# ANALYSIS OF SOIL CONSERVATION PRACTICES AND ADOPTION IN FEDERAL CAPITAL TERRITORY, NIGERIA.

**Ojo M.A., Egbelehulu D., Olaleye R.S., Ojo A.O., Tsado J.H. and Ajayi O.J.**
Department of Agricultural Economics and Extension Technology,
Federal University of Technology, Minna, Niger State, Nigeria
Corresponding author e-mail: akinmikky@yahoo.co.uk

## ABSTRACT

*This study examined the adoption of soil conservation practices among arable crop farmers in Federal Capital Territory, Nigeria. Structured questionnaire was used in collecting data from 80 arable crop farmers who were randomly selected from the study area. Data on the socio-economic characteristics of the respondents, their farm output and income as well as different conservation practices adopted and the perceived effectiveness of the conservation practices adopted by the various farmers were also collected. Descriptive statistics and Probit regression analysis were used to analyze data collected. The findings indicated that majority (73.8 %) of the farmers were male with mean age of 42.7years old. The mean household size was 6 people and majority of the farmers (85%) had formal education. The study also showed that farmers in the study area adopted different combination of cultural and biological methods of soil conservation practices with crop rotation (95%) and contour farming (85%) as the most commonly adopted methods, while the least practiced method was zero tillage method (1.3%). The study revealed that the most effective soil conservation practice as identified by the farmers in the study area was crop rotation which was considered to be effective by majority of the farmers. The empirical results from probit analysis further showed that years of farming experience, educational level, land size and farm income had positive and significant effect on the level of adoption of soil conservation practices in the study area. It is therefore recommended that extension agents should create more awareness on different types, methods and techniques of soil conservation practices available to further increase the farmers level of adoption and therefore boost arable crop production. Appropriate subsidy system and training are urgently needed to improve farmers' adoption of soil conservation practices*

***Key words:*** *Soil conservation, Adoption and Probit model*

## INTRODUCTION

Soil degradation is widely recognized as one of the most significant problems impacting the sustainability of agricultural productivity in many parts of the world (Barrett *et. al.*, 2002; Gebremedhin and Swinton, 2003). The fast growth in the agricultural sector in Nigeria has led to resource degradation, with adverse impact on sustainability. The major source of environmental damage associated with agriculture is land degradation, particularly soil erosion on the steeply sloping lands. The process of intensification in agricultural production has increased soil erosion in agricultural systems up to a point in which it is a main agricultural externality and a main threat for agricultural sustainability, as it reduces the potential for agricultural production. The amount of yield reduction as a result of loss of topsoil each year is increasing substantial (Abera, 2003). This makes the issue of soil conservation not only necessary but also a vital concern if the country wants to achieve sustainable development of its agricultural sector and its economy at large.

The avoidance of soil loss by improved management and conservation of the natural resources is important to combat low agricultural production, food insecurity, and the rapid increase in levels of poverty (Ehui and Pender, 2005). Research on soil conservation has already been done for many

years in different parts of Nigeria. The existing initiatives have resulted in a range of on-farm and off-farm technologies (Junge *et. al.,* 2007). Most of the country farmers apply soil conservation practices for their fields. They use either mechanical, biological or cultural conservation measures or a combination of these. However, according to Erabadupitiya (2006), for appropriate soil conservation, all mechanical, biological and cultural practices should be applied together but farmers who are facing similar soil erosion problems may adopt different combinations of soil conservation practices to achieve different levels of soil conservation. It can be categorized as good, average or poor conservation, based on farmers' different socio-economic conditions.

A persistent puzzle is why many farmers do not adopt conservation practices, or discontinue their adoption at the end of any conservationprojects?. Numerous factors have been identified to explain adoption, including profitability and economic incentives, imperfect capital markets, land tenure, human capital, risk attitudes, and other farmer characteristics among others (e.g. Adesina, *et al.*, 2000 ; Fuglie and Kascak, 2001). Owing to the high cost in soil conservation, farmers do not adopt proper soil conservation measures which lead to land degradation in areas cultivated. The impact of these improper cultivation practices has caused soil erosion and other environmental problems (Samarakoon, 2004). For instance, different farmers may have different attitudes towards soil conservation and these may affect the selection of soil conservation practices. Sometimes farmers who have good attitudes also may not practice soil conservation at a good level due to the socio-economic failures (Bandara and Thiruchelvam, 2008). In 2004, Samarakoon, reported that there was an influence of socio-economic factors such as education, age, land ownership, debt and subsidies on farmers'decision to adopt soil conservation measures. However, only few studies have been conducted to identify the effectiveness of soil conservation measures adopted by farmers and the effect of socio-economic factors on farmers' adoption decision.

Therefore, the main objective of this study was to analyze the adoption of soil conservation practices among crop farmers in Federal Capital Territory, Nigeria. The specific objectives are to:

(i) ascertain the socio-economic characteristics of the farmers in the study area.
(ii) examine the various soil conservation practices adopted in the study area
(iii) determine the effectiveness of these conservation practices in checking soilerosion in the study area
(iv) examinefactors affecting the adoption of these soil conservation practices.

## METHODOLOGY

### Study area

The study was conducted in the Federal Capital Territory (FCT), Nigeria. The Federal Capital Territory falls within latitude 7° 25' and 9° 20° north of the equator and longitude 5° 45' and 7° 39' east. The FCT is divided into six area councils namely, Abuja Municipal, Gwagwalada, Abaji, Kuje, Bwari and Kwali with land area of 7,607square km and population of 1,405,201 people (Nigeria Bureau of Statistics, 2006 and Wikipedia, 2011). The FCT falls within the Savannah Zone vegetation of the West African sub-region but patches of rain forest, however, occur in the Gwagwa plains that form one of the surviving northern-most occurrences of the mature forest vegetation in Nigeria. The FCT is predominantly featured with hills, highlands and other distinguishing features. It is also endowed with fertile land for agriculture and at the same time a yearly climate that is neither too hot

nor too cold. The major crops grown in the area include rice, maize, millet sorghum, yam and cassava.

**Sampling technique and sample size**

The data mainly from primary sources were collected using a multi-stage sampling technique. The first stage involved the purposive selection of four area councils (Bwari, Abaji, Gwagwalada and Kwali) based on the preponderance of crop growers and having been regarded as the areas where soil erosion is prevalent. The second stage involved the random selection of twenty arable crop farmers in each area council making a total of eighty farmers sampled for this study.

**Method of data collection**

The data were collected with the use of structured questionnaire designed in line with the objectives of the study. The data collected include data on output of the crops planted by the farmers, inputs (such as seed planted fertilizers, agrochemicals and labour), different conservation practices adopted and the perceived effectiveness of the conservation practices adopted by the various farmers. The data collected also include the socio-economic characteristics of the farmers such as farmer's age, years of schooling, household size, number of contact with extension agents, accessibility to credit, etc.

**Analytical techniques**

***Descriptive Statistics:*** The method employed arithmetic mean, frequency distribution and percentage. The technique was used to group and summarize the data obtained from the field.

**Probit Analysis:** Probit model was used to examine factors affecting the adoption of soil conservation practices in the study area. The implicit form of the model is given as

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, e_i)$.....(1)

Where Y = Level of adoption (1 if high, and 0 otherwise)

$X_1$=Age of the farmer in years

$X_2$=Household size of the farmer

$X_3$= Farming experience of the farmer (years)

$X_4$=Educational level (Number of years spent in formal education)

$X_5$=Land size (hectare)

$X_6$= Farm income (naira)

$X_7$=Land ownership (1 if direct ownership; 0 otherwise)

$X_8$= Number of extension contacts during the 2010/2011 farming season

$e_i$ = Error term

Farmers' adoption level was estimated using a ranking method. A Llikert scale was used to give marks to each farmer. Then mean and standard deviation (SD) of marks were used to separate participants into low adoption level, and high adoption level as used by Bandara and Thiruchelvam (2008)).

Low adoption level---------- Less than (Mean – Standard Deviation)

High adoption level ----------Greater than or equal to (Mean + Standard Deviation)

## RESULTS AND DISCUSSION

### Socio-economic characteristics of sampled farmers

Some socio-economic characteristics may influence the farmer's choice of soil conservation practice in the area. The variables analyzed in this study include sex, age, education, years of farming experience, marital status and household size.

Table1 shows that majority of the respondents (73.8%) were males. This shows that arable crop production is male dominant in the study area. It was also shown that 73.7% of the sampled farmers were between the ages of 31 and 50 years. Thus, majority of the sampled farmers were middle aged, which could result in a positive effect on production. The result also indicated a low level of respondents' educational qualification as 5% of the respondents had tertiary education. However, large number of the farmers (85%) had formal education. This could enhance adoption of improved production technologies through extension activities in the area.

**Table1: Socio-economic characteristics of the farmers in the study area. (n = 80)**

| | Frequency | Percentage | Mean |
|---|---|---|---|
| **Sex** | | | |
| Female | 21 | 26.2 | |
| Male | 59 | 73.8 | |
| **Age (years)** | | | |
| 21-30 | 3 | 3.8 | |
| 31-40 | 37 | 46.2 | |
| 41-50 | 22 | 27.5 | 42.7 |
| 51-60 | 18 | 22.5 | |
| **Marital status** | | | |
| Single | 3 | 3.8 | |
| Married | 74 | 92.4 | |
| Widow | 3 | 3.8 | |
| **Household size** | | | |
| 1-5 | 42 | 52.5 | |
| 6-10 | 36 | 45.0 | 6 |
| 11-15 | 2 | 2.5 | |
| **Farming experience (years)** | | | |
| 6-10 | 28 | 35.0 | |
| 11-15 | 8 | 10.0 | |
| 16-20 | 20 | 25.0 | 12.6 |
| Greater than 20 | 24 | 30.0 | |
| **Level of education** | | | |
| Primary education | 5 | 6.2 | |
| Secondary education | 59 | 73.8 | |
| Tertiary education | 4 | 5.0 | |
| No formal education | 12 | 15.0 | |
| **Means of land acquisition** | | | |
| Inherited | 37 | 46.2 | |
| Rent | 42 | 52.5 | |
| Gift | 1 | 1.3 | |
| **Land size (ha)** | | | |
| 0.01-0.5 | 48 | 60.1 | |
| 0.51-1.00 | 15 | 18.8 | 0.54 |
| 1.01-1.50 | 15 | 18.8 | |
| 1.51-2.00 | 2 | 2.5 | |

Source: Field survey, 2011

Moreover, the results further showed that the average household size was 6 people. Generally, in any agrarian settlement, a large family size guarantees free and cheap labour. Also, the average years of farming experience of the respondents was 12.6 years. This implies that majority of farmers in the study area had been in the business of crop production for a long time.

**Types of Soil Conservation Practices Adopted in the Study Area**

The results(Table2) showed that farmers in the study area adopted different combination of cultural methods (contour farming, crop rotation, shifting cultivation and sand bag) and, biological methods (cover cropping, mulching and bush fallow) of soil conservation practices. Table2 also shows that the most commonly used soil conservation practice in the study area was crop rotation (95%) followed by contour farming method (85%) and the least practised method was zero tillage method (1.3%). These practices were done not just to reduce the effect of erosion but also to improve the nutrients of the soil.

**Table 2: Soil conservation practices adopted in the study area**

| Conservation practices | Frequency* | Percentage |
|---|---|---|
| Contour farming | 68 | 85.0 |
| Crop rotation | 76 | 95.0 |
| Mulching | 31 | 38.8 |
| Bush fallowing | 19 | 23.8 |
| Use of sand bags | 23 | 28.8 |
| Shifting cultivation | 41 | 51.3 |
| Cover cropping | 18 | 22.5 |
| Zero tillage | 1 | 1.3 |

* = Multiple response allowed.
Source: Field survey, 2011

**Effectiveness of the Adopted Soil Conservation Practices in the Study Area**

Table3 shows that the most effective soil conservation practice as identified by the farmers in the study area was crop rotation with 11.3% and 65% of the farmers perceived it as very high and low respectively. This is because it reduces the effect of surface run off and also conserves the nutrient of the soil. Also, crop rotation method was identified to have reduced the production cost by the sampled farmers. This confirms the report of Bandara and Thiruchelvam (2008) that cost of production has an inverse relationship with the level of soil conservation. This means that the unit cost of production is low with good level of soil conservation due to soil enrichment that leads to increased yield. The result in Table 4 also shows that 27.5% of the farmers that adopted contour practice indicated that the method was not effective.

**Table 3: Perceived effectiveness of the adopted soil conservation practices**

| Practices | Very High | | Low | | Poor | | Not Effective | |
|---|---|---|---|---|---|---|---|---|
| | Freq. | % | Freq. | % | Freq. | % | Freq. | % |
| Mulching | 2 | 2.5 | 8 | 10.0 | 10 | 12.5 | 11 | 13.8 |
| Contour | 2 | 2.5 | 8 | 10.0 | 36 | 45.0 | 22 | 27.5 |
| Cover cropping | 2 | 2.5 | 10 | 12.5 | 4 | 5.0 | 2 | 2.5 |
| Sand bag | 3 | 3.8 | 6 | 7.5 | 9 | 11.3 | 5 | 6.3 |
| Shifting cultivation | 2 | 2.5 | 22 | 27.5 | 6 | 7.5 | 11 | 13.8 |
| Zero tillage | 1 | 1.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Crop rotation | 9 | 11.3 | 52 | 65.0 | 14 | 17.5 | 1 | 1.3 |

Source: Field survey, 2011

**Factors Affecting Adoption of Soil Conservation Practices in the Study Area.**

The summary statistics of the variables used in the probit analysis is presented in Table 4. They include the sample mean and the standard deviation for each of the variables. The mean of ₦45,742.35 per annum was obtained from the data analysis with a standard deviation of ₦25,563.68. Analysis of the variables also revealed an average farm size of 0.54ha per farmer, an indication that the study covered small scale family managed farm units. The average age of the farmers, household size, year of schooling, years of experience and number of extension contact were 42.71, 6.00, 8.85, 12.64 and 2.29 respectively, meaning that the farmers were relatively young and with formal education.

The results of probit analysis of factors affecting the adoption of soil conservation practices in the study area are shown in Table 5.

**Table 4: Summary Statistics of the Variables in Probit Regression Model**

| Variable | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Age(years) | 42.71 | 7.68 | 28.00 | 60.00 |
| Household size | 6.00 | 2.34 | 0.00 | 13.00 |
| Farming experience (year) | 12.64 | 7.84 | 4.00 | 45.00 |
| Education (year) | 8.85 | 4.29 | 0.00 | 18.00 |
| Land size (ha) | 0.54 | 0.14 | 0.30 | 2.00 |
| Farm income (₦) | 45742.35 | 25563.68 | 10000.00 | 120000.00 |
| Number of extension contact | 2.29 | 0.67 | 0.00 | 4.00 |

Source: Field survey, 2011

**Table 5: Probit estimates of factors affecting adoption of soil conservation practices in the study area. (n = 80)**

| Adoption Variable | Coefficient | Z-value |
|---|---|---|
| Age($X_1$) | -0.003 | $-0.080^{N.S}$ |
| Household size($X_2$) | -0.158 | $0.115^{N.S}$ |
| Farming experience($X_3$) | 0.049 | 2.561* |
| Level of education($X_4$) | 0.008 | 3.570** |
| Land size($X_5$) | 0.227 | 2.832** |
| Income ($X_6$) | 1.150 | 2.240* |
| Land ownership($X_7$) | -1.443 | -2.51* |
| Extension contact($X_8$) | 0.107 | $0.290^{N.S}$ |

Log likehood = -34.7865
LR Chi Square =18.14*
Prob> chi-square =0.0202
Pseudo $R^2$ =0.4068
** = *Significant at 1% level of probability, * = Significant at 5% level of probability*
NS: *not significant.*
Source field survey, 2011

Table5, shows that the regression coefficients of farming experience ($X_3$), education ($X_4$), land size ($X_5$) and Farm income ($X_6$) were positive meaning that these factors have positive relationship with the adoption level of soil conservation practices in the study area. This indicates that when these factors are increasing, probability of adoption of soil conservation practice increases significantly. The coefficient of land ownership is negative indicating a significant negative relationship between this factor and farmer's adoption level of soil conservation practice.

The LR chi-square (18.14) was significant at 5 percent ($P<0.05$), implying that these factors significantly explained variations in the farmer's adoption level of soil conservation practices in the study area.

## CONCLUSION AND RECOMMENDATIONS

This study examined the adoption of soil conservation practices among arable crop farmers in Federal Capital Territory, Nigeria. The study revealed that majority (73.8 %) of the farmers were males with the mean age of 42.7 years. The study also showed that farmers in the study area adopted different combinations of cultural and biological methods of soil conservation practices with crop rotation (95%) and contour farming (85%) as the two most commonly adopted methods while the least practiced method was zero tillage method (1.3%). The study revealed that the highly effective soil conservation practice as identified by the farmers in the study area was crop rotation with about 11% and 65% of the farmers perceived its effectiveness as very high and low respectively. The empirical results from probit analysis further showed that factors such as years of

farming experience, educational level, land size and farm income had positive and significant effects on theadoption of soil conservation practices in the study area.

Therefore, it is recommended that extension agents should create more awareness on different types, methods and techniques of soil conservation practices available to further improve their adoption. This can be achieved by encouraging the farmers with a view to boosting arable crops production.

Also, government interventions are needed through an appropriate subsidy system and training is urgently needed to improve farmers adoption of soil conservation. Training on soil conservation practices is an essential issue. Information should be made available to the farmers, especially about impact of soil erosion, importance of soil conservation and modern low-cost soil conservation techniques.

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