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Original Research Article

Soil conservation practices adopted by small scale yam farmers in Osun State, Nigeria

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Farmers require demonstrable knowledge, skills, behaviour and attitude to enable them adopt new technologies at a certain performance standard. It is on this basis that the study was conducted to examine the soil conservation practices adopted by small scale farmers more specifically in Osun state, Nigeria. A multistage random sampling technique was used to select 120 farmers. Primary data was used for this study. The primary data were generated through interview and a well-structured questionnaire. The analytical tools used were descriptive statistics and Logit regression model. The result showed that the average age of the respondents was 48 years and about 65.0% were married. The major soil conservation practices adopted by the respondents were use of cover crop with a weighted mean of 2.35, mulching (χ =2.19), crop rotation (χ =2.19), strip cropping (χ =2.18) and multiple cropping (χ =2.15). The major perceived effects of soil conservation practices by the respondents were: increase in the organic matter and nutrient content of the soil with weighted mean of 4.34, increase in infiltration capacity of the soil (χ =4.32), increase the stability of fine pores (χ =4.30), helped in increasing the yield of crop (χ =4.24) and improved the physical properties of soil(χ =4.23). The result of the regression analysis revealed that the probability of adopting soil conservation practice is positively and statistically influenced by education, access to credit, household, farm size, and extension contact. The study also showed that low level of contact with extension agent, inadequate knowledge and information, difficulty to plough with oxen, lack of capital, lack of improved soil conservation practices, high labour and overlap with off-farm activities are the major constraints hindering the adoption of soil conservation practices in the study area. It was hence recommended that Government and non-Government organizations working within rural areas should endeavor to create more awareness on importance and effectiveness of soil conservation practices to improve the adoption rate.

Keywords: Farmer, adoption, soil conservation, practices

INTRODUCTION

In developing countries, agriculture remains a key activity for providing people the capacity to feed themselves by producing their own food or the source of employment and income to access to food supplies (Andzo-Bika and Kamitewoko, 2004; Kokoye et al., 2013). It represents the major subsistence activity for rural farmers (WEF, 2011; Bargout and Raizada, 2013) and contributes to 25% of the gross domestic product of the country (Singh and Cohen, 2014). However, Agricultural sector is facing serious soil erosion that widely impacts agricultural land fertility (Jolly

et al., 2006). Land degradation was a significant global issue during the 20th century and remains of high importance in the 21st century as it affects the environment, agronomic productivity, food security, and quality of life (Eswaran et al., 2001). Soil degradative processes include the loss of topsoil by the action of water or wind, chemical deterioration such as nutrient depletion, physical degradation such as compaction, and biological deterioration of natural resources including the reduction of soil biodiversity (Lal, 2001). Agricultural productivity is a crucial determinant in developing countries' ability to meet food security and economic development objectives in times of rapid population growth (Wiebe et al., 2001; Kokoye et al., 2013). In face of the current global challenge of increasing and stabilizing farmers' income to achieve poverty reduction and environmental management, adoption of sustainable practices become inevitable (FAO, 2012a; Arslan et al., 2014).

Too often, agricultural planners and scientists forget that farmers, best understand their own lands and objectives. While national policy and top–down agricultural development strategies have their place, these may only be implemented through the active participation of farmers. It is the farmers who mobilize their resources and take risks, to assist their crops overcome soil constraints on productivity. Many farmers are aware of land degradation, but their priorities are food production and income generation during the current or next cropping cycle, rather than in the more distant future. This dilemma between short term household security and longer term conservation issues highlights the need for sound policy on soil conservation as a resource base.

Farmers in Osun State often mask the effects of soil degradation by converting their land to less demanding uses, or increasing levels of compensating inputs such as applying more fertilizer (Abu et al., 2011). Improved nutrient cycling can be achieved through the application of organic inputs and the retention of crop residues (Abu et al., 2011. Avoidance of biomass burning is a management practice that helps to control soil erosion trends through their mulching effect. Land clearing in preparation for ridging is sometimes done by setting fire on grasses and crop residues. At other times during hunting, biomass burning is also practiced (Akinbile and Odebode, 2012). The actions of annual bush by farmers usually hinder organic matter accumulation in the soil (Ibetoye et al., 2019). Educational efforts among farmers on the potential impacts of their actions may be necessary (Bayard et al., 2006). Financial constraints are a barrier to the adoption of any farm management strategies. The rehabilitation of degraded landscape depends on the costs relative to the value of output or environmental benefits expected. It is essential to consider the financial implications associated with any course of action. Also, one limiting factor to farmers' appreciation of the importance of soil conservation is that, returns on labour and investments are not immediately evident and are often beyond the planning horizon. It is on this basis that this study attempted to examine the soil conservation practices adopted by small scale farmers in Osun state, Nigeria. The specific objectives of the study were to describe socioeconomic characteristics of the respondents; determine the level of adoption of soil conservation practices; assess the respondent's perception on the effectiveness of soil conservation practices; determine the factors affecting farmers' adoption of soil conservation practices and examine the constraints to the adoption of soil conservation.

METHODOLOGY

The study was conducted in Osun state, Nigeria. It is located between longitudes 4°30′ E and 4°51' E and latitude 7°30' N and 7°50' N, South-western Nigeria (Adebayo and Oluronke, 2014). It covers an area of approximately 14,875 square kilometers. The sate runs an agrarian economy with a vast majority of the populace taking to farming (SEED, 2010).

Primary data was used for this study, it was collected through the administration of questionnaires and structured interview schedule. Multistage sampling technique was adopted for this study. The first stage involved random selection of two local government area (LGA). The second stage was random selection of two villages from each of the selected LGA which include Esa-oke and Elwure villages from Ilesa east LGA, Owode-Ede and Akoda villages from Ilesa west LGA. The third stage involves random selection of one hundred and twenty (120) respondents from the sample frame using 20% of the respective sample frames as shown below in Table 1.

Data were analyzed through the use of descriptive Statistics such as frequency counts, percentages, means and Inferential statistics (Logit regression model). The logit model is given as:

$Y = \alpha + \beta x_i + e$

Logit regression model in its implicit form is given as:

$Y = f(X_1, X_2, X_3, X_4, \ldots\ldots\ldots\ldots X_n)$

The explicit form is expressed as:

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots \beta_{10} X_{10} + e$

Where:

Y = Adoption of soil conservation practice (High adopters = 1, Low adopters = 0)

α = Model intercept

$\beta_1 - \beta_8$ = Coefficients of the independent variables

$X_1 - X_9$ = Independent variables

e = error term

X_1 = Age (in years).

X_2 = Household size (in number).

X_3 = Education (in years).

X_4 = Experience (in years).

X_5 = Farm size (Hectare).

X_6 = Labour (man-day)

X_7 = Access to credit (yes=1, no=0)

X_8 = Cooperative member (No. of cooperative)

X_9 = Extension contact (No of contact).

Table 1. Format of sampling procedure

LGA	Selected Local Government Area	Communities	Sampling frame (N)	Sample Farmers(20%)
Osun	Ilesa east	Esa-oke	205	41
		Elwure	176	35
	Ilesa west	Owode-Ede	77	15
		Akoda	148	29
Total	**2**	**4**	**606**	**120**

Table 2. Socioeconomic Characteristics of the Respondents (n = 120)

Variables	Frequency	Percentages	Mean
Age (Years)			
21-30	20	16.7	
31-40	23	19.2	
41-50	19	15.8	
51-60	33	27.5	
60 Above	25	20.8	
Total	120	100.0	48.4
Marital Status			
Single	23	19.2	
Married	78	65.0	
Widowed	18	15.0	
Separated	1	0.8	
Total	120	100.0	
Household size			
1-5	42	35.0	
6-10	61	50.8	
10 Above	17	14.2	
Total	120	100.0	6.5
Educational level			
Non formal	40	33.3	
Primary education	19	15.8	
Secondary education	41	34.2	
Tertiary education	20	16.7	
Total	120	100.0	
Farming experience (Years)			
1-10	37	30.8	
11-20	23	19.2	
21-30	40	33.3	
30 Above	20	16.7	

For the level of adoption and constraints to adoption of soil conservation practices, 3-point rating scale were used: aware (1 point), tried (2 points) and adopted (3 points) and very serious (3 points), serious (2 points) and not a constraints (1 point) for adoption and constraints respectively. The scores were weighed and weighted average found as used by (Odinwa et al., 2011). The critical mean 2.0 derived from 3-point likert rating scale (3+2+1/3) was used to describe farmers' adoption and constraints. The adoption and constraints scores greater than or equal to critical mean of 2.0 depicts high adoption and serious constraint, respectively. Similarly, 5-point Likert scale rating of: Highly ineffective = 1, Ineffective = 2, somewhat effective = 3, Effective = 4 and Very Effective = 5 was used to examine the constraints faced by yam farmers in adopting the new technology. The critical mean 3.0 derived from 5-point Likert rating scale (5+4+3+2+1/5) was used to assess farmers' perception on the effectiveness of soil conservation practices. The perception statement score greater than or equal to critical mean of 3.0 depicts high effectiveness.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

Table 2 showed the socioeconomic characteristics of farmers which include age, marital status, household size, education level, and years of farming.

Age: Table 2 revealed that more than half (51.7%) of the respondents were between the age ranges of 21-50 years of

age. The mean age was 48.4 years. This is in line with the findings of Akinbile and Odebode, (2012) who stated that farmers in the study area with mean age of 34 years were still at their active workforce age with the chance of having more years to practice agriculture.

Marital status: Marital status as indicated in Table1 showed that majority (65.0%) of the respondents were married, while 19.2%, 15.0%, and 0.8% of the respondents were single, widowed and separated respectively. This will increase the number of family labour since majority of them engage in farming as their primary occupation. This result agrees with Adebo (2014) who reported that high proportion of married people enhance the supply of farm labour and commitment in working to enhance their productivity.

Household size: Table 2 showed the household size with a mean of 7 people. It was observed that majority (85.8%) of the respondents had family size of between 1-10 individuals, while 14.2% had family size of above 10. The implication of this is that larger households tend to consume more and therefore have more needs to cater for. As such farmers with larger household would want to adopt soil conservation practices to earn more incomes to cater for their family needs.

Educational Level: Education is very vital in the adoption of new technology and innovation. It was revealed in Table 2 that majority (66.7%) of the respondents had one form of formal education on the other hand only 33.3% of the respondents do not have any form of formal education at all. This implies that considerable number of the respondents had formal education which could enhance adoption of new agricultural technology (such as soil conservation practices) also the more educated farmers are the easier it will be for them to handle and operate new innovations. The result is in consonance with the findings of Yusuf et al. (2015) who opined that education have implication on the responsiveness and adoption of innovation. Educational status is expected to enable them to make better and well informed decision.

Farming experience: Farming experience as indicated in Table 2 revealed that more than half (52.5%) of the respondents had 11-30 years of experience, 30.8% had 1-10 years of farming experience while 16.7% had years of farming that is above 30 years. The mean farming experience was 22.1 years. Years of experience in farming were important because management skills of farmers improved with experience which is a good sign of a good future in farming in the study area. This finding is in disagreement with Godson-Ibeji et al., 2016 who reported that majority of the farmers where within the age of 11 – 15years.

Level of adoption of soil conservation practices among the farmers

Respondents level of adoption of various soil conservation practices are shown in Table 3. The respondents adoption were said to be high for the following practices: use of cover crop (χ =2.35), use of mulch (χ =2.19) crop rotation (χ =2.19), strip cropping (χ =2.18), multiple cropping (χ =2.15) use of farmyard manure (χ =2.12), mixed farming (χ =2.10) and planting of nitrogen fixing legume (χ =2.03). These practices were said to be more compatible with the small scale farmers cultural practices and it is often believed that farmers accept and adopt new technologies that are compatible with their cultural practices more rapidly. This agree with the findings of Akinbile and Odebode (2007) in their study on level of respondents adoption of the sustainable soil conservation practices and reported that respondents level of adoption of sustainable soil practices is moderate.

Respondent's perception on the effectiveness of soil conservation practices

Table 4 revealed the respondents perception on the effectiveness of soil conservation practices. soil conservation were said to be high effective for the following practices: increase in organic matter and nutrient content of the soil (χ =4.32), infiltration capacity of the soil has increase through soil conservation (χ =4.32), increase the stability of fine pores (χ =4.30), increase the yield of crop (χ =4.24), it improved the physical properties of the soil(χ =4.23), it increases the earthworm activities in the soil thus lead to increase in crop output (χ =4.21), it increases the soil moisture of the soil (χ = 4.18), it increases soil stability and soil aggregate (χ =4.15), it improved the nutrient recycling capacity of the soil, it reduces erosion, it suppress weed activities (χ =4.12 respectively). This implies that various soil conservation practices is effective as it helps to prevent/reduce farming risk, planting nitrogen fixing plant alongside crops that require much nitrogen during growth ensures that varieties of food crops are available for home consumption in subsistence agriculture. This is in line with the findings of Akinbile and Odebode (2007) who reported that inorganic fertilizer helps to ensure nutrients availability to crops for immediate use while organic manure helps to maintain soil structure and later release nutrients.

Factors affecting farmers adoption of soil conservation practices

Out of nine independent variables as shown in Table 5, age, household size, years of education, farm size, labour, access to credit and contact with extension were found to be statistically significant and were positively related to innovation adoption, however, age was negatively related to adoption, this implies that an increase in age of the respondent will lead to a decrease in adoption. Based on the findings of this research,a unit increase in credit will lead to increase in adoption rate of soil conservation practices. This is in agreement with the report of Mohammed and Temu, (2008); Simitowe and Zeller (2006) and Sènakpon et al. (2016) who reported that access to credit promotes the adoption of technologies. The result of

Table 3. Farmers level of adoption of soil conservation practices (n= 120)

Soil conservation practices	Weighted score	Weight mean (χ)	Remark
Use of cover crop	282	2.35	H
Strip cropping	261	2.18	H
Use of mulches	263	2.19	H
Crop rotation	263	2.19	H
Use of fallow system	185	1.54	L
Hedgerow tree planting	184	1.53	L
Multiple cropping	258	2.15	H
Mixed farming	237	2.10	H
Minimum tillage	194	1.62	L
Organic with inorganic	219	1.83	L
Slash and biomass	198	1.65	L
Nitrogen fixing legume	243	2.03	H
Use of farmyard manure	254	2.12	H
Contour ridges	199	1.66	L
Total (χ)		**27.14**	
Critical mean	**≥ 2.0 = ****		
	< 2.0 = *		

Table 4. Respondents perceived effects of soil conservation practices (n = 120)

Perceived effects	Weighted score	Weight mean (χ)	Remark
It increases the organic matter and nutrient content of the soil	521	4.34	Positive
Through soil conservation practices, the infiltration capacity of the soil has increase	518	4.32	Positive
Soil conservation practices increase the stability of fine pores.	513	4.30	Positive
Soil conservation practices has helped in increasing the yield of crop	509	4.24	positive
It improved the physical properties of the soil.	508	4.23	Positive
Soil conservation increases the earthworm activities in the soil thus lead to increase in crop output.	505	4.21	Positive
Soil conservation practices increases the soil moisture of the soil.	501	4.18	Positive
It increases soil stability and soil aggregate.	498	4.15	Positive
It reduces wind erosion.	494	4.12	Positive
Suppression of weed activities.	494	4.12	Positive
It improved the nutrient recycling capacity of the soil.	494	4.12	Positive
Total (χ)		**46.33**	
Critical mean	**≥ 3.0 = ****		
	< 3.0 = *		

H=High L=Low

the regression analysis shows a pseudo R^2 of 0.6364 (Table 4) implying that about 63.64% variation in adoption of soil conservation practices in the study area was explained by the independent variables in the logit regression model, while the remaining 36.36% was due to non-inclusion of some important explanatory variables and errors in estimation.

Constraint faced by farmers in adoption of soil conservation practices

Table 6 revealed that the respondents faced enormous problems in adopting soil conservation practices, among this problems low level of contact with extension agent (χ=2.78), lack of adequate knowledge and information (χ=2.76) difficulty to plough with oxen (χ=2.70), lack of capital (χ=2.67), lack of improved soil conservation practices (χ=2.67) and high cost of labout (χ=2.60) ranked high and as such were the most severed constraints faced by the small scale farmers. This agrees with the findings of Adedayo and Oluronke (2014).

CONCLUSION AND RECOMMENDATIONS

From the study, it can be concluded that the mean age of

Table 5. Logit Regression estimates of factors affecting the adoption of soil conservation practices

Variables	Coefficient	Standard error	Z
Constant	3.929517	1.494497	2.63**
Age	-0.5448607	0.3861536	-1.41*
Household size	0.4189733	0.2976235	1.41*
Years of education	0.8448217	0.2386536	3.53***
Farming experience	-0.1398518	0.4709521	-0.30
Farm size	0.2622934	0.1363105	1.92*
Labour	-0.5790321	0.2288914	-2.53**
Credit	1.587477	0.6454636	2.46**
Cooperative	0.1453864	0.4150925	0.35
Extension contact	0.3383245	0.2293099	1.48*
Mcfadden Pseudo R-square	0.6364		
Chi- squared	117.03		
Log likelihood function	-43.653279		

Z= Z- value

Table 6. Constraints to the adoption of soil conservation practices (n = 120)

Constraints	VS	S	NS	WS	WM	Ranking
High labour	76(63.3)	40(33.3)	4(3.3)	312	2.60	7th
Lack of adequate knowledge	95(79.2)	21(17.5)	4(3.3)	331	2.76	2nd
Lack of capital	86(71.7)	28(23.3)	6(5.0)	320	2.67	5th
Lack of improved soil conservation practices.	82(68.3)	36(30.0)	2(1.7)	320	2.67	5th
Overlap with off-farm activities.	72(60.0)	43(35.8)	5(4.2)	307	2.56	8th
Difficult to plough with oxen.	90(75.0)	24(20.0)	6(5.0)	324	2.70	4th
Lack of adequate information	93(77.5)	25(20.8)	2(1.7)	331	2.76	2nd
Low level of contact with extension agent	96(80.0)	21(17.5)	3(2.5)	333	2.78	1st

VS= Very sever, S=Sever, NS =Not sever WS= Weighted sum WM=Weighted mean

the farmers was 48.4 years and where mostly married. Also farmers level of adoption of soil conservation practices by farmers is moderate while increases in organic matter and nutrient content of the soil was the most perceived effects of soil conservation practices. On factors affecting farmers adoption of soil conservation practices, age, household size, years of education, farm size, labour, access to credit and contact with extension were found to be statistically significant and were positively related to adoption, however, age was negatively related to adoption. Furthermore it was concluded that respondents faced enormous problems in adopting soil conservation practices, among which includes problems low level of contact with extension agent, lack of adequate knowledge and information, difficulty to plough with oxen, lack of capital, and high cost of labour. However, it was recommended that

- Government, NGOs should provide a platform for training farmers on soil conservation practices and provide credit either in cash or input materials to help in facilitating the adoption of soil conservation practices to boast small scale farmers' productivity.
- Extension agents should ensure that they have regular contact with farmers so as to ensure free flow of information, training and education on how best to use the various conservation practices by the extension agents.
- Farmers should try to be educated since education was found to enhance adoption of soil conservation practices.

Conflict of interests

The authors declare that they have no conflicting interests.

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