Sustainable land management practices and its correlates among smallholder food crops farmers in Ogbomoso agricultural zone of Oyo state

Canadian Journal of Agriculture and Crops
Vol. 8, No. 1, 12-21, 2023
e-ISSN: 2518-6655

(Corresponding Author)

Fanifosi, Gbenga Emmanuel[1]
Faniyi, Tolulope Oreoluwa[2]
Adeyemi, Toyin Rebecca[3]

[1,3]*Department of Agricultural Economics and Extension, Ajayi Crowther Universitym Oyom Nigeria.*
[1]*Email: ge.fanifosi@acu.edu.ng*
[3]*Email: tr.adeyemi@acu.edu.ng*
[2]*Department of Crop and Animal Science, Ajayi Crowther Universitym Oyom Nigeria.*
[2]*Email: to.faniyi@acu.edu.ng*

ABSTRACT

The increasing declination of the soil nutrient, land degradation and loss due to desertification has called for sustainable land management (SLM) practices. Smallholder farmers who are the major food producers in Nigeria faced challenges of land management due to land tenure security and fragmentation. However, this study examines SLM and its correlates among smallholder food crops farmers in Ogbomoso Agricultural zone of Oyo State. About 240 smallholder farmers were proportionately sampled from the study area. Using Focus group discussion, the needed information for this study was collected from the farmers. Both Descriptive statistics and Multivariate probit model was applied to analyse the information collected from the sampled farmers. About 40.8% of farmers practice mixed cropping, 27.5% and 15% practice minimum tillage and crop rotation respectively. Although, most (45.8%) acquire the farmland through inheritance, 18.3% rent the farmland while 14.2% purchase the farmland but the choice for the SLM depends on factors such as age, gender, household-size, education, farm-size, tenure security, extension contact, experience, number of farm plots and farm distance. In conclusion, demographic factors, farm-specific factors and tenure security are important drivers of the choice of SLM; therefore an urgent need to prioritize tenure security for increasing sustainability of agricultural land is required.

Keywords: *Crop-rotation, Food crop, Land, Multivariate, Probit, Terrace.*

DOI: 10.55284/cjac.v8i1.911
Citation | Emmanuel, F. G., Oreoluwa, F. T., & Rebecca, A. T. (2023). Sustainable land management practices and its correlates among smallholder food crops farmers in Ogbomoso agricultural zone of Oyo state. *Canadian Journal of Agriculture and Crops*, *8*(1), 12–21.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
History: Received: 10 March 2023/ Revised: 26 April 2023/ Accepted: 4 May 2023/ Published: 10 May 2023
Publisher: Online Science Publishing

Highlights of this paper:

- This paper examines sustainable land management practices and its correlates among smallholder food crops farmers in Ogbomoso Agricultural zone of Oyo State.
- Specifically, the socioeconomic factors and farm specific factors related to adoption of the identified SLM were estimated.
- The result showed that smallholder farmers practice SLM that are less cost effective which has serious implication on land investment.

1. INTRODUCTION

The quest of increasing agricultural production for self-sustenance has in no measure led to increase use of agricultural land. This has invariably reduced the agricultural productivity as a result of depletion of soil nutrient and land degradation. Land – a factor of production is important to food crop production [1]. It is a free gift of nature and rich in minerals that could aid the growth of agricultural crops, and silviculture. It is also a habitation for some animals which burrow through the ground. Increased food production has attributed to the expansion of the land under cultivation and not only the productivity of the arable crop lands. But significant loss of agricultural lands has also been recorded which are mainly caused by edaphic factors, human activities, cultivation on steep slopes, soil nutrient mining, degradation, deforestation, land alienation and loss due to desertification [2].

Pressures emanating from the increment in the population growth contributed also to the increase demand of land and the encroachment to agricultural land for urban development, infrastructural building and others. In addition, studies Bamire and Manyong [3]; Oyekale [4] and Kayode, et al. [5] have reported shortened period of land fallowing, this is becoming frequent in recent time in Nigeria farming system and it could be attributed to shortage of cultivable lands. Though, studies Buckles and Erenstein [6] and Erbaugh [7] have shown the benefit and potentials of driving agricultural growth by rise in the use of land, but constant depletion of soil fertility, decline in productivity, loss of soil structure, soil erosion and land degradation ensue if the growth was not driven. Hence, SLM practices among smallholder farmers could cushion the negative effect of the problems.

SLM practices are vital to increasing agricultural production in the face of degradation and fertility loss or depletion which is the experience of most agricultural lands in Nigeria. World Bank [8] define SLM as knowledge-based practice which allow incorporation of land, water, biodiversity and management of the environment (sustaining ecosystem services and livelihoods) to meet up with the increasing demand of food and fibres. Motavalli, et al. [9], identify conservation agriculture, soil and water conservation, integrated ecosystem management practices and natural resources management as SLM practices. Several studies (5; 10-13) posited and identify some factors responsible for change in adoption and used of SLM practices. Chukwuone, et al. [10] found out that mulching, education of the farmers and access to climate change information significantly influence SLM. In furtherance, education status, access to extension services drives the choice of manure and terracing in Tole district of Ethiopia [11] while Zeleke and Aberra [12]; Kayode, et al. [5] and Saguye [13] reported that age, household size, livestock ownership, proportion of livestock owned, extension contact, and access to climate information and perception of severity of land degradation were the main determinant of SLM practices.

2. MATERIAL AND METHODS

Smallholders' crop farmers in Ogbomoso Agricultural zone of Oyo State, Nigeria were considered in this study. Employing a three-stage sampling procedure, the study selected two out of three (Surulere, Ogo-Oluwa and Oriire) agrarian Local Government Area (LGA) in the zone. The study randomly select five (5) cells/wards each from the ten cells/wards in the selected LGAs. The third stage involves the selection of two villages each from the selected cells/ward and proportionate sampling was adopted to select two hundred and forty smallholder farmers in the

final stage. Data were collected from the selected farmers through a well-structured questionnaire, both descriptive and inferential statistics were used to analyse the information collected from the respondents.

Figure 1 showing Ogbomoso agriculture zone in th context of Oyo state.

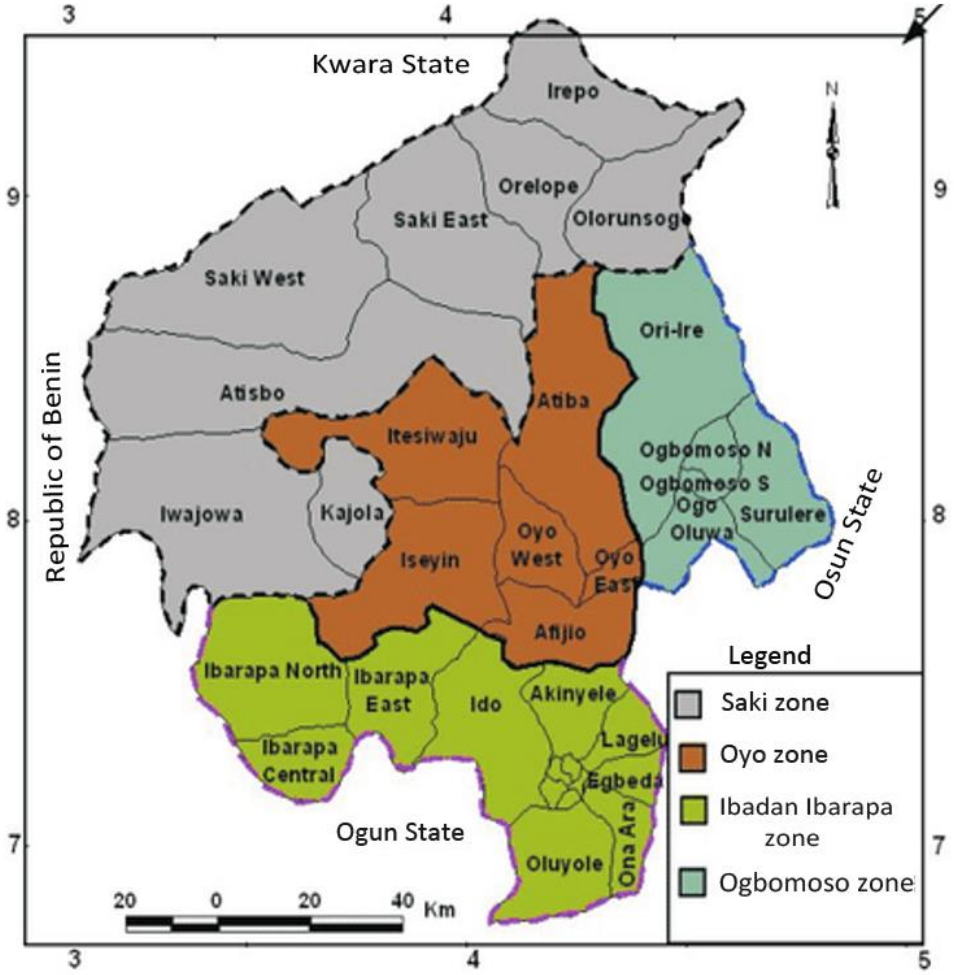

Figure 1. Map of Oyo State showing Ogbomoso agriculture zone.
Note: Ashley-Dejo, et al. [14].

2.1. Model Specification

Multivariate probit model was used to examine the effect of some explanatory variables on the choice of land management practices. The explanatory variable include: Farmers' socio-economic characteristics, farm specific variables and production information that influences the choice of SLM. Unlike multinomial logit regression which permits mutually exclusive choices, Multivariate probit model was found appropriate as the choices are mutually inclusive. The multivariate probit model is specified as:

$$L_i = a + \phi_1 Z_1 + \cdots\ldots\ldots \phi_n Z_n + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots\ldots\ldots \beta_k X_{ik} + \mu_i$$

Where:

L_i = Measures of the choice of land management practices (crop rotation, mixed cropping, shifting cultivation, minimum tillage, alley farming and terracing).

The X_is comprises the farm and farmers specific socio-economic characteristics.

X_1 = Gender of farmer (Male =1, Female =0).

X_2 = Age.

X_3 = Years of schooling.

X_4 = Marital status.

X_5 = Household/ Family size (number).

X_6 = Tenure security (Secure =1, unsecure =0).

X_7 = Contact with extension (Yes =1, No contact =0).

X_8 = Farm size (Acres).

X_9 = Years of experience in farming.

X_{10} = Number of farm plot.

X_{11} = Distance of farm from farmer's homestead (kilometers).

β_1 and β_k are the parameters to be estimated.

μ_i = Disturbance term.

Table 1 presents the description, measurement and expected sign of some variable included in the inferential model used in the study. Age represents the age of the respondents measured in the actual age of the farmers. Tenure security is assign 1 if the land is secure and 0 otherwise; years of schooling is the actual number of years the farmer spent on education; the farm size denote the farm size cultivated by the farmers while extension contact is dummy measured as 1 if farmers had extension contact during production year or 0 if not. The number of farm plots denotes the number of fragmented land cultivates by the farmers and the distance of farm was measured in kilometer.

Table 1. Variable description and measurement.

Variables	Description	Measurement	A-priori expectation
Age	Age of the farmer	Years	+
Gender	Sex (Male/female)	Male = 1, 0 otherwise	+
Household size	Number of household members	Number	+
Years of schooling	Number of years spent in acquisition of formal education	Years	+
Marital status	Whether the respondent is married or not	Married = 1, 0 otherwise	+/-
Farm size	The size of the farmland	acres	+
Tenure security	If the cultivated land are secure or not	1 if land is secure, 0 otherwise	+
Extension contact	Farmers having contact with extension agents	1 if yes, 0 otherwise	+
Farming experience	Number of years of farming	Years	+
Number of farm plot	The number of land parcel the farmers cultivate	Number	+/-
Distance of farm	Distance of home to farm	Kilometers	+

3. RESULTS AND DISCUSSIONS

The result presented in Table 2 reveals that 73.3% of the farmers in the study area are male as while just 26.7% are female; this indicated the dominance of male in agricultural production than the female. Lack access to productive assets such as land could be responsible to the low participation of females in agricultural production. Most women participate in processing and marketing of agricultural produce. About 31% of the respondents were between the ages of 50 and 59, averagely the result shows that most of the respondents were still active and in their productive age but tending towards the unproductive age. Adetunji and Raufu [15] reported high education status of farmers in south west Nigeria. This study showed that more than 50 percent of the respondents to have one form

of western education or the other, the result suggest that most of the respondents were literate and could transform this into adoption of new innovation – even to the extent of accessing better SLM. Most (81.7%) of the farmers were married, 6.7% are separated, 1.7 percent are divorcee while 8.3% are widowed. About 38 percent of the respondents had household's size with 6-7 members and 35.8% had between 4-5 members. The mean household size was 7.6; implying a relatively large household size. Although, large household size might be advantageous in the area of family labour which constitute the most used form of labour in subsistence agriculture. Furthermore, the table reveals the farmers' years of experienced, about 40.1 percent had farming experience between 11-15 year and the mean farming experience stood at 18.3. The average years of farming of the respondents indicate that most of the respondents have a better farming experience which could transform to increased production through better and enhanced agronomic practices.

Table 2. Distribution of respondents' socioeconomic characteristics.

Socioeconomic variables	Frequency	Percentage
Age (Years)		
20-29	8	3.3
30-39	28	11.6
40-49	68	28.4
50-59	74	30.8
60-69	54	22.6
≥70	8	3.3
Mean = 56.1		
Gender		
Male	176	73.3
Female	64	26.7
Marital status		
Married	196	81.7
Single	4	1.7
Separated	16	6.7
Divorced	4	1.7
Widowed	20	8.3
Household size		
1-5	102	34.8
6 – 10	138	62.7
Mean = 7.6		
Level of education		
No formal education	112	46.7
Primary education	116	48.3
Secondary education	12	5.0
Farming experience (Years)		
1-5	6	2.5
6-10	58	24.1
11-15	96	40.1
16-20	56	23.4
21-25	24	10
Mean = 18.3		
Primary occupation		
Farming	208	86.7
Trading	30	12.5
Artisan	2	0.8
Total	240	100.0

3.1. Distribution of Respondents Based on Sustainable Land Management (SLM) practices

Table 3 shows the type of land management practices used by the respondents. The result revealed that 40.8% of the respondents practice mixed cropping, 27.5% carryout minimum tillage on their farmland, 15% of the selected farmers practice crop rotation, while 6.7% of the respondents were found practicing shift cultivation. The result established the adoption of different land management practices among the smallholder food crop farmers in the study area. These management practices were mainly adopted by the farmers to enhance soil fertility, reduce exposure of soil to runoff, soil nutrient depletion, increased resistance to pests and weeds and loss of biodiversity and boost the activities of soil microbes. The processes which will in turn improve productivity and by chance increase the revenue accrue from crop production.

Table 3. Land management practices adopted by the respondents.

Land mgt. practices	Frequency	Percentage (%)
Mixed cropping	98	40.8
Crop rotation	36	15.0
Shift cultivation	16	6.7
Alley cropping	12	5.0
Terracing	12	5.0
Minimum tillage	66	27.5
Total	240	100.0

3.2. Land Acquisition

Land is a factor of production and the management of land most of the time demand the knowledge of the mode of it acquisition. Studies Kayode, et al. [5] and Sallawu, et al. [16] have revealed that most of the inherited land face problem of fragmentation and that inheritance is the major means of farmland acquisition for the smallholder farmers. In Table 4, the result shows that 45.8% of the smallholder farmers inherited their farm land. About 14% bought their farm land, 18.3% rent their farm land, and 15.8% were by gift, while 5.8% borrowed their farm land. This implies that highest percentage of the farmers in the study area inherited their farm land.

Table 4. Distribution of respondents based on land acquisition.

Land acquisition	Frequency	Percentage
Inheritance	110	45.8
Bought	34	14.2
Rented	44	18.3
Gift	38	15.8
Borrowed	14	5.8
Total	240	100.0

3.3. Factors influencing the choice of Sustainable Land Management (SLM) Practices

Table 5 presents the determinants of land management practices among the smallholder food crop farmers in the study area. Six (crop rotation, mixed cropping, shifting cultivation, alley farming, minimum tillage and terracing) SLM practices results were presented on the table and the choice of each of the SLM practices was regressed against some predictors from the demographic characteristics and farm-level variables.

Crop rotation: The result showed the coefficient of gender ($P \leq 0.1$), household size ($P \leq 0.05$), tenure security ($P \leq 0.05$), extension contact ($P \leq 0.05$), farm experience ($P \leq 0.1$) and the number of farmplot ($P \leq 0.01$) had significant effect in the choice of crop rotation LMP. This indicated that increase in these variables will increase the chance of choosing crop rotation. Tenure security plays important role in management of agricultural land. The practices of

some land management requires the level of security of the land, as farmers will not invest much on land that are not secure. The finding of this result was in consonance with that of Adesina, et al. [17].

Shifting cultivation: On the shifting cultivation model, the coefficient of gender and extension contact were negatively significant- an indication that increase in male farmers in the study area will decrease the likelihood of practicing shifting cultivation and additional extension contact will decline the probability of practicing shifting cultivation. Also, the coefficient of farm size, farming experience and distance to farm were positive and statistically significant on the shifting cultivation model. The result implied that an increase in these variables will lead to increase in the likelihood of adopting shifting cultivation.

Mixed cropping: Household size, marital status, farm size and number of farm plot significantly influence the choice of mixed cropping in the study area. The coefficients of all the variables except marital status were positively significant, which implied that there will be chance of increment in the choice of mixed cropping with an increase in these variables. The coefficient of marital status indicated that additional married farmers in the study area will decline the likelihood of practicing mixed cropping.

Alley farming: In the same vein, the coefficient of age, household size, farm size, tenure security and farming experience determines the choice of alley farming in the study area. Studies Matthews-Njoku [18]; Nnadi and Akwiwu [19]; Amsalu and De Graaff [20] and Bawa, et al. [21] have shown that agricultural innovations adoption increases with the age of the farmers, farm size and other institutional factors. Alley farming involve land investment, farmers with tenure security tend to practice alley farming than those who their land are not secure.

Terracing: the model showed that the coefficient of age, gender, years of schooling, farm size, tenure security and farming experience significantly drive the choice of adopting terracing in the study area, all the significant variables positively related to the likelihood of adopting terracing – an indication of the increase chance of adoption with an increase in the variables. Farmers who have the farmland secured could invest on the plot unlike when the tenancy will not guarantee another production on the land. In other words, there is higher chance of investing in terracing when the land is secure.

Minimum tillage: gender, years of schooling, farming experience and the number of farm plot were positive and significantly influence the choice of adoption of minimum tillage in the study area. Increase in years of schooling increases the chance of practicing minimum tillage. Also, farmers who are better experience in farming are likely to practice minimum tillage than those who have lesser farming experience. Experience is key in taken farm decision such as time to plant, fertilizer application, weeding, and other agronomic practices for production.

Table 5. Factors influencing the choice of land management practices.

Predictors	Crop rotation	Shifting cultivation	Mixed cropping	Alley farming	Terracing	Minimum tillage
Constant	-2.570	-3.270	8.376	2.566	1.947	0.451
	(-2.45)**	(-3.57)***	(1.581)***	(4.43)***	(1.66)	(0.149)***
Age	-0.393	0.331	0.0002	0.009	0.004	0.006
	(-1.19)	(0.98)	(0.91)	(2.07)**	(2.06)**	(0.182)
Gender	0.493	-0.727	-0.0192	0.066	0.012	0.526
	(1.80)*	(-1.84)*	(-0.02)	(1.22)	(2.94)***	(0.172)***
Household size	0.409	-0.173	0.0019	0.008	0.036	0.407
	(2.08)**	(-0.80)	(2.13)**	(2.28)**	(1.53)	(0.264)
Years of schooling	-0.817	0.102	0.0004	0.173	0.001	0.360
	(-1.06)	(1.24)	(0.88)	(0.26)	(1.99)**	(0.186)*
Marital status	0.184	-0.29	-0.098	0.038	0.239	0.013
	(0.27)	4(-0.43)	(2.63)***	(1.53)	(1.44)	(0.027)
Farm size	0.259	0.113	0.0047	0.019	0.008	0.109
	(0.46)	(1.73)*	(1.99)**	(1.83)*	(2.23)**	(0.106)
Tenure security	0.562	0.937	0.40411	0.229	0.091	0.006
	(2.08)**	(1.27)	(1.40)	(2.43)**	(1.75)*	(0.182)
Extension contact	1.004	-0.284	0.016	0.039	0.205	0.135
	(2.32)**	-2.23)**	(0.20)	(1.43)	(1.63)	(0.250)
Farming experience	0.604	0.623	-1.091	0.034	0.186	0.155
	(1.93)*	(-2.66)***	(0.42)	(1.97)*	(1.94)*	(0.066)**
Number of farm plot	0.656	0.625	0.004	0.011	0.010	0.058
	(3.10)***	(1.04)	(2.26)**	(0.55)	(0.66)	(0.235)
Distance of farm	-0.749	-0.675	0.007	0.010	0.338	0.821
	(-0.12)	(-2.23)**	(1.51)	(0.99)	(1.27)	(0.426)*

Note: ***, **, * significant at 1%, 5%, 10% probability level respectively Value in parenthesis are z – value.

4. CONCLUSION

This study was conducted to examine adoption of sustainable land management practices and its correlates among the smallholder food crops farmers in Ogbomoso Agricultural Development zone of Oyo State. The empirical question in the study revolved around: identification of ways and tenure system of land acquisition and SLM practices adopted by the farmers and examining the factor that influences the choice of these SLM among various food crops farmers in the study area. Evidence from the result revealed that food crops farmers inherited most of the cultivable farmland and that mixed cropping, minimum tillage and crop rotation were the prominent SLM practices they adopted. Furthermore, the result showed that tenure security positively aid crop rotation, terracing and alley farming – indicating that tenure security should be prioritize by the policy makers and other relevant stakeholder as this will afford the farmers right to invest on the land.

REFERENCES

[1] E. E. Ekong, "Rural sociology: An introduction and analysis of rural Nigeria." Uyo, Akwa Ibom State, Nigeria: Dove Educational Publishers, 2003, p. 34.

[2] L. E. Brown, *Outgrowing the earth: The food security challenge in an age of falling water tables and rising temperatures*. New York: Earth Policy Institute. W.W. Norton & Co, 2005.

[3] A. Bamire and V. Manyong, "Profitability of intensification technologies among smallholder maize farmers in the Forest-Savanna transition zone of Nigeria," *Agriculture, Ecosystems & Environment*, vol. 100, no. 2-3, pp. 111-118, 2003.

[4] A. Oyekale, "Intensive land use and efficiency of food production in South Western Nigeria," *Journal of Agricultural*, vol. 2, pp. 172-179, 2007.

[5] A. Kayode, F. Oladipo, and A. Daudu, "Determinants of adoption of land management practices in Kogi State Nigeria: A gender analysis," *Agro-Science*, vol. 16, no. 2, pp. 52-58, 2017.

[6] D. Buckles and O. Erenstein, "Intensifying maize-based cropping systems in the Hacksaw of Santa Marta," presented at the Veracruz. NRG. Paper 96-07 D.F.: CIMMYT, 1996.

[7] J. Erbaugh, "Agricultural Intensification in Uganda: Progress or environmental involution," *Proceedings of African Crop Science Society*, vol. 4, pp. 599-607, 1999.

[8] World Bank, *Sustainable land management: Challenges, opportunities and trade-offs*. Washington, D.C: The International Bank for Reconstruction and Development/The World Bank., 2006.

[9] P. Motavalli, K. Nelson, R. Udawatta, S. Jose, and S. Bardhan, "Global achievements in sustainable land management," *International Soil and Water Conservation Research*, vol. 1, no. 1, pp. 1-10, 2013.

[10] N. A. Chukwuone, C. Chukwuone, and E. C. Amaechina, "Sustainable land management practices used by farm households for climate change adaptation in South East Nigeria," *Journal of Agricultural Extension*, vol. 22, no. 3, pp. 185-194, 2018. https://dx.doi.org/10.4314/jae.v22i3.18

[11] D. D. Heyi and I. Mberengwa, "Determinants of farmers' land management practices: The case of tole district South West Shewa zone, Oromia national regional State Ethiopia," *Journal of Sustainable Development in Africa*, vol. 14, no. 1, pp. 76-96, 2012. https://doi.org/10.21203/rs.3.rs-1256471/v1

[12] M. T. Zeleke and Y. Aberra, "Determinants of the adoption of land management strategies against climate change in North-West Ethiopia," *Ethiopian Renaissance Journal of Social Sciences*, vol. 1, no. 1, pp. 93-118, 2014.

[13] T. S. Saguye, "Assessment of farmers perception of climate change and variability and its implication for implementation of climate-smart agricultural practices; the case of geze gofa district, Southern Ethiopia," *Journal of Geography & Natural Disasters*, vol. 7, no. 191, pp. 1-9, 2017.

[14] S. Ashley-Dejo, I. Omoniyi, O. Olaoye, E. Fakoya, and A. Adelaja, "Adoption of improved fish hatchery production technologies by fish hatchery managers in Oyo State, Nigeria," *Nigerian Journal of Animal Production*, vol. 43, no. 2, pp. 399-411, 2021. https://doi.org/10.51791/njap.v43i2.846

[15] M. O. Adetunji and M. O. Raufu, "Determinant of land management practices among crop farmers in South-Western Nigeria," *Global Journal of Science Frontier Research*, vol. 12, no. 1, pp. 9-14, 2012.

[16] H. Sallawu, L. Tanko, J. N. Nmadu, and A. M. Ndanitsa, "Determinants of income diversification among farm households in Niger State," *Nigeria Russian Journal of Agricultural and Socio-Economic*, vol. 2, no. 50, pp. 55-65, 2016. http://dx.doi.org/10.18551/rjoas

[17] A. A. Adesina, D. Mbila, G. B. Nkamleu, and D. Endamana, "Econometric analysis of the determinants of adoption of alley farming by farmers in the forest zone of Southwest Cameroon," *Agriculture, Ecosystems & Environment*, vol. 80, no. 3, pp. 255-265, 2000.

[18] E. C. Matthews-Njoku, "Farmers' adoption of improved soil conservation and management practices in a rainforest zone of Nigeria," *Global Approaches to Extension Practice: A Journal of Agricultural Extension*, vol. 1, no. 1, pp. 24-30, 2005.

[19] F. Nnadi and C. Akwiwu, "Rural women\'s response to selected crop production technologies in Imo State, Nigeria," *Global Approaches to Extension Practice: A Journal of Agricultural Extension*, vol. 1, no. 1, pp. 47-54, 2005.

[20] A. Amsalu and J. De Graaff, "Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian Highland watershed," *Ecological Economics*, vol. 61, no. 2-3, pp. 294-302, 2007. https://doi.org/10.1016/j.ecolecon.2006.01.014

[21] D. Bawa, A. Ani, and P. Bzugu, "Influence of sources of agricultural information on maize farmers in Southern Borno, Nigeria," *New Media and Mass Communication*, vol. 31, no. 1, pp. 68-72, 2014.