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ISSN (Print): 2651-6144; ISSN (Online): 2651-6365 Website: http://www.jasd.daee.atbu.edu.ng CHARACTERIZATION AND CLASSIFICATION OF SOILS DEVELOPED ON COASTAL PLAIN SOILS FOR CROP PRODUCTION IN ORON LGA, SOUTH- SOUTH, NIGERIA ¹Iyanam, M. V., ²Ijah, C. J., ³Chukwu, G. O. and ⁴Akpan, U. S.

¹Department of Agriculture, Ministry of Agriculture, Uyo, Nigeria ²Department of Soil Science, Akwa Ibom State University, Obio Akpa, Nigeria ³Department of Soil Science and Land Resources Management, Michael Okpara University, Umudike, Nigeria

⁴Department of Soil Science and Land Resources Management, University of Uyo, Uyo, Nigeria Corresponding author's <u>E mail : iyanammfoniso0@gmail.com</u> GSM: +2348032554236

ABSTRACT

Soils are characterized and classified based on its unique properties. Detailed characterization of four representative areas of Oron coastal plain soils in South -South, Nigeria was carried out. Soil samples were collected from pedogenic horizons of soils in four sampling sites. Routine analysis of soil properties was carried out in the laboratory with standard laboratory procedures. Soil data was subjected to descriptive statistics using statistical analytical system. The soils have a deep well drafted profile of about deep 200 cm. The soil texture varied in areas ranging from loamy sand to sandy loam, sandy and sandy clay loam while bulk density increased down the natural horizons. The pH varied between moderately acidic to strongly acidic in the soils of the study area. The morphology of soils ranged in various colour matrix of hues (10-7.5) and Chroma values (1-8) in all horizons. The soils were characterized by Dark Brown (10YR3/3), Dark Greyish Brown (10YR4/2) and Yellowish Brown (10YR 5/4) to Grey (7.5YR6/2). The soils had low concentrations of exchangeable cations (Ca, Mg, Na and K). The Coefficient of variation (CV%) values ranged from 0.74 to 91.6 in Ca, Mg, Na and K. All the parameters in the soils of the study area showed low and medium mean values except soils of Esin Ufot1 and 2 which showed high mean values of Na with Esin Ufot 2 having the highest mean value of sodium to be 0.18 Cmol/kg. Suborder soils were classified as Grossarenic Kandiaqualfs (CEC > 16 Cmol/kg) for Esin Ufot1.Esin Ufot2, Esuk Oron1 while Esuk Oron 2 were classified as Typic Kandaquults (CEC < 16 Cmol/kg). A great importance in providing adequate data to enable right decision taking in the choice of site for developmental projects and crop production.

Keywords: Characterization, Classification, Coastal, Properties and Soils

INTRODUCTION

The study of soil is relevant in our times as it provides adequate data for decision making on the choice of sites for certain projects and development. It is essential for soil management and land use planning without proper understanding of soil characteristics; it would be very difficult to manage soil as a natural resource (Idoga *et al.*, 2005). Soils are end products of the complex interaction among the factors of soil formation. The way and manner these factors interact determine the kind and nature of soil that is formed. The type of soil formed under a particular set of environment is a function of the parent material and time. Soil physico-chemical properties and micronutrients vary in their contents from soil to soil and from the parent material to the other. Coastal zone soils are found along rivers, lakes, lagoons.

There are fundamental challenges as regard to food security due to the result of everincreasing population and high demand for available food. Presently, there are increasing importance on the use of coastal soils for food production and economic growth because of their great potentials for agriculture (Nnabuihe *et al.*, 2022). Soils are the bases for most development projects. In order to ensure that soil is put to the most appropriate and sustainable use, there is every need for characterization and classification of the soil.





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Soil characterization, soil classification and soil mapping provide a powerful resource for the benefit of mankind, especially in the area of food security and environmental sustainability (Esu, 2004). Soil classification is a major building block for understanding the soil, classifying it and getting the best understanding of the environment. It is categorizing soils based on their characteristics. Presently, information on characteristics of most coastal plain soils especially in the study areas are scanty, which constitutes a serious problem for the efficient management and utilization of these soils by farmers (Yakubu *et al.*, 2008).

The study investigates the characteristics and classification of four pedons developed on coastal plain soils of Oron, Akwa Ibom State in South- South Nigeria. In order to illustrate the obvious need to increase our understanding soils. Coastal Plain Soils of Oron investigated for this study were developed from the same parent material hence the need for representative areas to be characterized specifically. The objective of this study was to characterize and classify the selected coastal soils of Oron for arable crop production.

MATERIALS AND METHODS

The Study Area

The study was carried out in different areas which were representatives of the coastal soils in Oron Local Government Area, South -South Nigeria. The areas were Esuk Oron I, Esuk Oron 2, Esin Ufot 1 and Esin Ufot 2 all in Afaha Okpo District in Oron Local Government Area. The study area lies between latitude 4^0 81^0 N and 0° 14^0 N and longitude 08^0 07^0 60° E. Esuk Oron 1 and Esuk Ufot 5^0 50.5° N and 9^0 8^010° E. The climate is sub humid tropical, having distint rainy and dry seasons. The rainfall pattern is bimodal with peaks in July and September. The mean annual rainfall ranges between 1,200 mm to 2,000 mm and spread between April to early November. The average minimum and maximum temperatures are between 26° C and 30° C. Soils of Esuk Oron 1 and 2 were derived from coastal swamps and have been altered by constant deposits of sediments by the overflow of the river particularly during the rainy season where as Esin Ufot 1 and Esin Ufot 2 were derived from the floodplains but soils of Esuk Oron 2 were predominantly sandy deposits found at the top soils. This was probably due to its closeness to the river bank. The research was carried out in the dry season.

Soils of Esuk Oron 1 are dominated by marshy roots and have clayey feeling when tourched' Evidence of redox reaction is noticed in the colour of soil. Esuk Oron 2 are deposits of stony and sandy soils while Esin Ufot 2 soils 1 and 2 have been cultivated. Certain areas were under fallow during the sampling period. Esin Ufot 1 were dominated with cassava plants and many stands of oil palm. Soils were very marshy as the water table was very lowing that area. For Esuk Oron 2 very high sand and stony soil structure was found around certain areas (Bay). Far from the bay, farmers cultivated various crops like water leaf, maize etc.

Soil Sampling and Laboratory Analysis

Reconnaissance visits were made to the project area, profile pits were dug, (one each for the four different areas). Each profile pit was described and sampled according to genetic horizons for characterization and classification (FAO, 2014). The soil samples were air dried crushed and made to pass through 2.0mm mesh sieve. Samples were also collected with core samples for bulk density and hydraulic conductivity. Particle size distribution was performed using the Bouyoucous hydraulic method (Gee and Bauder, 1986). Particles were separated using sieves into various sizes.

Bulk density was calculated using core method according to Grossman and Reineh (2002). Total Exchangeable base (Ca, Mg, K and Na) was extracted with (IN NH_4 O Ac) ammonium acetate of P^H 7.0 (Thomas, 1982). Ca and Mg were determined by EDTA complexion and metric titration while exchangeable potassium and sodium were determined by flame photometry (Jackson 1962). Effective cation exchange capacity was obtained by the



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% BS =Total Exchangeable base x 100

ECEC

Analytical Technique

Data generated were analyzed using descriptive statistics (mean, mode, median and standard deviation). Coefficient of Variation (C.V) as used by wilding (1985) (Table 2) was used in the study to estimate the degree of variability existing among soil properties in the study site. Comparisons were made from the results of the laboratory analysis of the pedons. Percentage Coefficient of variation as determined using the equation.

% $CV=\underline{SD}$ × 100 Mean

...(2)

...(1)

Where SD=Standard Deviation X =Mean

RESULTS AND DISCUSSION

Morphological Properties of Soils

The Morphological Properties of the Pedons in the Study Area is presented in Table 1. The result shows that soils were characterized with Dark brown, dark grey, light greyish brown, grey to yellowish brown colour matrix of hues (10 to 7.5). This is similar to the colour description found in the study conducted by (Iyanam *et al.*, 2023) for wetland soils . The Chroma values (of 1-8) were found in different horizons. These colours indicate redox reactions which is very likely due to the parent material. These findings agree with the findings of Nkhaloane *et al.* (2012) who reported that the changes in colour matrix of hues and chroma values in all horizon may be due to the parent material.

Horizon	Depth (cm)	Munsell	Texture	Structure	Consistence	Boundary	Other features		
		Colour							
Esin Ufot 1									
А	0-25	10YR3/3	LS	2,me,g	Fr	Sc	Few roots		
Bt	25-45	10YR6/4	SL	2,me,g	V.Fr	W.g	Few med.root		
Bt	45-66	7.5YR6/4	SCL	2me,g	Fm	W,g	None		
Bt	66-106	7.5YR6/2	SCL	2,me,g	Fm	-	Water table		
Esin Ufot 2									
А	0-20	10YR4/3	LS	2mesbk	Fr	Sc	Many fine roots		
Bt1	20-52	10YR4/2	LS	2mesbk	Fr	Sg	Few med. roots		
Bt2	52-85	10YR8/8	SCL	2mesbk	Fr	Ŵ	Few med. roots		
Bt 3	85-110	7.5YR6/8	SCL	2mesbk	Fm	-	Water table		
Esuk Oron									
1 AP	0-10	10YR2/3	SL	1fg	Fr	Sc	Few roots		
В	10-45	10YR5/4	SL	1fg	Fr	Wg	Few med. roots		
BC	45-80	10YR4/6	SCL	1fg	S	-	Water table		
Esuk Oron									
2 Ap	0-15	10yr 2/3	SL	1fg	Fr	Wg	Few loose roots		
В	15-47	10yr 3/1	SL	1fg	Fr	g	Few loose roots		
С	47-90	10yr 4/3	SCL	1fg	S	-	Water table		

Table 1: Morphological Properties of the Pedor	ns in the Study Area
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Textures:LS=Loamy Sand,SL=sSandy loam,SCL=Sandy clay loam.Structures:1fg=weak fine granules,2meg=moderate medium granules

2mesbk=moderate mediun subangular blocky,Concistency:Fm=Firm,Fr=Friable,Boundary;Sc=Smoothclear,Sg =Smooth gradual.g=gradual Wg=Wavy gradual

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<u>ISSN (Print): 2651-6144; ISSN (Online): 2651-6365</u> <u>Website: http://www.jasd.daee.atbu.edu.ng.</u> The alternate wetting and drying conditions in these soils resulted in reduction and subsequent release of iron oxide which circulated in the form of mottles in some part of the profiles and the colour changes down the horizon. The structural development of the soils in the study site ranges from weak fine granules to moderate medium granules and medium sub angular block. The soils were friable and firm. Soils were observed to have dry consistence but as the depth decreased close to the water table, they became moist and slightly sticky. These agree with the findings of Iyanam *et al.* (2023) that consistency, when moist became slightly sticky.

The low water table hydrology influences the soil structure of soils in coastal plain soils of Oron. The general sandy nature of the top soil of Esuk Oron 2 when compared to other profiles could be attributed to the constant overflow of the Oron River which deposits itself around the river banks. Parent material and climate factors play a major role in determining the soil structure across the different soil horizons,

Physical Properties of the Study Soils

The Physical Properties of the Study Soils is presented in Table 2. However, mean Sand, Silt and Clay content ranged from 67, 16 and 20 respectively (CV% 9.13, 8.26 and 12.7) with mean sand fraction greater than other fractions as presented in Table 2. This may be attributed to deposition of alluvium sediments and distribution of soil separates which may have influenced drainage characteristics of soil (Onweremadu *et al.*, 2007). These may also be due to the parent material in which the soils were formed (Ijah *et al.*, 2021). The drainage pattern of soil ranged from well drained in the top soil to poorly drain in the deepest horizon. Variation in the drainage pattern of these horizons could be due to the differences in clay content than the surface horizon which invariably reduces infiltration rate (Senjobi and Ogunkunle, 2011). The same results were found in Esin Ufot2 which had mean sand, silt and clay content of 72,17 and 16. This results was similar in range when compared with the research findings of soils in pedon 2 of a study carried out by Iyanam *et al.* (2023) who reported CV% of 9.30,9.20 and 15. Mean sand fraction was higher than silt and clay while mean silt content was slightly higher than clay.

For Esuk Oron 1, the mean sand, silt and clay content ranged from 79,8 and 10% respectively with sand fractions greater than all other fractions but clay content was higher than silt. (CV% 0.25,56,2 and 34.0) while in Esuk Oron 2, the soils had higher sand than silt and clay although clay is slightly higher than silt. CV% of 11.3,77.0 and 30.1) for sand silt and clay respectively. Soil textural class ranged from sandy, sandy loam, loamy sand and sandy clay loam. Esin Ufot1 had sandy loam and sandy clay loam. Esin Ufot2 had sandy, sandy loam and sandy loam. The physical properties of Esuk Oron 2 had sand greater than fractions at the top soil. This may be attributed to the deposition of soil separates which may have influenced drainage characteristics of soils (Onweremadu *et al.*, 2007).

Soils of Esuk Oron 2 may also have the sandy top soil due to its closeness to the Oron River which may have deposited itself on the sea shore or bay during its overflow stage probably during the periods of high rainfall. The Sandiness of the soil is due to parent materials and agrees with the findings of Eze *et al.* (2016) and Orimoloye *et al.* (2018) who characterized some alluvial soils of southern Nigeria. Clay movement down the profile (argillic horizon) was clear in most profiles but without defined pattern which could be due to eluviation and illuviation, surface erosion or runoff, overflows of river banks or combinations of these process.

Mean bulk densities and saturated hydraulic conductivities ranged from 1.40-1.80g/cm³(cv%>0.11 \leq 8.94),0.45-1,82cm/hr.(CV%>0.25 \leq 11.30). Bulk density of soils are influenced by organic matter content, compaction less aggregation, compaction of overlying layers and clay movement down the profile (Ndukwu *et al.*, 2009; Anikwe, 2010). Low bulk density show that soils were not compacted (Esu and Ojanuga, 1986). The soils of Esuk Oron 2 had the lowest mean value for bulk density of 0.11g/cm when compared with other pedons , although the bulk density was generally low in all horizons as shown in Table 2. This could



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<u>ISSN (Print): 2651-6144; ISSN (Online): 2651-6365</u> <u>Website: http://www.jasd.daee.atbu.edu.ng.</u> imply that the soils of Esuk Oron 2 were not compacted as postulated by Esu and Ojanuga (1986). Esoaka and Esu (2000) While working on soils of central cross river had bulk density values ranging between 0.88gcm³ and 1.6gcm³ with mean of 132gcm³. The soils of EsinUfot1 and 2 did not tally with the findings of Ernest and Onweremadu (2016) who stated that the bulk density increased down the profile ,rather it increased down the horizon thereby creating low porosity and less compaction of soil which made the soil loose and water logged causing restrictions to root growth as only few crops can grow under water logged condition. Saturated hydraulic conductivity is generally highest in top soils (Igwe and Akamigbo, 2001; Iqbal *et al.*, 2005) this was evidence in soils of Esin Ufot1 and Esuk Oron 2 probably due to the high sand content.

Profile	Horizon	Depth	BD	KS (cm/hr)	San	Silt	Clay	Textural class		
location			(g/cm^3)		d					
Esin Ufot 1	Ар	0-25	2.02	0.40	75	17	17	Sandy loam		
	Bt	26-45	1.89	0.49	65	15	20	Sandy clay loam		
	Bt_2	45-66	1.60	0.66	68	14	18	Sandy loam		
	BC	66-102	1.72	0.32	59	17	24	Sandy clay loam		
		MEAN	1.80	1.63	67	16	20			
		CV%	8.94	28.0	9.13	8.26	12.7			
		RANKING	LV	MV	LV	LV	MV			
	А	0-20	1.90	0.32	80	18	12	Loamy Sand		
Esin Ufot 2	Bt	20-52	1.70	0.44	76	16	17	LoamySand		
	Bt_2	52-85	1.88	0.52	64	18	18	SandyClayLoam		
	BC	85-110	1.64	0.55	66	16	18	Sandy Clay Loam		
		MEAN	1.78	0.45	72	17	16			
		CV%	7.80	19.77	9.30	9.20	15.6			
		RANKING	LV	MV	LV	LV	MV			
Esuk Oron 1	Ap	0-10	1.4	1.90	80	4	16	Sandy loam		
	B	10-45	1.52	2.64	82	15	13	Sandy loam		
	BC	45-80	1.44	0.70	76	4	10	Loamy sand		
		MEAN	1.45	1.75	79	8	10	·		
		CV%	3.80	45.7	0.25	56.2	34.0			
		RANKING	LV	HV	LV	HV	MV			
Esuk Oron 2	Ар	0-15	1.3	1.75	90	3	7	Sandy		
	\mathbf{Bt}_1	15-47	1.44	1.90	68	18	15	Sandy loam		
	Bt_2	47-90	1.47	1.82	80	5	12	Sandy Loam		
		MEAN	1.40	1.82	80	9	11	2		
		CV%	0.11	3.29	11.3	77.0	30.1			
		RANKING	LV	LV	LV	HV	MV			

Table 3: Physical Properties of the Study Area

Chemical Properties of the study soils

The soil was generally acidic to moderately acidic (Table 3). This is as a result of heavy rainfall resulting in leaching of basic cations from the exchange site. The findings from this study is in consonant with the report of (Ijah *et al.*, 2021). The acidic nature of coastal soils under the study area could also be attributed to oxidation of anions like nitrites and sulphides. The results revealed a high acidic mean result of (pH. 5 - 6.40). According to a study by the (Iyanam *et al.*, 2023) the pH values of wetland soils in the study area of south-south, Nigeria ranged from 4.9 to 6.20 with mean value of 5.32 under wet conditions of soils. Mean results of nitrogen contents of soils ranged from 0.32-0.40% (CV% 16.05-76.56%). Landon 1991 reported that interpretation of data on total nitrogen depends on the soil and its location. All the pedons had low nitro gen content and this may be as a result of high nitrogen loss sustain in the soil through leaching of nitrates as well as the rapid mineralization of organic matter under the

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<u>ISSN (Print): 2651-6144; ISSN (Online): 2651-6365</u> <u>Website: http://www.jasd.daee.atbu.edu.ng.</u> isohyperthemic soil temperature region (Eshiet *et al.*, 1990). Total nitrogen is usually highest in top soil decreasing down the profile (Ukaegbu and Ukamigbo, 2004). Available phosphorus was generally low in soils of Esuk Oron1 and 2 but higher in Esin Ufot 1 and 2. The mean value of available phosphorus ranged from 2.40-10.30mg/kg. The result obtained from this study was similar to that of the study carried out by Iyanam *et al.* (2023) who observed, that available phosphorous ranged from 7.15–10.20mg/kg.

Mean value of sodium for Esin Ufot 1 and 2 and Esuk Oron 1 and 2 were 0.4 - 0.7 cmol/kg. Exchangeable magnesium ranged from 2.50 - 2.60 cmol/kg. Mean value of calcium for the study was low as it ranged from 2.30 to 11.06. The values of exchangeable potassium were low as it ranged from 0.11 to 0.18cmol/kg. Onyekwere *et al.* (2001) observed that the soils of coastal zones of Ebughu in Akwa Ibom State had moderate to high levels of exchangeable bases. They also stated that soils acidity, salinity and flooding conditions are major soil related constraints of soil for improved agricultural production. The cation exchange capacity ranged from 9.90 - 24.00cmol/kg (CV% 4.34 - 22.31). Soil become acidic quickly when CEC is low (Chukwu *et al.*, 2019). This could be a result of the strong acidity of the soils. Exchangeable sodium percentage mean value ranged from 8 to 11%. The low ESP results agree with the findings of Ogbodo (2011). The electrical conductivity was low with mean values ranging from 0.10 to 0.22 dS/m. The findings are in consonant with the report of Isaac *et al.* (2024) in soils formed from coastal plain sand of Akwa Ibom State.

Soil Classification

Data collected from the study site were subjected to summary statistics such as Mean, Coefficient of Variation (CV) was used to estimate the degree of variability existing among soil properties in the study site. Coefficient of Variation is ranked as follows: low variation \leq 15percent, moderate variation15percent \geq 35 percent and high variability 35 percent (Wilding *et al.*, 1994). Soil classification according to the USDA Soil Taxonomy (Soil Survey Staff, 1999). Ultisols are soils that have an argillic or kandic horizon with low base saturation. Base saturation in most ultisols decreases with increasing depth because the vegetation has concentrated the bases at a shallow depth. The have dark brown, dark grey to yellow brownish subsurface horizons, strongly acid to moderately acid 5.00-6.40 low base saturation. Suborder Soils were classified as Aquults. Soils of Esin Ufot 2 and are classified as Grossarenic kandiaqualfs (CEC>16cmol/kg) while Esin Ufot 2, Esuk Oron 1 and Esuk Oron 2 were classified as Typic kandaquults (CEC<16cmol/kg). They were classified Typic because their properties were typical in their groups. UT AND

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Table 3: Chemical Properties of the Study Area																
Profile	Horizon	Depth	PH	Org.M	Total N	Avail	Exc. B	ases		Exc. A	cidity				EC	Esp/w
Location		(cm)	$(\mathbf{H}_{2}0)$	(%)	(%)	Р	(Cmol	/kg)		(Cr	nol/kg)		ECEC	Base	ds/m	
						(mg/kg)	Ca M	g K		Na AL H						
													(Cmol/l	kg)		
Esin Ufot 1	Ар	10-25	6.40	3.50	0.40	10.30	2.15	2.60	0.20	0.06	2.80	0.73	25.5	74	0.09	10
	Bt_1	25-45	6.20	3.20	0.24	10.20	2.20	2.60	0.19	0.06	2.50	0.80	26.20	72	0.10	12
	Bt_2	45-60	6.60	3.00	0.32	10.30	2.40	2.50	0.15	0.07	1.65	1.25	20.5	73	0.12	10
	Bc	66-102	6.50	2.90	0.46	10.40	2.46	2.42	0.17	0.08	1.70	1.50	20.5	80	0.21	11
		MEAN	6.40	3.20	0.40	10.30	2.30	2.50	0.17	0.07	2.20	1.07	23.20	75	0.13	11
		CV%	2.34	7.31	23.57	0.68	0.74	3.24	12.12	12.37	22.70	29.76	11.57	4.16	36.4	7.87
		RANKING	LV	LV	MV	LV	LV	LV	LV	LV	MV	MV	LV	LV	HV	LV
Esin Ufot 2	Ар	0-20	6.20	3.30	0.50	9.50	2.12	2.45	0.18	0.04	2.90	0.62	22.22	70	0.08	09
	Bt	20-52	6.30	3.40	0.35	10.20	2.20	2.55	0.17	0.03	2.70	0.75	24.22	73	0.09	11
	Bt_2	52-85	6.28	3.25	0.42	10.15	2.25	2.60	0.18	0.03	2.50	1.10	25.00	74	0.10	12
	Bt ₃	85-110	6.40	2.80	0.34	10.20	2.50	2.70	0.19	0.04	1.90	1.40	23.00	75	0.12	13
		MEAN	6.30	3.20	0.40	10.00	2.30	2.60	0.18	0.04	2.5	1.00	24.00	73	0.10	11
		CV%	1.13	1.66	16.05	2.96	0.91	9.85	3.88	17.50	14.96	30.60	4.75	2.50	15.00	13.60
			LV	LV	MV	LV	LV	LV	LV	MV	LV	MV	LV	LV	LV	LV
Esuk Oron 1	Ар	0-10	4.52	2.14	0.25	2.56	12.80	2.60	0.08	0.08	1.50	0.26	9.94	11	0.24	10
	B	10-45	5.60	2.26	0.35	2.40	10.20	2.50	0.09	0.08	1.40	1.40	8.92	12	0.22	7
	Bc	45-80	5.70	2.10	0.52	2.30	10.20	2.40	0.15	0.07	1.36	1.20	5.64	15	0.19	6
	76.56	MEAN	5.30	2.20	0.37	2.40	11.06	2.50	0.11	0.07	1.40	1.00	8.20	13	0.22	8
		CV%	10.09	3.31	30.17	0.49	11.03	3.20	30.0	28.50	4.28	49.0	22.31	13.30	9.09	21.62
			LV	LV	MV		LV	LV	MV	MV	LV	HV	MV	LV	LV	MV
Esuk Oron 2	Ар	0-15	4.72	2.20	0.27	2.48	10.30	2.51	0.10	0.09	1.47	1.30	10.20	10	0.23	9
	B	15-47	4.90	2.30	0.29	2.50	10.35	2.59	0.12	0.07	1.49	1.36	9.72	11	0.20	8
	Bc	47-90	5.20	2.36	0.42	2.55	10.40	2.62	0.14	0.04	1.50	1.40	9.80	13	0.18	6
		MEAN	5.00	2.30	0.32	2.51	10.35	2.60	0.12	0.07	1.50	1.40	9.90	11	0.20	8
			10.60	15.21	76.56	6.49	1.75	7.69	91.6	66.66	7.66	15.0	4.34	9.09	64.5	12.5
			LV	LV	HV	LV	LV	LV	HV	HV	LV	LV	LV	LV	HV	LV

Orgc = Organic Carbon, TN = Total Nitrogen, AVP = Available Phosphorus, Ca = Calcium, Mg = Magnesium K = Potassium, Na = Sodium, BS = Base Saturation, ECEC = Effective Cation Exchange Capacity, TEA=Total Exchangeable Acidity.

LV=Low Variability,MV= Medium Variability,HV = High Variability.

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CONCLUSION AND RECOMMENDATIONS

It was observed that variations in various pedogenic physical and chemical properties were found across the horizons of the four profile pits. The coastal soils of Oron have a very low water table and as such a lot of chemical reactions take place within the soils which are mostly oxidation and reduction. This is evidence by the various changes in soil colour and presence of mottles. The low water table can be attributed to the presence and closeness of the Oron River to the region of embankment as it overflows occasionally thereby depositing solutes and increases the soil solution which later drains and is deposited lower down within the soil profile, in coastal soils found within the study area. Climatic factors such as heavy rainfall and humidity also plays a role in the soil forming processes. The coastal soils are adequate for cultivation of lowland rice, vegetables and various crops that do well in water logged soils. Although adequate drainage is recommended to avoid loss of crops and ultimate death of plants. Mineral fertilizers and liming are also recommended for soils of the study area.

REFERENCES

- Anikwe, M. A. N. (2010). Carbon Storage in Soils OF Southeastern Nigeria under different management practices. *Carbon Balance & Management Journal*, **5**(1):5-8.
- Esoaka, A. N. and Esu, I. E. (2000). Profile distribution of sesquioxides in the inland valley soils of Central Cross River State, Nigeria. Proceedings of the 26th Annual Conference of the Soil Science Society of Nigeria, Ibadan, Oyo State, October, 30th-November, .3rd. Pp24-31.
- Esu, I. E. and Ojanuga, A. G. (1986). Soil Characteristics Studies within the Natural levees of River Kaduna, Nigeria. *Nigerian Journal of Soil Science*, **6**(1):1-13.
- Esu, I. E. (2004). Soil Characterization and Mapping for Food Security and Sustainable Environment in Nigeria. A keynote address presented at the 29th Annual Conference of Soil Science Society of Nigeria held at the University of Agriculture, Abeokuta, Nigeria pp9-18. Nov, 2004.
- FAO (Food and Agriculture Organization) (2014). World Reference Base for Soil Resources. International Soil Classification System for Naming Soil and Creating Legends for Soil Maps. World Soil Resources Reports.No106, FAO Rome, Italy,191 Pp.
- Gee, G. W. and Bauder, J. W. (1986). Determination of Particle Size Analysis In: Method of Soil Analysis: Physical and Mineralogical Method. Part 1Wute, A (ed), Soil Science Society of America, Madison, Wisconsin USA,1188 Pp.
- Grossman, R. B and Reinsch, T. G. (2002). Bulk density and linear extensibility p.201-228. In: J. H. Dane and G.C. Topp (ed.) Methods of Soil Analysis Part 4 Physical Methods of Soil Science Soc. America book series No5ASA and SSA Madison, W.I Pp225-293.
- Idoga, S., Abagyeh, S. O. and Agber, P. I. (2005). Characteristics and Classification of Crop Production Potentials of Soils of Aliade Plain, Benue State, Nigeria. *Journal of Soil Science*, **1**(5):101-110.
- Igbal. J., Thomason, J. A., Jenkins, J. N., Owens, P. R. and Whisler, F. D. (2005). Spatial Variability Analysis of Soil Physical Properties of Alluvial Soils. *Soil Science Society of American Journal*, **6**(9):1338-1350.
- Igwe, C. A. and Akamigbo, F. O. R. (2001). Application of topomaps and aerial photointerpretation in a detailed soil survey for irrigation purposes in a derived savanna zone of Southeastern Nigeria. In: Proceedings of the 27th Annual Conference of the Soil Science Society of Nigeria held at University of Calabar, Nigeria. Pp18-28.
- Isaac, V. M., Ijah, C. J., Uduak, I. G. and Uwah, I. D. (2024). Assessment of some Micronutrients, copper, Iron and Zinc (Cu, Fe, Zn) in soils formed from coastal plain sand, Akwa Ibom State, Nigeria. *Direct Research Journal of Agriculture and Food Science*, 12(2):201-207.
- Ijah, C. J., Essien, G. G., Umoh, F. O. and Edem, T. T. (2021). Amelioration of Soil acidity using local liming Materials for the Production of Chilli Pepper. In Acid Ultisol of South –Eastern. *Nigeria. AKSU Journal of Agriculture and Food Science*, 5(2):10-19.
- Ijah, C. J., Umoh, F.O. Essien, I. G. U. and Moses, V. I. (2023). Profile Distribution of Iron and Zinc in Soils Formed from Three Different Parent Materials in Akwa Ibom State. *Nigeria AKSU Journal of Agriculture and Food Science*, 7(2):40-51.
- Iyanam, M. V., Chukwu, G. O., Akpan, U. S., Nkanga,N.A and Ijah,C.J. (2023). Suitability Evaluation of Wetland Soils for Rice Production in Etinan,South -South Nigeria. *Nigerian Journal of Agriculture Food and Environment*, 19(1):37-46.

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- Jackson, M. L. (1962). Soil Chemical Analysis . New York: Prentice Hall Inc. Pp498
- Ladon, J. R. (Ed) (1991). **Booker tropical Soil Manual**. A Handbook for Soil Survey and Agricultural Land Evaluation in the tropics & subtropics, Longman Scientific and Technical, Essex, New York.474p.
- Ndukwu, B. N., Idigbor, C. M., Onwudike, S. U., Okafor, P. O. and Osuaku, K. S. (2009). Spatial Variability in Some properties of Soil formed under differ. Lithology's in Southeastern Nigeria. In the Proceeding of the 5th National Conference of Organic Agriculture Project in Tertiary Institution in Nigeria, Pp: 94-97.
- Nnabuihe, E. C., Onweremadu, C. O., Madueke, T. V., Okafor, M. V., Ibeh, C. U., Ibigweh, M. N. and Nwaiwu, C. J. (2021). Characterization and Classification of Flood plain soils of different geomorphic surfaces along onumirikwe river Ulakwo, Owerri, Southeastern. Nigeria. Proceedings of the 45th Conferences of Soil Science Society of Nigeria on: Understanding Organic Matter Dynamics: Key to Sustainable Ecosystem Health, Pp312-318.
- Nkheloane, T., Olaleye, A. O. and Matin, R. (2012). Spatial heterogeneity of Soils Physico-chemical properties in contrasting wetland soils in two agro-ecological zones of Lesotho. Soil Research Report.6: LESO
- Ogbodo, E. N. (2011). Effects of Crop Residue on Soil Chemical Properties and rice grain yield on an ultisol at Abakaliki south eastern Nigeria. *World Journal of Agricultural Sciences*, 3(1):58-62.
- Onyekwere, I. N., Akpanidiok, A. U., Amalu, U. C., Asawalam, D. O. and Eze, P. C. (2001). Constraints and Opportunities in agricultural utilization of some wetland soils in Akwa Ibom State, Proc. of 27th Annual Conference of Soil Science Society of Nigeria, Pp 139 -146.
- Onweremadu, E. U., Ndukwu, B., Opara, C. C. and Onyia, V. N. (2007). Characterization of Wetland Soils of Zamara, Bayelsa State Nigeria in relation to Iron and Manganese Distribution. *International Journal of Agriculture & Food System*, **1**(1):80-86.
- Orimoloye, J. R., Alasa, I. R. and Umweni, A. S. (2018). Characterization and Classification of Some Flood Plain Soils at Weppa, Edo State, Nigeria for Sustainable Agricultural Productivity. *Journal of Agriculture*, **30**(3):1-18.
- Soil Survey Staff (2014). Keys to Soil Taxonomy,12 Edition United States Department of Agriculture, Washington DC,372pp
- Senjobi, B. A. and Ogunkunle, A. O. (2011). Effect of different land use types and their implication on land degradation and production in Ogun State Nigeria. *Journal of Agric. Biotech and Sustainable Development*, 3(1):7-18.
- Thomas, G. W. (1982). Exchangeable cations. In: A.L. Page; R. H. Miller and D. R. Keeney(eds.). Methods of Soil Analysis ,Part 2,Chemical& Microbiological Properties .Madison, Wisconsin Pp159-165.
- Ukaegbu, E. P. and Akamigbo, F. R. (2004). Influence of Physiographic on the Properties and Land Use of Soils of the Cross-River Plains: A Case Study of a strip of Land at Ishiagu, Ebonyi State In: Proceedings of the 29th Annual Conference of the Soil Science Society of Nigeria held at University of Agriculture , Abeokuta Pp103 -109
- Wilding, L. P. (1994). Soil Testing: For improving nutrient recommendation. Madison. wis, USA. SSSA, ASA. XIIV, 220Pp.
- Yakubu, M., Abdullahi, I., Ibrahim, B. and Noma, S. S. (2008). Characterization of upland and floodplain soils for management implications in Dundaye District Sokoto, Nigeria. Proceedings of the 32nd Annual Conference of the Soil Science Society of Nigeria, Federal Univ. of Tech., Yola, Nigeria: 44-62.