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A Survey of Cation Exchange Capacity of Soil Subjected To Arable Crop Production in Abraka,Nigeria

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Abstract

The study was design to examine the cation exchange capacity and pH of soil subjected to arable crop production in Abraka with a view to ascertain the environmental requirements of maize and cassava. The study was conducted in seven plots measuring 10m by 15m in the two ecosystems. It involved the experimental approach to examine soil properties of arable and forest sites to determine the farm areas that support maize and cassava production in the soils. The samples were collected at (0-10cm) surface and (10-20cm) sub surface. The soil data were analyzed for both exchangeable cation and soil pHin the laboratory. The results of statistical analyses show that, soil properties were at variance in the two ecosystem .Although, the arable landscape supported the production of maize and cassava in this region, the mean yields in the mature forest ecosystem are higher. This is obviously due to the higher nutrient content resulting from the support by organic matter composition in the mature forest which is supported by higher letter fall. The comparism of the soils was also determined using the student's t-test at 0.5 level of significance. Finally, the researcher advances some recommendations towards improving the soil plant growth.

Keywords: *Forested farm land, Cation exchange Capcity, Arable crops, Ecosystems and Abraka*

1. Introduction

Soil is a dynamic entity which is developed from pathogenic process during and after weathering of rocks (Chandy, 2012). It is made up of mineral and organic matter, possessing bothchemical, physical, mineralogical and biological properties which provides a medium for plant growth and therefore, it is one of the most important requisite for apiculture. On the other hand, cation exchange capacity of a soil(C.E,C) is the measure of the total capacity of a soil to hold exchangeable cations and indicate the negative charge per unit mass of soil (Johnny,2014). This can be further explained to mean that the surface of clay particles and organic matter (humus) are negatively charged and as such capable of storing and supplying plant nutrients that are positively charged.

The exchangeable cations of importance in soil are Calcium (Ca2+), Magnesium (Mg2+), Sodium (Na+), Potassium (k+), Hydrogen (H+) and Aluminum (Al3+). Therefore CEC is thus important for retaining nutrient and making them available to plant. Soil organic matter and clay minerals are the two most important constituents that influence soil cation exchange capacity.

In Nigeria, soil type is governed by different ecology and geographical factors which variably result in regional variation in soil fertility hence variation in soil types. For example, soils in northern part of the country support the cultivation of groundnut, cowpea, cotton, rice and guinea corn, this can be added to the nature of the soil cation exchange capacity in northern Nigeria soil. While in the Southern part, the cultivation of crops like cocoa, cassava, yam, pepper, melon, maize, plantain, okro, etc is due to the soil nature of cation exchange capacity of this ecology zone.

In view of the southern ecological soil with particular reference to Abraka. The soil show Abraka soil has a texture that is Sandy, loamy sandy and loamy clay. From observation, cassava, plantain, maize, Yam, are predominant crops cultivated in this area, similar areas that is governed by the same geographical factor of soil texture and structure also cultivate these crops. The question is, could this be a reflection of the effect of cation exchange capacity (CEC) of Abraka soil on these crops? Hence the purpose of this research work is to take a critical survey of the role of cation exchange capacity (CEC) in the cultivation and production of these arable crops.

In order to achieve this aim, the following objectives will be pursued as follows:

- To examine cation exchange capacity of soil in Abraka.
- To compare cation exchange capacity between arable and forest areas.
- To determine the pH values of the soil.
- To suggest measures in improving the soil cation exchange capacity for greater food production.

2. Materials and Method

Abraka lies between Latitude 5°45’and 5°50’ north and longitude 6°15’has a total area of about 164Sq.km (See Fig 1)

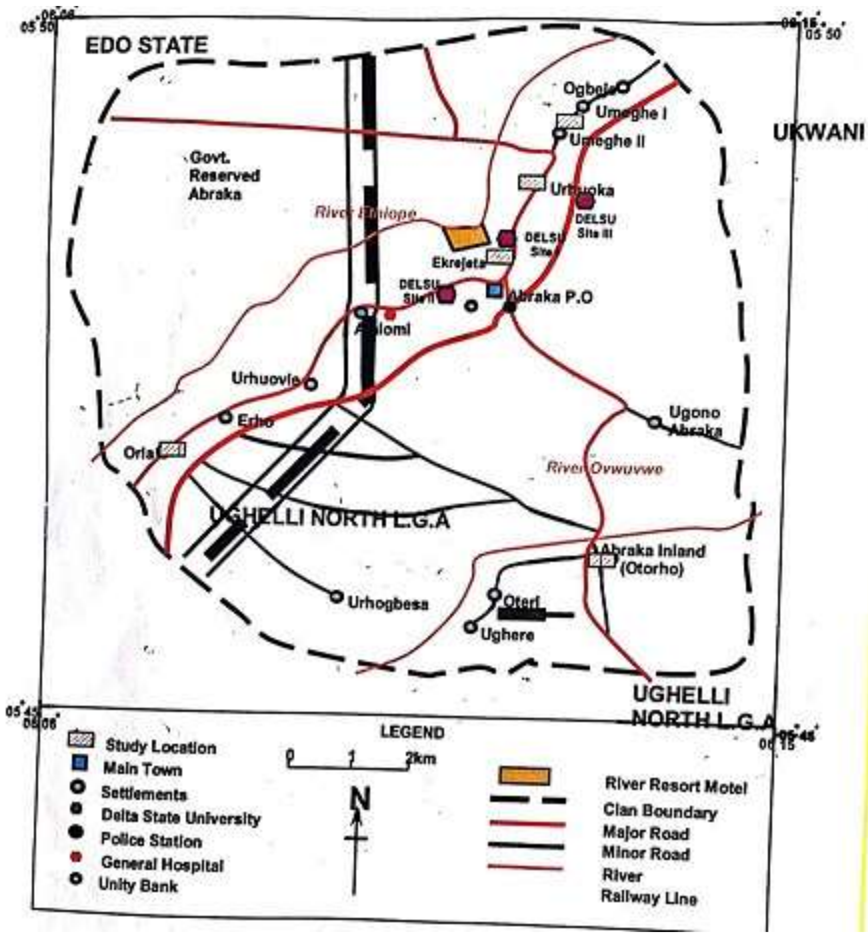

Fig.1 Map of Abraka Showing Sample Areas
Source: Field work (2021).

The area is a low landscape grouped under the coastal lowland of western Nigeria. The topography consists of rolling lowland plane generally 45m above sea level. Geographically, the area is characterized by temperature above 20 ^{0}c with annual rainfall of over 250cm.The wet season last for about 6 months from Match – September. While the dry season prevails from mid-October through February. Apart from these two seasons, there is also the August break.

Soil and vegetation are closely related and the soil within this area is made up of ferrasols precisely the red and brown soil with abundant free iron oxide. The vegetation cover serves as an indicator of the soil status for the local people and their agricultural and other primary production activities.

The types of vegetation found in this area are rainforest and patches of savanna communities, the predominant of which is the luxuriant rainforest vegetation ecosystem . However, the rainforest ecosystem has been greatly replaced by secondary regrowth and derived savanna landscape owing to deforestation.

Agro forestry is also an aspect of the plant cover in the study area. It is the practice of integrating trees into farmland in order to maintain soil fertility by adding litter to the soil, improving soil physical status while the root absorbs nutrient from the subsoil and from weathering zone of rock below the ground and consequently recycling such nutrients to the topsoil (Sanchez, 2011).

Samples for this study were drawn from the southern Nigeria soil. The ecological setting of the soil has been affected by different human activities, but emphasis of this study was centered on an aspect of the cation exchange capacity (CEC) of soil which has been affected by the activities of man. The study was stratified into two forest site; each of it was divided into seven distinct quadrant of 10 meter by 15 meters respectively. Also arable farm sites were established in each cation exchange capacity in the adjoining rainforest areas. These arable sites were equally divided into seven quadrants of 10 meters each. Quadrants of this size were considered adequate for sampling the arable crop production and forest areas. A total of 140 quadrants was setup for the study (7 from forest site, 7 from arable sites). In each plot, two soil samples each was collected for the top soil 0- 10cm and sub soil 10-20 respectively. The study was zoned using the alphabetic notation A-G as follows;

A-Umeghe, B-Urhoka, C-Ekrejeta, D-Abraka P.O, E-Ajalomi, F- Urhuovie, G-Erho

The use of letter A-G for the zones was based on convenience and to ensure adequate sampling to achieve a significant result.

Data for this study were drawn from both secondary and primary and field work was embarked upon in two phases. The first was a reconnaissance survey to access the sites with a possibility to conducting an effective research, the second phase was on collection of soil samples from representative soil within the study area using hand trowel, shovel, cutlass and a scale ruler calibrated from 0-10m depth for the surface samples and 10-20m depth for sub surface samples which were packed into a labeled polythene bags and taken to the laboratory for analysis. On the other hand, the secondary source of data was from the internet, journals, and textbooks. Data were collected from seven arable and seven forest sites. The data collected were based on exchangeable cations (Potassium, Calcium, Sodium and Magnesium) as well as soil pH. The data were counted for the essential requirement to explain the effect of the cation exchange capacity on arable crop production in the study area.

CEC (cation exchange capacity) is the ability of soil to retain and release elements such as K+, Ca2+, Mg+ and Na+. The CEC determination was calculated based on the extracted soil test value converted to millimeter equivalent.

This study adopted the electrometric method where soil pH was determine potential metrically in 0.01m Calcium Chloride (soil pH is 0.01 MCUC12) using a soil to calcium chloride solution ration of 1.2. The purpose is to provide a constant soluble salt concentration thus reduce differences in pH value due to variations ratios. The major advantage of determining soil pH in 0.01m calcium chloride rather than in water 1:1 soil to water ratio is that the readings obtained truly reflect the degree of soil base saturation.

The result of Laboratory analysis was subjected to both inferential and descriptive statistics determine the mean of bulked soil sample result for the two plots in each ecosystem respectively; the mean and standard deviation for the arable crop field. Students "T" test and analysis of variance (ANOVA) was used to examine the differences in the soil characteristics between the two soil layers.

3.0 Results and Discussion

3.1: Concentrations of Exchangeable Cations

The result derived from the soil test were used to access the relationship between arable farmland topsoil table 3.1.1 and subsoil table and mature forest topsoil

Table 3.1.1: Concentration of exchangeable cation in Arable farm land area (mg/kg)

s/n		Arable topsoil				Arable subsoil			
		K^+	Ca^+	Na^+	Mg^+	K^+	Ca^+	Na^+	Mg^+
1	Umeghe	64	778	60	199	21	332	24	76
2	Urhouka	68	779	47	287	18	321	16	102
3	Ekrejeta	56	803	42	256	15	380	14	98
4	AbrakaP.O	55	791	55	253	17	346	23	97
5	Ajalomi	54	804	59	240	16	390	21	99
6	Urhuovie	68	802	56	300	20	390	18	129
7.	Erho	57	808	56	188	19	408	19	80
	Mean	60.29	79.14	53.57	246.14	18.00	366.71	19.29	97.29
	S.D	6.18	12.51	6.61	41.54	2.16	33.39	3.64	17.24

Source: Fieldwork, 2021

Cations in topsoil and subsoil of the arable farm land areas indicate that the mean concentration of potassium, calcium, Sodium, and magnesium are 6.29, 79.14, 53.57, and 246.14 mg/kg in the topsoil; while the standard deviation values are 6.18,12.51,6.61, and 41.45 mg/kg.

The corresponding mean values of the exchangeable cations the subsoil are 18.0, 366.71, 19.29, and 97.29 mg/kg; while the standard deviation values are 2.16,33.39, 3.64, and 17.24 respectively.

This value show that in the arable farm land area, the concentrations of exchangeable calcium is high in both the top soil and subsoil, while that of sodium is lowest in the concentrations were tested with the **ANOVA** statistics and result are presented in table 3.1.2 and 3.1.3.

Table 3.1.2: One way ANOVA results for the concentrations of exchangeable cations in top soil of the arable farmland

	Sum of squares	Df	Mean	F	Significant
Between groups	2560278	3	853425.952	1738.012	.000
Within groups	11784.857	24	491.036		
Total	2572063	27			

Table 3.1.2: present the ANOVA results in the difference of concentration of exchangeable cations in top soil of the arable farmland. The results show that the exchangeable cations (potassium, calcium, sodium and magnesium) differ in concentrations within the top soil with the f- value of 1738.01 and significant value of 0.000; the difference is significant at the 0.05 level of confidence. Therefore, the exchangeable cations are significantly difference in concentrations in the topsoil.

Table 3.1.3: One way ANOVA results for the concentrations of exchangeable cations in Subsoil of the arable farmland

	Sum of squares	Df	Mean	F	Significant
Between groups	572725.8	3	190908.607	533.992	.000
Within groups	8580.286	24	357.512		
Total	581306.1	27			

The ANOVA results in the difference of concentration of exchangeable cations in subsoil of the arable farmland. The results show that the exchangeable cations (potassium, calcium, sodium and magnesium) differ in concentrations within the top soil with the f- value of 533.99 and significant value of 0.000; the difference is significant at the 0.05 level of confidence. Therefore, the exchangeable cations are significantly difference in concentrations in the subsoil of arable farmland.

Table 3.1.4: Concentration of exchangeable cation in mature forest areas (mg/kg)

s/n		Forest topsoil				Forest subsoil			
		K^+	Ca^+	Na^+	Mg^+	K^+	Ca^+	Na^+	Mg^+
1	Umeghe	94	1042	98	487	22	343	30	129
2	Urhouka	125	2023	76	499	22	757	24	102
3	Ekrejeta	97	1879	81	512	19	499	27	228
4	Abraka P.O	86	1898	88	485	25	477	26	134
5	Ajalomi	156	1834	100	388	30	515	28	294
6	Urhuovie	139	1694	104	510	30	515	28	102
7.	Erho	107	1808	105	506	19	486	36	263
	Mean	114.86	754.0	93.14	483.86	23.86	535.0	28.57	178.71
	S.D	25.91	330.30	11.52	43.58	4.67	136.20	3.82	80.85

Source: Fieldwork, 2021

Table 3.1.5: present the concentrations of exchangeable cations in topsoil and subsoil of the mature forest area. The mean concentrations of potassium, calcium, sodium and magnesium in the topsoil are 114.86, 754.0, 93.14 and 483.86; while the standard deviation values are 25.91, 330.30, and 43.58 mg/kg.

The corresponding mean values of the exchangeable cations the subsoil are 18.0, 23.86, 535.86, 535.0, 28.57 and 178.71 mg/kg; while the standard deviation values are 4.67, 136.20, 3.80 and 80.85 mg/kg respectively. These values show that in the mature forest areas, the concentrations of exchangeable calcium are highest in both topsoil and subsoil. The difference in the concentrations were tested with ANOVA and the results are presented in tables 3.1.6 and 3.1.7

Table 3.1.6: One way ANOVA results for the concentrations of exchangeable cations in topsoil of the mature forest.

	Sum of squares	Df	Mean	F	Significant
Between groups	126586.30	3	4286210.131	153.353	.000
Within groups	670800.6	24	27950.024		
Total	13294.31	27			

The ANOVA results in the difference of concentration of exchangeable cations in subsoil of the arable farmland. The results show that the exchangeable cations ($K^{+,}$ $C^{+,}$Naand Mg^+) differ in concentrations within the top soil with the f- value of 153.35 and significant value of 0.000; the difference is significant at the 0.05 level of confidence. Therefore, the exchangeable cations are significantly difference in concentrations in the topsoil of the mature forest.

Table 3.1.7: One way ANOVA results for the concentrations of exchangeable cations in subsoil of the mature forest.

	Sum of squares	Df	Mean	F	Significant
Between groups	12096339	3	403212.988	64.199	.000
Within groups	150736.0	24	6280.667		
Total	1360375	27			

The ANOVA results in the difference of concentration of exchangeable cations in subsoil of the mature forest area. The results show that the exchangeable cations ($K^{+,}$ $C^{+,}$Naand Mg^{+}) differ in concentrations within the subsoil with the f- value of 64.199 and significant value of 0.000; the difference is significant at the 0.05 level of confidence. Therefore, the exchangeable cations are significantly difference in concentrations in the subsoil of the mature forest.

4.1 Cations exchange capacity (CEC)

The Cations exchange capacity (CEC) of the soil were also determine using the four important plant nutrients such calcium, potassium, sodium and magnesium which contribute to the capacity of soils to retain plant nutrient cations. The result from the soil test was used to calculate the mean CEC of arable farmland and mature forest using t-test in table 4.2 and 4.4 respectively.

Table 4.2: Mean cation exchange capacity values of soils in meq/100g
of soils in arable areas.

S/n	**Sites**	**Mean CEC in Arable Areas**	
		Topsoil	**Subsoil**
1	Umeghe	7.17	3.64
2	Urhuoka	7.87	3.78
3	Ekrejeta	7.67	4.02
4	Abraka P.O	7.65	3.88
5	Ajalomi	7.62	4.11
6	Urhuvie	8.13	4.36
7	Erho	7.20	4.04
Mean		7.62	3.98
S.D		0.34	0.24

Source: Fieldwork, 2021

Table 4.2 indicates the mean cations exchange capacity values of soil in arable farmland area. The mean topsoil and subsoil are 7.62 meq/100g of soils, while the standard deviation values are 0.34 and 0.24 meq/100g of soils respectively. Cations exchange capacity is highest at the Urhuovie site and lowest at Ajalomi sites. This shows that the level of CEC differ amongst the difference soil layers. Difference is tested with the independent sample t-test statistics and the results are presented in table 4.3.

Table 4.3: Independent Sample T-tested results for the Topsoil and Subsoil CEC in Arable Farmland.

Independent Samples Test

	Levene's test for quality of variance		**Test for equality of means**						
	F	Sig	T	Df	Sig 2-tailed	Mean Diff	Std Error Diff	95% confidence interval of the diff	
								Lower	upper
CECA equal variance assumed	485	499	23.168	12	.000	3.64000	.15711	3.29768	3.98232
equal variance not assumed			23.168	10.626	.000	3.64000	15711	3.29271	3.98729

Table 4.3 indicates the results of the independent samples t-test for the value of difference between the topsoil and subsoil. The f-value is 0.485, t- value is 23.

168 with significant 2 tailed of 0.00. Therefore, there is a significant difference in the CEC of the arable farm land between the topsoil and subsoil.

Table 4.4: Mean cation exchange capacity values of soils in meg/100g in mature forest areas.

S/n	**Sites**	**Mean CEC in Arable Areas**	
		Topsoil	**Subsoil**
1	Umeghe	11.14	4.19
2	Urhuoka	16.13	5.99
3	Ekrejeta	15.47	5.77
4	Abraka P.O	15.33	4.88
5	Ajalomi	14.93	4.83
6	Urhuvie	14.73	7.20
7	Erho	15.19	6.30
Mean **S.D**		14.20 1.63	5.56 1.00

Source: Fieldwork, 2021

Table 4.4 indicates the mean cations exchange capacity values of soil in mature forest area. The mean topsoil and subsoil are 14.70 and 5.56 meq/100g of soils, while the standard deviation values are 1.63 and 1.00 meq/100g of soils respectively. Cations exchange capacity is highest at the Urhuoka site and lowest at Umeghe sites. This shows that the level of CEC differ amongst the difference soil layers. Difference is tested with the independent sample t-test statistics and the results are presented in table 4.5.

Table 4.5: Independent sample T-tested results or the topsoil and subsoil CEC in mature forest.

Independent Samples Test

	Levene's test for quality of variance		**Test for equality of means**						
	F	Sig	T	Df	Sig 2-tailed	Mean diff	Std Error diff	95% confidence interval of the diff	
								Lower	upper
CECFequal variance assumed	209	.65	12.635	12	.000	9.14714	.72397	7.56974	0.72454
equal variance not assumed			12.635	9.951	.000	9.14714	.72397	7.53294	0.76134

Table 4.5 indicates the results of the independent samples t-test for the topsoil and subsoil CEC in mature forest area. With The f-value is 0.209, t- value is 12.635 and significant 2 tailed of 0.000.The difference in the CEC between the topsoil and subsoil are significant difference in the CEC of the mature forest area between the topsoil and subsoil.

Table 4.6: Independent sample T-tested results for the topsoil CEC between arable farmland and mature forest.

Independent Sample Test

	Levene's test for quality of variance		**Test for equality of means**						
	F	Sig	T	Df	Sig 2-tailed	Mean Diff	Std Error diff	95% confidence interval of the diff	
								Lower	upper
CECT equal variance assumed	2.771	.122	-11237	12	.000	-7.8714	.63070	.846132	5.71296
equal variance not assumed			-11.37	6.527	.000	-7.08714	.63070	8.60068	5.57361

Table 4.6 indicates the results of the independent samples t-test for the topsoil and subsoil CEC between arable farmland and mature forest area. With The f-value is 2.77, t- value is 0.122 and significant 2 tailed of 0.000.The difference in the CEC between the topsoil of the arable farmland and that of the mature forest area significant at the 0.05 level of confidence.Therefore, there is a significant difference in the CEC of the topsoil between the arable farmland and mature forest area at the 0.05 level.

Table 4.7:Independent sample T-tested results for the subsoil CEC
Between arable farmland and mature forest.

Independent Sample Test

	Levene's test for quality of variance		**Test for equality of means**						
	F	Sig	T	Df	Sig 2-tailed	Mean diff	Std Error diff	95% confidence interval of the diff	
								Lower	upper
CECS equal variance assumed	9.007	.011	-4.066	12	.022	-1.5800	.38863	2.42676	-73324
equal variance not assumed			-4.066	6.661	.055	-1.58000	.3863	2.50855	-65145

Table 4.6 indicates the results of the independent samples t-test for the subsoil CEC between arable farmland and mature forest area. With The f-value is 9.007, t- value is 4.066 and significant 2 tailed of 0.011,The difference in the CEC between the subsoil of the arable

farmland and that of the mature forest area are significant at the 0.05 level of confidence. Therefore, there is a significant difference in the CEC of the subsoil between the arable farmland and mature forest area at the 0.05 level.

5.1 Soil pH Values

Soil solution could be acid, neutral or alkaline due to the presence of certain ions in the soil. This is an important aspect of soil solution. The PH of the soil analyzed showed a mean PH values of 5.84 for topsoil and 5.39 for subsoil in arable farmland and 6.84 for topsoil and 5.39 for subsoil in arable farmland and 6.36 for topsoil and 5.97 for subsoil in mature forest. The soil PH therefore ranges from moderately to slightly acidic. This is a characteristic of soil in the southern belt of Nigeria and the area under happens to fall within the acid sand of southern Nigeria.

Ejemeyovwi (2006) was of the view that soil pH value of 6.5 to 7.5 are ideal for cultivation of most arable crops since the range favor the availability and uptake of most essential and non-essential nutrient. From table 4.7, some of the soil ph below 6.5 like AJalomi, Urhouka, and Ekrejeta needs liming for crop production, while within the range of 6.5 to 7.0 are for crop production like Abraka P.O farmland.

Table 5.2: soil pH in Arable Areas

S/n	**Sites**	**Soil pH in arable area**	
		Topsoil	**Subsoil**
1	Umeghe	6.1	5.8
2	Urhuoka	5.7	5.5
3	Ekrejeta	5.6	5.2
4	Abraka P.O	6.4	5.8
5	Ajalomi	5.3	4.9
6	Urhuvie	5.5	4.9
7	Erho	6.3	5.6
Mean		5.84	5.39
S.D		0.42	0.39

Source: Fieldwork, 2021

Table 5.2 present the soil pH in arable farmland areas of the study for the topsoil and subsoil respectively. The mean soil ph for the subsoil are 5.84 and 5.39, while the standard deviation values of 0.42 and 0.39 respectively. The soils are slightly to moderately acidic, with highest pH value at Abraka P.O and lowest at Ajalomi. The difference in the pH concentrations are tested with the independent samples t-test, and the results are represented in table 5.3.

Table 5.3:Independent sample T-tested results for the topsoil and subsoil in Arable Farmland.

Independent Samples Test

	Levene's test for quality of variance		Test for equality of means						
	F	Sig	T	Df	Sig 2-tailed	Mean diff	Std Error diff	95% confidence interval of the diff	
								Lower	upper
PHA equal variance assumed	151	705	2102	12	.057	.45714	21744	.01661	93090
equal variance not assumed			2.102	11.914	.057	.45714	.21744	-.01699	93128

Table 5.3 indicates the results of independent samples t-test for the topsoil and subsoil pH in arable farmland area. With f-value of 0.151, t-value of 2.102 and significant 2 tailed value of 0.057, the difference in soil pH between the topsoil and subsoil are not significant at the 0.5 level of confidence. Therefore, there is no significant difference in the pH value of the topsoil and subsoil in the arable farmland area.

Table 5.4: soil pH in Forested Areas

S/n	**Sites**	**Soil Ph in arable areas**	
		Topsoil	**Subsoil**
1	Umeghe	6.0	5.6
2	Urhuoka	6.2	6.0
3	Ekrejeta	5.6	5.4
4	Abraka P.O	7.0	6.3
5	Ajalomi	6.2	6.0
6	Urhuvie	6.2	5.8
7	Erho	7.3	6.7
Mean **S.D**		6.39 0.59	5.97 0.44

Source: Fieldwork, 2021

Table 5.4 present the soil pH in mature forest areas of the study for the topsoil and subsoil respectively. The mean soil pH for the subsoil are 6.36 and 5.97, while the standard deviation values of 0.59and 0.44 respectively. The soils are slightly moderately acidic, and near neutral to alkaline; with highest pH value at Erhoand lowest at Ekrejeta. The difference in the pH concentrations are tested with the independent samples T-test, and the results are represented in table 5.5.

Table 5.5: Independent sample T-tested results for the Topsoil and Subsoil pH in mature forest

Independent Samples Test

	Levene's test for quality of variance		Test for equality of means						
	F	Sig	T	Df	Sig 2-tailed	Mean diff	Std Error diff	95% confidence interval of the diff	
								Lower	upper
PHF equal variance assumed	.715	.414	1.395	12	.188	.38571	.27652	-12677	.98820
equal variance not assumed			1.395	11.048	.190	.38571	.27652	-22258	.99401

Table 5.5 indicates the results of independent samples t-test for the topsoil and subsoil pH in mature forest area. With f-value of 0.715, t-value of 1.39 and significant 2 tailed value of 0.188, the difference in soil pH between the topsoil and subsoil are not significant at the 0.5 level of confidence. Therefore, there is no significant difference in the pH value of the topsoil and subsoil in the mature forest areas.

Table 5.6:Independent sample T-tested results for the Topsoil pH between Arable and Mature Forest.

Independent Samples Test

	Levene's test for quality of variance		Test for equality of means						
	F	Sig	T	Df	Sig 2-tailed	Mean diff	Std Error diff	95% confidence interval of the diff	
								Lower	upper
PHAFT equal variance assumed	.427	.526	-1.877	12	.085	-51429	- 27405	-1.11138	.08281
equal variance not assumed			-1.877	10.904	.088	-51429	27405	-1.1811	.08954

Table 5.6 indicates the results of the independent samples t-test for the topsoil pH between arable farmland and mature forest area. With The f-value is 0.427, t- value is 1.877 and significant 2 tailed of 0.085, The difference in the pH between the topsoil of the arable farmland and that of the mature forest area not significant at the 0.05 level of confidence. Therefore, there

is no significant difference in the pH value of the topsoil between the arable farmland and mature forest area at the 0.05 level.

The work discovered that cation exchange capacity of Abraka soil has a major impact on crop production especially potassium (k). It was discovered that the soil was loamy. Thus, leaching is not predominant. It was discovered that Abraka soil have very high exchangeable base. Some of these are calcium, Magnesium and potassium. For the mean CEC of arable farm, Urhouvie has the highest value of 8.13mel/100g.(see table 4.2)

It was also revealed that the hypothesis tested, that significant difference exist between CEC arable site and forest site finally, it was discover that there was a significant difference between exchangeable cations and soil pH is distributed in Abraka soil .

It was discovered that Abraka have an equatorial type of climate and experience high rainfall as well as marked dry season under tropical condition. It has high temperature of about 35^{o}c and rainfall of about 3000mm annually. It was also discovered in the study that the concentrations of exchangeable cations varied from potassium to magnesium with Erho, Erhouvie, Ekrejeta having calcium as the highest and Umeghe as the lowest for Arable,while Urhoukahas the highest and Umeghe the lowest in forest areas.Furthermore, it was discovered that only Erho has the same exchangeable potassium from arable subsoil and forest subsoil with its value as 19meg/100g.

6. Conclusion and Recommendations

The work was undertaken to study the cation exchange capacity of soil subjected to Arable crop production in Abraka. The study revealed that fallow lands of the study area are used in the production of maize and cassava crops. The maize are usually cultivated in April period owning to the necessary climatic requirement because of its adaptation.In both the arable and forest landscapes, it was found out that the topsoil layer of the soil profiles contained more nutrient than in the subsoil layer, and since maize plants are shallow feeder crops, they established more impact on the topsoil than on the subsoil layers. The reverse is the case for cassava production. This was attributed to the support given by the tree plant to improve the organic matter composition of the soil through litter fall. The result of the analysis show that Abraka soils have some pH value less than 6.5 like Ajalomi, Urhnovie and Ekrejeta, this is not a desirable feature for crop production. But it should be limed for effective crop production while the one above 6.5 like Abraka P.O is suitable for crop production.

Since the pH of Abraka soil range from 4.9 to 6.4 for Arable areas that is strongly to slightly acidic, the crops grown should be such that can tolerate acidic condition and these include cassava, maize and pineapples. However, the soil should be limed to maintain a recommended pH of 6.5 to 7.0 for crop production. Although,this is available in forested areas where the farm land has not been put to use especially in Erho and Abraka P.O farmland.

Also a proper rotation programme of crops can be used effectively to maintain soil fertility. The alteration of legume and non-leguminous crop can also be practiced by farmers to maintain soil fertility by improving the soil quality

In realization of the problems unmanaged soil may cause to agriculture, which is the key sector of the economy of most developing countries such as Nigeria, the management of soil should be the sole responsibility of the peasant farmers. The government should therefore through the help of research programme, science and technology and the soil scientist should adopt an economic and effect method in order to keep the soil permanently productive.

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