# Building Resilience for Sustainable Food Production through Agricultural Conservation Practices in Anambra State, Nigeria: Implications for Agricultural Extension Services

Ifeoma Q. Anugwa, Agwu E. Agwu and Audrey R. Ezeh

*Department of Agricultural Extension, University of Nigeria, Nsukka,*
*Ifeoma.irohibe@unn.edu.ng*

**Abstract:** This study assessed farmers' use of agricultural conservation practices and implications for agricultural extension services in Anambra State. Purposive sampling technique was used in selecting eighty respondents from four town communities in Anambra state where intensive crop farming is carried out in the state. Descriptive statistics and multiple regression were used to analyze the data. Findings indicated that the major soil conservation practices used by the farmers were: returning crop residues to soil to decay as manure, use of herbicides for weed control, establishment of cut-off drains due to flooding, intercropping, shifting cultivation, crop rotation and selective clearing. With respect to water conservation practices used by the respondents, the majority of the respondents practice regeneration of useful trees, crops and shrubs and the establishment and protection of watersheds. The multiple regression results showed that number of years spent acquiring formal education, household size, ownership of livestock and membership in social organization significantly influenced farmers' use of soil conservation practices, while sex significantly influenced their use of water conservation practices. The more serious constraints to the use of soil and water conservation practices as perceived by the respondents include: inadequate government support, increase in price(s) of input, high cost of recommended technologies and inadequate extension delivery, among others. This study therefore recommends that extension agents should improve the dissemination of information about land improvement options and strategies among farmers so as to enable them conserve soil and water resources for improved and sustained food production.

**Key words:** conservation practices, food production, soil and water resources, sustainability.

## Introduction

The attainment of food self-sufficiency is one of the prominent developmental agenda facing most nations of Sub-Saharan Africa (SSA) (Saka, Okoruwa, Oni & Oyekale, 2011), Nigeria inclusive. In Nigeria, there have been challenges of reducing dependence on food import through improvement in food self- sufficiency ratio which, in turn, is dependent on increased domestic food production (Saka *et al.*, 2011). However, with the continued growth of human population, competition for limited land resources have steadily increased over recent years resulting to an intensive use of arable land in Nigeria (Onuoha, 2000). Consequently, increased land-use intensity without commensurate conservation practices could lead to continuous depletion of soil fertility, decline in productivity, loss of soil structure, soil erosion and land degradation (Sivanappan, 1995).

According to Onuoha (2000), the widening degradation of agricultural land, coupled with the low use of environmentally friendly and socio-economically robust technologies among resource-poor rural households in Nigeria have created a serious gap in meeting the objective of food production to feed the ever increasing population. A major challenge facing rural farming households is how to increase food production while sustaining the productive capacity of the soil and water resources. Soil and water degradation results primarily from inappropriate land uses and poor land management practices. Soil resources (nutrients and water) are renewable and they can be replaced through agricultural conservation practices which aim to reduce losses, sustain resources and enhance productivity (Mgbenka, Ozor, Igbokwe & Ebe, 2012).

Agricultural conservation practices can be viewed as agricultural systems or practices involving or geared towards achieving minimum soil disturbance, permanent residue soil cover and diversified crop rotation (Hobbs, Sayre & Gupta, 2008). It is a mix of agronomic practices proposed as essential for soil and water conservation, building and maintaining healthier soils, optimal crop production and maintenance of a rich agro-biodiversity. Conservation farming is a technique which covers a wide range of minimum tillage systems, integrated pest, soil and water conservation practices (Nyagumbo, 2002). According to Mgbenka, *et al.*, (2012), soil and water conservation practices are control measures including managerial, vegetative, and structural practices aimed at reducing the loss of soil and water. Such methods seek to encourage water infiltration into the soil, reduce its velocity and check run off losses.

Soil and water conservation practices are arguably considered the strategy suitable to maintain environmental sustainability. This approach can sustainably increase yields of crops and can bring both environmental and economic benefits for farmers (Roling & Pretty, nd). The soil and water conservation practices commonly used are strip cropping, mulching, crop rotation, contour cultivation, planting of grasses for stabilizing bunds, planting of trees and afforestation, terracing, gully control, control of stream and river banks, irrigation and other water harvesting technologies (Mgbenka, *et al.*, 2012). Efficient use of soil and water conservation practices ensure achievement of farm level objectives in terms of economic viability, food security and environmental sustainability (Udoh & Akintola, 2002).

Farmers' decision about using conservation practices are inherently dynamic, affected by changes in environmental, economic and social conditions (Daloglu, Nassauer, Riolo & Scavia, 2014). This is the case in Anambra State where farmers having experienced a decline in land productivity over the years due to soil erosion and other forms of land degradation (Egboke & Nwafor,1994), engaged in traditional redemptive action, such as land-fallow practices, clearing new land areas or crop rotation. However, with increasing land constraints in most areas, fallow periods have drastically declined and the traditional farming system that farmers have previously employed to sustain their productivity is no longer effective due to population pressure (Onuoha, 2000). Additionally, water shortage concerns, arising from climate change have led farmers to engage in water harvesting or moisture conservation methods.

Concerns about the effects of land degradation on sustainable food production in Anambra State have led to increased awareness and promotion of agricultural conservation practices by extension agents. Some conservation techniques introduced to farmers were: organic/plant residue management, correct use of fertilizer, crop rotation, mulching, contour ridging and bounding, strips cropping, irrigation, tillage, tie mounds/ridges/ploughing, stop wash lines, tree planting, alley cropping, use of leguminous cover crops or grass, terracing, inter cropping of arable crops with tree crops and similar practices (Anambra State ADP, 1991). According to ministry and ADP sources, methods used in disseminating information on these control measures to farmers include the use of extension staff to teach the farmers, use of radio/television, seminars, exhibitions, hand outs, farm visits and personal contacts by farmers with specialists (Anaeto, Matthews-Njoku and Onu, 2005).

In spite of the favourable agricultural conservation measures introduced to farmers in Anambra State, studies by Anaeto (2000), Onu (1991), Onwujiobi (1995), had shown that there have not been enough impact on farmers as far as land-use management is concerned. The level of favourable conservation behavioral change is unsatisfactory to cope with the increasing agricultural intensification problems so as to ensure a sustainable production system in the long run. Furthermore, Benites (2003) state that, conservation farming is a dynamic technology which develops and changes with time. Thus, with the deterioration in land productivity due to soil degradation and erratic rainfall, which is also evident to farmers themselves, it is expected that most farmers should have embraced the conservation practices by now in order to build resilience for sustainable food production. Hence, this study was conducted to investigate the extent in which farmers are using soil and water conservation practices in Anambra State. Specifically, the objectives of the study were to: ascertain farmers' sources of information on soil and water conservation practices; assess farmers' level of use of soil and water conservation practices; determine factors influencing farmers' use of soil and water conservation practices; ascertain perceived constraints to farmers' use of soil and water conservation practices; and discuss the implications of the extent of farmers' use of agricultural conservation practices for extension services.

**Methodology**

The study was conducted in Anambra State, Nigeria. The state lies between longitudes 6°35′ and 7°21′ East and latitudes 5°38′ and 6°47′ North of the Greenwich Meridian. It is bordered by Delta State to the West, Imo State to the South, Enugu State to the East and Kogi State to the North and also Abia State. Projection from 2006 census figure showed that Anambra State had an estimated population density of 7, 821, 850 million persons (Udemezue, 2013). The state's climate is typically equatorial with two main seasons, the rainy season which starts at the end of the month of March and lasts till end of October and about four months of dryness (the dry season) which starts in the month of November and ends in the month of March. It records about 3,000mm of rain water per annum, which makes the area suitable for agricultural production. The state has humid climate with a temperature of about 30.2°C. Among crops grown by farmers in the state are yam, palm produce, rice, pepper, cassava, cocoyam, vegetables, and different varieties of fruit trees among others. (Udemezue, 2013). Anambra State has 21 local government areas, viz: Aguata; Awka North; Awka South; Anambra East; Anambra West; Anaocha; Ayamelum; Dunukofia; Ekwusigo; Idemili North; Idemili South; Ihiala; Njikoka; Nnewi North; Nnewi South; Ogbaru; Onitsha North; Onitsha South; Orumba North; Orumba South; and Oyi.

The population for the study comprised all crop farmers in the state. Multi-stage sampling procedure was used in selecting the study population. Two, out of the twenty one local government areas in the state, Anambra east and Ayamelum, were purposively selected in the first stage based on the preponderance of crop farming activities. In the second stage, Mmiata-Anam and Umueze-Anam (Anambra East) and Ifite-ogwari and Omor (Ayamelum) town communities were selected through simple random sampling technique from each local government, giving a total of four town communities. In the third stage, a list of forty crop farmers who were actively involved in crop production were compiled by community leaders in each community. Out of the list, twenty crop farmers were selected through simple random sampling technique. Thus, the total sample size for the study constituted eighty respondents. Data were collected from the respondents using semi structured interview schedules. Focus group discussions (FGDs) were also conducted to obtain in-depth information on the subject matter from the respondents. A pilot test was conducted as part of the instrument validation and to test for reliability. These instruments were validated by experts in the department of agricultural extension. The thirty soil conservation practices and twelve water conservation practices examined in the study were obtained from literature and the list of soil and water conservation technologies disseminated by the agricultural extension agents to farmers in the state.

To ascertain farmers' sources of information on soil and water conservation practices, the respondents were required to indicate where they got information on soil and water conservation practices from a list of sources such as other farmers, family, television, internet, extension agents, etc. The types of information sourced as well as the most preferred source of information was also ascertained. To compute the level of use of soil and water conservation practices, a list of thirty soil conservation practices and twelve water conservation practices were made, out of which the respondents were required to indicate the conservation practices they used as well as their frequency of using it. The total number of conservation practices used by each respondent was computed and used to generate the intensity of use score. This was further categorized into low use, medium use and high use. For the soil conservation practices, thirty practices were listed and from the list, each answer had one point. The highest score was thirty points and the lowest was zero. The respondents were thereafter categorized into three groups based on the number of soil conservation practices used namely: low users (for those respondents with 1-10 score), moderate users (for those respondents with 11-20 score) and high users (for those respondents with 21-30 score). For the water conservation practices, twelve practices were listed and each answer had one point. The highest score was twelve points and the lowest was zero (0). The respondents were thereafter categorized into three groups based on the number of water conservation practices used namely: low users (for those respondents with 1-4 score), moderate users (for those respondents with 5-8 score) and high users (for those respondents with 9-12 score). Also, a five-point Likert-type scale of 'Always', 'Often', 'Sometimes', 'Rarely' and 'Never" was used to ascertain their frequency of use of these practices. The values were added up to get ten which was later divided by five to get a mean value of two. Variables with mean values of two and above were regarded as 'frequently used' conservation practices, while those with mean values less than two were regarded as 'not frequently used' conservation practices. To ascertain respondents' level of use of soil conservation practice.

Multiple regression analysis was used to determine factors influencing farmers' use of soil and water conservation practices. The equation is expressed below:

$$T = a + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 \ldots \beta_{10}X_{10} + \mu$$

Where T = dependent variable (use of soil/water conservation practices measured by the individual farmer's use score)

$a$ = constant term
$\beta_1$ - $\beta_{10}$ = regression coefficients
$\mu$ = error term
$X_1$ = age (years)
$X_2$ = sex (male = 1; female = 2)
$X_3$ = educational status (number of years spent in formal schooling)
$X_4$ = household size (number of persons living under a roof)
$X_5$ = farm size (hectares)
$X_6$ = ownership of livestock (yes = 1; no = 2)
$X_7$ = membership of social organization (yes = 1; no = 2)
$X_8$ = access to credit (yes = 1; no = 2)
$X_9$ = access to extension contact (yes = 1; no = 2)
$X_{10}$ = income in Naira

Perceived constraints to farmers' use of agricultural conservation practices was ascertained by asking farmers to indicate the extent to which the constraints seriously affected their effective use of agricultural conservation practices. A five-point Likert-type scale of “very serious”, “moderately serious”, “serious”, “not serious” and “not at all” was used. The values were added up to get ten which was divided by five to get a mean value of one. Variables with mean values of two and above were regarded as serious constraints to respondents’ effective use of conservation practices while those with mean values less than two were not regarded as serious constraints.

## Results and Discussion

### Information sources on soil and water conservation practices

Entries in Table 1 show that a greater proportion (60.00%) of the respondents do not source for information on soil and water conservation practices, while the remaining 40.00% who do, source information on fertilizer application (50.00%) in terms of the appropriate fertilizer to apply on a particular crop, when and how to apply it. Also, 25.00% source for information on how to improve soil fertility without overuse of chemicals like fertilizers. The remaining 6.25% each source for information on mulching, irrigation, weed and erosion control, respectively. The table further shows that, a greater proportion (31.25%) of the farmers prefer friends and fellow farmers as an information source, 18.80% prefer extension agents, while 12.50% prefer the internet. This shows that, very few of the farmers actually go out of their way to seek information on soil and water conservation practices. However, the other majority, especially older respondents who do not source for information, believe that they have adequate experience on how to conserve soil and water for agricultural production and as such may not need additional information. This may hinder extension efforts in the dissemination of soil and water conservation practices in the study area

It was also discovered that a major proportion of respondents’ sourced for information from friends and fellow farmers and preferred them for reasons which ranges from choices, ease of access to ability to understand information from such source easily, etc. Ownership of assets such as mobile phone and radio which are expected to enhance use of soil and water conservation practices are not being utilized by the respondents. This is because radio is a major source of information on agricultural practices in rural areas (Benites, Ashburner & Friedrich, 2002). However, most of the respondents complained of not having the time to listen to radio programmes due to farm activities which can be very demanding. Also, mobile phones would have eased communication on conservation practices between farmers and other information sources. However, public charge-points have become a thriving and lucrative gold mine in places like Ifite-Ogwari community which has been in a permanent state of power outage close to ten years running; therefore, the respondents hardly use electronic devices or media. Most of them barely manage to power their mobile phones in these commercial charge-points for a token due to problems of inconsistent electric power supply.

Table 1: Distribution of respondents according to information sources and frequency of use of information sources on soil and water conservation practices

| Variables | Percentage |
|---|---|
| **Do you source for information?** | |
| Yes | 40.00 |
| No | 60.00 |
| **Types of information sourced** | |
| Fertilizer | 50.00 |
| Mulching | 6.25 |
| Irrigation | 6.25 |

| | |
|---|---|
| Weed control | 6.25 |
| Improve soil fertility | 25.00 |
| Erosion control | 6.25 |
| **Information sources** | |
| Radio | 6.25 |
| Internet | 12.50 |
| Friends/fellow farmers | 31.25 |
| Print media | 6.25 |
| Seminars and trainings | 6.25 |
| Dealers and sales agents | 6.25 |
| Extension agents | 18.80 |
| Research institutes | 6.25 |
| Fadama | 6.25 |
| **Preferred information source** | |
| Radio | 6.25 |
| Internet | 12.50 |
| Friends and farmers | 31.25 |
| Print media | 6.25 |
| Seminars and trainings | 6.25 |
| Dealers and sales agents | 6.25 |
| Extension agents | 18.80 |
| Research institutes | 6.25 |
| Fadama | 6.25 |

**Respondents' use of soil conservation practices**

Table 2 indicates that the majority (95.0% and 90.0%) of the respondents return crop residues to soil to decay as manure and use herbicides for weed control, respectively, while 88.8% and 85% of them establish cut-off drains due to flooding and intercrop respectively, as soil conservation practices. Also, 78.8%, 75% and 75% of the respondents practice shifting cultivation, crop rotation and selective clearing, respectively. Based on their frequency of using soil conservation practices, 73.8% and 73.8%, of the respondents always use integrated cropping and enlargement of row width, respectively. These findings imply that almost all the respondents have an idea of soil conservation practices. Based on the results, the use of the soil conservation practices are in line with the promising soil conservation technologies for the savannah region as agreed by Junge, Deji, Abaidoo, Chikoye & Stahr (2011) which are agronomic measures, such as mulching and cover cropping, as well as conservation tillage which can contribute to enhanced soil resource management in Nigeria. According to Hobbs, Sayre & Gupta (2008), agricultural conservation practices are geared towards achieving minimum soil disturbance, permanent residue soil cover and diversified crop rotation. This is commendable as majority of the respondents practice crop rotation, albeit not always. Though, conservation farming is a technique which involves minimal tillage (Nyagumbo, 2002), majority of the respondents agreed to almost never practicing zero tillage before planting, the tilling is mostly to form ridges and give the crops balance against flooding and subsequent erosion as well as to free soil particles and enable root penetration and air spaces within the soil. The tilling was mainly manual and even those who used machinery reduced it to the barest minimum to avoid the implications noted by Adeyemo & Agele (2010) that soil compaction is a major cause of soil degradation in most agricultural soils because in a compacted soil, the particles are pressed together, thus reducing pore spaces which contain air and water necessary for good plant growth. Furthermore, based on the frequency of use of conservation practices, they always used the ones which probably solved their felt needs such as enlargement of row width which is done to balance crop well against flood and prevent erosion.

**Table 2: Distribution of respondents according to use of soil conservation practices and frequency of usage**

| Soil conservation practices | Percentage (%) | Mean | Std. deviation |
|---|---|---|---|
| Cover cropping | 67.5 | **2.34*** | 1.81 |
| Contour farming | 40.0 | 1.10 | 1.57 |
| Strip cropping | 37.5 | 1.10 | 1.65 |
| Mulching | 71.2 | **2.39*** | 1.77 |
| Crop rotation | 75.0 | **2.43*** | 1.71 |
| Terracing | 21.2 | 0.55 | 1.22 |
| Fertilizer application | 63.8 | 2.28 | 1.84 |
| Manure/bio-fertilizers | 37.5 | 0.90 | 1.36 |
| Selective clearing | 75.0 | **2.83*** | 1.73 |
| Cut-off drains | 88.8 | **3.06*** | 1.39 |
| Control traffic farming | 46.2 | 1.64 | 1.87 |
| Zero tillage | 28.8 | 0.50 | 0.89 |
| Reduced number of machinery passes | 72.5 | **2.74*** | 1.77 |
| Seasonal livestock confinement | 45.0 | 1.54 | 1.83 |
| Enlargement of row width | 85.0 | **3.24*** | 1.45 |
| Working soils when moist | 82.5 | **3.11*** | 1.55 |
| Lime application | 13.8 | 0.33 | 0.97 |
| Selective/controlled burning | 82.5 | **2.96*** | 1.55 |
| Fallowing | 78.8 | **2.73*** | 1.65 |
| Agro-forestry | 22.5 | 0.85 | 1.62 |
| Nursery | 65.0 | **2.00*** | 1.77 |
| Bunding | 63.8 | **2.23*** | 1.84 |
| Shifting cultivation | 78.8 | **2.13*** | 1.61 |
| Integrated cropping | 85.0 | **3.23*** | 1.47 |
| Returning crop residues to soil | 95.0 | **3.34*** | 1.14 |
| Across slope cultivation | 17.5 | 0.43 | 1.08 |
| Use of herbicides for weed control | 90.0 | **3.13*** | 1.36 |
| Manual weeding | 13.8 | 0.40 | 1.07 |
| Use of pesticides/insecticides in pest control | 2.50 | 0.90 | 0.62 |

**Most frequently used soil conservation practices*

***Categorization of the respondents based on level of use of soil conservation practices***

Entries on Figure 2 show that the majority (81.2%) of the respondents were categorized as medium users of soil conservation practices while 10.0% of them were discovered to be high users of soil conservation practices. The remaining 8.8% of them were categorized as low users of soil conservation practices. The overall result reveals medium use of soil conservation practices by the respondents and this could be as a result of inadequate income to encourage investment on soil conservation practices. Long term viability of conservation farming will be determined by short term practices which in turn determine the health and productivity of the land (Baudron, 2001).

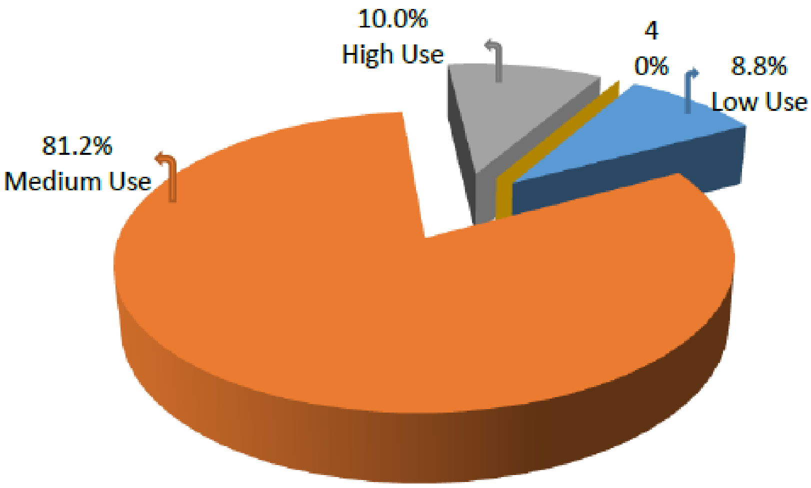


Figure 2: Respondents' level of use of soil conservation practices

**Respondents' use of water conservation practices**

Results in Table 3 reveal that the majority (85%) of the respondents practice regeneration useful trees, crops and shrubs, while 68.8% of them establish and protect watersheds. Based on their frequency of using water conservation practices, 75% and 45% of the respondents always regenerate and establish diversion or drain ditches, respectively. This implies that regeneration may be a very cheap or cost effective way to conserve water since majority of the farmers used it. It may also be less demanding in terms of time and money. Trees and shrubs could check erosion too by acting as windbreaks against wind erosion as well as holding the soil particles against water erosion. Due to frequent flooding in the study area, there is little wonder as to why most of the respondents establish and maintain watershed. This could be in a bid to check erosion and also have steady water supply to cultivate so that some crops do not drown while others dry up.

**Table 3: Distribution of respondents according to use of water conservation practices and frequency of usage**

| **Water conservation practices** | **Percentage (%)** | **Mean** | **Std. Deviation** |
|---|---|---|---|
| Irrigation | 46.2 | 1.04 | 1.36 |
| Water recycling | 7.5 | 0.13 | 0.54 |
| Drought-resistant crop/seed | 48.8 | 1.51 | 1.74 |
| Digging of catchment pits | 36.2 | 0.91 | 1.46 |
| Construction of dams | 18.8 | 0.63 | 1.36 |
| Water-holding reservoirs | 10.0 | 0.34 | 1.08 |
| Rotational grazing systems | 18.8 | 0.75 | 1.57 |
| Diversion/drain ditches | 68.8 | **2.19*** | 1.79 |
| Establishment of watershed | 31.2 | 0.89 | 1.48 |
| Ripper-furrow system | 31.2 | 0.78 | 1.36 |
| Regeneration | 85.0 | **3.21*** | 1.48 |

** Most frequently used water conservation practices*

***Categorization of respondents based on level of use of water conservation practices***

Entries on figure 3 show that the majority (62.5%) of the respondents were categorized as low users of water conservation practices while 35.0% were found to be medium users of water conservation practices. The remaining 2.5% of them were ranked as high users of water conservation practices. This result reveals low use of water conservation practices by the respondents which could range from meagre income to encourage investment in some practices, inadequate knowledge on the benefits of water conservation practices as well as poor access to credit facilities, etc. A reduction of surface run-off by structures such as trees, etc, or by changes in land management will also help to reduce erosion. Such practices are good because Hudson (1987) agrees that studies show that there are usually strong links between measures for soil conservation and measures for water conservation.

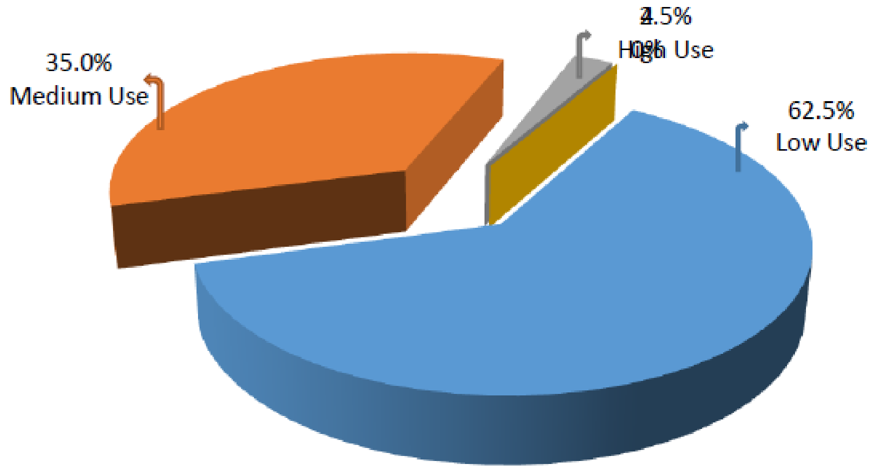


Figure 3: Respondents' level of use of water conservation practices

**Factors influencing respondents use of soil conservation practices**

Results in Table 4 indicate that there was a significant influence (f =2.982, p<0.05) of the socio-economic characteristics of the respondents on their use of soil conservation practices. The results show that ownership of livestock (t = 3.208; p = 0.002) and household size (t = 2.133; p = 0.036), had positive significant influence on farmers' use of soil conservation practices, while membership of social organization (t = -2.012; p = 0.048) and years spent in formal education (t = -2.604; p = 0.011) had negative significant influence on farmers' use of soil conservation practices. The implication of a positive significant influence on livestock ownership is that the more livestock is owned by the farmer, the more their probability of using soil conservation practices. As Pawley (1963) reports, the introduction of grazing livestock to a field can be beneficial to the farmer and also the land. Livestock can be used as natural fertilizer for a farmland because livestock produce compost or manure which are a great help in generating soil fertility. Since ownership of livestock significantly influences their use of soil conservation practices, livestock owners may spend less on chemical fertilizers and supplement with bio-fertilizers from their livestock. Also, household size significantly influenced farmers' use of soil conservation practices thereby implying that the larger the household size, the more their use of soil conservation practices. Irohibe (2010) clearly states that a large household size could serve as an insurance against shortfalls in the supply of farm labour as household size plays a great role in the provision of family labour in the agricultural sector. Families with relatively large household size may face lesser labour constraints in the farm and this could encourage their use of soil conservation practices.

Membership of social organization was discovered to have a negative significant influence on farmers' use of soil conservation practices. This implies that if farmers belonged to a social organization, their probability of using soil conservation practices is low or nil. Though contrary to *a prior* expectations, this could probably be because the few who belong to social organizations have benefits that improve their use of soil conservation practices. They may have more access to information on soil conservation practices, credit facilities to encourage investment in these practices, better access to extension services, etc, since they are organized enough to be able to poll resources together and participate in government provisions such as access to loan from banks, etc. The number of years spent in acquiring formal education also significantly influenced farmers use of soil conservation practices, albeit negatively. This implies that the more the number of years spent in acquiring formal education, the lesser the probability of farmers using soil conservation practices.

Table 4: Multiple regression analysis of factors influencing farmers' use of soil conservation practices

| **Variables** | **Unstandardized Coefficients** | | **Standardized Coefficients** | | |
|---|---|---|---|---|---|
| | **B** | **Std. Error** | **Beta** | **t** | **Sig.** |
| (Constant) | 16.28 | 3.20 | | 5.08 | 0.00 |
| Age | 0.02 | 0.04 | 0.06 | 0.56 | 0.58 |
| Sex | -1.15 | 0.90 | -0.15 | -1.28 | 0.21 |
| Number of years spent in formal schooling | -0.24 | 0.09 | -0.29 | -2.60 | **0.01*** |
| Household size | 0.47 | 0.22 | 0.24 | 2.13 | **0.04*** |
| Farm size | 0.11 | 0.12 | 0.10 | 0.87 | 0.39 |
| Ownership of livestock | 2.59 | 0.81 | 0.34 | 3.21 | **0.00*** |
| Access to credit | 0.16 | 1.08 | 0.02 | 0.15 | 0.88 |
| Extension visit | 1.35 | 1.10 | 0.16 | 1.24 | 0.22 |
| Income | -8.025E-6 | 0.00 | -0.15 | -1.21 | 0.23 |
| Membership of social organization | -2.09 | 1.04 | -0.25 | -2.01 | **0.05*** |

**Significant values at* $p \leq 0.05$

**Factors influencing respondents use of water conservation practices**

Table 5 shows that there was a significant influence (f = 1.217, p<0.05) of the socio-economic characteristics of the respondents on their use of water conservation practices. The results show that sex (t = -2.196; p = 0.032) had a negatively significant influence on farmers' use of water conservation practices. Since majority of the respondents were married, they probably had the males as breadwinners and this could give the females more time to engage in water conservation practices. Also, since the females may earn less income, they could engage in water conservation practices which require little or no cost such as regeneration.

Table 5: Distribution of respondents based on the factors that influence their use of water conservation practices

| Variables | Unstandardized Coefficients | Standardized Coefficients | | | |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | t | Sig. |
| (Constant) | 5.27 | 1.73 | | 3.05 | 0.00 |
| Age | -0.02 | 0.02 | -0.11 | -0.85 | 0.40 |
| Sex | -1.06 | 0.48 | -0.28 | -2.20 | **0.03*** |
| Number of years spent in formal schooling | 0.00 | 0.05 | 0.01 | 0.05 | 0.96 |
| Household size | 0 .19 | 0.12 | 0.21 | 1.66 | 0.10 |
| Farm size | -0.07 | 0.07 | -0.15 | -1.11 | 0.27 |
| Ownership of livestock | 0.30 | 0.43 | 0.08 | 0.68 | 0.50 |
| Access to credit | -0.05 | 0.58 | -0.01 | -0.09 | 0.93 |
| Extension visit | -0.41 | 0.59 | -0.10 | -0.71 | 0.48 |
| Income | 1.474E-6 | 0.00 | 0.06 | 0.42 | 0.68 |
| Membership of social organization | -0.55 | 0.58 | -0.13 | -0.94 | 0.35 |

**Significant values at $p \leq 0.05$*

**Perceived constraints to farmers use of soil and water conservation practices**

Entries in Table 6 indicate that the most serious constraints perceived by the respondents were: inadequate government support (M = 2.79); increase in prices of inputs especially fertilizer (M = 2.74); high cost of some recommended technologies (M = 2.74); and inadequate extension service delivery (M = 2.68). Mazvimavi (2007) notes that given the right macroeconomic environment, favorable incentives and effective extension services, farmers who are resource-constrained find conservation farming as a good alternative to their conventional cropping systems. If public institutions cannot provide incentives for agricultural practices that conserve natural capital, the productive base of a country will shrink (Dasgupta, 2007) as productivity will decline. Furthermore, high cost of recommended technologies such as irrigation, planters, harvesters, fertilizers, weed killers, etc, makes it difficult for farmers to put them to use in their farms. In conservation farming, disadvantages in the short term may include the high initial costs of specialized planting equipment and the completely new dynamics of a conservation farming system, which may require high management skills and a learning process by the farmer. Though the existing extension delivery system is epileptic, this constraint can be tackled with a stronger extension service delivery and a lower extension to farmer ratio. Long term experience with conservation farming all over the world has shown that conservation farming does not present more or less but different problems to a farmer, all of them capable of being resolved (Benites *et al.,* 2002).

Table 6: Mean score of perceived constraints experienced by respondents in the use of soil and water conservation practices

| Perceived constraints | Mean | Std. deviation |
|---|---|---|
| Low level of education of rural farmers | 1.99 | 0.86 |

| | | |
|---|---|---|
| Meagre income to encourage investment in some practices | **2.66*** | 0.62 |
| Large number of household size | **2.19*** | 0.92 |
| Time constraint to fully engage in some practices | 1.76 | 0.77 |
| Labour constraints in carrying out essential farming activities | **2.01*** | 0.76 |
| Delayed time for results/effects of practice(s) to show | 1.84 | 0.80 |
| Poor health of respondent | 1.56 | 0.86 |
| Poor knowledge of respondents on certain practices | 1.76 | 0.75 |
| Inadequate extension service delivery | **2.68*** | 0.65 |
| Cultural barriers to use of certain practices | 1.18 | 0.55 |
| Poor access to credit facilities | **2.39*** | 0.77 |
| Past record of failures of such measures | 1.35 | 0.66 |
| Increase in the price of input(s) | **2.74*** | 0.55 |
| Negative attitude of opinion leaders towards practice(s) | 1.39 | 0.65 |
| Land tenure issues | 1.43 | 0.78 |
| Pessimistic attitude towards the success of certain practices | 1.59 | 0.65 |
| Pests and disease incidents | **2.55*** | 0.67 |
| Inadequate government support towards agricultural activities | **2.79*** | 0.54 |
| Difficulty in accessing and using ICTs | **2.10*** | 0.79 |
| High cost of some recommended technologies | **2.74*** | 0.59 |
| Lack of technical know-how in the use of farm machinery | **2.41*** | 0.78 |
| Poor agronomic/cultural practices (plant spacing, weeding) | 1.55 | 0.73 |
| Declining soil fertility | 1.96 | 0.80 |
| Accelerated soil erosion | 1.59 | 0.72 |
| Poor access roads to farm | 1.28 | 0.69 |
| High transportation cost of produce | 1.08 | 0.38 |
| Poor storage facilities | 1.18 | 0.57 |
| Lack of improved seeds | 1.10 | 0.44 |
| Flooding | 1.50 | 0.31 |

**Perceived constraints*

**Implications of farmers use of agricultural conservation practices to extension services**

It is evident from the study that even though the respondents were generally medium users of soil conservation practices, but they were low users of water conservation practices thereby implying that farmers may either not have adequate knowledge or the right behaviour/attitude to the use of these conservation practices. Hence, extension agents have a big role to play in improving the knowledge/skills of farmers and modify their behaviour/attitude towards the use of conservation practices. Thus, there is need for extension agents to intensify efforts in disseminating unambiguous, easily understood and accurate information to farmers on how to conserve the soil and particularly water resources in order to ensure sustained production of food. For this to be achieved, extension agents need to assure farmers of the long-term multiple economic and non-economic benefits derivable from using these conservation practices. It is also very important for the indigenous knowledge of farmers on these agricultural conservation practices to be incorporated with modern conservation technologies in order to encourage locality-specific adoption. For this to be achieved, extension agents must make use of farmers' knowledge and ensure their active participation in the entire process. This would entail showing farmers the extent of land degradation which make unsustainable farming practices untenable. In addition, extension can demonstrate the feasibility of using these conservation practices. Even more important is to give farmers the tools for observation and to train them to monitor the situation on their own farms. Finally, extension agents can facilitate learning on the part of farmers by understanding the learning process, provide expert advice where required, convene and create learning groups, and help farmers overcome major hurdles in using these conservation practices.

**References**


Adeyemo, A. J. & Agele, S. O. (2010). Effects of tillage and manure application on soil physicochemical properties and yield of maize grown on a degraded intensively tilled alfisol in Southwestern Nigeria. *Journal of Soil Science and Environmental Management*, *1* (8), 205-216.

Anaeto, C. F. (2000). *The effect of Anambra State agricultural extension service on farmers' adoption of improved soil conservation technologies* (M.Sc. Thesis). Federal University of Technology, Owerri.

Anaeto, C.F., Matthews-Njoku, E.C. & Onu, D.O. (2005). The development and adoption of improved land management practices under the intensified agricultural production system in Anambra State, Nigeria. *Journal of Agriculture and Social Research*, 5 (1), 54 – 61.

Baudron, F. (2001). *Challenges for the adoption of conservation farming by small holders in semi arid Zambia*. CIRAD. Harare, Zimbabwe

Benites, J. (2003). *Conservation agriculture benefits on water holding, carbon mitigation and reducing soil losses.* New Delhi, India: LEISA

Benites, J. R., Ashburner, J. & Friedrich, T. (2002). Opportunities and constraints for conservation agriculture in Africa. *LEISA Magazine*, 18 (3).

Daloglu, I., Nassauer, J.I., Riolo, R.L. & Scavia, D. (2014) Development of a farmer typology of agricultural conservation behaviour in the American Corn Belt. *Agricultural Systems*, 129: 93 – 102.

Dasgupta, P. (2007). Nature and the economy. *Journal of Applied Ecology*, 44(3), 475–487.

Egboka, B. & Nwafor U.E.J. (1994): River boundary agricultural lands in Anambra State. Agricultural Forum, National Light Newspaper, August 10th, p.11.

Hobbs, P.R., K. Sayre, & R. Gupta (2008). The role of conservation agriculture unsustainable agriculture. *Philosophical Transactions of the Royal Society 363* (1491), 543-555.

http://www.farmradio.org/english/radio-scripts/44-3script_en.asp.

Hudson, N. W. (1987). *Soil and water conservation in semi-arid areas*. Food and Agriculture Organization of the United Nations. Rome: Italy.

Irohibe, I., (2010). *Assessment of food security situation among rural farming households in six local government areas of Kano state* (B. Agric. Thesis). University of Nigeria, Nsukka, Enugu, Nigeria.

Mazvimavi, K. (2007). Conservation farming impacts in Zimbabwe. *Guidelines for agricultural relief programs in Zimbabwe.* ICRISAT Publications Bulawayo, Zimbabwe.

Mgbenka, R.N, Ozor, N., Igbokwe, E.M & Felix, E. (2012). Soil and water conservation capabilities among farmers and extension agents in eastern region of Nigeria. *African Journal of Agricultural Research*, 7 (1), 58 – 67.

Onuoha, E.E. (2010). *Economics of soil conservation practices among small scale farmers in Enugu State* (M.Sc thesis). University of Nigeria, Nsukka. Retrieved 06/05/2017 online from: http://repository.unn.edu.ng:8080/jspui/bitstream/123456789/371/1/ONUOHA%2C%20EBELE%20E.pdf

Pawley, W.H. (1963). *Possibilities of increasing world food production*. Food and Agriculture Organization of the United Nations, Rome: Italy.

Udemezue, J. C. (2013). *Adoption of Faro-44 rice production technologies by farmers in Anambra State* (M.Sc thesis). Department of Agricultural Extension, University of Nigeria, Nsukka.

Roling, N. & Pretty, J. N. (nd). *Extension's role in sustainable agricultural development. Improving agricultural extension.* A reference manual. Rome, Italy: FAO.