INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 22, No. 4, p. 136-144, 2023
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Potentials of different sources of plant residue ash on chemical properties of an Alfisol, in South-southern, Nigeria

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Article published on April 19, 2023

Key words: Residue ash, Chemical properties, Myrianthus leave, Plantain peels, Sand paper leave, Empty palm bunch

Abstract

This tryout was conducted at the Delta State University Farm complex, Asaba, Southsouth agro-ecological zone, Nigeria. Objective of the research was focused on the potentials of different sources of plant residue ash on chemical properties for three successive years. This research was mapped out in a Randomized Completely Block Design (RCBD) with five treatment, T_0 (Control), T_1 (Ashes of plantain peels), T_2 (Ashes of sand paper leaves), T_3 (Ashes of empty palm bunch) and T_4 (Ashes of myrianthus leaves) multiplied in three replicates. Total nitrogen, available phosphorus, pH, organic carbon, organic matter, calcium, magnesium, potassium, sodium, exch. acidity, effective cation exchange. capacity and base saturation were chemical properties studied. *In all the cropping years, results showed that soils with ash of sand paper leaves* (T_2) gave the best data determined but was highest in the 3rd cropping year with the following records: 6.8, 20.2 mgkg^{-1}, 1.88 gkg^{-1} and 18.2 gkg^{-1}, for soil pH, avail. phosphorus, total nitrogen and organic carbon. Recorded values of exch. cations were 7.70, 6.9, 4.05 and 1.12 cmolkg^{-1} for calcium, magnesium, phosphorus and sodium (Y3). Observed records for exch. acidity indicates that control soil rated higher than the treated soils as 1.44 compared to 1.22 noted in treatment 2 (T_2) while effective cation exch. capacity and base saturation. had both 21.3cmolk^{-1}and 94.3% (Y3). Findings of this trial, gave an approval that the use of ashes of sand paper leaves was best when applied to the soil at the rate 100 g/ha, for the increase of chemical properties.

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Introduction

The use of plant residue ashes as agricultural wastes manure for soil nutrient activation and crop development has become necessary in tropical countries. In recent times, researchers were focused on only the use of inorganic fertilizers and on the use of most common manure such as cattle manure, goat manure and poultry droppings, without understanding the chemical reactions and the content acidification of the soil. Plant residues which are origins from plant parts such as plant leaves, stems and roots are processed through combustion into ash contents and can be directly applied into the soil for several soil nutrient sustainable purposes. These plant residues, particularly plant leaves, are heaps of wastes in various farming environment with positive potentials on soil fertility. Though the use of these plant leaves ash as manure, has not received much attention for the treatments and reclamation of soils acidifications and leaching. Unlike other ash origins such as wood ash, sawdust ash, fly ash and so many other forms of ash, has gained interest in recent times. Ash produced from plant such as wood and sawdust ash can be used to counteract natural and anthropogenic acidification of forest soils, farmland and loss of nutrient resulting from plants and tree harvesting (Saarsalmi, *et al*., 2001). The neutralizing capacity of ash depends on the contents of its oxides, hydroxides and carbonates of Ca, mg, and K. Most of these residue ashes contain some readily soluble salts like Sulphate and Chlorides of K and Na. The use of residue ash of different plants, produced through combustion or burning, is predominantly promising as it contents can increase soil pH level, improve exchangeable cations of the soil and also increase phosphorus and potassium availability in the soil (Agusto, *et al.,* 2008). Nevertheless, plant residue ash can also be hazardous to the soil if not properly applied or monitored. Ash combustion or burning processes, plant origins and application rates, are dependent determinants for both negative and positive ash reactions in the soil (Nabeela, *et al.,* 2015). Ashes have also been used to produce potash which is major source of some nutrient to soil. Traditionally, an effort to obtain the real potash by leaching the ash with water has been attempted severally (Kelvin, 2002).

The extract obtained traditionally may be colored (usually brown) and may contain a lot of impurities. According to Pettigrew, (2010), Potassium (K) is the most abundant cation in plants and is associated with logical processes supporting crop growth and development. Adequate potassium (K) supply is essential for both organic and conventional crop production. Potassium is involved in many plant physiological reactions which make up the attributes to the importance of potassium in soils and in plants (Robert, 2007). Specific roles of potassium in both plants and soils include osmo-regulation, internal cation and anion balance, enzymes activation, proper water relations, photosynthetic translocation, protein synthesis, tolerance of external stress such as frost, drought, heat and high light intensity (Robert, 2007). According to Zhao, *et al.* (2001), reported that shortage of potassium will lead to reduction in photosynthetic activities, leads to lower yield, weaker stem, increased risk of damaged by drought and stress, resistance of disease is reduced, production of protein and enzymes is reduced and dry matter content, sample size, tuber number and starch content are reduced. However, the availability of K to plants has been affected by several factors including man's activities on the earth crust. More potassium is removed during harvest than is returned to soils, thereby depleting the availability of potassium needed by crops. Leaching and erosion is inevitable. So, making use of different sources of plant derived potash can help in replenishing loss of K and other chemical elements from the soil and plants it can also enlarge the production and marketability of crop and its yield. Reasons for the deploy of these plants derived potash materials as an organic amendment; can also help in preventing environmental pollution. The objective of the study is to determine the potentials of different sources of residue plant ash on chemical nutrient elements in an alfisol.

Materials and methods

This practical examination was conducted at the Delta State University Farm complex, Asaba located in Oshimili South Local Government Area of Delta State, Nigeria. It is located between latitude 6^{o} 41^{I}N longitudes 6^{O} 49^{I}E.

The area has high temperature that ranged from 28ºC-30º, mean humidity 77.2%, with mean sunshine of 4.8 bars and annual rainfall that ranged from 1,500-1847.3 mm (MOA, 2016). The area is located in the rainforest agro-ecological zone.

Readiness for plants derived potash materials

The plantain peels, sand paper leaves, myrianthus leaves and oil palm empty fruit branch after collection were sun dried for two weeks and burnt, then each of these ashes were weighed at 100 g (0.1 kg) before application.

Field Methods

Experimental site preparation

Site measuring 22 m x 15 m (330 m^2) was weeded, ploughed and harrowed for easy access of soil nutrient elements. The area was separated into 4 m by 4 m (4 m^2) plot sizes.

Experimental design

The trial was developed and configured in RCBD (Randomized Completely Block Design) with Five (5) treatments (zero experiment (T_0), T_1 = Ashes of plantain peels, T_2= Ashes of sand paper, T_3 = Ashes of *myrianthus* leave, and T_4 = Ashes of empty palm branch at a constant rate of 100 g, and treatments were reproduced into 3 times.

Soil Analysis

Soil chemical properties studied were, soil pH **(**H_2O**)**, soil total nitrogen (%), soil organic carbon (%), available phosphorus (mgkg^{-1}), exchangeable cations, (calcium – sodium) (cmolkg^{-1}), exchangeable acidity (cmolkg^{-1}) and base saturation (%).

Data Analysis

Composed data for chemical properties were investigated using a one-way Analysis of Variance (ANOVA) as stated by Steel and Torrie, (1980). Treatments means were separated using FLSD (Fisher's Least Significant Differences) and its significance was expressed at 5% probability level.

Results and discussion

Initial soil properties

Table 1, showed the figs. registered for most nutrient elements studied at the initial analysis. The soil particle size classification was sandy loam and sand gave 82.4%, silt 12.30% and clay 5.4% and it is an indication that the soil could be prone to leaching of exchangeable cations, low nutrient capacity and acidic to slightly acidic in nature. The trial report is also as reported by Anikwe, (2000). The soil pH recorded was 5.4 as slightly acidic. The reason for slightly low pH at initial sample could be as a result of large content of water that moved through the soil rapidly during rainfall. Soils of this nature can also become acidic, when basic elements held by soil colloids are replaced by hydrogen ions during leaching as also observed by Landon (1991).

According to the results of soil OC and OM (1.33 and 2.29 g/kg^{-1}) in this trial, were low in their status. Low status of these nutrients may have been under the influence of low buffering capacity and high rate of water percolation and infiltration. Also, low results of this soil type, could be attributed to climate and management of the soil. The assumption of the above trial, aligned with the findings of Enwezor *et al.* (1989). Exchangeable cations recorded Ca (3.41), mg (2.30), K(0.16) and Na (0.14) (cmo1kg^{-1}) respectively were observed as low rates. Low exchangeable cations which are also known as basic elements were reduced due to leaching through high rainfall which one of the most sensitive quality affect on tropical soils.

When the exchangeable cation of a soil is low, it therefore implies that the nutrient status of the soil is low and directly can lower the fertility of the soil. Slightly high exchangeable acidity (7.23) cmo1kg^{-1} was recorded because, as exchangeable cations were leached through the soil by rainfall, these leached nutrients were replaced by hydrogen ions thereby increasing the acid content of the soil. This statement is also in agreement with FMARD, (2012) classification of nutrient composition status. Effective cation exchange capacity of the area were low with 1.22 (cmo1kg^{-1}) and was classified to be low as illustrated by IITA (2008) classification of nutrient composition status. Values recorded (83%) for BS was slight increased. Effective cation exchange capacity and base saturation were lower than the treated plots because of lowered soil colloidal fraction which were not able maximize the rich base ions due to absence of treatments.

Table 1. Initial soil chemical properties before application of derived potash materials.

Tested Chemical Property	Values
Particle size distribution	
Sand%	82.40
Salt%	12.2
Clay%	5.4
Textural class	(Sandy loam)
Soil pH (H_2o)	5.4
Org.Cgkg^{-1}	1.33
Org. mgkg^{-1}	2.29
Total Ngkg^{-1}	0.21
Avail. Pmgkg^{-1}	11.4
Exch. bases	
Calcium cmolkg^{-1}	3.41
Magnesium cmolkg^{-1}	2.30
Potassium cmolkg^{-1}	0.16
Sodium cmolkg^{-1}	0.14
Exch. Acidity cmolkg^{-1}	1.22
ECEC cmolkg^{-1}	7.23
% BS	83

Origin: Laboratory experimentation 2020

Chemical properties of plant derived residue ash materials

Table 2 represents values of available nutrient as contained in plant derived potash materials used for this study. The study shows that soil pH, SOC, SOM, total nitrogen, (calcium, magnesium and potassium), zinc, iron copper were highest under ashes of sand papers with the following values 10.1, 12.54% 21.62%, 1.75%, (4.17, 1.452 and 2.35 cmolkg^{-1}) and (3.15, 1.30 and 16.50 mg/kg^{-1}) while sodium was highest under ashes of oil palm empty fruit bunch as 0.55 cmolkg^{-1}.

Post-harvest soil nutrient elements results (chemical elements)

Soil pH, available P, total nitrogen and organic carbon

Generally, amended treatments such as ash of plantain peels (T_1), ash of sand paper leaves (T_2), ash of myrianthus leaves (T_3) and ash of empty palm bunch (T_4) were rated higher in values of all the nutrient element studied, relative to zero exp. (T_0) and were significantly different *($P>0.05$)* to each other for post-harvest analysis in all the experimented years (Year 1, 2 and 3). Table 3, 4 and 5 represents the potentials of different sources of plants residue ash materials on soil pH, AP, TN and OM at harvest. Soil pH was tested slightly acid, with T_2 (APSL) recording the highest values of 6.5 - 6.8 while T_0 recorded lowest value of 5.5-5.6 (Y_1-Y_3). The sequence of increment shows that T_2 (ASPL)> T_1 (APP)> T_3 (AML)> T_4 (AEPB)> zero expt. (T_0) respectively. Slightly acid tested for pH under study could be as a result of high rainfall and leaching of nutrient elements.

Table 2. Chemical properties of plant derived residue ash materials.

Chemical properties Analyzed	Treatment (1) Ash of plantain peels	Treatment (2) Ash of sand papers	Treatment (3) Ash of myrianthus leaves	Treatment (4) Ash of empty palm bunch
pH	9.8	10.1	6.9	8.40
Org C	9.41	12.54	0.39	0.20
Org M	16.22	21.62	0.67	0.34
AP	9.6	12.6	3.22	5.20
N	1.33	1.75	0.77	0.84
Ca	0.681	4.17	2.18	3.77
Mg	0.266	1.452	0.817	0.683
K	1.91	2.35	2.12	2.32
Na	0.325	0.520	0.525	0.55
Zn	0.400	3.15	0.90	1.15
Fe	1.25	1.30	0.150	3.25
Cu	410	16.65	8.60	10.96

Origin: Laboratory experimentation 2020

The above inference is in reference with the findings of Onyekwere, (2008) who stated that slightly acidic soils occurs as a result of high rainfall resulting to leaching of exchangeable cations. Slight increase in soil pH in sand paper leaves ash plots, could be attributed to high neutralizing power and capacity of the sand paper leaves ash material in acid soil over other treatments. Also soil pH may have generally increased in treated plots than the control due to zero application of ash to the soil. Available P was said to be slightly low with the following records; 10.8, 14.2, 17.4, 14.9 and 13.3 mgkg^{-1} (Year 1), 9.40, 14.8, 18.2, 15.2 13.9 mgkg^{-1} (Year 2) and 10.3, 16.0, 20.2, 18.3 and 15.6 mgkg^{-1} (Year 3) respectively in zero experiment (T_0), T_1 (APP), T_2 (ASPL) , T_3 (AML) and T_4 (AEPB). Treatment of T_2 (APSL) gave best available P with the value of 20.2 mgkg^{-1}, followed by T_3 (AEPB) with 16.0 mgkg^{-1} and lowest available P was recorded zero experiment (T_0) in relation to other treated soils. The increasing arrangement stated that, T_2 (ASPL)> T_1 (APP)> T_3 (AML)> T_4 (AEPB)> zero experiment (T_0) respectively. Stated result of T_2 (ASPL) ranked higher than T_4 (AEPB) by 12.9%. Available phosphorus was slightly increased with 17.4, 18.20 and 20.20 mgkg^{-1} above the nutrient critical limit (< 15) in plots treated with sand paper ash more than other treated plots.

The reason for this, might be related to the fact that soil available P may have slightly reacted with Al and Fe to form Al_3PO_4 and $FePO_4$ that were slightly fixed in the soil thereby making P not fully readily available for soil productivity. The deduction of this proof is also in agreement with that of Gichangi, *et al.* (2007) Total nitrogen recorded was 0.10 to1.42 gkg^{-1} (Year 1), 0.12 to 1.85 gkg^{-1} (Year 2) and 0.12 to 1.88 gkg^{-1} (Year 3) starting from T_0 as lowest, to T_2 (ASPL) as highest. The least rates among the amended plots was in (T_3) ash of myrianthus leaves with TN of 0.40, 0.80 and 0.80 gkg^{-1} in year 1, 2 and 3.

Total nitrogen values of these ash materials were classified to be low according to the nutrient threshold, as stated by Landon (1991). Though, ash contains most of the 13 essential nutrients that the soil supplies for plant growth, but when it burns, it gives off nitrogen and sulfur as gasses. But calcium, potassium, magnesium and other trace elements don't volatilize; they remain with the ash. Judging from the above statement, low nitrogen registered in this trial might be as a result of nitrogen volatilization. According to Table 3, 4 and 5. Organic carbon was highest under treatment T_2 (ASPL) with 16.18, 17.23 and 18.21 gkg^{-1} while zero exp. (T_0) gave the least result of 4.29, 3.99 and 3.97 g/kg^{-1}.

The ascending order of OC was in the following direction; T_2 (ASPL)> T_1 (APP)> T_3 (AML)> T_4 (AEPB)> zero exp. (T_0) respectively. In the 1st, 2nd and 3rd year of cropping, treatment of T_2 (ASP) was better improved than zero expt. (T_0) by 58%, 62.4% and 62.24% respectively. These increases may have been caused by the combination of the former soil nutrient and the presently applied ash nutrient to the soil. Soil OC increment, could also be attributed to the reduced temperature intensity and increased clay content during the cropping seasons. In contrary, Hall (2001) explained that low organic carbon, was as result of the effect of high temperature and low clay content of the soil. According to IITA (2008) nutrient classification range, values rated for SOC of this trial, were classified to be moderately high.

Table 3. Potentials of different source of plant derived residue ash materials on soil pH, avail. P, total N and organic C at harvest in the first cropping year.

Treatments	Soil pH	Available phosphorus,	Total nitrogen	Organic carbon
zero expt. (T_0)	5.5	10.8	0.10	4.29
T_1 (APP)	6.2	14.2	1.42	14.21
T_2 (ASPL)	6.5	17.4	1.80	16.18
T_3 (AML)	5.8	14.9	0.40	12.00
T_4(AEPB)	5.6	13.3	0.80	9.22
FLSD	1.3	2.2	1.4	1.25

Zero expt. (T_0)= Control , T_1 (APP)= Ashes of plantain peels, T_2 (ASP)= Ashes of sand paper leaves, T_3 (AML)= Ashes of Myrianthus leaves, T_4 (AEPB)= Ashes of oil palm empty fruit bunch, All at the rate of 100g.

Table 4. Potentials of different sources of plant derived residue ash materials on soil pH, avail. P, total N and organic C at harvest in the second cropping year.

Treatments	Soil pH	Available phosphorus	Total nitrogen	Organic carbon
zero expt. (T_0)	5.5	9.40	0.12	3.99
T_1 (APP)	6.0	14.80	1.46	14.62
T_2 (ASPL)	6.8	18.20	1.88	17.23
T_3 (AML)	5.4	15.20	1.10	13.11
T_4(AEPB)	5.6	13.90	0.80	9.74
FLSD	1.42	2.32	1.38	2.25

Zero expt. (T_0)= Control , T_1 (APP)=Ashes of plantain peels, T_2 (ASP)= Ashes of sand papa leaves, T_3 (AML) = Ashes of Myrianthus leaves, T_4(AEPB)=Ashes of oil palm empty fruit bunch, All at the rate of 100g.

Table 5. Potentials of different sources of plant derived residue ash materials on soil pH, avail. P, total N and organic C at harvest in the third cropping year.

Treatments	Soil pH	Available phosphorus	Total nitrogen	Organic carbon
zero expt. (T_o)	5.4	10.6	0.12	3.97
T_1 (APP)	6.2	16.0	1.50	15.19
T_2 (ASPL)	6.8	20.20	1.88	18.21
T_3 (AML)	5.6	18.25	0.80	14.14
T_4(AEPB)	5.8	15.60	1.14	10.56
FLSD	1.38	2.12	1.36	1.25

Zero expt. (T_o) = Control , T_1 (APP) = Ashes of plantain peels, T_2(ASP) = Ashes of sand papa leaves, T_3 (AML) = Ashes of Myrianthus leaves, T_4(AEPB) = Ashes of oil palm empty fruit bunch, All at the rate of 100g.

Start from here

Exchangeable cations (calcium, magnesium, potassium and sodium)

Results showed for exchangeable cations (Ca, mg, K and Na) were recorded in Tables 6, 7 and 8 of the 1^{st}, 2^{nd} and 3^{rd} year of cropping with the same statistical rank(NS). Results of all the treatment indicates that T_2(ASPL) had the largest values of all the exch. cations with Ca ranging from 6.88 –7.70 cmolkg^{-1} ,mg, from 5.88-6.89 cmolkg^{-1}, K, from 3.32-4.05cmolkg^{-1}and Na, from 1.12-1.14 cmolkg^{-1} successively in all the years of cropping, while values observed in zero expt.(T_o) for Ca were 3.40-3.60 cmolkg^{-1},mg were 3.10 - 3.21 cmolkg^{-1}, K were 0.29 – 0.30 cmolkg^{-1} and Na were 0.21 – 0.22 cmolkg^{-1}. In 1 – 3 years of cropping, Ca had tremendous increase with ash of sand paper leaves application to the soil. Generally, exchangeable cations had tremendous increase above control plots because plant ash materials, was able to reduce the acid content in the soil and then build up the CEC of the soil thereby increasing the exchangeable cations of the soil in the study area. The reasons for high cations in the study area may have been attributed to reduction in leaching of basic nutrient cations down the soil profile due to application of plant ash residues and low rainfall. In line with this experiment, Odedina *et al.* (2003) found that incorporation of different types of ash materials in the soil, increased soil pH and enhanced soil calcium, magnesium, potassium and sodium in the soil but excelled in Ca content than other cations. The increase in soil pH and cation relative to control associated with plant residues ash application affirms that Obi and Ekperigin, (2001) successively used plant ash as source of lime and replenishment of exch. cations. In this trial, it was observed that the leftover cropping year (Y_3) gave the best and exceeding results of all studied soil chemical attributes.

Table 6. Potentials of different sources of plant derived residue ash materials on soil exchangeable cat. (cmolkg^{-1}) at harvest in the first cropping year.

Treatments	Calcium	Magnesium	Potassium	Sodium
zero expt. (T_o)	3.40	3.10	0.29	0.21
T_1 (APP)	6.08	5.88	3.48	0.99
T_2 (ASPL)	6.88	5.99	3.32	1.12
T_3 (AML)	5.24	5.08	2.94	0.69
T_4(AEPB)	4.17	4.09	2.12	0.48
FLSD	ns	ns	ns	ns

Zero expt. (T_o)= Control , T_1 (APP)=Ashes of plantain peels, T_2 (ASP)= Ashes of sand papa leaves, T_3 (AML) = Ashes of Myrianthus leaves, T_4 (AEPB)=Ashes of oil palm empty fruit bunch,All at the rate of 100g.

Table 7. Potentials of different sources of plant derived residue ash materials on soil exchangeable cat. (cmolkg^{-1}) at harvest in second cropping year.

Treatments	Calcium	Magnesium	Potassium	Sodium
zero expt. (T_o)	2.98	2.80	0.29	0.14
T_1 (APP)	6.50	6.00	3.60	1.08
T_2 (ASPL)	7.05	6.25	3.80	1.20
T_3 (AML)	5.95	5.66	3.05	0.90
T_4(AEPB)	4.66	4.40	2.60	0.68
FLSD	ns	ns	ns	ns

Zero expt. (T_o)= Control , T_1 (APP)=Ashes of plantain peels, T_2 (ASP)= Ashes of sand papa leaves, T_3 (AML) = Ashes of Myrianthus leaves, T_4 (AEPB)= Ashes of oil palm empty fruit bunch, All at the rate of 100g.

Table 8. Potentials of different sources of plant derived residue ash materials on soil exchangeable cations (cmolkg^{-1}) at harvest in third cropping year.

Treatment	Calcium	Magnesium	Potassium	Sodium
Zero expt. (T_o)	3.60	3.21	0.30	0.21
T_1 (APP)	6.80	6.22	3.69	0.99
T_2 (ASPL)	7.70	6.89	4.05	1.12
T_3 (AML)	5.50	5.88	3.39	0.69
T_4 (AEPB)	5.55	5.08	2.08	0.48
FLSD	ns	ns	ns	ns

Zero expt. (T_o)= Control , T_1 (APP)= Ashes of plantain peels, T_2 (ASP)= Ashes of sand papa leaves, T_3 (AML) = Ashes of Myrianthus leaves, T_4(AEPB)=Ashes of oil palm empty fruit bunch, All at the rate of 100g.

Displayed results for exchangeable acidity, ECEC and %BS in Table 9, 10 and 11, showed the same significant ranking (NS) at probability level (P>0.05). Exch. acidity in control, ranged from 1.42 - 1.44cmolkg^{-1}as highest ranking values relative to treated soils while ECEC values were from 8.42 - 8.77cmolkg^{-1} and base saturation were from 83.2 - 83.6% as smallest values observed in the zero expt. (T_o).

The trend on potentials of treatments on exch. acidity, showed that treated soils reduced exch. acidity more than the control. On the other hand, effective. cation exch. capacity and %BS, were highest in the amended soils with plant residue ash than the zero expt. (T_o) but had an overall increase with application of (T_2) ash of sand paper leaves in which ECEC values ranged from 18.57 cmolkg^{-1} in the 1st year to 19.55 cmolkg^{-1} in the 2nd year and in the 3rd year of cropping, 21.32 cmolkg^{-1} was documented.

The same trend of increase also occurred for %BS with the range of 93.2 - 94.3% (Y1-Y3). In 2nd and 3rd cropping year, treatment (T_2) ash of sand paper leaves exceeded greatly over control by 43.8% and 41.7% under ECEC and was higher than control by 7.1% and 6.01% for %BS. According to this study, the leftover year of cropping (Y3) was excellently increased more than other years of cropping due to accumulations of plant residue ash materials which has given positive impact on soil chemical attributes. Results on exch. acidity, ECEC and %BS with the application of plant residue ash in this trial shows that exch. acidity was reduced while ECEC and %BS were increased in the amended plots above the critical limit.

The increase could be as result of the increase in the soil colloidal fractions that gave rise to high rich base ions of the amended plots and also reducing the acid content of the trial area. This trial is in agreement with ash materials of rice husk dust on groundnut by Nottidge, *et al.* (2009). The trial also affirms that application of plant residue ash increased soil pH, exch. cations, ECEC and %BS while there was enormous reduction in exchangeable acidity, as also confirmed by Nottidge, *et al.* (2006)

Table 9. Potentials of different source of plant derived residue ash materials on exch. acidity (cmolkg^{-1}), effective cat. exch. capacity (cmolkg^{-1}) and percentage base saturation (%), harvest in first cropping year.

Treatments	Exch. Ac	Eff. cat. Exch. Capa.	% Base saturation.
Zero expt.(T_o)	1.42	8.42	83.0
T_1 (APP)	1.30	17.73	92.7
T_2 (ASPL)	1.26	18.57	93.2
T_3 (AML)	1.36	15. 28	91.3
T_4 (AEPB)	1.35	11.71	88.4
FLSD	ns	ns	ns

Zero expt. (T_o)= Control , T_1 (APP)= Ashes of plantain peels, T_2 (ASP)= Ashes of sand papa leaves, T_3 (AML)= Ashes of Myrianthus leaves, T_4 (AEPB)= Ashes of oil palm empty fruit bunch, all at the rate of 100 g.

Table 10. Potentials of different source of plant derived residue ash materials on exch. acidity (cmolkg^{-1}), effective cat. exch. capacity (cmolkg^{-1}) and percentage base saturation (%) harvest in second cropping year.

Treatments	Exch. Ac	Eff. cat. Exch. Capa.	% Base saturation.
Zero expt.(T_o)	1.44	7.65	81.2
T_1 (APP)	1.28	18.5	93.1
T_2 (ASPL)	1.25	19.6	93.6
T_3 (AML)	1.30	16.9	92.3
T_4 (AEPB)	1.33	13.7	92.2
FLSD	ns	ns	ns

Zero expt. (T_o)= Control , T_1 (APP)=Ashes of plantain peels, T_2 (ASP)= Ashes of sand papa leaves, T_3 (AML) = Ashes of Myrianthus leaves, T_4 (AEPB)=Ashes of oil palm empty fruit bunch, All at the rate of 100 g.

Table 11. Potentials of different source of plant derived residue ash materials on exch. acidity (cmolkg^{-1}), effective cat. exch. capacity (cmolkg^{-1}) and percentage base saturation (%).
Harvest in third cropping year.

Treatments	Exch. Ac	Eff. cat. Exch. Capa.	% Base saturation.
Zero expt.(T_o)	1.44	8.8	83.6
T_1 (APP)	1.25	19.2	93.5
T_2 (ASPL)	1.22	21.3	94.3
T_3 (AML)	1.27	18. 2	93,0
T_4 (AEPB)	1.30	15.9	91.8
FLSD	ns	ns	ns

Zero expt. (T_o)= Control , T_1 (APP)=Ashes of plantain peels, T_2 (ASP)= Ashes of sand papa leaves, T_3 (AML) = Ashes of Myrianthus leaves, T_4 (AEPB)= Ashes of oil palm empty fruit bunch, All at the rate of 100 g.

Conclusion

The study evaluated, potentials of different sources of plant derived potash such as ashes of plantain peels, ashes of sand paper leaves, ashes of myrianthus leaves and ashes of empty palm branch, all at the rate of 100g on the chemical properties of the soil in Asaba campus. Records of the study, has demonstrated that treated soils with ashes of sand paper leaves (T_2) gave almost highest for all chemical properties except for exchangeable acidity and potassium with values of 1.36 $cmolk^{-1}$ and 3.48 $cmolk^{-1}$ respectively while among amended plots, plot of ashes of empty palm branch recorded lowest. Taking cognizance of the positive release of nutrient elements by ashes of sand paper leaves (T_2), the researchers concluded that the productions of sand paper leaves should be processed in the form of ash to the awareness of the farmers.

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