International Journal of Recent Engineering Research and Development (IJRERD)
ISSN: 2455-8761
www.ijrerd.com || Volume 05 – Issue 01 || January 2020 || PP. 38-43

Impact of Farming on Soil Quality in Ebikoro-Obinze, Owerri West L.G.A. of Imo State

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Abstract: The impact of farming activities on the physico-chemical properties of the soil in Obinze was carried out. Soil samples were collected randomly from different locations from a farmland in Ebikoro and from an adjoining forest in Umuokanne. The samples were collected at depths of 0-15cm, 15-30cm and 30-45cm using soil auger. The physico-chemical properties determined were pH, Soil moisture, Bulk density, Total nitrogen, Phosphorous, Organic matter, Sodium, Potassium, Calcium and Magnesium. Descriptive statistics and Pearson correlation were used to analyze the result. The result showed that the samples from the farmland recorded mean values of 1.47%, 1.73g/cm^3, 5.12, 0.054%, 12.63mg/kg, 1.59%, 0.139mg/kg, 21.4mg/kg, 14.4mg/kg and 13.0mg/kg for Soil moisture, Bulk density, pH, Total nitrogen, Phosphorous Organic matter, Sodium, Potassium, Calcium and Magnesium respectively. While samples from the forest recorded mean values of 2.73%, 1.49g/cm^3, 6.0, 0.71%, 16.6mg/kg, 2.8%, 0.19mg/kg, 22.9mg/kg, 18.6mg/kg and 21.0mg/kg for Soil moisture, Bulk density, pH, Total nitrogen, Phosphorous, Organic matter Sodium, Potassium, Calcium and Magnesium respectively. The result showed both wide and narrow variations in the soil properties. The result also revealed that soil samples from the forest had greater values of soil physico-chemical properties when compared to samples from the farmland, except Bulk density which was higher for the farmland. This indicated that farming activities had negative impact on the soil in Obinze. The correlation analysis showed that the soil properties exhibited correlations of different magnitudes. This study established that farming activities in Obinze affected the soil quality negatively and suggested measures to improve the soil conditions in the area. The study recommended the adoption of good agricultural practices in the area such as farming systems that encourage conservation.

Keywords: conservation, farmland, impact, soil quality.

1.0. Introduction

Although soils are ecological component of the environment, the perception is that enough is already known about soils so that generalization made for all soils is correct. There is also a failure to recognize that agriculture is one of the major stressors of the environment (Virmani *et al.,* 1984) particularly from a soil degradation point of view (Beinroch *et al.,* 1994). Recently, due to rapid population growth, a large area of forest has been clear cut and converted to farm lands. This conversion could leave the land more susceptible to soil degradation, including high soil bulk density, lower hydraulic conductivity and higher soil erosion (Spaans, 1989). A large body of information is now available that shows clearly severe damage to the soil quality and increased soil erosion caused by agricultural practices in the forest areas (Knuti *et al.,* 1979). Mroz *et al* (1985) mentioned that total tree harvesting may have severe effect on forest soils including nutrient removal in the harvested material, increased erosion rates and/or percolation, losses of nutrients, and also soil compaction. Soil degradation due to land mismanagement is a major concern that threatens economic and rural development, especially in the third-world countries (El- Swaity, 1994).

Soil quality is one of the most important factors for sustaining the global biosphere and developing agricultural practice (Wang and Gong, 1998). Monitoring of soil quality provides an opportunity to evaluate soil and land management system. An understanding of the basic soil properties is also essential for developing soil management practices that will maintain the productive potential of a soil. This is particularly true of the tropical soils with inherent properties of low cation exchange, low organic matter content, low water holding capacity and structural instability which make them vulnerable to soil erosion. The subject of soil erosion and its associated menace have become a matter of concern in Nigeria today. It has undoubtedly become known as a potential environmental hazard to almost every community in Nigeria. This menace affects soil properties and potential of soil resource in many communities all over the federation. The knowledge of the soil and land use capacities through the assessment of soil quality is the bedrock of any modernization process in agriculture.Valuable soil nutrients have been lost due to soil degradation and severe damage to soil quality.

The practice of agriculture and its associated impact has become a matter of serious concern in Imo State in general and Owerri West in particular. Farming activities, though an important source of livelihood

which equally has economic importance, has contributed to a number of environmental degradation such as erosion, loss of soil fertility and loss of biodiversity. Some agricultural practices affect soil physico-chemical properties and soil potential in many localities and this effect hasbothlocal, regional and global effect.

Obinze in Owerri West, is one of the areas noted for cultivation/ farming activities, mainly subsistence farming and shifting cultivation. The practice of cutting down trees and bush burning for the purpose of farming is having a profound impact on soil conditions in Owerri West in particular and Imo State in general. This work therefore seeks to determine the impact of farming on soil physico-chemical properties in Ebikoro-Obinze, Owerri West L.G.A of Imo State.

2.0. Methodology

2.1. Study Area

Obinze is a town in Owerri West Local Government Area of Imo state, Nigeria. It shares boundaries with NgorOkpala LGA in south, Owerri municipal council in the east, Mbaitolu LGA in the north and Ohaji/Egbema LGA in the west. Its geographical coordinates are Latitude 5°25'0" North and Longitude 6°58'0" East. It has an average annual rainfall of about 2550 mm, a relative mean temperature which ranges annually between 24.50 and 25.50^{o}C. High rainfall occurs from the months of June to October while the months of December to February experience low rainfalls, higher temperatures and low humidity (ISADAP,2000). The estimated terrain elevation above sea level is 61 metres. The area lies within the tropical rainforest region of Nigeria, with its evergreen vegetation. The people are land resource dependent and they practice shifting cultivation, crops grown on the area are maize, melon, yam, and cocoyam. The population of Owerri West local Government is estimated to about 99,265(National Population Census, 2006) and it is a major centre for agricultural/farming activities in Imo state with most of its people as farmers.

The high population density, farming and anthropogenic activities arising from agricultural activities around this region have led to serious deforestation of the forest in the area. Many locations in the LGA have therefore become exposed and contribute to soil degradation, erosion and loss of soil nutrients, Ebikoro being a case study.

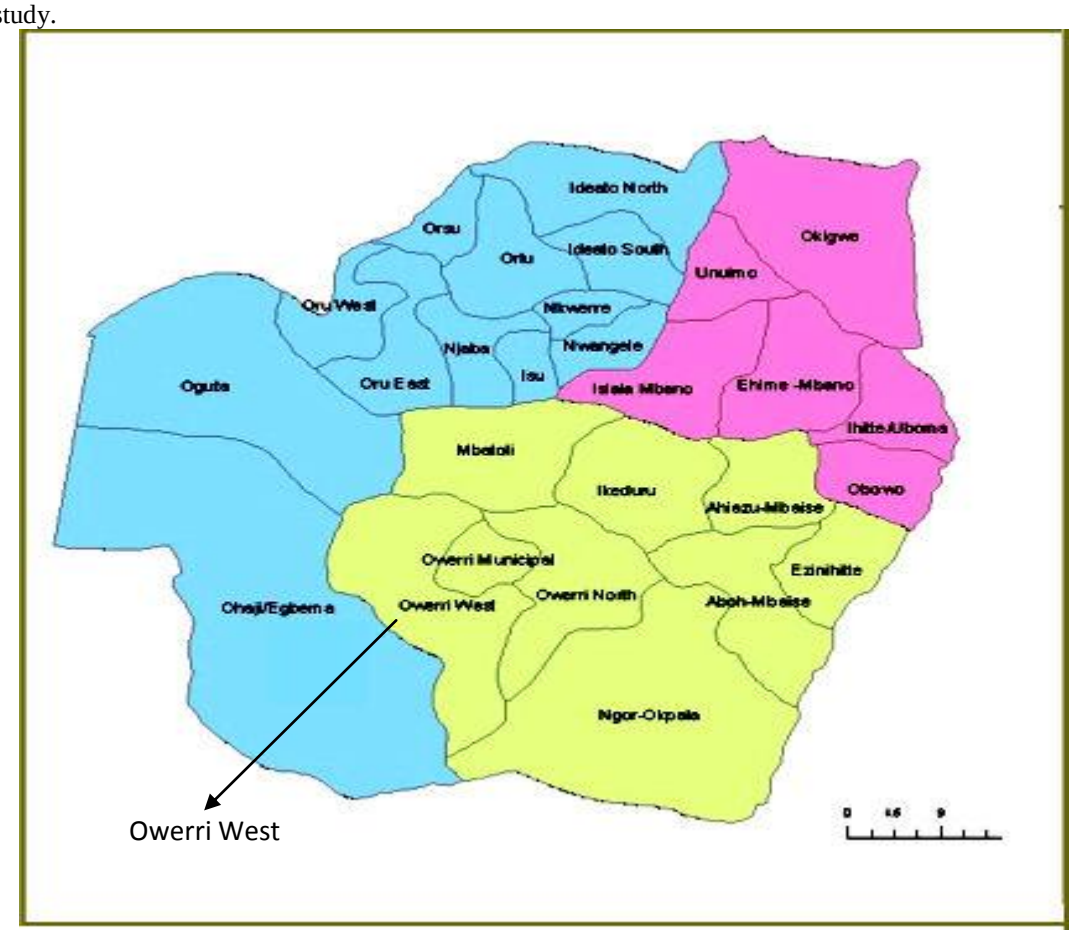

Fig.1. Map of Imo state showing LGA of study- Owerri West

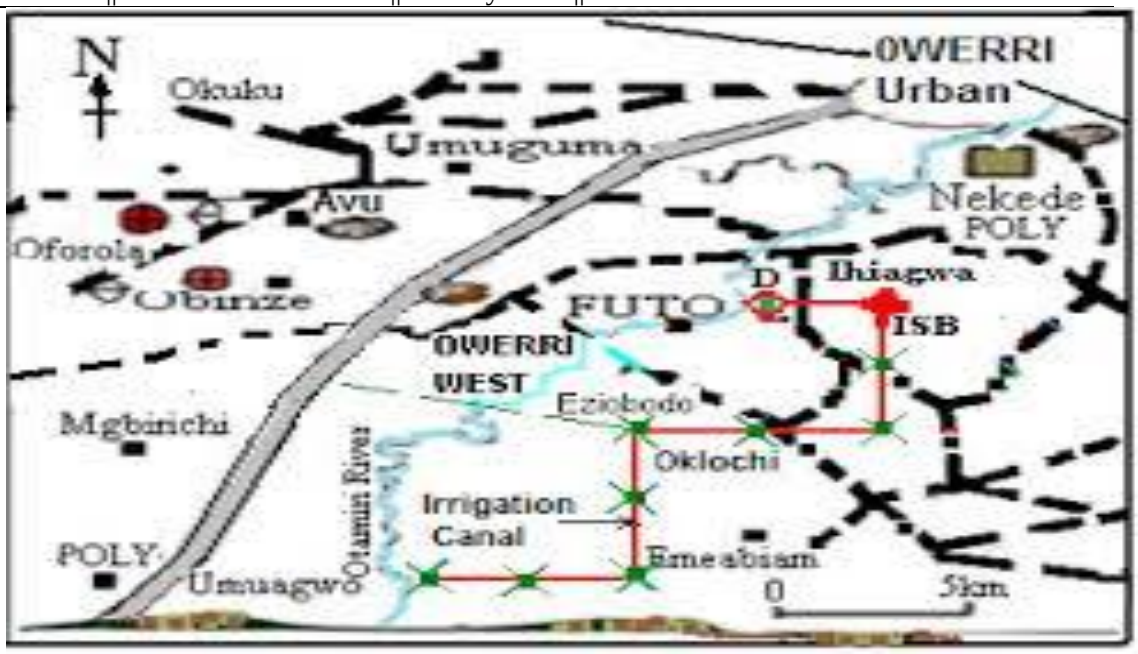

Fig 2. Map of Owerri West LGA showing area of study Obinze.

2.2. Data Collection and Analysis

Two sampling locations (Ebikoro and Umuokanne both in Obinze) were established within a farmland area and a forest area. At each point, soil samples were collected randomly during the rainy season using a simple random method from farmland in Ebikoro and a forest in Umu-okanne with depths ranging from 0-15cm, 15-30cm, and 30-45cm using auger to prevent contamination. The samples were thereafter composited and sent to the laboratory in labeled polythene bags for specific agricultural soil nutrients analysis within 24 hours of collection.

The following soil properties were determined using standard methods:

- Soil moisture content was determined using an oven dry method in which samples were dried to constant weight (Ahuja *et al*, 1976) and the difference in mass of wet and dry samples recorded and expressed in percentage.
- Bulk density was determined by using the Core method of (Grossman and Reinch, 2002). The sampler was pressed not too far as compressing the soil in the confined space of the sampler.
- pH was determined using the method of McLean, 1982.
- total nitrogen,
- available phosphorous,
- organic matter,
- sodium, potassium,
- calcium and magnesium.

3.0. Result and discussion

3.1. Result of Soil Analysis from Farmland

Table 1: Descriptive Statistics of Physico-Chemical Properties of Soil From Farmland in Ebikoro- Obinze, Owerri West L.G.A

Parameters	Minimum	Maximum	Range	Mean	SE
Soil moisture (%)	1.2	1.8	0.6	1.47	0.17
Bulk density (g/cm^3)	1.56	1.9	0.34	1.73	0.09
pH	4.83	5.6	0.77	5.12	0.24

Total nitrogen (%)	0.048	0.62	0.572	0.054	0.004
Phosphorous (mg/kg)	8.9	15.3	6.4	12.63	1.92
Organic matter (%)	0.86	2.1	1.24	1.59	0.37
Sodium (mg/kg)	0.120	0.152	0.032	0.139	0.009
Potassium (mg/kg)	13.2	28.4	15.2	21.4	4.42
Calcium (mg/kg)	5.4	19.9	14.5	14.4	4.53
Magnesium (mg/kg)	4.3	22.1	17.8	13.0	5.14

Researcher's computation 2017
SE: standard Error of Mean

The result of analysis of physico-chemical properties of soil from farmland revealed that the levels of magnesium, calcium and potassium varied widely (range=17.8mg/kg, 14.5mg/kg and 15.2mg/kg respectively) while other parameters had narrow variations. pH, Soil moisture, Bulk density, Total nitrogen, Phosphorous, Organic matter and Sodium varied between 4.83-5.6, 1.2–1.8%, 1.56 -1.9g/cm^3, 0.048-0.62 %, 8.9–15.3 mg/kg, 0.86–2.1 % and 0.120-0.152mg/kg respectively.
The results further revealed that Potassium varied from 13.2–28.4 mg/kg, Calcium between 5.4–19.9mg/kg and Magnesium varied between 4.3–22.1mg/kg (Table 4.1). The mean values were 1.47%, 1.73g/cm^3, 5.12, 0.054%, 12.63mg/kg, 1.59%, 0.139mg/kg, 21.4mg/kg, 14.4mg/kg and 13.0mg/kg respectively for Soil moisture, Bulk density, pH, Total nitrogen, Phosphorous, Organic matter, Sodium, Potassium, Calcium and Magnesium respectively.

3.2. Result of Soil Analysis from Forest
Level of Edaphic variables (Result of soil analysis from forest):
Table 2: Descriptive Statistics of Physico-Chemical Properties of Soil from Forest in Umuokanne- Obinze, Owerri West L.G.A

Parameters	**Minimum**	**Maximum**	**Range**	**Mean**	**SE**
Soil moisture (%)	2.3	3.4	1.1	2.73	0.33
Bulk density (g/cm^3)	1.4	1.6	0.2	1.49	0.059
pH	5.8	6.2	0.4	6.0	0.11
Total nitrogen (%)	0.056	0.085	0.029	0.071	0.008
Phosphorous (mg/kg)	14.8	17.9	3.1	16.6	0.93
Organic matter (%)	2.2	3.5	1.3	2.8	0.37
Sodium (mg/kg)	0.16	0.22	0.06	0.19	0.017
Potassium (mg/kg)	18.9	27.2	8.3	22.9	2.39
Calcium (mg/kg)	14.7	22.7	8.0	18.6	2.31
Magnesium (mg/kg)	14.5	26.1	11.6	21.0	3.42

SE: standard Error of Mean

Table 2 revealed variations in the levels of physico-chemical parameters of soil from the forest. Almost all the soil parameters had narrow variations except Magnesium (range = 11.6mg/kg) and to some extent Calcium and Potassium (range= 8.0 and 8.3mg/kg respectively).

The result of analysis revealed that pH, Soil moisture, Bulk density, Total nitrogen, Phosphorous, Organic matter, Sodium, Potassium, Calcium and Magnesium varied between 5.8 –6.2, 2.3–3.4%, 1.4-1.6g/cm^3, 0.056–0.085%, 14.8–17.9mg/kg, 2.2–3.5%, 0.16–0.022mg/kg, 18.9–27.2mg/kg, 14.7–22.7mg/kg and 14.5–26.1 mg/kg respectively as shown in Table 2.

The mean values were 2.73%, 1.49g/cm^3, 6.0, 0.071%, 16.6mg/kg, 2.8%, 0.19mg/kg, 22.9mg/kg, 18.6mg/kg and 21.0mg/kg for soil moisture, Bulk density, pH, Total nitrogen, Phosphorous, Organic matter, Sodium, Potassium, Calcium and Magnesium respectively as shown in Table 2.

3.3. RELATIONSHIP BETWEEN SOIL PROPERTIES FROM FARM LAND

Table 3 Correlation matrix for linear relationships between soil parameters obtained from farmland.

	Soil moisture	**Bulk density**	**pH**	**Total nitrogen**	**Phosphorous**	**Organic matter**	**Sodium**	**potassium**	**calcium**	**Magnesium**
Soil moisture	0	0.932	0.8107	0.9421	0.608	0.3054	0.6087	0.20755	0.5356	0.81247
Bulk density	0.1063	0	0.2570	0.0099	0.323	0.6267	0.3234	0.72464	0.3965	0.11972
pH	-0.292	0.919	0	0.2470	0.580	0.8838	0.5804	0.9816*	0.6536	0.37675
Total nitrogen	0.0907	0.99*	0.9256	0	0.333	0.6367	0.3333	0.73457	0.4065	0.12965
Phosphorous	0.5765	0.873	0.6123	0.8660	0	0.3033	9.0031	0.40124	0.0731	0.20368
Organic matter	0.8871	0.553	0.1815	0.5401	0.888	0	0.3033	0.0977*	0.2302	0.50706
Sodium	0.5765	0.873	0.6123	0.8660	1	0.8885	0	0.40124	0.0731	0.20368
Potassium	0.9473	0.419	0.0287	0.4049	0.807	0.9882	0.8078	0	0.3280	0.60492
Calcium	0.6664	0.812	0.5176	0.8029	0.99*	0.9353	0.9934	0.87014	0	0.27687
Magnesium	0.2903	0.98*	0.8299	0.9793	0.949	0.6992	0.9492	0.58152	0.9069	0

*significant at P<0.05

4.0. Conclusion

The study was able to establish significant ($p < 0.05$) variability between both soil samples from the farmland in Ebikoro and samples from the forestland in Umuokanne (both in Obinze) in the soil parameters. The values of the parameters obtained were higher for the forestland than in the farmland except for Bulk density which was higher for the farmland. This showed that farming activities degraded the soil quality.

The complex connections between the different soil properties which could not be easily observed physically were deduced from the correlation analysis. The correlation analysis showed the relationship among the various physico-chemical parameters including Soil moisture, Bulk density, pH, Total nitrogen, Phosphorous, Organic matter, Sodium, Potassium, Calcium and Magnesium. The analysis showed mostly positive correlations of different magnitudes.

In conclusion, the result of laboratory analysis including the statistical analysis indicated variations in the levels of physico-chemical properties of the soil. The result further revealed that human activities such as farming have negative impact on the soil quality.

5.0. Recommendation

Based on the findings of this work, the following recommendations were made:

I. There is need to adopt proper farming systems that will reduce soil degradation. Such farming systems should include organic farming methods, green house gardens, alley agriculture, conservation tillage
II. deforestation should be avoided in order to protect the soil
III. there is need to educate farmers in the rural and urban areas so as to create awareness on the impacts of poor farming practices on the soil quality
IV. Government should assist farmers by providing them with micro finance to enable them practice modern conservation agriculture.

References

[1]. Ahuja, L.R., El-Swaify, S.A., and Rahman, A. (1976).Measuring Hydraulic Properties of Soil with a Double ring Infiltrometer and Multiple-depth Tensiometers. *Soil Sci. Soc. Am. J*., 40:494-754.

[2]. Beinroch, L.H.G., Hoogenboom, J. P., Calixte, J.W. and Jones, G., H. (1994). Using Crop Models and GIS for Regional Production Analysis. Transaction of ASAE 36(1): 177-184.

[3]. EI-Swait, Y.S.A. (1994). State-of-the-art for Assessing Soil and Water Conservation Needs in T.L. Napier, S.M. Camboni, and S.A. EI-Swaify (eds.), Adopting Conservation on the Farm. Soil and Water Conservation Society, Ankeny, LA.pp 13-27.

[4]. Grossman, R.B., and Reinsch, T.G. (2002). Bulk Density and Linear Extensibility in Dane, J. H, and Topps, G. C. (Eds). Methods of Soil Analysis, Part 4 SSSA Nadison, WI. Pp201-254.

[5]. ISADAP. (2000). Imo State Agricultural Development Agency Report. Ministry of Agriculture, Owerri.

[6]. Knuti, L.L., Williams, D.L. andHide, J. C. (1979).Profitable Soil Management. Prentice-Hall, Inc., New Jersey.

[7]. Mroz, G.D., Jurgensen M., F. and Frederick, D.J. (1985). Soil Nutrient Changes Following Whole Tree Harvesting on Three Northern Hardwood Sites. Soil Sci. Soc. Am. J.49:1552-1557.

[8]. Spaans, E. J.A., Baltissen, G. A.M., Bouma, J., Miedeme, R., Lansu, A.L.E., Schoonderbeek, D. and Wielemaker, W.G. (1989). Changes in Physical Properties of Young and Old Volcanic Surface Soils in Costa Rica After Clearing of Tropical Rain Forest. Hydrological Processes 3: 383–392.

[9]. Virmani, S.M., Sivikumar, M.V.K. (1984). Crop Productivity in Relation to Interception of Photosynthetically Active Radiation. Agricultural and Forest Meteorology 31:131-141.

[10]. Wang, X., and Gong, Z. (1998). Assessment and Analysis of Soil Quality Changes After Eleven Years of Reclamation in Subtropical China. Geoderma 81: 339-355.