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STUDIES ON THE GROWTH AND YIELD RESPONSE OF GUINEA CORN (*Sorghum bicolor* L.) TO ORGANO-MINERAL FERTILIZER APPLICATION IN ILORIN, NORTH CENTRAL NIGERIA

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Abstract
Farmers in southern guinea savanna zone of Nigeria cultivate crops such as yam, cassava, vegetables and cereal crops. However, the soils of the region are inherently infertile due to low vegetation cover, soil erosion and low organic matter content occasioned by constant bush fire. However, the zone is highly endowed with potentials for the cultivation of cereals such as maize, rice and guinea corn using low external inputs for fertility maintenance. Field experiments were conducted at the Teaching and Research Farm of the University of Ilorin, Ilorin, Nigeria, during the 2012 and 2013 cropping seasons to evaluate the effects of organo-mineral fertilizer on the performance of guinea corn. The organo-mineral fertilizer was incorporated into the soil two weeks before sowing of the guinea corn seeds at the rate of 0, 1, 2, 3 and 4 t/ha. The experiment was laid out as a randomized complete block design replicated three times. Data were collected on growth parameters (plant height, number of leaves and number of tillers) and yield parameters (weight of seeds per plant and seed weight per hectare). The result of the experiments indicated that applying organo-mineral fertilizer significantly affected the growth and yield parameters that were evaluated in the two years of study. Applying organo-mineral fertilizer at 4tha^{-1} gave highest growth and yield attributes which was similar to the 3t/ha application but significantly different ($P \leq 0.05$) from the other treatments. Percentage mean yield for the two years combined was 71.1 more than the control.

Keywords: Organomineral fertilizer, soil properties, growth, sorghum

Introduction
Sorghum (*Sorghum bicolor* (L.) Moench) is regarded as one of the most important food crops in the world, following wheat, rice, maize and barley [1] and has a wide range of uses; as grain crop, sweetener in syrup, animal feed, silage, building material and in broom making [2]. The crop is also used for local beer, spirit, vinegar and dye production; stem is chewed like sugar cane [3]. In Nigeria, the cultivation of crops especially the cereals are constrained by poor soil nutrient status, which is a general feature of soils in the southern guinea savanna due to constant bush burning and erosion. Maintenance of high crop yields under

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intensive cultivation is only possible by using fertilizers in the zone and inorganic fertilizers are expensive and beyond the reach of peasant farmers. To overcome this pitfall, there is a need to look for an alternative that is cheap, readily available and environmentally friendly and this is possible with the use of organo-mineral fertilizer (OMF). Organo-mineral fertilizer application will give the benefits of applying an organic fertilizer as well as applying small quantity of inorganic fertilizer. Organo-mineral fertilizer has two major components; mineral component which is readily available to plants and the organic component which is slowly released for plant's utilization [4]. Compared with mineral fertilizer, OMF releases more nutrients; controls soil acidity, have residual effect on soil fertility and crop performance [5].

In the guinea savanna zone, the use of inorganic fertilizers to increase yield of crops is a common practice, which helps to increase crop performance as well as the chemical properties of soils [6]. However, the use of chemical fertilizers to sustain cropping systems on a long-term basis has not been very effective [7]. It usually leads to a decline in soil organic matter content, soil acidification and soil physical degradation, which consequently leads to increased soil erosion [8]. However, its continuous use is not sustainable by peasant farmers because of its cost and could cause nutrient in-balance [8].

The integrated use of fertilizer is therefore necessary to balance and maintain optimum levels at which nutrients could be used without being detrimental to the soil thereby increasing food production. Studies have shown that fertilized crops with organic manures are more naturally nourished, store longer and do not show susceptibility to rapid mould and rotting unlike mineral fertilizers [9]. In recent times, application of combined organic and inorganic fertilizers has been suggested to be more sustainable than the separate application of each organic and inorganic fertilizer [10, 11]. Organic manure, which is cheap, readily available and environmentally friendly, can be used as an alternative to chemical fertilizer to maintain sustainable crop yield and soil fertility. Its application has been shown to sustain crop yield, better nutrient recycling and soil productivity [12, 13]. However, organic manures release nutrients slowly and they are rarely available to small-scale farmers in the required quantities [14]. Therefore, there is the need for more attention on the integrated nutrient supply involving organo-mineral fertilizers.

Although guinea corn can thrive in marginal soils with reduced yields, the use of organo-mineral fertilizer will help to increase its yield potentials. This work was therefore an investigation of the effect of organo mineral fertilizer on the growth and yield of guinea corn.

Materials and Method

The experiment was carried out during the 2012 and 2013 cropping seasons at the Teaching and Research Farm of the University of Ilorin, Ilorin, Nigeria (9^0 29^1 N, 4^0 35^1 and 307m above sea level) in a Southern Guinea Savanna zone. The area is characterized by a bimodal rainfall pattern, a long rainy season from late April

to July and a short rainy period that extends from September to late October after a dry spell in August and a dry season (November – March). The site was a three-year fallow land after it was cropped to maize and cassava for two years prior to the establishment of the experiment. Soil samples collected from 0-30 cm depth from twenty locations prior to planting and application of organo-mineral fertilizer within the experimental plots, were bulked and a composite was taken for physio-chemical characterization at the beginning and the end of the cropping seasons. Soil pH was measured (soil: water ratio, 1:2) using a glass electrode; total N content was analyzed by micro - Kjeldahl method [15]; available phosphorus was analyzed following Bray No 1 (1 N NH_4F + 0.5N) HCl extractant by vanadomolybdophosphoric acid method [16]. Organic carbon was analyzed using the modified Walkley – Black method [17] and exchangeable bases extraction done using 1N ammonium acetate. Exchangeable K and Na were analyzed using flame photometry while Ca and Mg were analyzed by atomic absorption spectrophotometry.

Land was cleared of existing vegetation, ploughed, harrowed and ridges were made. Each plot consisted of five ridges measuring 5 metres separated by a 0.5-metre avenue. The organo-mineral fertilizer (OMF) was manually worked into the soil using a hoe two weeks before sowing and sowing of the seeds (S K 5912 variety) was done on the 28th of July, 2012 and 28th of July 2013 at a spacing of 50 x 50cm. Three hand weedings were carried out at 3, 6 and 9 weeks after sowing.

Data collected on five tagged plants were vegetative parameters (plant height, number of leaves and number of tillers) and yield parameters (grain weight per plant and grain weight per hectare). The plant height was assessed by measuring from the base of the plant to the terminal point of the stem; the number of tillers and leaves were assessed by visual count of the green leaves and tillers; grain weight per plant was recorded by using a sensitive balance and the weight per hectare was extrapolated from the weight per plant. Analysis of variance (ANOVA) for all measurements were performed using Genstat software version 12 statistical packages for randomized complete block design (RCBD) and mean separation was done based on the work of Steele and Torrie [18].

Results and Discussion

Data on the chemical properties of soil and organomineral fertilizer is presented in Table 1. The result showed that the soil had a pH of 6.2 that is slightly acidic. The organic matter content, N, P, K and Ca were low. The analysis of the OMF used for the study revealed that it was slightly acidic (6.1), contained high organic matter content and high N. The available P and exchangeable K were moderate, but Ca was low. Makinde *et al.* [19] reported the presence of nutrients in OMF in adequate amount for the utilization of plants for their growth and development. Organo-mineral fertilizer combines the attributes of organic and inorganic fertilizer and therefore acts as a nutrient reservoir providing favorable

pH, aeration and improving other physical and chemical properties of the soil [20]. Organic matter acts as nutrient reservoirs and on decomposition, releases plant nutrients, which the crops absorb through their roots for growth leading to higher yields [21]. The total nitrogen content before cropping was very low (Table 1). At the end of the first cropping season, the nitrogen content was moderately increased from 0.08 to 0.13% indicating an increase in the soil fertility status because of OMF incorporation. Aderni [22] opined that the application of organic manure significantly increased level of organic carbon, nitrogen as compared to the application of inorganic fertilizer. OMF could have improved the availability of nutrients to the crop by enhancing the supply of readily available nutrients to the soil microbial community [23].

Table 1: Chemical Properties of Organo-Mineral Fertilizer and Soil of the Experimental Site before and After Cropping In 2012 And 2013

Year	Soil pH	Percent			mg/kg	cmol/kg		
		Org C	Org. matter	Total N	Avail. P	K	Ca	Mg
2012a	6.2	0.61	1.05	0.08	3.43	0.12	2.15	0.90
2012b	6.5	4.02	6.95	0.13	3.28	0.21	2.06	0.84
2013	6.6	0.30	0.52	0.07	3.32	0.14	1.67	0.70
OMF	6.1	8.34	14.42	0.43	7.05	0.36	2.85	3.90

a. Before initial cropping, b. End of first year cropping, OMF = Organomineral fertilizer

Data on the plant height of guinea corn in 2012 is presented in Table 2. The result indicated a progressive increase in plant height of the crop with increasing rates of organo- mineral fertilizer application up to the highest rate. There was a significant increase in plant height with time. In 2013, OMF similarly increased plant height to an optimum of 4t/ha (Table 3). As in 2012; plant height increased with time. There were significant differences ($P \leq 0.01$) across the three sampling periods of 4, 8 and 12 weeks after sowing (Table 3). This is in conformity with the findings of Egbuchua and Enujeke [24]; Ojeniyi *et al.* [25] posited that increasing the rate of organo-mineral fertilizer increased the plant height of rice and maize respectively. Ipimoroti *et al.* [26] also reported that plant height and leaf area of tea increased with increased rates of organo-mineral fertilizer application. The result is also in agreement with the findings of Olaniyi *et al.* [27] who opined that the application of organo-mineral fertilizer significantly increased plant height of okra. In the same vein; Eifediyi *et al.* [28] posited that organo-mineral fertilizer increased the plant height of jute mallow. Ahmed *et al.* [29] also reported similar result in sorghum while Ayoola and Makinde [30] reported

better height of maize when treated with a mixture of organic and inorganic fertilizer.

Data on the mean number of leaves at 4, 8 and 12 weeks after planting are presented in Table 2. In 2012, as the rate of application increased, there was an increase in the average number of leaves across the three sampling periods of 4, 8 and 12 weeks after planting; the highest number of leaves was observed at the 4t/ha application which was at par with the 3t/ha OMF but significantly different ($P \leq 0.01$) from the other treatments.

Similarly in 2013, there was a progressive increase in the number of leaves as the rate of OMF application increased (Table 3). The differences between their means was significant ($P \leq 0.01$) across the three sampling periods of 4, 8 and 12 weeks after sowing. The highest number of leaves was produced at the $4tha^{-1}$ application, which was at par with the $3tha^{-1}$ application, the application of $3tha^{-1}$ of organo-mineral fertilizer was enough to produce good vegetative growth necessary for assimilate production. This is in contrast with the findings of Makinde [31] who observed no significant difference in the average number of leaves of maize in the first trial of maize using OMF but recorded significant increase in the number of leaves in the second year. Olaniyi and Akanbi [32] reported the use of 3t/ha organo-mineral to enhance the growth of fluted pumpkin (*Telfaria occidentalis*). The result of this experiment is in agreement with the findings of Said [33] who reported that the addition of different sources of organic manures increased plant growth characteristics, namely, plant height and number of leaves of plants.

In 2012, there was an increase in the number of tillers with time (Table 2) and the optimum was observed at 4t/ha and there was significant differences ($P \leq 0.01$) across the sampling periods of 8, 10 and 12 weeks after planting. Applying OMF increased the number of tillers, which is desired by farmers because the production of many tillers will in turn produce more grains. The use of OMF at 3t/ha was sufficient to produce vigorous and healthy plant growth comparable to plants treated with synthetic fertilizers. This is in agreement with the findings of Satyanarayana *et al.* [34] who reported significant response of rice to organo-mineral fertilizer application, which means enough nutrients were released earlier for utilization by plants. Adeniyan and Ojeniyi [5] had also reported that balanced plant nutrition and enhanced crop production are ensured with the use of organo-mineral fertilizer. Akanbi *et al* [35], in their fertilizer treatment studies reported that crops that received Organo-mineral fertilizer performed better in all growth and yield components compared to the control.

Table 2: Effects of organo-mineral fertilizer on the vegetative traits of guinea corn at 4, 8 and 12 weeks after sowing (2012)

OMF application (t/ha)	Plant height (cm)			Number of leaves/plant			Number of tillers/plant		
	4	8	12	4	8	12	8	10	12
0	15.10	60.43	168.8	5.2	10.57	12.30	1.60	1.87	2.50
1	17.40	63.90	171.8	5.60	11.07	14.90	2.00	2.23	2.63
2	17.63	70.27	179.8	5.83	12.13	15.37	2.40	2.87	3.03
3	18.93	71.37	183.3	6.03	12.47	15.90	2.90	3.27	3.50
4	19.00	72.17	183.7	6.13	12.50	15.93	2.93	3.27	3.40
Mean	17.61	67.65	177.5	5.76	11.75	14.88	2.37	2.27	3.01
LSD(0 .01)	3.755	2.226	9.91	0.404	0.897	0.280	0.397	0.195	0.342

Table 3: Effects of organo-mineral fertilizer on the vegetative traits of guinea corn at 4, 8 and 12 weeks after sowing (2013)

OMF application (t/ha)	Plant height (cm)			Number of leaves/plant			Number of tillers/ plant		
	4	8	12	4	8	12	8	10	12
0	13.97	60.53	161.90	5.23	11.27	12.37	1.50	1.73	1.80
1	17.70	65.53	166.00	5.57	11.40	15.47	1.93	1.97	2.03
2	18.00	67.63	169.03	6.40	12.07	15.57	2.20	2.90	3.00
3	18.37	72.00	181.07	6.77	12.43	15.73	2.63	3.43	3.50
4	18.57	72.07	181.67	7.13	12.37	15.70	2.63	3.53	3.57
Mean	17.32	65.55	171.93	6.22	11.91	14.97	2.18	2.71	2.78
LSD(0 .01)	1.374	2.308	6.518	0.512	0.626	0.833	0.504	0.509	0.541

Across both 2012 and 2013 planting seasons, the organo-mineral fertilizer had significant effect (P≤0.05) on the grain yield per plant and grain yield per hectare of sorghum (Table 4). The grain yield per plant increased with increase in the rate of organo-mineral fertilizer application. The 4tha^{-1} application produced the highest grain yield per plant, which was statistically similar to the 3tha^{-1} treatment but significantly different from the other treatments.

The mean across the two years, indicated the 4t/ha^{-1} treatment produced the highest grain yield per plant and per hectare, which was similar to the 3tha^{-1} application but significantly different from the other treatments. The 4tha^{-1} and 3tha^{-1} had superior yield attributes compared to the other treatments; this could be attributed to increased nutrient availability to the crop because of higher rate of organo-mineral fertilizer application. The importance of fertilization in improving soil fertility in

sorghum cultivation was clearly demonstrated by the increased grain yield per plant and per hectare, which was recorded across the two years of the study. The application of organo-mineral fertilizer at 4t/ha can lead to luxury consumption by the plant because there was no significant difference between applying 3 and 4t/ha. This is in agreement with the findings of Makinde [31] with the use of OMF at the rate of 3 t/ha in maize. Ahmad *et al.* [36], Thorup-Kristensen *et al.* [37] had reported that organic manure high in organic matter content could help in moisture conservation that will ultimately improve mineral nutrition and crop yield. Aliyu and Olarewaju [10] reported that the use of combined organo-mineral and NPK fertilizer gave highest fruit yield of pepper. Olaniyi *et al.* [38] stated that organo-mineral fertilizer gave the highest fruit yield of okra. The highest grain yield in this study was higher than what was reported by Buah and Nwinkaara [39] from farmer's field in Ghana (0.80t/ha) because of the incorporation of OMF.

Mugandi *et al.* [40] reported an increase in the grain yield in a *Leucaena* biomass combined with mineral fertilizer as compared to sole use of mineral fertilizer on *Leucaena* biomass. Akanbi *et al.* [35], Olatunji and Ayuba [41] using different crops, reported that Organo-mineral fertilizer performed better in growth and yield components than the control, which could be attributed to the nutrient qualities of the organo-mineral fertilizer.

Table 4: Effects of organo-mineral fertilizer on grain weight per plant and grain weight per hectare of guinea corn

OMF application (t/ha)	2012 Grain wt ($gplant^{-1}$)	2013 Grain wt ($gplant^{-1}$)	Mean	2012 grain wt ($kgha^{-1}$)	2013 Grain wt ($kgha^{-1}$)	Mean
0	34.01	35.30	34.65	1360.0	1411.9	1386.2
1	42.31	42.29	42.30	1692.0	1698.2	1695.3
2	46.78	45.99	46.38	1871.0	1840	1855.6
3	48.80	48.65	48.73	1952.0	1946.5	1949.3
4	48.93	48.58	48.76	1957.0	1943.5	1950.3
Mean	44.17	44.16	44.16	1766.4	1768.0	1767.4
LSD(0.05)	1.951	1.759	1.469	78.2	67.48	56.48

Conclusion

From the results of the study, it is obvious that the optimum rate of application of organo-mineral fertilizer for sorghum in Ilorin is $3tha^{-1}$, which gave the highest growth and grain weights in both experiments. Thus applying organo-mineral fertilizer, which is cheap and readily available, could be beneficial to sorghum production because the

traditional fallow periods which farmers rely on has been drastically reduced due to high population and infrastructural development.

References

1. F.A.O. Official Agricultural Statistics 18th edition, Food and Agricultural Organization, Canada. Pg 1002 – 1004 (2006).
2. J.B. Jones. Agronomic Handbook: Management of crops, soil and their fertility. CRC Press Washington DC, 450pp (2006).
3. M. Brink and G. Belay (Editors), Plant Resources of Tropical Africa 1. Cereals and Pulses. PROTA Foundation, Wageningen, Netherlands / Backhuys Publishers, Leiden, Netherlands/CTA Wageningen, Netherlands, 298pp (2006).
4. A.B. Osumah and E.H. Tijani, Influence of NPK (15:15:15) and organo-mineral fertilizer on the performance of pepper. *Journal of Agriculture and Veterinary Sciences,* **2**: 1- 7 (2010).
5. O.N. Adeniyan and S.O. Ojeniyi, Effect of poultry manure, N.P.K 15:15:15 and combination of the reduced levels on maize growth and soil chemical properties. *Nigerian Journal of Soil Science,* **15**: 34-41 (2005).
6. S.O. Ojeniyi. Effect of goat manure on soil nutrients and okra yield in a rain forest area of Nigeria. *Appl.Tropical Agric.,* **5**: 20-23 (2000).
7. R. Rodale, Your farm is worth more than ever: Put your farm's internal resources to work New Farm Magazine. *Regenerative Agriculture,* pp8 (1995).
8. J.W. Doran, M. Sarrantonio and M.A. Liebig, Soil health and sustainability. *Advances in Agronomy,* **56**: 42-45 (1996).
9. E.A. Makinde, L.S. Ayeni, and S.O. Ojeniyi, Effects of Organic, organo-mineral and NPK Fertilizer Treatments on The Nutrient Uptake of *Amaranthus cruentus* (L) on Two Soil Types in Lagos, Nigeria. *Journal of Central European Agriculture,* **12**: 114-123 (2011).
10. L. Aliyu and J.A. Olarewaju, Comparative effectiveness of combined application of organic and mineral fertilizer on pepper. *Nigeria Journal of Horticultural Science,* **4**: 14-16 (2000).
11. K.E. Giller, Targeting Management of Organic Resources and Mineral Fertilizer. In: Integrated Plant Nutrition Management in sub-saharan Africa from concept to practice Vanlauwe B, Diels Sangunga Merck (Eds) Pp155-171 (2002).
12. P.K. Mutuo, J.P. Mukalama, and J. Agunda, On – farm testing of organic and inorganic phosphorous source on maize in western Kenya. In the biology and fertility of tropical soils. TSBF Report, 22pp (2000).
13. A. Belay, A.S. Classens, F.C. Wehner, J.M. De Beer. Influence of residual manure on selected nutrient elements and microbial composition of soil under long term crop rotation. *S. Afr. J. Plant Soil* **18**:1-6 (2001).
14. P. Nyathi and B.M. Cambell. The effect of trees leaf litter, manure, inorganic fertilizer and their combinations on above ground production and grain

yield of maize. *African Crop Science Journal,* **3(4)**:451-456 (1995).
15. J.M. Bremner. Total N: In C.A. Black (Ed.) Methods of soil analysis part 2, Agron. No 9. American Society of Agronomy Madison, Wisconsin. 1149-1178 (1965).
16. S. Kuo. Phosphorus. In methods of soil analysis. Part 3 Chemical methods. D. L. Sparks (Ed.) American Society of Agronomy, Madison pp 869 – 919 (1996).
17. D.W. Nelson and L.E. Sommers, Total carbon, organic C and organic matter In D. L. Sparks (Ed.) Methods of Soil Analysis. Part 3 Chemical method, SSSA Book series Number 5, Madison, W.I. Am. Soc. Agron. (1996).
18. R.G.D. Steel and J.H. Torrie, Principles and Procedures of Statistics with Special Reference to the Biological Sciences McGraw Hill Book Co. Inc. New York 481pp (1980).
19. E.A. Makinde, M.O. Akande and A.A. Agboola, Effects of Fertilizer type on performance of melon in a maize-melon Intercrop. *ASSET Series A,* **(2)**: 151-158 (2001).
20. Uma Singh and T.C. Pokhriyal, Effects of de-oiled tree seed cakes and growth and biomass production in *Dalbergia sissoo* seedlings. Proceedings India National Science Academy B63 No. 6 pp 625– 630 (1997).
21. S. Kumar, D. Singh, and V. Nepalia, Performance of Fenugreek (*Trigonella foenum-graecum*) varieties at various fertilizer levels and bio-fertilizer inoculations. *Indian J Agr. Res.,* **79**: 80-83 (2009).
22. N.D. Aderni. Mixed paper mill sludge effects on corn yield, nitrogen efficiency and soil properties. *Agronomy Journal,* **198**: 1471 – 1478 (2006).
23. A.A. Yusuf, E.N.O. Iwuafor, Z. Ladan, A.S. Agbaji, Z. Abdusalam and H.A. Yusuf. Evaluation of neem based compound fertilizer for crop production in Samaru, moist savanna of Nigeria. *Journal of Agricultural Science and Technology,* (2011) *235 – 243* (2011).
24. C.N. Egbuchua and E. C. Enujeke, Effects of Different Levels of Organo-mineral Fertilizer on the Yield and Yield Components of Rice (*Oryza sativa* L.) In A Coastal Flood Plain Soil, Nigeria. *Journal of Agriculture and Veterinary Science,* **4**: 1- 5 (2013).
25. S.O. Ojeniyi, O. Owolabi, O.M. Akinola and S.A. Odedina, Field study of effect of organo- mineral fertilizer on maize growth, yield, soil and plant nutrient composition in Ilesha, South West Nigeria. *Nigeria Journal of Soil Science,* **19**:11-16 (2009).
26. R.R. Ipimoroti, M.A. Daniel and C.R. Obatolu, Effect of organo-mineral fertilizer on Tea growth at Kusuku, Mambilla Plateau, Nigeria. *Moor J. Agric. Res.,* **3(2)**:180-183 (2002).
27. J.O. Olaniyi, J.O. Ogunrinde, O.S. Olabode and W.B. Akanbi, Effect of organic mineral fertilizer application on growth, yield and nutrient uptake of maize. *Journal of Applied Agricultural and Apicultural Research,* **2**:10-19 (2005).
28. E.K. Eifediyi, K.O. Mohammed and S.U. Remison, Influence of organo-mineral fertilizer (OMF) on the

performance of jute mallow *(Corchorous olitorius)* in North Central Nigeria. *Nigerian Journal of Agriculture, Food and Environment,* **9(3)**:54-58 (2013).

29. A. Ahmed, I. Qadir, and N. Mahmud, Effect of integrated use of organic and inorganic fertilizers on fodder yield of sorghum (Sorghum bicolor L). *Pak.J. Agric. Sc.* **4**: 415-421 (2007).
30. O.T. Ayoola and E.A. Makinde, Fertilizer Treatment Effects on Performance of Cassava under Two Planting Patterns in a Cassava-based Cropping System in South West Nigeria. *Res. J. Agric. Biol. Sci.,* **3(1)**: 13-20 (2007).
31. E.A. Makinde, Evaluation of organo-mineral fertilizer on growth and yield and quality of *Amaranthus cruentus* on two soil types in Lagos State, Nigeria. Ph.D. Thesis, Department of Agronomy, University of Ibadan. Ibadan, Nigeria 154pp (2007).
32. J.O. Olaniyi and W.B. Akanbi, Effect of organo-mineral and inorganic fertilizer on the yield quality of fluted pumpkin *Telferia occidentalis. African Crop Science Proceedings*, **8**: 347 – 350 (2007).
33. A.H. Said, Influence of some organic fertilizers on the growth and yield of pepper plants (*Capsicum annum* L.) cultivated under plastic houses. M.Sc. Thesis, Fac. Agric. Ain Shams Univ., Egypt (1997).
34. V. Satyanarayana, P.V. Vera Prasad, V.R.K. Murthy and K.J. Boote, Influence of integrated use of farmyard manure and inorganic fertilizers on yield and yield components of irrigated lowland rice. *Journal of Plant Nutrition,* **25(10)**: 2081-2090 (2002).
35. W.B. Akanbi, E.A.O. Illupeju, A.O. Togun and S.A. Adeyeye, Effects of Nigerian commercial organic fertilizers compost and NPK on maize performance, plant and soil nutrient content. *International Journal of Organic Agricultural Research and Development,* **1(1)**: 135-149 (2010).
36. R. Ahmad, M. Naveed, M. Aslam, Z.A. Zahir, M. Arshad and G. Jilani, Economizing the use of nitrogen fertilizer in wheat production through enriched compost. *Renewable Agriculture and Food Systems,* **23(3)**: 243-249 (2008).
37. K. Thorup-Kristensen, D.B. Dresboll, and H.L. Kristensen, Crop yield, root growth, and nutrient dynamics in a conventional and three organic cropping systems with different levels of external inputs and N re-cycling through fertility building crops. *Eur. J. Agron.*, **37(1)**: 66-82 (2012).
38. J.O. Olaniyi, W.B. Akanbi, O.A. Olaniran and O.T. Ilupeju, The effect of organomineral and inorganic fertilizer on the growth, fruit yield quality and chemical composition of okra. *J. Anim. Plant Sci.,* **9**: 11354-1140 (2010).
39. S.S.J. Buah and S. Nwinkaara, Response of Sorghum to nitrogen fertilizer and plant density in the guinea savanna zone. *Journal of Agronomy,* **8**: 124 – 130 (2009).
40. D.N. Mugandi, P.K.R. Nair, J.N. Mugwe, M.K.O. Neil and P.L. Woomer, Callindra and Leucaena alley cropped with maize; Part 1 soil fertility changes and maize production in the sub-humid

highlands of Kenya. *Agrof. System*, **46**: 39-50 (1999).

41. O. Olatunji and S.A. Ayuba, Effects of combined application of poultry manure and NPK 20-10-10fertilizers on soil chemical properties and yield of maize *(Zea may L.)*. Proceedings of the 35th Annual Conference of the Soil Science Society of Nigeria. 7th – 11th March 2011, Minna, Nigeria. (2011).