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Combined Effect of Rice Bran And Nitrogen Fertilizer on Soil Properties And Yield of Cassava In Obubra, Cross River State, Nigeria.

Attoe, E. E., [1]Kekong, M.A; [1]Uke, J. A., [2]Peter, O.U.
[1]*Department Of Agronomy, Faculty Of Agriculture, Cross River University Of Technology, Obubra Campus, Cross River State, Nigeria.*
[2]*Department Of Soil Science And Land Resources Management, Faculty Of Agriculture,University Of Uyo, Akwa Ibom State, Nigeria.*

Abstract: *An experiment was conducted in 2012 and 2013 cropping seasons to determine the combine effect of rice bran and nitrogen fertilizer on soil properties and yield of cassava in Obubra, derived savannah belt of Cross River State, Nigeria. Seven rates of rice bran viz; 0t/ha, 5t/ha, 10t/ha,5t/ha + 10kgN/ha, 5t/ha + 20kgN/ha, 10t/ha + 10kgN/ha and 10t/ha +20kgN/ha were laid out in a randomize complete block design (RCBD) and replicated three times. All the rice bran and in combination with nitrogen fertilizer apart from the control improved soil P^H , organic matter and available phosphorus. Application of 10t/ha rice bran +10kgN/ha and 10t/ha rice bran + 20kgN/ha both produce the highest yield of 21.8t/ha and 22.1t/ha in 2013 season in the soil of the study area but application of 10t/ha rice bran + 10kgN/ha seems to be ideal for cassava production in Obubra area of Cross Rivers State based on cost.*

Key words: *Cassava Cutting, Rice Bran, N-Fertilizer, Soil Properties and Yield*

I. Introduction

Soil organic matter is very important in the function of soil in as much as it is a good indicator of soil quality because it mediates many of the chemical, physical and biological processes controlling the capacity of a soil to perform successfully. A comparism of cultivated and uncultivated soils has demonstrated a reduction in soil organic matter with cultivation (Mann, 1986). The limitations of agricultural production are generally attributed to inadequate nutrient supply which is controlled mostly by organic matter. Although the use of mineral fertilizer is a convenient way for rapid correction of nutrient deficiencies in soils, its scarcity and high cost limits its wide application by farmers (Gardner *et al*., 1995). Thurston (1997) posited that increased cost of inorganic fertilizer has renewed interest in using organic matter such as fresh or composted crop and animal residues, mud from rivers and streams, human and animal wastes and aquatic plants have been used by traditional farmers to amend the soil towards increased soil productivity.

Santhi and Selvakumari (2000) observed that the application of organic manures has various advantages such as increasing soil physical properties, water holding capacity, and organic carbon content apart from supplying good quality of nutrients. The addition of organic sources could increase the yield through improving soil productivity and higher fertilizer use efficiency. Enwezor *et al* (1989) reported that rice husk as a source of organic manure is extremely high in the major plant nutrients (N, P, K, Ca, Mg, and Na). The need for increasing demand has resulted in the cultivation of several lands whose inherent characteristics severely limited their production capacity (SMSS, 1986). This necessitates the adoption of improved soil management techniques to arable continuous cultivation to preserve the resource base and maintain high environmental quality.

The conventional sources of organic matter include animals and plants residues in the form of compost and farm yard manure (FYM), both of which are not readily available in large quantity (Obiefuna, 1986). Improving soil fertility through the use of organic matter is a popular practice among peasant farmers before the advent of mineral fertilizers, therefore farmers are reverting back to the old practice thereby using crop residues rice bran and other vegetative residues incorporating it into the soil as a source of plant nutrient which affect high yield.

However, rice bran is readily available in large quantity from rice mill that abound in the rice producing areas of Cross River, Ebonyi, Kaduna, Niger, Sokoto, and Adamawa States of Nigeria (Schoereich, 1992). The suitability of any organic materials as fertilizer will depend on the rate of mineralization and liberation of the nutrients present in them (Weeraratna, 1979).

The potentials of rice bran apart from burning have not gotten proper awareness on its alternative uses. It therefore calls for more studies. The aim of this study is to investigate the combined effect of rice bran and nitrogen fertilizer on soil properties and yield and to make appropriate recommendation on the use of rice bran and nitrogen fertilizer on cassava in Obubra, Cross River State, Nigeria.

II. Materials And Methods

This research was carried out at the Teaching and Research Farm of Cross River University of Technology, Obubra Campus during the 2012 and 2013 cropping seasons. The study area lies between latitude 6^0 06 ^{1} North and Longitude 8 ^{0} 18^1 east in the Derived Savannah zone in Nigeria. The mean annual rainfall of Obubra is 2250-2500mm per annum (CRADP.1992). The textural class of the study area is sandy loam. The topography of the land undulating has a slope of about 2 percent.

The experiment for the two seasons was laid out in a randomized complete block designed. Each experimental plot measured 5m x4m with block boundaries of 1m and intra plot boundaries of 0.5m. The treatment consisted of seven rates of combinations (Rice bran and Nitrogen fertilizer) replicated three times as follows;

T1 – control,
T2 – 5t /ha rice bran
T3 – 10t /ha rice bran
T4 – 5t /ha rice bran + 10kg N/ha
T5 – 5t /ha rice bran + 20kg N/ha
T6 – 10t /ha rice bran + 10kg N/ha
T7 – 10t /ha rice bran +20kg N/ha

The different rates of the treatments were incorporated into the soil and allowed for two weeks before planting. The cassava cuttings variety used was the TME 419,95 flash 0829 cultivar developed by the International Institute for Tropical Agriculture (IITA) Ibadan, Nigeria. The cassava cuttings were planted on the field at a spacing of 0.5m x 1m intra and inter row spacing respectively. The cuttings were planted in May, 2012 and April, 2013. Herbicide (glyphosate) was applied to get rid of the weeds that were predominantly perennial weeds. Three weeks later, the area was cleared, stumped and packed manually. The plot was then ridged. Weeding was done manually at 6, 12 and 16 weeks after planting (WAP) using weeding hoe.

Data on plant height were collected at two weeks interval starting from 14WAP to 20WAP using measuring tape and plant height was taken from the base of the crop to the tip of the flush.

Soil samples were collected from representative plots at 0- 30cm depth before planting, composited for routine analysis. The tubers were harvested after eight months of planting by pulling manually. The harvested tubers were then separated from the stumps using matched. The tubers were counted and weighed using a top loading scale.

Data for growth and yield parameters were subjected to analysis of variance (ANOVA) tests as described by Gomez, K.A and Gomez, A.A. (1984) and means were separated using least significant difference (LSD).

The soil samples were air dried, sieved and subjected into routine laboratory analysis for the physical-chemical properties; particle size analysis as described by Weil (1993) using hydrometer, soil reaction (pH) using a glass electrode at a soil: water ratio of 1:2.5 as described by Mclean (1982) organic carbon using the walkley and black method (Nelson and Summers; 1982).

Available phosphorus was determined using Bray and Kurtz P-1 method (Page *et al*., 1982). Total Nitrogen by the micro kjeldal method (Bremmer and Mulvaney, 1982) and exchangeable K and Na were determined using the EEL flame photometer while Ca and Mg were estimated using versenate titration method. The soil textural class was determined from the soil textural triangle.

III. Result And Discussion

The result as shown in **Table 1** indicated that the soil of the experimental site was sandy loam for the two planting season. The soil was acidic and low in organic matter. The soil total N and available P were also low as well as the exchangeable cations of Ca, Mg, K and Na. The low total N, available P and low organic matter content of this soil is an indication of the poor fertility status which is characteristic of tropical soils as reported by Attoe *et al.*,(2005).

Result of soil properties as shown in **Table 2** indicates that application of rice bran singly and in combination with nitrogen fertilizer affected soil properties. The treatment either or in combination increase soil pH, total N, available P, Organic carbon, exchangeable Ca and Mg. The manure treatment also increased the ECEC of the soil and the Base saturation. The control treatment where no manure was applied decreased pH, total N, available P, ECEC and the Base Saturation. These improvement and increase in some physical and chemical properties of the soil treated with single and combined application of rice bran is a primary function of organic manure. Vanlance *et al*., (2001) had earlier reported addition of organic materials to the soil increased the supply of plant nutrient, in addition to improved soil physical properties. The improved particle size of sand, silt and clay as observed in this experiment agree with the earlier observations of pandey *et al*., (1985). The increase in pH in this experiment also agrees with the work of by Lal *et al.*, (2000) who also worked on rice straw. Similarly, Mbah and Onweremadu (2009) reported higher level of soil organic carbon and available phosphorus due to application of unburnt rice bran. Also Idris *et al*., (2010) had reported that amended burnt rice bran increased exchangeable calcium, magnesium and CEC of a savanna soil in Nigeria.

Table 1: Result of the physio-chemical soil properties of the experimental site before the experiment for 2012 and 2013 seasons

Parameter	Unit	Value	
		2012	**2013**
Sand	%	72.6	70.5
Silt	,,	15.4	16.2
Clay	,,	12.0	11.3
Textural class	-	sandy loam	sandy loam
pH	-	4.3	4.8
Total N	%	0.04	0.6
Organic carbon	,,	0.56	6.2
Available P	mg/kg	5.5	5.7
Calcium	cmol/kg	2.0	2.2
Magnesium	,,	0. 6	0.4
Potassium	,,	0.07	0.7
Sodium	,,	0.04	0.4

Table 2: Soil Properties as Influenced by Combined Effects of Rice Bran and Nitrogen Fertilizer Application

Trt.	pH	Org. C (%)	T.N (%)	Avail P. (mg/kg)	Ca	Mg	k	Na	Clay	Silt	Sand
					←	cmol/kg		→	←	%	→
T1	4.3	0.50	0.03	5.30	1.0	0.4	0.08	0.05	7.0	17.7	82.3
T2	5.2	0.84	0.07	13.87	2.0	0.2	0.69	0.06	8.0	17.7	74.3
T3	5.2	0.88	0.08	21.12	1.8	0.6	0.07	0.06	6.0	14.7	79.3
T4	5.2	0.70	0.08	13.0	1.4	0.2	0.06	0.05	8.0	12.7	79.3
T5	5.2	0.72	0.06	23.12	1.2	0.6	0.06	0.04	7.0	14.7	78.3
T6	5.2	0.82	0.07	20.37	1.6	0.4	0.07	0.05	8.0	12.7	79.3
T7	5.2	0.78	0.08	16.75	1.6	0.4	0.08	0.06	6.0	15.7	78.3

Table 3: Mean Plant Height (cm) of Cassava as Influenced by Combined Rice Bran Application.

Treatment	Plant Height (cm)							
	14WAP		**16WAP**		**18WAP**		**20WAP**	
	2012	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
T1	55.8	54.2	71.10	70.4	77.1	78.0	81.9	82.4
T2	70.8	74.1	79.40	80.5	86.3	85.2	96.4	94.7
T3	81.8	80.9	87.20	86.4	89.8	90.4	100.4	101.5
T4	80.8	83.4	89.96	87.5	90.8	90.8	100.5	103.1
T5	84.9	84.6	97.4	89.8	108.7	104.3	118.73	117.5
T6	84.1	86.2	95.5	96.2	104.8	106.4	115.5	118.6
T7	82.6	84.9	90.7	92.4	106.4	107.3	116.2	117.5
LSD	9.40	8.94	12.64	12.01	13.30	12.81	14.80	14.01

Application of rice bran singly and in combination with nitrogen fertilizer significantly affected the growth of cassava shown in **Table 3**. The application of rice bran singly and in combination with nitrogen

fertilizer at the rate of 10t /ha (T3), 5t /ha+10kg N/ha (T4), 10t /ha bran +10kg N/ha (T6), 5t /ha rice bran +20kg N/ha (T5) and 10t /ha rice bran +20kg N/ha (T7) produced tallest plants at 14 weeks after planting (WAP), this was followed by plants treated with 5t /ha rice bran (T2) and the least plant was obtained from the control (T1) where no manure was applied in 2012 and similar trend was also observed in 2013.
The effect of application of the single and combined rice bran on growth of cassava at 16, 18 and 20 weeks after planting (WAP) showed a progressive increase in plant height with that of 2013 slightly higher than that of 2012. There was no significant difference in plant height for the two years.

Table 4: Cassava Yield in Tonnes Per Hectare as Influenced by Combined Application of Rice Bran in 2012 and 2013 Planting Seasons.

Treatment	No. of Tubers /Plants		Tuber weight t/ha	
	2012	2013	2012	2013
T1	2.30	2.10	6.4	5.8
T2	4.80	5.10	11.0	11.6
T3	5.3	6.21	11.7	12.4
T4	4.33	5.88	14.4	15.8
T5	4.03	6.10	14.7	15.6
T6	5.30	6.91	17.7	21.8
T7	6.10	7.10	21.7	22.1
LSD	NS	1.86	3.2	3.10

The yield of cassava tuber in tonnes per hectare as shown in **Table 4** reveals that the single and combined application of rice bran at all rates did affect the number of tubers produced by the cassava. The yield results obtained from this experiment indicate the potentials of combined application of organic manures in crop production, particularly when combined with nitrogen fertilizer. The result obtained in the yield of cassava tubers is expected because rice bran combined with nitrogen fertilizer made available nutrients especially nitrogen, phosphorous and organic matter. These nutrient elements and organic matter are essential for plant growth which eventually leads to higher tuber yield of cassava. The result obtained in this experiment agree with the earlier findings of Pillars *et al.,* (1987) and Amanallah *et al.,* (2007) who reported higher tuber yield of arable crop due to organic manure application.

IV. Conclusion

Result from this study showed that application of rice bran singly and in combination with nitrogen fertilizer as soil amendment is a good source of plant nutrient for soil fertility and crop production. Application of 10t /ha rice bran + 10kg N/ha is ideal for higher tuber yield of cassava TME 419,95 flash 0892 cultivar in Obubra area of Cross River State, Nigeria and is therefore recommended for use by farmers in this region.

References

[1]. Amanullah, M.M; Vaiyapuri K; Sathyamoothi K and Pazhanivelan S. (2007): Nutrient uptake, tuber yield of cassava (Manihot esculenta crantz) and Soil fertility as influence by organic manures. Journal of Agronomy. 6(1): 183-187.

[2]. Attoe, E. E; Akpan-Idiok, A. U. and Isong, L. E. (2006). Studies on the relationship between organic matter and exchangeable aluminuim in representative soils of Cross-River State. Global Journal. of Agric. Sci. Vol. 5 No. 2: 177-182.

[3]. Bremner, J.M. and Mulvaney C.S. (1989). Total Nitrogen in methods of soil Analysis Part 2. A.L. Page et al.,. American Society of Agronomy, Madison W.Pp595-624.

[4]. Cross River Agricultural Development Project (1992) Review of Cross River Ecological Map.

[5]. Enwezor, W. O.; Usoro E. J; Ayotunde, K. A; Adepeju, A.J; Chude, V.O and Udegbe C.E (eds) (1989); Fertilizer Use and Management Practices for Crops in Nigeria FMANR, Lagos Nigeria 18p.

[6]. Gardner H.; Asante E.; Owuju,O; Bennoah, E and Maro K. (1995), Ghana fertilizer Privatization Sector Roles and Public Sector Responsibilities in the Needs of Farmers. IFDC Africa, Lome ,Togo.

[7]. Gomez, K.A and Gomez, A.A. (1984) Statistical Procedure for Agric Research 2nd edition New York. John Willey and Son, 680pp.

[8]. Idris, I.I; Kalu, B.A and Ayuba, S.A. (2010) Effect of Application Rice Husk and Cassava Peels on the Physico-Chemical Properties of Soil, Growth, Development and Yield of Hybrid Maize, (zea mays). Nigeria Journal of Soil Science 20(1) 105-113.

[9]. Lal, J. K; Mishra, B and Sarkar, A. K (2000) Effect of Plant Residues Incorporation on Specific Microbial Groups and Availability of some Plant Nutrients in Soil. Journal of the Indian Society of Soil Science, 48(l): 67-71.

[10]. Mbah, C.N and Onweremadu, E.U (2009) Effect of Organic and Mineral Fertilizer Inputs on Soil and Maize Grain Yield in an Acid Ultisol in Abakaliki, South Eastern Nigeria. American Eurosian Journal of Agronomy 2(10-12, ISSN 1995-896x).

[11]. Mclean, E. O. (1965). Exchangeable aluminum In: C. A. black (ed.) Methods of Soil Analysis. Plant II Agron. 9: 985-990.

[12]. Nelson,D.W. and Summer,L.E (1982).Total carbon,organic carbon and organic mater.In A.L.Page(ed) method of soil analysis part 2. Agronomy mono graph, No.9 AM soil Agron Madison,W.I. Pp 539-579.

[13]. Obiefuna,J. C. (1986).The Effect of Sawdust, mulch and Increasing Level of Nitrogen on the Weed, Growth and Yield of False horn Plantation (Musa Spp.AAB).Biological Agriculture and Horticulture. vol.3 Pp 353-359.

[14]. Page, A.L,Miler,R.H and Keenery D.R.(1982).Method of Soil Analysis Part 2,Chemical and Microbial Properties. ASA Madison.

[15]. Pandey, S. P., Harisifankar K and Sharma, V. K., 1985, Efficacy of Some Organic and Inorganic Residues in Relation to Crop Yield and Soil Characters. Journal of the Indian Society of Soil Science, 33:179-181.

[16]. Pillars, N.G; Mohankumar, B; Nair, P.G; Abeerthumma,S.K and Mohankumar,C.R (1987) Effect of Continuous Application Manure and Fertilizers on the Yield and Quality of Cassava in Laterite Soil. In proc, symposium on production and utilization of tropical tuber crop CTCRI, trivandrum, India, Pp; 109-114.

[17]. Santhi, R and Selvakumari,G (2000) Use of Organic Source of Nutrient in Crop Production in theme Papers on Integrated Nutrient Mgt (eds) Kannaiyan et al Published by Tamil Nadu Agric Univ. Tamil Nadu Dept. Agriculture Pp 87-101.

[18]. Schoeneich. L. (1992). Deteriorating Quality of Ground Water as a Result of Application of Fertilizer. Two Case Studies From Poland National Seminar on Environmental Pollution Jos Nigeria p. 47.50.

[19]. Soil Management Support Services (1986) Procedure Symp. Law act. Clay (LAC) Soil.Washinton D.C. Tech.Mong.No.14.p.14.

[20]. Thurston, H.D (1997), Slash and Mulk System, Sustainable Method for Tropical Agricultural Publication Southern Row London, 5723pp.

[21]. Vanlance, B ; Diel, J; Lyasse, O; Aihous, K; Iwafor, E.N.O; Sanginga, N; Merche, R and Deckers, J. (2001) Fertility Status of Soil of the Derived Savanna and Guinea Savanna Bench Marks and Response to Major Plants Nutrient as Influence by Soil Type and Land Use Management. Nutrient cycling in Agro Ecosystems 60:124-133

[22]. Weil, R.R. (1993) Laboratory Manual for Introductory Soil Analysis. 6th Edition. Kendal and Hunt Publishing Company.