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FIELD EVALUATION OF BIOWISH-CROP ORGANIC FERTILIZER IN 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. 09° 45'N; Long. 06° 7'E. Three rates of Biowish-Crop (5, 4 and 3kg/ha) were combined with inorganic fertilizer at either recommended, ⅔ or ½ recommended rate and applied two days after the basal application foliarly as per treatment quantity in a spraying volume of 200l/ha of water using a 2l-capacity hand operated Sprayer. The results indicated that Biowish organic fertilizer enhances growth and yield performance of rice. If Biowish organic fertilizer is to be used complementarily with inorganic fertilizer in lowland rice production, then its application at 5kg/ha in combination with ⅔ recommended inorganic fertilizer would be a preferable option for recommendation. Higher profits will also be obtained if the production of the paddy is for seeds rather than for grains.

Key words: Biowish-Crop; lowland rice; organic fertilizer

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INTRODUCTION

Biowish-Crop is a hi-potency enzymatic crop protection and is 100% organic based commercial fertilizer that helps increase micronutrient uptake in plants, improves plant vigor and stimulates microbial activity in the soil.. The active ingredient composition as stated by the manufacturer are: Crude protein, 20.45%; Moisture, 7.96%; Crude fat, 0.71%; Crude fibre, 6.30% and Ash, 12.30%. As part of Integrated Soil Fertility Management strategy for increase crop performance, the combined use of organic and inorganic nutrient sources is necessary. It has been stated that the integrated approach of combining the use of inorganic and organic fertilizer will enhance both soil (Belay *et. al.* 2001) and crop productivity. One of the limiting factors hindering high yield of crop production is inadequate nutrient supply to the crop. High cost and unavailability of inorganic fertilizer are common constraints among small-scale farmers in Nigeria in their crop production engagement (Sobulo and Osiname, 1985, Adeoluwa and Oshunsaya, 2009) The laboratory analysis carried out at the Ahmadu Bello University, Zaria showed the following chemical composition of Biowish: Total nitrogen (N), 5.08%; Ammoniacal N,1.70%; Phosphorus (P_2O_5), 1.34%; Potassium (K_2O), 2.10%; Calcium (Ca), 2.30% and Magnesium (Mg), 0.60%. Other elements include: Copper

(Cu), 5.10mg/kg; Zinc (Zn), 7.20mg/kg; Cadnium (Cd), 2.10mg/kg and Lead (Pb), 0.00mg/kg (Amapu, 2011). The remarks in respect of the analysis was that the product qualified as organic fertilizers but there is the need to ascertain the efficacy on crops using agronomic techniques under green house and or field conditions (Amapu, 2011)

This product has never been tested in lowland rice production. Hence this experiment was carried out to determine the effectiveness of Biowish-Crop organic fertilizer in complementary usage with inorganic fertilizer in lowland rice production.

MATERIALS AND METHODS

The experiment was carried out at the lowland experimental field of National Cereals Research Institute, Badeggi in the 2011 and 2012 wet season. National Cereals Research Institute, Badeggi is located at Lat. 09^{o} 45'N; Long. 06^{o} 7'E. The experimental design was Randomized Complete Block with three replicates. Initial soil sample of the experimental site was taken at 20 cm depth and analyzed for physico-chemical properties.

Manual land preparation through heaping, scattering and leveling were done before transplanting into the field. Three weeks old seedlings of FARO 52 rice variety was transplanted on August 12, 2011 and 13 August, 2012. Basal inorganic fertilizer was applied two weeks after transplanting where applicable and as per required rate using NPK 15:15:15 compound fertilizer source. Half of nitrogen and all the phosphorus and potassium were applied basal and the other half of nitrogen applied top dress at six weeks after transplanting using Urea 46%.

The Biowish-Crop organic fertilizer was applied two days after the basal application foliarly as per treatment quantity in a spraying volume of 200l/ha of water using a 2l-capacity hand operated Sprayer. The liquid was sieved with clean white cloth to prevent nozzle blockage during application.

Three rates of Biowish-Crop (5, 4 and 3kg/ha) were combined with inorganic fertilizer at either recommended, ⅔ or ½ recommended rate. There were eleven treatments.

Weeds were managed through the application of Propanil + 2,4-D at three weeks after transplanting and supplementary handweeding at six weeks after transplanting.

The following data/observation were taken: days to 50% flowering; plant height at maturity, 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; very high in organic carbon; moderately low in total nitrogen; high in available phosphorus but very low in potassium. By texture, the soil was more sandy in nature.

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

	2011	2012
pH	5.16	5.17
Organic Carbon %	2.71	1.27
Organic mtter %	4.67	9.23
Total Nitrogen %	0.14	0.05
Available P (ppm)	23.3	197.6
Exchangeable cations		
Na Cmol/kg^{-1}	0.43	0.99
K Cmol/kg^{-1}	0.13	0.18
Ca Cmol/kg^{-1}	5.52	33.17
Mg Cmol/kg^{-1}	4.22	26.24
EA Cmol/kg^{-1}	0.68	0.2
CEC Cmol/kg^{-1}	11.16	60.6
Sand %	81.96	82.68
Silt %	15.56	12.28
Clay %	2.48	5.04

Days to 50% flowering

The number of days to 50%flowering is not affected by the different treatments in both years (Table 2) as there was no significant difference in the number of days to 50% flowering among the treatments.

Plant height at maturity

There was no significant difference in the rice plant height at maturity among the treatments in 2011 but the values of rice plant height in 2012 showed significant difference (Table 3). Application of recommended inorganic fertilizer and 4kg/ha Biowish in combination with ½ recommended inorganic fertilizer gave significantly taller rice plant than no fertilize. Other treatments showed no significant differences in rice plant height at maturity. The mean plant height of the two years also indicated significant shorter rice plant height in the treatment where fertilizer was not applied (Table 3). In 2011, highest % increase advantage in plant height over no application of fertilizer treatment (12.6%) was obtained in treatment where 5kg/ha Biowish was applied in combination with recommended inorganic fertilizer. In 2012, % increase advantage in plant height over no application of fertilizer treatment was in the recommended inorganic fertilizer treatment and that of Biowish applied at 4kg/ha in combination with ½ recommended inorganic fertilizer treatments (Table 4). The rice plant height mean of the two years showed significant highest % increase in the 5kg/ha Biowish in combination with recommended inorganic fertilizer treatment.

Table 2: Influence of Biowish organic fertilizer on days to 50% flowering in 2011 and 2012

Treatment	Days to 50% flowering		
	2001	**2012**	**Mean**
1. No application of either fertilizer	105.7[a]	85.3[a]	95.5[a]
2. Recommended inorganic fertilizer NPK 80:40:40 only	105.7[a]	85.7[a]	95.7[a]
3. 5kg/ha Biowish + Recommended inorganic fertilizer	104.7[a]	86.7[a]	95.7[a]
4. 5kg/ha Biowish + ⅔ Recommended inorganic fertilizer	107.0[a]	84.7[a]	95.9[a]
5. 5kg/ha Biowish + ½ Recommended inorganic fertilizer	104.3[a]	83.7[a]	94.0[a]
6. 4kg/ha Biowish + Recommended inorganic fertilizer	104.3[a]	85.0[a]	94.7[a]
7. 4kg/ha Biowish + ⅔ Recommended inorganic fertilizer	103.7[a]	84.0[a]	93.9[a]
8. 4kg/ha Biowish + ½ Recommended inorganic fertilizer	104.3[a]	83.7[a]	94.0[a]
9. 3kg/ha Biowish + Recommended inorganic fertilizer	104.3[a]	83.7[a]	94.0[a]
10. 3kg/ha Biowish + ⅔ Recommended inorganic fertilizer	104.7[a]	87.0[a]	95.9[a]
11. 3kg/ha Biowish + ½ Recommended inorganic fertilizer	104.7[a]	86.3[a]	95.5[a]
SE±	2.9	2.1	0.7
CV%	6.8	4.4	1.0

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

Table 3: Influence of Biowish organic fertilizer on rice plant height at maturity in 2011 and 2012

Treatment	Plant height at maturity, cm		
	2011	**2012**	**Mean**
1. No application of either fertilizer	98.7[a]	96.7[b]	97.7[b]
2. Recommended inorganic fertilizer NPK 80:40:40 only	99.4[a]	108.3[a]	103.9[ab]
3. 5kg/ha Biowish + Recommended inorganic fertilizer	111.1[a]	106.7[ab]	108.9[a]
4. 5kg/ha Biowish + ⅔ Recommended inorganic fertilizer	108.4[a]	106.7[ab]	107.6[ab]
5. 5kg/ha Biowish + ½ Recommended inorganic fertilizer	105.3[a]	100.0[ab]	102.7[ab]
6. 4kg/ha Biowish + Recommended inorganic fertilizer	100.2[a]	103.3[ab]	101.8[b]
7. 4kg/ha Biowish + ⅔ Recommended inorganic fertilizer	102.8[a]	103.3[ab]	103.1[ab]
8. 4kg/ha Biowish + ½ Recommended inorganic fertilizer	105.5[a]	108.3[a]	106.9[ab]
9. 3kg/ha Biowish + Recommended inorganic fertilizer	105.3[a]	106.7[ab]	106.0[ab]
10. 3kg/ha Biowish + ⅔ Recommended inorganic fertilizer	106.8[a]	101.7[ab]	104.3[ab]
11. 3kg/ha Biowish + ½ Recommended inorganic fertilizer	105.9[a]	105.0[ab]	105.5[ab]
SE±	6.0	3.5	2.1
CV%	9.8	5.8	2.9

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

Table 4: Influence of Biowish organic fertilizer on % increase advantage of rice plant height over no application of fertilizer treatment at maturity in 2011 and

	Plant height at maturity, cm		
Treatment	**2011**	**2012**	**Mean**
1. No application of either fertilizer	0	0	0^{b}
2. Recommended inorganic fertilizer NPK 80:40:40 only	0.7	12.0	6.4^{ab}
3. 5kg/ha Biowish + Recommended inorganic fertilizer	12.6	10.3	11.5^{a}
4. 5kg/ha Biowish + ⅔ Recommended inorganic fertilizer	9.8	10.3	10.1^{ab}
5. 5kg/ha Biowish + ½ Recommended inorganic fertilizer	6.7	3.4	5.1^{ab}
6. 4kg/ha Biowish + Recommended inorganic fertilizer	1.5	6.8	4.2^{b}
7. 4kg/ha Biowish + ⅔ Recommended inorganic fertilizer	4.2	6.8	5.5^{ab}
8. 4kg/ha Biowish + ½ Recommended inorganic fertilizer	6.9	12.0	9.5^{ab}
9. 3kg/ha Biowish + Recommended inorganic fertilizer	6.7	10.3	8.5^{ab}
10. 3kg/ha Biowish + ⅔ Recommended inorganic fertilizer	8.2	5.2	6.7^{ab}
11. 3kg/ha Biowish + ½ Recommended inorganic fertilizer	7.3	8.6	8.0^{ab}
SE±	-	-	2.2
CV%	9.8	5.8	44.9

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

Grain yield

Lowest significant grain yield was recorded in the no application of fertilizer treatment in both years (Table 5). The grain yield obtained in 2012 was lower than that of 2011 in each respective treatment. In 2012, highest significant grain yield of 4291.1kg/ha was obtained in the applied 5kg/ha Biowish in combination with recommended inorganic fertilizer treatment. This same treatment gave the highest yield in 2011.

Table 5: Influence of Biowish organic fertilizer on grain yield in 2011 and 2012

	Grain yield, kg/ha		
Treatment	**2011**	**2012**	**Mean**
1. No application of either fertilizer	3022.2^{b}	1071.1^{c}	2046.7^{c}
2. Recommended inorganic fertilizer NPK 80:40:40 only	4466.7^{a}	3811.1^{b}	4138.9^{ab}
3. 5kg/ha Biowish + Recommended inorganic fertilizer	4750.0^{a}	4291.1^{a}	4520.6^{a}
4. 5kg/ha Biowish + ⅔ Recommended inorganic fertilizer	4488.9^{a}	3088.9^{c}	3788.9^{ab}
5. 5kg/ha Biowish + ½ Recommended inorganic fertilizer	3733.3^{ab}	2782.2^{c}	3257.8^{b}
6. 4kg/ha Biowish + Recommended inorganic fertilizer	4688.9^{a}	2315.5^{d}	3502.2^{ab}
7. 4kg/ha Biowish + ⅔ Recommended inorganic fertilizer	4444.4^{a}	2217.0^{d}	3330.7^{b}
8. 4kg/ha Biowish + ½ Recommended inorganic fertilizer	3600.0^{ab}	2166.7^{d}	2883.4^{bc}
9. 3kg/ha Biowish + Recommended inorganic fertilizer	4200.0^{ab}	1946.9^{d}	3073.5^{bc}
10. 3kg/ha Biowish + ⅔ Recommended inorganic fertilizer	3933.3^{ab}	1480.0^{c}	2706.6^{bc}
11. 3kg/ha Biowish + ½ Recommended inorganic fertilizer	3555.6^{ab}	1231.1^{c}	2393.4^{bc}
SE±	482.0	139.6	367.7
CV%	20.4	10.1	16.0

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

Table 6: Influence of Biowish organic fertilizer on % yield increase in 2011 and 2012

Treatment	% yield increase over no fertilizer application		
	2011	**2012**	**Mean**
1. No application of either fertilizer	0	0	0^{b}
2. Recommended inorganic fertilizer NPK 80:40:40 only	47.8	255.8	151.8^{ab}
3. 5kg/ha Biowish + Recommended inorganic fertilizer	57.2	300.6	178.9^{a}
4. 5kg/ha Biowish + ⅔ Recommended inorganic fertilizer	48.5	188.4	118.5^{ab}
5. 5kg/ha Biowish + ½ Recommended inorganic fertilizer	23.5	159.8	91.7^{ab}
6. 4kg/ha Biowish + Recommended inorganic fertilizer	55.1	116.2	85.7^{ab}
7. 4kg/ha Biowish + ⅔ Recommended inorganic fertilizer	47.1	107.0	77.1^{ab}
8. 4kg/ha Biowish + ½ Recommended inorganic fertilizer	19.1	102.3	60.7^{ab}
9. 3kg/ha Biowish + Recommended inorganic fertilizer	39.0	81.8	60.4^{ab}
10. 3kg/ha Biowish + ⅔ Recommended inorganic fertilizer	30.1	38.2	34.2^{b}
11. 3kg/ha Biowish + ½ Recommended inorganic fertilizer	17.6	14.9	16.2^{b}
SE±	-	-	41.7
CV%	-	10.1	71.1

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

All the fertilizer treated plots had yield increase advantage over the no fertilizer application plot (Table 6) indicating that fertilizer enhances the growth of rice.

Table 7: Influence of Biowish organic fertilizer on production cost, gross and net benefit of mean of the two years (seed production)

Treatment	Production Cost ₦	Gross Benefit ₦	Net Benefit ₦
1. No application of either fertilizer	196.924^{h}	$613,995^{c}$	$417,071^{b}$
2. Recommended inorganic fertilizer NPK 80:40:40 only	243.412^{g}	$1,241,670^{ab}$	$998,258^{ab}$
3. 5kg/ha Biowish + Recommended inorganic fertilizer	299.458^{a}	$1,356,165^{a}$	$1,056,707^{a}$
4. 5kg/ha Biowish + ⅔ Recommended inorganic fertilizer	285.413^{b}	$1,136,670^{ab}$	$851,257^{ab}$
5. 5kg/ha Biowish + ½ Recommended inorganic fertilizer	277.254^{c}	$977,325^{b}$	$700,071^{b}$
6. 4kg/ha Biowish + Recommended inorganic fertilizer	284.003^{b}	$1,050,660^{ab}$	$766,657^{ab}$
7. 4kg/ha Biowish + ⅔ Recommended inorganic fertilizer	270.758^{d}	$999,210^{b}$	$728,452^{ab}$
8. 4kg/ha Biowish + ½ Recommended inorganic fertilizer	262.819^{c}	$865,005^{bc}$	$602,186^{b}$
9. 3kg/ha Biowish + Recommended inorganic fertilizer	272.290^{cd}	$922,035^{bc}$	$649,745^{b}$
10. 3kg/ha Biowish + ⅔ Recommended inorganic fertilizer	258.666^{c}	$811,995^{bc}$	$553,329^{b}$
11. 3kg/ha Biowish + ½ Recommended inorganic fertilizer	251.218^{f}	$718,005^{bc}$	$466,787^{b}$
SE±	1905	110,295	108,532
CV%	1.0	16.0	21.7

Price of 50kg inorganic fertilizer = ₦5,000; Price of 1kg Biowish = ₦11,000; 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

Table 8: Influence of Biowish organic fertilizer on production cost, gross and net benefit of mean of the two years (Grain production)

Treatment	Production Cost ₦	Gross Benefit ₦	Net Benefit ₦
1. No application of either fertilizer	166,924[c]	173,966[c]	7,042[b]
2. Recommended inorganic fertilizer NPK 80:40:40 only	226,912[d]	351,807[ab]	124,895[a]
3. 5kg/ha Biowish + Recommended inorganic fertilizer	269,458[a]	384,247[a]	114,789[a]
4. 5kg/ha Biowish + ⅔ Recommended inorganic fertilizer	255,413[b]	322,057[ab]	66,644[ab]
5. 5kg/ha Biowish + ½ Recommended inorganic fertilizer	247,254[bc]	276,909[b]	29,655[ab]
6. 4kg/ha Biowish + Recommended inorganic fertilizer	254,003[bc]	297,688[ab]	43,685[ab]
7. 4kg/ha Biowish + ⅔ Recommended inorganic fertilizer	240,758[c]	283,110[b]	42,352[ab]
8. 4kg/ha Biowish + ½ Recommended inorganic fertilizer	232,819[cd]	245,085[bc]	12,266[b]
9. 3kg/ha Biowish + Recommended inorganic fertilizer	242,290[c]	261,244[bc]	18,954[b]
10. 3kg/ha Biowish + ⅔ Recommended inorganic fertilizer	228,666[d]	230,066[bc]	1,400[b]
11. 3kg/ha Biowish + ½ Recommended inorganic fertilizer	221,218[d]	203,435[bc]	-17,783[b]
SE±	3812	31,251	31,595
CV%	2.3	16.0	110.7

Price of 50kg inorganic fertilizer = ₦5,000. Price of 1kg Biowish = ₦11,000. Price of 1kg grain = ₦85 (farm gate price)

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

Cost-benefit

The production cost, gross and net benefits of producing rice paddy as seeds in this experiment are shown in Table 7 while that of production as grains are indicated in Table 8. Highest significant production cost either as seeds or grains was recorded in the 5kg/ha applied Biowish in combination with recommended inorganic fertilizer treatment while the lowest was observed in the no application of fertilizer treatment. Production cost in the recommended inorganic fertilizer treatment was lower than in the other treatments where Biowish was applied in combination with inorganic fertilizer in respect to seed production. Both gross and net benefits indicated higher profit in the recommended inorganic fertilizer; 5kg/ha Biowish + recommended inorganic fertilizer; 5kg/ha Biowish + ⅔ recommended inorganic fertilizer and 4kg/ha Biowish + recommended inorganic fertilizer treatments (Table 7 and 8).

The inference that can be made from the results of grain yield and cost – benefit of this experiment showed that if Biowish organic fertilizer is to be used complementarily with inorganic fertilizer in lowland rice production, then its application at 5kg/ha in combination with ⅔ recommended inorganic fertilizer would be a preferable option for recommendation. Higher profits will also be obtained if the production of the paddy is for seeds rather than for grains.

CONCLUSION AND RECOMMENDATION

Biowish organic fertilizer enhances growth and yield performance of rice. If Biowish organic fertilizer is to be used complementarily with inorganic fertilizer in lowland rice production, then its application at 5kg/ha in combination with ⅔ recommended inorganic fertilizer would be a preferable option for recommendation. Higher profits will also be obtained if the production of the paddy is for seeds rather than for grains.

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