SOIL CONSERVATION PRACTICES OF ARABLE CROP FARMERS IN ATISBO LOCAL GOVERNMENT AREA OF OYO STATE, NIGERIA

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Abstract

Environmental effects of drought, flooding and erosion results to soil degradation. Sustainable soil conservation practices are thus inevitable for agricultural production, food security, farmers' well being and rural economy. This study therefore investigated the soil conservation practices to mitigate soil degradation among arable crops farmers in Atisbo Local Government Area of Oyo State, Nigeria. Multi stage sampling technique was used to select 128 arable farmers. Data were collected with structured interview schedule. Frequencies, percentages, means, PPMC and t-test were used to summarize and analyze the data. Bush burning, soil erosion, soil compaction and deforestation were presumed by the arable crop farmers to be the causes of soil degradation in the area. Majority (60.2%) of the arable crop farmers perceived the effect of soil degradation to be disastrous and the common soil conservation practices are mulching, manure application and bush fallowing. The challenges in the adoption of soil conservation strategies are insufficient fund, unfavourable land tenure system, lack of incentive, inadequate information, little technical knowhow and low soil conservation skills. The perception of soil degradation among arable crop farmers is irrespective of their age and marital status, but depends largely on their educational level and religion. However, the higher the farmers' presumption of the causes of soil degradation, ($r= -0.02$, $p=0.825$) the lower they adopt soil conservation strategies. It is recommended that farmers be educated on efficient soil use practices through cross fertilization of ideas among research, extension and farmers' groups on sustainable soil use.

Keywords: Conservation agriculture, Soil degradation, Environmental challenges, Atisbo, Land management strategies

Introduction

Mankind is faced with a catalogue of environmental problems that seem to threaten its supportive ecosystem. Yahaya and Olajide (2002) stated that Nigeria is faced with a vast number of environmental problems such as flood, drought, soil erosion and water pollution; many of which has been blamed on climate variation. Unchecked drought, flooding and erosion of agricultural land cause soil degradation. The soil loses some of its chemical, physical and organic qualities and thereby becomes less productive. The demise of soil structure, texture and fertility diminishes the ability of soil to nourish and support optimum crop growth (Uzokwe, 2000).

Soil degradation can either be as a result of natural factors or due to inappropriate soil conservation practices by humans. Natural factors are steep slopes, frequent floods, blowing of high velocity wind, high intensity rain, strong leaching in humid regions and drought in dry regions. Deforestation of fragile land, over cutting of vegetation, shifting cultivation, overgrazing, unbalanced fertilizer use, non-adoption of soil conservation practices, over-pumping of ground water (in excess of capacity for recharge) are some of the human factors that causes soil degradation (Garcia, 2010).

Different forms of chemical degradation of soil include: salinization, acidification and soil pollution. Physical degradation of soil occurs through soil erosion, use of heavy machinery and trampling by cattle. The heavy reliance on agrochemicals and neglect of manure application has also caused organic degradation of soil. Soil erosion is the predominant cause of soil degradation (Wickama and Nyanga, 2009). It is the washing away, transportation or impoverishment of top soil by water and/or wind. It is as a result of erodible soil, strong winds and high annual total rainfall characterized by high intensity. Prevalence of overgrazing, deforestation and quarrying also worsen the situation. In Atisbo Local Government Area, soil degrading practices are mono-cropping, continuous cropping, overgrazing, overstocking, over-tilling, overdependence on agrochemicals, removal of tree shades and bush burning among many others.

In the face of these numerous soil degrading challenges, intentional efforts should be made towards effective soil conservation. Several strategies have been devised to combat soil degradation. Among them are cover cropping, agro-forestry, intercropping, terracing, no-till farming, contour plowing, crop rotation, controlled soil pH, soil water maintenance, manure application, salinity conservation and appropriate change in planting pattern/time.

The dense canopy of cover crops prevents rain drops from detaching soil particles and this keeps soil loss to tolerable limits. Cover crops also positively influence physical soil properties such as the infiltration rate, moisture content and bulk density. They increase the organic matter content, nitrogen (N) levels and hence crop yields. Agro-forestry is the integration of woody perennials with crops and/or animals on the same land (Onumadu et

al., 2000). Intercropping systems include different kinds of annual crops planted in alternating rows and reduce soil erosion risk by providing better canopy cover than sole crops. Planting pattern, plant density and time of planting also play an important role in soil conservation. Crops planted at close spacing provide a higher canopy during periods with high rainfall intensities and hence protect the soil from erosion. Additional advantages are a decreased risk of total crop failure and the suppression of weeds.

Terracing is the leveling of a section of a hilly cultivated area to prevent rapid surface runoff of water. Terracing gives the landmass a stepped appearance thus slowing the easy washing down of the soil. In addition, no-till farming is a way of growing crops without tilling the soil because tillage could lead to soil compaction, soil organic matter loss and death of soil organisms. Contour plowing helps in the percolation of water into the soil. Plowing across the contour lines of a slope also helps in slowing the water runoff and prevents the soil from being washed away along the slope Fakayo (2000). However, some pathogens build up in soil if the same crops are cultivated consecutively. Continuous cultivation of the same crop leads to an imbalance in the fertility demands of the soil. Crop rotation, which is a method of growing a series of dissimilar crops in an area sequentially, is therefore used to prevent these adversities from taking place.

Nigeria's population explosion has put significant pressure on the natural resource base available for human sustenance with resultant decrease in fallow period of land. Land use intensification, reduction in land productivity, rapid soil losses and disruption of water resources is therefore common (Kuponiyi, 2001). The rapid increase in population means a reduction in the available land space for farming and consequently reduced food production. In agrarian communities where most arable crops come from, soil erosion and degradation of agricultural land pose a threat to food security (Oladeji, 2007). Avoidance of soil degradation by improved soil conservation is therefore important to maintain the functions of the soil and contribute to food security today and for future generations (Ehui and Pender, 2005). In order to sustain agricultural production, food security, farmers' well being and rural economy, sustainable soil conservation practices are inevitable.

The study therefore sought to determine soil conservation practices of arable crops farmers to combat soil degradation in one of the food basket area of Oyo State, Nigeria. This study intended to determine the arable crop farmers' personal characteristics, presumed causes of soil degradation, perceived effect of soil degradation, adopted soil conservation strategies to mitigate soil degradation, trend of arable crops' yield and challenges in the adoption of the soil conservation strategies. The null hypotheses were that there was no significant relationship between farmers' presumed causes of soil degradation and their soil conservation practices; and there was no significant difference in farmers' arable crop yield in 2009 and 2011

Methodology

The study was carried out in Atisbo Local Government Area of Oyo State. It is found in Oke Ogun area of Oyo state which has an area of 2,997 km² and a population of 110,792 (NPC, 2006). Atisbo Local Government consists of seven towns. The name of the local government area is an acronym for Ago-Are, Tede, Irawo, Sabe, Baasi, Ofiki and Owo communities. It falls between derived savannah zone with tropical wet and dry season and annual rainfall of between 100mm-200 mm. The primary occupation of the people is farming. Population of the study was arable crop farmers in the seven towns. Multi stage sampling technique was used in the study. One hundred and twenty eight experienced farmers were selected for the study. Survey was done and information on the research objectives were collected with structured interview schedule. Frequencies, percentages, means, PPMC and t-test were used to summarize and analyze the data.

Results and Discussion

Personal characteristics of the arable farmers

Table 1 shows that the largest proportion (28.1%) of the arable farmers fell between 51 and 60 years of age, with mean age of 55 years. This implies that farm labour strength is diminishing as it constituted mainly of aged population. However, farming experience is likely higher with older farmers. Also, males dominated farming activities in the area, negating the findings of Baba (2002) that more females are into arable crop farming while more males are into cash crop farming. More than three-quarter of the farmers were married, implying that household labour might complement farming activities. It also indicates that there is a demand for steady arable crop production to maintain household food security. The fact that largest proportion (35.9%) of the farmers had between 11 to 20 years of farming experience (mean = 16 years) implies that they are equipped to overcome their farming challenges to a considerable extent. It is important to consider the religious bias of people, especially because some farming practices and systems are religious sensitive. Most (47.7%) of the farmers were Christians, 34.4% were Muslims while only 18.0% were traditional worshippers. According to Akegbejo and Aromolaran (2000), dwindling farmers' household size has reduced the significance of household labour, farmers now have to hire labourers to meet up with farm labour demands. This conclusion is in tandem with the result in table 1 that shows that most of the farmers had a household size of between four and six; an indication that farm household labour is diminishing. On the other hand, Oladeji (2007) opined that large household size means that there are more dependants to be fed and has negative implication for household food security. Lastly, the educational level of farmers is expected to boost their understanding and facilitate favourable perception of the harm of soil degradation (Baba, 2002). However, the largest proportion (35.9%) of these arable crop farmers has no formal education.

Table 1: Distribution of the arable farmers' personal characteristics (N=128)

Variables	Categories	Frequency	Percentage
Age in years	21-30	7	5.5
	31-40	23	18.0
	41-50	26	20.3
	51-60	36	28.1
	61-70	28	21.9
	Above 70	8	6.2
Mean = 55 years			
Sex	Male	117	91.4
	Female	11	8.6
Marital status	Single	4	3.1
	Married	103	80.5
	Divorced	10	7.8
	Widowed	11	8.6
Years of farming experience	1-10	26	20.3
	11-20	46	35.9
	21-30	34	26.6
	31-40	12	9.4
	41-50	8	6.3
	51-60	2	1.6
Mean = 16 years			
Religion	Christianity	61	47.7
	Islam	44	34.4
	Traditional	23	18.0
Household size	1-3	22	17.2
	4-6	56	43.6
	7-9	42	32.8
	Above 9	8	6.3
Educational level	Non formal	46	35.9
	Primary	31	24.2
	Secondary	35	27.3
	Tertiary	16	12.5

Source: Field survey, 2012

Farmers' Presumed Causes of Soil degradation

Table 2 shows that bush burning (84.4%), soil erosion (76.6%), soil compaction (74.2%) and deforestation (74.2%) are presumed by the arable crop farmers to be the major causes of soil degradation in the area, while flooding is presumed to be the lowest cause of soil degradation in the area. This little significance of flooding is because of the absence of water bodies that could overflow their banks in the area. The significant detriment of

heavy rainfall is thus soil erosion. The result is in tandem with the assertion of Wickama and Nyanga (2009) that running water is the main agent of soil degradation.

Table 2: Distribution of farmers' presumed causes of soil degradation (N=128)

Agent of degradation	Frequency	Percentage	Rank
Soil erosion	98	76.6	2nd
Deforestation	95	74.2	3rd
Bush burning	108	84.4	1st
De-vegetation	92	71.9	5th
Soil compaction	95	74.2	3rd
Flood	33	25.8	7th
Acidification	88	68.8	6th

Source: Field survey, 2012 *Multiple responses

Perceived effect of soil degradation

Table 3 shows that majority (60.2%) of the arable crop farmers perceived the effect of soil degradation to be disastrous while 39.8% of the respondent perceived the effect of soil degradation not to be worthy of concern. This is in agreement with the research findings of Garcia (2010) which explicitly described the adversities of soil degradation. This implies that most of the farmers had the understanding of the economic detriments of soil degradation and would probably adopt measures to stop the trend. The 39.8% that do not appreciate the adversity might not take measures to address the challenge and this is a major source of concern.

Table 3: Distribution of the level of perception of soil degradation in the area (N=128)

Level	Frequency	Percentage
Favourable	51	39.8
Unfavourable	77	60.2

Source: Field survey, 2012

Soil conservation practices

Table 4 shows that the more often used soil conservation practices were mulching (77.3%), bush fallowing (45.3%) and manure application (41.4%). No-till farming and agro-forestry are the less adopted strategies among arable crop farmers. On the average, manure application, mulching, planting of cover crops and crop rotation is practiced by most of the farmers. Some of these practices might be an incidental or intentional part of the farmers' farm practices, whichever the case; the practices are good for soil conservation. This finding shows that farmers are not adopting more effective soil conservation practices as Fakayo (2000) stated. However, soil degradation would have been worse if not for the indigenous farm practices of the farmers and with more

motivation from all agricultural stakeholders; soil degradation will not be a problem in this area.

Table 4: Percentage distribution of soil conservation practices (N=128)

Strategies adopted	No	Yes		
		Often	Sometimes	Rarely
Crop rotation	6.3	53.9	28.1	11.7
Agro-forestry	89.8	1.6	3.9	4.7
Shifting cultivation	58.6	14.8	11.7	14.8
Planting of cover crops	5.5	35.2	44.5	14.8
Mulching	4.7	77.3	14.8	3.1
Intercropping	23.4	33.6	31.3	11.7
Planting pattern	58.6	15.6	11.7	14.1
Planting indigenous crops	52.3	12.5	18.0	17.2
No-till farming	88.3	3.1	1.6	7.0
Bush fallowing	16.4	45.3	28.1	10.2
Manure application	3.9	41.4	26.6	28.1

Source: Field survey, 2012

Arable crop yield in 2009, 2010 and 2011

The need to determine the change in yield of the major arable crops cannot be overemphasized. The yield was measured in 50kg bags and baskets which is a uniform form of measure in the study area. Table 5 shows that there is little difference (0.3) in the yield of maize and sorghum in 2009, 2010 and 2011. In the case of cassava and soybean yield, there was an increase in 2010 and a decline in 2011. The yield of soybean in 2009, 2010 and 2011 has a negative difference (- 2.1). This reduction in the yield of a crop that increases soil fertility suggests a reduction in soil fertility in the area. However, there is a continuous increase in the production of yam in the area. The result reveals that crop yields in the area are relatively stable. It might be inferred that the farmers' soil conservation practices had helped the soil to maintain its productive ability. Otherwise, farmers' other agricultural intensification practices are also helping to mitigate the adverse effects of soil degradation.

Table 5: Mean distribution of yield of major crops from 2009 to 2011

Crops	2009	2010	2011	Difference
Maize (bags)	23.0	24.3	23.3	0.3
Cassava (baskets)	79.1	89.2	86.5	7.4
Yam (tubers)	5111.4	5338.0	5929.4	818.0
Sorghum (bags)	4.6	4.8	4.9	0.3
Soybeans (bags)	11.7	12.1	9.6	- 2.1

Source: Field survey, 2012

Challenges in the adoption of soil conservation strategies

Table 6 reveals that the challenges in the adoption of soil conservation strategies are the insufficient fund, unfavourable land tenure system, lack of incentive, inadequate information, little technical knowhow and low soil conservation skills in descending order. The arable crop farmers believe that adoption of soil conservation strategies requires more expenditures and incentives should be provided to encourage them. Also, land tenure system constitutes another challenge because land is not always a free-to-use resource and makes fallowing difficult. Onumadu et al. (2000) equally stated that farmers usually claim that the cost of effective soil conservation practices is high. This implies that farmers would not assume the responsibility of soil conservation alone; they would therefore not make much effort at it without the contribution of all land management stakeholders.

Table 6: Percentage distribution of challenges in the adoption of strategies

Constraints	Very severe	Severe	Not severe
Unfavourable land tenure system	68.8	7.8	23.4
Lack of incentive	77.3	13.3	9.4
Cultural barrier	35.9	26.6	37.5
Insufficient fund	82.0	16.4	1.6
Unavailability of information	62.5	32.8	4.7
Population pressure on land	43.8	25.8	30.5
Lack of technical knowhow	68.0	25.0	7.0
Inadequate soil conservation skills	61.7	23.4	14.8
Little road access to lands	52.3	33.6	14.1
Insufficient farm labour	53.9	27.3	18.8

Source: Field survey, 2012

Test of hypotheses

Hypothesis 1: There is no significant relationship between arable farmers' presumed causes of soil degradation and their soil conservation strategies

Table 7 shows that there is no signification relationship between arable farmers' presumed causes of soil degradation ($p>0.05$) and their soil conservation strategies. However, the relationship is negative ($r= -0.02$), implying that the higher the presumption of the causes of soil degradation by the arable crop farmers, the lower they adopt soil conservation strategies. This may be because they presume that the causes of soil degradation are beyond them and so, they do not bother to adopt strategies to reverse the trend. This is one of the reasons why USDA (1999) concluded that farmers alone do not

have to pay the price for soil conservation. This also agrees with the result of analysis on table 7 that lack of incentive is a very severe constraint to adopting soil conservation practices.

Table 7: PPMC test of relationship

Variable	r-value	p-value	Decision
Causes of soil degradation *versus* Soil conservation practices	-0.02	0.825	NS

Source: Field survey, 2012

Hypothesis 2: There is no significant difference in farmers' arable crop yield in 2009 and 2011

Table 8 shows that there is no significant difference in the yield of maize, sorghum and soybeans in 2009 and 2011 because the p-value for each is greater than level of significant which is 0.05. This implies that there is a reduction in the yield of maize, sorghum and soybean in 2011 compared to 2009. However, there is a significant difference in the yield of cassava and yam in 2009 and 2011 because the p-value is less than level of significant which is 0.05. This implies that there is a remarkable increase in the yield of cassava and yam in 2011 compared to 2009. Cassava and yam are tuber crops, and tuber crops are known to be resilient enough to grow and develop well even in adverse environmental situations. Therefore, the reason why there is a reduction in the yield of the non-tuber crops might be because of adverse environmental circumstances like soil degradation.

Table 8: t-test of difference

Variables	Mean	SE	df	t-value	p-value	Decision
Maize yield in 2009	23.0315	0.6191	126	-0.103	0.918	NS
Maize yield in 2011	23.2835	0.9791				
Cassava yield in 2009	79.1231	0.5139	64	-2.529	0.014	S
Cassava yield in 2011	86.4769	0.2307				
Yam yield in 2009	5111.3934	0.6282	121	-2.307	0.023	S
Yam yield in 2011	5929.4262	0.3196				
Sorghum yield in 2009	4.5795	0.4277	43	-0.661	0.512	NS
Sorghum yield in 2011	4.9091	0.2814				
Soybean yield in 2009	11.7000	0.5771	29	0.927	0.361	NS
Soybean yield in 2011	9.6333	0.4493				

SE-Standard Error, df-degree of difference, t-value - t-test coefficient,
p-value – probability coefficient, NS-Not Significant at $p \geq 0.05$, S-Significant at $p < 0.05$
Source: Field study, 2012

Conclusions and recommendations

Bush burning, soil erosion, soil compaction and deforestation were presumed by the arable crop farmers to be the major causes of soil degradation in the area. Majority of the arable crop farmers perceived the effect of soil degradation to be disastrous and the most often used strategies against soil degradation were mulching, manure application and bush fallowing. Also, there was little difference in the yield of maize and sorghum in 2009, 2010 and 2011, while there was a continuous increase in the production of yam in the area. The challenges in the adoption of soil conservation strategies were the inadequacy of finance, land tenure system, incentive, information, and technical knowhow and soil conservation skills. The arable crop farmers believed that adoption of soil conservation strategies requires more expenditures and incentives should be provided to encourage them. In addition, the perception of soil degradation among arable crop farmers was irrespective of their age and marital status. However, the perception of soil degradation among arable crop farmers was culturally and literacy inclined. The higher the presumption of the causes of soil degradation by the arable crop farmers, the lower they adopted soil conservation strategies. There was a reduction in the yield of maize, sorghum and soybean in 2011 compared to 2009. However, there was a remarkable increase in the yield of cassava and yam in 2011 compared to 2009. It is inferred that only rugged tuber crops increased in yield between 2009 and 2011. In order to increase the practices of soil conservation techniques and increase the yield of all crops; governments, nongovernmental organizations and private institutions should support agricultural research and extension to motivate farmers to conserve the productive ability of the soil.

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