Evaluation of Proportionate Combinations of Indigenous Rice Bran and Mineral Fertilizer for Improved Performance of Tomato (*Lycopersicon lycopersicum)* Under Low Fertile Soil conditions

ABSTRACT

Under tropical soil conditions, where soils are mostly marginal and deliberate fallowing of farmlands is very uncommon, integration of two or more different fertilizer materials, at pre-determined proportions, may be beneficial to soil quality improvement and enhanced crop productivity. Field experiment was carried out in the year 2015, at the Teaching and Research Farms, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, to determine the complementary effect of organic and inorganic ~~N~~ fertilizer ~~materials~~ at different rates on the performance of tomato, under low fertile soil conditions. Six treatments including the control ~~introduced~~ were used: ~~T0 (~~No fertilizer application~~)~~, ~~T1 (~~100% N.P.K~~)~~, ~~T2 (~~75% N.P.K + 25% Rice bran~~)~~, ~~T3 (~~50% N.P.K +50% Rice bran~~)~~, ~~T4 (~~25% N.P.K+ 75% Rice bran~~)~~ and ~~T5 (~~100% Rice bran~~)~~ arranged in randomized complete block design (RCBD), replicated three times. Data ~~collected~~ were collected on growth and yield parameters, and analysed using Analysis of variance (ANOVA). Means were separated using Duncan multiple range test (DMRT) at 5% level of probability. ~~All fertilizer materials applied~~Results showed that amended plots significantly enhanced tomato growth, yields and nutrient uptakes~~,~~ higher compared to the control. Sole application of 100% NPK and Rice bran significantly improved fruit yield by 831.5% and 597.1% respectively, while their combinations significantly enhanced tomato fruit yield ranging from 819% to 1127%. These indicate that combined application of organic and inorganic fertilizers is better than sole application. Also, significantly prolonged leaf production was observed (which equally promoted prolonged flowering and fruiting), in tomato plants which received Rice bran applications at 50% level and above. Therefore, since there is an increasing awareness nowadays, on the environment friendly benefits of applying organic materials to farmlands, application of either 75% or 100% NPK fertilizer should be totally discouraged. Hence, 75% Rice Bran + 25% NPK could be recommended or alternatively 50% Rice Bran + 50% NPK, for tomato production in the study area. This will improve soil organic matter content, reduce soil chemical fertilizer loads or inputs and alleviate the residual effects of synthetic fertilizers, for improved soil quality and tomato production, in the study area.

Keywords: Tomato, Proportionate Combinations, Indigenous Rice Bran, Mineral Fertilizer, Soil Fertility, ~~and~~ Crop Performance.

1.0. INTRODUCTION

Tomato (*Lycopersicon lycopersicum* L. Mill) is an arable fruit vegetable. It belongs to the family solanaceae. Tomato ranks first amongst the common fruit vegetable crops in Nigeria and dominates the largest of the estimated vegetable crops production areas ~~(Rawshan, 1996)~~[1]. Tomatoes are normally propagated ~~either~~ by seeds, either sown directly

Comment [T1]: I suggest a modification on the title to read as "Evaluation of rice husk dust and inorganic fertilizer at different combination rates on the improved productivity of tomato (*Lycopersicon lycopersicum)* in degraded soils of South Western Nigeria".

Comment [T2]: How did you arrive at these figures as percent values from plots treated with these amendments in relation to the parameter measured?

Comment [T3]: Going by the above values, does this sentence agree with your sentence in lines 20 – 22? Note that the percentage values for sole application above were higher than the combined application.

Comment [T4]: Repetition of what you reported in the conclusion section of this manuscript.

Comment [T5]: Is not usually proper to feature words in the title of a research work as key words.

on the field or by transplanting of seedlings obtained from the nursery. Although tomato is grown throughout the year, the best period for tomato production in Nigerian Savanna is the dry season, when the weather is cooler and the incidence of pests and diseases is minimal ~~(Anonymous, 2000)~~[2]. Many varieties are now widely grown, sometimes in greenhouses in cooler climates. The plants typically grow up to 1-3 meters in height and have a weak stem that often sprawls over the ground and vines over other plants. More so, the dietary significance as well as the considerable versatility of tomato cannot be over-emphasized. The fruit is a berry type, and ripped ~~one~~ fruits could be eaten fresh or raw (e.g. salad), ~~when~~ could be cooked or processed, as in soup, stew, ketchup, paste, juice, powdered or canned tomatoes etc. ~~(Adebooye *et al.*, 2006; Babajide and Salami, 2012)~~[3, 4]. Tomatoes have been reported to be important sources of nutrient anti-oxidants such as lycopene and vitamin C in human diet (Clinton, 1998). Lycopene, the most important anti-oxidant has been linked with reduced risk of prostrate and other forms of cancer as well as heat diseases (Barber and Barber, 2002). The fruits are highly perishable and are commonly sliced and dried (due to poor storage facilities), to await future uses or sales (Babajide *et al.,* 2008).

Rice bran is obtained from rice processing (i.e. de-hulling). Rice bran is also referred to rice husk dust or rice hull. It is thereby regarded as a rice-mill waste ~~material~~. Although it is used for ~~economic~~ feeding ~~of~~ livestock, hence, ~~many tonnes~~ magnitudes of this material are found wastefully deposited in many rice processing villages in Nigeria. However, if properly managed, rice bran is a potential fertilizer material, which is relatively high in Nitrogen, and could be used as a sole soil amendment or for organic fortification of chemical fertilizer materials, suitable for arable crop production. Nitrogen is an essential nutrient element required in photosynthesis and was also reported to support luxuriant and vigorous plant growth (Anonymous, 2000; Akanbi, 2002; Babajide *et al.,* 2012). Inappropriate use of fertilizers greatly reduces fertilizer efficiency and imposes negative effects on soil

Comment [T6]: Is it heat or heart?

Comment [T7]: You need to introduce reasons behind this study as problem statement here. What really happened in the production of tomato in the study area that necessitated the use of this rice bran/rice husk dust? Was there decline in the production due to decline in soil fertility? Was the use of inorganic fertilizer in the improvement of the crop production difficult to realize and why? Why is complementary use of organic with inorganic fertilizer better than the sole use of each of them? Answers to these questions will help you make good links between the crop and the soil amendments.

Comment [T8]: I suggest you add here "Despite the magnitude of these wastes generated daily and the possible effects on the environment, no serious attempts have been made either for their effective utilization or safe disposal. The only disposal attempt is the partial burning of the wastes at the various dumping grounds, after which no agricultural uses of the wastes are made as a way of recycling (Nwite *et al.,* 2011)".

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productivity (Tejada *et al.,* 2005; Babajide, 2010). Both organic and inorganic fertilizers should be applied to match nutrient needs of crops (Indu and Savithri, 2003; Babajide, 2010). Hence, in cases of desiring a combined application of organic and inorganic fertilizer materials, it is important to pre-determine the accurate proportions (in percentage) of either of the fertilizers to be applied. Therefore, this research was conducted to evaluate the performance of tomato ~~under~~ at varying ~~proportionate~~ combination~~s~~ rates of organic and chemical N-fertilizers, so as to reasonably recommend the most suitable for optimum performance of tomato in the study area.

2.0 MATERIALS AND METHODS

The experiment was conducted in the year 2015~~,~~ at the Teaching and Research Farms, Ladoke Akintola University of Technology, Ogbomoso, Oyo state, Nigeria, to evaluate the response of tomato to sole and combined applications of different organic and inorganic fertilizer materials. The land was manually cleared of all existing vegetation. Soil sample~~s was~~ were collected from 0-15 cm depth at different points in the experimental site with soil auger and later mixed together to get a composite sample. The composite auger sample was ground and sieve~~d~~ through 2mm ~~gauge~~ mesh to remove stones and other large particles, for determination of soil physico-chemical properties. The seeds of Roma VF variety were sown in the raised nursery bed made up of bamboo trees and shaded with palm-fronds. The seedlings were nurtured for four (4) weeks before transplanting to the field. There were ~~S~~six (6) treatments including the control employed in the study~~introduced were~~: ~~T_0 =~~ the control or zero fertilizer application, ~~T_1 = application of~~ 100% NPK 15-15-15 fertilizer, ~~T_2 = combined application of~~ 75% NPK + 25% Rice bran, ~~T_3 = combined application of~~ 50% NPK + 50% Rice bran, ~~T_4 = combined application of~~ 25% NPK + 75% Rice bran, and ~~T_5 = application of~~ 100% Rice bran. All treatments were applied at recommended rate of 60kgNha^{-1} (Babajide *et al.,* 2012). Each plot size was 2.1m × 2.7m = 5.67 m^2~~,~~ ~~at a~~with plant spacing of ~~90cm~~ 30cm × ~~30cm~~ 90cm (~~0.9m~~ 0.3 m x ~~0.30~~ 0.9 m). The treatments were laid out in a ~~R~~randomised ~~C~~complete ~~B~~block ~~D~~design (RCBD), replicated three times. Data collection commenced ~~after~~ at four (4) weeks ~~of~~ after transplanting (4WAT). A water tank of 300 Litre capacities (connected to the Faculty of Agriculture bore hole), was placed at the centre of the experimental plot to ensure regular watering, using watering cans. Manual weeding was

Comment [T9]: Indicate the physical and chemical properties analysed from the composite sample and possibly show their various procedures.

Comment [T10]: Consider delete. Note that your treatments varied in rates and cannot have the same N supply.

Comment [T11]: Was the experiment a dry season study? How did you determine the amount of water applied with this method of irrigation, as variation in water applied to different plots might bring change in the performance of the crops?

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carried out with the aid of weeding hoes on every fortnight basis. The growth parameters determined at the early boom of flowering were; plant height (by using measuring tape), stem circumference (by using venier callipers which first gave the value of the diameter, converted later to circumference, using a fomular: πD (i.e. 3.142 multiplied by the original diameter (D) value measured with calipers), number of leaves, number of branches (determined by direct counting of all well-developed branches per plant) and leaf area [by graph method as described by Akanni and Ojeniyi, (2007)]. After each harvesting, number of ripe fruits per plant was determined (by direct counting) and weighed; using Mp 600H Electronic Weighing balance. Fruit diameter was also determined (using callipers). Moreso, from multiple harvestings spanning up to eight (8) weeks, the cumulative fruit weight values per plant per treatment were determined, which were later converted to fruit yield (in tons ha^{-1}). Also, all plants per treatment were carefully packed into giant-brown envelopes (65cm by 30cm), for oven-drying at 80^0C for 72 hours to a constant weight, to assess N, P and K concentrations (as described by IITA, 1982: Babajide *et al.,* 2012), and uptakes [using a formula: Nutrient uptake = Dry matter yield multiply by Nutrient content (%)]. All data collected were analyzed ~~following the procedures of~~using analysis of variance (ANOVA) according to the procedure for randomized complete block design (RCBD). Duncan's Multiple Range Test (DMRT), was used to compare differences between the treatment means at 5% level of probability, using Statistical Analysis System (SAS, 2015).

Comment [T12]: I suggest you replace with "girth".

Comment [T13]: Is graph method best or the use of tracing paper on the leaves?

Comment [T14]: I suggest you reframe the sentence as "The N, P and K concentration and uptake by plants were determined by careful packing all the plants per treatment into giant-brown envelopes (30 cm by 65 cm). These plant materials were oven-dried at 80^0C for 72 hours to a constant weight according to the procedure as described by IITA, [1982]: Babajide *et al.,* [2012].

3.0 RESULTS AND DISCUSSION

3.1.~~1~~ Initial Soil physico-chemical properties of the Study Area

The soil's pre-cropping physico-chemical analysis results showed that the soil was slightly acidic with pH value of 6.1 (Table1), and that it was very low in essential nutrient concentrations particularly N = 0.19 gkg^{-1}, P = 3.57 $mgkg^{-1}$ and K = 0.21cmolkg-1. These results corroborated the earlier research findings of Babajide *et al*., (2008) and Babajide *et al*., (2012) which indicated that the soils in the study area were grossly low in essential nutrients and mildly acidic in nature.

Comment [T15]: Is it pH in water or pH in KCl?

Comment [T16]: Why must the available P value be as low as 3.57 mg/Kg when the pH is 6.1 and the exchangeable Ca is as high as 19.59 cmol/Kg.

3.~~1.~~2 Nutrient compositions of fertilizer materials used

As indicated in Table 2, the values of nutrient concentrations in the chemical fertilizer materials used were already indicated on the bag containing the fertilizer as 15~~%~~ Kg

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each for N, P and K i.e. NPK 15-15-15 fertilizer grade, while those of the rice bran were analysed in the laboratory (IITA, 1982), and the results were 1.0%, 1.2% and 1.7% for N, P and K respectively. These values were relatively higher than N, P and K concentrations in some common weeds and wasteful plant residues (Babajide, 2010).

3.1.3 Growth Parameters of Tomato (*Lycopersicon lycopersicum* L. Mill) Under Combined Fertilizer Applications

Application of different fertilizers and their combinations significantly enhanced growth of tomato (Table 3). Application of 50% NPK + 50% Rice bran had significantly higher plant height (98.2cm), but the value was not significantly different from those obtained from applications of 100% NPK and other fertilizer treatments ~~tested~~ studied (except 100% Rice bran), but significantly higher than the control. Also, application of 75% Rice bran + 25% NPK produced the plant with significantly wider stem circumference value. Although the value was statistically similar to those produced by other fertilizer treatments, it was significantly higher than the control (Table 3). The highest values of both the leaf area and number of branches of tomato were observed in ~~the application of~~plots applied with 50% NPK + 50% Rice bran. ~~Those values were not significantly different from other fertilizer treatments investigated, but significantly higher than the control~~Generally, the result (Table 3) indicated that all the amended plots significantly ($p < 0.05$) increased both the leaf area and number of branches higher relative to the control. Application of 75% Rice bran + 25% NPK produced the highest significant number of leaves, ~~which was not significantly different~~ though significantly same with those from 50% NPK + 50% Rice bran and 100% Rice bran treated plots~~, but significantly higher than those produced from applications of both 100% NPK fertilizer and 75% NPK + 25% Rice bran, while the control had the least~~ (Table 3). ~~Hence, it could be deduced~~This result implies that the higher the level of NPK integration, the higher the possibility of leaf shedding. Also, as the level of organic fertilizer application or integration increased, delayed leaf shedding increased, and this may possibly promote indeterminate growth of tomato (Table 3). All these are in support of the research reports of Babajide (2010), who related improved sesame growth (and even prolonged leaf formation), to improved and continuous flow of soil nutrients from applied fertilizers. Also, the results were in line with research findings of Akanbi (2002), who reported improved growth of okra and maize, as induced by improved applications of both organic and inorganic fertilizers.

3.1.4 Fruit Yield and Fruit Yield Parameters of tomato (*Lycopersicon lycopersicum* L. Mill) Under Combined Fertilizer Applications

Sole application of fertilizers and their different integrations significantly influenced fruit yield and fruit yield parameters of tomato (Table 4). Applications 50% NPK + 50% Rice bran and 75% Rice bran + 25% NPK produced significantly higher and statistically similar values of fruit diameter (5.4cm and 5,3cm respectively). Application of other fertilizer treatments (75% NPK + 25% Rice bran, 100% NPK and 100% Rice bran) produced significantly lesser fruit diameters than those of 50% NPK + 50% Rice bran and 75% Rice bran + 25% NPK, but higher than the control (Table 4). Significantly earlier days to 50% flowering were observed in plants which received application of 50% NPK + 50% Rice bran.~~, but the value was statistically similar to all other fertilizer treatments tested, but~~ It was obtained that amended plots showed earlier days to 50% flowering significantly higher than the control. Hence, it could be deduced that fertilizer application irrespective of the sources may possibly promote early flowering and fruiting, compared to the control. This is in line with the research reports of Akanbi, (2002) and Babajide *et al.,* (2008). Application of 75%

Comment [T17]: Indicate the probability level here!!!

Comment [T18]: What do you mean by except 100% rice bran? If what you mean is that the plant height value was significantly higher than plots treated with 100% rice bran, I suggest you reframe the last part of the sentence to "and other fertilizer treatments except the 100% rice husk dust and the control.

Comment [T19]: Replace with "girth".

Comment [T20]: Not clear. Recast based on my earlier comment in line 134 above.

Comment [T21]: Delete, as this is not in proper agreement with your result.

Comment [T22]: Is it higher than the control?

Comment [T23]: Outline the submissions of these authors which you claimed to have agreed with your result.

Rice bran + 25% NPK produced ~~teh~~ the highest number of fruits (47.0), which was not significantly different from other fertilizer treatments but significantly higher than 100% Rice bran, while the control had the least value. Fruit weight value was significantly higher in 50% NPK + 50% Rice bran, which was equally statistically similar to other fertilizers tested, while the control had the least. Integration of 50% NPK with 50% Rice bran produced the highest fruit yield (82.3 tons ha^{-1}), which was not significantly different from other fertilizers (except 100% Rice bran), while the control produced the least (Table 4). All these results corroborated the research findings of Indu and Savithri, (2003), Chukwuaka and Omotayo (2009), and Babajide and Salami, (2012) who reported enhanced crop yield as influenced by improved soil nutrition.

3.1.5 Biomass Production of Tomato (*Lycopersicon lycopersicum* L. Mill) as Influenced by Combined Fertilizer Applications

Fertilizer applications significantly improved biomass production (Table 5). The fresh below ground biomass of tomato was significantly enhanced higher by application of 100% NPK fertilizer. This was followed by ……., while the least was obtained from …….. This value was not significantly different from those obtained from 75% NPK + 25% Rice bran and 50% NPK + 50% Rice bran, but significantly higher than other fertilizer treatments and the control. The dry below ground biomass production was significantly higher with application of 100% NPK, which was statistically similar to those obtained from 50% NPK + 50% Rice bran and 25% NPK + 75% Rice bran applications, but significantly higher than other fertilizer materials assayed, and the control (Table 5). Similarly, 100% NPK fertilizer application produced the highest values of fresh and dry above ground biomass. The result revealed that plots treated with 100% NPK fertilizer application statistically performed alike with plots amended with 50% NPK + 50% rice husk dust and 25% NPK + 75% rice husk dust ~~value of~~ in the fresh above ground biomass weight. ~~was not significantly different from 50% NPK + 50% Rice bran and 25% NPK + 75% Rice bran, but higher than other fertilizer treatments and the control.~~ The value of dry tomato biomass obtained from NPK fertilizer application was not significantly different from those obtained from75% NPK + 25% Rice bran and 50% NPK + 50% Rice bran, but significantly higher than other fertilizers tested, while the control produced the least (Table 5). These research results are in agreement with Akanbi *et al.,* (2005), Akanni and Ojeniyi (2007) and Babajide, (2010), who reported enhanced crop yield and biomass production, under tropical climate as influenced by application of different fertilizer materials.

3.1.6 Effects of Combined Fertilizer Applications on N, P and P uptakes of Tomato (*Lycopersicon lycopersicum* L. Mill)

Application of different fertilizers and their combinations significantly influenced nutrient uptakes of tomato~~,~~ higher compared to the control (Table 6). Generally, higher induced significant improvement ~~For~~ in the N, P and K uptakes was observed from the application of 25% NPK + 75% Rice bran ~~generally induced significantly higher uptakes~~, although ~~the values were~~ not significantly different from ~~other fertilizers (soles and their combinations)~~treatments investigated, ~~but the values were generally higher than~~ except the control (Table 6). The results vividly supported the research findings of Babajide and Salami (2010) and Babajide (2014) who reported improved nutrient uptakes via both sole fertilizer applications and their combinations under varying agro-ecological zones and soil fertility conditions.

Comment [T24]: Reframe this sentence based on my earlier corrections. You followed the same pattern of presentation in this your results and discussion section.

Comment [T25]: Recast.

Comment [T26]: See my corrections in lines 134 above and correct accordingly.

Comment [T27]: At what probability level?

Comment [T28]: The same pattern. Recast based on the example given here.

Comment [T29]: The same pattern. Recast.

Comment [T30]: Reframe based on earlier corrections.

Comment [T31]: At what probability level?

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4.0 CONCLUSION AND RECOMMENDATION

All fertilizer materials applied significantly enhanced tomato growth, yields and nutrient uptakes, compared to the control. Locally produced rice bran is a potential fertilizer material, which could be used for efficient arable crop production. ~~Rice bran is a dependable soil amendment, which could improve soil conditions and crop quality.~~ Integration of rice bran with chemical fertilizer may be more effective and efficient in inducing better crop performance~~,~~ than its sole application, particularly under low fertile soil conditions. Sole application of 100% NPK and Rice bran significantly improved fruit yield by 831.5% and 597.1% respectively, while their combinations significantly enhanced tomato fruit yield ranging from 819% to 1127%. Significantly delayed leaf shedding and prolonged leaf production observed in tomato plants which received rice bran applications at 50% level and above, is a good indicator of possible enhancement of prolonged flowering and fruiting, as also manifested in significantly higher fruit yields. Therefore, since there is an increasing awareness nowadays, on the environment friendly benefits of fertilizer production and usage, application of either 75% or 100% NPK fertilizer should be totally discouraged. Hence, 75% Rice Bran + 25% NPK could be recommended or alternatively 50% Rice Bran + 50% NPK, for tomato production in the study area. This ~~promotes continuous availability and maintenance of soil organic matter. Hence, improved soil quality and tomato production ensured. Also, alleviation of~~ will alleviate the problems associated with the use of chemical fertilizer ~~loads or inputs~~, as well as their residual effects established in soils~~,~~ of the study area.

Comment [T32]: How did you arrive at these % values? Delete the sentence as it is more results presentation than conclusion.

Table 1: Results of the physico-chemical analysis of the soil sample used

Soil Characteristics	Value
pH (H_2O)	6.10
Organic Carbon(gkg^{-1})	4.42
Total N (gkg^{-1})	0.19
Available P ($mgkg^{-1}$)	3.57
Fe (mgk^{-1})	11.10
Cu ($mgkg^{-1}$)	2.36
Zn ($mgkg^{-1}$)	2.87
Exchangeable K ($cmolkg^{-1}$)	0.21
Exchangeable Na ($cmolkg^{-1}$)	0.22
Exchangeable Ca ($cmolkg^{-1}$)	19.52
Exchangeable Mg ($cmolkg^{-1}$)	3.11

Comment [T33]: This value is outrageous.

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Sand (%)	**75.03**
Silt (%)	**14.15**
Clay (%)	**10.82**
Textural class	**Sandy loam**

Table 2: Nutrient compositions of fertilizer materials used

	NUTRIENT CONCENTRATIONS		
FERTILIZER MATERIALS	**N**	**P**	**K**
NPK FERTILIZER	**15.0 %**	**15.0 %**	**15.0 %**
RICE BRAN	**1.0 %**	**1.2 %**	**1.7 %**

Table 3: Effect of combining organic and inorganic Fertilizer materials on growth parameters of tomato (*Lycopersicon lycopersicum*)

Treatments	Plant height (cm)	Stem Circumference (cm)	Leaf Area (cm^2)	Number of Leaves	Number of Branches
Control	**42.1c**	**0.7c**	**16.2b**	**101.0c**	**4.0b**
100% NPK	**91.3a**	**2.9a**	**34.6a**	**186.3b**	**19.2a**
75% NPK + 25 % Rice Bran	**90.1a**	**2.8a**	**33.2a**	**201.4b**	**18.4a**
50 % NPK + 50 % Rice Bran	**98.2a**	**2.9a**	**36.6a**	**236.5a**	**20.2a**
25 % NPK + 75 % Rice Bran	**96.6a**	**3.3a**	**35.2a**	**242.3a**	**18.2a**
100% Rice Bran	**82.5b**	**2.5ab**	**31.2a**	**232.5a**	**16.3a**

Means followed by the same letters are not significantly different at p=0.05, using DMRT.

Table 4: Influence of combined application of organic and inorganic fertilizer materials on Fruit Attributes and Fruit yield of tomato (*Lycopersicon lycopersicum*)

Treatments	Days to 50% flowering	Fruit Diameter (cm)	Cumulative Number of Fruits	Cumulative Fruit Weight ($gplant^{-1}$)	Fruit Yield (tons ha^{-1})
Control	**92.2b**	**1.6c**	**15.0c**	**13.1b**	**7.3c**
100% NPK	**68.1a**	**4.0b**	**38.0ab**	**43.1a**	**60.7a**

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75% NPK + 25 % Rice Bran	**67.6a**	**4.2b**	**39.0ab**	**41.4a**	**59.8a**
50 % NPK + 50 % Rice Bran	**60.4a**	**5.4a**	**46.0a**	**48.3a**	**82.3a**
25 % NPK + 75 % Rice Bran	**60.6a**	**5.3a**	**47.0a**	**45.1a**	**78.5a**
100% Rice Bran	**71.2a**	**3.8b**	**30.0b**	**39.2a**	**43.6b**

Means followed by the same letters are not significantly different at p=0.05, using DMRT.

Table 5: Effect of organic and inorganic fertilizer combinations on biomass yield of tomato (*Lycopersicon lycopersicum*)

Treatments	Above- ground Biomass Fresh Weight (gplant^{-1})	Above-ground Biomass Dry Weight (gplant^{-1})	Below-ground Biomass Fresh Weight (gplant^{-1})	Below-ground Biomass Dry Weight (gplant^{-1})
Control	**116.1c**	**28.7d**	**12.8c**	**5.1cd**
100% NPK	**240.1a**	**78.3a**	**30.0a**	**9.8a**
75% NPK + 25 % Rice Bran	**196.1b**	**67.2ab**	**25.0a**	**6.4bc**
50 % NPK + 50 % Rice Bran	**204.6ab**	**68.1ab**	**24.7a**	**7.1ab**
25 % NPK + 75 % Rice Bran	**200.8ab**	**59.5bc**	**22.1bc**	**8.6ab**
100% Rice Bran	**162.2b**	**49.4c**	**15.6bc**	**6.0bc**

Means followed by the same letters are not significantly different at p=0.05, using DMRT.

Table 6: Nutrient uptakes of tomato (*Lycopersicon lycopersicum*) as influenced by organic and inorganic fertilizer combinations

	NUTRIENT UPTAKES (gkg^{-1})		
TREATMENTS	**N**	**P**	**K**
Control	**12.4c**	**1.1c**	**1.1d**
100% NPK	**46.7b**	**9.2b**	**14.6c**
75% NPK + 25 % Rice Bran	**57.3ab**	**21.5a**	**18.6b**

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50 % NPK + 50 % Rice Bran	**65.4a**	**21.2a**	**20.6ab**
25 % NPK + 75 % Rice Bran	**63.9a**	**24.1a**	**22.7a**
100% Rice Bran	**61.7a**	**22.3a**	**22.6a**

Means followed by the same letters are not significantly diffe

REFERENCES

Adebooye, O.C.; Adeoye, G.O. and Tijani-Eniola H. (2006). Quality of fruits of three varieties of tomato (Lycopersicon *esculentum* L. Mill) as affected by phosphorus rates. Journal of Agronomy 5 (3): 396-400.

Akanbi, W. B. (2002). Growth, Nutrient uptake and yield of maize and okra as influenced by compost and nitrogen fertilizer under different cropping systems. Ph. D. Thesis, Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria pp. 232.

Akanbi, W. B., Akande, M. O. and Adediran, J. A. (2005). Suitability of composted maize straw and mineral nitrogen fertilizer for tomato production. Journal of Vegetable Science 11(1): 57-65.

Akanni, D.I. and Ojeniyi, S. O. (2007). Effect of different levels of poultry manure on soil physical properties, nutrients status, growth and yield of tomato (*Lycopersicon esculentum*). Journal of Agronomy 1:1-4

Anonymous, (2000). Yield and fruit quality of tomato as influenced by mulching, nitrogen and irrigation interval. *International Research Journal Of Agricultural Science and soil science Vol. 1 (3) pp. 090 – 095.*

Babajide, P.A.; Olabode, O.S.; Akanbi, W.B.; Olatunji, O.O and Ewetola E.A. (2008). Influence of Composted Tithonia-biomass and N-Mineral Fertilizer on Soil Physico- Chemical Properties and Performance of Tomato (Lycopersicon lycopersicum). *Research Journal of Agronomy* Vol. 2 (4): 101-106.

Babajide, P. A. (2010). Response of Sesame (*Sesamum indicum* Linn.) to Integrated Nutrient Management Approach in an Alfisol, in Oyo State, Nigeria (Ph.D. Thesis), University of Ibadan, Ibadan, Nigeria. 173 pp.

Babajide, P. A.; Akanbi, W. B; Olabode, O. S., Olaniyi, J. O. and Ajibola, A.T. (2012). Influence of pre-application handling techniques of *Tithonia diversifolia* Hemsl. A.Gray residues on growth, seed yield and oil content of sesame (*Sesamum indicum L.*), in south-western Nigeria. *Journal of Animal and Plant sciences: Biosciences:* Vol.15 (2): 2135-2146.

Babajide, P.A. and T.B. Salami (2012). Effect of integrated nutrient management approach on soil chemical and physical properties and performance of tomato (*Lycopersicon lycopersicum*) under mildly acidic soil conditions. *International Journal of Applied Agricultural and and Apicultural Research, LAUTECH, Ogbomoso, Nigeria. IJAAAR.* Vol. 8 (1): 91-98.

Babajide, P.A. (2014). Contributions of bio-organo-chemical nutrient management approach to growth, yield and phytochemical composition of sesame (*Sesamum indicum* Linn.), under low fertile alfisol conditions. *International Journal of Current Microbiology and Applied Sciences.* ISSN:2319-7706. Vol.3 .No.3 (8): 957- 976.

Barber, N.J. and J. Barber, (2002). Lycopene and prostate cancer. *Prostate Cancer Prostatic Dis*., Vol. (5): 6-12

Chukwuka, K. S. and Omotayo, O. E. (2009). Soil fertility restoration potentials of Tithonia green manure and water hyacinth compost on a nutrient depleted soil in south west Nigeria. Research Journal of Soil Biology 1(1); 20-30.

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Clinton, S.K. (1998). Lycopene: Chemistry, biology and implications for health and disease. Nutr.Rev ., 56:35-51.

International Institute of Tropical Agriculture (1982). Selected Methods for Soil and Plant Analysis. International Institute of Tropical Agriculture, Ibadan Nigeria. IITA Manual Series, No. 7.

Indu K. P. and Savithri K. E. (2003). Effect of Biofertilisers VS Perfected chemical fertilization for Sesame grown in summer rice fallow. Journal of Tropical Agriculture 41 (2003); 47-49.

Rawshan, A. S. M. (1996). Effect of Plant Population Density on Tomato In: ARC-AVRDC training report. Kasetsart University, Bangkok, Thailand: *ARC-AVRDC*, Pp 152-156.

SAS (2015). Sas Institute Inc., Cary Nc., U.S.A. (Software Statistical programme). 2015.

Tejada, M., Benitez, C. and Gonzatez, J. L. (2005). Effects of Application of Two Organomineral Ferttilizers on Nutrient Leaching Losses and Wheat Crop. Agron. Journ. 97; 960-967

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