



Determinants of Crop Farmers' Adoption of Soil Conservation Techniques: A Case Study in Ikenne Local Government, Ogun State, Nigeria.

Bello Taofeek Ayodeji¹, *Afodu Osagie John¹, Ndubuisi-Ogbonna Lois Chidinma², Akinboye Olufunso Emmanuel³ Akpabio, Utibe-Obong Enobong¹

¹Department of Agricultural Economics & Extension, ²Department of Animal Science, ³Department of Agronomy and Landscape Design, School of Agriculture and Industrial Technology, Babcock University, Ilishan Remo, Ogun state, Nigeria.

Received 06 February, 2016; Accepted 16 March, 2016 © The author(s) 2015. Published with open access at www.questjournals.org

ABSTRACT:- Soil conservation is a set of management strategies for prevention of soil being eroded from the earth's surface or becoming chemically altered by overuse, salinization acidification, or other chemical soil contamination. Soil conservation technique is the application of processes to the solution of soil management problems. This research assessed the level of crop farmers' awareness of soil conservation, described the socio-economic characteristics of the crop farmers, and evaluated factors that determine or influence their adoption of soil conservation techniques in Ikenne local government area of Ogun State. One hundred (100) crop farmers were selected randomly for the research study but out of all the 100 questionnaires administered, only 97 were found useful for analysis. The demographic data collected were analysed using descriptive statistics, while the logit regression model was used to evaluate the factors determining crop farmers' adoption of soil conservation techniques. The descriptive analysis result showed that 61.9% of the respondents had farming as their major occupation, 87.6% had farmlands of their own, 38.1% belonged to farmers' groups/associations, and 71.1% were aware of soil conservation techniques. On the other hand, the logit result showed that age, ownership of farmland, farm size, and awareness of soil conservation were significantly associated with the adoption of soil conservation techniques at 1% level of significance ($P < 0.01$), while household size significantly influenced adoption of soil conservation techniques at 10% level of significance ($P < 0.1$). Based on the research findings, it is recommended that better educational services should be provided to guide and educate the younger generation of crop farmers to increase their awareness and interest to soil conservation techniques in the study area, as this has a significant effect on crop productivity. Also, the government should ensure the participation of crop farmers in groups/associations to enhance their awareness to soil conservation methods, thereby encouraging better soil management practices.

Keywords:- Determinants – awareness – crop farmers- soil conservation techniques - Ikenne

I. INTRODUCTION

Soil is an important resource needed for agricultural production systems. As a medium for crop growth, its functions include sustainability of crop productivity, maintenance of environmental quality, provisions for plants and animals. Soil is also a fixed asset that is essential to guarantee food security as well as cash and industrial crop production (Anjichi *et al.*, 2007). The deterioration of soil fertility in tropical regions is moving at an alarming rate a situation that poses a double challenge of increasing production and preserving natural resources simultaneously to smallholders. The deterioration also presents a threat to food security and sustainable food production in many developing countries (Nigeria inclusive).

Soil conservation is a set of management strategies for prevention of soil being eroded from the earth's surface or becoming chemically altered by overuse, salinization acidification, or other chemical soil contamination (Wikipedia, 2008). Soil conservation technique is the application of processes to the solution of soil management problems. The conservation of soil implies utilisation without waste so as to make possible a continuous high level of crop production while improving environmental quality. Soil conservation, in practice

*Corresponding Author: Afodu Osagie John

¹Department of Agricultural Economics & Extension,

refers to the protection of all surface deposits, not merely the near-surface, organic layers that are subject to present-day weathering (Schwab *et al.*, 1993). Some of the methods used to maintain planting of cover crops and use of manure.

According to Food and Agricultural Organization of the United Nations (2001), declining soil productivity without appropriate soil conservation techniques not only means less food can be grown but also that production of cash crops for export is endangered. Nigerian soils are characterized with low productivity due to inadequate moisture retention capacity and low organic matter. Various soil conservation technologies have been widely introduced to farmers by both government agencies and non-government organizations in Nigeria. In Oyo state for instance, the Oyo State Agricultural Development Programme (OYSADEP) and research institutes like Institute of Agricultural Research and Training (IAR&T) and International Institute of Tropical Agriculture (IITA) had introduced various soil conservation measures to farmers. Among such measures included planting of multipurpose tree hedgerows, contour vegetative hedges of vetiver, minimum tillage, double cropping, the establishment of cover crops and mineral fertilizers. Participatory methods like establishment of Small Plot Adoption Techniques (SPATs) and demonstration plots were used to introduce these measures. Despite this, the adoption of soil conservation measures has been less than overwhelming. This study is therefore carried out to identify various soil conservation measures introduced in the study area. It aimed to determine and analyse farmers' socio-economic characteristics and explore relationships that may exist between the adoption of soil conservation measures and farmers' characteristics. Understanding these relationships, will provide insights for designing appropriate strategies and programmes necessary for fostering the adoption of soil conservation measures. Soil conservation practice adoption is a multi-dimensional process. Numerous factors determine farmers' attitude towards a particular soil conservation practice. The multiplicity of factors combined with the potential interactions between them contributes to the complication in identifying features that contribute to adopting soil conservation practices.

II. PROBLEM STATEMENT

Today, the agricultural sector in Nigeria is characterized by low productivity and high exposure to risk due to adversely varying environmental conditions (Bezabih, 1998). The ecological discrepancy the country is facing today presents a serious challenge. Annual agricultural production cannot keep pace with the growing number of the population (World Bank, 1995) and this exposed the country's agricultural population to food insecurity. Currently, Nigeria is experiencing a wide food disparity with the food demanded and the food supplied from domestic production. A huge population pressure on the available land resource in the study area makes hardly possible to exercise proper soil conservation practices. This is because farmers have no time for adjustment. Thus, land is over utilized and eroded and its productive capability is diminished.

While the importance of effective technology is unquestioned, it is of little value to the individual or societal interest until it is applied (Jolly *et al.*, 1985). In the same vein, illiteracy, combined with a lack of awareness to information is a cause as well as a consequence of environmental degradation. Generally, the lack of awareness to information and illiteracy in Africa directly linked to the current level of environmental pollution and degradation in the continent. Farmers are more interested in issues related to their daily survival than environmental management; the lack of interest and awareness often lead to more reckless human behaviour which in turn breeds more environmental problems and leads to a vicious cycle of poverty.

III. RESEARCH QUESTIONS

- 1) What are the socio-economic characteristics of the respondents in the study area?
- 2) What is the level of awareness of soil conservation practices in the study area?
- 3) What are the factors determining or influencing the adoption of soil conservation practices in the study area?

OBJECTIVES OF THE STUDY

The main objective of the study is to determine the adoption of soil conservation practices by crop farmers in the study area. However, specific research study objectives include;

- 1) To describe the socio-economic characteristics of the respondents in the study area,
- 2) To assess the level of awareness of soil conservation techniques in the study area, and
- 3) To evaluate the factors influencing the adoption of soil conservation practices in the study area

JUSTIFICATION OF THE STUDY

Although several soil conservation technologies had been developed and promoted through past decades, the adoption of many recommended measures was still minimal. So studies needed to be conducted in search of factors influencing adoption of soil conservation practices.

The farmers are the target group of this study as they are at the receiving end of environmental degradation impact. This is because they are the people most exposed to the risks involved, as they bear the burden of losses in agricultural productivity. With appropriate information as well as cost effective adoption practices, the vulnerability of these farmers to environmental degradation will be minimized. The findings will therefore bring about increased outputs for farmers and hence enhanced income and reduced poverty.

In view of this, it would be worthwhile to evaluate the factors influencing adoption and use of soil conserving practices. Therefore, this study attempts to assess the sustainable use of physical conservation measures introduced through a major soil conservation program in the study area. The study attempts to provide an empirical explanation as to which factors are associated with farmers' adoption behaviour of conservation structures. A better knowledge of how the characteristics of individual farmers and their farming practices affect conservation investments can help policy makers in designing more effective conservation programs that will be better tailored to the needs of the farmers (Young and Shortle, 1984).

IV. MATERIALS AND METHODS

THE STUDY AREA

The study was carried out in Ikenne Local Government Area of Ogun State. Ikenne has its headquarters (Ikenne Remo, from the defunct Remo Local Government) in the town at 6° 52'N 3° 43'E. It is located after Sagamu and before Odogbolu and near Ilisan-Remo. It is bounded on the west by Obafemi-Owode Local Government, with an area of 144km². And a population of 118,735 (NPC 2006). The Local Government as a whole is semi-urban, comprising 5 major towns namely Iperu, Ilisan, Ogere, Ironu, and Ikenne (the Headquarters). The people are mainly of Remo stock with training and farming as their predominant occupation. The Local Government hosts many industrial/commercial establishments, while agriculture and allied activities also constitute the most important economic activities of the people. It includes planting of food crops like maize, rice, cassava, pineapple, cocoyam, cowpea, melon and cash crops like kola nut, oil palm trees, rubber, and timber.

V. METHOD OF DATA COLLECTION AND SAMPLING

This study employed primary data. The data were collected through well-structured questionnaires administered to the crop farmers in the study area, to obtain information required in accordance with the stated objectives. Information collected include socio-economic/ demographic characteristics, farming and non-farming activities, ownership of land, farm size, awareness and adoption of soil conservation techniques, group or association membership, etc. Simple random sampling was used in the selection of the respondent crop farmers from within the study area. One hundred farmers were randomly selected from the farmers in the study area, but only 97 questionnaire that were completely filled and used for the analysis.

Methods of Data Analysis

Descriptive statistical analysis was used to describe the socio-economic characteristics of the farmers as well as assessing the level of awareness of soil conservation techniques in the study area, but Logit Regression analysis was employed for evaluating the factors determining crop farmers' adoption of soil conservation techniques.

Model specification

Following Gujarati (1999) Logit model was considered to suit the regression equation. It is described as follows;

$$Y = \beta_0 + \beta_i X_i + u_i$$

Y = 1, Adoption of soil conservation practices

Y = 0, Non-adoption of soil conservation practices

β_0 = Intercept

β_i = Regression coefficient that evaluates the factors determining crop farmers' adoption of soil conservation practices

U_i = Error Term

X_i = Independent Variable (i = 1, 2, 3... 9)

The independent variables specified as factors influencing the adoption of soil conservation practices are defined below:

X_1 = Gender (Male = 1, Female = 0)

X_2 = Age of Household Head (Years)

X_3 = Household Size

X_4 = Educational Level (No formal education = 0, Primary = 1, Secondary = 2, Tertiary = 3)

X_5 = Farm Size (hectares)

X_6 = Awareness of Soil Conservation Practices (Yes = 1, No = 0)

X₇ = Primary Occupation

X₈ = Ownership of Farmland (Yes = 1, No = 0)

X₉ = Membership of farmer group/association (Yes = 1, No = 0)

VI. RESULTS AND DISCUSSION

SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

Table 1: Showing The Socio-Economic And Demographic Characteristics Of The Respondents

Socio-Economic And Demographic Characteristics		FREQUENCY	PERCENTAGE
GENDER	Female	24	24.7
	Male	73	75.3
AGE	Less than 30	12	12.4
	31-40	47	48.5
	41-50	24	24.7
	51-60	7	7.2
	Above 60	7	7.2
HOUSEHOLD SIZE	Less than 5	58	59.8
	5-8	35	36.1
	Above 8	4	4.1
EDUCATIONAL QUALIFICATION	No formal education	0	0
	primary	0	0
	Secondary	39	40.2
	Tertiary	58	59.8
PRIMARY OCCUPATION	Farming	60	61.9
	Trading	20	20.6
	Civil servant	15	15.5
	Others	2	2.1
OWNERSHIP OF FARM LAND	No	12	12.4
	Yes	85	87.6
FARM SIZE	None	4	4.1
	0.1-5.0	32	33.0
	5.1-10.0	34	35.1
	10.1-15.1	20	20.6
	Above 15.1	7	7.2
GROUP MEMBERSHIP	Yes	37	38.1
	No	60	61.9

Source: Field Survey, 2014.

Table 1 shows that male headed households dominate crop farming in the study area. Hence, the males are more likely to adopt soil conservation techniques.

Table 1 also shows that, 12.4% of the farmers were less than 30 years old, 48.5% were between the ages of 30 and 40, 24.7% between the ages of 40 and 50, 7.2% between 50 and 60, and 7.2% above the age of 60. The mean age of the respondent crop farmers is approximately 34 years, implying that a higher percentage of the crop farmers in the study area were still in their active age and hence are expected to contribute meaningfully to crop production, and implement various soil conservation practices.

Table 1 shows that 59.8% of the respondents have household size of less than 5, 36.1% have household size between 5 and 8 in number and 4.1% have household size of 9 and above in number. This implies that most of the crop farmers in the study area have relatively small household size, and this contributes significantly to the adoption of soil conservation practices with regards to the labour generated (Stocking and Abel, 1992).

Table 1 shows that 40.2% of the respondents had secondary education and 59.8% had tertiary education. This distribution indicates that the majority of the crop farmers in the study area are literate thus appreciation of awareness programs and adoption of soil conservation techniques is likely to be high.

Table 1 shows that 61.9% of the respondents have farming as their primary occupation, 20.6% have trading as their primary occupation, 15.5% of the respondents are primarily civil servants, and the remaining 2.1% are primarily involved in other occupations. This implies that most of the respondents in the study area are primarily farmers, and this increases the likelihood of adoption of soil conservation practices.

Table 1 shows that 87.6% of the respondents have farmlands of their own through rent, inheritance, purchase, etc. while the remaining 12.4% of the respondents do not have any farmland of their own. Land ownership is a very important determinant of adoption of soil conservation techniques i.e. if you do not have farmland, it is relatively impossible to practice soil conservation.

Table 1 shows that 33.0% of the respondents have farm size between 0.1 and 5.0 hectares, 35.1% have farm size between 5.1 and 10.0 hectares, 20.6% have farm size between 10.1 and 15.0, and 7.6% have farm size of 15.1 and above. However, the mean farm size is 10.3 hectares.

Table 1 shows 61.9% of the respondents are not members of any farmers' group or association, while 38.1% are members of various farmer groups or associations. This implies that most of the crop farmers are not involved in groups and associations. Group or association membership is needed to increase awareness on various agricultural innovations, and hence increases likelihood of adoption.

V. AWARENESS OF SOIL CONSERVATION TECHNIQUES

Table 2 shows that 71.1% of the respondents are aware of soil conservation techniques, while 28.9% are not aware of soil conservation techniques. This implies that most of the crop farmers in the study area are aware of soil conservation techniques.

Table 2: Distribution of Farmers By Awareness Of Soil Conservation Techniques

Awareness	Frequency	Percentage
NO	28	28.9
YES	69	71.1
TOTAL	97	100.0

Source: Field Survey, 2014.

DISTRIBUTION BY ADOPTION OF SELECTED SOIL CONSERVATION TECHNIQUES

The selected soil conservation methods include Manuring, Mulching, Cover Cropping, Shifting Cultivation, Bush Fallowing, Crop Rotation and Use of Fertilizer. From Table 3, it is seen that 22.7% of the respondents adopt Manuring, 11.3% adopt Mulching, 9.3% adopt Cover Cropping, 8.2% adopt Shifting Cultivation, 4.1% adopt Bush Fallowing, 8.2% adopt Crop Rotation, and 63.9% adopt the Use of Fertilizer.

Table 3: Distribution Of Farmers By Adoption Of Selected Soil Conservation Techniques

Selected Technique	Frequency	Percentage
Manuring	22	22.7
Mulching	11	11.3
Cover Cropping	9	9.3
Shifting Cultivation	8	8.2
Bush Fallowing	4	4.1
Crop Rotation	8	8.2
Use of Fertilizer	62	63.9
TOTAL	97	100.0

Source: Field Survey, 2014.

FACTORS DETERMINING FARMERS' ADOPTION OF SOIL CONSERVATION TECHNIQUES

The factors that determine crop farmers' adoption of soil conservation techniques were captured using the Logit regression. The result is shown in Table 4.

Table 4 showed the regression estimates of the determinants of adoption of soil conservation techniques among farmers in the study area. The coefficient of household size, primary occupation, ownership of farmland, and awareness of soil conservation techniques were positive, which implies that they had a direct relationship with adoption of soil conservation techniques. While that of age, education qualification, farm size, and group or association membership were negative, implying an inverse relationship with adoption of soil conservation techniques.

Of all the factors specified, only age, household size, primary occupation, farm size, and awareness of soil conservation techniques were significant at various levels.

The coefficient of age is negative and significant ($P < 0.01$), implying that the higher the age of the farmers, the lower their probability of adopting soil conservation techniques. From the result, if a farmer's age is increased by 100%, it means that the probability of adoption will decrease by 44.2%. This agrees with the past research works of Adesina and Zinnah (1993), but conflicts with the work of Hossain *et al.*, (1992) who found a positive relationship between age and adoption.

The coefficient of household size is positive and significant ($P < 0.1$), implying that the higher the household size of the farmers, the higher their probability of adopting soil conservation techniques. From the result, if a farmer's household size is increased by 100%, it means that the probability of adoption will increase by 47.1%. This concurs with the work of Bezabih (2000), who related household size and adoption positively.

Like that of household size, the coefficient of primary occupation is also positive and significant ($P < 0.01$), implying that the more the farmers having farming as their primary occupation, the higher their probability of adopting soil conservation techniques. This can be explained as farmers are more likely to adopt agricultural practices, unlike traders, civil servants, etc.

The coefficient of farm size is negative and highly significant ($P < 0.01$). This implies that the larger the farm size in terms of crop production, the lower their tendency to adopt soil conservation techniques, probably because of the cost incurred in applying the technique with respect to their farm size. A larger farm would incur a larger cost in implementing soil conservation compared to a small farm, with would incur less implementation cost. From the result, if a farmer's farm size is increased by 100%, it means that the probability of adoption will decrease by 89.3%.

The coefficient of awareness of soil conservation techniques is positive and significant ($P < 0.01$). This implies that increased awareness of soil conservation techniques increases the probability of adoption. The ability or capacity of a farmer to adopt any agricultural practice depends significantly on how aware the farmer is about that practice. From the result, if a farmer's awareness is increased by 100%, it means that the probability of adoption will also increase positively by 56.8%.

The other variables educational qualification, ownership of farmland, and group or association membership were not significant at any level of significance. The adjusted R^2 value (0.650) shows that 65.0% of the variation in adoption of soil conservation techniques by crop farmers was accounted for by the variations in the independent variables in the equation.

Table 4: Logit Regression Result For Evaluating Socio-Economic Factors Determining Crop Farmers' Adoption Of Soil Conservation Techniques

Variable(s)	Regression Coefficient	Standard Error
Constant	10.309	23.143
Age	-0.442***	0.130
Household Size	1.471*	0.840
Educational Qualification	-0.355	0.288
Primary Occupation	1.001***	0.406
Ownership of Farmland	33.038	34.609
Farm Size	-0.893***	0.066
Group Membership	-0.438	0.296
Awareness of Soil Conservation Techniques	8.568***	2.131

*significant at 10% level **significant at 5% level ***significant at 1% level

Nagelkerke $R^2 = 0.650$ -2log likelihood = 52.655 Chi-square = 5.886
Source: Computed from Field Data (2014)

VII. CONCLUSION

This research assessed the level of crop farmers' awareness of soil conservation, described the socio-economic characteristics of the crop farmers, and evaluated factors that determine or influence their adoption of soil conservation techniques in Ikenne local government area of Ogun State. The regression coefficients of age, educational qualification, farm size and group membership were negative, which implies that they had an inverse relationship with adoption of soil conservation techniques; while those of household size, primary occupation, ownership of farmland and awareness were positive, implying a direct relationship with adoption of soil conservation techniques. However, factors that affect crop farmers' adoption of soil conservation techniques in Ikenne local government area include; Age, Household Size, Primary Occupation, Farm Size, and Awareness of Soil Conservation Techniques. This, to some extent, is in accordance with the work of Rogers (1983).

POLICY RECOMMENDATIONS

Based on the findings of this research, the following policy recommendations should be considered;

- Educating the younger generation of crop farmers to improve their awareness to soil conservation techniques in the study area which has a significant effect on crop productivity. This agrees with the works of Ntege-Nanyeenya et al. (1997) and Nkonya et al. (1998).

- Ensuring the participation of crop farmers in groups/associations to enhance their awareness to soil conservation methods, thereby encouraging better soil management practices.

REFERENCES

- [1]. Adesina, A.A., Zinnah, M. 1993. Technology characteristics, farmers' perceptions and adoption decisions: A Tobit model application in Sierra Leone. *Agricultural Economics* 9: 297-311.
- [2]. Anijichi, V E., Mauyo, L. W. and Kispit, M. J. (2007) The Effect of Socio-Economic Factors on a Farmer's Decision to Adopt Farm Soil Conservation Measures. An Application of Multivariate Logistic Analysis in Butere/Mumias District, Kenya In: Bationo A., Waswa, B., Kihara, J. and Kimetu, J. (Eds), *Advances in Integrated Soil Fertility Management in sub-Saharan Africa: Challenges and Opportunities* Springer Netherlands, pp. 915 – 920.
- [3]. Bezabih, E. 2000. The role of new varieties and chemical fertilizer under risk: The case of smallholders in Eastern Oromia, Ethiopia, Shaker Verlag, Aachen, Germany.
- [4]. Food and Agricultural Organization, 2001. The economics of conservation agriculture, Rome.
- [5]. Gujarati, D. 1999. Essentials of econometrics. Irwin/McGraw-Hill, Boston, USA.
- [6]. Hossain, S., Alamgir, M., Croach, R. 1992. Patterns and determinants of adoption of farm practices: Some evidence from Bangladesh. *Agricultural Systems* 38: 1-15.
- [7]. Jolly, R.W., B. Elveld, V. McGraw and D. Raitt. 1985. Transferring soil conservation technology to farmers. In R.F. Follett and B.A. Stewart (eds.). Soil erosion and crop productivity. Madison: American Society of Agronomy - Soil Science Society of America - Crop Science Society of America, pp. 459-480.
- [8]. Nkonya, E., Schroeder, T., Norman, D. 1997. Factors affecting adoption of improved maize seed & fertilizer in Northern Tanzania. *Journal of Agricultural Economics* 4: 1-12.
- [9]. Ntege-Nanyeenya, Mugisa-Mutetikka, Mwangi, Verkuijl. 1997. An assessment of factors affecting adoption of maize production technologies in Iganga District, Uganda. Addis Ababa, Ethiopia, NARO/CIMMYT.
- [10]. Rogers, E. 1983. Diffusion of innovations: The Free Press, New York.
- [11]. Schwab, G.O., Fangmeier, D.D., Elliot, W.J. and Richard, K. F. (1993): Soil and Water Conservation Engineering, 4th ed. 1- 16.
- [12]. Stocking, M., Abel, N. 1992. Labour costs: A critical element in soil conservation. Let farmers judge: Experiences in assessing the sustainability of agriculture (pp. 78-84). Intermediate Technology Publication, London.
- [13]. Wikipedia, (2008). Soil conservation. Retrieved from <http://en .org/wiki/soil conservation>.
- [14]. World Bank. 1995. World development report, Washington, D.C., USA.
- [15]. Young, C. E., Shortle. J. S. 1984. Investments in soil conservation structures: The role of operator and operation characteristics. *Agricultural Economics Research* 36 (2): 10-15.