Original Research Article

Effect of Oil Palm Bunch Refuse Ash in Sustainable Production of Egusi-Melon (*Colocynthis citrullus*) in an Ultisol.

Abstract

Soil fertility management is a major challenge in high humid tropical regions of Nigeria. Field experiment were conducted at National Cereals Research Institute, Uyo Out-Station in 2011 and 2012 to investigate the response of egusi melon (*Colocynthis citrullus*) to different rates of OBRA (1,2,3,4, 5 and 6 t/ha) and 200kg/haNPK as recommended rate of inorganic fertilizer for egusi in the study area. The experiment was laid out in a randomized complete block design, replicated three times. Data collected on growth and yield of egusi-melon were subjected to analysis of variance. Significant means were compared using least significant difference at 5% probability level. Application of 6 t/ha OBRA produced significant seed yield of 243.40 and 253.10 kg/ha in 2011 and 2012. Treatment of 200kg/ha NPK produced seed yield of 193.60 and 201.75 kg/ha respectively. The control (no soil amendment) produced the least seed yield of 125.33 and 128.11 kg/ha in 2011 and 2012, respectively. Comparing with recommended rate of NPK (200kg/ha), treatment of 6t/ha OBRA had seed yield of 21 and 20 % greater than the recommended rate of NPK. Soil chemical properties at harvest indicated high soil pH (7.80 and 7.90) and organic matter (3.50 and 3.55 %) respectively compared with low soil pH (5.00 and 4.90) and organic matter (2.08 and 20.1 %) observed in NPK treatment. The study therefore concluded that application of 4t/h OBRA could be cheap alternative means of sustainable production of egusi melon in acid coastal plain soils of Nigeria.

Keywords: Egusi melon, oil palm bunch ash, yield and soil chemical properties.

Introduction

Egusi-melon (*Colocynthis citrullus*) is popular for its dietary and economic importance in West Africa. Egusi-melon belong to the plant family Cucurbitaceae. It is a substantial vegetable crops in Africa is which is a tendril climbing herbaceous annual crop. Egusi grows in almost all parts of Nigeria but however grows better in some part of the savannah belt region of Nigeria (Omale *et al*. 2022). The crop is one of the most neglected vegetables in Tropical Agricultural Research. It is one of the first crops sown when the rains begin in Nigeria (Makinde, *et al.*2007). In West Africa, the name Egusi is applied to members of the gourd family having seeds of high oil content. Egusi is of tropical African origin. Egusi Melon is cultivated in portions of West Africa, especially in Western Nigeria, for the seed and as a cover crop in maize, cassava, cocoyam, yam or other crops (van der Vossen *et al*. 2004; Ikeh *et al.* 2012)

In 2018, egusi- melon production statistics ranked Nigeria as the highest producer with a production of 585,347 tons of the seeds which translates to 60% of the global melon seed production. Egusi seed is widely grown in West Africa with Nigeria accounting for about 65% of total production (Anonymous, 2022). The areas of high melon seed production in the country include Enugu, Benue, Nasarawa, Taraba and Kogi state.

It is widely cultivated and consumed oil seed crop in many parts of Nigeria where could use in preparing soup and sauce. It is the true indigenous melon of West Africa under the name '*egusi'* in Igbo and '*egusi'* in Yoruba names in Nigeria. It consumed by all Nigerian tribes or regions, this make egusi-melon soup a special menu in many restaurant and hotels in Nigeria and other parts of West Africa. The seed of egusi-melon consist of carbohydrate, fibre, ash, vitamin, calcium, phosphorus and iron (Okokon and Ndaeyo, 2013). The oil content of egusi seed is 17-19% (wlw), consisting of 67 — 73% linoceic acid, 10-16% palmitic acid. It is estimate that the oil yield is approximately 400L/hectare (Zohary and Hopt, 2000). The seeds are the most important product and are primarily used as a thickening for sauce and soup (Ikeh, 2010). In southeastern Nigeria local paste seasoning "*Ogiri*" which is a product of egwusi melon seed is a popular food condiment (Ikeh, 2010). During its preparation, de-hulled melon seeds are boiled till they become soft, wrapped tightly in plantain leaves and left to ferment for about five days (Ikeh, 2010). The seeds can be boiled or fried and eaten as snack. After melon oil extraction, the offal could use in making egwusi local cake popularly known as "*Ogbarao tie*" Igbo or "*Ikpan*" in Ibibio all in Nigeria. Egusi melon is a national crop in Nigeria because every tribe in Nigeria consumes it in a similar way and also known it as egusi. In addition, the growth habit of egusi-melon makes it quite suitable for the use as live mulch in weed control in cultivated plots. The vines when fully formed, covers the soil to reduce weeds in the farm.

One of the major problems limiting egusi-melon production in southeastern Nigeria is low soil fertility. This has so far been checked by the application of plant nutrient to the soil either the organic or inorganic forms. Organic fertilizers apart from releasing nutrient to the soil also improve its physical properties, which enhance plant growth and development, although the release of nutrient is slow in organic fertilizer but more lasting compared to the faster release of nutrient by inorganic fertilizers, which are often lost rapidly by leaching in porous soil and heavy rainfall area like Akwa Ibom State which received annual rainfall of about 2500mm per annum. Frequent and application of high rate of inorganic fertilizers has resulted to environmental pollution and ecological problems, also inorganic fertilizer recently become expensive and scare in Nigeria. The major company that has the mandate in fertilizer manufacturing and distribution NAFCON (National Fertilizer Company of Nigeria) has been dormant for so many years; still every individual in Nigeria requires food in their table. In order to maintain progress in their food production, it therefore becomes necessary to carry out studies on alternative methods of soil amendment that will improve food production in Nigeria with locally available inputs in sustainable manner. The unavailability and cost implication of inorganic fertilizer led to intensification of research into cost effective, locally sourced, cheap, affordable and adoptable organic materials that could serve as a liming material and fertilizer. Akata (2015) and Akata *et al* (2016) studied effect of liming materials such as plant derived ash and saw dust on cucumber and cassava yields, the materials were found to increase soil pH and crop yield. Akata, 2016; Akinmutimi and Agwu, 2014; Ikeh *el al* 2016 has reported significant improvement in soil chemical properties and crop yields with application of organic ash derivatives. Ikeh et al (2016) reported increase in soil pH with application of crop residue ashes. Akata, 2016 reported significant increase in cassava storage root yield with application of oil palm empty fruit bunch. Effiong *et al* (2009) concluded that wood ash is an effective fertilizer and liming material for improving soil fertility. Ikeh et al (2013) reported that combined application of oil palm bunch ash and poultry manure at 2.5 t/h rate each resulted to high tuber yield in water yam, and while sole application of OBRA had no yam beetle attack. Ikeh et al (2016) reported significant response of maize to cocoa, plantain/banana peels and saw dust ash. However, the potential of OBRA as a liming and fertilizing material has not been adequately investigated in some crops such as egusi melon. Also the actual level required for egusi-melon has not been investigated. Therefore the objective of this study effect of oil palm bunch refuse ash(OBRA) on the soil, weed dynamic and yield productivity of egusi- melon in acid coastal plain soil of Uyo southeastern Nigeria.

Materials and Methods

The study was conducted during the 2011 and 2012 first farming season at the National Cereals Research Institute (NCRI). This study was conducted at National Cereals Research Institute (NCRI) out station located at Owot Uta, Ibesikpo/Asutan Local Government Area of Akwa Ibom State during 2011 and 2012 early planting seasons. Owot Uta is situated between latitudes $04^{0}30^{0}$, $5^{0}270$N, longitude $07^{0}50^{0}$E, and $80^{0}20^{0}$ with altitude of 80m above sea level (UCCDA, 1988). The area, which lies within the humid tropical rainforest zone of southeastern Nigeria, has an annual mean rainfall of 2500 mm and monthly sunshine of 3.14 hours and the mean annual temperature of 20^{o}C. Owot Uta has mean annual relative humidity of 70 % and evaporation rate of 2.6 cm^{2} (Peters et al, 1989). The rainfall of Owot Uta is bimodal. Rainfall usually starts in March and ends in November with a short period of relative moisture stress in August, traditionally referred to as "*August Break*" (Peters *et al*, 1989). The temperature of the area is generally high in the months of February through April ((Peters *et al*, 1989).The soil is an *ultisol* with well drained coastal plain sands of Benin formation.

A randomized complete block design was used and the treatment consisted of different six levels of oil palm bunch refuse ash (OBRA), 1, 2, 3,4,5, and 6 t/ha with two controls (check) of no soil amendment and the recommended rate of 200kg/ha of NPK fertilizer (15:15:15) (Udoh *et al*,2005). The eight treatments were randomly assigned to the plot within a block. Treatments were replicated four (4) times; each replicate measured 66m x 6m while a plot size was 6m x 6m with 8 plots per replicate, giving total 32 plots. The inter-block and plot spacing was 2m respectively. The entire plots were constructed into 6m ridges. During ridge preparation, OBRA was incorporated in the soil on treatment basis. Egusi melon seeds obtained from National Horticultural Research Institute (NIHORT) Okigwe Sub-Station was plant on the crest of the ridges (3 seeds per stand) at spacing of 1m x 1m in second week of March in 2011 and 2012 early planting season. The seedlings were later thinned to 2 seeding per stand 2 weeks after planting. Inorganic fertilizer (200kg/ha NPK) was applied on treatment basis at 3 WAP. Manual hoe weeding was done at 3 weeks after planting (WAP) while hand pulling of weeds was done 6 and 9 WAP. Incidence of insect pests and diseases were minimal in 2011 and 2012, hence no control was applied. Weed density and biomass were determined with aid 1m x 1m qudrat. Number of weeds per m^2 were counted and recorded. All the weeds appeared in each qudrat were uprooted, enveloped and dried in an oven at constant temperature of 80^0C. The weights after oven dry were recorded as dry biomass. Seven (7) plants were randomly tagged per plot within net plots for determination of vine length, number of leaves per plant, leaf area, number of branches per plant, length and circumference of pods, total pod yield and seed yield (kg/ha). Data collected were subjected to analysis of variance procedure and treatment means that showed significant significant difference were compared using least significant difference (LSD) at 5% probability level.

RESULTS

Results soil physico-chemical properties of the experimental site before planting and oil palm refuse bunch refuse ash (OBRA) are shown in Table 1. The soils were slightly acidic. The percentage organic matter content of the soil were; 2.10 and 2.20 in 2011 and 2012 respectively. The total Nitrogen (%) content were; 0.25 and 0.27, available P. 38.75 and 45.81 mg/kg, K, 0.18 and 0.20 coml/kg, Ca, 0.33 and 0.29 coml/kg as well as Mg 0.11 and 0.14 coml/kg in 2011 and 2012 cropping seasons, respectively. The oil palm refuse bunch ash (OBRA) had soil pH value of 8.80 and 8.70 in 2011 and 2012, respectively, with organic manure content (%) of 1.65 and 1.70, the K and Ca concentration were (31.9 and 8.41 coml/kg) and (32.5 and 9.30 coml/kg) in 2012 and 2013, respectively.

Table 2 shows the chemical properties of the after at harvest in 2011 and 2012 cropping seasons. The result shows increase in soil pH and all the chemical properties with increase in OBRA treatments. The controls (no soil amendment) and NPK application treatment plots were slight acidic. The result showed significant difference ($P<0.05$) in organic matter, total nitrogen, available P, K, Ca and Mg content. Treatment of 6 t/ha OBRA had the highest mean values of all the soil nutrients tested for but showed no significant difference when compared with values obtained from 4 and 5 t/h ash treatments. At harvest, 6t/ha OBRA had (3.50 and 3.55 %) organic matter content in both cropping seasons (Table 2). Treatment that received NPK had (2.08 and 2.01 %) organic matter content at harvest. Control treatment (no soil application) had the least organic matter content (1.18 and 1.16 %) in 2011 and 2012 cropping seasons, respectively. Comparing the total nitrogen content, the total N that ranged between (0.17 and 0.18 %) in no soil amendment and (0.38 and 0.37 %) in 6t/ha OBRA in 2011 and 2012 cropping seasons, respectively. Available P ranged between (10.31 and 9.15 mg/kg) in control and (49.78 and 58.11 mg/kg) in 6 t/ha OBRA in both cropping seasons (Table 2). In all the exchangeable bases (Ca, Mg and K), the results indicated increase in OBRA with significant increase in exchangeable base, although no significant difference was recorded from 3t/ha to 6t/ha in both cropping seasons (Table 2).

Weed Density and Biomass

Weed density in egusi melon field as influenced by OBRA level indicated significant difference in both cropping seasons (Table 3). Result showed that the treatments OBRA and NPK had the least weed density per m^2. Control treatment (no soil amendment) had significant higher weed density (28.45, 33.56 and 78.59 per m^2 at 3, 6 and 9 WAP) in 2011 and (39.45, 50.55 and 103.70 per m^2 at 3, 6 and 9 WAP) in 2012. The least weed density per m^2 (10.40, 5.92 and 11.30 per m^2 at 3, 6 and 9 WAP) in 2011 and (5.23, 1.55 and 8.64 per m^2 at 3, 6 and 9 WAP) in 2012 was recorded in the treatment that received 6t/ha OBRA.

Results of weed biomass also indicated significant difference (Table 4). Increase in application of OBRA resulted to decrease in dry weed biomass. Control (no soil amendment) treatment had significant higher dry weed biomass (30.69, 59.45 and 99.67 g/m^2 at 3, 6 and 9 WAP) in 2011 and (44.81, 89.74 and 122.45 g/m^2 at 3, 6 and 9 WAP) in 2012. Treatment of 6t/ha OBRA had the least dry weed biomass (6.33, 2.06 and3.45 g/m^2 at 3, 6 and 9 WAP) in 2011and (8.47, 2.55 and2.89 g/m^2 at 3, 6 and 9 WAP) in 2012

Number of leaves per plant

Number of egusi-melon leaves per plant as influenced by oil palm burnt refuse ash (OBRA) level varied significantly ($P<0.05$) at 3, 6 and 9 WAP in both cropping seasons(Table 5). The result showed significant increase in number of leaves per plant with increase in OBRA level (Table 5). The application of OBRA at 6 t/ha had significant higher number of leaves per plant (15.74, 29.30 and 34.78) and (15.40, 28.60 and 35.15) at 3, 6, and 9 WAP in 2011 and 2012, respectively. The number of leaves per plant recorded in 6t/ha treatment of OBRA showed no significantly difference when compared to number of leaves per plant recorded in 4 and 5 t/ha ash levels in both cropping seasons. The control (no fertilizer application) had least number of leaves per plant in both cropping seasons. At 6 and 9 WAP, the application of 6 t/ha OBRA produced 9-64 and 3-64 % higher number of leaves per plant compared to the other treatments in 2011, and 8-63 and 1-60% higher number of leaves per plant in 2012 when compared to other treatments.

Egusi melon vine length (cm)

The egusi-melon vine length as affected by application of OBRA level differed significantly in both cropping seasons (Table 6). The result maintain the same similar pattern as in number of leaves per plant where application of 6t/ha OBRA produced significant higher number of leaves per plant. The vine length recorded in 6 t/ha OBRA treatment was (73.60, 165.70 and 213.25 cm) in 2011 and (74.12, 170.14 and 221.70 cm) in 2012 at 3, 6 arid 9 WAP, respectively. The shortest vine (25.30, 97.30, 120.18 cm) in 2011 and (23.60, 86.30 and 112.33 cm) in 2012 at 3, 6 and 9 WAS, respectively, was recorded in zero application of manure (control treatment).

Egusi melon leaf area (cm^2)

The leaf area egusi- melon as influenced by OBRA levels varied significantly ($P<0.05$) in both cropping seasons (Table 7). The treatment that received 6 t/ha OBRA produced largest; 132.44, 179.60 and 186.51 cm^2 at 3, 6 and 9 WAP, respectively in 2011. It also had significant larger leaf area; 137.95, 178.06 and 181.92 cm^2, respectively in 2012. The least leaf area (90.33, 98.66 and 101.33 cm^2 in 2011) and (82.51, 99.11 and 112.36 cm^2 in 2012) was recorded in control treatment (no soil amendment). The treatment that received 6 t/ha OBRA had 1-33, 1-45 and 1-47 % larger leaf area compared to the other treatments at 3, 6 and 9 WAP, respectively in

2011 while the following corresponding leaf area percentage difference of 1-40, 3-44, and 0-38% was recorded in 2012.

Number of Egusi melon branches per Plant

The number of melon branches per plant as influenced by application of oil palm burnt refuse ash (OBRA) showed significant difference in both cropping seasons (Table 8). The result showed that increase in OBRA resulted to significant increase in number of branches per plant. At 9 WAP, the application of 5 and 6 t/ha OBRA produced 1-68% and 1-60% more number of branches per plant than other treatments in 2011 and 2012, respectively.

Number of Egusi Melon pods per plant

Number of egusi melon pod per plant as influenced by OBRA level showed significant difference ($P<0.05$) in both cropping seasons (Table 9). Number of pods per plant ranged between (2.11 and 2.61) in control (no soil amendment) and (6.40 and 6.80) in 6 t/ha in both cropping seasons. Treatment of 6 t/ha OBRA had 67 and 62 % more number of pods per plant than control(no soil amendment) and with only 23 and 29 % more number of pods than treatment of NPK in 2011 and 2012 cropping seasons, respectively.

Egusi-melon Pod Circumference and Length (cm)

The circumference of egusi-melon pod (cm) as influenced by OBRA levels differed significantly ($P<0.05$) when compared to control treatment (no soil amendment) in both cropping seasons (Table 9). The largest pod circumference; 38.03 and 38.16 cm in 2011 and 2012 cropping seasons, respectively was recorded in treatment of 6 t/ha OBRA level. The least pod circumference (20.31 and 21.00 cm) was recorded in control (no soil amendment). Length of egusi –melon pod showed no significant difference ($P<0.05$) among the treatments (Table 9). Pod length ranged between (17.36 and 18.76 cm) in control (no soil amendment) and (20.08 and 21.93 cm) in treatment that received 6 t/ha OBRA level in both cropping seasons.

Egusi-melon pod yield (t/ha)

The egusi-melon pod yield as influenced by OBRA dose varied significantly ($P<0.05$) in 2011 and 2012 (Table 9). Application of OBRA promote increase in number of pods per plant (Table 9). The result showed no significant pod yield from 2 t/ha OBRA level to 6 t/ha OBRA level in both 2011 and 2012 cropping seasons. The application of 4t/ha of OBRA produced (14.40t/ha pod yield in 2011, and 17.30 t/ha pod yield in 2012. Treatment of 6 t/ha OBRA produced significant 16.80 and 19.09 t/ha pod yield in both years. The least pod yield; 8.36 t/ha in 2011 and 8.51t/ha in 2012 was recorded in control treatment.

Egusi-melon seed yield (kg/ha)

In terms of seed yield, the application of 6 t/ha OBRA produced significant dry seed yield; 243.40 and 253.10 Kg/ha in 2011 and 2012 cropping seasons, respectively. This was followed by 239.50 and 241.01 Kg/ha recorded in the treatment of 5 t/ha OBRA level in 2011 and 2012 cropping seasons, respectively. The result of dry seed yield further indicated no significant difference ($P<0.05$) between the seed yield obtained from 5 and 6 t/ha OBRA in both cropping years. The least dry seed yield (125.33 and 128.11 Kg/ha) was obtained from control (no soil amendment) in 2011 and 2012 respectively. The dry seed yield recorded in treatment of 200kg/ha NPK-15:15:15 (inorganic fertilizer recommended rate) was 193.60 and 201.75 kg/ha in 2011 and 2012, respectively. The application of 6 t/ha OBRA level out-yielded other treatments with percentage difference of 2-49 and 5-49 % in 2011 and 2012, respectively.

DISCUSSION

The result of soil physic-chemical properties of the experimental site before planting showed that the soil was low in organic matter content, total nitrogen, low soil pH while the available P was adequate based on recommendation of Ibia and Udo (2009).This result was as expected, *ultisols* of southeastern Nigeria were reported to be low in pH, organic matter and exchangeable bases (Udoh etal, 20016). The low weed density and dry biomass observed in the treatment that received OBRA levels compared to zero application could be that OBRA supplied the nutrient requirements to egusi-melon which enables those treatment to be high vegetative, therefore enable them to suppressed weed growth and also reducing sunlight penetration in the soil which invariably might have reduced the temperature requirement for weed seed germination. This observation was also reported by Akata et al(2016) that increase in level of OBRA resulted to decrease in weed density, biomass and weed flora count in cassava grew in rainforest zone of southeastern Nigeria. Also lower weed density and biomass recorded in the treatment of higher dose of OBRA could be that the vigorous vegetative growth recorded in those treatment were able to smoother weed growth.

The results of the study revealed that OBRA have the affinity of improvement of soil fertility of acid coastal plain soil by improving it soil fertility and pH. The significant effects of oil palm bunch refuse ash had on the soil chemical properties could be attributed to low soil fertility status of the experimental site before planting. Akata (2015); Akata *et al* (2016) and Ikeh *et al* (2016) noted that crop response to fertilizer application is affected by nutrient status in the soil. If the soil fertility is low, response to fertilizer application will be high. The result showed that application of OBRA improved soil chemical content of the experimental site. This observation was in line with report of Ilodibia *et al* (2017) who reported observed that addition of manure increases soil water holding capacity and this means that nutrient would be made available to egusi melon where ash were applied. Leila *et al*. 2021), reported that soil amended with ash improved maize vegetative growth, yield and yield components. Result showed no significant increase in growth and yield of egusi-melon from 4t/ha to 6 t/ha ash rate. This could be attributed to the mineral composition of the OBRA, it has high concentrations of important elements but virtually no nitrogen which could have stimulate luxuriant growth when excess rate is being applied. The result revealed that nutrient concentration at 4t/ha ash rate were at optimum level for egusi-melon growth and yield. The application of organic manure such as OBRA which contains appreciable quantities of magnesium, calcium, magnesium and potassium might have helped in chlorophyll synthesis which in turn increased the rate of photosynthesis and translocate into sink source (seed yield). The increase in soil pH and exchangeable bases could be that OBRA served as liming material. This observation agrees with report of Udoh and Ndon (2016) that oil palm bunch waste have been useful in liming to increase soil pH. In this study, OBRA treatments enhanced vegetative growth and yield of egusi-melon, this could that OBRA served dual role by supplying soil nutrients and increases soil pH. Egusi-melon according to Udoh and Ndon (2016) tolerate well drained soil with high soil pH level (alkaline soil). In this study, the experimental soil was slightly acidic, therefore application of OBRA was judicious soil conservation method to improve the soil pH. The lower growth and yield parameters obtained from the treatments with lower soil pH proved that egusi-melon perform best in soil of higher soil pH. According Polomiski (2007), soil pH has great influence on the solubility of soil minerals and their availability of 13 out of 18 plant essential nutrients. Udoh and Ndon (2016) and Ikeh *et al* (2017) reported that an understanding of soil pH effects on plant growth is very important as both crops and soil microorganisms are strongly subject to its influence. Considering the significance of lowering soil pH in egusi-melon cultivation, Ikeh (2004), Ikeh (2010) and Ikeh *et al* (2017) reported that abundance of nutrients, plus other favourable soil conditions, will of course, moderate the negative impacts of unsuitable pH regarding nutrient availability and plant uptake.

The results showed variations in the vegetative traits, yield and yield components of egusi melon under different levels of OBRA. The increase could be as a result high concentration of micro and some macro nutrients in OBRA. Increased in number of fruits per plant and yield could also be attributed to improvement in physical and biological properties of soil. Akata *et al* (2016), reported significant increase in growth and yield of pepper when treatments of OBRA were compared to control (no soil amendment). The significant increase in growth and yield of egusi melon could be that OBRA application improved both physical and chemical properties of the soil which invariably enhanced growth and yield of egusi-melon. This agrees with the report of Leila *et al*. (2021), that wood ash application may strongly influence the soil texture, aeration, and water holding capacity, consequently having an impact on root growth dynamics leading to a range of possible effects on plant growth and yield performance.

The results were also in line with that of Ikeh *et al* (2017) who reported that application of organic fertilizer improved soil fertility and served as better soil conservation method in an *ultisol* of southeastern Nigeria. The high vegetative traits observed in the treatment that received OBRA could be due to ability of OBRA to improved soil pH of the experimental site from acidic to Alkaline as it was reported by Okokon and Ndaeyo (2013) that egusi-melon thrive best in sandy loam with soil pH of 6-7 and above. Also OBRA levels served as liming material which could have increase the pH of the soil (reducing the soil acidity), hence the acidity of the soil of the experimental site which might have caused the unavailability of nutrient elements to the crop was checked by the liming potential of OBRA. Obi and Ekperigim (2006);Etokeren *et al*. (2021) had confirmed that ash derived from plant sources were effective as liming materials and source of nutrients for different crops. The increase in both growth and yield of egusi-melon in this study could also be attributed to enhanced microbial activities in the plots that received OBRA, also supplying the limiting and lacking nutrients, production of organic matter and attendant increase in available N, P, K, Ca, Mg and other beneficial micro-nutrients.

Conclusion

The result of the study revealed that OBRA which is abundant in many communities in southeastern Nigeria could be the cheap alternative way of increasing egusi-melon production in a sustainable manner. Its application improve soil chemical properties and also enhanced significant seed yield. Application of OBRA could guarantee high egusi-melon yield in acid coast plain soils of southeastern Nigeria. Egusi-melon farmers should adopt 4t/ha OBRA since further increase in OBRA rate did not significantly increase egusi-melon seed yield.

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Table 1: Soil chemical properties of the experimental before Planting and OBRA Nutrient composition in 2011 and 2012

Soil Chemical Properties of the Experimental Site before Planting

2011							
Years	P^H	OM%	N%	P (mg/kg)	K	Ca	Mg
2011	5.10	2.10	0.25	38.75	0.18	0.39	0.11
2012	5.20	2.20	0.27	45.81	0.20	0.29	0.14
OBRA							
2012							
Years	P^H	OM%	N%	P (mg/kg)	K	Ca	Mg
2011	8.70	1.65	0.13	0.12	31.9	8.41	4.10
2012	8.70	1.70	0.18	0.14	32.5	9.30	4.21

Table 2: Effect of OBRA on Post Soil Chemical Properties in 2011 and 2012

Treatment	20 11						
	Soil pH	**OM%**	**N%**	**P(**(mg/k)	**K**	**Ca**	**Mg**
0t/ha Ash	5.10	1.18	0.17	10.31	0.07	0.12	0.07
1t/ha Ash	5.90	2.33	0.20	30.81	0.20	0.29	0.15
2 t/ha Ash	6.10	2.40	0.23	33.60	0.25	0.32	0.18
3 t/ha Ash	6.80	2.70	0.27	42.25	0.28	0.36	0.21
4 t/ha Ash	7.30	2.95	0.34	44.11	0.39	0.43	0.29
5 t/ha Ash	7.40	3.11	0.36	48.10	0.39	0.51	0.32
6 t/ha Ash	7.80	3.50	0.39	49.78	0.42	0.55	0.35
200kg/ha NPK	5.00	2.08	0.38	22.17	0.17	0.15	0.08
LSD(p<0.05)	**0.59**	**0.86**	**0.13**	**3.14**	**0.18**	**0.08**	**0.10**
2012							

0t/ha Ash	5.10	1.16	0.18	9.15	0.13	0.20	0.06
1t/ha Ash	5.80	2.34	0.22	30.45	0.23	0.25	0.18
2 t/ha Ash	6.00	2.42	0.24	42.51	0.27	0.28	0.21
3 t/ha Ash	6.20	2.75	0.38	48.60	0.31	0.33	0.23
4 t/ha Ash	7.20	2.90	0.40	50.31	0.34	0.40	0.36
5 t/ha Ash	7.80	3.55	0.38	58.11	0.45	0.58	0.38
6 t/ha Ash	7.90	3.55	0.38	58.11	0.45	0.58	0.38
200kg/ha NPK	4.90	2.01	0.37	15.70	0.14	0.30	0.09
LDS(p<0.05)	**0.46**	**0.81**	**0.16**	**4.22**	**0.16**	**0.11**	**0.11**

Table 3: Weed Density in Egusi- Melon Field as influenced by OBRA Levels

Treatment	**2011**			**2012**		
	Weeks after Planting			**Weeks after Planting**		
	3	**6**	**9**	**3**	**6**	**9**
0t/ha Ash	28.45	33.56	78.59	39.45	50.55	103.70
1t/ha Ash	20.75	19.59	23.40	23.77	15.14	38.45
2 t/ha Ash	16.20	10.42	18.40	10.20	13.73	23.40
3 t/ha Ash	15.70	8.75	14.77	8.70	11.69	18.26
4 t/ha Ash	11.40	8.25	13.33	8.11	8.11	9.45
5 t/ha Ash	10.92	6.20	11.48	5.26	2.33	9.20
6 t/ha Ash	10.40	5.92	11.30	5.32	1.55	8.64
200kg/ha NPK	10.46	8.75	13.43	6.20	7.84	11.55

LDS(p<0.05)	**3.55**	**4.33**	**5.19**	**3.48**	**6.32**	**7.74**

Table 4: Weed Dry Biomass (g/m^2) in Egusi- Melon Field as influenced by OBRA Levels

Treatment	**2011**			**2012**		
	Weeks after Planting			**Weeks after Planting**		
	3	**6**	**9**	**3**	**6**	**9**
0t/ha Ash	30.69	59.45	99.67	44.81	89.74	122.45
1t/ha Ash	22.40	13.66	25.06	30.30	24.12	40.43
2 t/ha Ash	11.73	6.75	9.43	21.39	13.40	18.77
3 t/ha Ash	11.70	3.44	5.77	15.40	6.75	12.46
4 t/ha Ash	6.88	2.51	5.45	10.31	3.11	9.89
5 t/ha Ash	6.51	2.22	5.33	9.76	3.06	8.47
6 t/ha Ash	6.33	2.06	3.45	8.47	2.55	2.89
200kg/ha NPK	8.45	6.40	9.09	11.88	6.69	9.78
LDS(p<0.05)	3.10	3.77	5.18	3.06	4.18	7.01

Table 5: **Number of Egusi - Melon Leaves per Plant as Influenced by OBRA Level in 2011 and 2012.**

Treatment	**2011**	**2012**
	Weeks after Planting	**Weeks after Planting**

	3	**6**	**9**	**3**	**6**	**9**
0t/ha Ash	4.37	9.81	12.60	3.31	10.60	14.16
1t/ha Ash	8.60	11.30	21.30	7.53	13.70	25.10
2 t/ha Ash	9.34	18.40	25.11	11.00	18.25	30.30
3 t/ha Ash	12.50	20.70	29.08	13.40	21.42	32.18
4 t/ha Ash	15.41	25.12	33.60	13.75	26.12	34.40
5 t/ha Ash	15.60	26.70	33.81	14.40	26.35	35.06
6 t/ha Ash	15.74	29.30	34.78	15.40	28.60	35.15
200kg/ha NPK	10.43	21.30	31.30	10.42	22.15	31.80
LDS(p<0.05)	**2.65**	**3.21**	**3.34**	**2.33**	**3.47**	**3.55**

Table 6: Melon Vine Length (cm) of Egusi-Melon as Influenced by OBRA Rates in 2011 and 2012

Treatment	**2011**	**2012**
	Weeks after Planting	**Weeks after Planting**

	3	6	9	3	6	9
0t/h Ash	25.30	97.30	120.18	23.60	86.30	112.33
1t/ha Ash	36.10	103.70	122.30	39.20	114.30	136.80
2 t/ha Ash	43.15	143.30	169.40	41.18	141.60	156.30
3 t/ha Ash	55.70	153.12	180.30	59.70	143.12	178.60
4 t/ha Ash	69.80	162.18	103.11	70.16	158.80	199.30
5 t/ha Ash	71.11	164.20	211.20	71.25	166.11	211.60
6 t/ha Ash	73.60	165.70	218.25	74.12	170.14	221.70
200kg/ha NPK	59.25	161.16	209.20	61.80	154.41	173.60
LDS(p<0.05)	**3.63**	**5.14**	**7.06**	**3.22**	**5.27**	**6.99**

Table 7: Melon Leaf Area (cm^2) of Egusi-Melon as Influence by OBRA in 2011 and 2012

Treatment	**2011**			**2012**		
	Weeks after Planting			**Weeks after Planting**		
	3	**6**	**9**	**3**	**6**	**9**
1t/ha Ash	90.33	98.66	101.33	82.51	99.11	112.36
2 t/ha Ash	120.61	143.06	158.11	116.31	131.60	142.40
3 t/ha Ash	121.66	154.47	167.81	119.35	133.71	153.63
4 t/ha Ash	126.73	163.33	169.40	127.61	164.31	169.45
5 t/ha Ash	131.77	176.41	174.11	135.44	169.81	178.40
6 t/ha Ash	132.44	179.60	186.51	137.95	178.06	181.92
200kg/ha NPK	131.83	177.51	174.91	137.33	173.40	181.71
LDS(p<0.05)	**2.40**	**4.36**	**5.33**	**2.52**	**3.77**	**4.81**

Table 8: Numbers of Egusi -Melon Branches per Vines as Influenced by Oil Palm Refuse Ash in 2011 and 2012

	2011	**2012**

Treatment	Weeks after Planting			Weeks after Planting		
	3	**6**	**9**	**3**	**6**	**9**
0t/ha Ash	1.11	2.33	4.31	2.10	2.38	5.60
1t/ha Ash	2.33	4.51	8.75	2.52	4.75	7.80
2 t/ha Ash	2.41	4.61	8.93	3.01	6.30	9.51
3 t/ha Ash	2.40	6.71	11.30	3.14	6.89	10.30
4 t/ha Ash	2.43	6.82	12.51	3.52	7.08	13.42
5 t/ha Ash	2.44	7.30	13.41	3.52	8.11	13.75
6 t/ha Ash	2.44	7.33	13.50	3.58	8.25	14.09
200kg/ha NPK	2.11	4.35	8.30	2.20	4.65	8.35
LDS(p<0.05)	**ns**	**2.01**	**2.23**	**ns**	**2.20**	**2.31**

***ns=** No Significant Difference

Table 9: **Yield and Yield Components of Egusi -Melon as Influenced by Oil Palm Burnt Refuse Ash in 2011 and 2012**

Treatment	Number of Pods per Plant	Circumference of Pod (cm)	Length of Pod (cm)	Pod yield (tha^{-1})	Seed yield (kg/ha)
	2011				
0t/ha Ash	2.11	20.31	17.36	8.36	125.33
1t/ha Ash	4.6	32.40	18.60	10.45	175.61
2 t/ha Ash	5.02	33.45	19.51	14.40	192.45
3 t/ha Ash	5.35	35.40	19.60	14.40	203.40
4 t/ha Ash	6.33	35.75	19.75	16.71	237.12
5 t/ha Ash	6.33	37.40	20.01	16.73	239.50
6 t/ha Ash	6.40	38.03	20.08	16.80	242.40
200kg/ha NPK	4.95	33.15	19.55	13.51	193.60
LDS(p<0.05)	**1.33**	**3.05**	**Ns**	**2.87**	**7.15**
	2012				
0t/ha Ash	2.61	21.00	18.71	8.51	128.11
1t/ha Ash	4.53	34.11	18.92	11.25	181.60
2 t/ha Ash	5.18	36.81	20.11	14.30	201.31
3 t/ha Ash	5.25	37.70	20.61	17.35	211.60
4 t/ha Ash	6.41	38.08	21.80	17.41	249.91
5 t/ha Ash	6.70	38.12	21.91	17.80	251.01
6 t/ha Ash	6.80	38.16	21.93	19.09	253.10
200kg/ha NPK	4.81	36.09	19.63	13.99	201.75
LDS(p<0.05)	**1.45**	**2.55**	**Ns**	**2.36**	**8.75**

***ns=** No Significant Difference