International Journal of Innovative Agriculture & Biology Research 12(3):57-61, July-Sept, 2024

© SEAHI PUBLICATIONS, 2024 www.seahipublications.org ISSN: 2354- 2934

10.5281/zenodo.13799258

Assessment on the Impact of Poultry Manure & Nitrogen Fertilizer on the Growth Components of Rice (*Oryza sativa*) In Northern Guinea Savanna, Nigeria

Abdullahi, R.[1,2*] & Haruna Y. R.[2]

[1]Department of Crop Science,
Faculty of Agriculture,
Umaru Musa Yar'adua University, Katsina, Katsina State, Nigeria

[2]Department of Agricultural Science Education,
Federal College of Education Katsina, Nigeria

***Corresponding author: rabiu.abdullahi@umyu.edu.ng**
(08032941978, 08026966087)

ABSTRACT

Integrating organic manure with mineral fertilizer helps restore the health of degraded soil by replenishing lost nutrients. Rice is an exhaustive crop that takes lots of nutrients from the soil rich in organic matter. Continuous application of mineral fertilizer alone without supplementary use of organic manure makes the soil low in build-up organic matter, water holding capacity, and nutrient imbalance, which may result in poor or low yield of *Oryza sativa*. The Field trial was conducted at the Umaru Musa Yar'adua University experimental Farms located at Layin Minister, Malumfashi, Katsina, Katsina State (Latitude 12° 53 '' 44' N and Longitude 7° 34'' 51' E.) in the Northern Guinea savanna zone, Nigeria during the 2024 rainy season to Validate the complementary application of organic and inorganic fertilizer for Rice production. The experiment consists of one variety of rice (Yar'yarima), three levels of poultry manure (0, 3 & 5 t ha^{-1}) and three levels of Nitrogen fertilizers (0, 60 & 80 kg Nha^{-1}). The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated three times. Each replication consists of sixteen plots. The result of this study showed that the tallest plants were recorded when rice plants were treated with poultry manure @ both 15 t ha^{-1} and 20 t ha^{-1} at 6 WAS. Statistically, corroborated results were obtained at 9 WAS with the same rates of manure, while the shortest plants were obtained from the untreated controls across the sampling periods. No significant difference was observed in rice plant height and number of tillers using all Nitrogen rates under study. Complementary application of poultry manure @ 20 t ha^{-1} with Nitrogen fertilizer at 80 kg N ha^{-1} gave the tallest plants at 6 & 9 WAS, which was significantly similar to those obtained by the application of 20 t ha^{-1} poultry manure with Nitrogen fertilizer at 60 kg N ha^{-1}. The shortest plants were exhibited by integrating poultry manure @ 10 t ha^{-1} with zero Nitrogen rate at 6 WAS.

Keywords: Plant height, poultry manure, nitrogen, tillers

INTRODUCTION

Rice (*Oryza sativa*) is the first most important staple food in the World in terms of global consumption but ranks third after Maize (*Zea mays*) and Wheat (*Triticum aestivum*) in terms of production. Rice consumption cuts across all the socio-economic classes in all the geopolitical zones of Nigeria. Its production in the country rose from 3.7 million metric tons in 2017 to 4.0 in 2018 (Anonymous, 2015).

In Nigeria today, rice has changed from a luxury food to a cereal crop that supplies Nigerians with a significant source of calories. It is a tropical crop, grown in two seasons (wet & dry seasons) every year, provided moisture is available to the crop. Rice, just like any other cereal crop, requires nitrogen for its growth and development. The cost of fertilizing this crop with nitrogen is the major constraint to the

peasant farmers who produce vast amounts of nitrogen for this country's ever-growing population. There is also serious concern about the sole use of chemical fertilizer, which affects crop yield and the environment by increasing water contamination and soil degradation from the nutrients applied. Declining soil quality and nutrient losses have been the foremost bane to increased rice production in Nigeria. To increase rice production commensurable to the country's rapid population growth, there is a need for the researchers to evolve a strategy that would, on the one hand, improve soil conditions (physical and chemical) and, on the other hand, save farmers from total reliance on the chemical fertilizers as the only means for fertilizing his crops.

Statement to Research Problem

Traditional shifting cultivation, characterised by a long fallow but a low crop yield, is gradually phasing out and being replaced by intensive cropping. This practice resulted in degraded soil, accelerated soil erosion, depletion of soil nutrients, reduced soil organic matter content, loss of soil physical structure and a steady decline in food production. This condition forced the farmer to embark on soil amendments using different materials to reclaim their soil status and enhance crop growth and yield. Sole application of mineral fertilizer has not been helpful under cropping because it aggravates soil loss. The need to use renewable energy has revived the use of organic fertilizers globally. Complementary application of organic and inorganic fertilizer has been found promising to be a sound soil fertility management of the World. A high and sustainable level of crop yield could be obtained with reasonable and balanced NPK fertilizer application in combination with organic matter amendments.

It is, therefore, against this background, this research is necessitated to achieve the following objectives:

Objectives of the study

1. To deermine the effect of poultry manure on the growth, yield and yield attributes of rice varieties.
2. To evaluate the effect of Nitrogen fertilizer on the growth, yield and yield components of rice varieties.
3. To determine the optimum combination of nitrogen fertilizer and poultry manure for rice in the study area.

Justification of the study

Rice (*Oryza sativa*) production is now receiving attention from many farmers across the geopolitical zones and socio-economic classes in Nigeria, intending to produce enough rice and curtail persistent rice importation as the government advocates. Despite all the efforts made by the government and other stakeholders to improve rice production in the country, the yield of rice in farmer's fields remains very low compared to the yield obtained from research fields. Rice production differs from one place to another with season due to variations in weather, climate, soil and agronomic practices. Many authors equally demonstrated variations in Cultivars. (Hussaini, 2013). Applying inorganic fertilizer and organic manure, such as poultry, compost, and green manures, has been reported to improve rice production (Hussaini, 2013). Using organic manure enhances crop productivity and soil chemical properties, decreases soil acidity, and improves the soil humus content. Combining organic manure with inorganic fertilizers is vital for enhancing greater stability in crop production improving the fertility status of the soil for crop nutrition. Rice yield increased by applying Cow dung at 3t/ ha with 80 kg N.

MATERIAL AND METHODS

Experimental site

Field trial was conducted at the Umaru Musa Yar'adua University experimental Farms located at Layin minister, Malumfashi, Katsina, Katsina State (Latitude 12^{o} 53 '' 44' N and Longitude 7^{o} 34'' 51' E.) in the Northern Guinea Savanna zone, Nigeria. Before land preparation, a composite soil sample was randomly collected from the experimental sites at 0-30 cm depth using a soil auger, bulked, air dried, ground and sieved using a 2 mm wire mesh before being subjected to laboratory analyses for physical and chemical properties using the standard procedure as described by Black (1965). The chemical properties of the poultry manure and N P & K were also determined.

The experiment consisted of one local variety of rice (), three levels of poultry manure (0, 3 & 5 t ha^{-1}) and three levels of Nitrogen fertilizers (0, 60 & 80 kg Nha^{-1}). The experiment was laid out in a

Randomized Complete Block Design (RCBD). The land for the experiment is virgin land. Therefore, site clearance was first conducted to clear all the existing vegetation for the smooth running of the agronomic practices for further seed bed preparations without any obstruction on the field. The land for this trial was harrowed to a fine tilth and level evenly. The site was marked into plots and replications. Poultry manure was uniformly applied according to treatments and incorporated into the soil two weeks before sowing for complete decomposition. The incorporation was done by opening the centre of each plot to about 15 cm and applying manure.

Rice seeds were sown on 5th July, 2024 when the rain was established. Nitrogen in urea (46% N) was applied in two split doses as per the treatment (0, 60 & 80 kg N ha^{-1}) at 3 & 6 WAS by side dressing. NPK compound fertilizer (15:15:15) was equally applied basally to supply 30 kg P_2O_5 ha^{-1} & K_2O ha^{-1} using MOP as a source of P & K, respectively.

Pre-emergence herbicide was applied immediately after sowing or sometimes before the emergence of the rice seedlings. Post-emergence herbicide was also applied to check the weeds that emerged in the rice fields. Hoe weeding was employed at 7 - 9 WAS in the form of earthen-up. Data was collected on the following parameters at different sampling periods: plant height, number of tillers, LAI, stem girth and shoot dry weight.

RESULTS AND DISCUSSIONS

A. *Characters measured in the study*

1) Plant height (cm): There were significant differences ($p < 0.05$) in plant height by the use of varying rates of poultry manure. The tallest plants were recorded when rice plants were treated with poultry manure @ both 15 t ha^{-1} and 20 t ha^{-1} at 6 WAS. Statistically, corroborated results were obtained at 9 WAS with the same rates of manure and the shortest plants were obtained from the untreated controls across the sampling periods. No significant difference was observed in rice plant height using all Nitrogen rates under study. The tallest plants recorded higher rates of poultry manure, which may be attributed to the effect of nitrogen released by the poultry manure, which was incorporated six weeks before the application of synthetic fertilizers.

2) Number of tillers per plant: The numbers of tillers were significantly affected by the various levels of poultry manure applied in this study. Across the sampling periods of study, the application of 15 t ha^{-1} and 20 t ha^{-1} both at 6 & 9 WAS gave the highest & statistically similar number of tillers per plant, significantly at far with the lowest obtained from the control treatments. The number of tillers recorded when rice plants were treated with poultry manure outweighs those obtained from the zero application of poultry manure. Based on this result, poultry manure has impacted the vegetative growth of rice plants, i.e., the higher the poultry manure rate, the more growth attributes there are for rice plants. No significant differences were observed in the number of tillers per plant across all the Nitrogen rates under study. The significant effect on the growth characteristics of rice crop by the use of poultry manure may be a result of the genetic makeup of the variety and its response to the growing environment coupled with the improvement of soil conditions and slow release of nutrients throughout the growing periods and making it available at all the critical periods (Amanullah *et al*., 2007).

Significant interactions were recorded across the varying rates of poultry manure at 6 & 9 WAS. Complementary application of poultry manure at 20 t ha^{-1} with Nitrogen fertilizer at 80 kg N ha^{-1} gave the tallest plants at 6 & 9 WAS, which was significantly similar to those obtained by the application of 20 t ha^{-1} poultry manure with Nitrogen fertilizer at 60 kg N ha^{-1}. The shortest plants were exhibited by integrating poultry manure @ 10 t ha^{-1} with zero Nitrogen rate at 6 WAS.

CONCLUSION

Based on the result of this study, poultry manure application at 15 and 20 t ha^{-1} resulted in taller plants. Plant height improved significantly with the application of 20 t ha^{-1} and 60-80 kg N ha^{-1}, while nitrogen alone has no significance on both plant height and number of tillers at 6 & 9 WAS.

RECOMMENDATIONS

Further study should be carried out to investigate the optimum rate and combination of poultry manure and Nitrogen for rice production in the study area.

Table 1: **Effect of poultry manure rates on Plant Height and Number of Tillers for Rice crop at 6 & 9 WAS during the rainy season, 2024 at Katsina.**

Treatments	Plant height @ 6 WAS	Plant height @ 9 WAS	Number of Tillers per plant@ 6 WAS	Number of Tillers per plant@ 9 WAS
Poultry manure (pm)				
0 t ha^{-1}	14.28b	25.05c	3.67b	6.19b
10 t ha^{-1}	18.47b	38.35b	6.23ab	11.55ab
15 t ha^{-1}	23.70a	42.50ab	6.72a	13.47a
20 t ha^{-1}	25.37a	49.50a	7.94a	14.25a
LSD $_{0.05}$	4.209	7.945	2.705	5.925
Nitrogen	(N)			
0 kg N ha^{-1}	18.59	36.55	5.45	9.97
60 kg Nha^{-1}	20.89	38.92	5.95	10.81
80 kg Nha^{-1}	20.79	38.29	5.98	11.06
100kgN ha^{-}	21.56	41.64	7.17	13.63
LSD $_{0.05}$	4.209	7.945	2.705	5.925
Interaction PM x N	0.017	0.115	0.007	0.025

Means followed by the same letter (s) in a column are not significantly different at $p< 0.05$ using Student Newman Keuls (SNK). PM = Poultry manure and N = nitrogen.

Table 2: Effect of interaction of poultry manure and Nitrogen rates on Plant Height for Rice crop at 6 & 9 WAS during the rainy season, 2024 at Katsina.

Treatments	Plant height @ 6 WAS	Plant height @ 9 WAS
PM1N1	13.27ef	22.08e
PM1N2	14.77cdef	27.10cde
PM1N3	14.36edf	25.78ed
PMIN4	14.70edf	25.22ed
PM2N1	12.37f	29.44bcde
PM2N2	17.97abcdef	37.78abcde
PM2N3	17.02bcdef	3.94abcde
PM2N4	26.50ab	51.22ab
PM3N1	23.04abcdef	45.67abcd
PM3N2	24.33abcde	39.00abcde
PM3N3	22.77abcdef	40.78abcde
PM3N4	24.67abcde	44.55abcd
PM4N1	25.67abcd	49.00abc
PM4N2	26.47abc	51.78a
PM4N3	29.00a	51.67a
PM4N4	20.36abcdef	45.66abcd

Means followed by the same letter (s) in a column are not significantly different at $p< 0.05$ using Student Newman Keuls (SNK). PM = Poultry manure and N = nitrogen.

REFERENCES

Anonymous (2015). Rice in Nigeria in Industry Dynamics. Sahel capital partners & Advisory limited Newsletter Vol. 12.

Awodun M. A., Oladele, S. O. and Adeyemo, A. (2017). Efficient nutrient use & plant probotic microbe interaction. Probotic in agroecosystem.

Dawit, A. and John, T. (2020). The emerging importance of rice as a strategic crop in Ethiopia. Working paper 44, Future Agricultures Consortium, Brighton.

Faloye, O. T., Alatise, M. O. and Ajayi, A. E. (2019). Effects of Biochar & inorganic fertilizer application on growth, yield & water use efficiency of maize under deficit irrigation. Agric. Water management 165-178.

Hussaini, S., Ramzan, M. and Rana, M. (2013). Effect of various planting techniques on yield &n yield components of rice. *Journal of Animal and Plant Sciences* 23: 672-674.

Imolehin, E. D. and Wada, A. C. (2003). Meeting the rice production and consumption demands of Nigeria with improve techniques, International rice commission newsletters. National Cereal Research Institutes, Badeggi, Bida, Niger State, Nigeria. 11.

Laary, J. K., Dogbe, W. and Boamer P. O. (2012). Evaluation of planting methods for growth & yield of digang rice (O. sativa), Ghana *APRN Journal of agriculture & Biological Sciences* 7: 814-819.