Journal of Agriculture and Agricultural Technology

(JAAT)

Journal of Agriculture and Agricultural Technology 14 (1), 2025

CHARACTERIZATION AND CLASSIFICATION OF SOME SOILS UNDER DIFFERENT LAND USE TYPES IN FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA, OGUN STATE, NIGERIA

[1]BASIL, E.C., [2]OLUTIMI, M.S., [3]ADEROLU, J.A, [4]SENJOBI, B.A

*[1,3,4]Department of Soil Science and Land Management, Federal University of Agriculture, Abeokuta, P.M.B. 2240 Abeokuta, Ogun State, Nigeria.

[2]Institute of Agricultural Research and Training, Moor Plantation, Ibadan

Corresponding e-mail: charlesejike7@gmail.com

ABSTRACT

An efficient soil classification system in agricultural development constitutes an essential element in soil surveys since it provides the framework for inventorying land resources. Based on this hypothesis, a detailed soil survey was conducted at the Federal University of Agriculture, Abeokuta. Modal profile pits were dug at the soil variations observed, described and sampled following standard guidelines. These soil samples were subjected to physical and chemical analyses. The results showed that the soil colour varied from reddish yellow to reddish brown at the crest but greyish at the valley bottom. The structure varied from single grain at the top horizon to sub-angular blocky at the sub-horizon. The consistency when wet varied from friable to very sticky. The organic carbon, available phosphorus and exchangeable bases were low across all the profiles. At the same time, the total nitrogen was only moderate at the surface but low as the soil depth increased. The soils fall within the soil order Alfisols in the USDA Soil Taxonomy.

Key words: Characterization, Classification, Land Use Types, Soil

INTRODUCTION

According to Buol *et al.* (2015), soil characterization involves the examination of soil in the field and determining physical and chemical characteristics in the laboratory. A great deal of inference can be drawn from the soil's morphology as seen on the field, and interpretations and predictions about its qualities can be made. Buol *et al*. (2015) further explained that for accurate interpretation and prediction, especially for modern agriculture and non-agricultural uses of soils, quantitative data on the composition of the soils are needed for characterization. Soil characteristics in any place result from five genetic factors: climate, organisms, relief, parent materials and time, and the effect of man's use. Soil is a combination of characteristics resulting from a combination of factors. Its future potentialities, as well as its previous history, are reflected by these characteristics (Schoonover and Crim, 2015). Okafor and Fabiyi (2011) listed soil depth, texture, structure, and consistency, among other morphological properties of the soil, that are very useful, while particle size analysis, bulk density, total porosity, infiltration rate, and soil moisture parameters are some of the physical properties useful for soil characterization. Key chemical parameters include pH, organic matter, cation exchange capacity, exchangeable cations, base saturation and free iron oxide (Buol *et al*., 2015). Akinde *et al.* (2020) also affirmed that examining the physical and chemical characteristics of the soils would provide an in-depth knowledge of their productive capacities for long-range agricultural development, planning, and management. This is because the amount of nutrients in the soil is usually taken as an index of fertility—common properties of the soil help in grouping the soil into various classes. An efficient soil classification system in agricultural development is essential in soil surveys since it provides the framework for inventorying land resources (Obi and Ogunkunle, 2022). This study characterized and classified the soil of the different land use types in the Federal University of Agriculture, Abeokuta.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted at the Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State. The area is located between latitude 70 15' N and 70 23' N, Longitude 3o 20' E and 30 24' E and on Elevation 108 m. The vegetation, which various agricultural practices have modified over time, is a derived savanna. The climate of Abeokuta falls between the humid and sub-humid tropics, with a mean annual rainfall of about 1120 mm, with two peaks in the distribution pattern and five dry months in the year. Temperature ranges between 25^0C and 28^0C**.** The soil temperature, which is relatively higher than the air temperature, is highest at 5cm depth (34^0C to 35^0C) and decreases with the depth from 10 cm to 50 cm from the surface, remaining above 300 C. The relative humidity is highest between July and September, ranging from 86 % to 88 % and lowest between January and February at 66 % to 68 % in most years (Basil *et al*., 2023b). The major land use types in the area are cashew, oil palm, arboretum, and fallow.

Field Survey: Four different land use types were considered for this study, namely: Arboretum (Land use 1), Cashew (Land use 2), Oil palm (Land use 3) and Fallow (Land use 4). For each land use type, an area of 4 hectares was demarcated for the study. A representative profile pit (2 * 1 * 2 m) was dug at each land use type or slope segment, and soil types/mapping units were encountered at each of the chosen land use types viz: crest, middle slope and valley bottom. The oil palm and the arboretum had 3 profile pits; each dug based on the slope segments of the top sequence. Cashew and the Fallow had 2 profile pits each, based on the soil types encountered on the sites. The general site description was determined, including climate, vegetation, land use, slope gradient, drainage type, soil surface form, type and degree of erosion, and soil texture by feel. The profile pits were described morphologically after FAO (2006) guidelines. The profile soils were sampled, placed in labelled bags, and processed in the laboratory after air-drying. Soil colour was determined using the Munsell colour chart.

Laboratory Analysis: The air-dried soil samples were ground and sieved with a 2 mm mesh sieve, and sub-samples were further sieved with a 0.5 mm sieve for the organic carbon and nitrogen determination. The Organic Carbon was determined using the Walkley and Black method (1934). Soil pH in water and 0.01M potassium chloride solution (1:1) was determined using a glass electrode pH meter (Mclean, 1965). Exchangeable cations were extracted with 1M NH_4OA_C (pH 7.0), sodium and potassium were determined using a flame photometer, and exchangeable Mg and calcium by an atomic absorption spectrometer (Spark, 1965). Available P was extracted using Bray-1 extractant followed by Molybdenum blue colourimetric. Exchangeable acidity was determined by the KCl extraction method (Mclean, 1965). Percentage Base saturation was determined, and adequate cation exchange capacity (ECEC) was calculated from the sum of all exchangeable cations. Total nitrogen was determined by Jackson's Macro-Kjeldahl digestion method (1962). The bulk density was determined by the core method. Soil porosity was estimated from the bulk density data at an assumed particle density of 2.65 $gm\text{-}^3$. The Bouyoucos hydrometer (1951) method used a Calgon as a dispersing agent to determine particle size distribution analysis.

Soil classification: The soil classification was done using the USDA Classification System of 2022 and the FAO/UNESCO (2010) Classification System.

RESULTS AND DISCUSSION

Results

Morphological Properties of the soils under different land use types

The morphological properties of the soils presented in Table 1 varied from one land use type to another in all four Land Use Types with respect to colour, texture, structure, consistency, boundary and root concentrations. It was observed that pedons at the crest and middle slopes in Land Use Types 1 and 3 (i.e. arboretum and oil palm plantation) were well-drained, while the pedons at the valley bottom were poorly drained. The soil colour at the crest varied from reddish yellow to reddish brownish but greyish at the valley bottom in Land uses 1 and 3. The colour ranges from 5YR4/2 to 7.5YR8/6 (Reddish brown to grey) across all the profiles. The texture varied from sandy to grave from the top horizon down to the sub-horizon in the arboretum. In the Oil Palm, the texture varied from silty to clayey from the top horizon to the sub-horizon in all the profiles. In cashew (Land Use 2) and fallow (Land Use 4), the texture varied from sandy to grave and silty, respectively. The soil structure across all the profiles in all the land use types varied from single grain at the top horizon to sub-angular blocky at the sub-horizons. The pedons varied from friable to very sticky in terms of consistency. The root concentration varied from very fine roots to many coarse roots. Iron and Mn concretions were present at the valley bottom in the arboretum (Land Use 1), cashew (Land Use 2), and fallow (Land Use 4). The soils are generally deep. The boundary was clear in some profiles and abrupt in some of the different Land uses employed.

Physical and Chemical Properties of the Soil Profile

The physical and chemical properties of the profile soils are shown in Table 2. The sand contents ranged from 840 g/kg at the surface to 630 g/kg at the sub-surface in Land Use 1. It ranged from 850 g/kg at the surface to 473 g/kg at the sub-surface at Land Use 2, while in Land Use 3, it ranged from 760 g/kg at the surface to 596 g/kg at the sub-surface. In Land Use 4, it ranged from 850 g/kg at the surface to 660 at the sub-surface. The clay contents ranged from 127 g/kg at the surface to 300 g/kg at the sub-surface in Land

Use 1. In Land Use 2, the clay contents ranged from 142 g/kg at the surface to 432 g/kg at the sub-surface. In Land Use 3, however, the clay contents ranged from 182 g/kg at the surface to 308 g/kg at the sub-surface, while in Land Use 4, it ranged from 131 g/kg at the surface to 300 g/kg at the sub-surface. Although the sand contents decreased as the depth increased, the clay contents increased as the depth increased, but the silt contents did not show any specific pattern in its distribution. The pH of the soils was neutral at both the surface and sub-surface in Land Use 1. In Land Use 2, it ranged from slightly acidic to moderately acidic, while in Land Use 3, it ranged from somewhat acidic to moderately acidic. In Land Use 4, it ranged from neutral at the surface to slightly acid at the sub-surface. The organic carbon was moderate at the surface in Land Uses 1 and 4 but very low at the sub-surface in other Land Uses. The total nitrogen was mild at the surface in Land Uses 1 and 4 (profile 10) but low in all other surface and sub-surface profiles. The available phosphorus was low in all the Land Uses. The exchangeable bases were not excluded in these variations. The potassium content was very high and very low in some profiles. It ranged from 5.22 cmol/kg to 0.01 cmol/kg at the surface across the profiles and 4.58 cmol/kg to 0.01 cmol/kg at the sub-surface. Sodium content followed the same trend as potassium as the values fluctuated across the profiles. It was very high on some surfaces and shallow on some profiles. This cut across all the profiles. The calcium content was low in all the Land Uses, while the magnesium content was moderate across all the profiles. The ECEC was also moderate in profiles 1, 2, and 3 and very low in profiles 4,5, 6,7,8,9,10. The percentage base saturation was >90% in all the profiles.

Soil Classification: The classification of the pedons is given in Table 3. The soils fall within soil order Alfisols in the USDA Soil Taxonomy (Soil Survey Staff, 2022). All the pedons with argillic B horizons and high base saturation (>50%) were classified as Alfisols or Luvisol (FAO/UNESCO, 2006). The pedons at the crest and middle slope of Land Use 1 were classified as Typic Eutrudalf (Soil Survey Staff, 2022) and Rhodic Luvisol (FAO/UNESCO 2006). At the valley bottom, it was classified as Plinthic Eutruaqualf (Soil Survey Staff, 2022) and Plinthic Luvisol/Plinthosol (FAO/UNESCO, 2006).

The pedons at the crest, middle and valley bottom of Land Use 2 were classified as Rhodic Plinthiudalf (Soil Survey Staff, 2022) and Plinthic Luvisol (FAO/UNESCO, 2006). The pedons at the crest and middle slope of Land Use 3 were classified as Typic Paleudalf (Soil Survey Staff, 2022) and as Eutric Luvisol according to (FAO/UNESCO, 2006). At the valley bottom, it was classified as Typic Paleaqualf (Soil Survey Staff, 2022) and Eutric Luvisol (FAO/UNESCO, 2006).

DISCUSSION

The variations in the soil's colour could result from the drainage pattern experienced in the soil, according to Senjobi (2007). The drainage pattern of the soils also suggests that the soils were well drained in some land uses. This is due to the differences in the clay contents and regional water table, according to Senjobi (2007). The sand content of> 800 g/kg at the surface indicated that the particle size was dominated by sand. The implication of this is that the infiltration rate and the rate of leaching would be high. This was evident in the exchangeable bases. This result was similar to the report of Senjobi *et al.* (2019). Basil *et al.* (2023a) also reported a similar result, indicating that the high percentage of sand indicates a high infiltration rate. Senjobi *et al.* (2010) further implied that soils of this quality can be eroded. The increase in clay content as the depth increases might result from a process known as argilluviation. This trend was similar to the result reported by Basil *et al*. (2023a). The clay movement down the profile is also a result of the leaching of clay materials caused by the downward movement of water and depositing them in the following profile horizons, according to Basil *et al*. (2023b). The low organic carbon observed in all the profiles could result from micro-organism activity, which aids the decomposition of organic materials favoured by the high temperature of the tropics. This is similar to the result reported by Senjobi (2007). Murphy *et al.* (2021) reported that organic carbon increase was not noted in oil palm plantations due to the uneven redistribution of recycled fronds. This was also supported by Rahman *et al.* (2020). Available phosphorus was low across the profiles. This suggests that all the land use types comprising tree plantations are heavy feeders of phosphorus, according to Onyekwelu *et al.* (2008). The parent materials of the soils could be poor in phosphorus minerals, according to Aiboni (2001). The results of soil classification show that all the soils, irrespective of their position along toposequence, are Alfisols. However, the lower slope and valley bottom pedons were expected to be mostly inceptisols and entisols, as reported by Ibrahim *et al*. (2020). The pedons of the lower slope and valley bottom are mature soils with their horizons developed beyond the stage of young soil. This is evidenced in the clay illuviation, with no indication of soil materials' recent or continuous deposition. There is also strong evidence to support their classification as Alfisols.

Table 1: Morphological Properties of Pedons

Profile No	Parent Material	Land use	Horizon design	Depth	Colour		Texture	Structure	Consistency	Horizon boundary	Roots	Drainage	Concretion
					Wet	Dry							
1	Basement complex	Arboretum	A	0-40	5YR4/2 dark reddish gray	5YR6/3 light reddish brown	LS	SG	FR	CL	Mfr	WD	N
Slope (6%)			B1	40-95	5YR4/4 Reddish brown	5YR7/3 Pink	LS	SG	NS	Ab	Vfcr	WD	N
			Bt	95-155	7.5YR8/6 Reddish yellow	2.5YR5/4 Reddish brown	SL	SG	SS		Vfcr	WD	N
2	Basement complex	Arboretum	A	0-40	5YR3/3 dark Reddish brown	5YR6/3 light reddish brown	LS	SG	FR	Ab	Mmr	WD	N
Slope (12%)			B1	40-120	5YR4/3 Reddish brown	5YR6/6 Reddish yellow	LS	SG	SS	Ab	Vffr	WD	N
			Bt	120-180	2.5YR4/4 Reddish brown	5YR6/3 light reddish brown	SL	SG	VS	Ab	Vffr		N
3	Basement complex	Arboretum	A	0-50	5YR4/2 dark reddish gray	5YR5/1 Gray	LS	SG	SS	CL&B	Mmr	WD	N
Slope (7%)			B1	50-120	7.5YR4/4 Dark brown	5YR6/3 Light reddish brown	LS	SG	SS	Ab	Fr	PD	Fe&Mn
			B2	120-160	7.5YR6/4 Light brown	5YR7/2 pinkish gray	SL	SG	S		Fmr	PD	n

S=Sand; SG=Single grain; FR= Friable; CL=Clear; WD= Well drained; n= None; Ab= Abrupt; St= Stony; Gr= Gravel; SS= Slightly sticky; s= sticky; PD= Poorly drained; VS= Very sticky; Si= Silty; vffr= very few fine root; mmr= many medium root; mfr= many fine root; vfcr= very few coarse root; C=Clay; CL&B= Clear & broken boundary; fr= fine root; SAB= sub-angular blocky; Cr=Crumbly;

Morphological Properties of Pedons continue

!	Basement complex	Oil palm	Ap	0-27	5YR5/8 Yellowish red	5YR6/3 Light reddish brown	LS	SAB	S	Ab	Ffr	WD	n
			Bt1	27-100	5YR6/8 Reddish yellow	5YR7/6 Reddish yellow	LS	SAB	VS	Ab	Vffr	WD	n
			Bt2	100-162	2.5YR5/8 Red	5YR6/6 Reddish yellow	SL	SAB	VS		N	WD	n
5	Basement complex	Oil palm	Ap	0-30	5YR5/2 Reddish gray	5YR6/2 Pinkish gray	LS	SAB	FR	Ab	mmr	WD	n
Slope (4%)			Bt1	30-100	5YR6/2 Red	5YR6/4 Light reddish brown	LS	SAB	VS	Ab	mmr	WD	n
			Bt2	100-152	5YR5/6 Yellowish red	5YR7/6 Reddish yellow	SL	SAB	VS		vfr	WD	n

S=Sand; SG=Single grain; FR= Friable; CL=Clear; WD= Well drained; n= None; Ab= Abrupt; St= Stony; Gr= Gravel; SS= Slightly sticky; s= sticky; PD= Poorly drained; VS= Very sticky; Si= Silty; vffr= very few fine root; mmr= many medium root; mfr= many fine root; vfcr= very few coarse root; C=Clay; CL&B= Clear & broken boundary; fr= fine root; SAB= sub-angular blocky; Cr=Crumbly;

Morphological Properties of Pedons continue

!	Basement complex	Oil palm	Ap	0-40	7.5YR3/2 Dark brown	5YR5/1 Gray	LS	SAB	FR	Ab	mmr	WD	n
Slope (6%)			B1	40-90	7.5YR5/4 Brown	5YR5/1 Gray	LS	SAB	FR	Ab	mmr	PD	n
			B2	90-105	7.5YR6/4 Light brown		SL	SAB	VS		vffr	PD	n
7	Basement complex	Cashew	A	0-50	5YR4/2 Dark reddish gray	5YR6/2 Pinkish gray	LS	Cr	NS	CL	mfr	WD	n
Slope (2%)			B1	50-110	10R4/6 Red	5YR6.4 Light reddish brown	LS	Cr	SS	CL	mfr	WD	Fe&Mn
			B2	110-145	5YR5/4 Reddish brown	5YR7/3 Pink	SL	Cr	S	Ab	vffr	WD	n

S=Sand; SG=Single grain; FR= Friable; CL=Clear; WD= Well drained; n= None; Ab= Abrupt; St= Stony; Gr= Gravel; SS= Slightly sticky; s= sticky; PD= Poorly drained; VS= Very sticky; Si= Silty; vffr= very few fine root; mmr= many medium root; mfr= many fine root; vfcr= very few coarse root; C=Clay; CL&B= Clear & broken boundary; fr= fine root; SAB= sub-angular blocky; Cr=Crumbly;

Morphological Properties of Pedons continue

!	Basement complex	Cashew	A	0-45	5YR4/4 Reddish brown	5YR7/3 Pink	LS	Cr	FR	Ab	mmcr	WD	n
Slope (2%)			Bt1	45-100	2.5YR5/8 Red	2.5YR6/4 Light reddish brown	SL	SAB	S	Ab	fmr	WD	Fe&Mn
			Bt2	100-160	10R Red	2.5YR6/4 Light reddish brown	SL	SAB	S	Ab	vffr	WD	n
9	Basement complex	Fallow	A	0-30	5YR4/2 Dark		LS	SG	SS	CL	mmcr	WD	n
Slope (5%)			B1	30-130	10R Red		LS	SG	VS	Ab	vffr	WD	n
			B2	130-160	5YR6/6 Reddish yellow		SL	Cr	S		vffr	WD	n
10	Basement complex	Fallow	A	0-46	2.5Y3/2 Very dark grayish brown	2.5Y7/2 Light gray	LS	Cr	Fr	CL	mfr	WD	n
Slope (3%)			B1	46-95	5YR5/3 Reddish brown		LS	SAB	Fr	CL	ffr	WD	n
			B2	95-110	5YR5/4 Reddish brown	5YR6/3 Light reddish brown	SL	SG	NS	CL	vffr	WD	Fe&Mn

S=Sand; SG=Single grain; FR= Friable; CL=Clear; WD= Well drained; n= None; Ab= Abrupt; St= Stony; Gr= Gravel; SS= Slightly sticky; s= sticky; PD= Poorly drained; VS= Very sticky; Si= Silty; vffr= very few fine root; mmr= many medium root; mfr= many fine root; vfcr= very few coarse root; C=Clay; CL&B= Clear & broken boundary; fr= fine root; SAB= sub-angular blocky; Cr=Crumbly;

Table 2: Physical and Chemical Properties of the Pedons

!	Depth (cm)	Sand (g/kg)	Silt (g/kg)	Clay (g/kg)	B.D (g/cm^3)	pH (H_2O)	O.C (%)	T.N (%)	Av.P mg/kg	K cmol/kg	Na cmol/kg	Ca cmol/kg	Mg cmol.kg	Ex.A cmol/kg	ECEC cmol/kg	%Base saturation
1	0-40	840.0	33.0	127.0	1.08	6.67	0.76	0.22	5.79	2.45	5.44	2.60	1.76	0.63	12.88	95.11
	40-95	843.3	18.0	138.7	1.12	7.00	1.23	0.19	2.58	2.65	3.28	2.74	2.22	1.33	12.22	89.12
	95-155	655.0	45.0	300.0	N.D	6.50	0.58	0.16	2.58	3.50	4.34	2.80	2.14	0.67	13.45	95.01
2	0-40	840.0	37.0	123.0	1.00	6.67	0.76	0.22	5.79	3.15	4.33	3.23	1.81	0.77	13.29	94.21
	40-120	785.0	25.0	190.0	1.22	1.23	1.23	0.19	2.58	6.19	5.94	3.11	2.08	0.73	18.05	95.96
	120-180	630.0	39.0	331.0	N.D	6.58	0.58	0.16	2.58	4.22	5.39	2.92	2..49	0.53	15.55	96.59
3	0-50	835.0	42.0	123.0	1.06	7.33	0.94	0.22	2.75	5.22	5.47	3.15	1.40	1.20	16.44	92.70
	50-120	810.0	49.0	141.0	1.10	7.17	0.90	0.19	3.31	4.58	2.90	2.06	1.84	0.63	12.01	94.75
	120-160	645.0	141.0	214.0	N.D	6.77	0.50	0.16	2.11	4.01	8.88	3.20	2.24	0.53	18.86	97.19
4	0-30	820.0	38.0	142.0	1.58	6.50	0.28	0.17	2.40	0.01	0.02	2.72	0.08	1.10	3.93	72.01
	30-45	770.0	38.0	192.0	1.60	6.30	0.40	0.14	3.55	0.03	0.03	2.80	0.11	1.00	3.97	74.81
	45-130	710.0	38.0	255.0	N.D	6.20	0.68	0.14	4.83	0.02	0.04	3.42	0.12	1.20	4.8	75.00
5	0-46	850.0	08.0	142.0	1.55	6.40	0.48	0.15	3.70	0.04	0.04	3.21	0.08	0.50	3.87	87.08
	46-95	580.0	18.0	402.0	1.41	6.10	1.04	0.15	1.75	0.04	0.04	3.30	0.11	1.10	4.59	76.04
	95-110	610.0	48.0	342.0	1.50	5.60	0.36	0.13	1.39	0.05	0.02	2.89	0.10	0.50	3.56	85.96

O.C= organic carbon; B.D= bulk density; T.N= total nitrogen; Av.P= Available phosphorus; K= porassium; Na= sodium; Mg= magnesium; Ex.A= exchangeable acidity; ECEC= effective cation exchange capacity

Table 2: Physical and Chemical Properties of the Pedons continue

Pit no	Depth (cm)	Sand (g/kg)	Silt (g/kg)	Clay (g/kg)	B.D (g/cm^3)	pH (H_2O)	O.C (%)	T.N (%)	Av.P mg/kg	K cmol/kg	Na cmol/kg	Ca cmol/kg	Mg cmol.kg	Ex.A cmol/kg	%Base saturation	ECEC cmol/kg
6	0-27	620.0	84.7	295.3	1.22	6.3	1.04	0.11	1.67	0.01	0.05	3.78	0.11	0.8	83.16	4.75
	27-100	620.0	84.7	295.3	N.D	6.1	0.68	0.11	2.31	0.01	0.03	3.47	0.15	0.6	85.92	4.26
	100-162	473.3	94.7	432.0	N.D	6.1	0.44	0.13	3.26	0.01	0.04	3.22	0.13	0.9	79.07	4.30
7	0-30	766.7	51.3	182.0	1.14	6.1	0.88	0.17	5.85	0.07	0.04	3.63	0.09	1.00	79.30	4.83
	30-100	660.0	31.3	308.7	N.D	5.7	0.76	0.10	3.14	0.03	0.05	3.22	0.12	0.8	81.04	4.22
	100-152	653.3	51.3	295.3	N.D	6.0	0.20	0.11	2.59	0.02	0.05	3.02	0.10	0.5	86.45	3.69
8	0-40	720.0	88.0	189.3	1.42	6.5	0.76	0.17	2.11	0.01	0.04	2.94	0.09	0.7	81.48	3.78
	40-90	746.0	48.0	207.0	1.38	6.3	0.76	0.17	2.71	0.01	0.09	2.27	0.13	0.7	78.13	3.20
	90-105	596.7	147.3	297.0	N.D	6.4	1.17	0.14	3.34	0.01	0.11	3.86	0.10	0.5	89.08	4.58
9	0-30	830.0	36	134.9	1.21	6.47	0.83	0.16	1.98	0.23	0.49	1.61	1.48	1.0	79.21	4.81
	30-130	805.0	28	167	1.23	6.07	1.02	0.12	2.00	0.31	1.05	2.86	2.18	0.73	89.76	7.13
	130-160	660.0	37	300	ND	6.20	1.07	0.11	4.69	0.13	0.71	3.32	2.15	0.63	90.92	6.94
10	0-46	850.0	19	131	1.78	6.67	0.76	0.22	5.79	0.41	0.44	2.88	1.95	0.67	89.45	6.35
	46-95	815.0	46	139	1.51	7.00	1.23	0.19	2.58	0.31	0.77	2.93	1.59	0.83	87.09	6.43
	95-110	715.0	67	218	ND	6.50	0.58	0.16	2.28	0.40	0.61	3.06	2.25	1.23	83.71	7.55

O.C= organic carbon; B.D= bulk density; T.N= total nitrogen; Av.P= Available phosphorus; K= porassium; Na= sodium; Mg= magnesium; Ex.A= exchangeable acidity; ECEC= effective cation exchange capacity Source: Basil *et al* 2023b

Table 3: Classification of Pedons of Land Use Types of the Study Sites

Profile No	Land use Type	Physiographic location	USDA	FAO/UNESCO
1	Arboretum	Crest	Typic eutrudalf	Rhodic luvisol
2	Arboretum	Middle slope	Typic eutrudalf	Rhodic luvisol
3	Arboretum	Valley bottom	Plinthic eutrudalf	Plinthosols
4	Cashew	Crest	Rhodic plinthiudalf	Plinthosols
5	Cashew	Valley bottom	Rhodic plinthiudalf	Plinthosols
6	Oil palm	Crest	Typic paleudalf	Eutric luvisol
7	Oil palm	Middle slope	Typic paleudalf	Eutric luvisol
8	Oil palm	Valley bottom	Typic paleaqualf	Eutric luvisol
9	Fallow	Crest	Rhodic paleudalf	Rhodic luvisol
10	Fallow	Valley bottom	Plinthic paleaqualf	Rhodic luvisol

Conclusion

It is concluded that the soil characteristics, physical and chemical, varied across the pedons. The organic carbon was found to be low, available phosphorus was also low, and total nitrogen was moderate at the surface. The soils were slightly acidic, as the exchangeable bases had been used up or leached away. This claim was confirmed in the soil pH. The soils are of the soil order Alfisols.

REFERENCES

Aiboni, V.U. (2001). Characteristics and Classification of Soils of a Representative Topography Location in UNAAB. *ASSET Series* A. 1(1): 35-50.

Akinde, P., Olakayode, A.O., Oyedele, D.J. and Tijani, F.O. (2020). Selected physical and chemical properties of soil under different agricultural land-use types in Ile-Ife, Nigeria. *Heliyon* 6(9). Doi:10.1016/j.heliyon.2020.e05090

Basil, E.C., Aderolu, J.A., Ajayi G.A., Olutimi, M.S. and Oloyede, S. (2023a). Georeferencing and Suitability Evaluation of Some Land in Ogun State, Nigeria for Commercial Cassava Production. *Asian Journal of Agricultural Research* 17(1): 25-32

Basil, E.C., Olutimi, M.S. and Aderolu, J.A. (2023b). Suitability evaluation of some land for commonly grown crop in Abeokuta, Ogun State: Challenges and limitations. *Journal of Agriculture, Forestry and Environment* 7(1): 1-11

Bouyoucos, G.H. (1951). A recalibration of the hydrometer for making mechanical analysis of soils. *Agronomy Journal* 43: 434- 438.

Buol. S.W., Hole, F.D., McCracken, R.J and Southard, R.J. (2015). Soil Genesis and Classification. Fourth Edition. Iowa State University Press, Ames, IA 50014.1997.Pp557. ISBN 0-8138-7464-2

FAO. (2006). Guidelines for Soil Description. 4th edition. Food and Agriculture Organization of the United Nations, Rome, 2006.

FAO/UNESCO. (2006). World reference base for soil resources. A framework for international classification, correlation and communication. Rome 2006

Ibrahim, J.A., Lazarus, M.A., Dolapo, A., Agaku, D.A and Slm, H. (2020). Impact of toposequence on soil properties and classification in Zaria, Kaduna State, Northern Guinea Savanna, Nigeria. *International Journal of Environmental Quality* 38. DOI:https://doi.org/10.6092/issn.2281-4485/10043

Jackson, M. L. (1962). Soil Chemical Analysis. Prentice Hall, Inc., Englewood Cliffs, NJ.

Mclean, E.O. (1965). Aluminum: In methods of soil analysis (ed. C.A. Black) agronomy No.9 part 2. *American Society of Agronomy,* Madison.Wisconisin pp978-998.

Murphy D.J., Goggin, K and Paterson, R.R.M. (2021). Oil palm in the 2020s and beyond: challenges and solutions. *CABI Agriculture and Bioscience* (2) 39.https://doi.org/10.1186/s43170-021-00058-3

Obi, J.C and Ogunkunle, A.O. (2022). Soil Survey, Land Evaluation and Food Security Scenario in Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension* 21(3). Pp 29-3

Okafor, B.N and Fabiyi, A.O. (2011). Application of Soil Information in Nigerian Agriculture: A case study of some horticultural farms in Ibadan, Oyo State. *Continental Journal of Agricultural Science* 5(2):31-35. http://www.wiloludjournal.com

Onyekwelu, J.C., Mosandl, R. and Stimm, B. (2008). Tree Species Diversity and Soil Status of Primary and Degraded Tropical Rainforest Ecosystems in Southern-Western Nigeria. *Journal of Tropical Forest Science* 20(3): 193-204. https://www.jstor.org/stable/23616500

Rahman, M., Giller, K.E., Andreas de Neergaard., Magid, J, Gerrie van de ven and Bruun, T,B. (2020). The effects of management practices on soil organic stocks of oil palm plantations in Sumatra, Indonesia. *Journal of Environmental Management* 278 (2021) 111446: 1-10

Schoonover, J.E and Crim, J.F. (2015). An Introduction to Soil Concepts and the Role of Soils in Watershed Management. *Journal of Contemporary Water Research and Education* 154(1): 21-47

Senjobi, B.A. (2007). Comparative Assessment of the Effect of Land Use and Land Type on Soil Degradation and Productivity in Ogun State, Nigeria. Published Ph.D. Thesis submitted to the Department of Agronomy, University of Ibadan, Ibadan. Pp 161.

Senjobi B.A. and Ogunkunle A.O. (2010). Effect of land use on soil degradation and soil productivity decline on Alfisols and Ultisols in Ogun state in South-western Nigeria. *Agriculturae Conspectus Scientificus*. Vol 75(1). pp 9-19

Senjobi B.A., Alabi, K.O, Ajiboye, G.A and Adeofun, C. O. (2019). Characterization and Classification of Soils of a Toposequence at Osun Sacred grove, Nigeria. *Nigerian Journal of Soil Science,* 29(1): 77-86

Soil Survey Staff (2022). Keys to Soil Taxonomy. 13th Edition. USDA, Natural Resources Conservation Service, US Department of Agriculture, Washington DC, pp.73

Sparks, D.L. (1996). Method of Soil Analysis. Part 3 Chemical Methods Soil Science Society of America and ASA Madison, W.I.P pp551-574

Walkley, A. and Blank, I.A. (1934). An examination of the Degtjareff method for determining soil organic matter and proposed modification of the chromic acid titration method. *Soil Science* 37:29-37