ECONOMICS OF SOIL CONSERVATION PRACTICES IN ABIA STATE OF NIGERIA

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Received: 09-01-2011 Accepted: 20-05-2012

ABSTRACT

Soil degradation and desertification are already severe issues in Sub-Saharan Africa especially Nigeria, where smaller size and resource-poor farmers follow extractive farming practices. This has led to the clarion call for environmental/soil conservation measures. This necessitated this study on the economics of soil conservation measures in Abia state of Nigeria. Specifically, the study examined the socio-economic characteristics of farmers practicing soil conservation, analyzed the cost structure of farms with respect to the level of investment in soil conservation, and the profitability of soil conservation strategies as well as determined the socio-economic factors that influence the level of investment in soil conservation strategies. Multi stage purposive and random sampling techniques were used in selecting the respondents used for the study. Data collected from 60 respondents using structured questionnaire and interview schedules were analyzed using descriptive statistical tools such as frequency distribution, percentages, means, profit analysis, and OLS regression analysis. Result of data analysis revealed that 45.16 percent, 23.24 percent and 31.60 percent of the total cost constitute variable, fixed and isolated conservation costs respectively, and a N41900 accruing from the farm operations per farmer. The significant factors influencing investment in soil conservation measures were farm size, number of farm locations, years of formal education, extension contact, ownership status of farm land and farm income. It was recommended that policies that would grant the farmers access to more land and secure tenure should be put in place to enable them to take advantages of economies of scale and increase their investment in conservation. Also, efforts at increasing crop production and environmental conservation should involve policies that strengthen educating the farmer, especially agricultural education and conservation practices. In this guise, the extension system should be tailored to meet the information other felt needs of the farmers.

Keywords: Economics, Soil Conservation, Practices.

INTRODUCTION

Soil provides living things with food, fibres and fuel. It supports wildlife and rural and urban activities. One of the most serious problems currently affecting agricultural productivity in developing countries of the tropics, including Nigeria, is land degradation. The intensification of cultivation resulting in the opening up of new lands exposes the top soil to the elements of degradation and alters the natural ecological conservatory balances in the landscape. Such imbalances pose great difficulty for productivity increase to meet the food and fibre needs of a rapidly growing population in the region, thus endangering food security (Lal, 2001; Senjobi, 2007). From the end of the 1940s to the beginning of the 1990s, over 90% of the degradation of productive land was due to overgrazing, deforestation and inappropriate agricultural practices. These changes in the soil affect over 2 billion people, most of the 852 million people suffering from hunger in particular (Scheer, 1999). Aromolaran (1998) noted that in population driven intensification areas and where household food security is a major concern, attention is usually given to cropping and resource management systems that permit modest yield increase without large amounts of external inputs systems that support improvement in soil fertility without necessarily sacrificing crop yields.

Human-induced soil degradation is a common phenomenon in Nigeria. Its severity is light for 37.5% of the area (342,917 km²), moderate for 43% (39,440 km²), high for 26.3% (240,495 km²),

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and very high for 27.9% (255,167 km²) (UN Food and Agriculture Organization 2005). Soil erosion is the most widespread type of soil degradation in the country and has been recognized for a long time as a serious problem (Stamp 1938). In 1989, 693,000 km² were already characterized by runoff-induced soil loss in the south and 231,000 km² were degraded, mainly by wind erosion, in the north. Sheet erosion dominates all over the country, whereas rill and gully erosion are common in the eastern part and along rivers in northern Nigeria (Ologe, 1988; Igbozurike et al., 1989).

Eswaran et al. (2001) noted that land degradation will remain an important global issue for the 21st century because of its adverse impact on agronomic productivity, the environment, and its effect on food security and the quality of life. Land degradation can be considered in terms of the loss of actual or potential productivity or utility as a result of natural or anthropic factors; it is the decline in land quality or reduction in its productivity. In the context of productivity, land degradation results from a mismatch between land quality and land use (Beimroth et al., 1994). On a global scale, the annual loss of 75 billion tonnes of soil costs the world about US$400 billion/year (at US$3/tonne of soil for nutrients and US$2/tonne of soil for water), or approximately US$70/person/year (Lal, 1998). With respect to agriculture, the Food and Agricultural Organisation (FAO) in 1984 estimated that 5 to 7 million hectares of land a year are lost globally to agricultural production as a result of erosion and related forms of land degradation, including siltation of water ways and dams.

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, acidification, salinization or other chemical soil contamination. It is a component of environmental soil science. It is the scientific use and protection of land including wise choice of land use and pursuit of necessary measures of soil management and erosion control. Soil conservation improves resource use through an integrated management approach. It contributes to sustainable production and its advantages include lower inputs, stable yields and improved soil nutrient exchange.

In Sub-Saharan Africa, soil conservation has a long tradition. Indigenous techniques from the pre-colonial era focused on erosion control in combination with water conservation by ridging, mulching, constructing earth bunds and terraces, multiple cropping, fallowing, and the planting of trees (Igbokwe, 1996; Scoones et al., 1996).

Research on soil conservation has been conducted for many years in Sub-Saharan Africa (e.g., Fournier, 1967; Greenland and Lal, 1977; Quansah, 1990; Kayombo and Mrema, 1998; Ehrenstein, 2002) and in Nigeria (Lal, 1976, Junge et al., 2008). Initiatives have resulted in various so-called on-farm strategies including agronomic measures, soil management, and mechanical methods, as well as off-farm strategies, including mechanical or biological soil conservation technologies. This study examined the socio-economic characteristics of farmers practicing soil conservation, analyzed the cost structure of farms with respect to the level of investment in soil conservation, and the profitability of soil conservation strategies as well as determined the socio-economic factors that influence the level of investment in soil conservation strategies.

**MATERIALS AND METHODS**

This study was carried out in Abia State of Nigeria. Abia state lies within approximately latitude 4°40' and 6°14' North and longitudes 7°10' and 8° east. It covers an area of about 5,243.75 square kilometers and has a population of about 2,833,999 million people (FRN, 2007; NPC, 2006). The predominant occupation of the inhabitants is farming.

Multi-stage purposive and random sampling techniques were used in selecting the respondents used for the study. In the first stage, one Agricultural Zones (Ohafia) out of the 3 Agricultural Zones in the State were randomly selected. In the second stage, 3 Local Government Areas (LGAs) in each Zone were selected using simple random sampling. The random selection of 2 autonomous communities from each LGA formed the third stage. The fourth stage involved the purposive selection of crop farmers in each chosen community. The list of crop farmers in each chosen community formed the respective sampling frames from which 10 crop farmers each were randomly selected. In all, a total of 60 respondents were used for the study.
Data collected using structured questionnaire and interview schedules were analyzed using descriptive statistical tools such as frequency distribution, percentages, means, profit analysis, and OLS regression analysis. The profit of the farmers was calculated using the formula:

\[
(\pi) = TR - (TVC + TF + ICC)
\]  

(1)

Where \(\pi\) is profit, TR is the total revenue (₦), TVC is the total variable cost (₦), TFC is the total fixed cost (₦), and ICC is the isolated cost of conservation (₦).

The regression model is specified in the implicit form as follows:

\[
Y = f (X1, X2, X3, X4, X5, X6, X7, X8)
\]  

(2)

Where:

- \(Y\) = Total direct investment in soil conservation practices in ₦ per annum
- \(X1\) = Age of the farmer in years
- \(X2\) = Farm size in hectares
- \(X3\) = Number of farm locations
- \(X4\) = Farming experience of farmer (in years)
- \(X5\) = Farmers years of formal education
- \(X6\) = Number of visits by extension agents in a year
- \(X7\) = Ownership status of farm (landowner = 1, tenant = 0)
- \(X8\) = Farm income in naira

Four functional forms (linear, exponential, double log and semi log forms) of equation 2 were fitted and the best fit model chosen as the lead equation.

**RESULTS AND DISCUSSION**

**Socio – Economic Characteristics of Farmers**

The socio economic characteristics of farmers were examined. They included age of the farmer, gender, marital status, farm size, farming experience, tenancy status of the farmer and educational attainment of farmers. The result is presented in Table 1. Table 1 shows that majority of the respondents fall within 25 - 45 years of age. This implies that the result shows that the bulk of the farmers are still energetic and should be reasonably enterprising, which would enhance the productive capabilities. Also, 53 percent and 47 percent of the respondents were males and females respectively. The result in Table 1 revealed that the bulk (78 percent) of the respondents were married. The result implies that majority of the farm households are stable. According to Nwaru (2004), this stability should create conducive environments for good citizenship training, development of personal integrity and entrepreneurship. These are essential for enhanced productivity.

**Source: Field survey data, 2010.**

The distribution according to the farm size revealed that 67 percent of the respondents have farm sizes of between 0.1-2ha. This is consistent with Iheke and Nwaru (2009) and Iheke and Echebiri (2010). These farms are usually small-sized, fragmented and scattered and not contiguous land holdings. According to Nwaru (2004), this thus poses a great challenge to the much-desired agricultural modernization/mechanization and commercialization in Nigeria and therefore depicts the need for urgent land reform policies and programmes that would give farmers access to more contiguous land holdings for increased agricultural production.

Table 1 depicted that 67.5 percent of the respondents have been in farming for between 11 and 30 years. This result implies that the respondents are reasonably experienced farmers. The result has some positive implications for increased agricultural productivity because according to Nwaru (2004) and Iheke (2006), the number of years a farmer has spent in the farming business may give an indication of the practical knowledge he has acquired on how he can overcome certain inherent farm production problems.

About 40 percent of the farmers were occupying their own farm land while 60 percent were farming as tenants. Insecurity of tenure associated with leasehold or renting of land serves as disincentive to farmers from investing meaningfully on the land since the land goes back to the owner after the cropping season (Iheke and Echebiri, 2010). As noted by Macours et al (2004), insecure property rights over land not only reduce sharply the level of activity on the land but also lead to matching in the tenancy market along socio-economic lines and hence limit severely access to land for the rural poor.

Table 1 equally revealed that 91.67 percent of the respondents had one form of formal education or the other ranging from primary to tertiary education. This is desirable because according to Obasi (1991), the level of education of a farmer not


### TABLE 1: Socio-economic characteristics distribution of farmers

<table>
<thead>
<tr>
<th>Age distribution</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 - 35</td>
<td>15</td>
<td>25.0</td>
</tr>
<tr>
<td>36 - 45</td>
<td>25</td>
<td>41.67</td>
</tr>
<tr>
<td>46 - 55</td>
<td>12</td>
<td>20.0</td>
</tr>
<tr>
<td>56 - 65</td>
<td>8</td>
<td>13.33</td>
</tr>
</tbody>
</table>

**Gender**
- Male: 32
- Female: 28

**Marital status**
- Married: 47
- Single: 9
- Widows and widowers: 4

**Farm size**
- 0.1 - 1.0: 15
- 1.1 - 2.0: 25
- 2.1 - 3.0: 11
- 3.1 - 4.0: 9

**Farming experience**
- 10: 19.5
- 11 - 20: 30.5
- 21 - 30: 10

**Tenancy status**
- Owner occupier: 24
- Tenant: 36

**Education**
- No formal education: 5
- Primary: 28
- Secondary: 16
- Tertiary: 11

only increases his farm productivity but also enhances his ability to understand and evaluate new production techniques. This result departs markedly from the findings Jaja et al (1998) and Nwaru (2001) who noted that the Nigerian agricultural landscape is characterized among other things by numerous isolated smallholder farm operators, the overwhelming majority of whom cannot read or write.

**Cost structure of the farms and farm profit**

The cost structure of the farms showing the average expenditure on variable cost items, fixed cost and isolated conservation cost as well as the mean profit is shown in Table 2. The Table revealed that 45.16 percent, 23.24 percent and 31.60 percent of the total cost constitute variable, fixed and isolated conservation costs respectively. Variable cost is highest and is made up of costs of seeds/planting materials, labour, transportation, etc. It is followed by investments in soil conservation and lastly, fixed cost (land rent, utility bills, capital, etc).

The Table equally revealed a profit of forty one thousand nine hundred naira (₦41,900) accruing from the farm operations per farmer. This implies that the farm operations were profitable, which might be attributable to conservation measures which increases soil fertility and hence yield. However, the low profit could have resulted due to the small scale operations which could not allow them to take advantages of economies of scale and the much needed mechanization.

**Source:** Field survey data, 2010.

**Factors affecting the level of investments in soil conservation practices**

The regression estimate of the socio-economic determinants of the level of investments in soil conservation is presented in Table 3. The linear functional form was chosen as the lead equation based on the magnitude of the coefficient of multiple determination, the number of significant variables, the conformity of the signs borne by the variables to a priori expectation as well as the F ratio.
TABLE 2: Cost structure of the farms and farm profit

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable cost</td>
<td>25,650</td>
<td>45.16</td>
</tr>
<tr>
<td>Fixed cost</td>
<td>13200</td>
<td>23.24</td>
</tr>
<tr>
<td>Isolated cost of</td>
<td>17950</td>
<td>31.60</td>
</tr>
<tr>
<td>conservation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost</td>
<td>56800</td>
<td></td>
</tr>
<tr>
<td>Returns</td>
<td>98700</td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td>41900</td>
<td></td>
</tr>
</tbody>
</table>

The coefficient of multiple determination (R2) was 0.9286 which implies that 92.68 percent of the variations in investment in soil conservation were explained by the independent variables (age of the farmer, farm size, number of farm locations, farming experience, farmers years of formal education, number of visits by extension agents, ownership status of farm, and farm income) included in the model. The F ratio was significant at 1 percent. This attests to the goodness-of-fit of the model. The significant variables influencing investment in soil conservation were farm size, number of farm locations, years of formal education, extension contact, ownership status of farm land and farm income.

The coefficient of farm size is significant at 1 percent level of probability and positively related to investment in soil conservation. This implies that the greater the size of the farm, the greater the level of investment in soil conservation. This conforms to a priori expectations as larger farms would, ceteris paribus, require more investment in soil conservation measures than smaller farms.

**Source:** Field survey data, 2010.

***, **, and * = significant at 1 percent, 5 percent, and 10 percent respectively

+ = lead equation and figures in parenthesis are the t-ratios

The coefficient of the number of farm locations is significant at 5 percent and is positively related to investment in soil conservation measures. This means that the greater the number of farm locations, the greater the investment in soil conservation measures. This is because it is much easier to maintain contiguous farm holdings than fragment land holdings.

Years of formal education of the farmer and extension contact were both positively related to investment in soil conservation measures and

TABLE 3: Socio-economic factors affecting level of Investment in soil conservation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Linear+</th>
<th>Exponential</th>
<th>Double log</th>
<th>Semi-log</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-6815.364</td>
<td>8.341 (17.98)***</td>
<td>6.858</td>
<td>-94602.52</td>
</tr>
<tr>
<td>Age of farmer (X1)</td>
<td>87.526</td>
<td>-0.003</td>
<td>-0.307</td>
<td>-9653863</td>
</tr>
<tr>
<td>(0.62)</td>
<td>(-0.34)</td>
<td>(-1.34)</td>
<td>(-1.02)</td>
<td></td>
</tr>
<tr>
<td>Farm size (X2)</td>
<td>313.824</td>
<td>0.039</td>
<td>0.135</td>
<td>2486.029</td>
</tr>
<tr>
<td>(2.73)***</td>
<td>(0.51)</td>
<td>(5.31)***</td>
<td>(2.45)***</td>
<td></td>
</tr>
<tr>
<td>No. of farm locations (X3)</td>
<td>188.088</td>
<td>0.128</td>
<td>0.271</td>
<td>-1117.074</td>
</tr>
<tr>
<td>(2.35)**</td>
<td>(2.42)**</td>
<td>(1.05)</td>
<td>(-0.11)</td>
<td></td>
</tr>
<tr>
<td>Farming Experience (X4)</td>
<td>69.798</td>
<td>0.016</td>
<td>0.332</td>
<td>8228.271</td>
</tr>
<tr>
<td>(0.20)</td>
<td>(1.30)</td>
<td>(1.82)*</td>
<td>(-0.11)</td>
<td></td>
</tr>
<tr>
<td>Years of education (X5)</td>
<td>295.821</td>
<td>0.014</td>
<td>0.438</td>
<td>27979.7 (1.62)*</td>
</tr>
<tr>
<td>(1.74)***</td>
<td>(0.53)</td>
<td>(1.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension contact (X6)</td>
<td>639.055</td>
<td>0.0803 (4.66)**</td>
<td>0.487</td>
<td>35546.64</td>
</tr>
<tr>
<td>(5.29)***</td>
<td></td>
<td>(3.71)***</td>
<td>(6.59)***</td>
<td></td>
</tr>
<tr>
<td>Ownership status of land (X7)</td>
<td>97.849</td>
<td>2.449</td>
<td>3.241</td>
<td>53.306</td>
</tr>
<tr>
<td>(1.97)**</td>
<td>(1.73)*</td>
<td>(0.59)</td>
<td>(0.80)</td>
<td></td>
</tr>
<tr>
<td>Farm income (X8)</td>
<td>0.029594</td>
<td>1.49e-06</td>
<td>0.090</td>
<td>2897.853 (0.61)</td>
</tr>
<tr>
<td>(2.30)**</td>
<td>(17.98)***</td>
<td>(0.78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.9286</td>
<td>0.4993</td>
<td>0.4348</td>
<td>0.5940</td>
</tr>
<tr>
<td>R²</td>
<td>0.9188</td>
<td>0.4993</td>
<td>0.3149</td>
<td>0.5079</td>
</tr>
<tr>
<td>F-Ratio</td>
<td>94.73***</td>
<td>6.84***</td>
<td>3.63***</td>
<td>6.90***</td>
</tr>
</tbody>
</table>
significant at 1 percent level of probability. Hence, increase exposure to education and extension contact would lead to increase in investment in conservation measures. Iheke (2010) noted that education increases the ability of the farmers to adopt agricultural innovation and hence improve their efficiency and productivity. This explains the direct relationship between education and investment in conservation measures. Obasi (1991) stated that the level of education of a farmer not only increases his farm productivity but also enhances his ability to understand and evaluate new production techniques. Therefore, efforts at increases crop production and environmental protection should involve policies that strengthen educating the farmer, especially agricultural education and conservation practices.

Iheke (2006) noted that as change agents, extension workers serve as channels for diffusion of technical innovations. Extension services provide informal training that helps to unlock the natural talents and inherent enterprising qualities of the farmer, enhancing his ability to understand and evaluate new production techniques leading to increased farm productivity and incomes. It is hoped that farmers’ interactions with extension agents would help them to receive and synthesize new information on conservation measures. The positive and significant relationship between extension contact and investment in conservation measures implies that the higher the number of contacts a farmer made with an extension agent, the higher his adoption and investment in conservation measures, which is in consonance with a priori expectations.

Ownership status of land is positively related to investment in conservation and significant at 1 percent level. This implies that there is increased investment in soil conservation if the farmer owns the farm than if he is a tenant farmer. This is consistent with a priori expectations. Insecurity of tenure associated with leasehold or renting of land serves as disincentive to farmers from investing meaningfully on the land since the land goes back to the owner after the cropping season (Iheke and Echebiri, 2010). As noted by Macours et al (2004), insecure property rights over land reduces sharply the level of activity on the land. According to Iheke (2006), security of tenure is necessary for stimulating agricultural investment and resource conservation. The coefficient of farm income is significant at 5 percent probability level and positively related to investment in conservation measures. This agrees with literature, because as the farmers’ income or profit level increase, he will have more margins to invest in soil conservation. This result is consistent with Krause et al. (1990). They reported that adoption of new technology was found to be sensitive to the amount of equity capital.

**CONCLUSION**

It could be concluded from this study that the farmers cultivated small hectares which resulted in the low profit they made and that the significant factors influencing investment in soil conservation measures were farm size, number of farm locations, years of formal education, extension contact, ownership status of farm land and farm income. It was recommended that policies that would grant them access to more land and secure tenure should be put in place to enable them to take advantages of economies of scale and increase their investment in conservation. Also, efforts at increasing crop production and environmental conservation should involve policies that strengthen educating the farmer, especially agricultural education and conservation practices. In this guise, the extension system should be tailored to meet the information other felt needs of the farmers.

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