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CHARACTERISATION AND FERTILITY CAPABILITY STATUS OF ALFISOLS UNDER DIFFERENT LAND USES IN OGUN STATE, SOUTH WESTERN NIGERIA

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ABSTRACT

This study was designed to assess the fertility potential of agricultural soils for optimal and sustainable production. Soils under five land uses were characterized and evaluated for fertility status using Fertility Capability Classification (FCC) systems.

The results showed that the morphology, physical, and chemical properties of the soils varied from one land type to another in all the five land use types with the major differences being in texture, structure, colour, drainage, and soil consistence. The FCC systems classified pedons in land use 1 as Leg' (Loamy acidic moist), Cevd'' (Clayey acidic dry), and Led'' (Loamy acidic dry); land use 2 as Le'' (Loamy acidic), and SLe' (Sandy Loam acidic); land use 3 as Le'' and Led''; land use 4 as Le, Le' and SLe; and land use 5 as Leg', SLe'' and Led soils. The FCC results showed that the basic differences between soils in all land use types examined were in the texture and condition modifiers with low ECEC (e) and gravel concentration (' and ''), being most prominent. In order to improve the productive capacity of the soils, application of inorganic fertilizer and organic manures, cultivation of cover crops, and correct usage of the land for the purpose it is best suited are recommended.

Keywords: Soil characteristics, fertility status, land use, optimal production, Nigeria

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INTRODUCTION

Uncontrolled soil erosion and continuous cropping with little or no improvement measures are major constraints reducing the soils productive capacity. One of the noticeable indicators of soil nutrient depletion is the decline in humus content as occurs after ploughing a virgin soil (Snakin *et. al*., 1996). Mining of soil nutrients through poor agricultural management naturally decreases the contents of such nutrients as nitrogen (N), phosphorus (P), and potassium (K). An increase in exchangeable sodium percentage (ESP) and a lowering of redox potential were indicative of soil nutrient depletion and decreased productivity of a land. Thus, the change in redox potential as occurs during water-logging of soils is a measure of soil quality.

According to Sanchez and Logan (1992), about 36 % (approximately 1.7 billion ha) of tropical soils are low in nutrient reserve as they contain less than 10% weatherable minerals in the sand and silt fractions. These intensively weathered soils can supply only a

limited amount of the nutrients such as P, K, Ca, Mg and S. They are particularly common in the humid tropics (66 % of the surface) and savannas (55 %). In western Nigeria, an average annual loss of 2,540 kg/ha of organic carbon, 210 kg/ha of N, 11.12 kg/ha of P, 18.6 kg/ha of K, 140 kg/ha of Ca and 11.0 kg/ha of Mg are attributed to run off and eroded sediments (Lal, 1988). Resulting from leaching, particularly in humid areas, soluble nutrients from the root zone can be transported into deeper soil layers. Acidification produces aluminium toxicity and ferrous oxide leading to phosphorus fixation of P which is no longer available for plants. A ferrous oxide/clay ratio of >0.2 is considered to be the threshold for P-fixation and affects 22 % of all tropical soils (Sanchez and Logan, 1992).

Phosphorus fixation is more frequent in the tropics and occurs to a significant degree in savannah and steep highlands. Substantial quantities of nutrients are exported from agricultural soils during harvest. If the exported nutrients are not replaced through biological N fixation, application of mineral fertilizers, manures and composts or subsequent delivery through weathering soil minerals, the nutrient content of the soil will decline rapidly.

In view of the above, there is need to assess the fertility status of agricultural soils in southwestern Nigeria, more so that consideration was not given to this by the peasant farmers as a means of optimising crop production. This study specifically focuses on characterization as well as determining the fertility status of agricultural soils with the aim of sustaining and optimising soil production to meet the global demand of food sufficiency.

MATERIALS AND METHODS

Description of the Study Area

The study area is Olabisi Onabanjo University Campus site, Ago-Iwoye, about 100 km southeast of Abeokuta, Ogun State. The area, about 3.50 km southwest from the town centre is located between latitudes 6^0 $55^{'}$ and 7^0 $00^{'}$ N and between longitudes 3^0 $45^{'}$ and 4^0 $05^{'}$ E.

Climate

Ago-Iwoye falls within the rain forest region of southwestern Nigeria with two main alternating wet and dry seasons which can be sub-divided into: the long wet season from mid-March to July, the short dry season in the month of August, the short wet season from September to early November and the long dry season from early November to mid-March during which the local harmattan period prevails between December to February. The area has a bimodal rainfall, with peaks between June-July and September-October. This is followed by a short period of dry season which is usually between November and February. It has an annual rainfall of about 1150 mm and is located in the rain forest belt. Mean relative humidity of the area is generally high (about 80%) with the peak between May and October. The diurnal temperature ranges from highest in November to May and the lowest from June to October. The annual mean temperature is 27^OC. Sunshine hour also follows the same trend as that of the temperature with the highest number of hours during dry season and the lowest during the wet season.

The Vegetation

The natural vegetation of the area consists mainly of secondary forest except where human interference through annual uncontrolled bush burning and small scale farming method have reduced the original forest to secondary ones, bush re-growth and thickets. The original forest is now mostly confined to river channels and swamps. The mature vegetation consists of:

(a) Very tall emergent trees with height range of 30-40 m scattered all over the region without continuous canopy;

(b) The middle layer trees with height range of 10-30 m; and

(c) A continuous layer of trees with height range of 10-16 m. These are impenetrable and are underlaid by shrubs and herbs and thickets undergrowth.

Tree species found in the study area include *Pentaclethra macrophylla, Bosqueia angolensis, Piptadeniastrum africanum, Antiaris toxicaria* var *africana, Cola milenii, Cola gigantea, Milicia excelsa, Guarea spp.* and *Mimusop spp.* There is also wide spread occurrence of *Elaeis guineensis* and the dominance of *Chlomolaena odorata*, a perennial weed in fallow lands. This perennial weed reduces the amount of litter regeneration and the rate of re-growth of other weedy species in the study area.

The dominant vegetation type is the secondary forest. Cultivated land and bush re-growth accounted for less than 10 % of the land area where Apomu, Egbeda and Olorunda soil series dominate. The isolated trees are often felled, cut into logs and used for lumbering.

The Geomorphology

The site is generally undulating with a few gentle to steep slopes. A range of relatively steep-sided hills running north to south is situated to the west of the site. The highest in the range is Oloro hill (110 meters). Another range of residual hills approximately parallel to the former occurs in the central part. Some scattered residual hills also occur to the southeast. These hills are dissected by the tributaries of river Erigba which form the western boundaries. River Omi has extensive alluvial plains on both banks although there is more of the alluvium on the southern bank than the northern one. River Omi meanders profusely through the site but this is more pronounced in the southwestern section of the site.

Geology

Most of the soils in the survey area developed from undifferentiated igneous and metamorphic, Pre-Cambrian basement complex rocks such as granite, biotite gneiss, biotite schist, quartz schist and quartzite. The rocks are fairly deeply weathered and the occurrence of rock out-crops in the survey area is not widespread. Soils of the western range of hills including those of Oloro hill evolved from cretaceous iron-rich sandstone. The top layers of the soil contain varied amounts of ironstone gravel formed from solubility, mobility and irreversible oxidation of iron in the ferruginesed sandstone. The alluvial sand deposits along River Omi are occasionally mixed with clay downstream.

The Soils

Most of the soils derived from coarse-grained rocks are generally characterized by their varying amounts of quartz and/or ironstone gravel with some occasional stones in the top one meter of the profile. Varying quantities of gravel and stones may be found on the surface of these soils.

The soils of the site have been classified into associations and series. Five soil associations occur on the site. Four of these, comprising Iwo, Egbeda, Okemesi and Jago derived from the basement complex rocks, while the fifth one (Oteyyi), developed from sandstones. In each soil association is found a number of soil series.

Land Use Types

The total area of the study site is 3,141 hectares, with about 35% opened for building construction while the other land use types occupy the remaining 65% currently. The major land use types in the study area are arable and cash crop production, and non-agricultural uses such as residential, commercial, and road construction. The major food crops in the area include cassava, maize, cocoyam, yams, melon, cowpeas, and a variety of vegetables and fruits are secondary crops. The major cash crops are cocoa, oil palm, kolanut and citrus while the commonest cropping pattern is early maize + cassava, yam + maize + melons. For the purpose of this study, five land use types were involved. These included the fallow land, secondary forest, arable cropping, oil palm plantation, and building sites.

The land is cropped 3 – 5 years before it is returned to fallow depending on the fertility status of the soil. Oil palm plantation which was basically established about thirty-six years

ago for commercial purpose is with little or no input of fertilizers. The predominant land types found at the study site are dissected, undulating (gentle or sharp), and flat lands.

Field Work

Identification and Demarcation of Land Types and Land Use Types

Five land use types, namely, arable cropping (land use 1), oil palm (land use 2), fallow (land use 3), secondary forest (land use 4), and building sites (land use 5) were studied. At each of the chosen land use types, an area of 50 hectares was identified with the aid of tape measurement. This was divided into 10 units of 5 ha each. In each of the 5 hectares unit, land degradation type, land type and soil type were recorded. Within each 5 ha area, soil samples were augered using grid survey approach at 100 m equidistant points. Bulk samples consisting of ten (10) surface (0-15 cm) and subsurface (15-30 cm) core samples were collected separately for physical, chemical and biological analyses

Identification, Mapping and Description of Soils of the Land Types and Land Use Types

Profile pits (2 m x 1 m x 2 m) were dug at the three predominant different land types or slope segments encountered. These were crest, middle slope, and valley-bottom. The general site description such as climate, vegetation, a nd land use, gradient of slope, drainage type, soil surface form, type and degree of erosion, field texture, micro-relief and depths to ground water table were recorded. The pits were described, sampled and the samples analysed according to Laboratory Manual for Agronomic Studies in Soil, Plant, and Microbiology (1986). A total of 15 profile pits were dug (3 at each land use) and soil samples (consisting of 48 profile samples and 152 core samples from the soil surface) were collected for laboratory analysis.

Laboratory Analysis

The soil samples were air-dried and sieved with a 2 mm - mesh sieve. Portions of the sieved samples were further passed through 0.5 mm - mesh sieve for organic matter and total N determination.

Soil samples were analysed for the following parameters: soil pH was determined in both water and 0.01 M potassium chloride solution (1:1) using glass electrode pH meter. Total nitrogen was determined using the macro-Kjeldahl digestion method, available P extracted using Bray-1 extract followed by molybdenum blue colorimetry. Exchangeable cations were extracted with 1 M NH_4OAC (pH 7.0), K, Ca and Na were determined using flame photometer and exchangeable Mg by Atomic Absorption Spectrophotometer (AAS). Exchangeable acidity was determined by the KCl extraction method, organic carbon (OC) using dichromate wet oxidation method. Organic matter (OM) content was got by multiplying the percent organic carbon by 1.72. Cation Exchange Capacity (CEC) was calculated from the sum of all exchangeable cations. Available micronutrients were determined by AAS method after leaching with NH_4Cl. Saturated hydraulic conductivity was determined using a constant head method; bulk density by core method with soil porosity estimated from the bulk density data at an assumed particle density of 2650 kgm-3. Water retention at 15 bar was determined in order to calculate available water holding capacities of the soil profile horizons (Mbagwu, 1985). Particle size analysis was by the Bouyoucos hydrometer method using calgon as dispersing agent.

Fertility Capability Classification (FCC)

The FCC system used here was developed and modified by Buol *et al*. (1982). The results from surface and sub-surface samples together with soil profile data of land use types employed were used to determine the FCC classes.

RESULTS

The Soil Properties of Land Use Sites

Morphological Properties:

The details of the morphological properties of the soils of land use types are shown in

Table1. The basic differences between pedons at different land use type locations were in colour, texture, structure and consistency. The soils of the land use types were characterized by brown (5YR 5/4 -10YR 6/4), sandy loam/loamy sand, topsoil over reddish brown (2.5YR 4/8 – 7.5 YR 6/8) sandy clay loam to sandy clay subsoil. The soils are deep and well-drained. The structure is single-grained at the top to sub-angular blocky and massive at the sub-horizons. All the land uses were generally well-drained except the valley bottom of the arable and building sites which were located on basement complex and sandstones, respectively. The concretions ranged from fine to very many with few mottles especially at the valley-bottom soils. The roots were fine to very fine.

Physical Properties:

The main physical properties of the soils are presented in Tables 2-6. The particle size distribution data showed that sand dominates at all the horizons of the profiles with >90% and this decreased with depth, except in some cases, particularly at the sub-soil horizon (>50 unit in depth) where the percentage was very high. The clay content in the soils ranged from 4.8 –38% and this increased down the profile. The silt content in the soil was generally low and there has no definite sequence in its distribution within the profile. The silt: clay ratios were generally low.

The water-holding capacity of the soils increased with increase in clay content of the soils. The porosities of the land use soils were directly proportional to percent sand and gravel concentration, whereas the permeabilities were inversely proportional to the clay content. The bulk densities and hydraulic conductivities were generally low with no definite sequence in their distribution within the profile.

Chemical Properties

The soil chemical properties are given in Tables 7-11. The pH values of the land use soils ranged between pH (H_20 (6.35 and 7.5) and KCl (5.10 and 6.30) in the surface layer. These values had no definite sequence in their distributions down the profiles. The exchangeable bases (K, Ca, Mg and Na) in all the pedons were generally low and the exchange complex of all pedons were dominated by Ca and Mg. The exchangeable acidity (EA) was also low (0.04 – 1.10) cmol. kg $^{-1}$ and fluctuated irregularly with depth in most of the pedons. The effective cation exchange capacity (ECEC) was high and followed the same trend with exchangeable acidity with the highest values being recorded in most pedons at the surface horizon. The values of ECEC ranged from 2.92 – 3.96 cmol. kg $^{-1}$ on the surface and 2.66 – 3.82 cmol. kg $^{-1}$ at sub-surface. The base saturation values were very high both in the surface and lower horizons in all the profiles of the land use types examined. While the distribution down the profile decreased in some, in the others they were very erratic.

The OC contents fluctuated irregularly with depth in nearly all the pedons indicating deposition material particularly from soils of sandstones origin. The values of OC ranged from 0.27% to 1.66% in the surface layers, with the highest contents being in the surface soils in most pedons. The total N was relatively low but with high concentration in most of the top soils where the range was between 0.02% and 0.16% and fluctuated irregularly with depth following the same trend as OC. Available P (Bray P1) contents in all the pedons were generally high and fluctuated irregularly with depth with high concentration at the sub-surface horizons in most pedons. This may be due to application of phosphate fertilizer. Extractable Zn and Cu relative to the critical levels established down the profiles were very high and erratic.

Fertility Capability Classification (FCC)

The different FCC units produced are shown in Table 12. The results showed that 2 out of 3 soil types in land use 1 were loamy in texture and were classified into the same FCC units as Leg' and Led'' with the latter having >35 % gravel content, while the remaining soil type had Cerd" as FCC unit with very sticky plastic

clay at the topsoil: 2 out of the 3 soil types are dry for more than 90 cumulative days per year within 20-60 cm depth. At land use 2 site, pedons were classified into the FCC units as Le'', SLe' and SLe' with 2 of them possessing sandy texture at the top surface and loamy texture at the sub-surface. Land use 3 soil types were classified into the FCC units as Le'', Led'' and Led'' with all of them having loamy texture at the surface and greater than 35 % gravel content.

Soils at land use 4 were classified as Le, Le', and SLe with only one of them having 15-35% gravel concentration. The pedons at land use 5 were grouped into Leg', SLe'' and Led FCC units with Led saturated with water for > 60 days in most year. This result showed that the basic differences between soils in all land use types examined were in the texture and condition modifiers. The CEC was the only one condition modifier common to all the soils. While some of them were dry, others were either moist or not. The prominent condition modifier in all the soils beside low ECEC (e) was the gravel concentration.

DISCUSSION

The morphological, physical and chemical properties of the soils studied varied from one land type to another in all the five land use types. The major differences observed were in structure, texture, colour, drainage and soil consistence. It was observed from the study that the pedons at the crest and middle slope were well-drained, while the pedons at the valley bottom were poorly-drained. This is attributable to the differences in clay contents and regional water table, with valley bottom section having higher clay content at the surface than the other land types which invariably reduces infiltration rate of the water; Philipson and Drosdoff, 1972.

The colour difference showed that pedons on the crest and middle slopes were more reddish to brownish but greyish at the valley bottom. This variation in soil colour was due to the obvious sequences of drainage. Besides the influence of drainage on soil colour variation, it has been reported by Majlis (1967) that soil colour has been expressed too as a function of iron and OM contents, pH and type of clay mineral in the soil. The fluctuating water table in the lower slope and valley bottom soils also resulted in the occurrence of hydromorphic mottles in these areas.

The gravel content was very high ranging from 6.0 to 95.9 % in nearly all the pedons except in pedon number 15 at the building site location. The pedons are composed of concretions, ferruginous nodules, quartz gravel and stones, which concentrate as stone lines or stone layers. The erosion exposes a sheet of gravel mantle, which is subsequently buried by the sedimentation of fine-textured materials. Stonelines interfere considerably with manual soil tillage and thereby limits the aggregate size of farmland that a farmer can put under cultivation. According to Babalola and Lal (1977), this type of physical feature is permanent and difficult to change.

The high percentages of sand (41.8- 91.2 %) in all the land use types is a good indication of the observable high infiltration rate and low water-holding capacity of the soils, thereby resulting into moisture stress as reported by Fagbami and Udoh (1982). In addition to the above, this scenario encourages rapid leaching of nutrients from the soils beyond the rooting zones of the planted crops, a situation that threatens increase in food productivity and food security.

The poor water-holding capability of the soils is as a result of the coarse-texture of the soils. This in turn will enhance erodibility of the soils on exposure either through cultivation or construction of buildings and roads. As a result of this, the topsoil is washed away leading to loss of nutrients and OM content. These erosion problems can be checked to the bearest minimal level through appropriate land use practices which are not only environmentally friendly and acceptable by land users, but which also ensure the maintenance and continuous vegetative cover over the soil surface (Senjobi, 2007).

The OC fluctuates irregularly with depth for most of the pedons and this is an indication of continuous deposition of organic material. The low OC values in some pedons may be partly due to the high temperature and high relative humidity, which favour rapid mineralization. Soil OM matter has been reported to have positive influence on the CEC, base saturation, structure, pH, buffering capacity, soil colour and water holding capacity (Majlis, 1967). The OM content of the surface horizons in all the land use types is appreciable. This may be due to the fact that most of the organic residues in both cultivated and virgin soils are incorporated or deposited on the surface. The OM contents of soils under fallow, secondary forest and oil palm cultivation are higher than those of building site and arable cultivation. This may be because the soils under those land use systems were always covered and they had not been subjected to intense cultivation and use as in arable and building land use types. The incorporation of organic residues into the soils through tillage practices at the arable land use type contributed to the relatively higher level of OM in this site than that of building site.

The total N contents in all the soils of land use types were generally low (0.01 – 0.19 %) compared with the critical value of 0.15 %. The intense cultivation of soils normally increases the rate of mineralization of the OM, thus negatively affecting the level of soil total N content. The available P values were generally moderate in most of the pedons and high in the remaining pedons compared with the critical level of 10 – 16 ppm.

The exchangeable Ca, Mg, K and Na were generally low in all the pedons. This may be attributed to intense cultivation, leaching of nutrients and weathering. Hence, the inherent low fertility status of the soils. According to FAO (1978), the decrease in OM status of the soils when the biomass or the crop residues are insufficient to replace the humus could be attributed to the rapid biological degradation of the soils. For most low activity clays of the tropical soils, the OM is the major exchange site for the basic nutrient cations in the soils. The soil OM is known to have an influence on the CEC and clay minerals of tropical soils. Onasanya (1992), however, observed that OM had a greater effect on ECEC than clay minerals, especially in tropical soils.

The results of the fertility capability classification (FCC) showed that the major differences among the studied pedons were in texture and moisture content. This is evident in the low nutrient status as reflected in the low CEC which was common to all the studied pedons indicating leaching loses. Apart from these factors, intense cultivation accelerated the soil degradation processes thereby reducing the FCC.

CONCLUSION

This study showed that the land use types employed on the study sites were in compatible with the characteristics of the soils. This inappropriate allocation of land to uses coupled with little or no management practices encouraged soil fertility deterioration. Measures that can be taken to remedy this situation include plausible land use approach, multiple cropping, organic mulching, contour ridging and cover cropping.

Table 1(a): Morphological properties of the pedons and soils under the different land uses

Profile No.	Parent material	Land use	Horizon designation	Depth (cm)	Colour		Boundary	Textural class	Structure	Consistency	Quartz	Concretions	Roots	Drainage	Mottles
					Moist	Dry									
P_1 (VB)	Basement Complex	Fallow/Cassava	Ap	0-46	10YR 6/4	10YR 5/6	Cl	SCL	Sg – sbk	ss,sp, vfr, Io	-	c	vf, f	pd	-
			Bc	46-76	10YR 5/6	–	Gs	SCL	P	ns, np, Io	f	vm	vf, vf	pd	5YR 5/4
			Bt	76-126	10YR 5/6	–	Cl	SCL	Co	s, p, h	f	f	vf, vf	pd	5YR 4/2fwv
					Slope (5%										
P_2 (MS)	”	Cassava/Plantain	Apc	0-18	7.5YR 3/2	–	ab, s	SC	G	ns, np, Io	f	vm	vf, f	wd	-
			Btc	18-57	5YR 5/4	–	cl, w	SC	Ab	s, p, fr	-	vm	vf, vf	wd	-
			Bt	57-118	5YR 5/6	–	ir	SCL	Sg	st, sp, fr	-	c	vf, vf	wd	-
					Slope (1%)										
P_3 (C)	”	Cassava/Maize	Apc	0-14	5YR 6/8	–	di, s	SCL	Ab	s, sp, f	f	vm	vf, vf	wd	-
			Bt	14-23	5YR 5/8	–	di, s	SCL	Ab	s, sp, f	f	vm	vf, vf	wd	-
			Btc	23-53	7.5YR 6/6	–	ab, s	SCL	G	vs, p, f	-	vm	vf, vf	wd	-
			Bt	53-112	2.5YR 4/8	–	cl	CL	M	vs, vp, vh	-	f	vf, vf	wd	-
					Slope (6%)										
P_4 (VB)	”	Oil palm	Ap	0-30	5YR 4/3		ab, s	SL	Sg	ns, ns, Io, vf	-	vm	c – m	wd	-
			Btc	30-110	5YR 6/6	5YR5/8	s	SCL	g/m	s, p, fr	-	vm	vf, vf		
					Slope (3%)										
P_5 (MS)	Basement Complex	Oil palm	Ap	0-34	5YR 2/2	5YR4/2	ab, s	S	Sg	ns, np, vfr		f	m, me-co	wd	-
			AB	34-69	5YR 4/4	5YR6/3	cl, ir	LS	Sg	ns, np	-	c	c, me	wd	-
			B	69-113	7.5YR 5/6	7.5YR5/8	g, ir	LS	G	ns, np	-	vm	f,m-co	wd	-
			BC	113-137	7.5YR 5/6	10YR6/6	di	LS	g-cr	ns, np	f	vm	vf,vf	wd	5YR 3/2
					Slope (0.5%)										
P_6 (C)	”	Oil palm	Ap	0-33	7.5YR 3/2	7.5YR4/4	cl, s	S	sbk –gb	ns, np	F	c	m, f- co	Wd	-
			BC	33-65	7.5YR 5/6	7.5YR6/4	cl, w	SC	Ab	ns, np, Io	f	vm	f, f– me	Wd	-
			Bt	65-112	10YR 5/8	7.5YR5/8	di, s	SC	M	vs, p, fr	-	vm	vf, vf	Wd	-

Table 1(b): Morphological properties of the pedons and soils under the different land uses

Profile No.	Parent material	Land use	Horizon designation	Depth (cm)	Colour		Boundary	Textural class	Structure	Consistency	Quartz	Concretions	Roots	Drainage	Mottles
					Moist	Dry									
P_7 (VB)	”	Fallow	Apc	0-25	10YR 4/4	-	ab, cl	SL	Ab	ns, Io	F	vm	m,f-co	Wd	-
			Bc	25-55	7.5YR 5/4	–	g w	SL	Sbk	ns, Io	F	vm	m,f-me	Wd	-
			Bt	55-100	5YR 5/4	–	di, ir	LS	Sg	ss, vfr	-	vm	m,f-co	Wd	-
			Btc	100-149	10YR 7/6	-	ir	SCL	M	ss, fr	F	vm	c,f-co	Wd	-
					Slope (2%)										
P_8 (MS)	Basement Complex	Fallow	Apc	0-19	5YR 5/6	–	ab, w	LS	G	ss, Io	F	vm	f, vf	Wd	-
			Bc	19-43	5YR 6/4	–	cl, s	SL	G	ss, fr	F	vm	vf, vf	Wd	-
			Bt_1	43-64	7.5YR 6/8	–	g w	LS	M	s, f	-	vm	-	Wd	-
			Bt_2	64-108	7.5YR 5/6		w	SL	M	vs, p, vf	-	vm	-	Wd	-
					Slope (4%)										
P_9 (C)	”	Fallow	Apc	0-41	5YR 5/4	–	cl, s	S	G	ns, io	F	vm	m,f-co	wd	-
			Bc	41-64	5YR 5/6	–	ab, s	SL	Sbk	ns, io, vf	-	vm	m,f-me	wd	-
			Btc_1	64-147	7.5YR 6/8	–	g, di	SL	Sbk	ns, io	-	vm	m,f-me	wd	-
			Btc_2	147-167	10YR 7/6	–	di	SCL	M	ss, fr	-	vm	vf, vf	wd	-
					Slope (4%)										
P_{10} (VB)	”	Secondary Forest	Apc	0-31	7.5YR 5/8	-	ab, s	SL	G	vs, fr	F	f	f, vf	wd	-
			Btc	31-108	2.5YR 4/8	–	di, ir	SL	Sg	Vs	-	f	vf, vf	wd	-
					Slope (2%)										
P_{11} (MS)	”	Secondary Forest	Ap	0-30	7.5YR 5/8	–	ab, s	LS	Sg	ns, lo	-	f	f, f-me	wd	-
			B	30-62	7.5YR 5/6	–	g, w	LS	Sg	ns, lo	-	f	vf, vf	wd	-
			Btc	62-112	7.5YR 7/8	–	Di	SL	G	vs, vf	F	vm	c,me-co	wd	-

Table 1(c): Morphological properties of the pedons and soils under the different land uses

Profile No.	Parent material	Land use	Horizon designation	Depth (cm)	Colour		Boundary	Textural class	Structure	Consistency	Quartz	Concretions	Roots	Drainage	Mottles
					Moist	Dry									
							Slope (1%)								
P_{12} (C)	Basement Complex	Secondary Forest	Ap	0-50	7.5YR 6/8	–	cl, w	LS	Sbk	vs, f	F	f	f, vf	wd	-
			Bt	50-86	7.5YR 5/8	–	Di,	SCL	M	vs, vp, vf	-	f	vf, vf	wd	-
			Btc	86-128	7.5YR 5/6	–	g, w	LS	Sg	ns, lo	-	vm	vf, vf	wd	-
							Slope (6%)								
P_{13} (VB)	Sand Stones	Building Site	Ap	0-30	5YR 5/4	-	ab, s	SL	Sg	ns, np, lo	-	m	m, vf-f	pd	-
			B	30-52	7.5YR 5/4	–	cl, w	SL	Sg	ns, np, lo	-	f	co, vf-f	pd	5YR 3/2
			Btc	52-82	7.5YR 6/6	–	W	LS	M	s, p, f	f	f	vf –vf	pd	-
							Slope (2%)								
P_{14} (MS)	Basement Complex	Building Site	Ap	0-45	7.5YR 5/4	–	cl, s	LS	Sg	ns, np, lo	-	f	m, vf-co	wd	-
			Bc_1	45-72	7.5YR 5/6	–	g, w	LS	G	ns, np, lo	f	vm	f, vf –f	wd	-
			Bc_2	72-104	7.5YR 5/6	–	Ir	SL	M	ns, np, lo	f	f	vf –vf	wd	-
							Slope (4%)								
P_{15} (C)	”	Building Site	Ap	0-26	7.5YR 3/2	–	ab, s	SL	Sg	ns, np, lo	-	f	m, f-co	wd	-
			AB	26-57	7.5YR 5/2	–	di, s	LS	Sg	ns, np, lo	-	f	co, f-co	wd	-
			Bt	57-102	7.5YR 6/8	–	S	SL	M	s, p, f	-	f	vf –vf	wd	-

+ Boundary: ab = abrupt, cl = clear, g = gradual, di = diffuse, s = smooth, w = wavy, ir = irregular.
[1] Textural class: LS = loamy sand, s = sand, SL = Sandy loam, SC = Sandy clay, SCL = Sandy clay loam.
[2] Structure: sbk = Subangular blocky, ab = angular blocky, sg = single grain, m = massive, co = coarse, p = prismatic, cr = crumb, g = ranular.
[3] Consistency: ns = non-sticky, np = non-pastic, lo = loose, s = sticky, p – plastic, f = firm, h = hard VS = very sticky, vp – very plastic, vh = very hard, fr = friable, vfr = very friable, sp = slightly plastic, ss = slightly sticky.
[4] Quartz: f = few, - = Absent
[5] Concretions: f = few, c = common, m = many, vm = very many.
[6] Roots: vf = very few, f = few, c = common, m = many (concentration) vf = very fine, f = fine, me = medium, co = coarse (size).
[7] Drainage: wd = well drained, pd = poorly drained.
[8] VB=Valley-Bottom, MS=Middle Slow and C=Crest

Table 2: Physical properties of the soil under cassava

Profile No.	Horizon designation	Depth (cm)	Gravel	Sand (g/kg)	Silt	Clay	Silt: Clay Ratio	Porosity (%)	Textural class	WHC (%)	BD (g/cm^3)	HC (cm/hr)	Permeability
P_1 (VB)	Ap	0-46	226	508	202	290	0.70	50.6	SCL	24.1	1.31	1.68	13.6
	Bc	46-76	775	642	148	210	0.70	47.4	SCL	28.3	1.40	1.53	12.5
	Bt	76-126	102	522	118	360	0.33	44.2	SC	28.5	1.41	1.55	12.2
P_2 (MS)	Apc	0-18	687	472	158	370	0.43	51.9	SC	34.8	1.28	2.82	23.8
	Btc	18-57	663	508	142	350	0.41	55.8	SC	31.6	1.17	0.54	3.24
	Bt	57-118	201	468	202	330	0.61	43.4	SCL	35.0	1.50	1.08	4.43
P_3 (C)	Apc	0-14	808	492	220	288	0.76	41.7	SCL	33.3	1.55	1.32	12.1
	Bt	14-23	593	672	120	208	0.58	45.9	SCL	38.9	1.44	0.99	7.4
	Btc	23-53	487	532	188	280	0.67	43.5	SCL	38.8	1.43	0.10	6.8
	Bt	53-112	135	418	202	380	0.53	42.6	CL	47.5	1.42	0.10	6.7

p = ploughed, c = concretion, t = illuvial accumulation of clay
LS = loamy sand, s = sand, SL = sandy loam, SC = sandy clay, SCL = Sandy Clay loam
VB=Valley-Bottom, MS=Middle Slow and C=Crest
WHC = water holding capacity (%), BD = bulk density (g/cm^3), HC = hydraulic conductivity (cm/hr)

Table 3: Physical properties of the soil under oil palm

Profile No.	Horizon designation	Depth (cm)	Gravel	Sand (g/kg)	Silt	Clay	Silt: Clay Ratio	Porosity (%)	Textural class	WHC (%)	BD (g/cm^3)	HC	Permeability (cm/hr)
P_4 (VB)	Ap	0-30	893	612	320	68	4.71	53.2	SL	43.8	1.24	0.57	5.01
	Btc	30-110	705	558	142	300	0.47	49.9	SCL	55.4	1.07	0.40	3.12
P_5 (MS)	Ap	0-34	174	912	40	48	0.83	30.6	S	18.6	1.84	0.84	6.12
	AB	34-69	253	872	80	48	1.67	37.4	LS	23.5	1.66	0.75	5.16
	B	69-113	631	872	40	88	0.45	41.0	LS	29.8	1.57	0.78	5.43
	Bc	113-137	612	812	140	48	2.92	42.8	LS	23.5	1.52	0.48	2.85
P_6 (C)	Ap	0-33	251	912	40	48	0.83	42.5	S	28.7	1.53	0.54	3.39
	Bc	33-65	627	508	142	350	0.41	35.1	SC	25.7	1.72	1.13	9.90
	Bt	65-112	899	532	120	348	0.34	53.4	SC	38.7	1.24	0.85	7.90

p = ploughed, c = concretion, t = illuvial accumulation of clay
LS = loamy sand, s = sand, SL = sandy loam, SC = sandy clay, SCL = Sandy Clay loam
VB=Valley-Bottom, MS=Middle Slow and C=Crest
WHC = water holding capacity (%), BD = bulk density (g/cm^3), HC = hydraulic conductivity (cm/hr)

Table 4: Physical properties of the soil under fallow

Profile No.	Horizon designation	Depth (cm)	Gravel	Sand (g/kg)	Silt	Clay	Silt: Clay Ratio	Porosity (%)	Textural class	WHC (%)	BD (g/cm^3)	HC (cm/hr)	Permeability
P_7 (VB)	Apc	0-25	959	712	160	128	1.25	37.2	SL	34.9	1.42	1.32	10.32
	Bc	25-55	819	612	280	108	2.59	50.2	SL	42.6	1.32	1.24	10.88
	Bt	55-100	872	792	120	88	1.36	51.0	LS	37.11	1.30	2.61	21.9
	Btc	100-149	933	512	140	248	0.56	34.0	SCL	31.10	1.22	0.93	6.81
P_8 (MS)	Apc	0-19	821	792	140	68	2.06	35.3	LS	28.5	1.72	0.60	3.81
	Bc	19-43	804	688	162	150	1.08	41.5	SL	38.9	1.55	0.87	6.39
	Bt_1	43-64	703	832	100	68	1.47	45.3	LS	30.3	1.52	0.84	10.62
	Bt_2	64-168	866	752	120	128	0.94	48.9	SL	36.6	1.36	1.17	8.97
P_9 (C)	Apc	0-41	629	912	40	48	0.83	55.3	S	10.5	1.40	0.63	4.20
	Bc	41-64	877	672	240	88	2.73	47.2	SL	18.0	1.83	0.99	7.62
	Btc_1	64-147	613	752	100	148	0.68	51.3	SL	27.0	1.19	0.84	6.12
	Btc_2	147-167	601	602	128	270	0.47	31.2	SCL	38.5	1.29	0.63	4.08

p = ploughed, c = concretion, t = illuvial accumulation of clay
LS = loamy sand, s = sand, SL = sandy loam, SC = sandy clay, SCL = Sandy Clay loam
VB=Valley-Bottom, MS=Middle Slow and C=Crest
WHC = water holding capacity (%), BD = bulk density (g/cm^3), HC = hydraulic conductivity (cm/hr)

Table 5: Physical properties of the soil under secondary forest

Profile No.	Horizon designation	Depth (cm)	Gravel	Sand (g/kg)	Silt	Clay	Silt: Clay Ratio	Porosity (%)	Textural class	WHC (%)	BD (g/cm^3)	HC (cm/hr)	Permeability
P_{10} (VB)	Apc	0-31	133	712	160	128	1.25	42.5	SL	23.8	1.53	1.05	7.89
	Btc	31-108	99	752	120	128	0.94	43.8	SL	23.1	1.49	2.22	18.48
P_{11} (MS)	Ap	0-30	60	812	140	48	2.92	54.2	LS	35.5	1.22	1.74	14.01
	B	30-62	157	812	120	68	1.76	38.9	LS	26.1	1.62	2.40	20.13
	Btc	62-112	444	672	140	188	0.74	31.2	SL	21.9	1.83	1.11	8.43
P_{12} (C)	Ap	0-50	143	872	80	48	1.67	44.0	LS	53.2	1.49	0.69	1.77
	Bt	50-86	95	672	120	208	0.58	40.5	SCL	43.2	1.57	0.57	3.81
	Btc	86-128	495	872	80	48	1.67	45.5	LS	34.0	1.45	0.30	1.38

p = ploughed, c = concretion, t = illuvial accumulation of clay
LS = loamy sand, s = sand, SL = sandy loam, SC = sandy clay, SCL = Sandy Clay loam
VB=Valley-Bottom, MS=Middle Slow and C=Crest
WHC = water holding capacity (%), BD = bulk density (g/cm^3), HC = hydraulic conductivity (cm/hr)

Table 6: Physical properties of the soil under building site

Profile No.	Horizon designation	Depth (cm)	Gravel	Sand (g/kg)	Silt	Clay	Silt: Clay Ratio	Porosity (%)	Textural class	WHC (%)	BD (g/cm^3)	HC (cm/hr)	Permeability
P_{13} (VB)	Ap	0-30	229	812	140	88	1.59	39.6	SL	29.1	1.61	0.60	3.54
	B	30-52	101	712	200	88	2.27	37.6	SL	24.0	1.66	1.05	7.89
	Btc	52-82	124	772	80	108	0.74	36.4	LS	30.2	1.58	1.02	6.84
P_{14} (MS)	Ap	0-45	78	852	80	68	1.18	48.3	LS	42.2	1.37	2.28	19.02
	Bc_1	45-72	504	812	100	88	1.14	47.4	LS	19.9	1.58	0.84	6.12
	Bc_2	72-104	152	712	120	168	0.71	43.2	SL	52.1	1.51	1.29	10.08
P_{15} (C)	Ap	0-26	61	772	140	88	1.59	47.8	SL	37.0	1.32	3.39	28.56
	AB	26-57	30	792	140	68	2.06	46.8	LS	46.0	1.41	2.67	22.3
	Bt	57-102	103	672	180	148	1.22	37.4	SL	28.0	1.66	0.51	3.27

p = ploughed, c = concretion, t = illuvial accumulation of clay
LS = loamy sand, s = sand, SL = sandy loam, SC = sandy clay, SCL = Sandy Clay loam
VB=Valley-Bottom, MS=Middle Slow and C=Crest
WHC = water holding capacity (%), BD = bulk density (g/cm^3), HC = hydraulic conductivity (cm/hr)

Table 7: Chemical properties of soils under cassava/maize/plantain/banana

Profile No.	Horizon designation	Depth (cm)	pH H_20	pH KCl	Exchangeable bases cmol.kg^{-1}				Ex AC	ECEC (soil)	BS %	% C	Total N (%)	P	Zn	Cu
					Na	K	Ca	Mg						Mg.kg^{-1}		
P_1 (VB)	Ap	0-46	7.20	5.10	0.34	0.21	1.04	2.06	0.05	3.70	98.65	0.32	0.02	4.71	5.70	5.60
	Bc	46-76	7.15	4.75	0.48	0.30	1.18	1.60	0.05	3.64	98.63	0.38	0.04	1.88	5.40	5.30
	Bt	76-126	7.05	5.65	0.29	0.19	0.86	1.73	0.05	3.12	98.40	0.29	0.02	5.18	6.90	5.10
P_2 (MS)	Apc	0-18	7.00	6.15	0.39	0.43	1.15	1.73	0.06	3.76	98.40	1.54	0.13	2.82	6.20	5.60
	Btc	18-57	7.25	6.10	0.30	0.36	0.78	1.87	0.05	3.36	98.51	0.29	0.03	13.65	5.80	3.70
	Bt	57-118	6.05	5.10	0.25	0.24	1.14	1.21	0.11	2.95	96.27	1.22	0.13	10.35	4.60	5.20
P_3 (C)	Apc	0-14	6.35	5.20	0.36	0.41	1.10	2.00	0.09	3.96	97.73	1.66	0.16	1.88	5.00	5.60
	Bt	14-23	5.95	5.20	0.27	0.21	1.16	1.19	0.11	2.94	96.26	0.40	0.03	10.35	7.00	6.10
	Btc	23-53	6.15	5.05	0.24	0.15	1.23	1.50	0.10	3.22	96.89	1.10	0.10	6.12	6.10	5.60
	Bt	53-112	6.05	4.95	0.23	0.14	1.18	1.65	0.11	3.31	96.68	1.13	0.11	7.06	6.40	4.80

P = ploughed, c = concretion, t = illuvial accumulation of clay
VB=Valley-Bottom, MS=Middle Slope and C=Crest
Ex. Ac = Exchangeable acidity
BS = Base saturation

Table 8: Chemical properties of soils under oil palm

Profile No.	Horizon designation	Depth (cm)	pH H_20	pH KCl	Exchangeable bases cmol.kg^{-1}				Ex AC	ECEC (soil)	BS %	% C	Total N (%)	P	Zn	Cu
					Na	K	Ca	Mg						Mg.kg^{-1}		
P_4 (VB)	Ap	0-30	7.10	6.15	0.25	0.21	1.05	1.56	0.05	3.12	98.40	1.57	0.16	11.76	5.30	5.90
	Btc	30-110	6.65	5.05	0.47	0.29	1.15	1.83	0.08	3.82	97.91	0.43	0.05	3.29	5.00	5.20
P_5 (MS)	Ap	0-34	6.70	5.65	0.20	0.12	1.14	1.38	0.08	2.92	97.26	1.01	0.10	14.12	6.20	5.70
	AB	34-69	6.60	5.75	0.21	0.10	1.25	1.44	0.08	3.08	97.40	1.31	0.13	7.06	5.80	6.50
	B	69-113	6.70	5.90	0.28	0.14	0.90	1.71	0.08	3.11	97.43	0.16	0.01	10.35	4.80	3.90
	Bc	113-137	6.95	5.90	0.24	0.14	0.89	1.89	0.06	3.22	98.14	0.38	0.04	10.00	4.90	4.50
P_6 (C)	Ap	0-33	7.50	6.20	0.31	0.30	1.04	1.75	0.04	3.44	98.84	0.99	0.10	5.18	6.00	4.90
	Bc	33-65	6.90	6.00	0.26	0.13	0.96	1.79	0.06	3.20	98.13	0.48	0.05	8.47	6.20	4.70
	Bt	65-112	6.80	5.90	0.26	0.15	0.99	1.19	0.07	2.66	97.37	0.50	0.06	6.59	6.00	6.50

P = ploughed, c = concretion, t = illuvial accumulation of clay
VB=Valley-Bottom, MS=Middle Slope and C=Crest
Ex. Ac = Exchangeable acidity
BS = Base saturation

Table 9: Chemical properties of soils under fallow

Profile No.	Horizon Designation	Depth (cm)	pH H_20	pH KCl	Exchange Bases cmol.kg^{-1}				Ex AC	ECEC (soil)	BS %	% C	Total N (%)	P	Zn	Cu
					Na	K	Ca	Mg							mg.kg^{-1}	
P7 (VB)	Apc	0-25	6.60	5.60	0.22	0.13	0.85	1.65	0.08	2.93	97.27	0.64	0.07	8.47	4.70	4.80
	Bc	25-55	6.30	5.85	0.22	0.18	1.23	1.56	0.09	3.28	97.26	1.19	0.11	8.00	5.90	6.50
	Bt	55-100	6.50	5.40	0.27	0.11	1.20	1.95	0.08	3.61	97.78	0.77	0.06	2.82	6.10	5.70
	Btc	100-149	6.40	5.05	0.27	0.16	1.25	1.40	0.09	3.17	97.16	2.12	0.19	6.59	7.10	5.90
P8 (MS)	Apc	0-19	7.00	6.10	0.34	0.28	1.04	2.06	0.06	3.78	98.41	0.70	0.07	1.14	5.30	5.50
	Bc	19-43	7.30	5.95	0.25	0.18	1.03	1.77	0.04	3.27	98.78	0.24	0.02	8.00	5.40	6.00
	Bt1	43-64	7.30	5.80	0.36	0.24	1.25	1.73	0.04	3.62	98.90	0.20	0.02	15.06	4.90	1.90
	Bt2	64-168	7.10	5.85	0.24	0.28	1.00	1.46	0.05	3.03	98.35	1.55	0.15	1.88	4.10	6.40
P9 (C)	Apc	0-41	6.80	6.30	0.25	0.18	0.94	1.81	0.07	3.25	97.85	0.62	0.05	10.00	5.10	4.40
	Bc	41-64	7.40	6.50	0.25	0.16	0.84	1.58	0.04	2.87	98.61	0.51	0.05	10.00	5.60	5.80
	Btc1	64-147	7.30	6.50	0.31	0.28	1.16	1.69	0.04	3.48	98.85	0.50	0.05	8.94	6.10	5.70
	Btc2	147-167	7.15	5.70	0.31	0.28	1.11	1.56	0.05	3.31	98.49	0.21	0.02	2.82	5.00	5.70

P = ploughed, c = concretion, t = illuvial accumulation of clay
VB=Valley-Bottom, MS=Middle Slope and C=Crest
Ex. Ac = Exchangeable acidity
BS = Base saturation

Table 10: Chemical properties of soils under secondary forest

Profile No.	Horizon Designation	Depth (cm)	pH H_20	pH KCl	Exchange Bases cmol.kg^{-1}				Ex AC	ECEC (soil)	BS %	% C	Total N (%)	P	Zn mg.kg^{-1}	Cu
					Na	K	Ca	Mg								
P10 (VB)	Apc	0-31	6.70	5.45	0.28	0.18	1.08	1.48	0.08	3.10	97.42	1.33	0.13	8.94	6.20	5.60
	Btc	31-108	6.40	5.65	0.23	0.13	1.03	1.38	0.09	2.86	96.85	0.67	0.07	5.18	6.00	5.40
P11 (MS)	Ap	0-30	6.90	6.45	0.32	0.50	1.08	1.93	0.06	3.89	98.46	0.27	0.03	3.76	5.70	5.30
	B	30-62	6.80	5.80	0.23	0.15	1.06	1.98	0.07	3.49	97.99	0.32	0.03	1.14	4.80	4.70
	Btc	62-112	6.65	5.75	0.33	0.28	0.90	1.87	0.08	3.46	97.69	0.21	0.02	0.94	4.80	4.50
P12 (C)	Ap	0-50	6.80	5.60	0.28	0.24	1.01	1.93	0.07	3.40	97.50	0.54	0.05	8.47	5.10	4.10
	Bt	50-86	6.75	5.80	0.26	0.29	0.91	1.93	0.08	3.47	97.69	0.66	0.06	13.17	5.30	4.40
	Btc	86-128	6.30	5.30	0.36	0.21	0.99	1.73	0.09	3.38	97.34	0.61	0.06	1.14	5.40	4.40

P = ploughed, c = concretion, t = illuvial accumulation of clay
VB=Valley-Bottom, MS=Middle Slope and C=Crest
Ex. Ac = Exchangeable acidity
BS = Base saturation

Table 11: Chemical properties of soils under building site

Profile No.	Horizon Designation	Depth (cm)	pH H_20	pH KCl	Exchange Bases cmol.kg^{-1}				Ex AC	ECEC (soil)	BS %	% C	Total N (%)	P	Zn mg.kg^{-1}	Cu
					Na	K	Ca	Mg								
P13 (VB)	Ap	0-30	6.85	5.70	0.29	0.18	1.09	1.89	0.07	3.52	98.01	0.64	0.06	0.94	4.10	5.10
	B	30-52	6.65	5.40	0.26	0.15	1.11	1.46	0.08	3.06	97.39	0.26	0.03	0.94	4.70	4.80
	Btc	52-82	7.10	5.50	0.32	0.26	1.11	1.95	0.05	3.69	98.64	0.21	0.02	16.47	5.60	5.30
P14 (MS)	Ap	0-45	6.85	5.50	0.25	0.24	0.80	1.67	0.07	3.03	97.69	0.32	0.02	2.35	4.90	5.30
	Bc_1	45-72	7.10	5.85	0.35	0.26	1.15	1.80	0.05	3.61	98.61	0.41	0.05	15.06	4.50	5.10
	Bc_2	72-104	7.00	5.85	0.30	0.32	0.88	1.56	0.06	3.12	98.08	0.32	0.03	2.82	4.60	5.20
P15 (C)	Ap	0-26	6.90	5.60	0.30	0.20	1.25	1.58	0.06	3.39	98.23	0.72	0.07	5.65	5.70	5.90
	AB	26-57	6.90	5.15	0.29	0.10	1.19	1.87	0.06	3.51	98.29	0.18	0.02	1.88	6.00	5.00
	Bt	57-102	6.50	5.05	0.31	0.10	1.13	1.48	0.08	3.10	97.42	0.12	0.01	7.87	4.80	5.40

P = ploughed, c = concretion, t = illuvial accumulation of clay
VB=Valley-Bottom, MS=Middle Slope and C=Crest
Ex. Ac = Exchangeable acidity
BS = Base saturation

Table 12: Fertility capability classification of the pedons of the study sites

Profile Name	USDA	FAO/UNESCO	*FCC	Soil Series
	Land Use 1 (Cassava / Maize Crops)			
P_1	Rhodic paleaqualf	Rhodic Fluvisol	Leg’	Jago
P_2	Typic plinthustalf	Plinthic Luvisol	Cevd’’	Ibadan
P_3	Typic paleustalf	Ferric Luvisol	Led’’	Egbeda
	Land Use 2 (Oil Palm Plantation)			
P_4	Typic paleudalf	Ferric Luvisol	Le’’	Jago
P_5	Rhodic plinthudalf	Plinthic Luvisol	SLe’	Apomu
P_6	Plinthic tropudalf	Plinthic Luvisol	SLe’	Egbeda
	Land Use 3 (Fallow)			
P_7	Typic paleudalf	Ferric Luvisol	Le’’	Jago
P_8	Typic plinthustalf	Plinthic Luvisol	Led’’	Apomu
P_9	Typic plinthustalf	Plinthic Luvisol	Led’’	Egbeda
	Land Use 4 (Secondary Forest)			
P_{10}	Typic paleudalf	Ferric Luvisols	Le	Jago
P_{11}	Typic paleustult	Ferric Alisol	Le’	Ibadan
P_{12}	Typic paleustult	Ferric Alisol	SLe	Egbeda
	Land Use 5 (Building Site)			
P_{13}	Rhodic paleaqualf	Rhodic Luvisol	Leg’	Oteyyi
P_{14}	Typic paleudalf	Ferric Luvisol	SLe’’	Olorunda
P_{15}	Typic paleustalf	Ferric Luvisol	Led	Egbeda

*L = Loamy topsoil and/or loamy subsoil, e = low CEC, g = gley, d = dryness, C = clayey topsoil, v = very sticky plastic clay, S = sandy topsoil,
’ = 15-35% gravel concentration, ’’ = > 35% gravel concentration

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