Anisotropy of Edaphic Properties in slope soils of a University Farm in Owerri, Southeastern Nigeria

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Abstract: This study investigated variability in properties of soils of three physiographic positions in the Teaching and Research Farm of the Federal University of Technology, Owerri, Southeastern Nigeria. A transect was used to align three profile pits representing three physiographic positions of crest, midslope and foot slope before the rains in 2007. Soil profile pits were dug and samples collected based on degree of horizon differentiation. Collected soil samples were prepared and analyzed in the laboratory using standard techniques. Data generated from various analyses were subjected to analysis of variance to measure anisotropy and correlation analysis was also used to estimate degree of relationship among soil properties in the slope soils. Results showed significant variation ($p=0.05$) in soil total porosity, clay, pH, organic carbon, total nitrogen, available phosphorus and base saturation. Organic carbon had significant relationship ($p=0.01-0.05$) with total nitrogen, available phosphorus, cation exchange capacity and base saturation. Detailed studies on these soils will certainly improve reliability and applicability of soil data especially in this era of precision agriculture. [The Journal Of American Science. 2007;3(4):52-61]. (ISSN: 1545-1003).

Key words: Anisotropy, arable farming, soil fertility, pedology, toposequence

Introduction

Topography is a principal factor in soil pedogenesis and variability of soil properties in response to topographic forms is used in predicting rates of ecosystem processes (Schimel *et al.,* 1991). Marked differences due to slope aspect were reported by Birkeland (1999). Hunkler and Schaetzi (1997) observed that slope aspect has its greatest influence in locations between latitudes 40 to 60 ^{o}N. Yet, Esu, (2005) reported pronounced increase in soil temperature for south-facing slopes in the northern hemisphere, possibly due to perpendicularity of such slope soils to sunrise. Soil organic carbon losses are more in shoulder complexes while gain of the same attribute were found in footslope ecomplexes (Pennock *et al.,* 1994). Marked changes in soil moisture content due to topography were also recorded in southwestern Nigerian soils (Ogunkunle and Onasanya 1992; Doer, *et al.,* 2000). In addition to the above, landscape positions influence run off, soil erosion, drainage and distribution of heavy metals such as mercury (Manville *et al.,* 2006; Parizanganeh *et al.,* 2007) Introduction of localized differences in soil properties such as carbon and nitrogen processes was due to toposequential variations (Hobbie, 1996).

Characterization and classification of soils of any given location help in generating soil and soil-related data which are useful in sustained use of soil resource. Non-use of soil survey data has resulted in soil and soil-related environmental problems like nutrient depletion (Onweremadu, 2006) compaction, flooding, and poor yield (Zinck, 1990). These problems are worsened by socio-economic pressures on soils caused by demographic increase (Ruecker, 2003). The indispensability of soil survey information rises as Krall and Lee (2004) reported a widened spectrum of usage of detailed soil information bringing in other soil users, and this becomes critical in a university environment where the resource is put in many and sometimes conflictive land use types. Taking into cognizance that soils differ with physiographic position and that management of each land use varies, it becomes expedient to investigate degree of variability of selected soil properties for sustainable usage. The main aim of this study was to characterize and classify slope soils of Teaching and Research farm of the Federal University of Technology, Owerri, Southeatern Nigeria for agricultural activities and /or any other likely use.

Materials and Methods

Study area: The study was carried out before the onset of rains in 2007 at Teaching and Research farm proximal to the Centre for Agricultural Research (CAR) farm, Federal University of Technology Owerri, Nigeria. Owerri lies between latitudes $5^0$43’34’’62’’ and longitude $7^0$39’34.49$^{''}$ (Handheld Global Positioning System-GPS) Receiver (Garmin Ltd, Kansas, USA). Soils are derived from Coastal Plain Sands (Benin formation) of the Oligocene-Miocene geologic era and were influenced by Otamiri River. Generally, the study area lies within the lowland geomorphology of southeastern Nigeria. Mean annual rainfall ranges form 2250 to 2500 mm with a mean annual temperature range of 27 to 28^{o}C. The area is dominated by rainforest vegetation whose density is substantially depleted by anthropogenic influence. Varying and conflicting land uses such as farming, sand mining, fishing, waste disposal, recreational facilities and engineering activities are common in the area.

Field Sampling: A transect was drawn from the crest to the footslope of the Otamiri riverslope at the Federal University of Technology, Owerri, southeastern Nigeria Three profile pits were aligned along a transect at an interpedon distance of 200 metres to represent three topographic positions of crest, midslope and footslope. The three pedons (profile pits) were dug and described in line with the procedure as recommended by FAO (1998). Soils are grouped in field mapping units primarily by identifying landscape attributes which are believed to be similar (Hudson, 1992) and this soil-landscape paradigm is a powerful guide in field delineation of soils (Young and Hammer, 2002).

In addition to profile pit sampling, random surface soil sampling was carried out in the study site. Twenty surface soil samples (0-10 cm) were collected from each physiographic position using an auger giving a total of 60 soil surface samples. Core samples were used to obtain samples for bulk density determinations. With the exception of core samples, other soil samples were air-dried and sieved using 2-mm sieve preparatory to laboratory analysis.

Laboratory analysis: Particle size distribution was determined by hydrometer method according to the procedure of Gee and Or (2002) while bulk density was measured by core method (Grossman and Reinsch, 2002). Total porosity was calculated using a mathematical relationship between bulk density and particle density (Foth, 1984). Soil pH was measured potentiometrically in 1: 1 soil–water ratio (Hendershot *et al.,* 1993). Soil organic carbon was estimated by combustion at 840^{o}C (Wang and Anderson, 1998) while total nitrogen was obtained by microkjeldahl method (Bremner, 1996). Cation exchange capacity was measured using ammonium acetate leaching at pH 7.0 (Rhoades, 1982). Available phosphorus was determined by Olsen method (Emteryd, 1989).

Calculations: Ratios of fine sand to coarse sand (FS/CS), silt to clay (SCR), carbon to nitrogen (C/N), and calcium to magnesium (Ca/Mg) were obtained by calculations.

Similarly, total porosity (TP) was computed as follows:

TP = 100% - BD/PD x100)…… 1 (Foth, 1984)
Where TP = total porosity
BD = bulk density (g/cm^3)
PD = Particle density (g/cm^3)

Again, base saturation (BS) was calculated as
BS = (TEB/CEC) 100%
Where BS = base saturation
TEB = total exchangeable basic cations
CEC = cation exchange capacity

Statistic: Means, analysis of variance (ANOVA) and correlation analysis were performed on the soil data. Levels of significance were tested at 1 and 5 % for correlation analysis and at 5% for ANOVA.

Classifications: Soils were classified using the USDA soil Taxonomy (Soil Survey Staff, 2003) and correlated to with FAO/UNESCO soil Map of the World Legend (FAO, 1998)

RESULTS

Physical Properties: Results of various laboratory analyses on some soil physical properties are presented in Table 1. Sand–sized soil particles dominated other fractions of the fine earth material irrespective of geomorphologic setting. Higher values of total sand were obtained at the crest and footslope that is, 80.0% and 78.0%, respectively. Higher values of coarse sand were obtained when compared with fine sand content in all physiographic positions. Generally, fine sand increased downslope at epipedons having 20% (Crest) 23% (midslope) and 28% (footslope). Higher values of fine sand were from surficial horizons unlike results on coarse sand sub-fractions. Unlike fine sand, coarse sand decreased downslope having 57% (Crest) 54% (midslope) and 48% (Footslope). The FS/CS ratio decreased intrapedally with depth. However, there were slight differences between FS/CS values among the studied physiographic positions. Values of FS/CS were consistent with the findings of Oti (2002) in a classification of erosion-degraded lands of the same agroecology.

Percent silt increased downslope but ranged from 5 to 10% in the study site. Values of percent silt were lower than results from a study conducted by Igwe (2003) in a similar agro-environment in southeastern Nigeria. Clay content ranged from 12 to 15 % in studied soils. Generally, clay content decreased towards the Otanuir River southeastern Nigeria. There was a distinct clay bulge in pedons dug on crest and midslope physiographic positions, and this intrapedal trend was not found in footslope soils. Again, values of silt-clay ratio were lower in crest and midslope soils when compared with soils of the footslope (1.01).

At epipedons, values of bulk density decreased downslope having 1.40, 1.39 and 1.36 g/cm^3 for crest, midslope and footslope, respectively. Mean values of bulk density from pedons showed the same trend as in the surficial distribution of bulk density. Generally, bulk density decreased with depth in all the profile pits irrespective of geomorphic setting. These results on bulk density are consistant with the findings of Akamigbo (1999) in soils of the same agroecology. However, values of bulk density were lower than critical limits for root restriction (1.75-180 g/cm^3) (USDA-NRCS, 1996)

Total porosity slightly decreased downslope at epipedal horizons as well as soils of various geomorphic settings. However, total porosity decreased consistently with depth in all the pedons. Total porosity values were similar to the results obtained by Nnaji *et al.* (2002) in soils of Nsukka area of the same Southeastern Nigeria agroecology.

Chemical properties: Table 2 presents results of chemical properties of the studied soils indicating strong acidity and low exchangeable bases, low cation exchange low organic matter content (Organic carbon content), low total nitrogen content, low calcium-magnesium ratio and low available phosphorus in the study site. Soil acidity decreased towards the footslope with mean values of 4.82 (Crest), 4.84 (midslope) and 5.04 (footslope). Values of soil pH were higher in middle horizons of soil profiles irrespective of physiographic position. Exchangeable calcium and magnesium increased towards the footslope and consequently calcium-magnesium ratio. Exchangeable potassium decreased downslope while there was no trend in the distribution of exchangeable sodium. Cation exchange capacity and base saturation increased towards the footslope. The relative abundance of exchangeable bases is in the decreasing order of Ca, Mg, Na and K. Generally, values of exchangeable Ca, Mg, K, and Na were high at surface and middle horizons of all soil of the study site.

Organic carbon values were higher in surface horizons, and showed no regular trend topographically. Organic carbon decreased with depth in all profile pits of the University Farm. Total nitrogen content was generally very low, and the pattern of its distribution closely follows that of organic carbon. Highest values of total nitrogen was obtained in footslope soils (0.064). and available phosphorus increased downslope and as follows: 5.11 ppm (crest), 5.37 ppm (midslope and 8.74 ppm (footshope). Carbon-nitrogen ratio ranged from 9.20 – 16. 42, with higher C/N ratios recorded in lower horizons of the profile pits especially soils of midslope and footslope.

Variability and Relationships: Some properties showed significant ($p=0.05$) variations in the study site at surface and sub-surface horizons (Table 3). With the exception of soil pH at sub-surface horizons of studied soils all measured attributes varied significantly ($p=0.05$), and this is consistent with the findings of Wang et al. (2001) in soils of Da Nangou catchment in China ($36^0$53'N; $109^0$19'E).Oti (2002) reported significant variations (p=0.05) in total nitrogen, bulk density, available phosphorus, cation exchange capacity and a non-significant relationship in soil pH and bass saturation. However, this study considered only two layers namely 0-10 and 10-20 cm.

A correlation matrix showing relationships between soil properties in the study site is shown in Table 4. Total porosity had a significant negative correlation (<0.05) with clay content, organic carbon, total nitrogen and available phosphorus. In all soils of the three physiographic positions,clay content had significant positive relationship (p=0.05) with organic carbon at the crest soil, and with cation exchange capacity in soils of all physiographic positions. Soil pH was highly correlated with available phosphorus (p=0.01) and cation exchange capacity (p=0.05). Organic carbon had a significant positive correlation with total nitrogen (p=0.01), available phosphorus (p=0.05), base saturation (p=0.05) and cation exchange capacity (p=0.01) irrespective of physiographic position. Available phosphorus had strong relationships (p=0.05) with cation exchange capacity and base saturation in the study site.

Classification: Based on the results of field, physical and chemical analyses, soils were classified as Typic Hapludults (crest and midslope soils) and Typic Eutrudepts (Footslope soils). These soils were correlated to FAO/UNESCO legend as Dystric Nitisols (Crest and Midslope soils) and Eutric Fluvisols (Footslope soils).

Table 1: Some physical properties of studied soils

Horizon	Depth (cm)	FS (%)	CS (%)	TS (%)	SL (%)	CL (%)	FS/CS	SCR	BD (g/cm^3)	TP (%)
	Crest									
	0-12	20	57	77	10	13	0.35	0.76	1.40	47
	12-29	30	59	89	5	6	0.50	0.83	1.41	46
	29-65	31	47	78	5	17	0.65	0.09	1.45	45
	65-105	10	60	77	3	20	0.16	0.15	1.48	44
	105-190	11	68	79	2	19	0.16	0.10	1.50	43
	Mean	20.4	58.2	80.0	5.2	14.8	0.36	0.38	1.44	45
	Midslope									
	0-13	23	54	77	9	14	0.42	0.64	1.39	47
	13-32	28	55	82	8	9	0.50	0.88	1.42	46
	32-75	29	45	72	9	19	0.67	0.47	1.46	44
	75-115	12	60	72	8	20	0.20	0.40	1.49	43
	115-196	9	68	77	5	18	0.13	0.27	1.56	41
	Mean	20.2	56.0	76.2	8	15	0.36	0.53	1.46	44
	Footslope									
	0-18	28	48	76	11	16	0.58	0.84	1.36	48
	18-33	26	51	77	13	10	0.51	1.30	1.44	45
	33-70	25	54	79	11	10	0.46	1.10	1.47	44
	70-118	10	68	78	10	10	0.14	0.83	1.54	41
	118-205	7	73	80	10	11	0.09	1.00	1.58	40
	Mean	**19.2**	**58.8**	**78**	**10**	**12**	**0.35**	**1.01**	**1.47**	**43**

FS – fine sand, CS = coarse sand, TS = total sand, Si = silt, Cl= clay, FS/CS = fine sand –coarse and ratio, SCR = silt-clay ratio, BD = bulk density TP = total porosity.

Table 2. Some chemical properties of studies soils

Horizon	Depth (cm)	pH (H_20)	Ca^{2+}	Mg^{2+}	K^+	Na^+	CEC	BG (%)	OC (%)	TN (%)	Av.P (ppm)	Ca/Mg	C/N
	Crest (7-9 % slope)												
	0-12	4.8	0.8	0.3	0.19	0.10	3.86	36	1.22	0.098	8.12	2.66	12.44
	12-29	4.7	0.5	0.2	0.04	0.08	3.72	22	0.92	0.56	6,08	2.50	16.42
	29-65	4.9	0.6	0.2	0.06	0.08	3.96	24	0.63	0.28	4.16	3.00	10.86
	65-105	4.9	0.9	0.3	0.08	0.10	4.02	34	0.39	0.42	4.11	3.00	9.20
	105-190	4.8	0.6	0.2	0.02	0.03	3.36	25	0.22	0.020	3.11	3.00	11.00
	Mean	4.82	0.68	0.24	0.07	0.08	3.78	28.2	0.67	0.040	5.11	2.83	11.78
	Midslope (3-5% slope)												
	0-13	4-9	0.9	0.4	0.09	0.09	0.09	4.42	33	0.068	9.16	2.25	11.47
	13-32	4.9	0.4	0.3	0.05	0.06	0.06	3.62	22	0.026	5.26	1.33	12.69
	32-75	4.9	0.7	0.4	0.06	0.06	0.06	3.86	28	0.022	4.22	1.75	13.63
	75-115	5.0	0.9	0.3	0.05	0.07	0.07	2.98	44	0.020	4.10	3.00	13.50
	115-196	4.8	0.6	0.2	0.02	0.02	0.02	2.56	28	0.019	4.16	3.00	12.63
	Mean	4.84	0.7	0.32	0.05	0.05	0.06	3.49	31	0.031	5.3	2.26	12.78
	Footslope (2-3% slope)												
	0-18	5.0	2.3	0.6	0.10	0.16	5.05	62	1.41	0.150	12.89	3.83	9.40
	18-33	5.0	1.8	0.5	0.07	0.09	4.64	53	0.52	0.080	9.24	3.60	10.00
	33-70	5.2	1.9	0.5	0.06	0.06	4.30	58	0.80	0.048	9.54	3.80	10.83
	70-118	5.1	2.4	0.6	0.06	0.06	4.88	63	0.23	0.18	6.82	4.00	11.15
	118-205	4.9	1.1	0.4	0.04	0.04	3.26	48	0.29	0.026	5.26	2.75	12.77
	Mean	5.04	190	0.52	0.06	0.08	4.42	56.8	0.65	0.064	8.74	3.59	10.83

CEC = cation exchange capacity, BS= base saturation, OC = organic carbon, T. N. = total nitrogen, Av. P = available phosphorus, Ca/Mg = calcium magnesium ration, C/N = carbon – nitrogen ratio.

Table 3. Variability in some physico-chemical properties of studied soils (surface and substance samples) N = 60

Physiography	TP (%)	Clay (%)	pH (H_2^0)	OC (%)	TN (%)	Av.P (ppm)	CEC (mg/100g)	BS (%)
	Surface soils							
Crest	1.41	12	4.8	1.23	0.089	8.10	3.96	38
Midslope	1.38	15	4.9	0.96	0.071	6.62	4.52	34
Footslope	1.33	11	5.2	1.34	0.073	9.98	5.08	60
LSD (0.05)	0.03	0.2	0.02	0.04	0.007	0.20	0.92	2.60
	Subsurface soils							
Crest	1.47	20	4.9	0.93	0.063	4.30	3.64	28
Midslope	1.49	21	4.9	0.68	0.048	2.96	4.04	29
Footslope	1.52	18	5.0	0.99	0.052	5.49	4.19	53
LSD (0.05)	0.01	0.01	NS	0.03	0.008	0.19	0.87	4.06

OC. Organic carbon, T.N. Total nitrogen, Av. P = available phosphorus, CEC = cation exchange capacity, BS= Base saturation, TP= total porosity.

Table 4. Correlation Matric among physiochemical properties on the three physiographic positions.

		TP %	CLAY (%)	pH (H_20)	OC (%)	TN (%)	Av. P (ppm)	CEC (Meg/100g)	BS (%)
TP (%)	Crest	1.00							
	Midslope	1.00							
	Footslope	1.00							
Clay (%)	Crest	-0.32*	1.00						
	Midslope	-0.44*	1.00						
	Footslope	-0.73*	1.00						
pH (H_20)	Crest	- 0.12	- 0.02	1.00					
	Midslope	0.02	-0.11	1.00					
	Footslope	0.03	-0.11	1.00					
OC(%)	Crest	-0.72**	0.36*	0.23	1.00				
	Midslope	-0.78**	0.27	0.24	1.00				
	Footslope	-0.83**	0.21	0.31	1.00				
TN %	Crest	-0.62*	0.22	0.26	0.91**	1.00			
	Midslope	-0.66**	0.12	0.21	0.98**	1.00			
	Footslope	-0.69*	0.22	0.19	0.79**	1.00			
Av.P (ppm)	Crest	-0.52*	0.29	0.92**	0.88*	0.42*	1.00		
	Midslope	-0.48*	0.31	0.91**	0.82*	0.32*	1.00		
	Footslope	- 0.49	0.21	0.92**	0.92*	0.21	1.00	1.00	
CEC Meg/100g	Crest	-0.52	0.51*	0.43*	0.78**	0.22	1.00	1.00	
	Midslope	-0.41	0.49*	0.53*	0.77**	0.29	0.62*	1.00	
	Footslope	-0.42	0.62*	0.48*	0.76**	0.42	0.64*	1.00	
BS (%)	Crest	- 0.12	0.42*	0.25	0.64*	0.23	0.59*	0.51	1.00
	Midslope	- 0.21	0.48*	0.32	0.58*	0.42	0.53*	0.49	1.00
	Footslope	- 0.26	0.55*	0.29	0.59*	0.29	0.57*	0.53	1.00

TP = total porosity, OC = organic carbon, TN = total nitrogen, Av.P = available phosphorus, CEC = cation exchange capacity, BS = base saturation.

Discussion

Sandiness of these soils are due to a combination of sandy parent material (Coastal Plain Sands), tropical climate and land use. These factors influence pedogenesis and properties of soils (Akamigbo, 1999; Wang e*t al.,* 2001). Although soils of the crest and midslope are highly weathered given low values of silt-clay ratios (0.38-0.53), higher values of coarse sand (56.0-58.2%) were obtained in the study, implying profound influences of this particle sub-fraction in the determination of maeroporosity and moisture retention characteristics of the study site when ccompared with other size fractions and sub-fractions. The consistent increase in per cent silt and clay at the epipedon downslope implies a preferential removal of these fractions and lightness due to their fineness. However, presence of clay bulge in soils of the crest and midslope is indicative of eluviation,argillation and illuviation typical of Ultisols of the tropics (Esu, 2005). Argillation was at its inception in soils of the footslope and data of silt-clay ratio show higher values (1.01) when compared with 0.38 (Crest soils) and 0.53 (midslope soils). These results show that more advanced weathering has taken place in crest soils, followed by midslope soils while those of footslope are at their youthful stage of pedogenesis.

Bulk density increased with depth in all soils irrespective of physiographic position and this could be attributed to overburden effect on deeper horizons as well as declining organic matter content with depth. There was a trend in the distribution of bulk density along the river slope in which values declined downslope possibly due to land use history of similar to a study conducted by the study site (Akamigbo, 1999) although the results of organic matter distribution in the latter did not show similar distribution. Total porosity contrasted with the distribution of bulk density as it a decreased with depth. However, high values of total porosity were recorded at the entire pedosphere, implying greater availability of soil air, soil water, soil aerobes and root abundance, and these have far-reaching beneficial effects on the agronomic suitability of soils of the University farm. These conditions are on the assumption that values of macroporosities of these soils are greater than those of microporosities since soils are textually coarser. However, the influence of porosity on soil moisture availability and uptake is a result of complex interactions among physicochemical properties in the soilsphere (Eynard *et al.,* 2006)

Increase in pH with depth is indicative of illuviation of basic cations translocated after intensive leaching from the surface horizons. Again, increased pH values downslope suggests movement of basic cations along the slope towards the footslope, and this may account for high base saturation, Ca/Mg ratio, total nitrogen, cation exchange capacity and organic carbon. Agronomically, soils of the footslope hold greater potentials for crop production with less fertilizer input while increased extraneous fertilizer sources are needed for enhancing soil fertility in crest and midslope soils. However, increased soil loss from high slope soils may result to sedimentation and burying of better quality soils of the footslope with time hence the call by Opara et al. (2007) to enhance aggregate stability of soils of southeastern agroecology with organic manure including using rabbit waste. Generally, soils of the study site are vulnerable to calcium and phosphorus deficiencies as they show low calcium-magnesium ratios. According to Landon (1984), a decrease of Ca/Mg ratio to a level below 3 results on the unavailability of calcium and phosphorus. Based on the results, soils of the Crest and Midslope positions are very susceptible to Ca and P fertility constraints. Despite the fact that soils are situated in the rainforest agroecology characterized by abundant leaf litter, soils of the study site have low exchangeable calcium. This trend was reported in European forest soils (Thimonier *et al.,* 2001), and could be attributed to enhanced leaching of soils by organic acids derived from decomposed organic debris. Unavailability of sufficient soils calcium in the root zone have been associated with low productivity of some soils of Nigeria (Osemwota *et al.,* 2003).

Other fertility parameters, namely cation exchange capacity, base saturation, organic carbon, total nitrogen and available phosphorus had values below recommended levels for optimal productivity in tropical soil of Nigeria (FDALR, 1985; Enwezor *et al.,* 1990). Of these factors, organic carbon ranks among the principal factors governing fertility of tropical soils of Southeastern Nigeria (Onweremadu *et al.,* 2007); influencing structural aggregate stability (Mbah *et al,* 2007; Opara *et al.,* 2007), phosphorus availability (Dodor and Oya, 2002), exchangeability of cations and buffering capacity of soils. These soil parameters varied significantly (P = 0.05) in both epipedons and sub-surface horizons irrespective of geomorphic setting, suggesting delineation of soils of the University farm into mapping units for their sustained use for agricultural and/or non-agricultural enterprises. Again, the relationship between organic carbon and some soil properties notably total nitrogen, available phosphorus cation exchange capacity, and base saturation suggests the use of these parameters for modelling which enhances predictiveness in precision agriculture, especially after subjecting the principal factors to multiple regression analysis using organic matter (organic carbon) as dependent variable.

The classification of a riverslope soils Federal University of Technology into Typic Hapludults (Crest and Midslope soils) and Typic Eutrudepts (Footslope soils) was based on a combination of differentiae (criteria for classification) as contained in Soil Survey Staff (2003). Soils of the crest and midslope geomorphic settings are characterized by argillic horizons (Bt) and low silt-clay ratios, indicating advanced weathering and a consistent decrease in organic matter content with depth while soils of the footslope lacked argillic horizons, had high silt –clay ratio and irregular organic matter distribution with depth.

Conclusions

We evaluated anisotropic properties of soils lying on three physiographic positions of a University farm in southeastern Nigeria. The study revealed variability in selected edaphic properties irrespective of physiography and soil depth. Total porosity, clay content, pH, organic fractions, available phosphorus, cation exchange capacity and base saturation showed a significant variation (p=0.05) at epipedal horizon while only soil pH was non-significant in sub-surface soil horizons. A correlation matrix of attributes in the study showed that organic carbon had pronounced influences on total nitrogen,available phosphorus, cation exchange capacity and phosphorus. This study suggests more intensive sampling as well as detailed investigation of soil and soil -related parameters in the university farm occupying over 200 hectares of cultivable arable land. Data generated from such detailed studies would be beneficial especially when subjected to multivariate statistical techniques for the purpose of increasing accuracy of predictions in present and future land uses.

Acknowledgment

I am grateful to the technical staff of the Department of Soil Science, University Nigeria, Nsukka Nigeria for technical support to this investigation.

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Received: 11/10/2007

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