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Original Research Articles

ANALYSIS OF BENEFITS OF AGROFORESTRY PRACTICES AMONG FARMERS IN SOUTH WEST NIGERIA

Abstract

The study examined the benefits of agroforestry practices among farmers in South West Nigeria. It highlighted the extent of agroforestry, the ownership and management of agroforestry practices, the utilization and sustainability of the practices, the benefits derived from agroforestry, as well as the challenges faced by farmers practising agroforestry. In the study area, multi-stage sampling technique was used to select 200 agroforestry farmers, while a validated structured questionnaire was used with other participatory techniques to obtain the required data. Descriptive and inferential statistics which include Pearson Product-Moment Correlation and T-test analyses were used to analyse the data. Most of the respondents (82 %) are married and the respondents mean age was 52 years. Majority of the respondents had formal education while 92 percent are involved in farming as their primary occupation. The analysis in the study area revealed the growing adoption of agroforestry with sustained environmental and economic benefits. The mean income before and after adoption of agroforestry practices were $1462.89 and $2131.82 , respectively. It was shown that various determinants cutting across personal factors, social factors and environmental factors contributed to adoption and sustainability of agroforestry practices in the study area. Given the fact that farmers derived substantial benefits from the practice, the avenue of agroforestry practice could further be effectively exploited to enhance sustainable food production and environmental management.

Key words: Agroforestry, Adoption, Sustainability, Farmers.

Introduction

The need for sustainable agroforestry practices is key to optimizing the mix of products and services from the forest. Optimizing benefits in the long term involves making trade-offs between benefits, which can be reaped today, and those which should be left for the future as argued by Onumadu et al.(2000). Nearly 500 million people around the world depend on forest for their livelihood, among them is high number of forest and wood workers. Sustainable forest management must include safe, stable jobs, adequate wages and working conditions (Udofua, 2005).

The forest and its resources are economic resources because they have utility, in the face of poverty, unemployment and lack of resources for meeting their economic needs such as farm lands, timber, firewood, leaf vegetables, fruits nuts, seeds barks, oils and resins, wildlife and honey both for domestic and commercial purposes (Udo et al. 2008). Most forest-dependent people wholly live on the forests for their sustenance, some at subsistence level, and others on commercial basis. However, due to the increasing pressure on the forest to meet increasing demands, for forest goods and services coupled with uncontrolled exploitation occasioned by lack of effective management plans and the increase drive by government for increased forest revenue generation, there is over exploitation of the forest resources. These, together with forest reservation by various governments for other land users, have led to deforestation which reduces the areas and potentials of the remaining forests to produce enough of the forest products the

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country needs and also protect the environment. There is also the problem of non-quantification of forest services as a component of the country's Gross Domestic Product. For example, the value of the protection that forest provide the soils, wildlife, water, bodies and the environment in general, say annually, is normally overlooked as it is not monetarily quantified and reflected in government financial records because of their intangible nature. Consequently, the actual value and contributions of the forest sector to the economy is not known and appreciated by government and the general public. Adoption of agroforestry practices by farmers might have been a response, as a means to ensure alternative sources of sustaining their families (Okunade et al, 2007). Most of the rural villages in this area are generally inaccessible and lack basic infrastructure (Akinwalere, 2007). These have contributed negatively to result in wastage of farm products especially during harvest periods, and consequent loss of income to the farmers. The adoption of agroforestry might have been an attempt by the farmers to ensure security against crop losses and wastage, as the agroforestry products will provide alternatives to food income and other uses. On the other hand, some factors might have hindered the adoption practices of agroforestry in South West Nigeria. One of such factors is the land tenure system. In this area, the land tenure system is traditional and communal (Adedipe et al, 1998). The communal ownership of the land especially in the rural parts has encouraged land fragmentation, and in some cases, the "slash and burn" system which is associated with large scale deforestation (Oke, 2002). Furthermore, immigrant settlers of these areas have problems in acquiring land for cultivation, and they do so only in a temporary basis. These factors have all combined to hinder the large scale adoption of agroforestry in the area. The inaccessible nature of most parts of the rural areas in the South West of Nigeria coupled with the absence of basic infrastructure have for a long time perpetrated poverty within the area (Akinwalere, 2007). The perpetration of poverty has therefore been an obstacle to farmers' investment in agriculture generally in terms of procurement of inputs, and particularly the procurement of tree seedlings and animal species for agroforestry practices. Therefore, the paper analyzed the economic benefits of agroforestry practicing in Southwest Nigeria, with the following objectives: (i) ascertain the socio-economic characteristics of the respondents;(ii) identify the benefits derived by participating in agroforestry practices and;(iii) identify the major constraints confronting farmers in the sustainability of agroforestry practice.

The following hypotheses were tested in null form as:

Ho_1: There is no significant difference between farmers' income before and after adoption.

Ho_2: There is no significant relationship between farmers' adoption of agroforestry and the benefits derived.

Methodology

The study was conducted in Southwest zone, Nigeria, among farmers practising agroforestry selected from both Ondo and Osun States, Nigeria. Multistage sampling was used in selecting samples, Ondo and Osun states were randomly selected**.** The States fall within the tropical humid climate that is characterized by wet and dry seasons, agriculture is the main occupation of the people in both states and this provides income and employment for over 75% of the population in the States. The farmers in the States grow food and other crops for domestic consumption and export. These include Cocoa, Cashew, Cassava, Rice, Palm produce, Coffee, Yam, Timber, Citrus, Plantain, Soyabeans, Cowpea and Kolanut. Three local government areas that have adopters of agroforestry practices were purposively selected from each state. Ife Central, Oriade

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and Ila local government areas in Osun State, Akure North, Ose and Owo local government areas in Ondo State. Two communities were randomly selected within the purposively chosen local government areas; each community was divided into three wards out of which one was randomly selected. From each ward eighteen farmers were randomly selected and interviewed, given a total of 36 respondents from each local government area and a total of 216 for the two states, out of which 200 respondents were selected as the total sample size being the respondents having adequate information required for the survey. Focus group discussion was also used to obtain information from the farmers. Descriptive Statistics such as frequencies, means and percentages among others were used to analyze the socio-economic characteristics of the respondents. T-Test was carried out at 5% level of significance to test for the existence of any significant difference between farmers' income before and after adoption of agroforestry practices. Pearson Product-Moment Correlation Coefficient (PPMC) was used to test for the significant relationship between farmers' participation and benefits derived from agroforestry, where Correlation Coefficient 'r' is defined as:

$$r = \frac{\sum xy}{\sqrt{\sum x2 \sum y2}}$$

Likert scale was used to measure the perception of respondents as to the factors they considered affecting their adoption of agroforestry practices. Respondents were made to respond to altitudinal statements that were both in positive and negative forms. The responses were in 4 point likert scale of Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD) with scores assigned as 4, 3, 2 and 1 respectively. The mean scores were calculated, and interpreted.

SA = 4
A = 3
D = 2
SD = 1

Mean score was calculated as $\sum(f_n x_n)/N$

f_n = Frequency of 'n' occurrence
x_n = Score assigned to 'n' occurence
N = Total number of respondents

Results and Discussion

Socio-economic profile of respondents.

Mean age of farmers was 52 years with 87% falling below 65 years of age, 52% were between ages 25 and 55, this implied that most of the respondents were in their active years and as such could participate effectively in agroforestry activities. Sixty-eight percent of the respondents were male, while 32% were female. This implies that there is dominance of male gender in farming activities and also in adoption of new improved technology. Recent studies stated that male headed households usually out-number female headed household in most communities in Nigeria (Alfred, 2001; Adedotun, 2000). Majority of the respondents (82%) were married, only 3% were single; 13% were widowed, while 2% were divorced. A large proportion (81.5%) of the respondents had both formal and non-formal education while 18.5% did not have any form of

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education. This result supports the earlier findings of Okunlola et al (1994) and Iwala (2004) that education is related not only to the ability to obtain and process information, but also to the use of more sophisticated techniques by the farmers. Forty-nine percent were household heads. Majority of farmers (83%) were Christians, while 17% were Moslems. It was observed that half of the population of respondents (51%) has been in farming business for more than 15years.

Respondents' human and agricultural activities

Farmers in the study area were involved in various agricultural activities such as cultivation of food crops, economic crops and livestock farming among other activities. Primary occupation: Majority of the farmers (91.5%) were crop farmers while 0.5 percent were livestock farmers (Table 1). Other primary occupations engaged by the respondents include trading (1.5%), civil service (5%), gathering and selling of non-timber forest products (1%) and 0.5% did not indicate their specific primary occupation. This shows that farming is the primary occupation in the study area.

Majority of the respondents (70.5%) were members of cooperatives societies. The mean farm size of the respondents was 2.7 hectares and out of the four sources of farmland ownership identified, almost half, 48.5% and 56% inherited land for food crop and tree crop production, respectively. Only 28.5% got their land from leased agreement for food crop production, while for tree crop it was 7.5%. About 27% got their land from family source for tree crop production as against 16.5% and 12% for vegetable and food crop production, respectively. In this study, respondents were accorded land ownership status according to the condition of ownership of land that forms the bulk of each respondent's farmland. Majority of the respondents (95%) were involved in wood collection while about 85% collected seasonal fruits, fodders for animal use (70%), snails (66%), mushroom (65%) leafy vegetable (52%), 42% collected herbs for medicinal purposes and bush meat each, while 23% and 20% collected materials for building purposes and edible insects respectively. This serves as additional income to the farmers.

The total costs of adoption before and after were considered in the study. Mean cost before and after adoption of agroforestry practices were ₦63, 345.91 ($3248.51) and ₦92, 486.84 ($463.59) respectively. The specific cost before adoption ranged from ₦(5,000- 320,000) and after adoption, ₦(10,000-700,000). Farm cost considered included cost incurred for operation such as land preparation and planting, fertilizer, chemicals, harvesting and processing, labour costs, administrative and selling expenses. Table 1 showed distribution of respondents cost before and after adoption of agroforestry practices. Table 2 showed Annual Estimated revenue before and after adoption for the respondents. Before adoption, majority of the respondents (78.5%) earned below ₦300, 000.00 while the figure reduced to 52% after adoption which means more farmers (48%) earned above ₦300,000.00 after adoption of agroforestry techniques as against 21.5% of respondents recorded before adoption. The mean before and after adoption of agroforestry practices were ₦291,188.81($1459.59) and ₦424,337.74($2127.00) respectively while the range fell between ₦(30,000-1,300,000) and ₦(55,000-2,000,000), respectively.

Table 1: Annual Estimated Cost

Cost Range in Naira	Cost before Adoption	Cost after adoption

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	Frequency(%)	Frequency (%)
5,000 - 20,000	42(21.0)	31(15.5)
20,001 – 50,000	53(26.5)	44(22.0)
50,001 - 100,000	76(38.0)	57(28.5)
100,001 – 150,000	18(9.0)	38(19.0)
150,001 and above	11(5.5)	30(15.0)
Total	200(100.0)	200(100.0)

Mean before =$ 3248.51 Mean after =$ 463.59
Source: Field survey, 2010

Table 2: Annual Estimated Revenue

Revenue Range in Naira	Revenue before Adoption	Revenue after adoption
	Frequency (%)	Frequency (%)
30,000 - 100,000	20(10.0)	13(65)
100,001 – 300,000	137(68.5)	91(45.5)
300,001 - 600,000	35(17.5)	70(35.0)
600,001 – 1,000,000	6(3.0)	19(9.5)
1,000,001and Above	2(1.0)	7(3.5)
Total	200(100.0)	200(100.0)

Mean before = $1459.59 Mean after = $2127.00
Source: Field survey, 2010

Factors enhancing the adoption of agroforestry practices.

About 63.5% of the respondents strongly agreed that their level of education enhanced their utilization of agroforestry practices. Sixty-nine percent strongly agreed that their gender is an important factor contributing to their utilization, while 13% strongly disagreed. The implication of this is that gender is an important factor to be considered for future policy affecting adoption of agroforestry practices. Many of the respondents (41.5%) strongly agreed that it was the activities of Non Governmental Organization (NGO) and other community based organizations that help in enhancing their utilization of agroforestry activities, this assertion was agreed upon by 24.5% of the respondents, 6% disagreed with this while 28% also strongly disagreed. This means that Non-Governmental Organisations and other community based organizations have really contributed a lot in the areas of information dissemination and

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monitoring activities needed by the farmers to make a success of their agroforestry practices. This could be because some of the NGOs have programmes and fundings on environmental management and climate change. This is further corroborated by majority (82%) of the respondents that agreed that increase in farm output realized is a factor enhancing their utilization, 2% disagreed while 16% strongly disagreed. This is because the farmers were able to obtain products from more than one source. This agrees with the fact that agroforestry practices bring about increase in farm output for the farmers. This could be through improvement in soil fertility, which 66% of the respondents strongly agreed have contributed to enhancement of agroforestry utilization in their communities. This conforms with the findings of Aweto (2000), conducted on farmers in Urhobo land area of Niger Delta Nigeria who practiced integrated farming that used palm trees along side other crops to maintain soil fertility. It could also be due to the fact that the practice is cost effective as strongly agreed to by 64.5% of the respondents.

Sixty-three percent strongly agreed that the need to control soil degradation in the farmland is a major factor for their utilization of agroforestry practice, 16% of the respondents agreed, 4% disagreed while 17% strongly disagreed with the assertion.

Table 3: Respondents' perception of factors enhancing adoption of agroforestry practices

Variables	Strongly Disagreed	Disagreed	Agreed	Strongly Agreed	Total Raw Score	Mean Score
	Frequency(%)	Frequency(%)	Frequency(%)	Frequency(%)		
Level of Education	26 (13.0)	7 (3.50)	40 (20.00)	127 (63.50)	668	3.3
Gender	26 (13.00)	11 (5.50)	25 (12.50)	138 (69.00)	675	3.4
Status in the Society	34 (17.00)	10 (5.00)	22 (11.00)	134 (67.00)	656	3.3
Level of income	26 (13.00)	4 (2.00)	31 (15.50)	139 (69.50)	683	3.4
Information Sources.	36 (18.00)	-	28 (14.00)	136 (68.00)	664	3.3
Visitation of Extension Agents	60 (30.00)	76 (38.00)	9 (4.50)	55 (27.50)	459	2.3
Activities of NGO/CBOS	56 (28.00)	12 (6.00)	49 (24.50)	83 (41.50)	569	2.8
Increase in my farm output	32 (16.00)	4 (2.00)	50 (25.00)	114 (57.00)	646	3.2
The need to improve soil fertility						

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of my farm	31 (15.50)	2 (1.00)	35 (17.50)	132 (66.00)	668	3.3
The need to control soil degradation	34 (17.00)	8 (4.00)	32 (16.00)	126 (63.00)	650	3.3
The practice is simple	49 (24.50)	16 (8.00)	22 (11.00)	113 (56.50)	599	3.0
The practice is cost effective	42 (21.00)	8 (4.00)	21 (10.50)	129 (64.50)	637	3.2

Figures in parenthesis: Percentages
Source: Field Survey, 2010

Respondents perception of factors affecting adoption of agroforestry practices

Forty-eight percent of the respondents strongly agreed that agroforestry practice is very complex to understand and 12.5% strongly disagreed. This implies that most of the respondents agreed that it is a complex practice that its understanding and utilization can be enhanced through further training and education, as corroborated by 63.5% of the respondents in Table 3 that education has really enhanced their utilization of agroforestry practices. Fifty-nine percent also strongly agreed that it is not a costly practice to adopt, Inputs required are easily available for the farmers to use as 64.5% of the respondents strongly agreed, though 30% of the respondents strongly agreed that the practices take lot of time to practice, 60.5% disagreed, Table 4 shows that agroforestry has increased respondents' land area for cultivation. This is because a total of 51% of the respondents agreed with the ascertion, while 49% disagreed and this could could be as a result of the type of agroforestry practice a respondent is involved in, for example, a respondent practising improved fallow will have to move from one farm land to another, thereby having multiple farm lands.

The study also revealed that, majority of the farmers (65%) stated that their crop yield have been affected by the adoption of agroforestry practices, 34.5% of the respondents strongly agreed that their land ownership pattern affects pattern of adoption, 5.5% agreed to this also, this conforms with Oke (2002) that sustainability of fallow system is being affected by shortage of land and increasing population pressure. Other factors affecting their adoption as stated by the respondents includes, cultural compatibility (3%), high labour requirement (57%) conform with the land system (66.5%), (this further confirms the assertion that "land ownership pattern affects pattern of agroforestry practice adopted), Lack of access to credit (61%) an inadequate source of information(65%). The implication of this is that information needed for effective and sustainable agroforestry practices were not available to the farmers. This could be due to lack or inadequate information and extension visits to farmers.

Table 4: Respondents' Perception of factors affecting Adoption of Agroforestry practices

Statements	Strongly	Agreed	Disagreed	Strongly	Total	Mean

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	Agreed			Disagreed	Raw Score	Score
	Freq.(%)	Freq.(%)	Freq.(%)	Freq.(%)		
i. Agroforestry practice is very complex to understand	96(48.00)	20(10.00)	59(29.50)	25(12.50)	567	2.9
ii. Practice not costly to adopt	118(59.00)	17(8.50)	40(20.00)	25(12.50)	628	3.1
iii. Inputs required are easily available	129(64.50)	16(9.50)	21(10.50)	34 (17.00)	640	3.2
iv. It takes lot of time to practice	60 (30.00)	19(9.50)	88(44.00)	33 (16.50)	506	2.5
v. It has increased my land area for cultivation	74 (37.00)	28(14.00)	70 (35.00)	28 (14.00)	548	2.7
vi. It affects the crop yield	131 (65.50)	18(9.00)	17 (8.50)	34 (17.00)	646	3.2
vii. My land ownership pattern affects pattern of adoption	69 (34.50)	11 (5.50)	75(37.50)	45 (22.50)	504	2.5
viii. Practice is culturally compatible	142.(71.00)	6 (3.00)	17 (8.50)	35 (17.50)	796	4.0
ix. It is not socially feasible	124(62.00)	17 (8.50)	25 (12.50)	34 (17.00)	631	3.2
x. Practice has high labour requirement	98 (49.00)	17 (8.50)	51 (25.50)	34 (17.00)	589	2.9
xi. It conforms with the land tenure system in my area	118(59.00)	15 (7.50)	19 (9.50)	48 (24.00)	603	3.0
xii.My Lack of access to credit facilities	104.(52.00)	18 (9.00)	34 (17.00)	44(22.00)	572	2.9
xiii. Inadequate source of information on the practice	102 (51.00)	28(14.00)	34 (17.00)	36 (18.00	596	3.0

Figures in parenthesis: Percentages
Source: Field Survey, 2010

Benefits derived from agroforestry practices

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Considering the number of benefits derived from the use of agroforestry practices by the respondents, Table 5 outlined these benefits as given by the respondents in order of ranking. Increase in income was ranked 1st as the most benefit with a mean score of 2.50. This is in line with Adekunle et al. (2004) that agroforestry allows good production and add to per capita income of the farmers. Crops produced by the farmers were not only consumed by the family, but were also sold for cash thus serving as means of meeting some family needs. Similarly, the products of the tree components of agroforestry are also cash oriented. Furthermore, the proceeds from the livestock of agroforestry farmers had also generated additional income to the farmers. Provision of forest materials for building was ranked 2nd. Farmers used tree component of agroforestry during the construction of their houses, this also goes a long way in reducing cost of building incurred by the farmers. Availability of more source of revenue was ranked 3rd, there is greater benefit and reduction in economic risks when systems produce multiple products as explained earlier. This provides a guaranteed source of income to the farmers. Increased crop yield was ranked 4th. Respondents claimed participation in agroforestry had afforded them benefit of enjoying increased yield and variety of crops. Improvement in the management of soil fertility through application of livestock dung waste as manure and conservation of soil nutrient by the same nitrogen–fixing trees and shrubs has really contributed to increase in crop yield realized by the farmers. The fifth benefit was extraction of tree leaves and barks for medicinal purposes. The extracted tree barks and leaves are usually boiled, and the liquid is consumed orally, for the treatment of a wide range of illnesses.

Enhancement of the environment was ranked 6th by the respondents and the communities also enjoyed a substantial stability of the ecosystem, the system helps in moderating micro climates, shelter given by trees improves yields of nearby crops and livestocks, shades are beneficial for livestock, reducing stress. Despite the fact that this benefit cannot be quantified, it was none-the-less taken for granted by the farmers since they still acknowledge it. This study agreed with the findings of Odurukwe (2004) where a large majority of households in Abia State showed their awareness of the positive impacts of agroforestry systems in their environment.

Table 5: Benefits derived from the use of agroforestry practices in order of ranking

Benefits.	Mean Score	Rank
Increase in income	2.50	1st
Forest materials for building	3.50	2nd
Availability of more sources of revenue	3.55	3rd
Increased crop yield	4.00	4th
Source of medicinal plants	4.55	5th
Enhancement of environment	4.75	6th
Fodder for animals	5.00	7th
Use of fallow of croplands	5.50	8th

Source: Field survey, 2010

Hypothesis 1

Ho_1: There is no significant difference between farmers' income from agroforestry practice before and after adoption.

The result from the Table 6 shows that there was a significant relationship between farmers' income from agroforestry practice before and after adoption as the paired sample test of income

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before and after adoption shows t value of 6.690 at 0.05 level of significance. This further confirmed the earlier hypothesis result that income is a significant factor of adoption in the study area.

This means that with the adoption of the practice, farmers benefit more and this brings a positive attitude towards adoption of the practices.

Therefore, the null hypothesis is rejected.

Table 6: Paired Sample Test of income before and after adoption of agroforestry practices.

Paired variables	Sample size	T value	Df	Mean difference	P-value	Decision
Income before adoption- Income after adoption	200	6.690	93	133,148.93	0.001	S

S = Significant

Source: Computed from field data,2010.

Hypothesis 2

HO_2: There is no significant relationship between farmers' adoption of agroforestry practices and the benefits derived. The result showed strong correlation between farmers' adoption of agroforestry and the benefit derived from it (r = 0.37; P = 0.00). This further buttressed hypothesis 2 above. Benefits derived include; increase income, increase crop yield' fodder for animals' forest materials for building among others (Adekunle et al. 2004).

Table 7: Correlation coefficient (r) of farmers' adoption of agroforestry practices and and benefit derived.

Variable	R	P value	Decision
Farmers' adoption and benefits	0.378*	0.000	S

*Significant

Source: Computed from field survey, 2010.

Conclusion and Recommendations

This study has explored agroforestry practices of Nigeria with a major focus on the expenses at two Southwest states. The analysis in the study areas revealed the growing adoption of agroforestry with sustained environmental and economic benefits. It has been shown that various determinants cutting across personal factors, social factors and environmental factors contributed to adoption and sustainability of agroforestry practices in the study area. To build upon the success stories in the community studied in order to minimize the problems of poverty, food scarcity and environmental degradation, adequate information on agroforestry and proper funding were recommended.

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