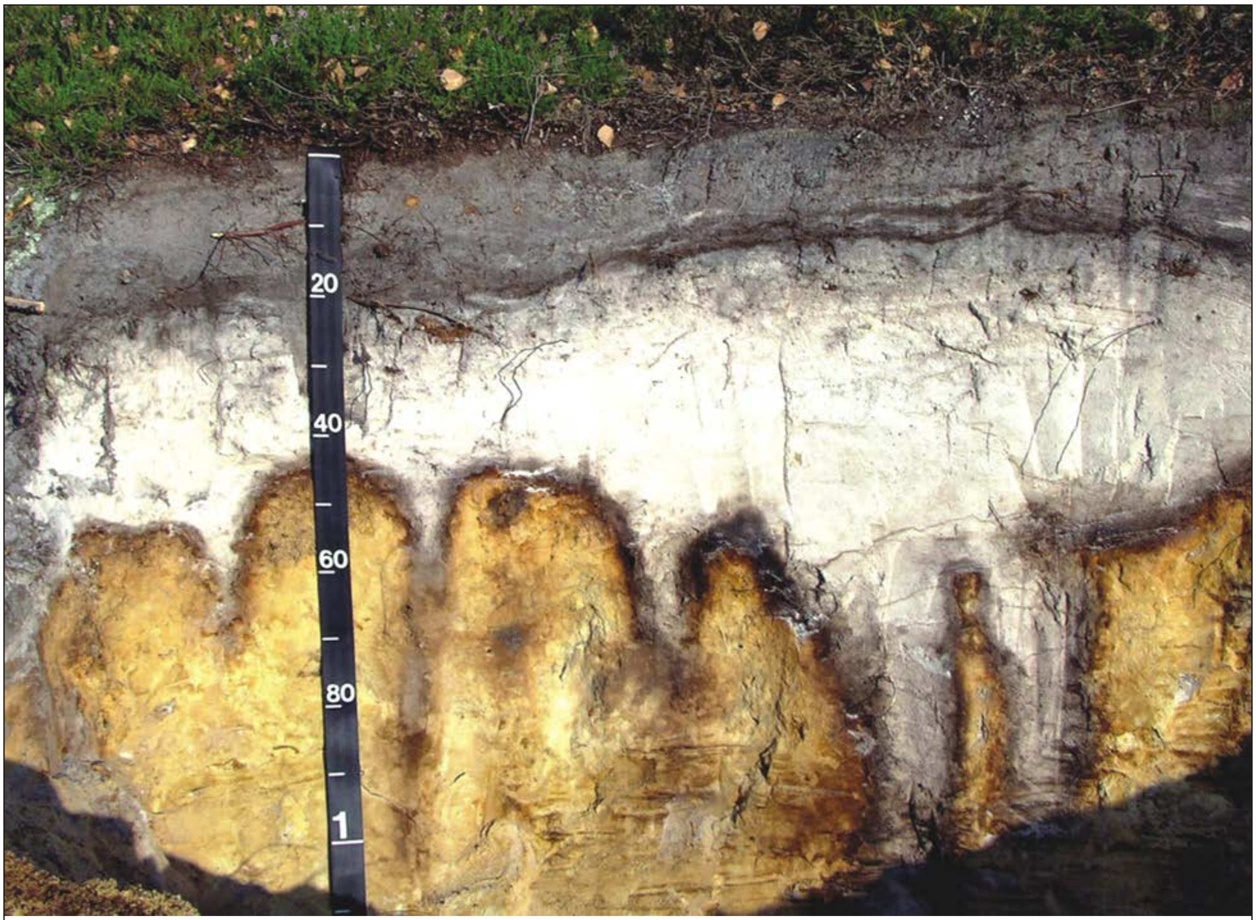

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Properties, Genesis, Classification, Capability and Sustainable Management of Soils from South-Western Nigeria

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ABSTRACT
Soils derived from some parent materials in South-Western Nigeria covering 219,580 ha of land were mapped at a scale of 1:50,000 using a combination of conventional and remote sensing methods of soil survey. The aim is to generate detailed information on the properties, genesis and land characteristics of these soils for their sustainable use and management. Seven soil series were identified and classified (Kulfo series, Typic Paleudalf; Ibeshe series, Typic Rhodudalf; Idesan Series, Fluventic Eutrudept; Iweke Series, Typic Udipsamment; Alagba Series, Typic Haphudalf; Ondo Series, Typic Ferrudalf and Fago Series, Typic Plinthudult). Soils of Ondo and Fagbo series contain a lot of iron manganese concretions, quartz stones and gravels. The soils are very strongly acidic (4.50) to moderately acidic (5.70). The soils have moderately low inherent natural fertility with low exchange basic cations (Ca, Mg, K, Na), organic carbon, cation exchange capacity, total nitrogen but moderate to high micro-nutrients (Cu, Fe, Mn and Zn). Soils of the sedimentary origin (Alagba, Iweke, Idesan, Kulfo and Ibeshe) were observed to be more fertile and more variable in soil properties than those derived from the basement complex (Ondo and Fagbo series). Dominant pedogenic processes which influence the rate of soil development within the study area include hydrolytic weathering, lessivation, plinthization, pedoturbation, braunification, induration, leaching, erosion and colluvial deposition. The soils were classified into land capability classes. Only four (I, II, III and IV) out of the eight capability classes were encountered. Recommendations for sustainable use and management of these soils are discussed.

Key words: Soil properties, genesis, classification, sustainable management, South Western Nigeria

INTRODUCTION
One of the major factors limiting optimum crop production in the tropics is the lack of detailed information on soil and land characteristics. Soil characterization provides the information for our understanding of the physical, chemical, mineralogical and microbiological properties of the soils we depend on to grow crops, sustain forests and grasslands as well as support homes and society structures (Ogunkunle, 2004). Previous efforts at understanding the genesis, chemical and mineralogical properties of soil formed in the basement complex of South-Western Nigeria have been directed at the study of veneer of pedisediment over saprolite. Amusan and Ashaye (1991)

suggested that a consideration of the interaction episodic landscape erosion and pedo-genesis was required to explain soil genesis. In the basement complex area, there is a strong relationship between topographic position and soil genesis (Moorman, 1981). Landscapes position influences run off, drainage and soil erosion, hence soil genesis is affected. Different soil properties encountered along landscapes will affect pattern of crop production, soil physical properties such as clay content distribution with depth and sand content which have been shown to be highly correlated with soil genesis while soil organic matter has been shown to vary with slope position (Miller *et al*., 1988). Other studies which support the current study have been documented (Yakubu and Ojanuga, 2009; Ojetade *et al*., 2014; Esu *et al*., 2014; Fasina *et al*., 2007a). Sharu *et al*. (2013) reported that coupling of soil characterization and classification provides a powerful resource for benefit of mankind especially in the area of food security and environmental sustainability while, Lekwa *et al*. (2004) reiterated that soil characterization provides the basic information necessary to create functional soil classification schemes and assess soil fertility in order to unravel some unique soil problems in an ecosystem. This present study therefore examines the genesis, properties of soil resulting from weathering of sedimentary and basement complex parent materials under humid tropical climate and attempts at classifying the soils and recommending appropriate sustainable management systems for these soils.

MATERIALS AND METHODS

Study site characteristics: The location of the study area is Ijebu East Local Government in Ogun State, Nigeria. The area lies approximately between longitudes 04°0' E and 04°30' E and latitudes 06°40' N and 07°0' N. The survey area falls within rain forest zone. The geology is a mixture of sedimentary and crystalline rock of the basement complex rocks especially granite gneisses. The time duration of the study was between February 2013 and January 2014.

Methodology: A combination of the conventional and remote sensing method of soil survey was used in this study. Digital data on landform used followed the landform model using the ASTER 30 meter resolution Digital Elevation Model (DEM) projected to Universal Transverse Mercator (UTM), World Geodetic System (WGS) 84. The digital landscape data used was from the vegetation and land use project of Forestry Management Valuation and Coordinating unit (FORMECU) of the Federal Ministry of Environment. Digital geologic data was however derived from the geologic maps of the Federal Geological Survey of Nigeria. Provisional photo-soil maps were obtained when the land form/land use and geology vector GIS layers were loaded into Arc. The GIS 10 and the spatial proximity function, intersect was used to spatially merge the three into one layer. This way, every single polygon had defined the land-use, geology and landform data. A new composite class mapping units were then created with the combination of the three parameters. The provisional soil photo maps were then taken to the field for detailed soil survey using grid method within the selected sampling areas. The result was then used to extrapolate the whole study area. After the mapping exercise, soils with similar characteristics were grouped together as the mapping unit. Seven soil types were identified. Soil profiles pits (07) were located and dug to represent each of the soils identified on the field. The soil profiles were described and soil samples collected for laboratory analysis. For each of the soil profile samples collected, records were taken on soil colour, texture, structure, consistence, stoniness, mottles, cutans and concretions. Major diagnostic horizons were also identified using major morphological properties.

Laboratory analysis: Samples were prepared and routinely analyzed following the guidelines of IITA (1979).

Soil classification: The soils identified were classified according to Smyth and Montgomery (1962), Moss (1957), FAO and UNESCO (2014) and USDA (2014).

Land evaluation: The potential of the soil for land use was assessed using Land Capability Classification (LCC) as modified by USDA (Khingebid and Montgomery, 1961).

RESULTS

Morphological and physical properties: Seven soil mapping units were identified in the study area, denoted by: JB1, JB2, JB3, JB4, JB5, JB6 and JB7 (Table 1).

Soil unit JB1: It is deep, poorly drained, dark grayish brown (10YR4/2, dry) colour with sandy loam texture coming down to light gray (10YR7/2, dry) to brownish gray (10YR6/2, dry) sandy clay loam subsoil. The soil unit occupies the narrow flood plain (Fadama/inland valley which experience seasonal flooding and water-logging. The soils are weakly structured and there is evidence of stratification with weak horizon differentiation on the field. Stratification of parent materials is not uncommon in soils having alluvial origin such as the one encountered on this soil mapping unit. Bulk density values ranged from 1.43 g cm^{-3} on top to 1.46 g cm^{-3} in the sub-soil and these values are rated low. Soil pH ranged from 4.50-5.50 in the sub-soil indicating very strong acid to strongly acidic Soils of this unit have moderately low inherent natural fertility. This is because they are low in organic matter and were highly weathered. They were also low in exchangeable basic cation such as Ca, K, total Nitrogen, but moderate in Mg and available phosphorous. The soils were however high in available Cu, Fe and Mn but low in Zn.

Soil unit JB2: It is deep, well drained with sandy loam texture on top and they occupied the middle slope portions of the landscape with dominant gradient of 2.5%. Soil colour range from dark brown (7.5YR3/4, dry) on top coming down to yellowish red. (5YR5/8, dry) Red (2.5YR5/8, dry) with sandy clay subsoil. Structural aggregates are weak to moderate. Bulk density values ranged from

Table 1: Summary of the major characteristics, classification and land capability classification of soils of Ijebu East, South-Western Nigeria

Locations/ mapping units	Hectares (ha)	Geology/parent materials	Effective soil depth (cm)	Soil textures	Soil classification systems USDA	FAO	Series	Land capability classes
Agerige/JB1	5919.23	Alluvial	164	SL-SCL	Fluventic Eutrudepth	Eutric Fluvisol	Idesan	I
Imegun Junction/ JB2	1963.84	Sandstone	120	LS-SC	Typic Paleudalf	Ferric Lixisol	Kulfo	IIe
Ogbere Atakobo/ JB3	105,532.7	Granite gneiss	149	LS-SCL	Typic Ferrudalf	Ferric Luvisol	Ondo	IIe
Ijebu Ife/JB4	7,949.60	Sandstone	167	S-SC	Typic Hapldult	Dystric Acrisol	Alagba	IIs
Ebute Imobi/JB5	229.61	Coastal plain sand	189	S-LS	Typic Undissamment	Gleyic Arenosol	Iweke	IIIs
J4-1								
JB6	56,271.59	Granite gneiss	105	LS-SC	Typic Ferrudalf	Humic Nitosol	Fagbo	IV (6% slope) >70% concretions
Terelu Imobi/JB7	41,714.43	Coastal plain sand	184	LS-SC	Typic Rhodoudalf	Rhodic Nitosol	Kulfo	IIs

1.30-1.72 g cm^{-3} in the subsoil. These bulk values are rated low and will not impair crop production. The soils are very strongly acidic (5.4). The soils are low in cation exchange capacity, basic cations (Ca, Mg, K), total nitrogen available phosphorus and organic carbon. The soil unit was however moderate in available micronutrients (Cu and Zn) but high in Fe and Mn.

Soil unit JB3: It occupies upper slope to middle positions of the landscape with dominant gradient of 3-4% with a granitic parent material. They were mostly deep and well drained. They are low in their inherent fertility status. They have low cation exchange capacities, Ca, Mg, K, N, P, K and organic carbon, but moderate in Cu and Zn but high in Mn and Fe. Bulk density values range from 1.54 g cm^{-3} on top coming down to 1.54 in sub soil.

Soil nit JB4: It occupies slightly undulating upper slope positions of the landscape with dominant gradient of 2%. They were mostly deep, well drained and developed over sandstone parent material. Soil colour ranged from weak Red (2.5YR4/2, dry) with loamy-sand on top coming down to sandy clay with Red colour (10R4/6, dry) in the subsoil. The soils have moderate, medium sub-angular blocky structure on the surface coming down to strong medium sub-angular blocky structure in the subsoil. Bulk density values range from 1.41 g cm^{-3} on top coming down to 1.62 g cm^{-3} in the sub-soil. The soil mapping unit was low in their inherent fertility status. They have low cation exchange capacities, Ca, Mg, K, N, P, K and organic carbon. They are also low in Zn, moderate to high in Mn, Cu and Fe. The soils are moderately acidic (5.6-5.7).

Soil unit JB5: It is the deepest and the most well drained of the soil mapping units. The unit occupies the nearly flat lower slope to the foot slope positions of the landscape developed on coastal plain sand. They have a surface colour of dark brown (10YR2/2, dry) with a sand texture coming down to dark yellowish brown (10YR4/4, dry)/brown (10YR4/3, dry) to reddish yellow (7.5YR6/6, dry) sand subsoil. Bulk density values range from 1.28-1.43 g cm^{-3} in the subsoil. These soils are also low in their inherent fertility status. They have low cation exchange capacities, Ca, Mg, K, N, P and organic carbon. They are low in Cu and Zn but high in Mn and Fe. The soils are moderately acidic (5.80) to strongly acidic (5.20).

Soil unit JB6: It occupies upper slope to crystal position of the landscape with gradients of about 3%. The soils were moderately deep to deep and well drained. Quartz and gravels were encountered at a depth of about 50 cm downwards. The soil has a dark brown (5YR3/2, dry) colour with a loamy sand texture on top coming down to yellowish red (5YR5/8, dry) gravelly Sandy clay. The soil has a weak medium crumb structure on the surface coming down to strong moderate coarse sub-angular blocky structure in the subsoil. Soils bulk density values range from 1.32-1.62 g cm^{-3} in the subsoil. The soils are strongly acidic (5.4-5.60). The soil mapping unit was low in their inherent fertility status. They have low cation exchange capacities, Ca, Mg, K, N, P and organic carbon. They were also low in Cu and Zn, moderate in Mn and high in Fe.

Soil unit JB7: It occupies the middle to upper slope position of the landscape with gradients of about 3% and developed on coastal plain Sand. The soils were moderately deep to deep and well drained. The soil has loamy sand texture with yellowish red colour (5YR5/8, dry) on top coming down to red (2.5YR 4/6, dry) sandy clay subsoil. Quartz and gravels were encountered at a depth of about 50 cm downward. The soil mapping unit was low in their inherent fertility status. They have low cation exchange capacities, Ca, Mg, K, N, P and organic carbon. They are however, high in Cu, Zn, Mn and Fe. Bulk density values range from 1.31-1.37 g cm^{-3}. The soils are moderately acidic (5.6-5.8).

DISCUSSION

Morphological and physical properties: The Ap horizon on all the profiles have high sand content (>66%) with low clay content and weak structure. These properties make the soil very vulnerable to erosion in as much as they are easily detached under the impact of rain-drops or running water. When loose sand is deformed, there is a volume reduction due to sliding or rolling down into a compact state. The particles tend to lie in close contact because of a lack of bridging materials like organic matter. The land on which most of the soils are situated should not be mechanically cleared because of the fragile and sandy, loose nature of the soils. This is because mechanical land clearing would expose the structurally imbalanced subsoil to erosion, leaching, degradation and compaction. Under bushing of the bush and the use of chainsaw to clear the trees are recommended. In addition to the inherent physical properties of the soils, the soils are in areas of high rainfall erosivity and undulating topography. There is the need to understand these properties for a judicious use of the soil. Matching these properties with an appropriate land use would be the cardinal principle for using these soils. Some of these soils have been reported to have given reasonably good yields with good soil management.

The silt/clay ratio ranged from 0.11-2.25. Van Wambeke (1962) reported that “old” parent materials usually have a silt/clay ratio below 0.15 while silt/clay ratios above 0.15 are indicative of “young” parent materials. Results of this study shows that most of the soils have silt/clay ratio above 0.15 indicating that the soil are relatively young with high degree of weathering potential. Silt/clay ratios are relatively higher in the surface horizon and decrease with increase depth in the pedons. The decrease in silt/clay ratio with depth is an indication that sub-soils horizons are more weathered than surface horizons.

There is appreciable variation among and within the soils in bulk density value and this is due to differences in mineralogy, clay content and structural development. The values ranged from 1.27-1.44 g cm^{-3} in the Ap horizon and 1.11-1.73 g cm^{-3} in the subsurface horizon. Plants perform best in bulk densities below 1.4 and 1.6 g cm^{-3} for clayey and sandy soil respectively (Miller and Donahue, 1990). With the Ap horizon bulk density of <1.53 g cm^{-3}, the surface soil of the study area do not appear to offer any resistance to root penetration or growth. Root growth could also be inhibited due to high bulk density because of soil resistance to root penetration, poor aeration, slow movement of nutrients and water and build up of toxic gases and root exudates as reported by Tarawali *et al*. (2001) and Odunze (2006). However, the bulk density values of all the soils are favourable for crop production.

Porosity values ranged from 47.2-52.1% on the surface of all the soils. Maniyunda and Malgwi (2011) reported similar values in the soil of Zaria, Kaduna State, Nigeria. Fetter (1998) and Rieu and Sposito (1991) recommended that soils having porosity of over 50 and 45-50% of volume are good agricultural soils. The values of porosity recorded for soils in this study shows that they are good agricultural soils. The porosity values decreased gradually with depth owing to poor structural development in the sub-surface horizons.

The surface soils are very strongly acidic (4.5) to strongly acidic (5.3) on the surface. Soil pH was observed to increase or decrease irregularly with increasing depth. Similar trends have been observed and reported by Sharu *et al*. (2013) and Fasina *et al*. (2007a). According to Landon (1991), a pH range of 5.5-7.0 is the preferred range for most crops. Factors suggested to be responsible for the acidic soil may include heavy rainfall, the acidic nature of some of the parent rock and the acidic precipitation around the study area. Annual rainfall around the study area is about 1362.20-2133.4 mm and most of this fall within five to seven months in the year. This distribution of rainfall is considered adequate for leaching and colloid translocation.

Organic carbon in all the pedons decreased irregularly with depth and very low with values being <10.0 g kg^{-1} in the Ap horizons except the high value (23.14 g kg^{-1}) recorded at JB2 site. The low organic carbon content of the soil recorded might be due to continuous cultivation and frequent burning of farm residues which tend to destroy much of the organic materials that could have been added to the soil. It might also be due to the effect of high temperature and relative humidity which favour rapid mineralization of organic matter (Fasina *et al*., 2006). The low organic matter content recorded on the average for most of the soils cannot sustain crop production program. Therefore, the organic matter content has to be substantially increased through effective crop residue management.

Total nitrogen status for some of the soils range from very low to low (JB1 = 0.35-0.84 g kg^{-1}, JB3 = 0.56-0.55 g kg^{-1}, JB4 = 0.70-0.70 g kg^{-1}, JB5 = 0.70-0.70 g kg^{-1}, JB6 = 0.42-0.35 g kg^{-1}, JB7 = 0.56-1.96 g kg^{-1}) while it was moderate for JB2 = 1.12-0.28 g kg^{-1}. Similar results of very low to low N values have been reported by Fasina *et al*. (2006). The total nitrogen values of the soil in the area changed irregularly with depth and this could be attributed to influence of continuous cultivation, a common practice on Nigerian soils caused by crop residues removal (Noma *et al*., 2011).

The exchangeable bases of the soil are generally low. Exchangeable Ca dominated the exchange site. Similar results have been reported by Fasina *et al*. (2006) and Noma *et al*. (2004). The values of Exchangeable Sodium Percentage (ESP) in all the soils are generally low (<15%), the critical limit for sodicity (Brady and Weil, 2002). The soils are therefore not sodic. Cation Exchange Capacity (CEC) of the soil are generally from low to medium according to Esu (1991) rating of <6 = low, 6-12 medium and >12 = high. The low CEC values indicate that the soil have low potential for retaining plant nutrients, hence the necessity for adequate soil management. The low CEC of the soils could be attributed to the nature of clay minerals (Kaolinite) (Hassan *et al*., 2011; Yakubu *et al*., 2011).

Soil classification: The soil morphological, physical and chemical properties were used to classify the soil according to USDA (2014), FAO/UNESCO (FAO and UNESCO., 2014) and local system of Smyth and Montgomery (1962). The seven soil mapping units that were identified in the study area and denoted by JB1, JB2, JB3, JB4, JB5, JB6 and JB7 are as discussed below:

JB1 (Agerige): This group of soil is characterized by altered horizon. They are recognized on the field by weak evidence of horizonation with the presence of cambic B horizon. There is evidence of stratification. Soils are developed on alluvial deposits. The soil has subangular blocky at the surface. These soils were classified as order Inceptisol and suborder Udept. They are also classified as Eutrudept because they have a base saturation of 50% or more in one or more horizons at a depth between 25 and 75 cm. They are later classified as sub-group Fluventic Eutrudept because there is an irregular decrease in organic-carbon content between a depth of 25 cm and at a depth of 125 cm. The soil was classified as Eutric Fluvisol because of the high base saturation of the soil and the fluventic nature of the soil. They were also classified at series level as Idesan series. The results obtained for this pedon agreed with the findings of Fasina *et al*. (2007b).

JB2 (Imegun Junction): This pedon is characterized by presence of argillic horizon and base saturation was more than 50%. These soils were classified as order Alfisols and suborder Udalf and great group Paleudalf and subgroup Typical Paleudalf. Using World Reference Base (2014), the soils are classified as Ferric Lixisols and as Idesan series at local level. Yakubu and Ojanuga (2009) also obtained similar results in a similar study.

JB3 (Ogbere Atakobo): Pedons were characterized by presence of argillic horizon with base saturation greater than 50%. These soils were also classified as order Alfisol. They are later classified as suborder Udalf and great group Ferrudalf because they are enriched with iron, i.e. presence of ferric horizon (iron and manganese) concretions with mottles. They are classified as subgroup Typic ferrudalf. They are classified as Ondo series at local level. Using World Reference Base (2014) they are classified as Ferric Luvisol.

JB4 (Ijebu Ife): These are well drained soils with brownish red and friable sand on top coming down to sandy clay in the subsoil. They are developed on ferruginous sandstone and also on younger less consolidated sands and are found located on upper slope (2%). There is presence of argillic horizon with low base saturation less than 50% in the major parts between 20 and 100 cm from the soil surface. This soil was classified as order Ultisol and great group Hapludult and subgroup Typic Hapludult (USDA, 2014). Also using the World Reference Base (2014), the soil was classified as Dystric Acrisol and as Alagba Series at local level.

JB5 (Ebute Imobi): This pedon shows no major diagnostic horizon, with evidence of recent deposition or continuous deposition and also with clay minerals less than 15% throughout th soil profile. This type of soil was classified as order Entisol (USDA., 2014) and suborder Psamment and great group Udipsamment and subgroup Typic Udipsamment. Using World Reference Base (2014), they are classified as Gleyic Arenosol and as Iweke series at local level.

JB6 (J4-1): These are well drained, black soil on top coming down to red sub-soil with diffuse horizon boundaries with argillic B horizon with nut-shaped structure, shining ped faces and appreciable amount of Fe_2O_3. They also have low base saturation. They are classified as order Ultisol, suborder Udult and great group Plinthudult (have plinthites within 150 cm of the surface). They are classified as Typic Plinthudult and as Plinthic Acrisol (World Reference Base, 2014). They are classified as Fagbo series at local level.

JB7 (Terelu Imobi): These are soil having within 150 cm of the soil surface a subsurface layer 30 cm or more thick, with a munsell hue redder than 5YR. There is evidence of argillic horizon with high base saturation (>50%). They are therefore classified as order Alfisol, sub-order Udalf and great group Rhodoudalf, sub-group Typic Rhodoudalf and Rhodic Nitosol (World Reference Base, 2014). They are classified as Kulfo series at local level.

Soil genesis: Hydrolytic weathering was observed as one of the major pedogenic process within the study area. High rainfall, high soil temperature, acidic precipitation and geo-chemical nature of the parent rock all seems to encourage hydrolytic weathering since precipitation is higher than 0.8 PET in this region, leaching of basic cation is also encouraged. High temperature encourages photolysis of water. Ojanuga (1979) remarked that warm soil temperature causes marked dissolution of soil water, ending to a build-up of hydrogen ions. Siever (1962) reported that high soil temperature and extreme leaching favour rapid disilication and accumulation of iron, immobilized in ferric oxide forms under oxidizing conditions. Most of the pedogenic processes that do occur within the study area are being favoured by humid conditions, free internal drainage, geomorphic stability over prolonged period of time and strong weathering intensity (Beinroth, 1982). In the basement complex region of South-Western Nigeria, the climate is humid as precipitation is greater than evapotranspiration (ET) for greater part of the year with continually high temperature. Both the climate geologic and physical settings of the region predispose the parent rock to ferralitization (Tessens and Shamshudin, 1992). Soils of Ondo (JB3) and Fagbo series (JB4) experienced ferralitic weathering, while lessivation, braunification, floral and faunal pedoturbation, erosion were experienced by JB1, JB2, JB5, JB6 and JB7 soils. Induration, mobilization and subsequent immobilization of iron during redox cycles in soils and cyclic change of climate were considered as other dominant pedogenetic processes in these soils.

Sustainable management of the soils: The land on which most of the soils are located should not be mechanically cleared because of the fragile and sandy loose nature of the soils. This is because mechanical land clearing would expose the structurally imbalanced sub-soil to erosion, leaching, degradation and compaction. Under-brushing of the bush and use of chainsaw to clear the trees is recommended. The acidity nature of the soil warrants lime application, especially in the subsurface layers which support the roots of most of the arable and tree crops. The organic matter which is low has to be substantially increased through effective crop residue management with increase use of leguminous plants as well as judicious use of organic fertilizers. Appropriate use of chemical fertilizers will ameliorate exchangeable base limitations, but the use of ammonium sulphate fertilizer should be avoided in order to prevent erosion, leaching and an increase in the level of acidity of the soil (prevent leaving acidic residues in the soil). Post harvest incorporation of plant residue into the soil instead of the usual burning of crop residue to stimulate the emergence of new flushes for grazing will stabilize the soil aggregates. Minimum tillage is recommended because of the concretionary nature of some of the soils (JB3 and JB4). The soil with hardpan concretions and induration must always be under cover to prevent serious erosion. Only four of the eight original classes of Land Capability Classes (LCC) were encountered, these are I, II, III and IV. Class I land is very good, rarely level land, with deep easily worked soil that can be cultivated safely with ordinary good farming methods. This type of land (class I) was encountered at Agerige (MU JB1) and constitute 2.7% of the total land area of study. Mapping units JB2, JB3, JB4 and JB7 were classified into class II. This type of land class is good but it has some limitations. It needs moderately intensive treatment if it is to be cultivated safely. This land class covers 22.5% (49,664,03Ha) of the total area of study. This land class has a good potential for most arable crop production (e.g. maize, cassava, yam, etc). Mapping units JB5 falls into capability class III. This land class is moderately good and can be used for cultivated crops regularly in a good rotation if ploughed on the contour of slopping fields. It has limitations of such degree that intensive treatment is necessary. This type of treatment may be terracing or strip cropping to control erosion, or intensive water management on flat areas. Mapping unit JB6 was classified in capability class IV. This class of land is good for pasture or forestry, because its use for cropping is very limited by natural features such as slope, erosion, adverse soil characteristics (texture) or adverse climate. The Framework for Evaluating Sustainable Land Management (FESLM) as proposed by Smyth and Dumanski (1993) can be adopted in the sustainable management of these soils.

CONCLUSION

Seven soils (JB1, JB2, JB3, JB4, JB5, JB6 and JB7) derived from sedimentary and basement complex origin in Ijebu East were mapped, characterized, classified and their genesis discussed. The soils are strongly acidic (4.50) to moderately acidic (5.7). The soils also have moderately low inherent natural fertility with low exchange basic cations, organic carbon, cation exchange capacity, total nitrogen but moderate to high micronutrients (Cu, Fe, Mn and Zn). Soils of the sedimentary origin (Alagba, Iweke, Idesan, Kulfo and Ibeshe) were observed to be more fertile and more variable in soil properties than those derived from the basement complex (Ondo and Fagbo series). Appropriate recommendations for the sustainable use of these soils are discussed.

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