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RESEARCH ARTICLE

SOIL FERTILITY STATUS OF AGRICULTURAL LANDS AND SUITABILITY ASSESSMENT FOR SUSTAINABLE CROP PRODUCTION IN KAURA, KADUNA STATE, NIGERIA

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ABSTRACT

Sustainability of agricultural lands ensures sustainable crop production. Continuous monitoring of the already impoverished soil fertility status of farm lands and producing a digitize soil fertility and suitability maps will be a step toward redefining the farm management practices adoption by farmers in the bid to sustain soil fertility and improve crop yield. This study aimed at assessment of the soil fertility status of agricultural lands and establishing the land suitability map of the area. The LGA was purposively chosen as a pilot study and soils were collected from the two Chiefdoms, namely Kagoro and Moroa. Soil samples were collected and composite from agricultural lands within a soil depth of 0-20cm. The sampling produced 12 samples of soils from cultivated and uncultivated lands, while 6 soil samples were collected from dug pit profiles. The collected soils were taken to laboratory for analyses. The result of the textural class of the soils was loamy to sandy loam soil in nature. The pH ranged from 6.6 to 7.3 percent. EC was low (2-4ds/m) to non-saline (0-2ds/m), total nitrogen (0.2-1.0 percent), organic carbon (<0.1 percent), sodium (<1.0cmol/kg), potassium (<0.4cmol/kg), phosphorus (10-25ppm) and CEC (>12 Meq/100g). The soil parameters were within acceptable and favorable threshold limits considered ideal and good for the cultivation and sustenance of plant growth. The suitability rating for crop production was found to be moderate (S2), marginal (S3) and non-suitable (N1) due to certain constraints. The study recommends that for agricultural lands to be sustained, the soil fertility constraints should be addressed by adopting appropriate cultural practices including organic manuring, mulching, planting of legumes and cover cropping among others. Similarly, sustainable practices that will help to mitigate any negative findings should be implemented.

Keywords: Soil; fertility; agricultural lands; suitability, sustainability

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1.0. INTRODUCTION

Land has been a fundamental resource for human livelihood since time immemorial, more importantly, agricultural land. Unfortunately, this has become scarce due to increasing demand by ever increasing population. It has become a big issue for growing countries in their bid to sustain crop production (Oriola & Atiyong, 2020). Land suitability assessment is a land evaluation method proposed by Food and Agriculture Organization to assess the suitability of land for agriculture uses using scientifically standard techniques (Aswathy et al., 2021). Land suitability assessment is a practice that should be encouraged by farmers because of its importance in sustaining the quality and fertility of agricultural lands for generation yet unborn.

Aswarthy et al. (2021) stressed that the main parameters to be considered for establishing suitability of land assessment for agricultural uses are topography, erosion, soil depth, soil texture, nutrient status among others. This classification helps with land use planning and management, guiding decisions about where to prioritize certain activities. Land area can be classified as “Suitable” or “Not Suitable” for a certain use; suitable areas can be portioned in classes, which reflect the degree of suitability. The Food and Agriculture Organization (FAQ 1976); recommends three suitability classes with the following denominations: Class S1: Highly suitable, Class S2: Moderately Suitable, Class S3: Marginally suitable, Class N: Not suitable. It is pertinent to note that soil fertility or nutrient status of agricultural lands and soil depth are most important parameters for establishing suitability of lands for sustainable crop production.

Therefore, to achieve sustainable crop production and food security in Nigeria and Kaura LGA in particular, a good knowledge of the fertility status of soil through empirical research and determination of the suitability of agricultural lands in this modern time will not only boost high crop yield, but sustains the fertility of agricultural lands. Cherubin (2016), noted that soil remains the most important and viable natural resource for crop production, yet in terms of quality and nutrient statue of the soil for the sustenance of high crop yield, it is the most scarce and mismanaged resource. Food and Agriculture Organization (FAO, 2010), asserted that in the past fifty years and thereabout, twenty percentage of farmlands in the continent has suffered so much destruction and may not be reversible. They also noted that failure to check the rate at which the destruction is presently going, about thirty percent of farmlands could lose its ability to produce high crop yield. These therefore, require urgent remedial measures that will improve and sustain the soil quality of farmlands for improve crop yield and consequently a reduction in food insecurity.

United Stated Agency for International Development (USAID, 2022) stressed that the world will have to be more proficient on how it meets its needs in the face of dwindling scarce environmental resources and other challenges. The crucial role of soil fertility in sustainable crop production under appropriate agricultural land practices has been widely recognized by researchers and policy makers alike (Oriola & Bamidele, 2014; Ketema et al., 2015; Muche et al., 2015; Cerda *et al.,* 2016 cited in Atiyong and Oriola, 2020) among others. Since there are no alternative means of attaining sustainable agricultural productivity or higher crop yields except by sustaining soil fertility status of agricultural lands for maximum benefits of the land resources, it then means that all the factors, processes, procedures and treatment that will protect the potential of the soil qualities for increased production should be the concern of farmers' stakeholders and Government at all level. This call for continues monitoring of the soil fertility of agricultural lands, digitalizing the soil properties on a soil map matrix and producing a land fertility assessment map to be shared with, farmers, stakeholders and Government at all level is a step toward creating awareness on the status of agricultural lands.

Kaduna State is located within the Northern and Southern Guinea Agro-Ecological Zone of Kaduna with very extensive lands for sustainable agricultural practices. However, due to inadequate data on soil quality monitoring and soil fertility map of this area, maximum crop yield per farmer per year is grossly affected. A good knowledge of the soil fertility statues of farmlands by the farmers will help in crop preference and cropping systems for sustainable crop production in this region. Internationally accepted soil-classification work has not yet been conducted in Kaduna State (Bennett *et al.,* 1997). Even if it has been done in the past, there is a need to carry out a study on such an important area of research to meet up with today's contemporary issues on food security for all and soil fertility restoration in the face of climate change. The study assessed soil fertility status and land suitability of agricultural lands for sustainability to crop production in Kaura LGA, Kaduna State. The research sought to address the following specific objectives: assess the fertility status of soils from the two

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Chiefdoms and produce a soil map matrix of the study area, and establish the land suitability status of the soil for sustain agricultural practices.

2.0. DESCRIPTION OF THE STUDY AREA

Kaura Local Government Area is located between latitude 9^0 29^1 53^{11} North to 9^0 43^1 28^{11}' North of the Equator and longitude 8^0 19^1 32^{11}' East to 8^0 35^1.55^{11} East of the Greenwich Meridian in Southern part of Kaduna State and forms one of the LGA that makes up the Kaduna South Senatorial District. The study area covers approximately 484.927 square kilometers, with a projected population of 3297,325 constituting 150,795 Males and 145,531 Females as of 2023 (National Bureau of Statistics [NBS], 2015). Kaura LGA shares boundaries with Zangon Kataf LGA to the West, Kauru LGA to the North, Jema'a LGA to the South and Plateau State to the East, respectively. The relief ranges from 450m to 56m above mean sea level. The study Area is made up of two administrative Chiefdom, Kagoro and Moroa Chiefdom with six districts namely Bondon, Zankan, Manchok, Kadarko, Kukum and Fada (Figure 1).

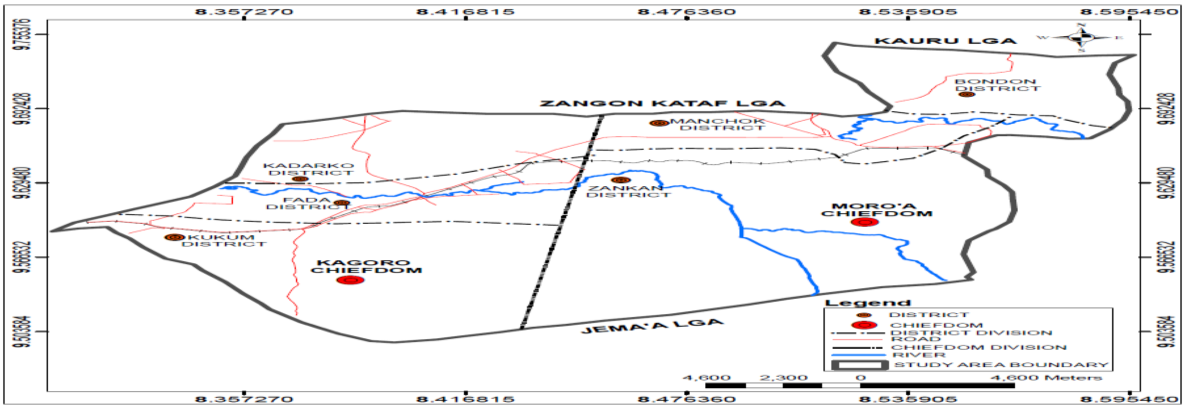

Figure1: Location of the Study Area.
Source: Adapted from Kaura Administrative Map (2025).

3.0. MATERIALS AND METHODS

3.1. Sampling Procedures

Purposive sampling was adopted in the selection of six settlements from the six districts for soils collection which included Katanga, Fadan Daji, Kukum Daji. Kaura, Bondon, and Zankan respectively (Table 1). Six hectares of farmlands were identified in each of the six study settlements and 6 composite soil samples each were collected from cultivated and un-

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cultivated fields (Control) which have been fallowed for more than five years using stratified grid sampling techniques. Furthermore, 3 farmlands and 3 uncultivated (control) were purposively selected for soil profiling across the six study settlements (Table 1). Soil samples collected were taken to a standard soil laboratory for analyses. The analyses were carried out on the fine fraction for particle size distribution, Hydrogen ions (pH), Electrical Conductivity, Cation Exchange Capacity (CEC) at pH H_2O, Total Nitrogen, Available Phosphorus, Organic carbon, Sodium, Potassium and Phosphorus; because they are the most essential for healthy plants growth. In addition, drainage, vegetation cover, soil depth and slope were also considered.

Table 1: Study Settlements and Soil Sampling

S/N	Chiefdoms	Districts	Settlements	No. of Soil sample from cultivated lands	No. of Soil sample from uncultivated lands (Control)	Soil profile collection
1	Kagoro	Kadarko	Katanga	1 and 1 profile	1	1 cultivated- Katanga
		Fada	Fadan Daji	1	1 and 1 profile	1 uncultivated –F/Daji
		Kukum	Kukum Daji	1and 1 profile	1	1 cultivated- K/Daji
2	Moroa	Kaura	Kaura	1	1 and 1 profile	1 uncultivated -Kaura
		Bondon	Bondon	1 and 1 profile	1	1 cultivated- Bondon
		Zankan	Zankan	1	1 and 1 profile	1 uncultivated –F/Attakar
Total	**2**	**6**	**6**	**6 and 3 profiles**	**6 and 3 profiles**	**3**

Source: Authors Field Study, 2024

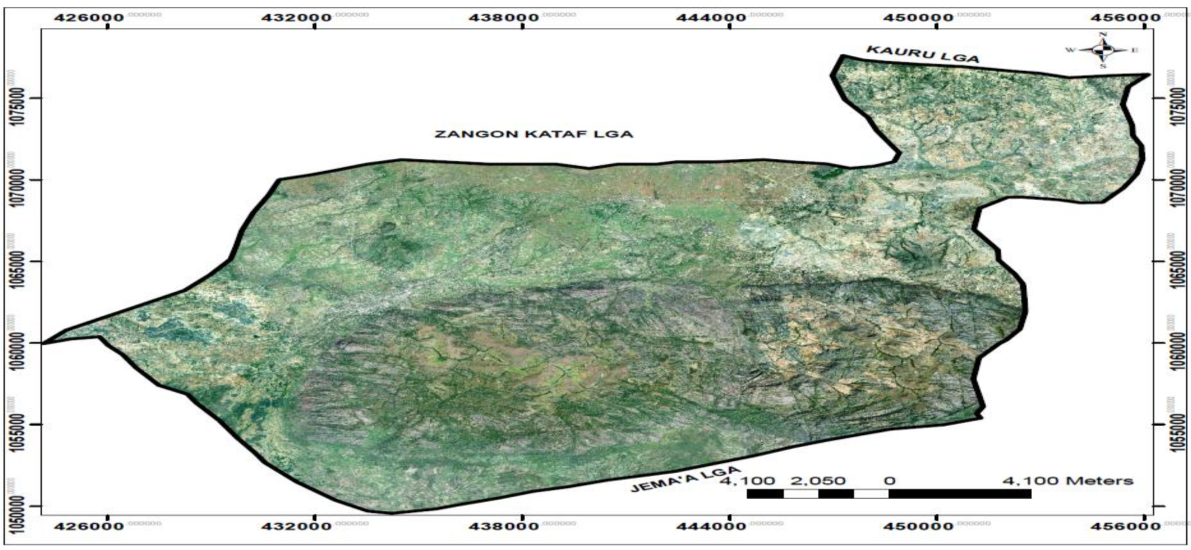

Figure 2: High Resolution Imagery of the Study Area
Source: WorldView-3 Maxar of the United State (2024).

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The high-resolution imagery Worldview-3 Maxar of the United State achieved 2024 (Figure 2) was used to present the UTM coordinates of soil sampling points (Table 2) and Figure 3). The WorldView-3 high resolution satellite imagery of 2024 was used for the digitization and presentation of the soil results (Figure 4-11), this Satellite imagery was grided into regular 5 x 5 Km using ArcGIS 10.8 software. Furthermore, the image was used for Multi-Spectral Classifications of land uses/ land cover analyses (Figure 12), and the land suitability assessment (Figure 13).

Table 2: The Coordinates of the Soil Sample Points

S/No	Settlement	X	Y	Z
1	Kumkum Daji	431380.3428	1061521.864	29.9 ft
2	Kumkum Daji	429564.6973	1060664.637	25.87 ft
3	Kumkum Daji	430855.4554	1060669.472	26.60 ft
4	Fada Daji	429056.6963	1062781.308	26.19 ft
5	Fada Daji	427490.3598	1061638.305	26 ft
6	Fada Daji	429469.1533	1063982.755	25.14 ft
7	Katanga	431268.6649	1068497.214	27.55 ft
8	Katanga	432651.1171	1066829.388	27.76 ft
9	Katanga	432183.3307	1065886.686	27.79 ft
10	Kaura	439663.4008	1068609.739	32.14 ft
11	Kaura	441548.8733	1067620.628	31.60 ft
12	Kaura	441803.6852	1068818.203	31.47 ft
13	Bondon	449217.8899	1072502.906	30.18 ft
14	Bondon	448809.1468	1070465.924	30.25 ft
15	Bondon	447005.1299	1070465.184	30.04 ft
16	Zankam	448830.4432	1066762.089	30.49 ft
17	Zankam	450539.3033	1067092.765	30.36 ft
18	Zankam	450827.0061	1065830.048	30.16 ft

Source: Fieldwork, 2024

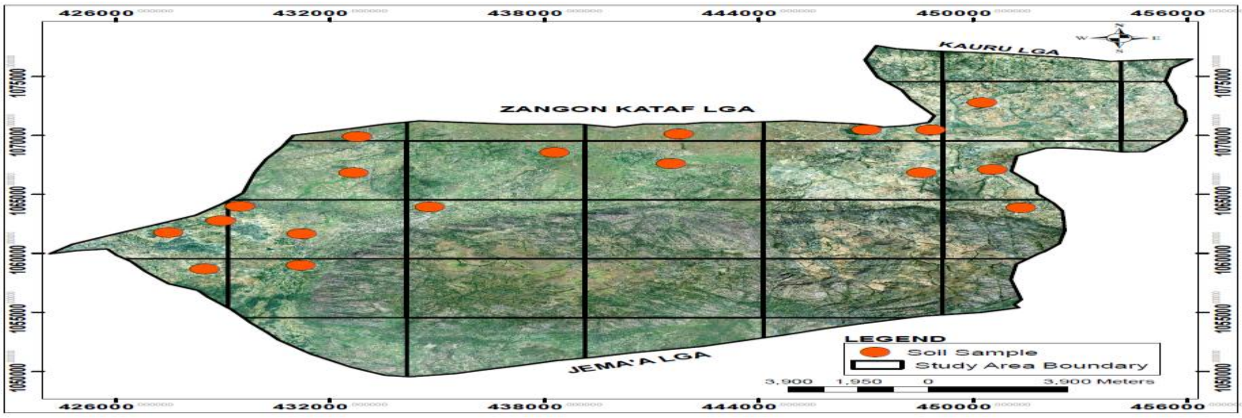

Figure 3: Coordinate of Soil Sample Overplay on Gridded Matrix
Source: Fieldwork Analysis (2025).

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3.3. Method of Data Analysis

The geo-statistics was inbuilt in ArcGIS 10.8 software under spatial analyst tools, Inverse distance weighted (IDW) was used for interpolation of soil sample points areas to assess the fertility status and production of maps, and attributes data. The global standard classification scale ranges for soil parameters were used to determine the status of soil result as depicted in Tables 3 present the analyzed soil sampled parameters test result which was used to established the soil fertility status of agricultural lands and the use of the satellite imagery to produce the current soil map matrix status of the study area.

Table 3: Global Standard Rating level of Soil Test Value

S/N	Parameter	Very low	Low	Medium	High	Excessive
1	Sodium (Na) cmol/kg		<1.0	1.0-2.5	>2.5	
2	Magnessium (Mg) cmol/kg		<0.5	0.5-1.5	>1.5	
3	Calcium (Ca) cmol/kg		<5	5-10	>10	
4	Potassium (K) cmol/kg		<0.4	0.4-0.6	0.6-2.0	>2.0
5	(Organic Carbon) O/C %		<10	10-15	>15	
6	Total Nitroggen (TN) %	<0.1	<0.1-0.2	0.2-0.5	0.5-1.0	>1.0
7	Phosphorus (P) cmol/kg	<0.5	6-12	13-25	26-50	>50
8	CEC Meq/100g		<6	10-12	>12	
		Acidic	**Normal**	**Alkaline**		
9	pH7.0 (%)	<6.5	6.6-7.3	>7.4		
10	**Level of salinity EC, ds/m**	**Salinity Value**	**Suitability for crop prod**			
	Non-salinity	0-2	Marginal			
	Low salinity	2-4	Unsuitable for crop product			
	Medium salinity	4-8	-			
	High salinity	8-16	-			

Source: Dan et al. (2014), The United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), (1998) & Azabdaftari, (2016).

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Table 4: Results of the Soil Sample Laboratory Analysis

S/n	Settlement	PH %	EC ds/m	Na cmol/kg	N %	P ppm	K cmol/kg	Ca cmol/kg	Mg cmol/kg	O/C %	CEC cmol(+)/kg	Textural class
1	Kaura/fallow	6.10	2.90	0.53	0.51	19	0.23	1.8	0.57	0.60	13	LS
2	Kaura/cultivated	7.40	2.41	0.49	0.83	26	0.22	2.36	0.44	0.10	12	LS
3	Kaura/profile A	6.80	2.24	0.45	0.06	19	0.19	2.1	0.6	0.50	13	LS
4	Bondon/fallow	7.00	2.10	0.52	1.4	35	0.22	2.7	0.69	1.20	17	LS
5	Bondon/cultivated	6.20	2.00	0.43	0.08	18	0.21	2.39	0.61	0.85	14	LS
6	Bondon/Profile A	6.30	3.22	0.42	0.16	21	0.3	2.42	0.7	2.10	15	LS
7	Zankam/fallow	6.90	2.90	0.3	0.45	21	0.6	2	0.48	0.70	14	SL
8	Zankam/cultivated	6.20	2.40	0.5	0.9	27	0.34	2	0.6	0.80	17	LS
9	Zankam/Profle A	6.40	2.10	0.55	0.11	24	0.29	2.73	0.8	6.52	16	SL
10	K/Daji Fallow	7.10	2.80	0.4	0.12	23	0.18	2.5	0.55	0.55	6	SL
11	K/Daji Cultivated	6.80	2.00	0.3	0.6	26	0.34	3.21	0.6	0.90	17	SL
12	K/Daji Profile A	6.90	2.40	0.46	0.13	23	0.18	2.35	0.25	0.10	14	LS
13	Fada Daji/fallow	6.40	2.00	0.48	0.61	24	0.25	0.22	0.53	0.14	10	LS
14	F/Daji/cultivated	6.72	2.50	0.56	0.85	28	0.3	2.44	0.98	0.25	17	LS
15	F/Daji/ Profile A	6.30	3.20	0.15	0.13	25	0.21	2.3	0.75	0.62	14	LS
16	Katanga/fallow	7.10	2.70	0.64	0.3	25	0.24	2.65	0.72	0.70	17	SL
17	Katanga/cultivated	6.62	2.40	0.47	0.68	27	0.23	2.31	0.5	0.72	14	SL
18	Katanga/profile A	6.50	2.20	0.65	0.15	25	0.3	2.34	0.7	0.30	7.3	SL

Source: Fieldwork Analysis (2025).

4.0. PRESENTATION OF RESULTS AND DISCUSSIONS

4.1. Soil Properties and Fertility Status of the Agricultural Lands

The results of the soil textural class from the soil physical properties distribution as presented in Table 4 shows that not less than 61.1 percent of the soils in the entire study area belong to loam sand and 38.9 percent is sandy loam. These soil textures were considered good for the cultivation of both cereal crops and other tuber crops, because the percentage of sand separate is more virtually in most of the soil samples of the study areas. This is an indication that all the soils of the study area can retain and store moisture for plant use and also allows for adequate aerations of the soils. This result is in consonance with the study of Atiyong and Oriola (2020) where 60 percent of the soil in Southern Part of Southern Kaduna belong to two textural class, namely sandy loam and loam. Oertli (2008) stressed that there is tendency for productivity of a soil to be better on medium-textured soils consisting of a mixture of sand, silt, and clay than on soils that are light, heavy or mainly silt.

The result of the pH distribution of the study area is presented in Figure 4. The result showed a high neutral coverage of area with pH between 6.6-7.3 percent, slightly acid medium size of between 6.1-6.50 percent, and slightly alkaline contents between pH of 7.4-7.8 recorded. This

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result is contrast with the study of Atiyong and Oriola (2020) on the soil fertility under different management practices in Southern part of Southern Kaduna, where pH was slightly acidic with a pH range of between 5.4-6.4%, which they rated high in most of practices. The pH within the range of 5.0-6.80% are considered ideal for most cultivated crops as stated by

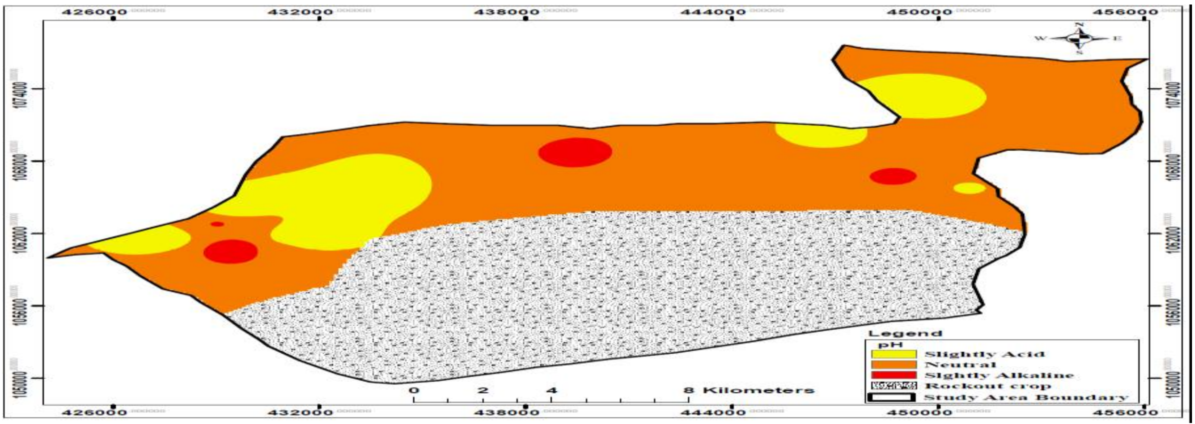

Figure 4: pH Spatial Distribution of the Study Area
Source: Author's Fieldwork Analysis (2025).

4.2. Electrical Conductivity Result

The result of the Electric Conductivity (EC) is presented in Figure 5. It is well known fact that the salt affected soils usually occur in arid and semi-arid regions owing to the high evaporation rate. Negatively affected salt soils affect plant growth in several ways. The result indicates a high area coverage of non-salinity ranging between 0-2ds/m and a low area of low salinity of between 2-4ds/m coverage which indicate a marginal suitability for crop production. EC levels within the range of 0-2ds/m is a good range for growing crop, any result greater than 2.0ds/m would indicate low nutrient level and microbial activity (Azabdaftari and Sunar, 2016).

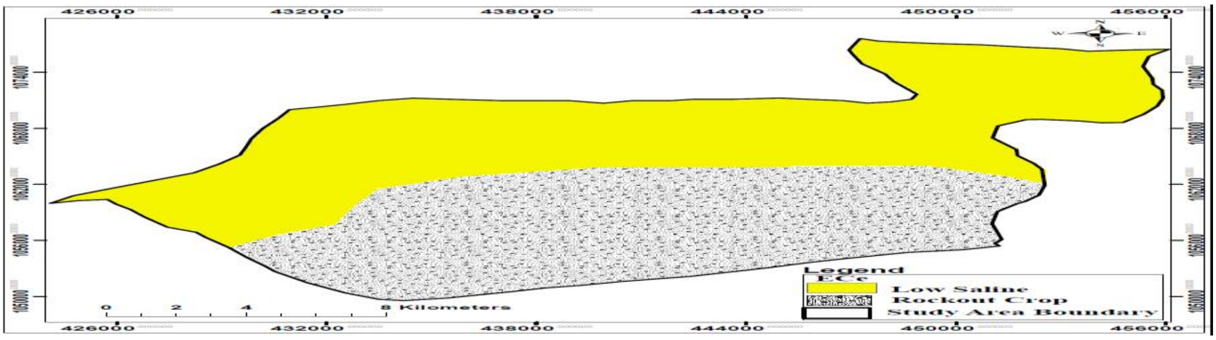

Figure 5: Spatial Distribution of Electric Conductivity (EC).
Source: Author's Fieldwork Analysis (2025).

4.3. Organic Carbon Result

The result of the Organic Carbon is presented in Figure 4. The result indicates low organic carbon of less than 0.1 percent covering a large area. The low organic carbon can be attributed to the extensive cultivation without allowing fallowing of the land to enable accumulation of organic materials to encourage microbial activities.

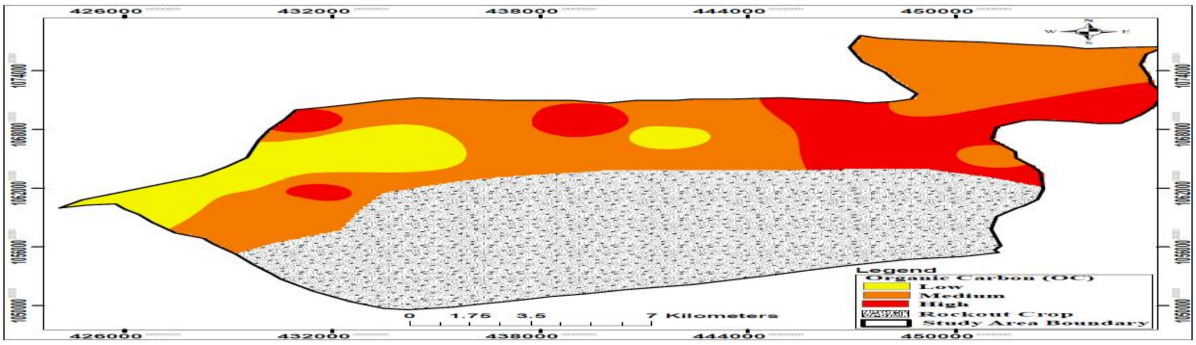

Figure 6: Spatial Distribution of Organic Carbon
Source: Author's Fieldwork Analysis (2025).

4.4. Total Nitrogen Content

The Total Nitrogen contents of soils presented in Figure 7 showed moderate total nitrogen contents of between the ranges of 0.2-1.0 percent with very high significance land area coverage. The result depicts a high total Nitrogen content of the soil and the implication is that, the soil will be suitable and favorable for the cultivation of crops that requires nitrogen contents for their growth. These result is in consonance to the result of the study of Holland *et al*. (1989) cited in Essoka & Essoka (2014), on land evaluation and agriculture in Calabar, where total nitrogen was within the range of 0.04-0.18 percent, which they rated as high. Likewise, Defoer et al. (2000), in their study on managing soil fertility in the Tropics cited in Essoka & Essoka (2014), considered the soil to be very good since nitrogen value greater than 0.1 percent is rated good.

4.5. Sodium Content Result

The Sodium contents of soils presented in Figure 7 showed low concentration of sodium (Na) between the range of 1.0 percent and below indicating a significant land area coverage, which indicate low risk of plants toxicity. Sodium is not a plant nutrient and therefore is not

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necessary for plant growth. High levels of sodium are detrimental to soil structure, soil permeability, and plant growth (Dan *et al.*, 2014).

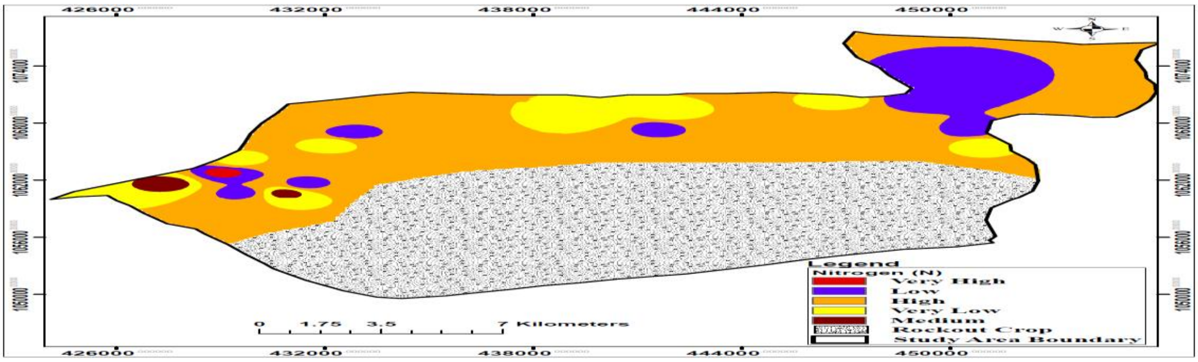

Figure 7: Spatial Distribution of Total Nitrogen Contents
Source: Author's Fieldwork Analysis (2025).

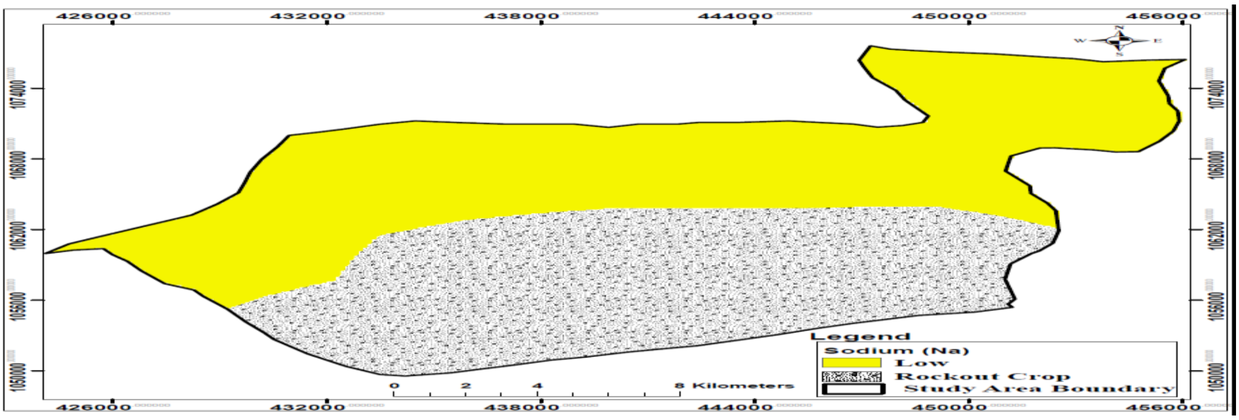

Figure 8: Spatial Distribution of Sodium Content
Source: Author's Fieldwork Analysis (2025).

4.6. Potassium Result

The result of Potassium content presented in Figure 9 showed low presence of Potassium (K) between the range of < 0.4 cmol/g with very high significance area coverage and moderate in concentrations that was slightly above 0.4 cmol/g at a locality covering small land area. Yusuf (2021) stressed that potassium, phosphorus, and nitrogen are the major elements used by crop plants and are required in large amount and quantity. In situation where potassium is deficient in soils, according to him, potassium is commonly applied to soils as fertilizers and a component of mixed fertilizers as NPK.

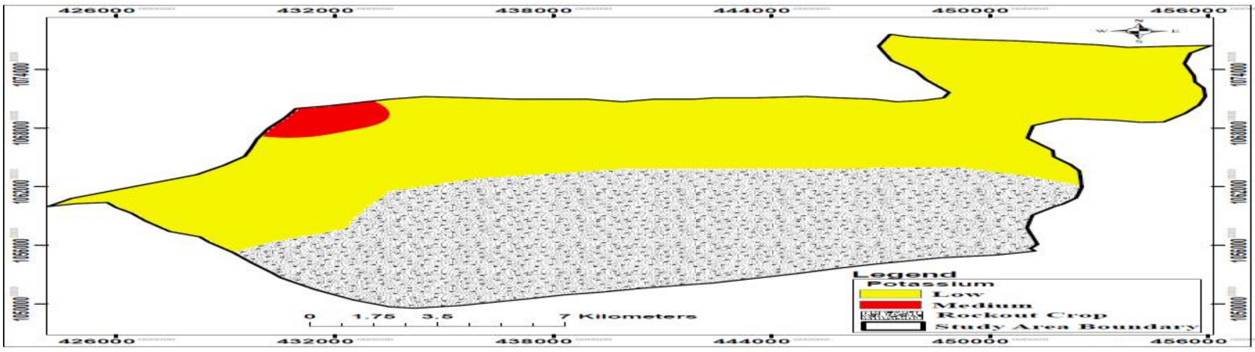

Figure 9: Spatial Distribution of Soil Potassium
Source: Author's Fieldwork Analysis (2025).

4.7. Phosphorus Content of the Soil

Phosphorus is one of the major plant nutrients in the soil. It is vital for seedling and young plants. The optimal level for phosphorus in the soil is 23ppm, while available phosphorus levels are generally between 2 to 20ppm. The content of available phosphorus result presented in Figure 10 revealed a phosphorus range between 10-25ppm signifying a medium coverage of Phosphorus (P) soil concentration while some areas have high phosphorus contents of range greater than 25ppm with less area coverage. The result is similar to findings of Abdulrazak et al. (2024) on the content of phosphorus in the study area. The implication of this result signifies that phosphorus in the study area is at the normal level and that the soil is suitable for optimal plant crop

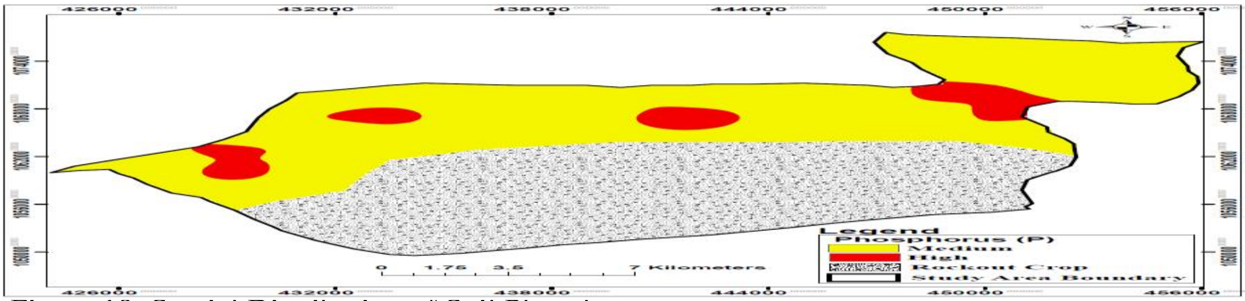

Figure 10: Spatial Distribution of Soil Phosphorus
Source: Author's Fieldwork (2025).

4.8. Cation Exchange Capacity (CEC) Result

The CEC is an expression of soil negative charge. It is desirable that soils of agricultural lands should present a high CEC, as it represents capacity to retain the elements necessary for plants growths (Rangel-Peraza et al. 2017)., and indicates the soil potentials to provide

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Calcium (Ca^{2+}), Magnesium (Mg^{2+}), and potassium (K^{+}), to plants. In this regard, the content of CEC presented in Figure 11 shows high Cation Exchange Capacity greater than 12 cmol(+)/kg having a highly significance area coverage and medium CEC of between the range of 10-12 cmol(+)/kg with small area of coverage. This is considered moderately unsuitable for plant growth. A high CEC, with an average value of 36.34cmol/kg according to Rangel-Peraza et al. (2017), is considered as soil with great natural fertility. Similarly, a figure above 10 cmol(+)/kg is preferred for plant production. Soils with high levels of swelling clay and organic matter can have a CEC of 30 cmol(+)/kg or more.

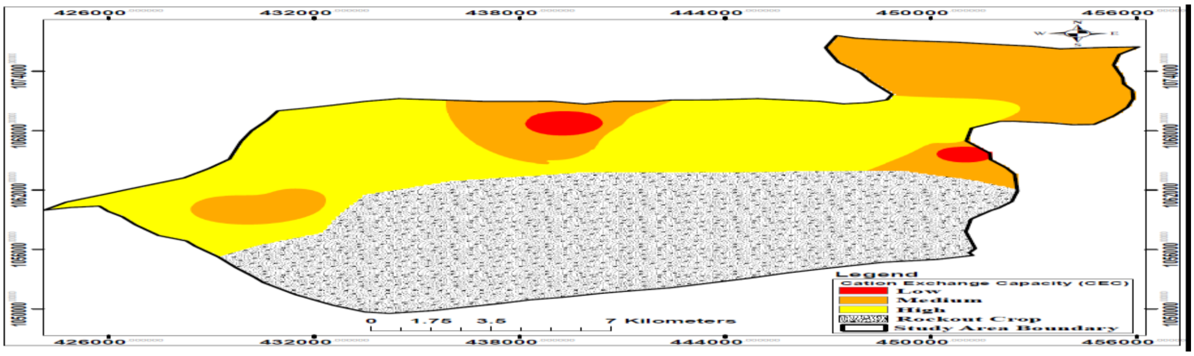

Figure 11: Spatial Distribution of Cation Exchange Capacity.
Source: Author’s Fieldwork Analysis (2025).

4.9. Land use/Land Cover Coverage of the Area

The statistical size estimate of the land use/ land cover suitability of the study area is presented in Table 5. The result shows that 209 Sq Km^2 of total land area is suitable for agriculture and has the highest land coverage.

Table 5: Land use/ Land cover Statistical Estimate for the Study Area

S/NO	Land use/Land cover	Size Unit (SqKm^2)	S-Suitable/N-not Suitable
1	Agriculture Area	209	S2- Moderately Suitable
2	Built-up Area	45	N1- Not Suitable
3	Swamp Area	7	S2- Moderately Suitable
4	Degraded Area	8	N1- Not Suitable
5	Open Space	8	S3- Marginally suitable
6	Rock outcrop	182	N1- Not Suitable
7	River	2	S3- Marginally Suitable
8	Vegetation	24	S1- Moderately Suitable
	TOTAL	**485 Sq. KM^2**	

Source: Fieldwork Analysis, 2025.

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The result also showed that 34 Sq Km^2 of land is covered by Vegetation swampy area and drainage systems which can also be utilize for agricultural practices. However, a large chunk of land is covered by Rockout crop size 182 Sq Km^2, Built-up with 45 Sq Km^2, degraded and Open space (8 Sq Km^2) respectively.

4.10. Land Suitability of the Area

Figure 12 and Table 5 presents the current digital status of the land suitability assessment of the study area. The suitability assessment depicts large area covered by agricultural farmlands, which is an indication of moderately suitable (S2) lands for agricultural farming when correlated with the fertility status of the area. This is in accordance with FAO (1976) that moderately suitable land is land that is clearly suitable but which has limitations that either reduce productivity or increase the input require to sustain productivity. Moderate levels of limitation restrict the choice of crops or reduce productivity. Soil conservation practices and sound management are needed to overcome the moderate limitations to cropping use. Furthermore, there are areas that are marginally suitable (S3). These are lands having limitations which in aggregate are severe for sustained application of a given use, thereby reducing productions. Cost of production is only marginally justified. In contrast, there are landuse and land cover that are not suitable (N1) for agricultural farming as depicted in Table 6 and Figure 14. According to FAO (1976) these are Land with limitations to sustained use that cannot be overcome at a currently acceptable cost.

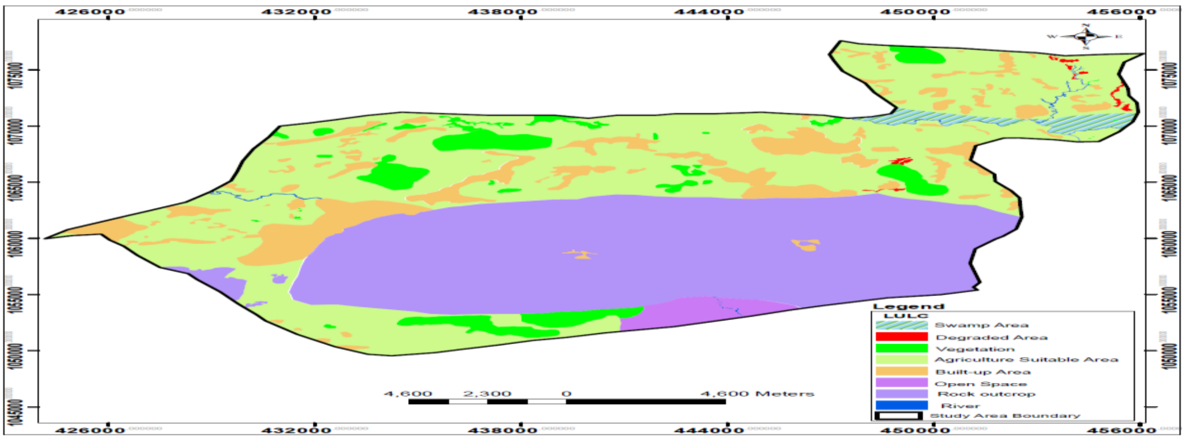

Figure 12: Land use/ Land cover estimate of the Study Area
Source: Fieldwork (2025).

5.0. CONCLUSION AND RECOMMENDATIONS

The textural class of the soils was loamy sand to sandy loam soil in nature considered good for the cultivation of both cereal crops and other tuber crops because the percentage of sand separate was more virtually in most of the soil samples. While the pH exhibits more of neutrality. EC exhibit low to non-saline, total nitrogen, organic carbon, sodium, and potassium exhibits low concentration considered normal, phosphorus and CEC are moderate and considered suitable for plant growth. All the soil parameters were within acceptable and favourable threshold limits considered ideal and good for the cultivation and sustenance of plant growth. The suitability of the study area for crop production was found to be moderately suitable (S2), marginally suitable (S3) and non-suitable (N1) due to certain constraints. The study recommends that the low fertility status of these soils should be sustained by the complementary use of inorganic fertilizer alongside organic compost, animal dung, crop residue incorporation, legumes and cover cropping which will enhance more of the nutrients available, thereby improving soil condition and retention of nutrients and water resources. In addition to, liming and any management practice that should be used to improve the pH condition are required, specifically to the fields with strongly acidic reactions. More so, sustainable and recovery practices that will help to mitigate any negative findings should implemented by farmers.

Competing Interest

The author declares that no conflicting interest exist in this manuscript.

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