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Evaluation Of Rice Bran Compost Fertilizer On Growth And Yield Of Cowpea (*Vigna Unguiculata* (L.))

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ABSTRACT
Pot experimental was conducted in the screen house of the Department of Agricultural Technology, Oyo State College of Agriculture and Technology, Igboora, Oyo State, Nigeria to study the effect of rice bran compost on growth and yield of cowpea (*Vigna unguiculata*). The experimental design was Completely Randomized Design (CRD) replicated six times. The treatments of RBC are applied in 2.0t/ha (T1), 4.0t/ha (T2), 6.0t/ha (T3), 8.0t/ha (T4), 10.0t/ha (T5) and control. The result of this study have demonstrated that application of rice bran compost have a profound significant influence on cowpea enhancing plant growth, development and yield. Maximum growth and yield was obtained with application of rice bran at the rate of 8.0 t/ha and 10.0 t/ha. The results of this study have demonstrated that the application of rice bran compost has a profound significant influence on cowpea and enhanced plant growth and development when compared to untreated plots.

Keywords: Cowpea, Rice Bran Compost, Growth, Yield

INTRODUCTION
Cowpea (*Vigna unguiculata* (L) Walp), as a grain legume crop is an important source of food, income and livestock feed and forms a major component of tropical farming systems because of its ability to improve marginal lands through nitrogen fixation and as cover crop. It is a valuable and reliable asset that brings income for many smallholder farmers and traders in sub-Saharan Africa (Langyintuo *et al.*, 2003). The grain is also a good source of human protein, while the haulm is an important source of livestock protein (Fatokun, 2002)
Cowpea is an important food grain legume for over 200 million people in the dry savanna of tropical Africa. It is particularly important in West Africa with over 9.3 million metric tonnes of annual production (Oritz, 1998). The grain is a good source of human protein, while the haulms are valuable source of livestock protein (Fatokun, 2002). It is also a source of income for many smallholder farmers in sub-Saharan Africa and contributes to the sustainability of cropping systems and soil fertility improvement in marginal lands through provision of ground cover and plant residue, nitrogen fixation and suppressing weed. However, despite its

great importance**,** grain yield of cowpea crop is low, around 300 kg ha^{-1} (Cardoso *et al.*, 1995; Leite *et al.*, 1997). Compared with many other crops, the cowpea has received little attention from plant breeders and a large efforts needs to be made to break the yield barriers and if cowpea production is to keep pace with the other crops, especially cereals, its yield potential must be improved (Anonymous, 2004). Among factors responsible for the low yields is low soil fertility, as most tropical soils are deficient in essential nutrients particularly N and P (Jones and Wild, 1975). Traditionally, soil fertility in West Africa has been maintained through fallow. However, in Nigeria, intensive cropping is gradually replacing the traditional shifting cultivation that is associated with long fallow and hence low crop yield. The steady decline in food production due to reduced length of fallow on land has prompt farmers to amend soil with different materials (organic and inorganic) in order to enhance plant growth and increase yield (Adepetu, 1997). It has been suggested that organic manure should be used in place of chemical fertilizer to avoid long-term negative effects of chemical fertilizer on the soil (Parr *et al.*, 1990). However, organic manure is usually required in large quantity to sustain crop production and may not be available to the small scale farmers (Nyathi and Campbell, 1995). In many African countries including Nigeria, the main use of fertilizer is on maize, sorghum/millet and rice (Camara and Heinemann, 2006) with cowpea receiving little attention from farmers in terms of fertilizer application. As farmers lack adequate nutrient resources to fertilize all crops, they prefer to apply fertilizers to cereals and rarely target fertilizers directly to grain legumes which are mostly grown on residual fertility (Zingore *et al.*, 2008). This study was therefore designed to evaluate the effect of Rice bran compost on growth and yield of cowpea [*Vigna unguiculata* (L) Walp.].

MATERIALS AND METHODS

Location of Experiment

The research was conducted at the research farm of Oyo State College of Agriculture and Technology, Igboora, Oyo State. Nigeria, during 2017 cropping seasons. Igboora has an average rainfall about 1,455mm, bimodal mode of rainfall with the rainy season commencing from March to July and a dry spell in August, followed by second season from September and temperature range of 27^{0}C to 32^{0}C.

The rice bran compost (RBC) was acquired from the Crop Production Technology, Oyo State College of Agriculture and Technology, Igboora, Oyo State, Nigeria. An improved cultivated cowpea varieties line brown seeded IT99K -573 -1 -1 (semi-erect) was used and was sourced from the International Institute for Tropical Agriculture (IITA), Ibadan. Nigeria. The application of Rice bran Compost (RBC) was applied in the following rates of T1 = 2.0 t/ha, T2 = 4.0 t/ha, T3 = 6.0 t/ha, T4 = 8.0 t/ha, T5 = 10.0 t/ha and T0 = Control. The Pot experiment was arranged in a Complete Randomization Design (CRD) and the treatments were replicated six times. Application was done one week before sowing. One to two seeds were planted per hole, but later thinned to one plant per stand at about 10 - 14 day after planting (DAP). Weeding was done twice that is one month interval, while pest was controlled at every stage of its development. Vacant stands were supplied at 7 DAP, while screen nets were used to protect the research plot against rodents, squirrels and other associated destructive pests.

Data were collected on Number of Leaves, Number of Branches, Stem Girth, Number of Seed/Pod, 100-Seed Weight and Seed Yield/Plant. Data collected were subjected to analysis of variance (ANOVA) while Fisher's least significant difference (LSD) was used to compare means at 5% probability level. Before the commencement of the research, composite soil samples were collected randomly at the depth of 0 - 20 cm from the research site to determine the physical and chemical parameters.

RESULTS

TABLE 1: Chemical and Physical Properties of Soil analysis and Chemical properties of rice bran compost

PARAMETERS	soil.	PARAMETERS	rice bran compost
pH	6.47		
Total N (%)	0.61	N (%)	0.794
Available P. (Mg/kg)	5.59	P (%)	0.212
K (cmol/kg)	0.58	K (%)	0.940
Ca (cmol/kg)	3.98	Ca (%)	0.236
Mg (cmol/kg)	1.24	Mg (%)	0.939
Na (cmol/kg)	0.61	Na (g/kg)	0.376
Fe (Mg/kg)	8.75	Fe (g/kg)	3.944
Cu (Mg/kg)	1.19	Cu (g/kg)	0.039
Zn (Mg/kg)	4.16	Zn (g/kg)	0.276
Alt H (cmol/kg)	0.11		
ECEC (cmol/kg)	6.52		
Base saturation (%)	98.31		
Total Org C. (%)	4.03		
Mn (Mg/kg)	58.10		
Sand (%)	93.20		
Silt (%)	4.00		
Clay (%)	2.80		

The physical and chemical parameters of the soil before planting and Rice Bran Compost.

The physical and chemical properties of the soil are shown in Table 1. The chemical properties showed that soil is alkaline with pH of 6.47. The important soil chemical properties are Total Organic Carbon (4.03%), Total Nitrogen (0.61%), Phosphorus (5.59 mg/kg) and potassium (0.58 cmol/kg). The physical properties of the soil showed that it has 93.20% sand, 4.00% silt and 2.80% clay thereby having a sandy silt textural class. All these properties are within the range required for cowpea cultivation.

The Rice Bran Compost (RBC0 chemical parameters are shown in Table 1. The nutrient parameters are that it contains 0.794% Nitrogen, 0.212% phosphorus and 0.94% Potassium. With these parameters the RBC have higher nutrient contest than the soil and hence the potential to release the nutrients for the development of the crop.

TABLE 2: Plant Height (2- 6 WAP) of cowpea as influenced by the application of rice bran compost.

Trt (t/ha)	2WAP	3WAP	4WAP	5WAP	6WAP
0	21.43	37.15	38.25	56.75	63.75
1 (2.0)	23.08	26.05	34.00	54.00	58.25
2 (4.0)	22.18	22.05	26.25	35.00	38.50
3 (6.0)	17.88	18.15	40.25	58.75	62.50
4 (8.0)	20.50	23.75	32.50	44.50	49.50
5 (10.0)	24.63	27.70	30.25	43.75	48.75
sig	ns	*	ns	ns	ns

ns= not significant, *=significant at 5% level of probability

Plant Height

There were no significant effect of the treatment on the plant height of cowpea at 2, 4, 5 and 6 weeks after planting (WAP) while the significant effect is only at 3 WAP. T5 had the highest mean at 2WAP having and 24.63, T0 at 3WAP (37.15), T3 at 4WAP, 5WAP having 40.25 and 58.75 respectively while T3 had the least mean in 2WAP and 3WAP (17.88 and 18.15 respectively), T2 in 3, 4 and 5 WAP (26.25, 35.00 and 38.50 respectively). At 6WAP, T0 produced the highest mean of 63.50 and is not significantly different from other treatments.

TABLE 3: Number of Leaves (2- 6 WAP) of cowpea as influenced by the application of rice bran compost.

Trt (t/ha)	2WAP	3WAP	4WAP	5WAP	6WAP
0	8.00	12.25	18.25	23.75	25.50
1 (2.0)	8.75	13.50	18.00	30.50	33.50
2 (4.0)	9.00	12.00	14.25	22.00	25.75
3 (6.0)	9.75	14.00	18.25	22.25	24.00
4 (8.0)	9.75	13.25	15.25	21.50	23.00
5 (10.0)	12.00	13.50	17.25	18.50	19.00
sig	ns	ns	ns	*	*

ns= not significant, *=significant at 5% level of probability

Number of Leaves

Table 3 shows no significant effect of the treatment on the number of leaves at 2, 3 and 4 WAP with T0 having the least at 2WAP (8.00), T2 at 3WAP and 4WAP (12.00 and 14.25 respectively). The application of T5 produced the highest mean in 2WAP and 3WAP having 12.00 and 13.50 respectively while at 4WAP, T3 application had the highest mean of 18.25.

There were significant effect of the treatment on the number of leaves at 5WAP and 6WAP. The application of T1 produced the highest number of leaves at 5WAP and 6WAP having 30.50 and 33.50 respectively and was not significantly different from other treatment except the T5 application having the least number of leaves in 5WAP and 6WAP.

TABLE 4: Number of Branches (2- 6 WAP) of cowpea as influenced by the application of rice bran compost.

Trt (t/ha)	2WAP	3WAP	4WAP	5WAP	6WAP
0	2.75	4.25	6.25	7.75	9.00
1 (2.0)	2.75	3.75	5.75	9.75	10.75
2 (4.0)	2.50	3.50	4.75	7.00	8.25
3 (6.0)	2.25	4.25	6.00	7.25	8.00
4 (8.0)	2.50	3.75	5.75	6.75	7.50
5 (10.0)	3.50	4.00	5.25	5.75	6.25
Sig	ns	ns	ns	*	ns

ns= not significant, *=significant at 5% level of probability

Number of Branches

There were no significant effect of the treatment on the number of branches in all the weeks except at 5WAP.The application of T5, T3 and T1 produced the highest number of branches in all the weeks while the application of T3, T2, T4 had the least mean. At 6WAP, T4 application produced the least having 7.50 while the application of T1 had the highest having 10.75.

TABLE 5: Stem Girth (mm) (2- 6 WAP) of cowpea as influenced by the application of rice bran compost.

Trt (t/ha)	2WAP	3WAP	4WAP	5WAP	6WAP
0	1.13	1.15	1.35	1.70	2.00
1 (2.0)	0.75	0.78	1.18	1.45	1.68
2 (4.0)	1.48	1.53	1.65	1.90	1.98
3 (6.0)	0.98	1.05	1.30	1.53	1.80
4 (8.0)	1.33	1.40	1.63	1.78	2.10
5 (10.0)	1.43	1.48	1.70	1.78	1.98
Sig	ns	ns	ns	ns	ns

ns= not significant, *=significant at 5% level of probability

Stem Girth

There was significant effect of the application on the stem girth at 2, 3 and 4 weeks after planting (WAP). The application of T2 produced the highest mean in 2WAP and 3WAP having 1.48 and 1.53 respectively and T5 at 4WAP (1.70) and they were not significantly different from other application treatments except T1 which had the least in 2, 3 and 4 WAP having 0.75, 0.78 and 1.18 respectively.

At 5 and 6 WAP there was no significant difference among the treatment application with the application of T1 had the least of 1.45 and 1.68 respectively. While T2 and T4 produced the highest mean in week 5 and 6 respectively having 1.90 and 2.10.

TABLE 6: Number of Seed/Pod, 100-Seed Weight, Number of Pods/Plant and Seed Yield/Plant of cowpea as influenced by the application of rice bran compost

Trt (t/ha)	No. seeds/pod	100-Seed Weight	No. pods/plant	Seed Yield/Plant
0	8.50	0.64	6.95	50.03
1 (2.0)	8.25	0.78	8.03	55.67
2 (4.0)	9.50	0.80	6.75	55.62
3 (6.0)	11.00	0.82	7.00	61.62
4 (8.0)	11.50	0.84	8.56	77.69
5 (10.0)	12.25	0.86	9.25	70.45
Sig	*	*	ns	*

ns= not significant, *=significant at 5% level of probability

Number of Seed/Pod

There were significant difference in the number of seeds/pod as influenced by the treatment application. T5 application had the highest of 12.25 and is not significantly different from T3 and T4 application. The least was recorded in T1 application (8.25) and is not significantly different T0 and T2 application.

100-Seed Weight

There were significant differences among the treatment application on the 100-seed weight. T5 application produced the highest weight of 0.86 and is significantly different from other treatments. The least mean was recorded in T0 application having 0.64.

Number of Pods/Plant

There was no significant difference in the total number of pods harvested as influenced by the treatments application. The highest number of pods harvested was recorded in T5 application having 9.25 while the least was recorded in T2 application having 6.75.

Seed Yield/Plant

There were significant differences among the treatment application on the total seed weight/plant of cowpea. T4 application produced the highest of 77.69 and is not significantly difference from other treatments except T0 having least of 50.03 and is not significantly different from T1, T2 and T3 applications having 55.67, 55.62 and 61.62 respectively.

DISCUSSION

The increased effect of RBC applications on the soil improves the soil physicochemical properties. RBC added into the soil as an organic matter source increased the Organic Matter content, exchangeable Magnesium, Potassium and available Phosphorus contents, and decreased the soil pH, Sodium and exchangeable Calcium of the soil as reported by Demir and Gülser (2015). It was determined that RBC can be used as a soil conditioner to improve soil properties, sustain agricultural production and obtain high crop productivity. Recycling rice husk in agricultural lands by composting provides soil fertility and sustainability, and also makes a great contribution to the environment ecologically. 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.

The RBC application significantly increased plant growth attributes (plant height, leaf area and number of leaves/plant) and yield components of cowpea. This finding is in agreement with Adegoke et al. (2019) on Soybean, Gisela (2007) on cherry tomato, Moyin-Jesu (2015) on cabbage and Attoe et al. (2016) on cassava with their observation of increase in growth parameters with RBC application. RBC application significantly increased the number of pods/plant, hundred seed weight and grain yield. Similar findings were observed by Priyadharshini and Thayamini (2010) who reported that potassium acquired in RBC application increased grain yields of cowpea. Similar findings were observed by Yakardi et al. (1992) reported positive response for number of pods per plant and 100 seed weight by application of potassium. In most cases, application of 8.0 t/ha (T4) and 10 t/ha (T5) application out-performed the control in growth attributes and yield components. This can be attributed to the fact that the applications of RBC released more N and P nutrient to the soil as compared to the ones present without application.

CONCLUSION AND RECOMMENDATION

The results of this study have demonstrated that the application of rice bran compost has a profound significant influence on cowpea and enhanced plant growth and development when compared to untreated plots. Maximum yield was obtained with application of rice bran at the rate of 10 t/ha RBC. Therefore the above rate is recommended for cowpea production in the study area. This study provides evidence about the possibility of using organic fertilizers, such as the rice bran compost for growing cowpea plants and as well has safe, cheap and environmentally-friendly substitutes to mineral fertilizers.

REFERENCES

Adegoke J., O. Abel and J. Tunrayo. (2019). Effects of Rice-Bran Compost on Growth and Yield of Soybean (*Glycine max*) on an Alfisol in Ibadan, Nigeria. *Nigerian Journal of Soil Science*. 25-30. 10.36265/njss.2018.280203.

Adepetu J.A. (1997). Soil and Nigeria food security. Inaugural Lecture Series 119. Obafemi Awolowo University, Ile-Ife, Nigeria, pp: 19.

Anonymous (2004). Vigna Germplasm: Current Status and Future Needs. A report prepared by the Vigna Crop Germplasm Committee, pp: 1-11.

Attoe E. E., Kekong M.A., Uke J. A. and Peter O.U. (2016). Combined Effect of Rice Bran And Nitrogen Fertilizer on Soil Properties And Yield of Cassava In Obubra, Cross River State, Nigeria. *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS).* Volume 9, Issue 4. PP 71-75.

Camara O. and Heinemann E.D. (2006). Overview of fertilizer situation in Africa, 27 pp. In Proceedings of the African Fertilizer Summit. June 9–13, 2006, Abuja, Nigeria.

Cardoso M.J., A.S. Andrade Jnr, F.B. Melo and A.B. Prota (1995). Avaliacao agroeconomica da producao de sementes de caupi Sob irrigacao. Teresina: Embrapa-CPAMN (Communicado Tecnico, 62).

Demir Z. and C. Gülser (2015). Effects of rice husk compost application on soil quality parameters in greenhouse conditions. *Eurasian J Soil Sci* , 4 (3) 185 - 190.

Fatokun A.C. (2002). Breeding Cowpea for Resistance to Insects Pests, Attempted Crosses Between Cowpea and *Vigna vexillata*. In: *Challenges and Opportunities for Enhancing Sustainable Cowpea Production, Fatokun, C.A., S.A. Tarawali, B.B. Singh, P.M. Kormawa and M. Tamo (Eds.).* International Institute for Tropical Agriculture (IITA) Ibadan, Nigeria, pp: 52-61.

Gisela R. (2007). Effect of rice bran mulching on growth and yield of cherry tomato. *Ciencia e Investigación Agraria*. 34. 225-230. 10.7764/rcia.v34i3.401.

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.

Jones M.I. and A. Wild (1975). Soils of West African savanna. The maintenance and improvement of their fertility. *Technical Communication No 55 of the Commonwealth Bureau of Soils, Harpenden, UK. Commonwealth Agricultural Bureau (CAB),* Farnham Royal, UK., pp: 246.

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.

Langyintuo A.S., L. J. Faye, M. Lambert, D. Ibro, G. Moussa, B. Kergna, A. Kushwaha, S. Musa, and S. Ntoukam G. (2003). Cowpea Supply and Demand in West and Central Africa. *Field Crops Research* 82: 215–231.

Leite M.L., J.D. Rodrigues and J.S. Vigens Filho, (1997). Avaliacao de cultivares de coupi (*Vigna unguiculata* (L.) Walp) quanto a productividade e compomentes de productividade, sob condicoes de estufa plastica. *Revista de Agricultura, Piracicaba*, 72: 375-385.

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).

Moyin-Jesu E. I. (2015). Use of different organic fertilizers on soil fertility improvement, growth and head yield parameters of cabbage (*Brassica oleraceae* L). *International*

Journal of Recycling of Organic Waste in Agriculture. Volume 4, Issue 4, pp 291–298.

Nyathi P. and B.M. Campbell (1995). The effect of tree leaf litter, manure, inorganic fertilizer and their combination on above ground production and grain yield of maize. *Afr. J. Crop Sci*., 3: 451-456.

Oritz R. (1998). Cowpeas from Nigeria: A silent food revolution. Outlook Agric., 27: 125-128.

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.

Parr J.F., B.A. Stewart, S.B. Hornid and R.P. Singh (1990). Improving the Sustainability of Dry Land Farming Systems. A Global Perspective. In: *Advances in soil Science, Singh, R.P., J.R. Parr and B.A. Stewart (Eds.). Springer-Verlag Inc*., New York, pp: 1-8.

Priyadharshini J. and H. S. Thayamini. (2010). Paddy husk ash as a source of potassium for growth and yield of cowpea (*Vigna unguiculata* L.). *Journal of Agricultural Sciences*. 4. 10. 4038/jas.v4i2.1646.

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.

Yakardi M., Hussain M.M and V. Satiyanarayana (1992). Response of rainfed groundnut (*Arachis hypogaea* L.) to potassium with varying levels of nitrogen and phosphorus. *Indian Journal of Agronomy*, 37(1), pp: 202-203.

Zingore S., Murwira H. K., Delve R. J. and Giller K.E. (2008). Variable grain legume yields, responses to phosphorus and rotational effects on maize across soil fertility gradients on African smallholder farms. *Nutr Cycl Agroecosyst* 80: 1–18.