Fertility Capability Classification of Soils in Two Agro Ecological Zones in the Basement Complex Zone of Nigeria

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Abstract: *There is need to evaluate the fertility status of soils for sustainable soil management and productivity. The fertility capability of soils in two agro-ecological zones of Nigeria was evaluated. This is with the view of identifying limitations and management problems in terms of the nutrient supplying capacity of the soils. Seven soil pedons were identified in Ado-Ekiti (dry upland rainforest) and nine in Kabba (southern guinea savannah) in a 12 hectares land each. Soils samples were collected at the top and subsoil and analyzed for physical and chemical properties. The soils were predominantly loamy textured at the surface and loam to sand and clay textured at the subsurface. Major limitations observed at Kabba are high gravel percentage, (r^+) and anaerobic condition (g^+) while low nutrient capital K was observed at Ado-Ekiti. Low buffering capacity (e) and ustic moisture regime are limitations common to both locations. Management practices suggested include the utilization of wetland areas for rice production, application of fertilizer in split doses and adoption of legumes into crop production.*

Keywords: *fertility, evaluation, limitations, use, management*

1. INTRODUCTION

The development and survival of human of the human race is based on the performance of soils and its ability to productive in other to meet human food demand (Hillel, 2009) and the sustainable use of the soil in other to ensure food supply to the geometrically increasing world population have become one of the global issues of the 21st century (Lal, 2008, 2009; Jones *et al.*, 2009; Lichtfouse et al., 2009).

There has been decline in soil fertility in sub-Saharan zone of the world (Sanchez, 2002) which constitute serious threat to agricultural production and the performance of soils. The decline in soil fertility had been attributed to inadequate use of fertility inputs, on-going soil degradation, and increasingly intense land use without organic and mineral inputs to improve on soil fertility by burgeoning populations (St. Clair and Lynch, 2011). The rising temperature, drought, intense precipitation and other adverse weather conditions occasioned by the prevailing climate change could worsening the decline of soil fertility in the tropics (St. Clair and Lynch, 2011; Tabi *et al.* 2013).

Handling of soils by societies must be in a sustainable way in order to maintain its fertility and ensure that it is productive (Rao and Rogers, 2006; Hillel, 2009). It is also important to have information on the fertility status of the soil; this will go a long way as a guide for land users in other to develop proper management practices that will guarantee sustainable productivity. This can be achieved through Fertility Capability Classification (FCC).

The fertility capability classification (FCC) system was developed as an attempt to bridge the gap between sub-disciplines of soil classification and soil fertility, especially to interpret soil taxonomy and additional soil attributes in a way that is directly relevant to the plant growth (Zehetner and Miller, 2006; Geissen *et al.* 2009; Das, 2015). It accesses the soil function in relation to its capacity to supply nutrients to growing crops (Sanchez *et al.,* 2003), in that it considers the top soil believed to be the root zone of growing crops.

There is no report on fertility assessment data for the study areas. Soil management practices in are based on indigenous understanding and blanket recommendations, this will not guarantee sustainability and proper adoption/implementation of improved soil and crop management practices. Therefore, there is need for scientific understanding of the fertility of the soil around areas in other to guide in the management of the soils for optimum crop production.

The objective of this study is to evaluate the capability of the soils in the study area to sustain crop production using fertility capability classification.

2. MATERIALS AND METHODS

Ado-Ekiti is situated in Ekiti State of South Western Nigeria. The research site lies between latitude 7.710802N and 7.713800N and longitude 5.243230E and 5.246470E. The climate is of the upland Tropical Rain Forest type with distinct wet and dry seasons.

Kabba this is located in the western part of Kogi State of the North Central Nigeria and The research site lies between latitude 7.860376N and 7.862225N and longitude 6.069576E and 6.074468E. The area lies within the southern guinea savanna zone of Nigeria.
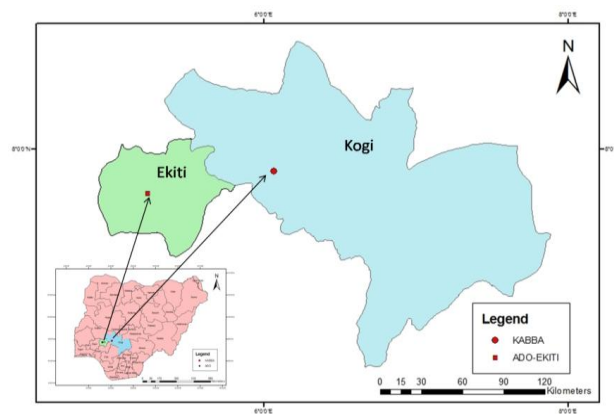

Figure1. *Map of Nigeria Showing the Location of the Two Sites*

Soil Survey and Sampling: Each of the location (Ado-Ekiti and Kabba) was mapped. The conventional method of soil survey involving rigid grid procedure was adopted. For both sites, observations were made along traverses of 50 m apart with soil auger. Soil morphological properties were described in the field following the procedure described in the USDA Soil Survey manual (Soil Survey Staff, 2014). Areas with same soil type were mapped together and plotted on a base map. An area of 12.4395 and 12.1841 hectares of land were mapped in Ado Ekiti and Kabba respectively. Soil map of the two locations are presented in figure 1 and 2. Soil profiles within each soil boundaries were dug, described and sampled. Soil samples collected were taken to the laboratory for analysis.
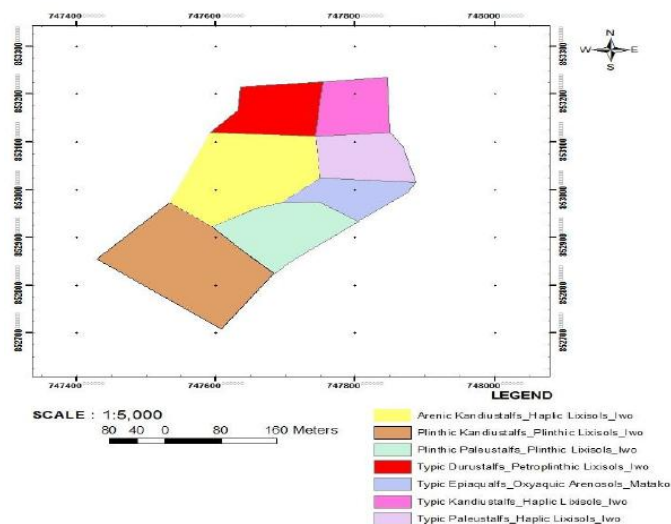

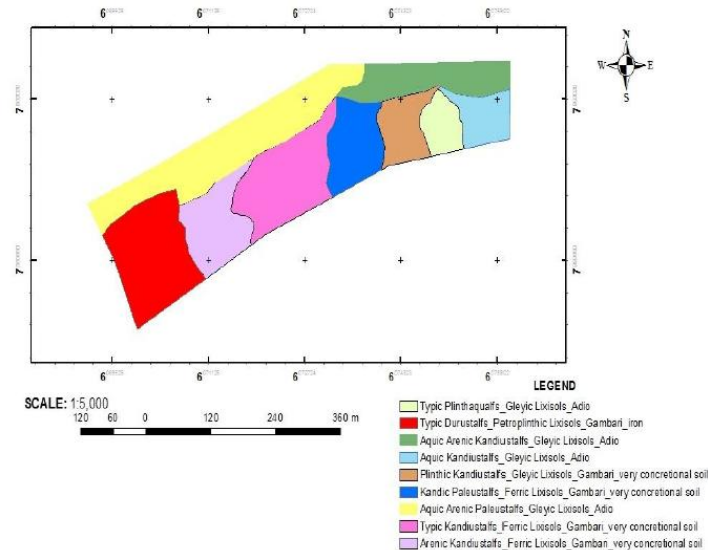**Figure2.** *Soil map of Ado-Ekiti study site*

LEGEND
- Typic Plinthaqualfs_Gleyic Lixisols_Adio
- Typic Durustalfs_Petroplinthic Lixisols_Gambari_iron
- Aquic Arenic Kandiustalfs_Gleyic Lixisols_Adio
- Aquic Kandiustalfs_Gleyic Lixisols_Adio
- Plinthic Kandiustalfs_Gleyic Lixisols_Gambari_very concretional soil
- Kandic Paleustalfs_Ferric Lixisols_Gambari_very concretional soil
- Aquic Arenic Paleustalfs_Gleyic Lixisols_Adio
- Typic Kandiustalfs_Ferric Lixisols_Gambari_very concretional soil
- Arenic Kandiustalfs_Ferric Lixisols_Gambari_very concretional soil

SCALE: 1:5,000
120 60 0 120 240 360 m

Figure3. *Soil map of Kabba study site*

Laboratory analyses: Soil samples collected from the various pedogenic horizons were air-dried in the laboratory, crushed with porcelain pestle and mortar and sieved to remove, material greater than 2mm (gravel). Percent gravel to total soil was calculated. The less than 2 mm materials were used to carry out Laboratory analysis for physico-chemical properties. Particle size distribution was determined using the modified hydrometer method (Bouyoucos, 1951). Soil pH was measured electrometrically in water at 1: 1 soil to liquid (weight/volume) ratio. Organic carbon was determined by the Walkley-Black wet oxidation method (Walkey and Black, 1965) and total nitrogen was obtained by the micro-Kjeldahl method (Bremner, 1996). Available phosphorus was extracted with Bray-1solution and the P was determined using the ammonium molybdate-blue method (Bray and Kurtz, 1945). Exchangeable cations (Ca, Mg, K and Na) were extracted with neutral, normal ammonium acetate solution. Calcium (Ca) and Mg were determined by atomic absorption spectrophotometry while K and Na were determined by flame emission photometry. Exchangeable acidity was extracted with a molar solution of KCl and determined titrometrically. Effective cation exchange capacity, exchangeable sodium saturation and based saturation were calculated. The results of the analysis are presented in table 1 and 2.

Fertility Capability Classification: This was carried out using the FCC Version 4 by Sanchez *et al.,* (2003).

3. RESULTS AND DISCUSSION

Fertility capability classification (FCC) evaluation was carried out for the soils studied at the two locations. Physico-chemical properties in Table 1 and 2 were used for the classification by comparing them with FCC version 4 framework. The framework consists of two categorical levels. The first category- type/substrata type- describes topsoil (0-20cm depth) and subsoil (0-50cm depth) texture and is expressed in capital letter. The second category- condition modifiers consist of modifiers defined to delimit specific soils conditions affecting plant growth with quantitative limits. Each condition is expressed as a lower case letter. Superscript + or − indicate a greater or lesser expression of the modifier. The summary of FCC is presented in table 3 and FCC maps in figures 3 and 4.

In the first category- type all the profiles were classified as L. This indicates that the soils have loamy topsoil with moderate to well-drained soil and good water holding capacity. At the substrata type level Profiles AA, AE and AF are classified as C this indicates that the sub soils underlying the top soil is clayey and will have low infiltration and high water holding capacity. AG was classified as S this indicates that the subsoil is sandy and will be porous. All other soils considered were classified as L this indicates that they have a loamy subsoil underlying the top soil. This is a pointer that the soils will have good infiltration and water holding capacity.

At the second category profiles KC, KF and KG were classified as g^+ and it indicates the soils have gleyic properties within 50cm of the soils depth. This is an evidence that these soils are being flooded

or water logged at a period of the year. These soils can support intensive agriculture in the production of rice during the wet period (Sanchez and Buol, 1985) and dry season farming as widely practiced all over Africa (Sanchez *et al.*, 2003). All the profiles with the exception of Profile AG were rated with d modifier; this implies that the soils have an ustic moisture regime. This favours soil dynamics such as slowing down of nitrogen mineralization and leaching as well as the death of many soil microorganisms (Sanchez *et al.*, 2003). However it may limit round the year production of crops except supplementary is supplied through irrigation. AG was rated g it implies that the soils has an aquic condition, this could be as a result of its lowland position in the landscape. The high water table will make crop cultivation to be greatly limited to crops adapted to high water table during the wet season. All the profiles on the schist parent materials were rated r$^+$. This implies that the soils contain gravel percentage that falls within the range of 10-35%. This may constitute impediment to tillage, most especially in mechanized tillage. All the soils are rated with modifier e. This indicates that the soils have low nutrient retaining ability hence high leaching potential. This could be as a result of prevalent granulated clayey soils with low activity clay minerals.

The aggregate fertility capabilities of the soils are as follows: KA, KB, KD, KE and KI were classified as LLdr$^+$e, KC, KF and KG is LLg$^+$dr$^+$e, AA and AF as LCde, AB and AD as LLde, AC as LLdke, AE as LCdke and AG as LSge.

4. CONCLUSION AND RECOMMENDATION

The soils of the study areas were observed to be limited by high gravel percentage, (r$^+$), anaerobic condition (g$^+$), low nutrient capital K, low buffering capacity (e) and ustic moisture regime.

The following management practices were suggested the utilization of wetland areas for dry season vegetable, rice and sugar cane production or other crops that can support anaerobic condition, application of potassium (K) rich fertilizer, application of fertilizer in split doses with integration of organic manure, adoption of legumes into crop rotation and agroforestry involving leguminous shrubs.

Table1. *Physico-Chemical characteristics of Kabba study area (Schists Belt)*

Horizon	Depth	pH	Exchangeable Cations (Cmol/kg)				EA	ECEC	ECEC (Clay)	Organic Carbon	Organic Matter	Total Nitrogen	Available P	BS	ESP	Gravel	Sand	Silt	Clay	Texture
	(cm)	(H$_2$O)	Ca	Mg	K	Na	(%)	(%)	(%)	(%)	(%)	(%)	(ppm)	(%)	(%)	(%)	(%)	(%)	(%)	
Profile KA 7.859302N 6.069769E Typic Durustalfs/Petroplinthic Lixisols/Gambari (Iron pan)																				
Ap	0 – 9	6.31	3.00	1.00	0.44	0.15	0.54	5.13	9.25	0.80	1.39	0.30	9.64	89.47	3.27	21.20	60.80	14.00	25.20	SCL
Bv	9 – 20	6.49	2.80	1.70	0.32	0.13	0.61	5.56	13.54	0.42	0.73	0.20	22.86	89.03	2.34	23.20	58.80	11.00	30.20	SCL
Bx	20 – 40	6.45	2.50	1.52	0.31	0.17	1.03	5.53	19.79	0.42	0.73	0.10	1.79	81.37	3.07	24.70	58.80	14.00	27.20	SCL
Profile KB 7.859440N 6.070209N Arenic Kandiustalfs/Ferric Lixisols/Gambari (Very concretional soil)																				
Ap	0 – 18	6.50	3.90	1.31	0.41	0.20	0.46	6.30	12.10	0.86	1.53	0.56	4.35	92.70	3.18	11.27	60.80	12.00	27.20	SCL
Bc	18 – 39	6.43	2.20	1.20	0.38	0.15	0.46	4.39	7.76	0.61	1.06	0.28	7.00	89.52	3.42	11.33	56.95	14.00	29.05	SCL
Bcg1	39 – 69	6.35	2.30	1.75	0.39	0.13	0.53	5.08	12.60	0.40	0.69	0.14	4.90	89.57	2.56	11.35	56.80	14.00	29.20	SC
Bcg2	69 – 130	6.32	3.00	1.70	0.41	0.16	0.53	5.80	13.30	0.32	0.56	0.08	6.30	90.86	2.76	11.30	60.80	4.00	35.20	SC
Bgx	130-200	6.52	2.10	1.90	0.40	0.15	0.48	5.03	9.76	0.40	0.69	0.10	5.06	90.46	2.98	11.00	54.80	8.00	37.20	SC
Profile KC 7.860822N 6.069576E Aquic Arenic Paleustalfs/Gleyic Lixisols/Adio																				
Ap	0 – 20	6.65	2.90	0.70	0.35	0.20	0.51	4.66	7.62	0.96	1.65	0.40	7.31	89.06	4.29	10.97	70.93	12.00	17.07	SL
Bt	20 – 46	6.14	3.00	1.30	0.31	0.11	0.34	5.06	10.63	0.86	1.49	0.38	4.43	93.28	2.17	10.97	68.72	12.00	19.28	SL
Bteg1	46 – 70	6.14	3.00	1.20	0.54	0.19	0.34	5.27	13.64	0.57	0.99	0.27	1.09	93.55	3.61	11.00	63.80	12.00	24.20	SCL
Bteg2	70 – 110	5.53	2.80	1.00	0.45	0.16	0.34	4.75	11.54	0.46	0.79	0.16	2.72	92.84	3.37	11.17	60.80	11.00	27.20	SCL
Btg	110-200	5.51	2.10	1.10	0.34	0.16	0.42	4.12	8.34	0.40	0.69	0.12	9.80	89.81	3.88	11.10	56.39	11.00	32.61	SCL
Profile KD 7.860376N 6.072108E Typic Kandiustalfs/Ferric Lixisols/Gambari (Very concretional soil)																				
Ap	0 – 20	5.63	3.20	1.10	0.51	0.16	0.43	5.40	9.90	0.66	1.81	0.24	6.69	90.93	2.96	20.04	50.80	18.00	31.20	SCL
Bteg1	20 – 74	5.55	4.00	1.40	0.34	0.19	0.52	6.32	16.54	0.52	0.89	0.20	3.11	93.83	3.01	16.04	56.80	16.00	27.20	SC
Bteg2	74 – 102	5.23	4.00	1.50	0.32	0.25	0.51	6.58	13.52	0.52	0.89	0.26	3.58	92.25	3.80	15.98	58.80	6.00	35.20	SC
Bteg3	102-145	5.17	4.30	1.34	0.32	0.24	0.51	6.71	15.86	0.13	0.23	0.04	1.17	92.40	3.58	10.81	50.80	9.75	39.45	SC
Profile KE 7.860811N 6.072108E Kandic Paleustalfs/Ferric Lixisols/Gambari (Very concretional soil)																				
Ap	0 – 24	6.35	3.00	0.80	0.39	0.17	0.67	5.03	7.68	0.84	1.53	0.72	3.58	86.68	3.38	21.94	56.50	16.00	27.50	SCL
Btc1	24 – 47	6.50	4.10	1.00	0.28	0.20	0.67	6.25	15.87	0.72	1.28	0.32	1.79	89.28	3.20	21.76	60.80	16.00	23.20	SCL
Btc2	47 – 67	6.46	3.00	1.10	0.36	0.18	0.52	5.16	7.00	0.71	1.22	0.30	4.36	90.27	3.49	18.99	58.80	3.00	38.20	SC
Btc3	67 – 99	6.34	2.00	1.80	0.35	0.15	0.49	4.79	8.13	0.46	0.79	0.18	2.88	89.77	3.13	17.90	56.80	4.00	39.16	SC
Btgx	99 – 150	6.24	3.00	1.00	0.31	0.18	0.49	4.98	9.06	0.40	0.69	0.08	3.58	90.16	3.65	16.69	56.50	4.00	39.50	SC
Profile KF 7.861024N 6.073063E Plinthic Kandiustalfs/Gleyic Lixisols/Gambari (Very concretional soil)																				
Ap	0 – 21	6.58	4.10	1.90	0.31	0.20	0.34	6.85	0.92	1.58	0.38	4.98	21.10	95.04	2.92	10.73	64.80	18.00	17.20	SL
Bv	21 – 41	6.15	3.00	1.50	0.43	0.19	0.23	5.35	0.46	0.79	0.19	6.53	12.87	95.70	3.55	10.75	58.80	12.00	29.20	SCL
Bcg	41 – 70	6.15	2.00	1.00	0.31	0.15	0.36	3.82	0.34	0.59	0.08	5.60	7.47	90.31	3.93	10.64	52.80	12.00	35.20	SCL
C1	70 – 86	6.12	2.20	2.00	0.34	0.16	0.36	5.90	0.31	0.53	0.08	4.20	12.28	93.90	2.71	10.79	58.80	2.00	39.20	SC
Cg	86– 120	6.10	3.00	2.00	0.35	0.17	0.34	5.86	0.38	0.66	0.08	6.69	11.56	94.20	2.90	10.72	58.80	2.00	39.20	SC
Profile KG 7.861874N 6.073964E Typic Plinthaquults/Gleyic Lixisols/Adio																				
Ap	0 – 24	6.29	3.90	1.10	0.18	0.18	0.22	5.80	0.86	1.53	0.62	6.38	10.26	96.21	3.10	11.73	56.80	16.00	27.20	SCL
Btcg1	20 – 62	6.42	2.80	1.70	0.43	0.17	0.20	5.30	0.75	1.29	0.36	4.12	9.84	96.23	3.21	11.60	56.80	16.00	27.20	SCL
Btcg2	62 – 99	6.51	3.60	1.80	0.36	0.16	0.20	6.12	0.88	1.52	0.46	0.86	12.06	96.73	2.61	11.70	56.80	18.00	25.20	SCL
Btv	99 -126	5.47	2.00	1.90	0.47	0.13	0.20	4.70	0.56	0.96	0.20	3.58	7.37	95.75	2.77	11.70	49.80	13.00	37.20	CL
Btx	126 -150	5.77	2.10	1.00	0.40	0.20	0.24	3.94	0.18	0.23	0.04	5.21	9.97	93.90	5.08	11.28	48.80	18.00	33.20	CL
Profile KH 7.862225N 6.074468E Aquic Kandiustalfs/Gleyic Lixisols/Adio																				
Ap	0 – 27	6.55	4.40	1.60	1.20	0.19	0.31	7.70	0.60	1.04	0.40	6.69	22.22	95.97	2.47	10.96	60.90	13.90	25.20	SCL
Btc1	27 – 52	6.36	3.00	1.90	0.37	0.14	0.30	5.71	0.57	1.02	0.43	4.90	12.73	94.75	2.45	10.87	56.80	14.00	29.20	SCL
Btc2	52 – 94	6.33	3.30	1.20	0.40	0.18	0.42	5.50	0.50	0.89	0.18	4.20	10.08	92.36	3.27	10.99	48.80	14.00	37.20	SCL
Btc2	94 –120	6.32	2.80	1.50	0.43	0.10	0.30	5.13	0.50	0.89	0.21	19.52	7.48	94.15	1.95	10.93	40.80	14.00	45.20	SC
Btg	120 -150	5.37	2.90	1.10	0.47	0.11	0.30	4.88	0.16	0.29	0.16	4.74	10.49	93.85	2.25	10.85	46.10	12.70	41.20	C
Profile KI 7.862129N 6.072258E Aquic Arenic Kandiustalfs/Gleyic Lixisols/Adio																				
Ap	0 – 33	5.72	4.30	1.00	0.36	0.21	0.54	6.41	0.61	1.06	0.30	5.91	15.72	91.58	3.28	11.34	76.21	10.00	27.20	SL
Btc	33 – 65	5.61	2.70	2.00	0.28	0.19	0.46	5.63	0.42	0.73	0.14	6.69	13.33	91.83	3.38	11.07	56.80	12.00	31.20	SCL
Btc2	65 -112	5.46	2.80	1.10	0.34	0.11	0.46	4.59	0.46	0.79	0.21	7.39	10.21	89.98	2.40	10.93	58.80	12.00	29.20	SCL
Bt	112 –130	5.66	4.10	2.50	0.35	0.15	0.31	7.41	0.31	0.53	0.10	6.69	20.27	95.81	2.02	10.74	56.80	12.00	31.20	SCL

TEB-Total exchangeable bases EA- Exchangeable acidity ECEC- Effective cation exchange capacity BS- Base saturation ESP- Exchangeable sodium percentage, EC- Electrical conductivity

Table2. *Physico-Chemical characteristics of Ado Ekiti study area (Older Granite)*

Horizon	Depth	pH	Exchangeable Cations (Cmol/kg)				EA	ECEC	Organic Carbon	Organic Matter	Total Nitrogen	Available P	ECEC (Clay)	BS	ESP	Gravel	Sand	Silt	Clay	Texture
	(cm)	(H₂O)	Ca	Mg	K	Na	(Cmol/kg)	(Cmol/kg)	(%)	(%)	(%)	(ppm)	(Cmolkg)	(%)	(%)	(%)	(%)	(%)	(%)	
														Profile AA 7.711121N 5.243230E Plinthic Kandiustalfs/Plinthic Lixisols/Iwo							
Ap	0 – 13	6.2	2.70	0.41	0.29	0.18	1.44	5.02	0.32	0.54	0.03	5.68	10.75	71.31	3.58	0.70	77.00	8.00	15.00	SL
Bt	13 – 36	6.4	1.70	0.22	0.17	0.12	1.68	3.89	0.23	0.40	0.02	5.06	9.95	56.81	3.08	1.36	65.00	4.00	31.00	SCL
Btv1	36 – 84	6.9	2.75	0.32	0.19	0.14	1.50	4.82	0.19	0.33	0.02	6.13	10.65	68.87	2.90	1.45	57.00	5.00	39.00	SCL
Btv2	84 – 118	6.5	2.80	0.31	0.22	0.13	1.28	4.74	0.11	0.18	0.01	5.91	8.89	72.00	2.74	2.11	47.00	4.00	49.00	SC
Btcx	118 – 130	5.7	2.85	0.33	0.21	0.11	1.12	4.63	0.11	0.18	0.01	5.83	8.84	75.91	2.37	4.05	46.00	6.00	48.00	SC
														Profile AB 7.710876N 5.245183E Plinthic Paleustalfs/Plinthic Lixisols/Iwo							
Ap	0 – 15	6.6	2.10	0.24	0.23	0.10	0.64	3.31	0.46	0.80	0.04	8.94	13.08	80.66	3.02	0.40	79.00	8.00	13.00	SL
Bt1	15 – 38	6.3	2.13	0.25	0.19	0.14	1.04	3.75	0.50	0.88	0.04	7.00	13.33	72.26	3.73	1.20	77.00	8.00	15.00	SL
Bt2	38 – 69	6.4	1.23	0.32	0.17	0.14	1.12	4.03	0.44	0.76	0.03	7.39	4.94	72.20	3.47	1.27	61.00	8.00	31.00	SCL
Btc	69 – 100	5.8	2.18	0.42	0.17	0.14	1.12	4.03	0.27	0.47	0.02	5.68	7.17	72.20	3.47	1.43	53.00	4.00	43.00	SC
Btx	100 – 114	5.7	2.00	0.42	0.17	0.15	1.20	3.94	0.15	0.25	0.01	14.98	7.59	69.54	3.80	1.91	49.00	6.00	45.00	SC
														Profile AC 7.712567N 5.244153E Arenic Kandiustalfs/Haplic Lixisols/Iwo							
Ap	0 – 19	6.7	2.50	0.22	0.15	0.07	1.12	4.06	1.05	1.81	0.09	14.93	2.57	72.41	1.72	0.20	75.00	10.00	15.00	SL
Bh1	19 – 35	6.2	1.60	0.22	0.13	0.10	1.12	3.17	0.57	0.98	0.05	10.42	5.88	64.67	3.16	0.80	70.00	10.00	20.00	SL
Bh2	35 – 60	6.1	1.18	0.28	0.22	0.09	1.04	2.81	0.45	0.83	0.04	8.01	4.26	63.00	3.20	1.65	67.00	4.00	29.00	SC
Bh3	60 -94	5.8	2.13	0.25	0.21	0.10	1.08	3.77	0.82	1.41	0.07	34.61	2.90	71.35	2.65	2.17	63.00	6.00	31.00	SC
														Profile AD 7.713800N 5.244635E Typic Durustalfs/Petroplinthic Lixisols/Iwo							
Ap	0 – 18	6.8	2.68	0.31	0.24	0.12	1.12	4.47	0.92	1.59	0.08	10.58	8.33	74.94	2.68	0.60	76.00	9.00	15.00	SL
B	18 – 34	6.2	1.45	0.25	0.21	0.09	0.96	2.96	0.71	1.23	0.06	8.01	1.76	67.57	3.04	0.80	62.00	11.00	27.00	SCL
Btx	34 – 64	6.2	1.48	0.21	0.19	0.14	0.96	2.98	0.38	0.66	0.04	4.74	5.00	67.79	4.70	0.51	56.00	11.00	33.00	SCL
														Profile AE 7.713694N 5.245869E Typic Kandiustalfs/Haplic Lixisols/Iwo							
Ap	0 – 35	6.1	2.53	0.34	0.14	0.12	1.04	4.17	0.77	1.36	0.06	9.49	5.46	75.06	2.88	0.40	64.00	9.00	27.00	SCL
Bh	35 – 79	6.4	1.73	0.26	0.21	0.11	1.12	3.43	0.76	1.30	0.06	10.11	2.20	67.35	3.21	2.61	58.00	7.00	35.00	SCL
Bhx	79 – 120	6.0	1.58	0.23	0.19	0.10	1.20	3.30	0.65	1.12	0.06	3.89	2.38	63.64	3.03	3.01	52.00	5.00	43.00	SC
														Profile AF 7.712131N 5.246052E Arenic Paleustalfs/Haplic Lixisols/Iwo							
Ap	0 – 20	6.6	2.68	0.31	0.23	0.12	1.88	5.22	0.87	1.55	0.08	22.24	13.80	64.00	2.30	0.20	74.00	11.00	15.00	SL
B	20 – 49	6.5	1.33	0.29	0.17	0.07	1.44	3.98	0.38	0.65	0.03	10.58	10.6	62.56	1.76	2.50	64.00	11.00	25.00	SL
Bt	49 – 85	6.3	1.50	0.21	0.18	0.08	0.88	2.85	0.32	0.54	0.03	5.76	4.44	69.12	2.81	3.11	54.00	7.00	39.00	SCL
Btx	85 – 105	6.0	1.53	0.20	0.16	0.15	1.12	3.16	0.23	0.40	0.02	13.77	5.48	64.56	4.75	4.60	48.00	9.00	43.00	C
														Profile AG 7.710802N 5.246470E Typic Epiaqualfs/Oxyaquic Arenosols/Matako							
Ap	0 – 9	6.5	2.98	0.40	0.26	0.18	1.60	5.42	1.39	2.48	0.21	13.53	3.96	57.33	2.67	1.41	76.00	10.00	14.00	SL
Bw1	9 – 20	5.2	1.78	0.18	0.09	0.11	1.75	3.91	0.44	0.76	0.04	5.44	18.23	39.86	3.78	0.68	80.00	7.00	13.00	LS
Bw2	20 – 60	5.6	0.88	0.17	0.08	0.10	0.72	1.95	0.08	0.15	0.01	4.90	12.85	63.08	5.13	0.20	80.00	7.00	13.00	LS

TEB-Total exchangeable bases EA- Exchangeable acidity ECEC- Effective cation exchange capacity BS- Base saturation ESP- Exchangeable sodium percentage, EC- Electrical conductivity

Table3. *Fertility capability classification of soils studied*

Profile	Type	Substrata types	Modifiers						Aggregate
			g	g⁺	D	r⁺	K	E	
KA, KB, KD, KE, KH, KI	L	L			+	+		+	LLd r⁺e
KC, KF, KG	L	L		+	+	+		+	LLg⁺dr⁺e
AA, AF	L	C			+			+	LCde
AB, AD	L	L			+			+	LLde
AC	L	L			+		+	+	LLdke
AE	L	C			+		+	+	LCdke
AG	L	S	+					+	LSge

L-Loamy textured, C- Clayey textured, S- Sandy textured g⁺- anaerobic condition (gley), g- aquatic moisture regime, d- ustic moisture regime, r⁺- gravel percentage between 10-35%, K- low nutrient capital reserves (K deficiencies) e- low buffering capacity ECEC <10cmol/kg soil by sum of EB+EA
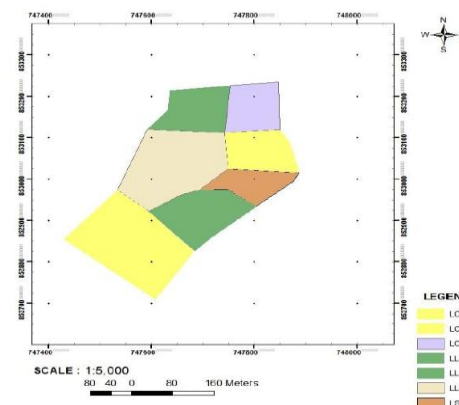

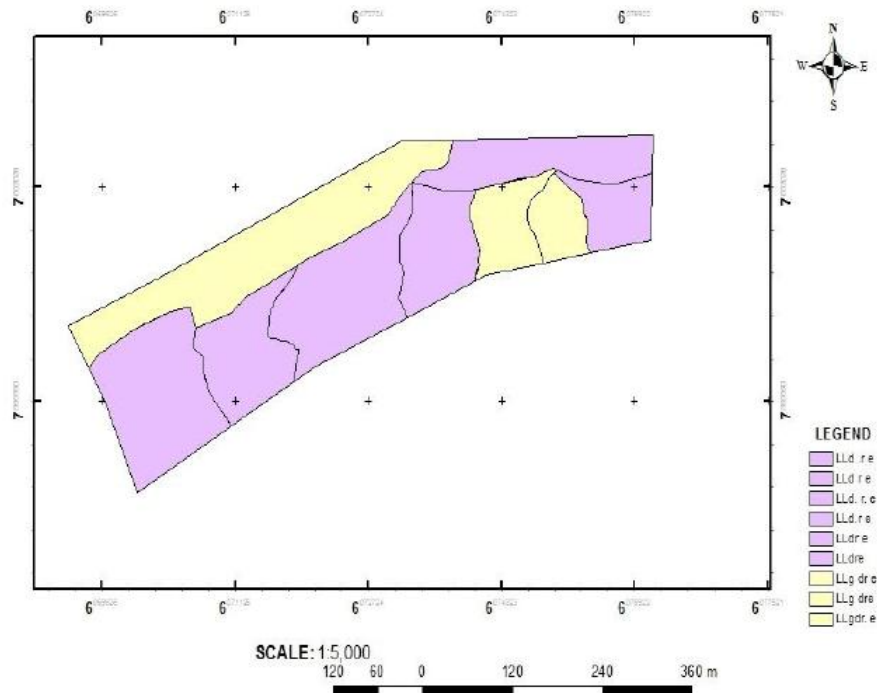**Figure4.** *Fertility capability classification of Ado Ekiti site (Older granite soils)*

Figure5. *Fertility capability classification of Kabba (Schist soils)*

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