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The Effect of Ash Application on Soil Properties and the Growth and Yield of Cucumber (*Cucumis sativus*) on Soils Derived from Coastal Plain Sand, Akwa Ibom State, Nigeria

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Abstract

Cucumber is a largely consumed vegetable in southern Nigeria, particularly in Akwa Ibom State. Its short growing time and affordability makes it a suitable choice for production by small scale farmers in this region. Oil palm bunch ash (OPBA) and wood ash are environmentally friendly and a cheaper alternative to inorganic lime used for neutralizing acidic soil. Determining the adequate rates of wood ash and OPBA required for liming on coastal plain sand soil will optimize cucumber production. A field experiment was conducted between March-May 2025 at the Akwa Ibom State University Teaching and Research Farm to evaluate the effects of lime application on soil properties, and on the growth and yield of cucumber. The experiment was laid out as a randomized complete block design with three replications. The treatments were wood ash, oil palm bunch ash and wood ash + palm bunch ash- all assigned at four rates (0 t/ha, 0.3 t/ha, 0.5 t/ha and 0.7 t/ha). The soils physicochemical properties before and at harvest were determined. The results showed that application of ashes significantly increased soil pH, organic matter content, phosphorus, nitrogen, calcium, and magnesium level compared with the control. Result also showed a significant fruit yield increase of 2.82 t/ha at a 0.3 t/ha rate of wood ash application while oil palm bunch ash produced the highest fruit yield (1.44 t/ha) at the rate of 0.5 t/ha application. Consequently, for cucumber production in coastal plain sand soils, the application of wood ash at 0.3 t/ha for increased fruit yield and the application of oil palm bunch ash at 0.5 t/ha for increased fruit yield may be considered. Future studies may explore multiyear and location trials on these environmentally friendly lime applications.

Keywords: Coastal plain sand, Soil properties, Wood Ash, Palm Bunch Ash, Cucumber yield

1.0 Introduction

Most soils in southern Nigeria are acidic and low in nutrient due to the nature of the parent material, also characterized by heavy leaching and weathering (Owolabi *et al.*, 2003). It

has been reported by several researchers (Umoh *et al.,* 2019; Umoh *et al,* 2015; Sunday *et al.,* 2020) that sandy soil are highly prone to leaching of essential nutrients (K and P) which leads to soil nutrient deficiency and high nutrient fixation. A high nutrient leaching soil significantly reduces the yield of maize (Umoh *et al*., 2021; Efretuei *et al*., 2024). Increased soil acidity and soil nutrient imbalance have drawn the attention of researchers to the use of agricultural waste that could serve as lime and fertilizer (Obi and Ekperigin, 2001; Ekwere *et al*., 2023), these wastes are cheap, acceptable and affordable by resource farmers. Odedina *et al.*, (2003), reported that wood, cocoa husk, sawdust and rice bran ash contain high amounts of N, P, K, Ca and Mg as macro nutrient element, which is needed by plant in a large quantity, they also observed that application of lime increased the yield of tomato and pepper. Obi and Ekperigin, (2001) studied the effects of liming materials such as wood ash, flue dust and incorporated legume, the combined effects increased maize yield. Udoh *et al.,* (2021) found that the yield of cocoyam crops increased with the applications of eggshell ash on coastal plain sand soils. Ojeniyi *et al.,* (2002) found that yield of vegetable crops and their nutrient content were improved by wood ash application in a trial conducted in south west Nigeria. Udounang *et al.,* (2023) observed higher yield of pineapple with the application rate of (4.0 t/ha) oil palm bunch ash.

Organic fertilizers have the potential to increase physical and biological storage mechanisms of soils through high organic matter content that improves soil structure, aeration, moisture holding capacity and water infiltration (Ojeniyi *et al.,* 2017; Byrne *et al*.,2021). In addition, increased organic matter content of the soil provides a source of food and energy for the beneficial soil macro and microorganisms (Ojeniyi, 2002). Cucumber (*Cucumis sativus)* is an important vegetable whose production in Nigeria is rapidly gaining popularity due to high medicinal and nutritive values, as well as being a chief ingredient in the preparation of salad and other Nigerian dishes (Udounang *et al.,* 2021). It is also consumed raw as a snack by many Nigerians, thus the demand for this fruit is high (Udoh *et al.,* 2025). In the bid to bridge the gap between the supply and demand of cucumber, many farmers have resorted to the use of fertilizers and lime to enhance soil fertility and nutrient uptake by plants, thus leading to greater yields (Ayoola and Adeniran, 2006; Udounang *et al*., 2024).

Oil palm bunch ash (OPBA) and wood ash are local lime materials, which are environmentally friendly products 40 % cheaper than inorganic fertilizer and also used commercially for neutralizing acidic soil effectively (Okon *et al.,* 2024). Its supplemented soil nutrients especially potassium and liming materials increased soil fertility, and nutrient uptake by maize (Umoh *et al*., 2021). However, the indiscriminate use of these lime by-products on farmlands without professional recommendations poses a major constraint to farmers due to risks of soil nutrient imbalance, so there is a need to ascertain the appropriate rates of lime application for different crops. Therefore, this study was carried out to assess the effect of wood ash rates and OPBA on coastal plain sand soil properties and on the growth, and yield of cucumber.

2.0 Materials and Methods

The field experiment was conducted during the early growing season (March - May) of 2025 at the Akwa Ibom State University Research Farm located in Obio Akpa campus, Akwa Ibom State. The location lies between 4.9704° N and 7.7569° E and is characterized by heavy rainfall ranging from 2500- 3000 mm, temperature ranges between 26 - 28°C and relative humidity of 75 - 80% within a year. The vegetation is rainforest, characterized by trees, shrubs and grasses. The soil samples for the study were collected at 0 - 15cm depth, air dried, sieved with a 2mm

wire mesh and used to determine the chemical and physical properties of the soil before and at harvest.

The ash used in the experiment was collected in March 2026 from Abak Timber market, where scrap wood (mahogany wood) is disposed of through burning, and also from oil mill factories. The ashes collected were stored in plastic containers, taken to the laboratory. The ash was sieved with a 2mm mesh and used to analyze some nutrient elements. The soils were also analyzed for particle size distribution using the Bouyoucos Hydrometer Method, and sodium hexametaphosphate was used as a dispersing agent. The soil pH was measured in soil to water ratio 1:2.5 using a grass electrode pH meter (Udo *et al.,* 2009). Electrical conductivity was measured with extract from 1:2.5 soil water suspensions using a conductivity bridge as described by Udo *et al*., (2009). Soil organic carbon was determined using the wet oxidation method. Nitrogen in the soil was determined using the micro Kjeldahl method as described by (Udo *et al,* 2009). Available Phosphorus in the soil was determined using the Murphy and Riley method, as described by Udo *et al.,* (2009) after extraction by Bray p 1 extractant. Exchangeable acidity was extracted with INKCL as described by (Udo *et al*., 2009). Exchangeable cations in the soil were extracted using IN NH_4OAc K and Na in the extract was measured using flame photometry while Mg and Ca were determined using spectrophotometry. Effective cation exchange capacity (ECEC) was obtain by summation of exchangeable cation and exchangeable acidity, Ca +Mg +K + Na + EA, as described by Udo *et al.,* (2009). Base Saturation (%) was calculated by the sum of total exchangeable bases X 100/ Effective Cation Exchange Capacity.

2.1 Experimental Design and Statistical Analysis

The experiment was arranged in a randomized complete block design (RCBD) with three replications, cucumber was used as the test crop in the experiment. The plant spacing was 0.75 x 0.7 m, each plot was measured 3 x 3m. The soils were treated with 4 different rates (R0= control, R1 = 0.3t/ha, R2 =0.5t/ha, R3 = 0.7t/ha each) for wood ash, oil palm bunch ash and wood ash + oil palm fruit bunch ash . Two seeds of cucumber were planted per hole and a total of six plant stands were obtained in each plot.

The following plant parameters were measured: plant height was measured with a meter rule from the base of the crop (ground level) to the tip of the plant. Number of leaves was assessed by counting the fully opened leaves per plants (at 2 weeks after planting), stem girth was measured with a vernier caliper, number of fruit was determined by counting the fruit and the fruit weight was determined using an electronic weighing balance.

Data generated from the laboratory and field was subjected to a one way analysis of variance for the effect of each treatment (wood ash, oil palm bunch ash, and wood ash + oil palm bunch ash) on plant and soil parameters measured and were there were significant differences means were separated using the Fisher's Least Significant Difference.

3.0 Results and Discussion

3.1 Chemical Compositions of Wood Ash and Oil Palm Bunch Ash

The chemical composition of wood ash and oil palm bunch ash are shown in Table 3.1 The results revealed that the pH value of wood ash was 10.7 which is highly alkaline, and the pH value of oil palm bunch ash was 13.8 which also indicates alkaline in nature. The results indicated that ashes contained high essential nutrient element: calcium had the highest values

while total nitrogen was the lowest. The trend was; 58g/kg (Ca) > 30.8mg/kg (Av.P) >24.8g/kg (Mg) >24.0g/kg (K) > 14.7% (OC) > 4.12g/kg (TN). Palm bunch ash contained high essential nutrients: calcium was the highest and total nitrogen was the lowest, the trend was; 44.0g/kg (Ca) > 36.4g/kg (Av.P) > 32.8g/kg (k) > 28.2g/kg (Mg) > 18.2% (OC) > 6.13 g/kg (TN).

3.2 Effect of Soil Treatment on Physiochemical Properties before and During the Experiment

The effects of ash treatment on soil properties are presented in Table 3.2a and b. The results showed that the sand, silt, and clay fractions did not differ significantly across the treated soils, but the overall soil texture remained sandy. The pH was significantly increased in treated soils than in the control (Table 3.2b) indicating a reduced acidic condition of the treated soils. The pH ranges were in the order R0 (5.43) < R_1 (5.73) < R_2 (5.90) < R_3 (6.07). Electrical conductivity, which measured the salt level in the soils showed a non-saline condition, the treated soil significantly increased organic matter content compared with the control soils and the order was as follows: R0 3.93 < R_1 4.07 < R_2 4.27 < R_3 4.40. Available phosphorus, total nitrogen was significantly higher in treated soils than in the control, the exchangeable cation increased in the order of Ca > Mg > K > Na and was significantly higher than the control soils. The effective cation exchange capacity increased with the application of ash. Base saturation also showed a significant difference between treatment R_3 (combination of wood ash and oil palm bunch ash). R_3 had the highest percentage of base saturation (81.67) when compared with control, the trend was as follows 0.7 t/ha (81.6) < 0.3 t/ha 80.6) < 0.5 t/ha (78.6) <0 t/ha (76.0 cmol/kg). The differences observed in the nutrient level could be due to the application of lime; similar observations were obtained by the following researchers (Okon *et al.,* 2004; Udoh *et al.,* 2021) that application of limes and animal manure in acid soils significantly increased soil nutrients.

2.3 Effect of Wood Ash on the Growth and Yield of Cucumber

Effect of different rates of wood ash applications on the growth and yield of cucumber is presented in Table 3.3 there was a significant difference in rates of wood ash applications in terms of plant height, number of leaves, number of flowers, numbers of tendrils and number of fruit. Wood ash treated soils at 0.3t/ha (R1) produced the tallest plants (43.9 cm) higher numbers of leaves (38.0) and numbers of fruits decreased with increasing rates of applications of wood ash. The fruit weight significantly decreased in these order: R_1 (2.82t/ha) > R_2 (2.15t/ha)> R_3 (1.30t/ha) > R_0 (0.73t/ha). The higher vegetative growth produced in R_1 significantly improved the yield of cucumber. Similar findings were observed by Okon *et al*., (2024) who confirmed that organic waste applied in soil improved the yield of crops.

3.4 The Effect of Oil Palm Bunch Ash on the Growth and Yield of Cucumber

The effect of different rates of oil palm bunch ash application on the growth and yield of cucumber is presented in Table 3.4. The results revealed that (0.5 t/ha) application produced the highest plant height, (25.7cm), number of leaves (54.00), number of flowers (21.33), number of tendrils (10.00) and number of fruits (15.6) above all treatments. The fruit weight decreased in the order: 0.5 t/ha, (2.54t/ha) > 0.3t/ha, (1.44t/ha) > 0.7t/ha, (1.22t/ha) > control (0.61t/ha).

3.5 The Effect of Oil Palm Bunch Ash Combined with Wood Ash on the Growth and yield of Cucumber

The effect of different rates of oil palm bunch ash combined with wood ash application is presented in table 3.5. Plants treated with 0.5t/ha of this combination produced the tallest plant

(39.5cm), largest stem girth (2.49 cm), highest number of leaves (37.0cm), flowers (14.00cm), and fruits (9.33t/ha). Fruit weight decreased in this order; 2.33 (0.5 t/ha), 1.80 (0.7t/ha), 0.63(0.3t/ha,) and 0.37 (Control). Udounang *et al., (*2023) had similar yield increase of cucumber with the application of palm fruit bunch ash on coastal plan soils.

Table 3.1: Chemical composition of wood ash and palm fruit bunch

Parameter	Wood Ash	Palm fruit bunch ash	Unit
PH $_{(H20)}$	10.7	13.8	–
AV.P	30.8	36.4	(mg/kg)
K	24.0	32.8	(g/kg)
Ca	58	44.0	(g/kg)
Mg	24.8	28.2	(g/kg)
TN	4.12	6.13	(g/kg)
OC	14.7	18.2	(%)

3.6 Correlation between Soil Properties with Growth and Yield of Cucumber

The correlation between soil properties and the growth and yield parameters of cucumber are presented in Tables 3.6, 3.7, and 3.8. Plant height, stem girth, number of leaves, number of fruits, and fruit weight exhibited a negative relationship with silt, organic matter, and base saturation in soils treated solely with wood ash. This negative trend is significant as it suggests a potential 'over-liming' effect; the rapid application of wood ash alone may have induced a sharp localized increase in pH, accelerating organic matter mineralization and temporarily locking up essential micronutrients required for cucumber development on fragile coastal plain sands. Conversely, growth and yield parameters showed a strong positive correlation with organic matter, calcium (Ca), magnesium (Mg), and sodium (Na). This highlights the agronomic value of ash as a critical amendment for nutrient-deficient coastal soils, where the liberation of Ca and Mg directly supports cucumber cell-wall integrity and photosynthetic capacity.

Interestingly, when wood ash was combined with oil palm bunch ash, a strong positive relationship emerged between silt, pH, Ca, and the growth and yield parameters. This synergistic effect indicates that the dual-ash combination provided a more balanced nutrient matrix likely due to the high potassium (K) content of oil palm bunch ash buffering the calcium-heavy wood ash. This combination optimized soil pH and enhanced the soil's micro-population and structure due to silt content ultimately creating a more favorable rhizosphere environment for cucumber yield optimization.

Table 3.2 a: Initial Physicochemical Properties of the Soil in the Experimental Site

Parameters	Sand %	Silt %	Clay	Texture	pH	EC Dsm-1	OM %	Av.P (Mgkg^{-1})	TN%	Ca	Mg	K	Na	TEB	EA	ECEC	BS %
Before experiment	**87.8**	**5.5**	**6.7**	**Sand**	**4.8**	**0.5**	**3.91**	**7.83**	**0.92**	**1.77**	**1.93**	**1.65**	**0.07**	**5.42**	**1.94**	**7.36**	**74**

3.2b Post Cultivation Physicochemical Properties of the Experimental soil

	Sand	Silt	Clay	Texture	pH	EC	OM	Av.P	TN	Ca	Mg	K	Na	TEB	EA	ECEC	BS%
	←	(%)	→			dsm^{-1}	(%)	(mgkg^{-1})	(%)	←			cmolkg^{-1}		→		(%)
R_0	87.70^{d}	5.53^{b}	6.77^{c}	Sand	5.43^{d}	0.07^{b}	3.93^{c}	7.80^{d}	0.63^{d}	2.41^{d}	1.62^{d}	1.68^{c}	0.08^{c}	6.09^{d}	1.88^{a}	7.97^{c}	76.00^{d}
R_1	87.77^{c}	5.31^{d}	6.92^{a}	Sand	5.73^{c}	0.07^{b}	4.07^{c}	7.89^{c}	0.93^{c}	2.62^{a}	2.03^{c}	1.69^{c}	0.11^{b}	6.43^{c}	1.68^{c}	7.94^{d}	80.67^{b}
R_2	87.80^{b}	5.41^{c}	6.79^{b}	Sand	5.90^{b}	0.07^{b}	4.27^{b}	8.11^{b}	1.01^{b}	2.59^{c}	2.09^{a}	1.84^{a}	0.16^{a}	6.69^{a}	1.76^{b}	8.44^{a}	78.67^{c}
R_3	88.00^{a}	5.49^{a}	6.51^{d}	Sand	6.07^{a}	0.08^{a}	4.40^{a}	8.27^{a}	1.05^{a}	2.61^{b}	2.07^{b}	1.80^{b}	0.16^{a}	6.64^{b}	1.47^{d}	8.11^{b}	81.67^{a}
LSD (0.05)	**0.34**	**0.06**	**0.34**	**Sand**	**0.19**	**0.01**	**0.25**	**0.26**	**0.44**	**0.05**	**0.51**	**0.04**	**0.02**	**0.05**	**0.10**	**0.27**	**2.82**

R_0= Control, R_1= Wood ash, R_2= Oil palm bunch ash, R_3= Wood ash + oil palm bunch ash

Table 3.3 Effect of Wood ash on the Growth and yield of Cucumber

Rate of Application	Plant Height (cm	Stem Girth (cm)	Number of Leaves	Number of Flowers	Number of Tendrils	Number of Fruits	Fruit Weight (t/ha)
R_0	7.50^{d}	1.37^{d}	5.67^{d}	1.67^{d}	1.00^{d}	3.00^{d}	0.73^{c}
R_1	43.9^{a}	1.60^{c}	38.0^{a}	4.00^{b}	4.33^{a}	17.0^{a}	2.82^{a}
R_2	31.8_{b}	2.24^{b}	24.3^{b}	4.33^{a}	3.67^{b}	10.3^{b}	2.15^{b}
R_3	18.8^{c}	3.11^{a}	14.3^{c}	3.33^{c}	3.33^{c}	5.67^{c}	1.30^{b}
LSD (0.05)	**5.62**	**0.29**	**6.24**	**0.67**	**1.32**	**3.23**	**0.51**

R_0 = Control, R_1 = 0.3t/ha, R_2 = 0.5t/ha, R_3 = 0.7t/ha

Table 3.4 Effect of Palm Bunch Ash on the growth and yield of cucumber

Rate of Application	Plant Height (M)	Stem Girth (Cm)	Number of Leaves	Number of Flowers	Number of Tendrils	Number of Fruits	Fruit Weight (t/ha)
R_0	7.33^{d}	1.70^{d}	7.33^{d}	1.67^{d}	1.33^{d}	4.00^{d}	0.61^{c}
R_1	21.1^{b}	2.37^{b}	44.0^{b}	13.3^{b}	8.00^{b}	8.00^{b}	1.44^{b}
R_2	25.7^{a}	2.53^{a}	54.0^{a}	21.3^{a}	10.0^{a}	15.6^{a}	2.54^{a}
R_3	12.5^{c}	2.03^{c}	11.3^{c}	4.67^{c}	4.33^{c}	8.33^{c}	1.22^{b}
LSD (0.05)	**2.70**	**0.24**	**11.3**	**2.07**	**1.53**	**2.03**	**0.28**

R_0 = Control, R_1 = 0.3t/ha, R_2 = 0.5t/ha, R_3 = 0.7t/ha

Table 3.5 Effect of Wood Growth Ash and Palm Bunch Ash on the Growth and Yield of Cucumber

Rate of Application	Plant Height (M)	Stem Girth (Cm)	Number of Leaves	Number of Flowers	Number of Tendrils	Number of Fruits	Fruit Wt (t/ha)
R_0	5.67^{d}	1.07^{d}	7.00^{d}	2.33^{d}	1.00^{d}	3.00^{c}	0.37^{c}
R_1	8.87^{c}	1.50^{c}	11.3^{c}	7.67^{c}	8.33^{c}	6.33^{b}	0.63^{d}
R_2	39.5^{a}	2.49^{a}	37.0^{a}	14.0^{a}	15.0^{a}	9.33^{a}	2.33^{a}
R_3	16.8^{b}	2.25^{b}	14.0^{b}	10.3^{b}	9.67^{b}	7.33^{b}	1.80^{b}
LSD (0.05)	**1.18**	**0.12**	**2.83**	**1.97**	**1.10**	**1.29**	**0.42**

R_0 = Control, R_1 = 0.3t/ha, R_2 = 0.5t/ha, R_3 = 0.7t/ha

Table 3.6: Correlation between soil physiochemical properties and growth/yield parameters of cucumber treated with wood ash

	Sa	Si	Cl	pH	OM	A.P	TN	Ca	Mg	K	Na	TEB	ECEC	Bsat	PH	SG	NL	NF	NT	NFt	FW
Sa	1																				
Si	-.997	1																			
Cl	-.996	.985	1																		
pH	-1.000**	.997	.996	1																	
OM	-1.000**	.997	.996	1.000**	1																
A.P	.500	-.569	-.419	-.500	-.500	1															
TN	-1.000**	.997	.996	1.000**	1.000**	-.500	1														
Ca	-.866	.904	.817	.866	.866	-.866	.866	1													
Mg	-.500	.569	.419	.500	.500	-1.000**	.500	.866	1												
K	.500	-.427	-.577	-.500	-.500	-.500	-.500	.000	.500	1											
Na	-1.000**	.997	.996	1.000**	1.000**	-.500	1.000**	.866	.500	-.500	1										
TEB	-.982	.994	.961	.982	.982	-.655	.982	.945	.655	-.327	.982	1									
ECEC	.451	-.523	-.368	-.451	-.451	.998*	-.451	-.837	-.998*	-.548	-.451	-.611	1								
Bsat	-.500	.569	.419	.500	.500	-1.000**	.500	.866	1.000**	.500	.500	.655	-.998*	1							
PH	.856	-.896	-.806	-.856	-.856	.876	-.856	-1.000*	-.876	-.019	-.856	-.938	.847	-.876	1						
SG	-.819	.863	.763	.819	.819	-.906	.819	.996	.906	.088	.819	.913	-.882	.906	-.998*	1					
NL	.907	-.939	-.865	-.907	-.907	.818	-.907	-.996	-.818	.089	-.907	-.970	.785	-.818	.994	-.984	1				
NF	.193	-.273	-.103	-.193	-.193	.946	-.193	-.657	-.946	-.753	-.193	-.375	.963	-.946	.672	-.721	.588	1			
NT	.942	-.967	-.908	-.942	-.942	.761	-.942	-.983	-.761	.182	-.942	-.989	.723	-.761	.980	-.964	.996	.510	1		
NFt	.912	-.943	-.872	-.912	-.912	.811	-.912	-.995	-.811	.102	-.912	-.973	.777	-.811	.993	-.982	1.000**	.577	.997	1	
FW	.830	-.873	-.776	-.830	-.830	.898	-.830	-.998*	-.898	-.068	-.830	-.920	.872	-.898	.999*	-.000*	.988	.707	.969	.986	1

Note: * Correlation is significant at the 0.05 level **Correlation is significant at the 0.01 level. SG-stem girth, NL-number of leaves, NF-number of flowers, NT-number of tendrils, NFt-number of flowers, FW-fruit weight

Table 3.7 Correlation between physiochemical properties and Growth/yield parameters of cucumber treated with oil palm bunch ash

	Sa	Si	Cl	pH	OM	A.P	Ca	Mg	Na	TEB	EA	ECEC	Bsat	PH	SG	NL	NF	NT	NFt	FW
Sa	1																			
Si	-.961	1																		
Cl	.961	-1.000**	1																	
pH	.500	-.721	.721	1																
OM	.866	-.693	.693	.000	1															
A.P	-.866	.693	-.693	.000	-1.000**	1														
Ca	.866	-.693	.693	.000	1.000**	-1.000**	1													
Mg	.866	-.971	.971	.866	.500	-.500	.500	1												
Na	.000	.277	-.277	-.866	.500	-.500	.500	-.500	1											
TEB	.000	-.277	.277	.866	-.500	.500	-.500	.500	-1.000**	1										
EA	.277	-.533	.533	.971	-.240	.240	-.240	.721	-.961	.961	1									
ECEC	.300	-.553	.553	.976	-.217	.217	-.217	.737	-.954	.954	1.000*	1								
Bsat	.000	.277	-.277	-.866	.500	-.500	.500	-.500	1.000**	-1.000**	-.961	-.954	1							
PH	.237	.042	-.042	-.723	.691	-.691	.691	-.281	.972	-.972	-.868	-.856	.972	1						
SG	.182	.098	-.098	-.761	.649	-.649	.649	-.334	.983	-.983	-.894	-.883	.983	.998*	1					
NL	.203	.076	-.076	-.746	.666	-.666	.666	-.313	.979	-.979	-.884	-.873	.979	.999*	1.000*	1				
NF	.405	-.135	.135	-.590	.808	-.808	.808	-.107	.914	-.914	-.766	-.751	.914	.984	.973	.978	1			
NT	.220	.059	-.059	-.735	.678	-.678	.678	-.297	.975	-.975	-.876	-.864	.975	1.000*	.999*	1.000*	.981	1		
NFt	.647	-.410	.410	-.337	.941	-.941	.941	.179	.763	-.763	-.553	-.533	.763	.894	.868	.878	.959	.886	1	
FW	.568	-.318	.318	-.429	.903	-.903	.903	.081	.823	-.823	-.633	-.614	.823	.934	.912	.921	.982	.928	.995	1

NB:* Correlation is significant at the 0.05 level, **Correlation is significant at the 0.01 level, SG-stem girth, NL-number of leaves, NF-number of flowers, NT-number of tendrils, NFt-number of flowers, FW-fruit weight

Table 3.8 Correlation between physiochemical properties and Growth/yield parameters of cucumber treated with wood ash +OPBA

	Sa	Si	Cl	pH	EC	A.P	TN	Ca	Mg	K	Na	EA	ECEC	Bsat	PH	SG	NL	NF	NT	NFt	FW
Sa	1																				
Si	1.000**	1																			
Cl	-1.000**	-1.000**	1																		
pH	1.000**	1.000**	-1.000**	1																	
EC	.500	.500	-.500	.500	1																
A.P	.500	.500	-.500	.500	1.000**	1															
TN	-1.000**	-1.000**	1.000**	-1.000**	-.500	-.500	1														
Ca	1.000**	1.000**	-1.000**	1.000**	.500	.500	-1.000**	1													
Mg	-1.000**	-1.000**	1.000**	-1.000**	-.500	-.500	1.000**	-1.000**	1												
K	.993	.993	-.993	.993	.596	.596	-.993	.993	-.993	1											
Na	-.500	-.500	.500	-.500	-1.000**	-1.000**	.500	-.500	.500	-.596	1										
EA	.866	.866	-.866	.866	.866	.866	-.866	.866	-.866	.918	-.866	1									
ECEC	.965	.965	-.965	.965	.711	.711	-.965	.965	-.965	.988	-.711	.967	1								
Bsat	.500	.500	-.500	.500	-.500	-.500	-.500	.500	-.500	.397	.500	.000	.254	1							
PH	.996	.996	-.996	.996	.572	.572	-.996	.996	-.996	1.000*	-.572	.906	.984	.424	1						
SG	.955	.955	-.955	.955	.733	.733	-.955	.955	-.955	.983	-.733	.975	.999*	.222	.977	1					
NL	.991	.991	-.991	.991	.611	.611	-.991	.991	-.991	1.000*	-.611	.925	.991	.380	.999*	.986	1				
NF	.889	.889	-.889	.889	.841	.841	-.889	.889	-.889	.936	-.841	.999*	.979	.049	.925	.985	.943	1			
NT	.852	.852	-.852	.852	.879	.879	-.852	.852	-.852	.907	-.879	1.000*	.960	-.027	.894	.969	.914	.997*	1		
NFt	.851	.851	-.851	.851	.881	.881	-.851	.851	-.851	.905	-.881	1.000*	.959	-.030	.892	.968	.913	.997	1.000**	1	
FW	.993	.993	-.993	.993	.602	.602	-.993	.993	-.993	1.000**	-.602	.921	.990	.390	.999*	.984	1.000**	.939	.910	.908	1

NB:* Correlation is significant at the 0.05 level, **Correlation is significant at the 0.01 level, OPBA-oil palm bunch ash, SG-stem girth, NL-number of leaves, NF-number of flowers, NT-number of tendrils, NFt-number of flowers, FW-fruit weight

4.0 Conclusion and Recommendations

In conclusion, the application of both wood ash and oil palm fruit bunch ash successfully modified the chemical properties of the acidic coastal plain sand soil without altering its characteristic sandy texture. Increasing application rates of the ash amendments consistently raised soil pH, while significantly boosting essential soil nutrients including organic matter, available phosphorus, total nitrogen, exchangeable bases, and the effective cation exchange capacity (ECEC) relative to the untreated control. Regarding crop performance, wood ash proved highly effective at a lower application rate, whereas oil palm fruit bunch ash required a slightly higher optimal rate to maximize cucumber vegetative growth and fruit yield. Consequently, to ensure sustainable cucumber production and optimize nutrient availability in coastal plain sand soils, the application of wood ash at 0.3 t/ha rate application produced 2.82 t/ha yield of cucumber and oil palm fruit bunch ash at a rate 0.5 t/ha produced the highest yield (1.44 t/ha) of cucumber. These rates are recommended for cucumber production on coastal plain sand soil.

References

Agbede, O. O. (2009). Understanding of soil and plant nutrition. Salmon press. Nasarawa State 32. agriculture. Springer. pp 20.

Ayoola, O. T., & Adeniyan, O. N. (2006). Influence of poultry manure and NPK fertilizer on yield and yield components of crops under different cropping systems in south west Nigeria. *African Journal of Biotechnology*, 5(15), 1386–1392.

Byrne, K. A., Efretuei, A., Walz, K., & Clay, G. D. (2021). Characterization of elemental ratios and oxidative ratio of horticultural peat. *Soil Use and Management*, *37*(3), 640-647.

Efretuei, A. O., Udoh, L., & Ekwere, O. (2024). The Performance of seven elite maize accessions from different African origins under rain-fed conditions in South-Eastern Nigeria. FUDMA Journal of Agriculture and Agricultural Technology, 10(1), 50-60.

Ekwere, O. J., Udounang, P. I., Efretuei, A. O., & Umoh, F. O. (2023). Evaluation of rabbit urine as bio-fertilizer for the growth and yield of cowpea (*Vigna unguiculata* (l.) walp). *AKSU Journal of Agriculture and Food Sciences*, *7*(3), 37-48.

Obi, A. O. and Ekperigin, J. (2001). Effects of wastes and soil pH on growth and grain yield of crops. African Soil, 32: 3-15.

Odedina, S. A., Odedina J. N., Ajeni, S.O, and Arowojolu, S. A and Ojeniyi, S.O. (2003). Effects of types of Ash on soil fertility, Nutrient availability and yield of tomato and pepper. Nigeria Journal of Soil Science, 13: 61-67.

Ojeniyi, S. O and Adejobi, K. B. (2002). Effect of ash and goat dung mane on leaf nutrients composition growth and yield of amaranths, Nigeria Agricultural Journey 33:46-57.

Ojeniyi, S. O. Adejuwon, A. and Abdulraheen, M. I (2015). Soil physiochemical properties and cassava yields in alfisol given tillage ash treatment. Nigerian Journal of Soil Science, 25: 71-82.

Ojeniyi, S. O. Oso, O. P. and Arotolu, A. A. (2002). Response of vegetables to wood ash fertilizer. Proceedings 35th Annual Conference of Agricultural society of Nigeria, 39-43.

Ojeniyi, S. O., Oyatoye, A. and Abdulraheen, G. (2017). Use of ash for soil fertility improvement effect on cowpea. Nigeria Journal of Soil Science, 27: 216-221.

Okon, S.I., Sunday, A.E., Umoh, F. O, and Ekwere, O. J.(2024) Influence of wood ash concentration on coastal plain soils and growth and yield of tomato (solanum

lycoperisum) in a humid tropical zone of south-eastern Nigeria. Akwa Ibom state university Journal of Agriculture and food science,8 (3), 33.45

Owolabi, O., Adeleye, A., Oladejo, B. T. and Oyeniyi, S. O. (2003). Effects of wood ash on soil fertility and crop yield in south west Nigeria.

Sunday, A. E, Umoh F.O. and Udoh, S. M. (2020). Assessment of phosphorus leaching potentials on soil from diverse parent materials in Akwa Ibom State, Nigeria proceeding of the 44th conference of Soil Science Society of Nigeria. Collquia SSSN 44: 487 - 492.

Udoh, E. J, Ibia T. O, Ogunwale, A. J, Ano, A. O. and Esu, I. V. (2009). Manual of soil, plant and water anlysis. Sibon Books Ltd, Lagos, Nigeria. 56-89

Udoh, O. E, Umoh, F. O. Etukudoh, N. E., Sunday, A. E, Bassey, E. Etisha (2025). Effects of Organic Manure and NPK fertilizer application on selected soil properties, growth and yield of cucumber Ccucumis sativus L.) in Obio Akpa, Akwa Ibom State, Nigeria. Academians Journal of Biology 1(2): 68-80

Udoh, O.E, Osodeke, V. E, Iren, O.B. and Umoh, F. O. (2021). Evaluation of Eggshell as a liming material for Amending Degraded Acid Sand of South Eastern Nigeria. AKSU Journal of Agriculture and Food Science, 5(2), 1-90

Udounang P. I and Umoh F. O (2024). Performance Evaluation of cocoyam – Based intercropping systems to different rates of fertilizer in Obio Akpa, South Eastern Nigeria. AKUS Jounal of Agricutural and Food Sciences 8 (2): 52-71

Udounang P. I, Umoh, F. O, Essien, O. A (2023). Effect of applixtion of palm bunch ash on the growth and yield of Eggplant (Solanum melongena L.) in a pineapple orchard. Ameican Journal of Life Science. 11 (4): 56-61.

Udounang P.I, Umoh, F. O, Essien O.A, Umoh E. E, Ndaeyo N U (2021). Effect of Application of palm bunch ah on the growth and yield of Eggplant (Solanum Melongena L.) in a pineapple orchard. American Journal of life Science. 11(4).56-61

Umoh, F. O, Umoinyang, A . T and Ekwere, O. J (2025). Kinetics of Phosphorous Release in coastal Plain Sand Soils Amended with animal manure in Akwa Ibom State, Nigeria. Academians Jounal of Biology. 1(2): 81 – 92

Umoh, F. O., Effiong, G. S., & Udo, E. I. (2019). Phosphorus fixation capacity of selected soils under mungbean (Vigna radiata (L.) Wilczek) cropping systems in South Eastern Nigeria. *AKSU Journal of Agriculture and Food Sciences*, 2(1): 26–34.

Umoh, F. O., Osodeke, V. E., & Asawalam, D. O. (2021). Varietal response of maize (Zea mays) to residual K fertilization on coastal plain sand of Akwa Ibom State, Nigeria. *AKSU Journal of Agriculture and Food Sciences*, 5(3): 77–89.

Umoh, F. O., Yah, C. J., Essien, O. A., & Eminue, B. E. (2021). Evaluation of soil properties as influenced by land use system in Obioakpa Community of Akwa Ibom State, Nigeria. *Journal of Agriculture, Forestry and Environment*, 5(1): 1–8.