Influence of Socio-Economic Factors on the Adoption of Soil Conservation Measures in Ibadan/Ibarapa Agricultural Zone of Oyo State

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Abstract: Soil conservation is a set of management strategies for preventing deterioration of soil fertility. Sustainability of the soil fertility is of paramount importance in enhancing food production and preserving natural resources simultaneously to small scale farmers. However, adoption of various soil conservation measures introduced to smallholders is not overwhelming. In this study, socio-economic factors influencing the adoption of soil conservation measures were examined. Data were collected from 204 farmers in three Local Government Areas selected from Ibadan/Ibarapa agricultural zone of Oyo state. Structured interview schedule was used to collect primary data from the respondents. Descriptive statistics and censored Tobit model were the analytical tools employed. The Tobit regression reveals that the following socio-economic factors: education, contact with extension agent ($p < 0.01$), farming experience and farm size ($p< 0.05$) significantly influenced the adoption of soil conservation measures among farmers in the study area. The analysis underscored the need for consideration of the socio-economic environment of the farmers in designing appropriate soil conservation technologies to encourage adoption. [Report and Opinion 2010;2(7):42-47]. (ISSN: 1553-9873).

Key words: Adoption, Influence, socio-economic factors, conservation measures

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*). 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). 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, 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. The study was therefore carried out to identify various soil conservation measures introduced in the study area. It aimed to determine and analyze 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.

Methodology

The study was carried out in Ibadan/Ibarapa agricultural zone of Oyo state, Nigeria. The climate is equatorial, notably with dry and wet seasons and relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. The vegetation of the zone is mostly evergreen forest, found in the southern part of the state where lumbering, plantation farming of cocoa, oil palm, cashew and is practiced. Farmers are endowed with the climate that favours the cultivation of food crops like maize, soybean, cowpea, yam, cassava, melon, sorghum and vegetables.

A multistage random sampling technique was used in selecting the respondents for this study. Four Local Government Areas (LGAs) were selected from the zone based on the concentration of farmers in these areas. The selected LGAs were Iddo, Oluyole, Akinyele and Ibarapa central. Six villages were then randomly chosen from the selected LGAs to make a total of twenty-four villages. From each of the selected villages, 10 farmers were then randomly selected to arrive at a total sample of 240 respondents.

Research Instrument

A structured interview schedule was used for data collection. The instrument contained information on the various soil conservation measures existing and adopted in the study area. It also contained some items relating to the socio-economics characteristics of the respondents. Content validity of the instrument was determined through consultations with experts in the fields of Agricultural Extension and Agronomy. Reliability of the instrument was determined using the test-retest method at an interval of two weeks in the two neighbouring LGAs not included in the study. A reliability co-efficient of 0.82 was obtained using a split-half method.

Analytical Framework

Descriptive statistics were used to describe the data. Data were also subjected to censored Tobit regression model analysis.

Tobit Regression Model

The censored Tobit regression, a hybrid of the discrete and continuous dependent variables, was used to determine the effects of the independent variables (socio-economic) on the adoption of soil conservation measures (dependent variables) among the farmers. The model is expressed below following Tobin (1958); Fernandez-Cornejo *et al* (2001).

$$\Psi_i^* = B'x_i + \varepsilon_i \quad \text{---------- (1)}$$
$$\Psi_i^* = 0, \quad \text{if} \quad \Psi_i \leq 0 \quad \text{---------- (2)}$$
$$\Psi_i^* = \Psi_i, \quad \text{if} \quad 0 < \Psi_i < 1 \quad \text{---------- (3)}$$
$$\Psi_i^* = 1, \quad \text{if} \quad \Psi_i \geq 1 \quad \text{---------- (4)}$$

Where Ψ_i^* is the limited dependent variable, which represent the farmers adoption indices,
Ψ_i is the observed dependent (censored) variable
X_i is the vector of independent variables,
B is a vector of unknown parameters,
ε_i, is a disturbance term assumed to be independently and normally distributed with zero mean and constant variance σ; and i = 1, 2,...n (n is the number of observations =240).
The following socio-economic (independent) variables were considered to estimate the Tobit regression model and are defined as follow.

AGE = Age of farmer in years (continuous variable)
GENDER = Gender of the farmer (1 = male, 0= female)
EDUCATION = Number of years of formal Education of the farmers
FARMEXP = Number of years of farming (continuous variable)
FARM SIZE = Farm size in hectares (continuous variable)
EXTCONT = Extension agent's contact (In contact = 1, otherwise = 0)
LANDONA = Ownership of farm land (if owned by farmer =1, otherwise=0)

If Ψ_i^* is assumed to be normally distributed, then consistent estimates can be obtained by performing a Tobit estimation using an iterative Maximum Likelihood algorithm. The use of maximum likelihood estimation guarantees that the parameter estimates will be asymptotically efficient and the appropriate statistical tests can be performed. This means that all the parameter estimators are asymptotical normal, such that test of significance analogous to the regression t- test can be performed according to Pindyck and Pubinfeld, (1967) as cited in Bamire (1999).

Results and Discussion

Socio-economic Characteristics of Respondents

Analyses of some socio-economic characteristics of the respondents revealed that majority (62.9%) of the respondents were within the age range of 41 – 50 years while only 18.8% were above 50 years (Table 1). The mean age of the respondents was 45.4 years indicating that most of them were still in their middle age and likely to be receptive to new techniques of farming. Majority (64.6%) of the respondents were

literates while 35.4% were not. This high literacy level could have a positive effect in respondents' ability to understand modern technologies as well as making them to be more responsive to the acceptance of innovations. About 88% of the respondents were male while only 18% were female. This may be due to female dependency on their husbands in taking farming decisions (Adeniji, 1991) and probably women are too involved in both farm non-farm activities a situation likely to make them less available for the interview. More than half (61.7%) of the respondents had farming experience of above 20 years while about 33% had between 10 -20 years of experience and only 5% had farming experience of less than 5 years. The mean farming experience was about 25 years indicating vast experience in traditional soil conservation and management practices. Majority (91.7%) of the respondents had farm size of between 1 – 5 hectares while, 6.7% had farm size within the range of 6 – 10 hectares and only 1.6% of them had farm size greater than 10 hectares. The mean farm size for the respondents was 3.2 hectares, indicating that the respondents were small scale farmers a situation that is likely to encourage their trying of new technology probably for maximum utilization of their farmlands.. About 77% of the respondents claimed to be the owners of the farmland they cultivated while about 23% did not own their farmlands. This pattern of ownership status is capable of discouraging the adoption of soil conservation measures as uncertainty of long term tenure system may discourage the investment on long-term conservation measures (Agus *et al*, 2001). Majority (82.5%) of the respondents had contact with extension agents while only 17.5% had non-contact with the extension agents.

Table 1. Distribution of Respondents by Socio- economic Characteristics n = 240

Characteristics	Frequency	Percentage
Age (Years)		
< 30	14	5.8
31 – 40	30	12.5
41 –50	151	62.9
> 50	45	18.8
Mean age = 45.4 years		
Education		
No formal education	85	35.4
Primary education	123	51.2
Secondary education	28	11.7
Tertiary education	4	1.7
Sex		
Male	196	81.7
Female	44	18.3
Farming experience (years)		
< 10	12	5
10 – 20	80	33.3
>20	148	61.7
Mean = 25.3 years		
Total	240	100
Farm size (Ha)		
1 – 5	220	91.7
6 – 10	15	6.7
> 10	4	1.6.
Mean = 3.2 ha.		
Land ownership status		
Owner of farm land	55	22.9
Non-owner of land	185	77.1
Extension advice		
Accessible	198	82.5
Inaccessible	42	17.5

Six soil conservation measures were analysed for adoption as shown in Table 2. Use of contour ridging had the highest adopters (89.6%). This was followed by planting of cover crop (69.6%), mulching (37%) and contour vegetative hedges of vetiver (17.9%). Multipurpose tree hedgerows (2.5%) and minimum tillage (1.7%) recorded low rates of adoption. Reasons for choosing a particular soil conservation measure include: to increase yield (98.3%), less labour intensive (76.3%), cost effectiveness (84.5%), compatibility (65.8%) and to improve soil fertility (54.2%, Table 3).

Table 2. Farmers' adoption rates of selected soil conservation measures n = 240

Measures	Adopters %	Non-adopters %
Contour vegetative hedges of vetiver	17.9	82.1
Minimum tillage	1.7	98.3
Contour ridging	89.6	10.4
Cover crop planting	69.6	30.4
Mulching	37	63
Multipurpose tree Hedgerows	2.5	97.5

Table 3 Distribution of respondents by reasons for choosing a particular soil conservation measures n = 240

Techniques	Frequency*	Percentage
To increase yield	236	98.3
Less Labour intensive	183	76.3
Cost effectiveness	203	84.5
Compatibility	158	65.8
To improve soil fertility	130	54.2

*** Multiple Responses**.

Tobit Estimates of the Socio-economics Influence on the Adoption of Soil Conservation Measures

The estimates of the Tobit analyses are presented in table 4. Five of the selected six variables considered in the model had significant coefficients at different levels between one percent ($P< 0.01$) and five percent ($P < 0.05$) levels of significance. The sigma (σ) value of 0.130 with a 't' value of 21.909 significant at ($P < 0.01$) depicts the fitness of the model. The following socio-economics characteristics: LANDONA ($P< 0.01$), EDUCATION ($P < 0.05$) and EXTADV ($P < 0.05$) had significant influence on the adoption of soil conservation measures among farmers in the study area. the positive signs of these variables imply that as these variables increase the adoption rate will also increases. For instance, as farmers advanced in education their adoption rates tend to increase this agree with the findings of (Okoye, 1999; Ahmad *et al,* 2009). They both agreed that education be it specific or general, commonly correlates positively with the adoption of conservation agricultural practices. Access to extension advice is likely to create awareness on the part of the farmers and serves as an obvious prerequisite for adoption soil conservation technology (Stonehouse, 1996). On the other hand years of farming experience (FARMEXP = $P < 0.01$) and farm size (FARM SIZE = $P < 0.01$) had negative and significant influence on the adoption of soil conservation measures implying that increase in both farming experience and size of farm will significantly reduce the level ,of adoption. This is an indication that owners of larger farms are likely to accept land consuming conservation measures than smallholders.

Table 4 Tobit estimates of farmers' socio- economic characteristics that influence the adoption of soil conservation measures in the study area n = 240

Variable	X_i	Coefficients	Standard Error	T – value
Constant		0.388	0.791E-01	4.903
AGE	X_1	0.721E-03	0.848E-01	0.850
LANDONA	X_2	0.457E-01	0.432E-01*	1.058
EDUCATION	X_3	0.307E-01	0.977E-02**	3.144
FARMEXP	X_4	- 0.227E-02	0.119E-02*	-1.893
FARM SIZE	X_5	- 0.126E-01	0.639E-02*	-1.962
EXTADV	X_5	0.701E-01	0.205E-02**	3.424

**= significant at P< 0.01, *= significant at P< 0.05
Sigma = 0.130; significant at p < 0.01

Conclusion

The adoption of soil conservation measures identified in the study area is very high. The main soil conservation measures in the area are: contour ridging, cover crops, mulching, contour vegetative hedges of vetiver, multipurpose tree hedgerows and minimum tillage. Contour ridging and planting of cover crops were soil conservation measures adopted by the farmers in the study area. Educational level, contact with extension agent, farming experience and farm size were the socio-economic factors found to have significant influence on the adoption of soil conservation measures among the farmers in the study area. It is very obvious that involvement of the farmers through agricultural, ecological and socio-economic diagnosis for determining the best and appropriate soil conservation strategies will certainly enhance the rate of farmers' acceptance and adoption of the technologies.

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