 meter alley surrounding the experimental fields. Each plot had an area of 20sqm measured 4 m x 5 m. The treatments were the following:

- T1- Control (no fertilizer)
- T2-100 kg/ha ammonium phosphate and 320 kg/ha of ammonium sulfate (based from soil analysis).
- T3 - 50 kg/ha of ammonium phosphate and 160 kg/ha of ammonium sulfate.
- T4 - 400 kg/ha of biochemical (Buffalo) fertilizer(full manufacturer's recommendation)
- T5 - 50 kg/ha of recommended rate of ammonium phosphate and 160 kg/ha ammonium sulfate + 200 kg/ha of biochemical fertilizer.

- T6 - 100 kg/ha of ammonium phosphate and 160 kg/ha ammonium sulfate + 400 kg/ha of biochemical fertilizer.

3.3 Land Preparation
The experimental field was plowed twice and harrowed three times a week before transplanting.

3.4 Seeding
Dapog method of raising seedlings was employed. Seeds were soaked in water for 48 hours and were sown in the prepared seedbed. Care of seedlings was done until 12-14 days after sowing.

3.5 Transplanting
The seedlings were transplanted in the field 14 days after sowing. Three to four seedlings were planted per hill spaced 20 x 20 cm.

3.6 Fertilization
Biochemical (*Buffalo*) fertilizer was applied following the recommendation a day before transplanting. While ammonium phosphate and ammonium sulfate were applied in split 20 days and 45-60 days after transplanting.

3.7 Weeding
Application of herbicide was done before and after weed seeds emerged from the soil. Hand weeding was also employed whenever necessary.

3.8 Crop Protection
Fungicides and insecticides following the recommended dosage were applied whenever necessary.

3.9 Harvesting
The plants were harvested when 90% of the grains were at maturity stage.

3.10 Threshing and drying of grains
Threshing was done manually and grains were dried at 16% moisture content. After drying, the grains were weighed in kg/ha.

4 DATA GATHERED

1. Grain yield in tons/ha. - The yield was computed from the dry weight of filled grains from the averageof three 4 sq m harvest.
2. Panicle count - The panicles formed per hill were counted at harvest from tagged 16 hills.
3. Tiller count - From the tagged 16 hills, tiller count was taken 30 days after transplanting (DAT) up to 51 DAT. Productive tillers were counted from the same number of hills at harvest.
4. Plant height - The height per hill was measured from the base of the plant to the height of the tallest leaf, 30 DAT to 65 DAT. Four samples were taken randomly and were tagged from the four corners of the plot.

5 RESULTS

5.1 Grain yield in tons/ha

Yield of samples differ significantly among treatments when compared using LSD test (Table 1.) Plots applied with recommended rate of 100 kg of ammonium phosphate, and 320 kg/ha of ammonium sulfate (T2) as well as plot (T5) purely applied with biochemical (*buffalo*) fertilizer obtained a yield of 0.33 kg/plot. Yield performances on these plots are similar but significantly different when compared to the untreated (T1) plot. This indicates that biochemical (*buffalo*) fertilizer can be a good alternative to inorganic fertilizer on rice. This is followed with plot (T3) applied with half of the recommended ammonium phosphate and ammonium sulfate (0.30 kg/plot), full recommendation of inorganic and biochemical fertilizer (T6) and half of combined biochemical and inorganic fertilizers (T4) with respective means of 0.30 and 0.28 kg/plot. All of the three treatments were declared not significantly different from the control.

Table 1: Yield (dry weight) in kg of 18 sample hills per plot of rice as affected by the application of biochemical (*buffalo*) fertilizer

Treatment	**Rep 1**	**Rep 2**	**Rep 3**	**Total**	**Mean**
T1	0.30	0.20	0.25	0.75	0.25
T2	0.35	0.30	0.35	1.00	0.33*
T3	0.35	0.30	0.25	0.90	0.30ns
T4	0.25	0.30	0.30	0.85	0.28ns
T5	0.30	0.30	0.40	1.00	0.33*
T6	0.30	0.25	0.35	0.90	0.30ns
Total	0.30	0.25	0.35		
Grand Total				5.4	
Grand mean					0.30

CV= 18.25%

ANOVA

SV	**DF**	**SS**	**MS**	**Computed F**	**Computed F**	
					5.00%	1.00%
Replication	2	0.01	0.005			
Treatment	5	0.02	0.004	4.00*	3.22	5.39
Error	10	0.01	0.001			
Total	17	0.04				

* significant

Legend:
T1- control (no significant)
T2- full recommendation of inorganic fertilizers
T3- ½ of the rec. inorganic fertilizers
T4- ½ of the rec. inorganic fertilizer + ½ of the biochemical (buffalo) fertilizers
T5- full recommended biochemical (buffalo) fertilizers
T6- full rec. inorganic fertilizer+ full rec. biochemical fertilizer

5.2 Number of panicles per plant

Number of panicles per plant did not differ significantly among treatments. Plants in fertilized and unfertilized plots had similar number of panicles (Table 2), despite of numerical differences. This indicates that all treatments had same performance in tiller production.. Biochemical (*buffalo*) fertilizer applied failed to show significant influence on the number of panicles per plant. Based on the result in tiller production (Table 3) all of the tillers produced formed into panicles, however, not all of panicles in each of the treatment were contributory in increasing yield. Some of the panicles had unfilled grains.

Table 2: Average number of panicles per plant of rice as affected by the application of biochemical (*buffalo)* fertilizer

Treatment	Rep 1	Rep 2	Rep 3	Total	Mean
T1	2.17	1.33	1.50	5.00	1.67
T2	0.94	1.44	1.39	3.77	1.26
T3	1.50	1.28	1.06	3.84	1.28
T4	1.22	1.44	1.33	3.99	1.33
T5	1.33	1.44	1.06	3.83	1.28
T6	1.39	1.67	1.17	4.23	1.41
Total	8.55	8.60	7.51		
Grand Total				24.66	
Grand Mean			1.37		

CV 10.67

ANOVA

SV	DF	SS	MS	Computed F	Computed F	
					5.00%	1.00%
Replication	2	0.13	0.065	0.89		
Treatment	5	0.38	0.076	1.04ns	3.22	5.39
Error	10	0.73	0.073			
Total	17	1.24				

Legend:
T1- control (no significant)
T2- full recommendation of inorganic fertilizers
T3- ½ of the inorganic fertilizers
T4- ½ of the rec.inorganic fertilizer + ½ of the biochemical (buffalo) fertilizers
T5- full recommended biochemical (buffalo) fertilizers
T6- full rec. inorganic fertilizer+ full rec. biochemical fertilizer

5.3 Tiller count per plant

Tiller production is shown in Table 3. No significant differences exist among treatment means as analysis of variance revealed. This implies that plants in all plots regardless of the fertilizers and the rate of application showed the same performance in producing tillers.

Samples in unfertilized plots (T1) and also in plot with full recommendation of both the inorganic and biochemical fertilizer (T6) however, have more number of tillers with respective means of 1.82 and 1.85 at 30 days after transplanting. Treatments 2, 3, 4 and 5 obtained average means ranging from 1.41-1.64 respectively.

Table 3: Average number of tillers per plant of rice as affected by the application of biochemical *(buffalo)* fertilizer

Treatment	**Rep 1**	**Rep 2**	**Rep 3**	**Total**	**Mean**
T1	2.28	1.67	1.5	5.45	1.82
T2	1.44	1.61	1.35	4.40	1.47
T3	1.39	1.44	1.42	4.25	1.42
T4	1.55	1.94	1.44	4.93	1.64
T5	1.44	1.39	1.39	4.22	1.41
T6	1.89	2.11	1.56	5.56	1.85
Total	9.99	10.16	8.86		
Grand Total				28.81	
Grand Mean			1.60		

CV- 12.66

ANOVA

SV	**DF**	**SS**	**MS**	**Computed F**	**Tabulated F**	
					5%	1%
Replication	2	0.23	0.12			
Treatment	5	0.60	0.12	2.93ns	3.22	5.33
Error	10	0.41	0.041			
Total	17	1.24				

ns- not significant

Legend:
T1- control (no significant)
T2- full recommendation of inorganic fertilizers
T3- ½ of the inorganic fertilizers
T4- ½ of the rec.inorganic fertilizer + ½ of the biochemical (buffalo) fertilizers
T5- full recommended biochemical (buffalo) fertilizers
T6- full rec. inorganic fertilizer+ full rec. biochemical fertilizer

5.4 Plant height (cm) per plant

Table 4 shows plant height in cm per plant. Plants in unfertilized plots (T1) appeared to be taller (33.71 cm.) than those in fertilized plots with pure biochemical (*buffalo*) fertilizer or in combination with inorganic fertilizer with means ranging from 32.29 to 33.52 cm. Despite ofthe numerical differences however, statistical analysis revealed no significant difference at all. Results indicate that samples inall treatments obtained the same height. This means that

application of fertilizer did not show any influence on the increase of height in plants.

Table4: Height in cm of sample plants per plot as affected by the application of biochemical (*buffalo)* fertilizer

Treatment	Rep 1	Rep 2	Rep 3	Total	Mean
T1	34.67	32.28	34.17	101.12	33.71
T2	35.17	31.67	31.67	98.51	32.84
T3	34.61	31.89	32.50	99.00	33.00
T4	32.89	33.39	32.50	98.78	32.93
T5	30.94	33.11	32.83	96.88	32.29
T6	34.11	32.28	34.17	100.56	33.52
Total	202.39	194.62	197.84		
Grand Total				594.85	
Grand Mean			33.05		

CV- 3.73

ANOVA

SV	DF	SS	MS	Computed F	Tabulated F	
					5%	1%
Replication	2	5.078	2.54			
Treatment	5	4.53	0.91	0.60ns	3.22	5.33
Error	10	15.16	1.52			
Total	17					

Legend:
T1- control (no significant)
T2- full recommendation of inorganic fertilizers
T3- ½ of the inorganic fertilizers
T4- ½ of the rec.inorganic fertilizer + ½ of the biochemical (buffalo) fertilizers
T5- full recommended biochemical (buffalo) fertilizers
T6- full rec. inorganic fertilizer+ full rec. biochemical fertilizer

6 DISCUSSION

The higher yield obtained in treatment 5 (pure biochemical fertilizer) comparable to that of the commercial inorganic fertilizer (T2) was due to the nutrient components of the fertilizer. On the basis of laboratory analysis, the higher amount of phosphorous (15.8%) potassium (24.1%) and nitrogen (2.05%) contributed to higher yield as compared to other treatments. Further, this fertilizer contains abundant amino acids, humic acids and trace elements (calcium, magnesium and boron). The addition of beneficial microbial groups particularly bacteria with synthetic chemical fertilizer enhanced its efficiency when applied to the target crops. The experimental field had inadequate supply of phosphate as indicated in the soil analysis thus, the higher phosphate content in the biochemical fertilizer applied contributed to the improvement of crop yield. The recommended application (400 kg/ha) showed some

effects because more amounts of these elements such as Nitrogen, Phosphorus and Potassium are needed to meet the nutrient requirements of plants. The synthetic fertilizer component of this test fertilizer also help in increasing grain yield as most of the type of solely manufactured organic fertilizers have lower N, P, K content than inorganic ones thus, a combination with inorganic fertilizers are likewise needed (PhilRice 1993) On the contrary, the negligible effects of the fertilizers in some of the treatments maybe due to the inadequate amounts applied and thereby insufficient supply of nutrients to the crop.

Fertilizers are contributory in promoting the production of tillers and eventually increase the potential number of panicles (PhilRice 1993). The similarities of the treatments in producing tillers and panicles resulting to differences in yield indicates that tillers produced were developed into panicles, but some of the panicles did not contribute to the weight of the grains. The rest of the panicles were probably half filled or with unfilled grains.

The application of biochemical (buffalo) fertilizer increased weight of rice grain and thereforecan be a good substitute of commercial inorganic fertilizer. It is recommended that this type of fertilizer be applied to other industrial crops as rubber, banana and abaca in the region.

REFERENCES

COSICO, WC (1993), *Organic Fertilizers. Their nature, properties and use*, Farming Systems and Soil Resources Institute, UPLB College, Laguna, 5.

Food and Agriculture (FAO). (2004) *Fertilizer used by crop in Malaysia,* [Online] Natural Resource Management and Environment Department.
Retrieved from: www.Fao.org./docrep/007/y5797.e06.html.

GARRITY, DP & FLINN, JC (1988), 'Farm–level management systems for green manure crops in Asian rice environments', In: *Sustainable agriculture-green manure in rice farming,* IRRI, Los Baños, Laguna, pp. 111-129.

KHIND, CS, JOSAN, AS & BERI, V (1985), 'N release from Sesbania green manure and effect of time of application of fertilizer on lowland rice', IRRI, Los Banos, Laguna, vol. 10 (4), pp. 26-27.

MANN, RA & GARRITY, DP (eds.) (1994), 'Green manures in rice-wheat cropping systems in Asia', In: *Green Manure Production Systems for Asian Rice Lands*, IRRI, Los Baños, Laguna, pp. 27-42.

MEHTA, RS (2001), *Biochemical fertilizer component*, [Online] Organica Inc. Retrieved from: www.freepatentsonline.com/622886.html.

PHILIPPINES. Agriculture, Forestry and Natural Resource Research and Development. Los Banos, Laguna, 110.

PHILIPPINES. PCAARRD. BSWM. (1999) 'Balanced fertilization strategy. Reformulating national fertilizer recommendation for rice', In: *Highlights' 98*, Los Baños, Laguna, pp. 23-24.

PHILIPPINES. PCAARRD. (2000) Sustainable Development through Organic Agriculture, Phil Council.

PHILIPPINES. PHILRICE. (1993) *Rice Production Technoguide*, Munoz, Nueva Ecija, 60.

VENKATARAMAN, A (1984), 'Development of organic matter-based agricultural systems in South Asia', In: *Organic matter and rice,* International Rice research Institute, pp. 57-58.