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Response of Lowland Rice to Rice Crop Specific Npk Fertilizer at Badeggi Central Nigeria

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ABSTRACT *The trial was carried at National Cereals Research Institute Lowland Experimental field in the year 2019 and 2020 to evaluate the response of lowland rice to application of Rice Crop Specific NPK fertilizer 1and commercial NPK fertilizer which was applied at two levels each recommended blanket rate of 80:40:40 NPK/ha and higher rate of 120: 60:60 NPK/ha for lowland rice as well as the control (Zero fertilizer). The results indicated that application of fertilizer has significant effects on rice growth there by increased the height of rice at different weeks after fertilizer application compared to control. Rice straw and grain yield production was significantly affected with application and the rates. RCS fertilizer applied at 120:60:60/ha produced higher tonnage of rice straw and grain while application of RCS fertilizer at 80:40:40/ha produced similar rice straw and grain yield with application of NPK 15: 15:15: at rate of 120:60:60/ha. There the adoption of RCS-NPK formulation at rate 80:40:40 kg/ha is recommended against the higher rates from commercial NPK to save cost for the resources poor farmer*.

KEY WORDS: Response, Lowland, Rice, Rice Crop Specific, NPK and Fertilizer

INTRODUCTION

Rice is a cereal grain belonging to the grass family of *Poaceae.* Rice belongs to two species namely *Oryza sativa* and Oryza *glaberrima.* It is a major staple food in both developing and developed worlds and its production has been essential for many countries. Morteza *et al,* (2008) reported that than one third of the human populations rely on rice for their sustenance, which makes it to be the most important of the world's food crops

Kurt, (2011) stated that rice is grown in such varied soils conditions that is difficult to point out the soil on which rice cannot be grown. Report showed that soils having good water retention capacity, good amount of clay and organic matter are considered ideal for rice cultivation. It grows well in soils having pH range between 5.5 and 6.5 The potential land area for rice production in Nigeria is between 4.6 - 4.9 million ha, out of which only about 1.7 million ha or 35 percent of the available land area is presently cropped to rice Faleye *et al*

(2012). This area includes five different rice environments or ecologies (Imolehin and Wada, 2000). The upland ecology/rain fed lowland accounts for 55 to 60 percent of the cultivated rice land. An estimated 25 percent of Nigeria's rice area is under inland valley swamp rice production. The irrigated rice ecology accounts for about 18 percent of cultivated rice land. Deep water or floating rice constitutes 5 to 12 percent of the national rice production area. Tidal (mangrove) swamp ecology contributes less than two percent to national rice production area (Imolehin and Wada, 2000).

Fertilizer played important role in increasing rice production as it is estimated that about 55% of the increase in food production comes from the effect of fertilizers (Horie *et al*. 1999; Erisman *et al*. 2008). Over the past several decades, conventional fertilizer application for rice, mostly divided into 3–4 applications and consisted of basal and top-dressing, is a high-demand, time-consuming and labor-intensive approach. .First of all, you have to take into consideration the soil condition of your field through semiannual or annual soil testing, before applying any fertilization method. No two fields are the same, nor can anyone advise you on fertilization methods without taking into account your soil's test data, tissue analysis and crop history of your field. However, we will list the most common rice fertilization schemes, used by a considerable number of farmers. Inadequate fertilizer applied through improper application technique is one of the factors responsible for low yield of rice (Alemayehu *et al*, 2013). Availability of plant nutrients, particularly nitrogen at various plant growth stages is of crucial importance in rice production. Recommendations on different period of nitrogen fertilizer application were given for various production systems. The number of splits is affected by the total amount of nitrogen fertilizer to be applied based on the desired yield level (Birhan *et al* 2017).

With a constantly growing population, Nigeria irrigated rice production must increased. However, further expansion of the rice planted area is a challenge because a majority of the arable land is already utilized for rice production or has been converted into urban infrastructure. Food security advances must be achieved by constantly improving grain yield per unit area. Despite the enormous area under rice production, production is low due to a number of interrelated problems. One of the main causes of low production is an imbalance in fertilizer use, and the continued use of one form of inorganic fertilizers has resulted in a decline in soil fertility. Chemical fertilizer application plays a vital role in enhancing rice (*Oryza sativa* L.) grain yield, which has been considered as an effective channel to address the food safety issue due to an increasing population Nigeria soils have low range of some these of plant nutrients such as Nitrogen, phosphorus and Potassium. Soil nutrient deficiency is brought about by soil degradation, leaching, erosion, evaporation and over mining by crops. This implies that the available Nitrogen, phosphorus and Potassium in the soil is not enough for crop requirement. Supplementing Nitrogen, phosphorus and Potassium will therefore enhance the availability of Nitrogen, phosphorus and Potassium for crop use and leading to increase in crop performance and yield The purpose of this trial was determined the response of low land rice to different form and rates of fertilizer

MATERIALS AND METHODS

The trial was carried at National Cereals Research Institute Lowland Experimental field in the year 2019 and 2020 to evaluate the response of lowland rice to application of two levels each of Rice Crop Specific (RCS) NPK fertilizer and commercial fertilizer NPK which was applied at NCRI recommended rate of 80:40:40 NPK/ha and higher rate of 120: 60:60 NPK/ha for lowland rice. The trial comprised of five treatments which was laid out in complete randomized block design and was replicated 3 times with the plot size of 10 x 5 m. The treatments were application of RCS NPK fertilizer at 120: 60:60 kg NPK/ha and 80: 40:40 kg NPK/ha while commercial fertilizer were at 120: 60:60 kg NPK/ha and NPK at 80: 40:40 NPK/ha as well as Zero application of fertilizer as control. Rice seedlings were raised in the nursery and transplanted at 3 Weeks after Sowing on nursery bed. Transplanting was done at rate two seedlings per hill at spacing of 20 x 20 cm at 21 days after sowing (Nurserey establishment)

Fertilizer application

Application was done in split (NPK 60: 60:60 and 40: 40:40) was applied at 3 weeks after transplanting as basal for 120: 60:60 NPK/ha and 80: 40:40 NPK/ha respectively while the balance of the Urea 60 kg and 40 kg/ha for 120: 60:60 NPK/ha and 80: 40:40 NPK/ha was applied as topdressing at booting stage of the rice.

Data collected

Soil sample were taken before planting and at harvest. Before planting five soil sample were taken within the trial site at each trial location and these were mixed together to form a composite sample for each site. The sample were taken using soil auger at the depth of 15 - 20 cm

Crop height was taken at 3, 6 and 9 weeks after fertilizer application and at harvest. Rice tiller per hill was taken at 3, 6 and 9 weeks after fertilizer application. Other data taken were Panicles per metre square and rice grain yield tones per hactare

All data that collected were subjected to analysis of variance. (ANOVA)

RESULTS

Pre-planting physico-chemical properties of soils at the experimental sites during 2019and 2020 cropping seasons are as shown in Table 1. The soil is of sandy clay textural class and slightly acidic (pH 5.16-5.4) during three years of study. Organic carbon was between 2.5 to 2.8%, total N was moderately low, available P was moderate and exchangeable cation contents were low (Peter *et a,l* 2006). The total N contents were for 2019 and 2020 and were considered too low for the optimum performance of rice. Rice growth was generally higher in 2020, probably due to the residual or cumulative effective of applied N fertilizer in the previous year. The application of fertilizer has significant effects on rice growth there by increased the height of rice at different weeks after fertilizer application compared to control. This result agreed with the findings of Djomo *et al*, (2017) who recorded increase in rice plant height with NPK fertilizer application at different days after planting compared to Zero application of NPK. The results indicated the fertilizer rates significantly affected the rice plant height which showed the that higher rates gave tallest rice plant height and results is in consonance with work of Djomo *et al*, (2017) that reported different rice plant height as result of different fertilizer dosage. It was found that the application of RCS-NPK fertilizer at 120: 60:60: kg/ha produced taller rice plant height throughout the sample periods when compared with the same rate of commercial NPK fertilizer at 120: 60:60 kg/ha. Application of RCS-NPK fertilizer at 80: 40:40/ha produced similar rice plant height with application of commercial NPK fertilizer at 120: 60:60/ha. The result is in consonant with findings of Budiono *et al* (2019) who observed significant difference in plant height at 35 day of age due to the effect of fertilizer application also agreed (Nneke, 2019 that height of plant increased significantly as the rates of nitrogen increase Rice yield and yield components were significantly affected with the application of fertilizer in which RCS-NPK fertilizer brand gave high number of rice panicles and productive tiller per meter square. No productive rice tiller number was not affected with application of fertilizer at all rates. Rice tiller production was affected by fertilizer forms and dosage in which application of RCS-NPK fertilizer at 120: 60:60 kg/ha: produced high number of rice tillers. Number of tillers per hill of rice increased over time by gradual elevation of nitrogen when compared with application of commercial NPK 15: 15: 15 at same rate. which showed that application of RCS-NPK fertilizer at 120: 60:60kg/ha gave good rice growth and was inline with the report of Tilahun and Zelalem (2019) that growth of new rice variety was ascribed by tiller number and dry matter The lower number of rice tiller was recorded in zero treatment plots which was in line with the findings of Budiono *et al* (2009) that recorded lowest number of tiller per hill from control treatment at all sampling dates. The productive and non productive tillers of rice were determined and the result indicated that nitrogen fertilization rates exerted significant effect on number of tillers. The results also indicated same trend of rice growth performance due fertilizer application were observed in throughout the sample periods. Rice yield was affected by application of fertilizer dosage and forms in which RCS-NPK fertilizer applied at 120: 60:60: produced high rice yield when compared with commercial NPK fertilizer at same rate. Rice straw and grain yield production was significantly affected with application and the rates. RCS-NPK fertilizer applied at 120:60:60/ha produced higher tonnes of rice straw and grain while application of RCS-NPK fertilizer at 80:40:40/ha produced similar rice straw and grain yield with application of NPK at rate of 120:60:60/ha. The high rice yield obtained from higher rate of fertilizer agreed with the findings of Opukiri *et al* (2001) who reported that with increase in the rate of applied N fertilizer, parameters such as number of spikelets per panicle, total dry matter and grain yield also increased significantly. However, beyond a certain rate considered as the optimum, no significant increases were observed.

CONCLUSION

Rice growth and yield were found to have increased as the dosage of N increased. However, the highest significant increases of both growth and yield were obtained with the application rate of RCS-NPK fertilizer at 120: 60:60/ha. This suggests that 150kgN/ha was the most suitable N rate for the topical wetland soil of the study area for rice production.

References

Alemayehu Assefa, Tilahun Tadesse, and Minale Liben (2013). Influence of Time of Nitrogen Application on Productivity and Nitrogen Use Efficiency of Rain-fed Lowland Rice (Oryza sativa L.) in the Vertisols of Fogera Plain, NorthwesternmEthiopia. *Ethiopian Journal of Science and Technology. Vol. VI, No. 1: 25-31.*

Budiono, R .P G Adinurani and P Soni (2019)Lowland rice (*Oryza sativa* L.) growth The 2nd International Conference on Natural Resources and Life Sciences (NRLS) The 2nd International Conference on Natural Resources and Life Sciences (NRLS) IOP Conf. Series: Earth and Environmental Science IOP Conf. Series: Earth and Environmental Science **293** **293** (2019) 012034 (2019) 012034 IOP Publishing IOP Publishing doi:10.1088/1755-1315/293/1/012034 doi:10.1088/1755-1315/293/1/012034

Birhan Abdulkadir, Sofiya Kassa, Temesgen Desalegn, Kassu Tadesse, Mihreteab Haileselassie, Girma Fana and Tolera Abera. Crop response to fertilizer application in Ethiopia: a review. In: Tamene L; Amede T; Kihara J; Tibebe D; Schulz S. (eds.) (2017). A review of soil fertility management and crop response to fertilizer application in Ethiopia: towardsmdevelopment of site- and context-specific fertilizer recommendation. CIAT Publication No. 443. International Center for Tropical Agriculture (CIAT), Addis Ababa, Ethiopia. 86 p. Available at: http://hdl.handle.net/10568/82996.

Faleye, T., David. J., Olulani, T., Dada-Joel, Y., Segun A. and T. Wakatsuki. (2012). Impact of Mechanization on Lowland Rice Production in Nigeria *Journal of Agricultural Science and Technology*. 2:114-120

Imolehin, E. D. and A. C. Wada. (2000). Meeting the rice production and consumption demands of Nigeria with improved technology. *Journal International Rice Commission Newsletter*. 49: 33-41

Kurt, L. (2011). All about agriculture: Climate and Soil for rice cultivation. www.agricultureandupdates.blogspot.com/.../climate-and-soil-for-rice-cultivation.htm

Morteza, N., Y., Nicknejad, H. Pirdeshti, D. B. Tari and S. Nasiri. (2008). Growth, Yield and Yield Traits of Rice Varieties in Rotation with Clover, Potato, Canola and Cabbage in North of Iran. *Asian Journal of Plant Sciences.* 7 (5): 495 -499

Nneke N.. E. (2006) Response to Different Rates of Ntrogen by Five Varieties of Swamp Rce (orza sativa linn) Under theTropical Wetland Conditions of Ini, Akwa Ibom state, Nigeria Rnal of Agricultural Sciences Vol. 15 : 21-26

Opukiri, S. B. Zuofa, K and Douglass, P. C. (2001). The influence of urea fertilization on yield of rice on acid soil in Rivers State. Nig. J. of Crop/Soil Science and Forestry (1): 42-45.

Tilahun Tadesse*, Zelalem Tadesse (2019) Review of Rice Response to Fertilizer Rates and Time of Nitrogen Application in Ethiopia *International Journal of Applied Agricultural Sciences* 5(6): 129-137

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Table 1: Physico – Chemical properties of the soils of experimental site

Soil characteristics	2019	2020
Physical		
Sand (g kg^{-1})	727	728
Silt (g kg^{-1})	65	65
Clay (g kg^{-1})	208	207
Textural Class	Sandy clay	Sandy clay
Chemical		
pH(H_2O)	5.16	5.15
Organic matter(g kg^{-1})	4.7	5.0
Total N (g kg^{-1})	0.07	0.086
Available P (mg kg^{-1})	43.28	43.1
Exchange bases ($cmolKg^{-1}$)		
Ca	5.52	5.08
Mg	4.22	4.21
K	0.13	0.14
Exchangeable acidity ($cmolKg^{-1}$)	0.03	0.04
CEC ($cmolKg^{-1}$)	11.16	10.12

Table 2: Effect of RCS-NPK fertilizer rates on rice height (cm) in2019 and 2020 cropping seasons

Treatments	Rice height@ 3WAFA		Rice height @ 6WAFA		Rice height @ 9 WAFA	
	2019	2020	2019	2020	2019	2020
RCS-NPK @ 120:60:60 kg/ha	62.9	70.4	78.0	85.6	113.8	116.1
RCS-NPK @ 80:40:40 kg/ha	56.3	60.6	71.0	76.6	103.7	107.4
NPK 15: 15: 15 @ 120:60:60 kg/ha	57.8	64.6	74.1	80.6	106.5	112.1
NPK 15: 15: 15 @ 80:40:40 kg/ha	54.5	55.2	67.4	71.3	95.7	97.1
NPK 0 0 0	36.5	36.2	54.6	61.3	66.0	67.0
LSD	6.9	5.6	6.3	4.6	7.7	7.8
CV %	7.1		4.9	3.5	2.6	4.2

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Table 3: Effect of RCS-NPK fertilizer rates on number of rice Tiller per stool in2019 and 2020 cropping seasons

Treatments	Tiller /stool@ 3WAFA		Tiller /stool@ 6WAFA		Tiller /stool@ 9 WAFA	
	2019	2020	2019	2020	2019	2020
RCS-NPK @ 120:60:60 kg/ha	18	26	36.	47	45	55
RCS-NPK @ 80:40:40 kg/ha	13	20	29	38	36	44
NPK 15: 15: 15 @ 120:60:60 kg/ha	16.	23.	31	42	39	48
NPK 15: 15: 15 @ 80:40:40 kg/ha	11	24	19	21	27	28
NPK 0 0 0	9	8	13	12	18	17
LSD	0.2	3.5	2.3	3.3	3.3	2.8
CV %	6.9	10.0	4.9	5.8	5.4	3.8

Table 4: Effect of RCS-NPK fertilizer rates on rice yield components in 2019 and 2020 cropping seasons

Treatments	Rice panicles/m^2		No productive tiller/m^2		Productive tiller/m^2	
	2019	2020	2019	2020	2019	2020
RCS-NPK @ 120:60:60 kg/ha	514	523	58	44	514	523
RCS-NPK @ 80:40:40 kg/ha	425	444	56	51	425	444
NPK 15: 15: 15 @ 120:60:60 kg/ha	467	477	59	60	467	477
NPK 15: 15: 15 @ 80:40:40 kg/ha	377	385	59	61	377	385
NPK 0 0 0	281	227	48	48	281	227
LSD	67.8	27	18.6	9.8	67.8	27
CV %	8.7	3.6	4.7	9.8	8.7	3.6

Table 5: Effect of RCS-NPK fertilizer rates on rice yield (t/ha) in2019 and 2020 cropping seasons

Treatments	Weight of 1000 rice grain (g)		Rice Straw yield (t/h)		Rice grain yield (t/h)	
	2019	2020	2019	2020	2019	2020
RCS-NPK @ 120:60:60 kg/ha	30.3	31.1	6.9	7.4	6.0	6.5
RCS-NPK @ 80:40:40 kg/ha	27.4	29.0	4.3	4.8	3.9	4.3
NPK 15: 15: 15 @ 120:60:60 kg/ha	29.0	29.3	5.6	6.3	4.0	5.3
NPK 15: 15: 15 @ 80:40:40 kg/ha	26.1	26.5	3.8	3.9	2.3	3.0
NPK 0 0 0	23.3	26.0	1.7	1.4	0.9	0.7
LSD	1.6	6.4	0.6	0.5	0.44	0.7
CV %	3.2	10.1	7.6	6.5	6.8	8.6