



## SMALL HOLDER FARMERS CLASSIFICATION OF FADAMA SOIL FERTILITY IN PERI URBAN SETTLEMENTS OF KADUNA METROPOLIS NIGERIA

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*As fadama soil is known for its high moisture retention throughout the year, this study aimed at the classification of fadama soil fertility in Peri – urban settlements of Kaduna metropolis, Nigeria by the smallholder farmers. The study was conducted using four settlements in Peri – urban Kaduna metropolis. The selected farming Settlements include Nassarawa in Rigasa, Hayin Na Iya/Malalin Gabas, Hayin Dan Bushiya and Dawn Quarters. Forty farmers were selected, ten from each of the farming settlements. Simple random sampling was the method applied in selecting the farmers. In this study, interview and questionnaire techniques were used in generating the data. The analysis of the data was done through the use of tables, chart, percentages, narratives analysis, Kruskal Wallis test and verbatim quotations. The findings revealed that the fadama farmers were able identify different type of soils in their local name with their properties through field observation. On the assessment of soil fertility over time, 32.5% of the farmers experienced soil fertility increase on their farms. The farmers were able describe the features of decreasing soil fertility where the major factors were change in the colour of crops (40%) and stunted growth of crops (25%). It was also discovered that soil fertility can be increased through the application of manure and fertilizer (35%) and application of fertilizer only (22.5%) from the majority of the farmers. However with application of K. Wallis test, it was revealed that there is no significant difference in the assessment of soil fertility in the four farming settlements. Finally, it was reported that support should be given to the local fadama farmers to enable them produce more food, engage in more enlightenment on how to use different types of soils. Similarly, adequate funds should be given to fadama farmers to boost their farming activities.*

**ABSTRACT**

*Key words: Small holder farmer, fadama soil, classification, Peri – urban, Kaduna metropolis.*

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## INTRODUCTION

The growth and productivity of plants is determined by the soil fertility available in a given area of land (Ogbena *et al*, 2016). The differences in soils quality are chiefly a function of prevailing climatic condition, vegetation cover and topography. Soil fertility decline is widespread and has been an issue of concern particularly in Sub-Saharan Africa where the problem cuts across many different soil types. Many endogenic (such as soil pH, organic matter, and texture, primary, secondary and micro nutrients) and exogenic (such as land use and farming systems, technological innovations and input management) factors combine to initiate and or exacerbate soil fertility decline. Majority of the factors are beyond the smallholder farmers' capability to handle because of their long standing experience in cultivating lands. Therefore, it is obvious that farmers ought to play stabilizing role in agricultural land management practices. Soil scientists and other professionals are somehow biased in

assessing the farmers' knowledge of soil fertility. However, small-holder practising farmers have a well-developed ability to perceive differences in the level of soil fertility between and within varieties of farmlands (Domchanget *et al*, 2014). It is part of these and similar assessments that these farmers use soil fertility indicators such as crop yields, soil depth, drainage, moisture, slow growth of plants, leaves coloration and other factors of soil's capacity for sustainable productivity (Nafi'uet *al* 2012). This enables them to link the current and past soil management regimes.

Nigeria has a wide variety of soil under diverse ecological conditions and with different level of fertility. Fadama soil is known to be rich in nutrients content with high fertility level. As far as the country is concerned the need for food sufficiency has brought a corresponding need to harness the fertility of Fadama soil as it shown the potential use for all year round. Fadama is a local (Hausa) name meaning the seasonally

flooded or floodable plains, irrigable lands, or low laying plains along major savanna rivers or depressions on the adjacent low terraces (Adeyeye, 2005). This type of soil is under continuous cultivation especially in Northern Nigeria in areas around Kano, Kaduna, Bauchi, Plateau, Niger, Kebbi and Sokoto among others

Several studies have been conducted both in Nigeria and other African countries on soil fertility using scientific soil assessment methods. Researchers conducted includes studies in Ethiopia (Fanuelet *al*, 2017), Bauchi (Shafi'u 2007), Gombe (Umaret *al*, 2011), Ekiti (Adeyeye and Omolaye, 2008), Plateau (Jauroet *al*, 2006), Borgu in Niger state (Ogbenaet *al*, 2016) among others. The farmers' ways of classifying soil fertility differs from the scientific methods. Similarly, researches conducted in Nigeria include those carried out by Rajiet *al*, (2011) in Kaduna State; Kundiriet *al*, (2007) in Yobe State; Ademola, (2002) in Kwara State; and Idoga (2006) in Makurdi, Benue State. The need to beef-up food production in order to meet up with food needs of our ever increasing population, necessitate the

harnessing of Fadama soil for food sufficiency in Nigeria. This brought about the initiation of the national Fadama projects (Fadama I, Fadama II, Fadama III).

The core objective of this study therefore was to appraise small – holder farmers classification of fadama soil fertility in Peri – urban settlements of Kaduna metropolis from their perception and experiences as practising farmers which is opposed to the quantitative scientific methodologies. The specific objectives of this study include examining farmers' identification of soil types and their perceived properties, farmers' assessment of soil fertility overtime, features of decreasing soil fertility and possible ways of increasing soil fertility in the four Peri – urban settlements. The study focused on the farmers using fadama land for their farming activities in North, South, east and Western parts of Peri – urban Kaduna metropolis which are all within the four local governments of Kaduna metropolis. These Local Government include Kaduna North local government, Kaduna south local government, Igabi local Government and Chikun Local Government. The study areas selected were farmers in

Peri – urban Nassarawa in Rigasa in the west in Igabi local government area, farmers in Hayin na Iya/Malalin Gabas in the North in Kaduna North local Government, farmers in Hayin Dan Bushiya in the East in Chikun Local government and farmers in Dawn Quarters in Makera (Kakuri) in the south in Kaduna South Local Government.

## **THE STUDY AREA**

Kaduna is the capital of Kaduna State. Kaduna metropolis is located between latitude  $10^{\circ} 25' 27''$  N and latitudes  $10^{\circ} 35' 29''$  N and Longitude  $7^{\circ} 22' 20''$  E and longitude  $7^{\circ} 30' 27''$  E. Kaduna metropolis is made up of four local government areas. These include Kaduna North and Igabi Local Government in the North and Kaduna South Local Government and Chikun Local in the south. Its climate is tropical wet and dry. The wet season is between May and October and the dry season is between end of November to early May. The rainfall is variable with its highest peak in August and September. The rainfall decreases from the south to North ward. The rainfall is heavier in the south. It has about 1500mm of

precipitation annually. The humidity follows the pattern of rainfall in the wet season with 60% and in the dry season with 20 – 30%. The temperature ranges between  $15^{\circ}\text{C}$  –  $38^{\circ}\text{C}$  with the highest temperature between April and May, while the lowest is between December and February. Kaduna is elevated at a range between 500 – 700m above sea level. It is among the Hausa plains.

The geology of the study area is essentially basement complex rocks. Most of the rock outcrops are made up of granites. The basement complex rock comprises of migmatites, gneisses, schists, pegmatites, quartzites, phyllites, metamorphic rocks and metasediments (Eze, *et al*, 2011) reported by (Mallo, 2019). The vegetation type in Kaduna is of Sudan Savanna type, it is characterized by numerous grasses. The soil of Kaduna is tropical ferruginous soil or nitrosols which are usually reddish in colour due to the absence of iron. The soils are also sticky when wet and hard when dry. They support the growth of Cocoyam, Cassava, Maize, Rice Guine Corn, Ground nut, Soya beans, Millet among others. Kaduna circumscribes different ethnic groups like

Hausa, Yoruba, Igbo, Fulani, Kadara, Gwari, Jaba, Bajju, Kaje, Igbira, igala, Kamanton, Nupe, Kamuku, Gwandara, Kagoma, Kataf, Marwa, Kahugu, Sanga, Surubu among

others. Kaduna State has a population of 6,066,562 million as betokened by the National Population Commission (NPC Census, 2006)

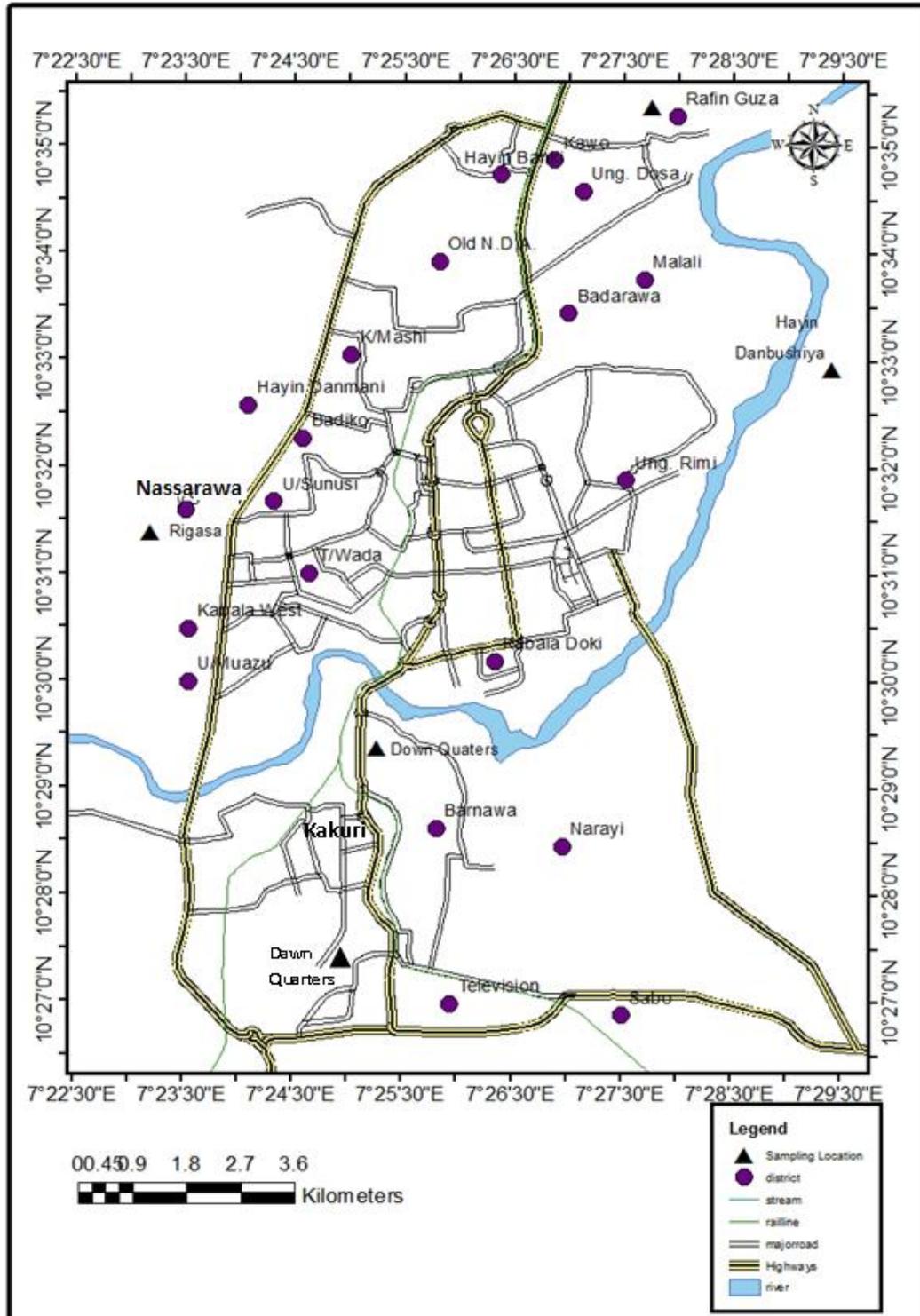


Figure: 1 Administrative Map of Kaduna Metropolis.  
Source: Department of Geography, Bayero University Kano  
2019.



## **METHODOLOGY:**

Reconnaissance visits were made prior to the actual field survey to get acquainted with the Fadama Farmers. The exercise served as a guide and it was used to determine the total population and the sample size of the population. Sample size based on Krejcie and Morgan (1970) was applied in selecting the samples out of the total population of 170 farmers. Thus, 40 fadama farmers (representing 23.5%) served as the sample size from the population of 170 farmers. The data was collected using structured questionnaire and interview methods with which the farmers were contacted at different times. Thus, ten farmers were drawn from each of the four farming communities which comprised farmers from Nassarawa Rigasa, Hayin na Iya/Malalin Gaba, Hayin Dan Bushiya and Dawn Quarters in Maketa Kakuri. Simple random sampling was employed in selecting the farmers (Ahmed, 2009). Forty questionnaires were administered to the fadama farmers on the field. The data analysis was done using descriptive statistics, tables, percentages and Kruskal

Wallis test statistics. The test was applied because it involved comparing three or more than three variables. The test was carried out at the level of significance of 0.05. It was expressed mathematically thus:

Where:

$N$  = Total sample size.

$R_1$  = Total of the ranks for the height sampled, that is, the sum of ranks for each sample.

$N_1$  = Sample size for the height sampled, that is, sample size of each group.

$K$  = The number of samples

## **RESULTS AND DISCUSSIONS**

The result has been presented using tables, charts while the statistical testing of the samples were done with SPSS of the latest version and MS excel.

### **Identification by Farmers of soil types and their perceived properties:**

Fadama soils are mostly used for recession farming. Therefore by assessing soil texture and soil drainage conditions by feeling and observation, the local farmers identify their fadama soil for recession farming. Integrating such local knowledge allows the farmer to give such names that have more meaning for the local farmers (Kundiriet *al*, 2007). The farmers' identification of the soil types and their perceived properties through interview carried out by the study discovered that farmers identified the soil into four different types such as using their local names as Yumbu soil, Yashi soil, Jangargari soil and Jigawa soils, corresponding Hydromorphic soil, Grainy Sandy soil, lateritic soil and fine grained soil. The Yumbu soil is a soil with high fertility, black in colour, high moisture retention, low manure demand and low erosivity. Emphasis was made by the farmers on this soil for fertility and retention of moisture. For instance, a respondent in Nassarawa Rigasa explained that "this Yumbu soil used for farming cannot be

compared with any of the soils in fadama land in terms of high fertility and moisture retention" (Plate 1).

The interview also discovered that the Yashi soil is described as the soil characterized with whitish colour, low fertility, very high demand for manure, high erosivity and low water retention. For example, one of the farmers in Hayin Na Iya/Malalin Gabas stated that "My first farm was very close to my neighbour's farm with a mixture of Yashi and Tabo soil, it was also found the man witnessed a great loss on his farm during the period of research because of low fertility and high demand for manure on the farm".

The farmers also described Jangargari soils as the soils with red and reddish brown colour, having fine particles, high demand for manure, moderate erosivity characteristics, moderate moisture retention and low fertility capacity. The red and reddish brown color of the soil is an indication of the presence of oxidized ferric iron oxides. The farmers attributed the soil low fertility to its color. The soil color was

used to describe badland topography of the farm where crops cultivation is not serious.

The Jigawa soil is described by the farmers as the soil with brownish colour, the type which indicates a soil with accumulation of organic matter especially on the surface of the soil which can be immediately used by the plants. It was also discovered from the interview that Jigawa soil is associated with fine particulates, moderate fertility, demand for manure, high erosivity and moderate moisture. The farmers also stated that Jigawa soil allows for the cultivation of many fadama crops, among which are rice, maize, wheat and many vegetables. For

instance, one of the farmers in Hayin Dan Bushiya stated that “my farm land being a fadama land has been used for many years for the cultivation of maize, and the maize is growing successfully for many years and the farm is more of Jigawa soil” (Plate 2).

However, it was observed during the study that in all the four study areas, most of the farmlands in the fadama land are associated with Yumbu, Taboor Laka type of soil and majority of the farmers preferred to farm on a fadama land consisting of Yumbu, Taboor Laka soil because of its high fertility rate, moisture retention capacity and low demand for manure by the soil.

### **FARMERS ASSESSMENT OF SOIL FERTILITY OVER TIME**

Table 1: Farmers assessment of soil fertility over time

<b>Fertility Increase</b>		<b>Fertility Decrease</b>		<b>Fertility Unchanged</b>	
<b>Number of farmers (40)</b>		<b>Number of farmers (40)</b>		<b>Number of farmers (40)</b>	
<b>F a r m e r s</b>	<b>Percentage</b>	<b>F a r m e r s</b>	<b>Percentage</b>	<b>F a r m e r s</b>	<b>Percentage</b>
1 3	3 2 . 5	8	2 0	1 0	2 5
9	2 2 . 5	1 0	2 5	1 1	2 7 . 5

1	0	2	5	1	2	3	0	9		2	2	.	5	
8		2	0	1	0	2	5	1	0	2			5	
4	0	1	0	0	4	0	1	0	0	4	0	1	0	0

Source:- Field work,( 2019).

Table 1 indicates different views of farmers in the assessment of the differences in the soil fertility. In terms of increase, decrease or unchanged in the soil fertility, the farmers pointed out the differences. The differences in increase decrease or change in soil fertility is attributed to some factors such as the growth of crops, change in colour of the plants, crop yield among others. From the four fadama farming communities in the Peri – urban areas, it was observed that 32.5% of the farmers experienced increase in the fertility of the soil. Those farmers whose soils are affected by soil fertility decrease formed 30%. However, some farmers constituting 27.5% portrayed a contrary opinion that

their soil fertility on their farmland remained unchanged. Researches were carried out with their findings in some other places on fadama soils. These findings attested to the instability in the fertility of fadama soils (Jamala, Shehu, Musa and Abraham, 2012; Kefas, Zata, Philip, Ukabiala and Ezekiel, 2016; Imadojemu, osujieke and obasic; 2017). It was also revealed that majority of the farmers (32.5%) in the four study areas experienced fertility increase on their fadama farms. Thus, the present study is similar with the above study because in the present study, the farms experienced soil instability in terms of soil fertility.

## FEATURES OF DECREASING SOIL FERTILITY

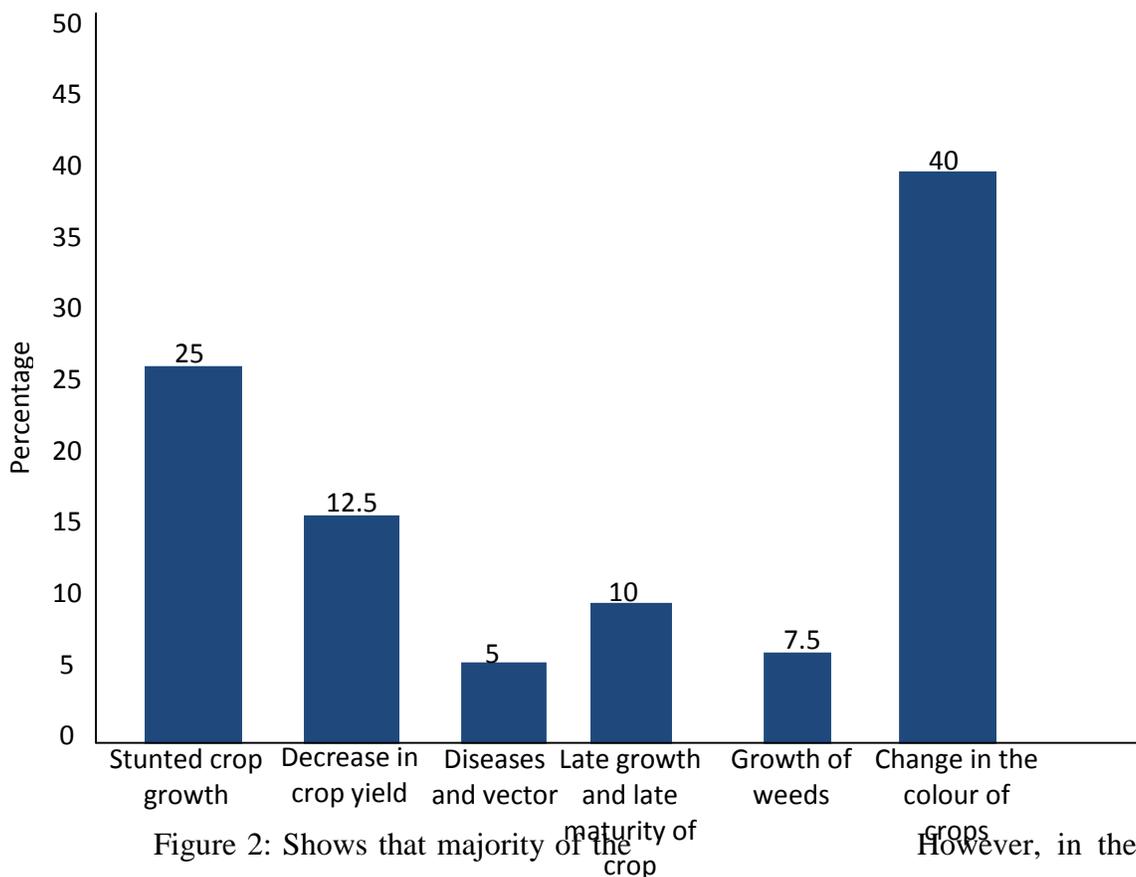


Figure 2: Shows that majority of the farmers (40% and 25%) related sign of decreasing soil fertility with change in the color of crops and stunted growth of crops. Other farmers stated other factors that are responsible for the decreasing soil fertility. These factors include decrease in crop yield, late growth and late maturity, growth of weeds and diseases and vectors.

Source: Field work 2019.

However, in the whole four study areas, out of the 40 fadama farmers, the highest indicator for the features of decrease in soil fertility is change in the color of crops which formed 40%. A similar study by (Usman, 2015) discovered many indicators responsible for the decrease in soil fertility which include stunted growth, decrease in crop yield, presence of small stones in the soil, decrease in depth of soils

among others. Therefore, the decrease in soil fertility is as a result of many factors as mentioned by the farmers in the study areas. Therefore, Usman's study share some similar views with the present study.

## **WAYS OF INCREASING SOIL FERTILITY**

Table 2: Shows ways of increasing soil fertility

<b>Ways of increasing soil fertility</b>	<b>F a r m e r s</b>	<b>Percentages</b>
A p p l i c a t i o n o f m a n u r e	7	1 7 . 5
A p p l i c a t i o n o f f e r t i l i z e r	9	2 2 . 5
A p p l i c a t i o n o f m a n u r e a n d f e r t i l i z e r	1 4	3 5

Practising of fallow farming	4	1	0
Practising of crop rotation	6	1	5
<b>T o t a l</b>	4	0	1 0 0

Source: Field work 2019

Table 2 outlined the responses by the forty farmers in the four study areas on how to increase soil fertility on their fadama farmlands. Out of the forty fadama farmers, 14 of them constituting 35% were of the opinion that their way of increasing soil fertility is through the use of manure and fertilizer on their farms. The use of chemical fertilizers such as NPK, Urea and superphosphate are the generic soil conditioner common in the Northern part of Nigeria despite the spatio-temporal variability in soil characteristics (Ukoje and Yusuf, 2013). Other farmers (22.5%) opined that application of fertilizer only is their means of increasing soil fertility on their farms, while some farmers (17.5%) insisted on using only manure for the increase of soil fertility on their farms especially by

keeping livestock through the use of their dungs. However, practising of bush fallow was adopted by some farmers in increasing their soil fertility; about 10% of them preferred this method of increasing soil fertility. In order to conserve soil nutrients, farmers must mobilize the nutrients in a such a way that it maintains a flow through the farming system (Harris, 1998). Because of the variations in the location of the farmers, some farmers (15%) hinted that the application of crop rotation is another way in which their soil fertility is increased. Therefore, crops rotation as one of the system of farming contributes towards soil fertility increase. However, among the 40 farmers in the four Peri – urban communities those fadama farmers who held the view that

application of both manure and fertilizer appeared to be the highest number of farmers with 35%, while the lowest is 10% for the farmers using fallow system of farming.

An example of Fadama Farm in Hayin Na Iya/MallainGabas is shown in plate 1 below.





**Plate 1: A Fadama Farm in Hayin Na Iya/Mallain Gabas**



## **CONCLUSION AND RECOMMENDATIONS**

Fundamental to this study is small – holder farmers’ classification of fadama soil fertility in Peri – urban settlement of Kaduna metropolis, Nigeria. From these research findings, it was discovered that Fadama soil is under intensive cultivation due to the global high need for food production. Scientist and local farmers play vital role towards the evaluation of the nutrient content of the fadama soil. The results of the study through interview revealed that the farmers identify the soils through their local names by observations and feelings. They were able to identify the soils properties with certain factors like moisture retention, colour, fertility and mode of erosion on the soil. It was also revealed that in their assessment of soil fertility over time, majority of them experienced fertility increase on their farms. The study also identified the factors of decreasing

soil fertility through change in the color of crops, stunted growth of crops, decrease in crop yield among others. Findings from this study also showed that the farmers have their ways of increasing the fertility of their farmlands through the application of manure, application of fertilizer, application of both manure and fertilizer, practising of fallow and practising crop rotation. It was also discovered that there is no significant difference in the assessment of soil fertility over time between fertility increase, fertility decrease and fertility unchanged.

In line with the above findings in this study, the following recommendations are suggested.

1. Encouragement should be given to farmers on how to identify soil types and their properties in order to use the soil for appropriate cultivation.
2. Authorities concerned should give more attention to farmers

especially when assessing the soil fertility on their farms.

3. Special assistance should be given to farmers to overcome the problem of decreasing soil fertility by the farmers.
4. Much attention should be given to the ways of increasing soil fertility to the farmers which could be through subsidizing the costs of procuring fertilizers or through the provision of loans to the farmers.
5. Where and when necessary, policy makers should provide different ways of encouraging farmers using fadama soil with sufficient funds.

## REFERENCES

- Ademola, K.B (2002). *Integrating Indigenous Knowledge and Soil to Develop a National Soil Classification Soil System for Nigeria*. Springer link, Agriculture and Human values. March 2002, volume 29,(1), pp – 75 – 80.
- Adeyeye, E.I. (2005). *Traces of Metals in Soils and Plants from Fadama Farms in Ekiti State, Nigeria*. Bulletin of chemical society of Ethiopia, 9, 23 – 34
- Adeyeye, E.I; Omolaye; F.O. (2008). *Physico-Chemical Properties of three Fadama Farms Site Soils in Ekiti State, Nigeria*. Orient Jehem 2008; 24(1)
- Ahmed, S. (2009). *Methods in Sample Surveys: Cluster Sampling*. Dept. of Biostatistics School of Hygiene and Public Health Johns Hopkins University. Visited on 6/9/2015
- Domchang, M; Nathan, A.L; Williams, M; Selchak, B.G; Stephen; A.A (2014). Assessment of some Micronutrients (Zn and Cu) Status of Fadama Soils under Cultivation Bauchi, Nigeria. *Journal of Biology, Agriculture and Health care*, ISSN 2225 – 093 x (on line) vol.4 No. 24, 2014
- Eze, C.L., Sunday, U.S.A Uko, E.D. & Ngah, S.A (2011). *Mechanical Model for Nigerian Intraplate Earth Tremors*; IEEE Earth Zijne, May 17, 2011 <https://earthzine.org/mechanical-model-nigerian-intraplate-earth-tremors>.

- Fanuel, L; Kibebew, K; Tekalign, M. (2017). *Farmers' Soil Knowledge, Fertility Management Logic and its Linkage with Scientifically analysed Soil Properties in Southern Ethiopia. Agricultural and Food Security*, 2017 6:57 <https://www.illdoi.org/10.1186/40066-017-0138-0>
- Harris, F. 1998 Nutrient Management Strategies of Small-Holder Farmers in a Short-Fallow Farming System in North-east Nigeria. *The Geographical Journal* Vol. 165, No. 3 pp. 275-285
- Idoga, S. (2006). Characteristics, Classification and uses of Fadama Soils in Makurdi Metropolis, Benue state, Nigeria. In: Idoga, S; Ayuba, S.A; Ali, A. Agbede, O.O and Ojeniyi S.O (eds). *Management of Fadama soil for Environmental Quality – food security and property Alleviation in Nigeria. Preceedings of the 30<sup>th</sup> Annual conference of soil science society of Nigeria, University of Agriculture, Makurdi Nigeria. pp 32 – 37*
- Imadojemu, P.E, Osujieke, D.N. and Obasi, S.N (2017). *7Evaluation of Fadama Soils along a Toposequence Proximal to River Donga in Wukari Area of Northeast Nigeria. International of Agriculture and Rural Development. Volume 20(2): 3150-3158, 2017*
- Jamala, G.Y, Shehu, H.E, Musa, A.M and Abraham, P. (2012). Evaluation of fertility status and irrigation potentials of selected Fadama soils in Adamawa State, North-eastern Nigeria. *Journal of Soil Science and Environmental Management* Vol. 3(7), pp. 176-181. DOI: 10.5897/JSSEM11.105 ISSN 2141-2391.
- Jauro, A.G; Udom, G.N; Mustapha, S. (2006). Soil Fertility Status of Fadama Land in the Northern and Central Zones of Plateau state, Nigeria. *Journal of Environment sciences*, 10,35 – 44.
- Kefas, P.K., Zata, A.I., Philip, H.J., Ukabiala, M.E. and Ezekiel, T.N. (2016). Soil Assessment of Selected Floodplain Soil in Nigeria to Support Agriculture Advancement. *International Journal of Plant & Soil Science* 11(2): 1-12, 2016; Article no.IJPSS.25665 ISSN: 2320-7035

- Krejcie, R.V. and Morgan, D.W. (1970). Determining sample size for research activities. Educational and Psychological measurement, 30,607-610
- Kundiri, A.M; Jarvic, M.G; Bullock, P. (2007). Traditional soil and land appraisal on Fadama lands in North East Nigeria.
- Mallo, I.I.Y. (2019). Paleoprogenitorial Genesis of Recurrent Seismotectonic Regimes Experienced in Africa and Nigeria. *Abuja Journal of Geography and Environmental Management*, vol.5, No. 1, pp 1 – 45.
- Nafi’u. A.K; Abiodun, N.A; Okpara, I.M; Chude, V.O. (2012) Soil Fertility Evaluation: a Potential tool for Predicting Fertility Requirement for Crops in Nigeria. *African Journal of Agriculture Research* Vol. 7(47), pp, 6204 – 6214. 13 December, 2012. Available on line at <http://www.academicjournals.org/AJAR> Doi: 10.5997/AJAR122010 ISSN1991-1637
- NPC (2006). *Population and Housing census 2006*; National population commission Abuja, Nigeria
- Ogbena, V.I; Balogun, A.M; Idris, M. (2016) Assessment of zinc and copper status of Fadama soils in Brogu local government Area Niger State. *International Journal of Environment and Agricultural Research (IJOEAR)*. ISSN, (2454 - 1850) Vol – 2
- Raji, B.A; Malagwi, W.B; Berding, F.R; Chude, V.O (2011). Intergrating Indigenous Knowledge and Soil Science Approaches to Detailed Soil Survey in Kaduna State, Nigeria. *Journal of Soil Science and Environmental Management* Vol. 2(3).pp – 66 – 73, [http://www.academicjournals.org/JSSEM/ISSN\\_2141\\_2391](http://www.academicjournals.org/JSSEM/ISSN_2141_2391)
- Shafiu, M. (2007). Physico – Chemical Properties and Fertility Status of some Haplic Plinthaquits in Bauchi Local Government Area of Bauchi State, Nigeria. *International Journal of Soil Science* 2:314 – 319, Doi: 10.3923/IJSS 2007, 314 – 319.
- Ukoje, J.A. and Yusuf, R.O. (2013). Organic Fertilizer: the Underestimated Component in Agricultural Transformation Initiatives for Sustainable Small Holder Farming in Nigeria.

*Ethiopian Journal of Environmental Studies and Management Vol. 6 Supplement 2013.*  
<http://dx.doi.org/10.4314/ejesm.v6i6.10S>

Umar, S; Abdulhamid, N.A; voncir, N. (2011). Status and Distribution of Some Available Micronutrients in the Haplic Usterts of Akko Local Government Area, Gombe state, Nigeria. *International Journal of Soil Sciences*.

Usman, S and Kundiri, A.M. (2015). Values of Organic Materials as Fertilizers to Northern Nigerian Crop Production Systems. *Journal of Soil Science and Environmental Management*. Vol. 7(12), pp. 204-211 December 2016 DOI: 10.5897/JSSEM2015.0532  
Articles Number: 14850D861737 ISSN 2141-2391

Yusuf, A. M. and Tukur, A. I. (2013). Nutrient Availability of Organic Manure for Arable Crop Cultivation in the Kano Close Settled – Zone Kano State, Nigeria. *International Journal for Agricultural Innovative and Research*. Yusuf et al. / IJAIR Vol. 2 Issue 7 ISSN: 2278-7844