FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 5 No. 1, March, 2021, pp 411– 417
DOI: https://doi.org/10.33003/fjs-2021-0501-585

ASSESSMENT OF SOIL MANAGEMENT PRACTICES OF FARMERS IN ZARIA LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

[*1]Suleiman Salamatu, [2]Adamu Usman Kibbon, [2]Abdullahi Jibril

[1]Department of Geography, Federal College of Education, Zaria
[2]Department of Geography, Ahmadu Bello University, Zaria.

[*]Corresponding author's email: ummuulaliyub028@gmail.com Phone no. 08065539808

ABSTRACT
This study examined the soil management practices of farmers in Zaria Local Government Area, Kaduna state, Nigeria. Both primary and secondary means of data collection were employed in the study. Purposive sampling technique was used to select both the study locations and the respondents based on the characteristics of the population and the objectives of the study. The sample size of 384 copies of questionnaire was purposively used to acquire data from the selected respondents. This was analyzed in SPSS 2.0 version, using simple descriptive statistics such as frequencies, percentages and mean derived from 4-point Likert scale. The study indicated that the most adopted soil management practice by the respondents was the use of animal manure with 28.1%. This is followed by Mixed Cropping (26.3%). while shifting cultivation is the least practice (1.7%). The results also revealed that manure application is the most effective soil management practice with a mean score of ($\bar{X}$ = 4.21). while the lowest mean score is zero tilling with a value of ($\bar{X}$ = 1.51). Findings also showed that Soil fertility depletion is the strongest challenge to soil management practices with 32.9%. The paper concludes that farmers in the study area can adopt many soil management practices. The paper recommends that there is need for mobile advisory teams of agricultural extension agents and the N-power agro unit to be set up, equipped, mobilized to reach out farmers to increase their awareness on adoption of improved agro soil management practices through training and consultation with farmers.

Keywords: Soil management, Practices, Effectiveness, Challenges, Zaria.

INTRODUCTION

Soil management practice has undergone several modifications over the years as a result of global climate change. Available evidence shows that intensive agricultural land use, which is characterized by monoculture, vigorous ploughing and high rates of mineral fertilization and application of pesticides, has negative consequences not only on soil but the environment in general (Matson, *et al.*, 1997). On the other hand, good soil management ensures that mineral elements do not become deficient or toxic to plants, and that appropriate mineral elements enter the food chain. Therefore, efficient soil management practice is important both directly and indirectly, to crop productivity, environmental sustainability and human health. Hence, Soil management practices which means all operations, practices and treatments used to protect the soil and enhance its performance has increasingly become important in recent times (Food Agriculture Organization, [FAO], 2013). Some of these management practices include; mulching, improved fallows, manure/composting system and improved efficiency of fertilizer use.

According to Lin, *et al.* (2006) there is close link between good and profitable farming, improving/maintaining soil fertility and good environmental management. This implies that what a farmer can achieve is highly dependent on good soil management and climate of the area. It is clear that poor soil management practices can drastically reduce the value of land for agriculture and lead to environmental problems which invariably lead to soil degradation. Other studies quantify agricultural inputs to land productivity, such as the use of nitrogen fertilizer or the application of pesticides (Rigby, *et al.*, 2001; Reidsma, *et al.*, 2006). Javad, *et al*. (2014) argued that population growth and other anthropogenic interferences in

land use have altered the physical and biological characteristics of the earth surface, leading to changes in soil properties; these changes vary with soil management system. As such, soil management practices which supports soil quality is crucial to crop production and environmental quality in general.

Highlighting the importance of soil conservation practices, Dumaski, *et al.,* (2006) opine that soil conservation efforts of farmers promote minimum disturbance of the soil by tillage, balance application of chemical inputs which are only required for improved soil quality for healthy crop and animal production with careful management. Accordingly, improved soil management practices reduce land and water pollution; reduce long-term dependency on external inputs which often times lead to increased cost of production, enhance environmental management, improved water quality and water use efficiency, reduced emission of greenhouse gases through lessened use of fossil fuel and finally improved agricultural productivity with minimum cost (Smith and Smithers, 2006). Thus, the common objective of soil management is the improvement of crop production and environmental protection (Pla, 2014). Hence, one of the main causes of soil degradation identified in various parts of Africa by the Food and Agriculture Organization of the United Nations (FAO, 2013) is the practice of inappropriate methods of soil preparation and tillage. The soil naturally replenishes itself when used properly. In an attempt to maintain optimum crop productivity, farmers adopt different management practices that would conserve the soil.

Agriculture is the main stay and major source of livelihood in Kaduna State and it remains the largest employer of labour which is the key contributor to wealth, income and poverty alleviation strategies. It is estimated that about 80% of the population is engaged in small and medium scale farming activities (Kaduna State Government, 2015). Similarly, in Zaria, farming is known to be the dominant economic activity engaged in by a large percentage of the people. This includes both irrigation and rain-fed agriculture. This is because, over the past two decades, agricultural lands in Zaria have severely been impacted upon through remarkable population expansion, urban growth and developmental activities such as residential building, road construction, deforestation and many other anthropogenic activities. The implication is that the farm lands are getting smaller and the parcels are scattered and fragmented into smaller plots which further reduces any profitable production. Consequently, in an effort to overcome the challenges associated with the shortfall on farm land, most farmers in the area have resorted to various soil management practices, some of which may be detrimental to soil quality which is a major determinant of land productivity. It's in light of the forgoing that this study set out objectives to:

identify the various soil management practices adopted by farmers in the study area; assess the strength/ effectiveness soil management practices adopted by the respondents. and identify the challenges/ barriers to effective soil management practices in the study area.

1.1 The Study Area.

This study was carried out in Zaria Local Government Area, Kaduna state of Nigeria. Zaria is located between Latitudes 10°56"N and 11°80"N of the equator and Longitudes 7°42" and 7°53"E of the Greenwich meridian. Zaria is the second largest city in Kaduna state and being a Local Government Area under the Zazzau emirate, it's one of the original seven Hausa city-States (Downs, 2003). According to Sani and Suleiman (2017), the study area covers a total land area of 563Km^2 with the altitude of about 762 meters above sea level (Ogunleye, 2006). Zaria urban area is located on the high plain of Hausa land in northern Nigeria, standing at an average height of 670m above sea level. It lies within the tropical wet/dry climatic zone and is characterized by strong seasonality in rainfall and temperature distribution (Umar, 2012). The relief of the area is between 500-600 meters above sea level popularly called the plains of Hausa land (Umar, 2012). According to Suleiman, *et al.,* (2019) three major rivers namely: Rivers Saye, Kubanni and Galma form a major tributary to river Kaduna (Adamu, 2004). The study area is located within the northern Guinea Savannah Vegetation zone in Kaduna state. A designation which implies a woodland vegetation type characterized by the presence of *Isoberlinia doka, Isoberlinia tomentosa* and *Upaca togonensis,* with well-developed grass layer of tufted and low ground cover of *Andropogoneae*. There are also specific tree species which are mainly found in the northern part of the country such as *Tamarindus indica*, Shea butter, Mango, Cashew, Baobabs, Locust bean, Neem and Eucalyptus (Abubakar, 2012). The soil type of the study area is highly leached ferruginous tropical soils developed on weathered regolith overlain by a thin deposit of sand blown silt from the Sahara-desert during many decades of the propagation of the tropical continental air mass into the area (Wright and McCurry, 1970).

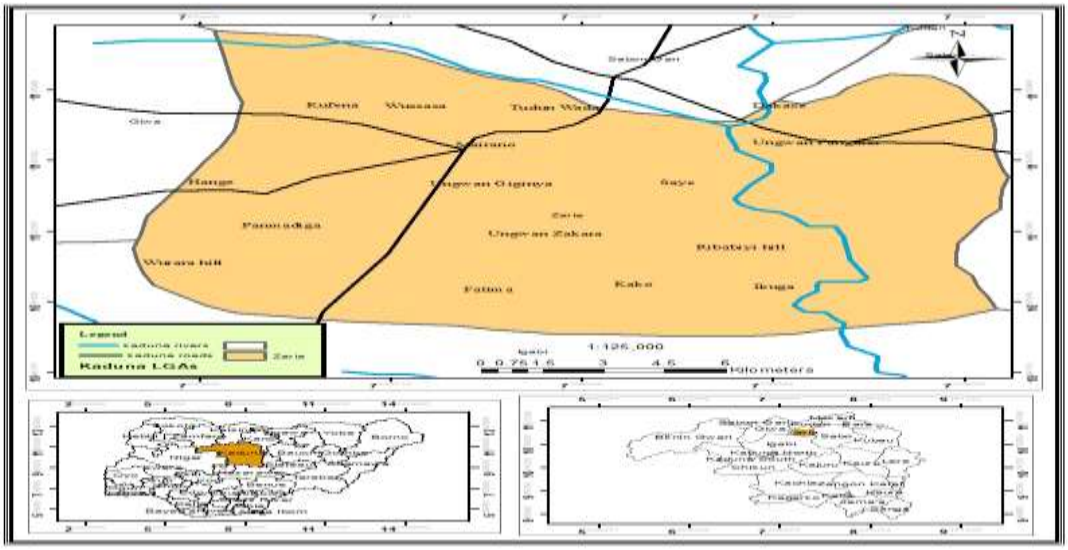

Figure 1: Map of Zaria Local Government Area.
Source: Modified from the Administrative Map of Kaduna State (2021).

MATERIALS AND METHODS

To determine the current population of the study area, the 1991 population census data of the study area was projected to the year 2018 using NPC (2006) population projection formula at the growth rate of 3%. The use of population census is due to the unavailability of data on number of famers both at Local Government and ward levels. However, the NPC (2006) population census data was not adopted because it does not contain wards population.

$[Po=P1\ (1+r)^{n}]$

Where: Po= projected population,
P1= Initial population,
r= Growth rate (at 3%)
n= Number of years projected

$$n = \frac{N}{1+N(e)\,2}$$

Where: n= sample size;
N= NPC Estimated population figure = 548,493
e=level of significance (set at 0.05 for this study)

$$q = \frac{n\ x\ 384}{N}$$

Where: n= sample size (copies of questionnaire)
n=Population of each ward
N=Projected population figure of the study area.

In determining the sample size of the study, Krejcie and Morgan (1970) formula was used to arrive at 384 copies of questionnaires which were administered to the respondents. Based on Krejcie and Morgan table of sample size, for a population between 75,000 to 1,000,000, the sample size is 384. Since the population of the study area (582,522) is within the range, therefore, the sample size of 384 was drawn at 95% confidence level and 0.05% margin of error.

Purposive sampling technique was also used to select adult male/female respondents for the administration of questionnaire in each of the five (5) selected wards which are: Gyallesu, Dambo, Dutsen Abba, Wucicciri and Kufena. The purposively selected respondents included community leaders and farmers who were interviewed using structured questionnaires as most of them have no formal education. Some of the respondents (farmers) were administered questionnaires at their farm sites between the hours of 6:30am-2:00pm within which the respondents were expected to be at their farm plots/sites, while others were administered questionnaires during meetings with community leaders. This method helped to ensure validity of responses and was done till the total numbers of questionnaires assigned to each of the selected wards were exhausted.

Data Collection and Analysis

Three hundred and eighty-four (384) copies of structured questionnaires were prepared and distributed to the respondents (farmers) in the study area. The questionnaire focuses on various adopted soil management practices of farmers in the study area. The data obtained was analyzed using simple descriptive statistics. Thus, the responses were encoded in SPSS 2.0 version and the results were summarized and presented in frequency tables, percentages and mean derived from 4- point Likert scale. The rating average (mean) for the Likert scale was calculated as follows:

$X_1 W_1 + X_2 W_2 + X_3 W_3 \ldots X\ n\ W\ n \div Total$

Where: x = response count for answer choice.
W = weight of answer choice
Total = No. of respondents.

RESULTS AND DISCUSSION

Table 1: Percentage Distribution of Soil Management Practices in the Study Area

Soil Management Practices	(N) Frequency	Percentage
Bush fallow	35	5.3
Cover crop	10	1.5
Crop rotation	42	6.4
Inorganic fertilizer application	171	25.9
Mulching	18	2.7
Ridging	14	2.1
Animal manures	186	28.1
Mixed Cropping	174	26.3
Shifting cultivation	11	1.7
Total	**661**	**100.0**

(N) = Multiple Response

Source: Field Survey, 2019

Table 1 showed that the use of animal manure dominated the soil management practices of farmers in the study area with 28.1%. This is followed by mixed-cropping with 26.3%. The use of inorganic fertilizer accounts for 25.9% in the study area.

In addition, cover cropping and shifting cultivation constituted the least soil management practices used by farmers in the study area with 1.5% and 1.7% respectively. The predominance of animal manure application as soil management practices of farmers was corroborated by the findings of Agele, *et al.,* (2000) that the crop residues application reduces the soil temperature by some degree in the upper centimeters of the top soil and offer better moisture conservation by decreasing the intensity of radiation, wind velocity and evaporation. As such, it is these elements that enhanced its prospects for land use improvement. This result is also in line with findings of Recha, *et al.,* (2014) who agreed that proper use of compost manure leads to an increased proportion of humus substances in the soil due to high micro-organic activity, and therefore, applying compost leads to quantitative and qualitative improvement in humus content of the soil and the increase in crop yields.

Furthermore, the finding also revealed that the use of mulching, ridging, cover cropping and shifting cultivation were low compared to the other methods used in the study area. This may be due to lack of awareness, technicalities of use, land shortages, soil type etc. This finding corresponds with the view of Birte, *et al.,* (2008) who noted that although, farmers were not generally unable to use mechanical soil conservation practices such as terraces and contours. The practices are effective soil conservation technologies as they reduce soil loss, but because the installation and maintenance are typically labour intensive, they are not commonly adopted by farmers due to excessive soil and wind erosion, loss of degraded lands, and silting up of the field.

Table 2: Effectiveness/ Strength of various Soil Management Practices by the Respondents in the Study Area

Soil Mgt. Practices	Poor	%	Fair	%	Good	%	Excellent	%	Mn.	Std. Dev
Crop Rotation	45	11.7	77	20.1	184	47.9	19	4.9	3.15	1.179
Bush Fallow	79	20.6	23	6.0	51	13.3	17	4.4	1.90	1.241
Manure application	7	1.8	24	5.2	146	38.0	185	48.2	4.21	1.045
Fertilizer usage	94	24.5	110	28.6	113	29.4	27	7.0	2.97	1.110
Zero tilling farming	45	11.7	22	5.7	34	8.9	1	0.3	1.51	.964
Planting of cover crops	144	37.5	80	20.8	52	13.5	8	2.1	2.28	1.059
Mixed cropping	10	2.6	46	12.0	194	50.5	98	25.5	3.80	1.135
Mulching	69	18.0	56	14.6	25	6.5	1	0.3	1.68	.967

Source: Field Survey, 2019

Results from table 2 indicated that manure application was the highest with a mean score of ($\bar{X}$ = 4.21). This is not unconnected to factors of affordability and availability and due to the fact that many farmers go to nearby dump site to find it. This was followed by mixed-cropping with mean score of ($\bar{X}$ = 3.80). Crop rotation also recorded a high mark as it attained a mean score of ($\bar{X}$ = 3.15). These findings are in conformity with the findings of Akinbile and Odebode (2007) who observed that farmers used multiple cropping, crop rotation, organic manure to conserve the soil. In contrast, zero tilling farming recorded the lowest score with a mean score of ($\bar{X}$ =1.51). This is not a common soil management practice in the study area, since its capital intensive and peasant farmers who dominated the study area use rudimentary tools and cannot afford mechanized farming system.

The results further agreed with findings of Dimelu *et al.*, (2012) which revealed that farmers commonly use both agronomic, soil management and mechanical strategies of soil conservation as strategies for improving the chemical, physical and biological properties of the soil. In the same vein, Olaitan and Omamia (2006) supported these findings with a view that agronomic soil conservation practices (cover crops, mulching, fallowing and others) are used to provide surface covers to reduce erosion by water and wind in order to conserve the soil, protect the soil from direct sun-rays and enrich the soil by the decay of fallen leaves.

Table 3: Challenges to Effective Soil Management Practices in the Study Area

Challenges/Barriers	(N) Frequency	Percentage
Loss of agricultural lands to other uses	115	20.8
Land/soil fertility depletion	182	32.9
Erosion	82	14.8
Flooding	100	18.0
Others	75	13.5
Total	**554**	**100.0**

(N) = Multiple Response

Source: Field Survey, 2019

Table 3 presents challenges to effective soil management practices in the study area. Findings revealed that land/soil fertility depletion ranked highest with 32.9%. This is followed by loss of agricultural lands to other uses at 20.8%. Other challenges such as financial constraints and lack of awareness on effective soil management strategies have the least score of 13.5%. These results correspond with the findings of Fapojuwo, *et al., (*2012) who postulated that the major constraints to effective use of soil conservation practices were population pressure on the land/urbanization, lack of knowledge on soil conservation techniques and inadequate information and education. These findings re-emphasize the need for training and employing extension services to provide farmers with information on different techniques/strategies.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it can be deduced that farmers in the study area employ various soil management practices to maximize yield and protect the soil from degradation. The most widely used soil management practices are mixed cropping, use of organic manure, cover cropping, inorganic fertilizer, crop rotation, mulching among other methods. The study also concludes that the use of animal manure was the most effective soil management practice adopted by the respondents. The study further identified challenges to effective soil management practices such as: soil fertility depletion, loss of agricultural lands and others like financial constraints and lack of adequate knowledge on effective soil conservation/ management strategies.

Based on the aforementioned findings the following recommendations were made:

i. There is the need for mobile advisory teams made up of agricultural extension agents and the newly established N-power agro unit comprising of e.g. agronomist, biologist, and economist to be set up, equipped, mobilized and reach out to more farmers to increase wider awareness on adoption of improved agro soil management practices through training and consultation with farmers.
ii. Government at all levels should subsidise agricultural inputs, particularly fertilizers and

pesticides to enable farmers to use the optimum amount. This will go a long way to mitigating financial burdens on poorer farmers usually arising from the purchase of such vital inputs by farmer. More so, research institutes like National Research Institute for Chemical Technology (NARICT), Zaria should be encouraged through provision of fund to produce more local manure in commercial quantity at least in the study area as this will reduce over reliance on chemical fertilizer.

REFERENCES

Abubakar, M. (2012) An Assessment of Men's Role and Attitude Towards Family Planning in Zaria L.G. A, Kaduna State, Nigeria. Unpublished M.Sc.Thesis, Department of Geography, Ahmadu Bello University, Zaria.

Agele, S. O., Iremiren, G. O., and Ojeniye, S. O. (2000). Effects of tillage and mulching on the growth, development and yield of late-season tomato (Lycopersicon esculentum L.) in the Humid South of Nigeria. *Journal of Agricultural Science*, 13(4), 55-59.

Akinbile, L. A and Odebode, S.O. (2007) Determinants of Farmers Use of Sustainable Soil Conservation Practices in Osun State, Nigeria. *American-Eurasian Journal of Sustainable Agriculture*. Vol No. 1, pp 1-7.

Birte, J., Abaidoo, R., David, C., and Karl, S. (2008). Soil conservation in Nigeria: past and present on-station and off-farm initiatives. Soil and water conservation society, Ankeny, Iowa, U.S.A.

Dimelu, M. U., Ogbona, S. C., and Enwelu, I. A. (2012). Soil conservation practices among arable crop farmers in Enugu-agricultural zone, Nigeria: implication for climate change. AESON Proceedings, 17th Annual Conference, 140-145.

Dumaski, J., Peiretti, J., Benitis, R., McCarry, D., and Pieri, C. (2006). The paradigm of conservation tillage. Proceedings of World Association of Soil and Water Conservation, pp. 58-64.

Fapojuwo, O. E., Olawoye, J.E., and Fabusoro, E. (2012). Soil Conservation Techniques for Climate Change Adaptation among ArableJournal of Agricultural Science and Technology. Crop Farmers in Southwest Nigeria. *Journal of Agricultural Science and Technology.* 12(2), 35-46.

Food and Agriculture Organization (FAO), (2014). The State of Food Insecurity in the World 2014:Strengthening the Enabling Environment for Food Security and Nutrition. Rome, FAO. Available online at http://www.fao.org/3/a-i4030e.pdf

Intergovernmental Panel on Climate Change IPCC (2007). Climate Change Synthesis Report. Contribution of Working Groups I, II & III to the Fourth Assessment Report. Geneva.

Javad, R. Hassan, K. and Esmaeil, H. (2014), Assessment of the Effect of Land Use Changes on Soil Physicochemical Properties of Jafarabad of Golestan Province, Iran. *Bulletin of Environment, Pharmacology and Life Sciences.* Vol 3 spl III. *296-300.*

Kaduna State Government (2015). Agriculture Sector Performance Report 2014. Ministry of Economic Planning.

Kreicie, R.V. and Morgan, D.W. (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement, 30, 607-610.

Lin, L., Cao, M., Y., and Baskin, J. M., (2006). Non-constituent Species in Soil Seed Banks as Indicators of Anthropogenic Disturbance in Forest Fragments. *Canadian Journal of Forest Research* 36, pp. 2300-2316.

Matson PA, Parton WJ, Power AG, Swift MJ (1997). Agricultural intensification and ecosystem properties. *Science* 277:504–509. doi:0.1126/science.277.5325.504

National Population Commission (NPC) (2009). *2006 National Population Census report*. National Population Abuja, Nigeria. March, 2009.

National Population Commission (NPC) (2009). Provincial Census Figure by States and Local Government in Nigeria. National population Commission, Abuja.

Ogunleye, E.K. (2006). Utilisation of Remote Sensing Products in Kaduna State: A Case Study of Kaduna and Zaria Metropolises. Unpublished PGD Project. Department of Geography and Regional Planning, Ambrose Alli University, Ekpoma, Edo State 3-10.

Olaitan, S.O and Omomia, O.A. (2006) Round-up Agricultural Science; A Complete Guide. Lagos: Longman Nigerian PLC. In Dimelu, M. U., Ogbona, S. C., and Enwelu, I. A. (2012). Soil conservation practices among arable crop farmers in Enugu-agricultural zone, Nigeria: implication for climate change. AESON Proceedings, 17th Annual Conference, 140-145.

Pla, I. (2014). Advances in soil conservation research: challenges for the future. Journal of Soil Science, 4(3), 265-282.

Recha, J., Kapukha, M., Wekesa, A., Shames, S., and K. Heiner. (2014). Sustainable Agriculture Land Management

Practices for Climate Change Mitigation: A training guide for smallholder farmers. Washington, DC. EcoAgriculture Partners.

Reidsma P, Tekelenburg T, van den Berg M, Alkemade R (2006). Impacts of land-use change on biodiversity: an assessment of agricultural biodiversity in the European Union. *Agric Ecosyst Environ* 114:86–102. doi:10.1016/j.agee.2005.11.026

Rigby D, Woodhouse P, Young T, Burton M (2001). Constructing a farm level indicator of sustainable agricultural practice. *Ecol Econ* 39:463–478. doi:10.1016/S0921-8009(01)00245-2

Sani, A.S. and Suleiman, S. (2017) Spatial Analysis of Traffic Hotspots in Zaria, Kaduna State, Nigeria. Yaradua University Journal of Sociology (YUJOSO). Vol. 1, No. 2.pp 141-148.

Smith, B., and Smithers, J. (2006). Adoption of soil conversation practices an empirical analysis in Ontario, Canada. Land Degradation and Rehabilitation, 3, 1-4.

Suleiman, U.B., Abdulhamed, A.I., Musa, I.J.and Yelwa, S.A (2019). Decadal Analysis and Estimation of Temperature Changes in Northern Senatorial Zone of Kaduna State-Nigeria. *FUDMA Journal of Sciences (FJS).* Vol.3 No.3 pp509-518.

Umar, S. (2012). Shika Dam Stability. *An Unpublished Undergraduate Project submitted to the Department of Physics, Kaduna State University, Kaduna, Nigeria.*

Wright, S.B. and McCurry, P. (1970): Geology. In Mortimore, M.J. (eds) (1970). *Zaria and Its Region* Occasional paper No. 4 Department of Geography A.B.U., Zaria. Pp. 5-12.