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EVALUATION OF ARATIBIOTECH ORGANOMINERAL FERTILIZER EFFECT ON LOWLAND RICE PRODUCTION

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ABSTRACT
A Randomized Complete Block Design experiment with three replicates was carried out at the lowland experimental site of National Cereals Research Institute, Badeggi in 2011 and 2012 wet season. National Cereals Research Institute, Badeggi is located at Lat. 09º 45'N; Long. 06º 7'E Organomineral fertilizer was applied at the rate of 2, 3, and 4t/ha while no fertilizer application as well as application of recommended inorganic fertilizer for lowland rice were included among the treatments as checks. The improved rice variety used was FARO 44 in 2011 but changed to FARO 52 in 2012. Data/observation taken included: plant height, plant aspect, days to 50% flowering, grain yield and cost-benefit. Data were analyzed with CropStat Software developed by International Rice Research Institute, Philippines. The results indicated that application of organomineral fertilizer enhances rice growth performance and yield. The cost-benefit parameter however showed that, if organomineral fertilizer is to serve as an alternative to the use of inorganic fertilizer in lowland rice production, then its application can be at 2t/ha but the paddy should be sold as seeds that have higher returns on investment than as grains in order to break-even.

Key words: Organomineral fertilizer; lowland rice
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INTRODUCTION
As inorganic fertilizers supply nutrients to the soil and crop, organic fertilizer improve the physical condition of the soil and also support good crop growth and development (Vanlauwe *et al*., 2001). Combined application of mineral and organic input is for sustainable agricultural production, hence the introduction of Integrated Plant Nutrient System (IPNS) that makes maximum use of local sources of plant nutrients of both organic and inorganic origin (Dudal and Roy, 1995). The observed improvements in soil fertility management have led to advocate for the use of organic and inorganic fertilizers (Tankou, 2004). The use of already blended together of organic and inorganic fertilizer will save cost of application and also increased the soil and crop productivity. The nutrient content of the Aratibiotech organomineral fertilizer are: pH in water (8.8); %N (4.45); %P (2.45); %Ca (19.43); %Mg (0.65) %K (0.25); ppmNa (41.92); ppmMn (344.91); ppmFe (442.64); ppmCu (13.49); ppmZn (86.45); %Carbon

(48.22) and C/N ratio (10.84). The application rate for the blended fertilizer in a specific crop needs to be evaluated. The Aratibiotech organomineral had not been evaluated in lowland rice production. The objective of this experiment therefore is to determine the appropriate rate of Aratibiotech organomineral fertilizer in lowland rice production

MATERIALS AND METHODS

The experiment was carried out at the lowland experimental site of National Cereals Research Institute, Badeggi in 2011 and 2012 wet season. National Cereals Research Institute, Badeggi is located at Lat. 09°45′N; Long. 06°7′E. The experimental design was Randomized Complete Block with three replicates. There were five treatments. Organomineral fertilizer was applied at the rate of 2, 3, and 4t/ha with no fertilizer application plot as well as application of recommended inorganic fertilizer for lowland rice as checks.

Transplanting of 21 days old seedlings of FARO 44 was done on September 7, 2011 and the organomineral fertilizer was applied once at 3 weeks after transplanting. The transplanting in 2012 was done on August 2, 2012 using FARO 52 rice variety. Where inorganic fertilizers were to be applied, the conventional method of split application was done. That is, basal at 2 weeks after transplanting and top dress at 6 weeks after transplanting using NPK 15:15:15 and Urea 46% respectively.

The plot size was 5m x 3m. Initial soil sample of the experimental site was taken at 20 cm depth and analyzed for physico-chemical properties.

Weed management was done by application of Orizoplus (Propanil + 2, 4 - D) at 4l/ha 3 weeks after transplanting and with a supplementary hand weeding at 6 weeks after transplanting.

Data/observation taken include: plant height, plant aspect, grain yield and cost-benefit. Data were analyzed with CropStat Software developed by International Rice Research Institute, Philippines and the means compare where significant, using the least Significant Difference (LSD) at P = 0.05

RESULTS AND DISCUSSION

Soil analysis

The initial soil sample physico-chemical properties are as listed in Table 1. The soil was acidic; high in organic carbon; low in total nitrogen in 2011 but high in 2012; high in available phosphorus and moderate high to medium in potassium. The soil is sandy loam. The soil in the experimental area was not too poor in nutrient content. This is one of the good characteristics of lowland soil as compared to upland soil which also make rice yield production normally higher in the lowland than upland ecology. However, soil nutrient sustainability is an important factor that needs to be put into consideration in rice production. This sustainability can be achieved through proper nutrient management by using appropriate soil management practices which include fertilizer use and management.

Table 1: Physico-chemical properties of the soil in the experimental site in 2011 and 2012

	2011	2012
pH	4.23	5.20
Organic Carbon %	1.50	3.47
Organic matter %	2.75	5.98
Total Nitrogen %	0.10	0.26
Available P (ppm)	49.96	35.62
Exchangeable cations		
Na cmol/kg^{-1}	0.96	0.48
K cmol/kg^{-1}	0.41	0.23
Ca cmol/kg^{-1}	5.28	3.10
Mg cmol/kg^{-1}	4.72	6.36
EA cmol/kg^{-1}	0.62	0.26
CEC cmol/kg^{-1}	11.99	10.43
Sand %	82.93	66.24
Silt %	14.56	25.28
Clay %	2.51	8.48

Plant height

Although shorter rice plant height was obtained in the no fertilizer treatment plot (Table 2 - 3), the high organic carbon in the soil enhanced rice growth in the no fertilizer applied plot as shown in its rice plant height values. The mean of the two years did not show significant difference in the rice plant height among the treatments both at 6 WAT and at maturity.

Table 2: Influence of organomineral fertilizer on rice plant height at 6 WAT in 2011 and 2012 wet season at Badeggi

	Plant height, cm		
Treatment	2011	2012	Mean
1. No application of any fertilizer	42.0	36.0	39.0
2. Recommended inorganic fertilizer only (NPK 80:40:40)	43.3	43.7	43.5
3. 2t/ha organomineral fertilizer	38.7	45.0	41.9
4. 3t/ha organomineral fertilizer	43.0	45.0	44.0
5. 4t/ha organomineral fertilizer	45.0	45.0	45.0
SE±	1.2	1.5	2.2
CV%	5.0	5.9	7.3

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

Plant aspect

This is the degree of morphological appearance of the plant and was measured visually using a scale rating of 1 – 10 where 1 = very poor and 10 = very good. Highest significant plant aspect of 8.0 was obtained at 8 WAT in the 4t/ha applied organomineral fertilizer plot in 2011 (Table 4). In 2012, rice plant aspect was significantly lower in the no fertilizer applied plot both at 8 and 10 WAT (Table 4 – 5) while other treatments had no significant difference in the rice plant aspect values. The mean value of both years indicated that rice plant aspect was higher in the orgnomineral applied plot at 4t/ha. The result indicated that the applied organomineral fertilizer enhanced rice growth performance.

Table 3: Influence of organomineral fertilizer on rice plant height at maturity in 2011 and 2012 wet season at Badeggi

	Plant height, cm		
Treatment	**2011**	**2012**	**Mean**
1. No application of any fertilizer	121.7[a]	90.0[b]	105.9[a]
2. Recommended inorganic fertilizer only (NPK 80:40:40)	123.0[a]	101.7[ba]	112.4[d]
3. 2t/ha organomineral fertilizer	123.0[a]	110.0[a]	116.5[d]
4. 3t/ha organomineral fertilizer	124.7[a]	115.0[a]	119.5[d]
5. 4t/ha organomineral fertilizer	124.7[a]	110.0[a]	117.4[d]
SE±	1.5	4.3	4.4
CV%	2.2	7.1	5.5

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

Table 4: Influence of organomineral fertilizer on rice plant aspect at 8 W.A.T in 2011 and 2012 wet season at Badeggi

	Plant aspect		
Treatment	**2011**	**2012**	**Mean**
1. No application of any fertilizer	7.0[b]	6.7[b]	6.9[b]
2. Recommended inorganic fertilizer only (NPK 80:40:40)	7.2[b]	7.8[a]	7.5[b]
3. 2t/ha organomineral fertilizer	7.7[ab]	8.0[a]	7.9[ab]
4. 3t/ha orgonomineral fertilizer	7.8[ab]	8.2[a]	8.0[ab]
5. 4t/ha organomineral fertilizer	8.0[a]	8.3[a]	8.2[a]
SE±	0.2	0.2	0.7
CV%	5.3	5.3	7.3

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

Table 5: Influence of organomineral fertilizer on rice plant aspect at 10 W.A.T in 2011 and 2012 wet season at Badeggi

	Plant aspect		
Treatment	**2011**	**2012**	**Mean**
1. No application of any fertilizer	7.5[a]	7.5[b]	7.5[b]
2. Recommended inorganic fertilizer only (NPK 80:40:40)	8.4[a]	8.8[a]	8.6[a]
3. 2t/ha organomineral fertilizer	7.7[a]	8.7[a]	8.2[a]
4. 3t/ha orgonomineral fertilizer	8.3[a]	9.0[a]	8.7[a]
5. 4t/ha organomineral fertilizer	8.5[a]	9.0[a]	8.8[a]
SE±	0.3	0.2	0.2
CV%	7.4	3.5	3.1

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

Grain yield

Significant difference occurred in the obtained grain yield in 2011 only while the grain yield obtained in 2012 did not show any significant difference among the treatments (Table 6).

Table 6: Influence of organomineral fertilizer on rice plant aspect at 10 W.A.T in 2011 and 2012 wet season at Badeggi

	Grain yield, kg/ha		
Treatment	**2011**	**2012**	**Mean**
1. No application of any fertilizer	2577.8[b]	4222.3[a]	3400.1[b]
2. Recommended inorganic fertilizer only	2888.9[ab]	4888.9[a]	3888.9[ab]
3. 2t/ha organomineral fertilizer	2644.4[b]	4888.9[a]	3766.7[b]
4. 3t/ha orgonomineral fertilizer	2911.1[ab]	5333.3[a]	4122.2[ab]
5. 4t/ha organomineral fertilizer	3533.3[a]	5333.3[a]	4433.3[a]
SE±	249.5	354.9	158.5
CV%	14.8	12.5	5.7

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

The mean grain yield of the two years indicated highest grain yield in the 4t/ha applied organomineral fertilizer plot which was however not significantly different compared with grain yield obtained in the 3t/ha organomineral fertilizer plot and that of recommended inorganic fertilizer plot. Although lowest grain yield was obtained in the no fertilizer application plot, the obtained grain yield was still high as a result of high nutrient in the soil.

Cost- benefit

The quantity of organomineral fertilizer in tonnage increased the production cost markedly. As the quantity of organomineral fertilizer increased, the production cost also increased in that order significantly (Table 7). With the quantity of organomineral required that is in tonnes, rice producers can only break-even if the paddy is sold as seeds and not as grains considering the production cost if the usage of the organomineral fertilizer is to be adopted. The net profit of paddy rice as seeds in this experiment indicated highest significant profit in the recommended inorganic fertilizer application treatment (Table 7).

Table 7: Influence of organomineral fertilizer on seed production cost, gross benefit and net benefit for mean of two years at Badeggi

	Grain yield, kg/ha		
Treatment	**2011**	**2012**	**Mean**
1. No application	199,181[e]	1,020,020[b]	820,834[b]
2. Recommended inorganic fertilizer	241,340[d]	1,166,670[ab]	925,330[ab]
3. 2t/ha organomineral fertilizer	441,166[c]	1,130,000[b]	688.830[b]
4. 3t/ha orgonomineral fertilizer	562,888[b]	1,236,660[ab]	673.772[ab]
5. 4t/ha organomineral fertilizer	683,332[a]	1,329,990[a]	646.608[a]
SE±	449.6	47,549	47.145.5
CV%	0.1	5.7	8.9

Price of 50kg inorganic fertilizer = ₦5,000. Price of 50kg organomineral fertilizer = ₦6,000. Price of 1kg seed = ₦300 (farm gate price)

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

The net profit in the other organomineral fertilizer applied plots though positive was not

significantly different. The net profit in the no fertilizer application plot is temporary and cannot be sustained; hence farmers should apply fertilizer to their rice field. The importance of integrated usage of organic and inorganic fertilizer cannot be over emphasized and if there could be reduced application to one period as in organomineral fertilizer, the operation will be easier and labour cost for application reduced.

Considering the production cost and gross benefits (Table 7), the most profitable net benefit of paddy rice as seeds in this experiment among the organomineral fertilizer applied treatments was the application of organomineral fertilizer at 2t/ha.

CONCLUSION AND RECOMMENDATION

Application of organomineral fertilizer enhances rice growth performance and yield. If organomineral fertilizer is to serve as an alternative to the use of inorganic fertilizer in lowland rice production, then its application can be at 2t/ha but the paddy should be sold as seeds and not as grains in order to break-even.

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