Fertility Status Under Land use Types on Soils of Similar Lithology

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Abstract: Fertility status under six landuse types (fallow, cassava, plantain, cocoyam, bamboo, and oil palm) in Mbaitoli and (Oil palm, Industrial site, cocoyam, bamboo, plantain and cassava) in Ikeduru were evaluated. Triplicate soil samples (0 -15cm) collected along a transverse on each landuse were characterized. Soils were predominantly sandy. Except fallow in Mbaitoli and oil palm, plantain and cocoyam in Ikeduru, silt/clay ratios of all landuses were below unity indicating high degree of weatherability. In both locations (Mbaitoli and ikeduru), bulk density was significantly lower in bamboo than others due to high organic matter and low soil disturbance. Wide variability in soil pH, organic matter, P, N, C/N ratio, CEC, Fe and Zn occurred under various landuses, with performance in cocoyam being better than others for both Mbaitoli and Ikeduru. Generally, soil properties were better in Ikeduru than Mbaitoli indicating that management requirement for sustained crop production in the later will be lower than the former. [The Journal Of American Science. 2007;3(4):20-29]. (ISSN: 1545-1003).

Introduction

Nigeria has an estimated land mass of about 923 768 sq km of which 75 488 square kilometers are in Southeastern Nigeria (Enwezor, et al: 1990, Esu, 2005, Anon, 2005). Several activities take place on the land. The purpose for which a tract of land is used constitutes its landuse (Anon, 2005). According to Vink (1975), landuse is any permanent or cyclic human interactions to satisfy human needs from complex natural and artificial resources which constitute land. It is a resultant interplay of available land resources with cultural, social and economic conditions of the past and present development when two or more landuse types occur on the same soil (Akamigbo and Asadu 2001).

Landuse has been categorized into major kind; as rain fed agriculture, grassland, fishpond, forestry, grazing and tourism and into primary or compound kinds in which more than one kind of landuse is practiced within an area (FAO, 2002). Of an estimated agricultural land area totaling 700,000sq km in Nigeria, about 300,000, 27,000, 40,000 and 150,000 sq kms are currently used for annual crops, perennial crops, permanent pasture and forestry respectively (Anon 2005).

Landuse affects soil fertility and productivity. These manifests as changes in soil properties such as nutrient content (N, P, K, Ca, Mg, S etc), pH, organic matter, CEC, structure etc (Aluko and Fagbenro 2000, Akinrinde and Obigbesan 2000, Akamigbo and Asadu 2001). For instance Aluko and Fagbenro (2000) observed increased pH and organic matter for soils under Gmelina aborea than those under Pinus canaborea, Treculia Africana, agro forestry and fallow. They also observed increased P in fallow compared to other land uses. Furthermore, Akamigbo and Asadu (2001) reported marked changes in morphological, physical and chemical properties which resulted to accelerated pedogenic processes and a decline in fertility of soil under traditional than forest landuse. It has been observed that as the fertility of the soil declines, soil structure weakens and the soil becomes susceptible to erosion (Adetunji, 2005).

Agricultural sustainability requires a periodic evaluation of soil fertility status. This is important in understanding factors which impose serious constraints to increased crop production under different landuse types and for adoption of suitable land management practices. Information so generated could also be useful in adjusting present landuse types or in the development of appropriate landuse policy for a given area. This is particularly important in southeastern Nigeria, where demographic factors, poor land management and inherent low soil fertility (Enwezor, et al; 1990) under different landuses often result in poor crop yields. The main objective of this study was therefore to evaluate the fertility statues under landuse types of soils over similar lithology in Imo state.

Materials and Methods

Soil Sampling and Site Description

Triphcate surface (0 – 15 cm) soil samples were collected from different landuse types (Table 1) at two locations (Mbaitoli and Ikeduru local government areas of Imo State Nigeria) in the rainforest agro ecological zone of southeastern

Nigeria. Mbaitoli LGA lies between latitude 5^{o} 29$^{/}$ N and longitude 7^{o} 07$^{/}$ E while Ikeduru is located between latitude 5^{o} 27$^{/}$ N and longitude 7^{o} 07 $^{/}$ E. The two locations are characterized by a bimodal rainfall pattern that peaks in the months of June and September with a short dry spell, the August break in the month of August. Mean annual rainfall ranges between 1750 -2000 mm. Mean annual temperature of 26.5 - 27.5^{oc} and a mean relative humidity that varies between 71.6 – 85.6%. Soil types are UItisol (USDA soil classification) derived from costal plain sand (Enwezor, et al: 1990).

Sample Preparation and Laboratory Analysis.

Soil samples were air derived under laboratory conditions for seven days, sieved using 2mm diameter sieve and the fine earth fractions analyzed for selected physical and chemical properties. Physical properties of soils from Mbaitoli and Ikeduru are presented in Tables 2 and 3 respectively while the chemical properties of soils from the locations are shown in Tables 4 and 5 respectively. Particle size (Gee and Bauder 1986), pH in 1:2.5 (solvent/solute) ratio (Maclean1982), available P using Bray II extractant (Olsen and Sommers 1982), exchangeable bases using NH_4 OAC extractant (Thomas 1982), exchangeable acidity in 1N KCL solution (IITA 1979); CEC obtained as a summation of exchangeable bases and acidity, total nitrogen (Bremner and Malveney 1982); organic carbon (Nelson and Sommers 1982), organic matter by multiplication of organic carbon with a factor of 1.72, Fe and Zn by AAS (Page et al 1882) and bulk density in undisturbed cone (Blake and Hartage 1986).

Table 1. Landuse Types in Mbaitoli and Ikeduru LGA

Sample No.	Town	Landuse type	Remarks
A. Mbaitoli			
M_1	Ubomiri	Fallow	1^{1}/2 year fallow
M_2	Ogwa	Cassava	8 month's old cassava farm
M3	Mbieri	Oil Palm	Over 40yrs oil palm plantation interspersed with cassava
M4	Mbieri	Plantain	5yrs with kitchen waste as nutrient source
M5	Orodo	Cocoyam	9 months mulched with palm fronds
M6	Ogbaku	Bamboo	10yrs old and harvested every 2yrs.
B. Ikeduru			
IK 1	Inyishi	Industrial	Aluminium extrusion site
IK2	Iho	Oil palm	Over 20yrs old interspersed with Cocoyam and cassava
IK3	Akabo	Plantain	5 yrs old with household waste as nutrient source
IK4	Atta	Cassava	A year old with NPK fertilization
IK5	Iho	Cocoyam	7 months and mulched with palm fronds
IK6	Iho	Bamboo	Recently harvested for roofing.

Table 2. Physical properties of soils under varying landuse in Mbaitoli

Sample No.	Landuse Type	Sand	Silt	Clay	Silt/Clay Ratio	Bulk density g/cc	Textural Class
		--------- g/kg ------					
M1	Fallow	882	84	34	2.5	1.54	Sandy loam
M2	Cassava	762	80	158	0.5	1.35	Sandy loam
M3	Oil palm	782	92	126	0.7	1.24	Loamy sand
M4	Plantain	902	40	58	0.7	1.47	Sand
M5	Cocoyam	802	93	105	0.9	1.42	Loamy sand
M6	Bamboo	842	60	98	0.6	0.86	Sand
L.s.d (0.05)		9.60	8.4	7.37	4.32	0.06	
CV		0.6	3.2	4.2	3.4	2.6	

Table 3. Physical Properties of Soils under varying landuse in Ikeduru

Sample No.	Landuse Type	Sand	Silt	Clay	Silt/Clay Ratio	Bulk density g/cc	Textural Class
		--------- g/kg --------					
Ik1	Industrial	822	33	45	0.3	1.59	Loamy sand
Ik2	Oil Palm	900	70	30	2.3	1.35	Sand
Ik3	Plantain	840	100	60	1.7	1.41	Sandy loam
Ik4	Cassava	760	40	200	0.2	1.31	Sandy loam
Ik5	Cocoyam	772	123	105	1.2	1.45	Loamy sand
M6	Bamboo	802	60	158	0.3	1.16	Sandy loam
L.s.d (0.05)		31.71	7.63	11.25	0.20	0.10	
CV		2.1	0.2	5.3	11.02	3.9	

Table 4. Chemical Properties of Soils under varying Landuse Types in Mbaitoli

Landuse Type	pH $H_2$0	pH 1 N KCL	OM gkg^{-1}	TN %	C/N	P mg g^{-1}	Ca	Mg	K	H	CEC	Fe	Zn
							-------- cmol kg^{-1}----					--- m g kg^{-1}----	
Fallow	6.50	6.48	27.9	0.09	18.0	9.34	0.34	0.38	0.02	0.38	1.43	6.61	6.53
Cassava	4.48	4.60	21.2	0.08	15.3	2.87	0.15	0.15	0.02	1.05	2.25	6.82	3.37
Oil palm	5.20	4.80	26.1	0.09	16.9	5.89	0.25	0.80	0.01	0.95	2.81	7. 66	3.41
Plantain	7.79	4.60	33.2	0.13	14.9	4.97	0.67	0.83	0.02	0.28	2.05	6.83	14.0
Cocoyam	8.31	7.36	23.0	0.09	14.9	5.89	1.33	1.32	0.02	0.40	3.42	7.25	11.4
Bamboo	8.31	4.74	18.6	0.07	15.4	1.08	0.18	0.22	0.02	0.58	1.54	7.51	2.46
L.s.d	0.16	0.16	0.67	0.32	1.51	0.17	0.04	0.04	0.01	0.14	0.25	4.32	0.32
CV	1.4	1.6	1.5	19.0	5.2	1.9	5.1	4.4	34.5	12.4	6.2	3.4	19.0

OM = Organic matter, TN = Total nitrogen, C/N = Carbon/ nitrogen, CEC = Cation exchange capacity.

Table 5. Chemical Properties of Soils under varying landuse in Ikeduru

Landuse Type	pH H_2O	pH 1NKCL	OM gkg^{-1}	TN %	C/N	P mg g^{-1}	Ca	Mg	K	H	CEC	Fe	Zn
							---- cmol kg^{-1}---------					-- mg kg^{-1} --	
Industrial	5.31	4.90	28.96	0.1	16.42	4.55	0.21	0.17	0.03	0.33	0.98	6.82	3.8
Oil Palm	5.4	5.37	16.55	0.06	15.46	5.62	0.23	0.26	0.02	0.38	1.19	6.80	2.56
Plantain	7.48	6.94	31.65	0.12	15.33	2.66	0.19	0.72	0.02	0.33	2.14	7.20	13.19
Cassava	6.80	5.51	14.48	0.06	13.66	3.11	0.27	0.31	0.03	0.26	1.31	7.42	2.90
Cocoyam	8.50	7.90	31.72	0.11	15.55	3.18	1.99	1.97	0.03	0.43	4.76	6.83	12.19
Bamboo	5.50	4.61	14.83	0.05	16.80	6.30	0.15	0.21	0.03	0.73	1.81	7.05	3.89
L.s.d(0.05)	0.03	0.03	0.91	0.29	0.05	0.03	0.02	0.02	0.02	0.02	0.02	0.23	0.18
CV	0.3	0.3	5.3	19.7	0.2	0.4	1.8	2.3	38.1	4.0	0.7	2.0	1.6

OM = Organic matter, TN = Total nitrogen, C/N = Carbon/ nitrogen, CEC = Cation exchange capacity.

Results and Decisions

Soil texture, Silt/clay ratio and Bulk density

Soils were predominantly sandy with about 75% of the land use being sandy loam in both Mbaitoli (Table 2) and Ikeduru (Table 3). The sandy nature of the soils reflects the parent materials from which they were formed which is coastal plain sand (Enwezor, et al: 1990, Uzoho 2005). Silt/clay ratio varied between 0.6 – 2.5 (CV =3.4%) with fallow land use being significantly higher than others in Mbaitoli (Table 2). The range was 0.20 – 2.3 (CV = 11.02%) being significantly lower in oil palm, bamboo and industrial site than the other landuses in Ikeduru. (Table 3). Averaged over locations, values for Mbaitoli (1.0) and Ikeduru (1.02) were similar (Table 6) probably due to the fact that the soils were of similar origin. It has been reported that Silt/clay ratios less than unity indicate low values, signifying that the soils are pedogenically ferraltic in nature (Essoka and Esu 2000). Comparing soils under the various land uses, one would conclude that the soils are highly weathered and pedologically mature due to the low silt content (Ahn 1993), and with the degree of weathering being higher in Mbaitoli than Ikeduru. Nwaka and Kwari (2000) observed that in sandy soils, high silt/clay ratio

may be related to the coarse texture or resistant skeletal composition of the parent material and youthfulness of the profile. Values of silt/clay ratio reported were low, confirming high weatherability of the soils and increased pedegenesis under land uses with silt/clay ratio less than unity

Bulk densities ranged between 0.86 - 1.54 g/cc (CV =2.6%).and 1.16 – 1.59 g/cc (CV = 3.9%) in Mbaitoli and Ikeduru respectively. In Mbaitoli fallow landuse was significantly higher than others while in Ikeduru the value was higher in industrial site than others. Averaged across locations, bulk density was higher in Ikeduru than Mbaitoli (Table 6). High bulk densities in fallow (Mbaitoli) and industrial site (Ikeduru) could be due to poor vegetal cover and soil compaction due to raindrop impact (Lal 1990, Brady and Weil 1990, Ogban et al., 2000, Babalola et al; 2000, Isirimah et al; 2003).

pH, Organic matter, N and C/N ratio

Soil pH varied as 6.50, 4.48, 5.20, 7.79, 8.31and 8.31 for fallow, cassava, oil palm, plantain, cocoyam and bamboo respectively in Mbaitoli (Table 4) and 5.31, 5.40, 7.48, 6.80, 8.50 and 5.50 for industrial site, oil palm, plantain, cassava, cocoyam and bamboo respectively in Ikeduru (Table 5) respectively. This showed that soils under cassava and oil palm in Mbaitoli and those under Industrial site, oil palm and bamboo in Ikeduru .were acidic. Under these landuses, crop production could be limited due to aluminium toxicity. It has been reported that aluminium toxicity occur in soils with pH value of about 5.5 and increases in intensity as pH decreases (Opara – Nadi 1988, Ernani et al; 2002.

Table 6. Means of Selected Properties of Landuse Types in Mbaitoli and Ikeduru

Parameters	MBAITOLI	IKEDURU
Texture	Sandy loam	Sandy loam
pH (H_20)	5.91	6.50
Silt / Clay ratio	1.0	1.0
Bulk density (g/cc)	1.31	1.36
Total Nitrogen (gkg^{-1})	0.09	0.08
Organic Matter (gkg^{-1})	24.98	23.03
Carbon/Nitrogen ratio	15.89	11.54
Available P (mg kg-1)	5.01	3.40
CEC (cmol kg^{-1})	2.25	1.34
Fe (g kg^{-1})	7.03	7.02
Zn (g kg^{-1})	8.45	2.50

However, being tolerant of soil acidity up to pH of 5.59, cassava and oil palm production may not be seriously affected (FMANR 1990). Generally, more than 60% of landuse types in both Mbaitoli and Ikeduru had pH values higher than 6.0 and attributed to complexion of soluble aluminum from organic matter decomposition (Aluko and Fagbenro 2000, Lillie 1999, Brady and Weil 1999). Averaged over locations, soil pH was lower in Mbaitoli than Ikeduru (Table 6). Optimum pH for most agricultural crops fall between 6.0 and 7.0 because nutrients are more available at pH about 6.5 (Wong, et al; 2001). It follows that, for the more acidic Mbaitoli soils, oil palm and cassava production are well suited while liming could be effective in reducing acidity for the production of other crops (Ernani et al; 2002, White et al; 2006).

Values of soil organic matter in Mbaitoli were 33.2, 27.9, 26.1, 23.0, 21.2 and 18.6 g/kg being a decreasing order of Plantain > fallow > oil palm > cocoyam > cassava > bamboo and a variability of 1.5%. Differences amongst the various land uses were significant. Values for Ikeduru were 31.72, 31.65, 28.96, 16.55, 14.83 and 14.48 g/kg and a decreasing trend of Cocoyam > plantain > industrial > oil palm > bamboo > cassava with a variability of 5.3% .Differences between cocoyam and plantain and between bamboo and cassava were not significant but differed significantly with the other landuses. Averaged over locations, organic matter was higher in Mbaitoli than Ikeduru (Table 6). When compared with critical values of 15 -20 g/kg (1.5 -2.0%) for tropical soils (Enwezor, et al; 1990), only soil under bamboo in Mbaitoli and oil palm, bamboo and cassava in Ikeduru fell below critical levels. Mean organic matter varied between 23.03 - 24.98g/kg in Mbaitoli and Ikeduru (Table 6). This is low when compared with critical values of 25.0, 30.0 and 35.5g/kg for West, North and Eastern Nigeria respectively (Akinrinde and Obigbesan 2000). It is also low when compared with a value of 30.0g/kg suggested as level to which response to N fertilization is not expected (Agboola 1973). The general low levels could be attributed to management practices involving high burning and to continuous farming as well as a reduction in the fallow period (Akinrinde and Obigbesan 2000).

Total N followed a similar trend as soil organic matter since organic nitrogen constitute the bulk of total N for tropical soils (Noma et al; 2005). It has reported that fertility of tropical soils depends on their organic matter content (Enwezor et al; 1990). Total N for all land uses in both Mbaitoli and Ikeduru were below 0.15%, the critical value for tropical soils (Enwezor, et al; 1990), and indicates high N deficiencies. It has been observed that the main cause of N deficiency in tropical soils is intense leaching and erosion due to the high tropical rainfall (White and Reddy 1999, Isirimah et al; 2003). This low N level signifies responses to N fertilization.

Except oil palm, C/N ratio was significantly higher in Fallow than other land uses in Mbaitoli (Table 4). Variation in Ikeduru was significant amongst landuse types being higher in Bamboo than others. C/N ratio relates to soil organic matter decomposition and nitrogen mineralization. It has been reported that net N mineralization occurs at C/N ratio below 30:1 (Catherine et al 1992). However, Ma et al; (1999) has observed, N mineralization in soils with higher C/N ratios and thus concluded a no relationship between C/N ratio and N mineralization. Averaged over location, C/N ratio did not significantly vary between Mbaitoli and Ikeduru.

Exchangeable Cations (Ca, Mg, K and H) and CEC

Ranges and variability in exchangeable Ca, Mg, K and H were 0.13 – 1.33 (5.1%), 0.15 – 1.32 (4.4%), 0.1 – 0.2 (34.5%) and 0.28 – 1.5 Cmol/Kg (12.4%) respectively in Mbaitoli (Table 4) and 0.19 – 1.99 (1.8%), 0.17 – 1.97 (2.3%), 0.02 – 0.03 (38.1%) and 0.26 – 0.73 Cmol/Kg (4.0%) respectively in Ikeduru (Table 5). Variation amongst landuse types was significant for exchangeable Mg and H, non significant for exchangeable K and non significant between bamboo and cassava for exchangeable Ca in Mbaitoli. In Ikeduru variations in Mg and K were similar amongst landuse as in Mbaitoli but non significant between Industrial, oil palm and plantain for Ca and between industrial and plantain for H. Critical values of soil nutrients have been reported by various workers. For instance Adeoye and Agboola (1984) have reported critical values of 2.0, 0.4 and 0.20 cmol/kg for Ca, Mg and K respectively. When compared with values obtained for landuse types in Mbaitoli and Ikeduru, shows low values and thus deficiencies of the nutrients in the soils studied. Compared with critical k values of 0.16 and 0.20 cmol/kg ((White and Reddy 1999, Isirimah et al; 2003). 0.10 cmol/kg (Ekpete 1972) and 0.18 - 0.20 cmol/kg soil (Obigbesan and Agboola 1974), all the soils studied still showed great deficiencies. Also using critical Mg value of 1.04 cmol/kg proposed for western Nigerian soils (Agboola and Corey 1976), more than 83% of soils under various landuse in both Mbaitoli and Ikeduru (exception being soil under cocoyam) showed deficiencies and will respond to Mg fertilization. Furthermore, when compared with 0.15-0.42 cmol/kg critical Mg values suggested by Lombin (1974), Mg deficiency may not be a problem for the soils studied. Low values of Ca, Mg and K, have however been reported for most Nigerian soils (Akinirinde and Obigbesan 2000) and could be attributed to leaching losses by the high tropical rain fall as well as low content in the parent rock. Exchangeable H varied with soil acidity with cassava and bamboo having highest values in Mbaitoli and Ikeduru respectively.

Variation in soil CEC was an increasing trend of fallow (1.43cmol/kg),bamboo 1.54 (cmol/kg), plantain (2.05cmol/kg), cassava (2.25 cmol/kg), oil palm (2.81 cmol/kg) and cocoyam (3.42cmol/kg) in Mbaitoli and industrial site (0.98 cmol/kg), oil palm (1.19 cmol/kg), cassava (1.31cmol/kg), bamboo (1.81 cmol/kg), plantain (2.14 cmol/kg) and cocoyam (4.76 cmol/kg) in Ikeduru. landuses. Soil CEC has been classified as low (<6cmol/kg-1), medium (6-12cmol/kg-1) and high (>12cmol/kg-1) (Adepetu et al 1979). On the basis of this classification, all the soils studied fell within the low range since their values were below 5 Cmol/kg. It has been reported that low to medium CEC value of tropical soils is due to the dominance of kaolinitic clays in the fine earth fractions (Ojanuga and Awojuola 1981). Most workers have observed that CEC of tropical soils is related to their organic matter content (Aluko and Oguntala 1997, Noma et al; 2005). This is true of the soils studied especially those under different land use type in Ikeduru. Also as the pH increased, CEC also increased

Available P, Fe and Zn

In Tables 4 and 5 are shown values of available P, Fe and Zn in Mbaitoli and Ikeduru respectively. Available P ranged from 1.09 to 9.40 mg kg-1 with the least and largest values being in bamboo and plantain respectively in Mbaitoli while the range was 2.66 to 6.30 mg kg-1 with a reverse least and largest values of plantain and bamboo respectively in Ikeduru. Averaged over locations, the range was 3.40 to 5.01mg kg-1 with Mbaitoli being higher than Ikeduru. A critical P range of 8 -12 mg kg-1 P has been reported for tropical soils (Enwezor et al 1990). This showed that with the exception of fallow soil in Mbaitoli all other land use types in the two locations are P deficient. Several workers (Busari et al 2005, Uzoho and Oti 2005, Jubrin et al; 2000, Bubba et al; 2003, Aluko et al 2000) have reported high P deficiency for tropical soils. Cause of the deficiencies has been attributed to high weatherability of the soils, presence of koalinitic clay as the dominant mineral, leaching by intense rainfall and adsorption reaction by soil constituents (Bubba et al; 2003,). P statues under various landuse types showed an increasing trend with soil organic matter and CEC and a decreasing trend with clay, Fe and Zn. The trend with soil pH was irregular.

Available Fe was significantly higher in oil palm than other landuses with variation being an increasing order of fallow < cassava < plantain < cocoyam < bamboo < oil palm and a coefficient of variability of 3.4% in Mbaitoli. Cassava varied significantly with other landuses, being a decreasing trend of cassava > plantain > bamboo > cocoyam > industrial > oil palm and a coefficient of variability of 2.0% in Ikeduru. Averaged over locations, Mbaitoli was higher than Ikeduru. In both locations, Fe contents under various landuses were beyond critical available level of 4.5 mg kg-1 (Kparmwang et al; 2000) or 2.5 – 5.0 (Sims and Johnson 1991).This indicates that Fe deficiency is not likely a problem as have been reported by others for most acid soils of warm humid zones of Nigeria (Kparmwang and Malgwi 1997, Kparmwang et al; 2000).

Variations in available Zn were 2.46, 3.37, 3.41, 6.53, 11.40 and 14.00 mg kg-1 for bamboo, cassava, oil palm, fallow, cocoyam and plantain respectively in Mbaitoli. It was 2.56, 2.90, 3.80, 3.89, 12.19 and 13.19 mg kg-1 for oil palm, cassava, industrial, bamboo, cocoyam and plantain respectively for Ikeduru. Plantain and cocoyam did not differ significantly but were significantly higher than other land uses in Mbaitoli while plantain was significantly higher than others in Ikeduru. As for Fe, available Zn was better in Mbaitoli than Ikeduru. Using critical available Zn levels of 0.8 mg kg -1 (Kparmwang 2000) or critical range of 0.2 – 2.0 mg kg-1 zinc deficiency did not appear a problem in the soils as have been reported for some sandstone and shale in Benue valley (Kparmwang 2000). However zinc deficiency has been reported for soils of coastal plain sand (Udo and 1979) and on basaltic soils of Northern Guinea savanna (Kparmwang et al 1995).

Conclusion

Landuse had no effect on soil texture being predominantly sandy, a reflection of the parent material (coastal plain sand). Silt/clay ratio in less than 40% of the land use types (Fallow in Mbaitoli, oil palm, plantain and cocoyam in Ikeduru) was more than unity indicating high degree of weathering in more than 60% of the landuses. Bulk density was significantly higher under fallow and industrial site than other landuses in Mbaitoli and Ikeduru respectively, probably due to higher organic matter content and lesser compaction. Soil chemical properties (pH, organic matter, N, C/N ratio, exchangeable Cations (Ca, Mg, K and H), CEC available P, Fe and Zn) varied widely with landuse, being better under cocoyam than other landuses in Mbaitoli and Ikeduru. Generally, landuse in Ikeduru had better properties than Mbaitoli indicating that for sustained crop production lesser inputs will be required in Ikeduru than Mbaitoli.

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