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The Journal provides rapid publication of researches throughout the tropics aimed at increasing and sustaining production and management of wood and non-woodresources of tropical forest ecosystem. The scope also covers detailed studies on ecosystem dynamics and environmental conservation. Emphasis will be on papers presenting original research. Occasional review papers drawing together past and current literature are also published.

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ASSESSMENT OF AGROFORESTRY PRACTICES AS A LAND-USE OPTION IN ATISBO LOCAL GOVERNMENT AREA OF OYO STATE, NIGERIA

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ABSTRACT

The paper examines the adoption of agroforestry practices as a land use option in Atisbo Local Government Area of Oyo State. Data were generated from primary and secondary sources. The primary data were obtained from structured questionnaire and direct interview of farmers in the study area, using purposive simple random sampling technique. Fifteen farmers were randomly sampled from each of the ten cells of Atisbo Farmers Association of Nigeria with 440 members. Data generated were analyzed using descriptive and inferential test statistics. Results show that although perception of farmers on agroforestry practices varied among respondents, out of the various forms of agroforestry being practiced in the study area, the tree crop system was dominant with a modal frequency of 67.3%. It was also discovered that farmers adopted agroforestry practices for various reasons. The most popular of which was the food and financial gains that accrued from the planting of fruit trees. However, paucity of information, bush burning, labour requirements and non-availability of incentives were considered as major constraints to the practice of agroforestry in the area. Test of hypotheses showed that although there existed significant differences in the type of agroforestry practices among the farmers in the study area (χ^2 = 39.60; df = 33; Pr = 0.19), there was no significant variation in the perception of agroforestry among the farmers. It was also noted that there was significant enhancement in the soil fertility of the study area through the practice of agroforestry (χ^2 = 3.81; df = 4; Pr = 0.43); and that there existed significant relationship between agroforestry practices and productivity in the study area (χ^2 = 209.74; df 48; Pr < 0.01). An implication of the findings is that agroforestry presents huge opportunities for food production and developing forestry practices in the study area.

INTRODUCTION

Food according to Sheik Nur-ud-din Wali (Quoted from Hoskins, 2004) will last so long as forests do. This is a pointer to the indispensable role of forestry in improving the present and future world food security, most especially in the developing part of the global village. As reported by Lean *et* al (1990), over a billion people (about one in every five on earth) do not get enough food to lead fully productive lives. One-fifth of these people live in Africa where food production is 27% less than required (Lean *et al.* op. cit.). Increasing per capita food production is therefore important in this part of the globe. One of the reasons advanced for the shortfall in food production is the loss of grip on the practice of traditional bush fallow system of farming owing to population pressure (Wilson and Kang, 1981). Also related to this is the quickening pace of forest destruction

with attendant environmental, social and economic hazards. Functioning forests have been reported to play an important, though often silent, role in the lives of millions, possibly billions of people (Olawoye, 1996). But as submitted by Bryant *et* al (1997) only 18% of the original forest cover in the tropics is still found in large contiguous tracts. Recuperating from the rapid rate of deforestation in Africa, of which over 10% is due to slash – and – burn farming on at least 5.1 million hectares of land each year, William (1992) is beyond reforestation programme or natural regeneration processes of the ecosystem. There have been many efforts aimed at improving conditions for human social existence. These include the production of crops and construction of development projects such as dams for irrigation, terracing of hill-sides and construction of dykes for flood control; which constitute drastic transformations of the natural environment (Barraclough and Ghimire, 1995). Apart from the various activities of man tampering with and hence altering the environmental quality; biological diversity; and ecological stability, diverasified agricultural productivity to meet increasing population needs also poses a special problem in developing tropical countries. The traditional system of fallow and shifting cultivation requires more land, which is not available. In addition, the use of high external input technologies has not been generally successful because of soil, climatic and socio-economic incompatibility (Lal, 1987). Evans and Alexander (2004) link serious decline in biodiversity that is associated with farmland to intensified farming practices

Against this backdrop, a sustainable land-use system that maintains the long-term biological and ecological integrity of natural resources, provides economic returns to individual farmers and farm-related industries, contribute to the quality of life of rural populations, and strengthens the economic development of countries in the humid tropics is very imperative. Agroforestry has been claimed, to have the potential of improving agricultural land-use systems towards providing lasting benefits and alleviating adverse environmental effects at local and global levels in the tropics.

ATISBO Local Government contributes significantly to food supply in Oyo State, Nigeria. Nevertheless, the low fertility level of tropical soils amidst population pressure often lowers crop production in this region. Coupled with these, decreasing agricultural land and uncontrolled exploitation of forest resources pose a serious threat to environmental sustainability in the area.

However, there has been an increasing emphasis on agroforestry practices as a means of stabilizing and increasing productivity level. Thus, this study examined the existing agroforestry practices/techniques in the study area with the aim of providing background information that could be relevant in designing agroforestry schemes, which would be acceptable to small-holder farmers at all levels.

METHODOLOGY

The Study Area

The study covers the ATISBO Local Government Area (LGA) of Oyo State in Oke-Ogun, the food basket of the State. ATISBO LGA, Oyo State, Nigeria, lies between Lat 8^0 40' N and 8^0 10' N and Long 2^0 40' E and 3^0 3' E. It is one of the largest LGAs in the State in terms of landmass and population. The land area is estimated at 2,837,417Km^2 while the 1991 census gave the population of the area as 97,646. The LGA falls within the savanna zone of the Southwestern states of Nigeria. It is characterized by wet and dry seasons, a mean annual rainfall about 1000mm, a temperature range of between 25°C and relative humidity of between 75% and 90%.

Land properties in Atisbo LGA are held according to Yoruba traditional practice but leasing for advanced agriculture and ranching is becoming common. Although the majority of inhabitants are Yoruba, settlements of Hausa/Fulani cattle rearers and other ethnic groups, who are mostly into commercial activities, farming, cattle ranching and minning, are also noticed in Atisbo LGA. According to Orekoya and Agbugba (2001), inhabitants practice mechanized and subsistence farming with opportunities for investment in food processing, storage and marketing.

Sources of Data

The data for this study were collected from two main sources – Primary and Secondary. The primary data were collected through field survey with the use of structured questionnaires and direct interviews to elicit information from farmers.

The Secondary data were obtained from publications of OYSADEP such as bulletins, annual reports and magazines. Other information were obtained from the Council's Department of Agriculture and Natural Resources (MANR) and also, from the state Meteorological Service.

Population of the Study

The study involved the entire farming population that adopted in agroforestry practices in ATISBO Local Government Area irrespective of their scales of production.

Sampling Procedure and Size

A simple random sampling method was used to select respondents from the study population using the medium of the Atisbo Farmers' Association of Nigeria (AFAN). Atisbo Local Government had 10 cell groups – (Tede 1, Tede II, Irawo I, Irawo II, Alaga, Ofiki, Ago-Are I, Ago-Are II, Sabe/Agunrege/Owo and Baasi/Corner Owo). This cuts across all the towns and villages in the area. Fifteen farmers were selected from each cell-group giving a total of 150 respondents and sampling intensity of 34.09%. The questionnaires were personally with the assistance of extension agents in some cases.

RESULTS AND DISCUSSION

The study revealed that 97% of the respondents farmed for the market and domestic consumption (Fig. 1). This deviates from Lowe's (1986) submission on traditional African belief about farming not being a profit making venture but a way of life. According to Lowe (Op. cit.), farming was engaged in mainly to produce food for subsistence needs and meet social responsibilities. However, Orekoya and Agbugba (2001) saw farming as being more of an economic rather than a social venture.

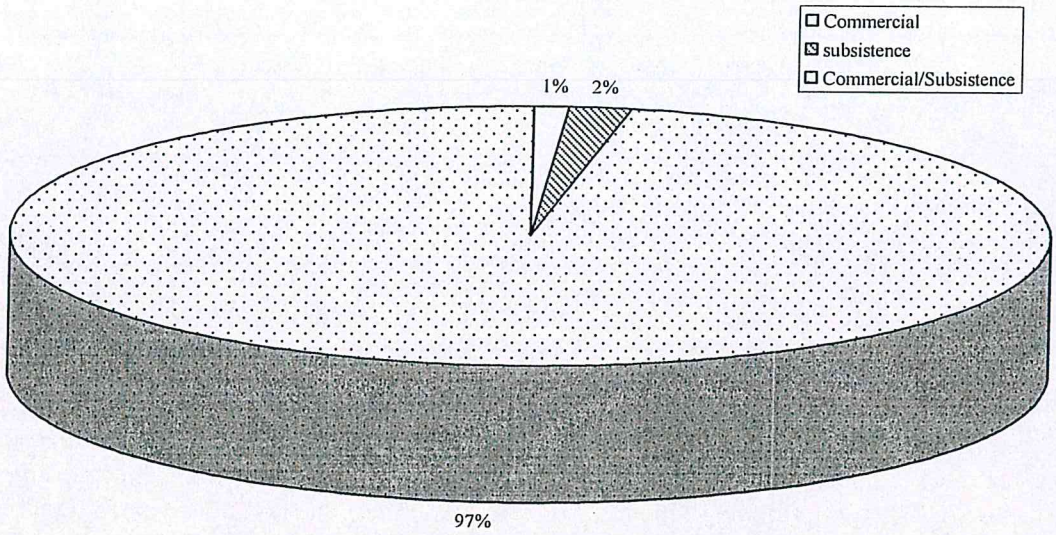

Fig. 1:Distribution of Respondents' Scale of Farming in the Study Area

Agroforestry System and Crop(s) Cultivated

Findings from questionnaire survey showed that various combinations of food and tree crops were cultivated in the study area using several variants of agroforestry practices (Table 1). In all the combinations, maize, yam and cassava were more prominent while guinea corn and groundnut were the least favoured food crops cultivated. Among the tree crops cultivated, fruit trees (Cashew, Mango and Citrus) were more favoured compared with timber (Gmelina and Teak). Also worthy of note was the presence of *Gliricidia sp.* among some of the identified combinations.

On the agroforestry system adopted in the study area, the survey revealed that the tree crop system was mostly favoured by the respondents (67.3%). The tree crop system is that which emphasizes the tree rather than the arable crop component of the system. This further reveals the importance of agroforestry rather than farm system in the study area (Table 2).

Table 1: Frequency Distribution of Food and Tree Crops Cultivated

Characteristics		
Types of food crops cultivated	**Frequency**	**Percent**
Maize – Yam – Beans	4	2.7
Maize – Beans - Rice	7	4.7
Maize – Yam - Cassava	47	31.3
Maize – Yam - Rice	9	6.0
Maize – Cassava – Rice	1	0.7
Beans – Yam – Cassava	14	9.3
Maize – beans – Yam – Cassava	38	25.3
Maize – Beans – Yam – Rice	1	0.7
Beans – Yam – Cassava – Rice	1	0.7
Maize – Beans – Yam – Cassava Groundnut	2	1.3
Maize – Beans- Yam – Cassava - Rice	21	14.0
Maize – Beans – Yam – Cassava – Guinea-corn	5	3.3
Total	150	100.0
Types of Trees crops grown	**Frequency**	**Percent**
Cashew – Mango – Citrus	13	8.7
Cashew – Mango - Teak	1	0.7
Cashew – Mango - *Gliricidia*	1	0.7
Cashew – Citrus – Teak	2	1.3
Cashew – Teak – Pineapple	3	2.0
Mango – Citrus – Teak	7	4.7
Cashew – Mango – Citrus – Teak	40	26.7
Cashew – Mango – Citrus – *Gmelina*	3	2.0
Cashew – Mango – Citrus – Pineapple	1	0.7
Cashew – Mango – Citrus – *Gliricidia*	1	0.7
Cashew – Mango - Citrus	1	0.7
Cashew – Mango – Teak – Gmelina	1	0.7
Cashew – Mango – Teak – *Gliricidia*	7	4.7
Cashew – Citrus – Teak – Gmelina	1	0.7
Mango – Citrus – Teak – *Gmelina*	1	0.7
Mango – Citrus – Teak – *Gliricidia*	5	3.3
Citrus – Teak - Pineapple – Pawpaw	1	0.7
Cashew – Mango – Citrus - Teak - *Gmelina*	5	3.3
Cashew – Mango – Citrus – Pineapple	47	31.3
Cashew – Mango – Citrus – Teak – *Gliricidia*	8	5.3
Cashew – Mango – Citrus – Pineapple - *Gliricidia*	1	1.7
Total	150	100.0

Source: **Field Survey, 2003**

Table 2: Frequency Distribution of Agroforestry Systems Adopted

Characteristics		
Agroforestry system adopted	**Frequency**	**Percent**
Taungya	1	0.7
Bush fallow	3	2.0
Tree crop system	101	67.3
Alley cropping – tree crop system	11	7.3
Taungya – tree crop system	13	8.7
Bush fallow – tree crop system	11	7.3
Mixed home garden – taungya and tree crop system	1	0.7
Taungya – bush fallow – tree crop system	1	0.7
Mixed home garden – tree crop system	5	3.3
Mixed home garden –bush fallow - tree crop system	1	0.7
Bush fallow – tree crop system	1	0.7
Alley – bush fallow – tree crop system	1	0.7
Total	**150**	**100.0**

Source: **Field Survey, 2003**

Impact of Agroforestry

According to the respondents, agroforesty was found to have reduced bush fallowing (76.7%), soil erosion (96.7%), and the use of chemical fertilizer (84.7%) apart from increasing farm output (93.3%) in the study area (Table 3). An average annual yield of 21 – 30 sacks of grain was also claimed by respondents (Fig. 2) to be harvested from their agroforestry plots.

Table 3: Impact of Adoption of Agroforestry Practices

Characteristics		
Impact of agroforestry on bush fallowing	**Frequency**	**Percent**
Yes	115	76.7
No	18	12.0
Partially	17	11.3
Total	**150**	**100.0**
Contribution of agroforestry to soil erosion reduction		
No	5	3.3
Yes	145	96.7
Total	150	100.0
Contribution of Agroforestry to reduction of the use of chemical fertilizer		
No	23	15.3
Yes	127	84.7
Total	150	100.0
Contribution of agroforestry to increasing farm output		
No	10	6.7
Yes	140	93.3
Total	150	100.0

Source: **Field Survey, 2003**

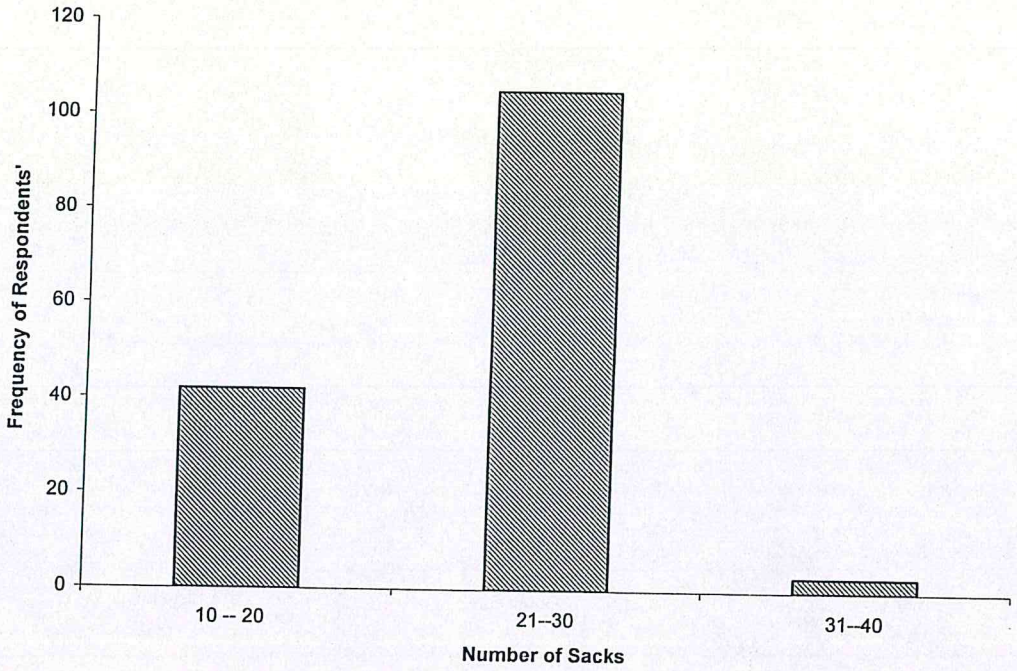

Fig. 2: Distribution of Respondents' Average Annual Grain Yields (In sacks)

Table: 4: Frequency Distribution of Sources and Problems Encountered in Getting Labour

Characteristics	Frequency	Percent
Sources of labour		
Family labour	27	18.0
Workgroup	3	2.0
Hired labour	37	24.7
Family labour & workgroup	2	1.3
Family labour & hired labour	77	51.3
Work group & hired labour	2	1.3
Total	148	98.7
Missing system	2	1.3
Total	150	100.0
Problems encountered in getting labour		
High cost of labour	101	67.3
Theft by hired labour	38	25.3
Labour not readily available	11	7.3
Total	150	100.0

Source: **Field Survey, 2003**

TEST OF HYPOTHESES

Ho_1: There was no significant difference in the type of agroforestry practices among farmers in the study area

Table 5: Summary of Chi-square tests

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.602[a]	33	.199
Likelihood Ratio	29.928	33	.621
Linear-by-Linear Association	.007	1	.934
N of Valid Cases	150		

a. 42 cells (87.5%) have expected count less than 5. The minimum expected count is .02.

The above test shows a significant difference in the type of agroforestry practices among farmers in the study area ($\chi^2 = 39.60$; df = 33; Pr = 0.19).

Ho_2: There was no significant enhancement in soil fertility through the practice of agroforestry in the study area.

Table 6: Summary of Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.81[a]	4	.428
Likelihood Ratio	4.986	4	.289
Linear-by-linear association	2.262	1	.133
N of valid cases	149		

a. 5 cells (55.65) have expected count less than 5. The minimum expected count is .21.

This test was not significant ($\chi^2 = 3.81$; df = 4; Pr = 0.43). Therefore the null hypothesis was rejected. Invariably, there is significant enhancement in soil fertility through the practice of agroforestry in the study area

Ho_3: Agroforestry did not impact productivity in the study area.

Table 7: Summary of Chi-Square Test

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	209.742[a]	48	.000
Likelihood Ratio	118.330	48	.000
Linear-by-Linear Association	.496	1	.481
N of Valid Cases	150		

a. 53 cells (81.5%) have expected count less than 5. The minimum expected count is .01.

The test shows a significant relationship between agroforestry practices and productivity in the study area ($\chi^2 = 209.74$; df 48; Pr < 0.01). The null hypothesis is therefore rejected.

Ho_4: There was no significant variation in the perception of agroforestry among farmers in the study area.

Table 8 below shows that there was no significant variation in the perception of farmers with regards to identified problems (VAR 00052 and VAR 00054 – VAR 00058) militating against the practice of agroforestry in the study area.

Box 1

VAR00052 – Tree crops on farmland competed with arable crops for nutrients and hence constituted a nuisance

VAR00054 – All tree belonged to government

VAR00055 – Getting information on agroforestry practice was more tedious than benefits derived there from

VAR00056 – Shade created by trees impeded the development of arable crops

VAR00057 – Cropping trees required a long period of investment

VAR00058 – Credits were not available for agroforestry practice.

The null hypothesis was accepted for all the variables defined in Box 1.

On the other hand, farmers, differed strongly in their opinion with respect to variable 00053 i.e. "Procuring tree seedlings and other motivating inputs is an onerous task". For this variable, the null hypothesis is rejected.

Table 8: Analysis of variance test

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
VAR00052	Between Groups	1.230	2	.615	1.133	.325
	Within Groups	79.200	146	.542		
	Total	80.430	148			
VAR00053	Between Groups	1.222	2	.611	5.674	.004
	Within Groups	15.718	146	.108		
	Total	16.940	148			
VAR00054	Between Groups	.835	2	.417	1.239	.293
	Within Groups	49.192	146	.337		
	Total	50.027	148			
VAR00055	Between Groups	1.947	2	.974	2.659	.073
	Within Groups	53.462	146	.366		
	Total	55.409	148			
VAR00056	Between Groups	.588	2	.294	2.271	.107
	Within Groups	18.902	146	.129		
	Total	19.490	148			
VAR00057	Between Groups	1.289E-03	2	6.443E-04	.007	.993
	Within Groups	12.992	146	8.899E-02		
	Total	12.993	148			
VAR00058	Between Groups	5.800E-02	2	2.900E-02	.533	.588
	Within Groups	7.942	146	5.440E-02		
	Total	8.000	148			

DISCUSSION

The study revealed that there were as many variants of agroforestry practices as land-use systems among farmers in the study area. These variants of agroforestry practices included; Alley cropping, Taungya, Mixed home garden system, and the tree crop system. The tree crop system was however dominant (Table 2) with the cultivation of cashew tree.

A one-way analysis of variance test carried out on the soil enhancement capacity of agroforestry practice indicated significant enhancement of soil fertility, through the practice of agroforestry. Agroforestry practices therefore, was one of the most promising long – term strategies for maintaining soil productivity in the humid savanna regions of the tropics where the hoe remains the primary implement for tillage. More majority of the respondents claimed they harvested between 21 and 30 sacks of agricultural produce (Fig. 3), from the little land under cultivation

Agroforestry practices were also claimed to be effective in reducing the length of bush fallowing among traditional shifting cultivators who adopted the practices (Table 3). It

spared the farmers the onerous task of clearing new land for farming each year due to declining productivity.

The success of agroforestry practices in the study area could be hinged on its capacity to increase farmer's low output and income generation hence, raising their socio-economic status. Given the reality of awareness among the farmers of multiple land use management, the need to improve on the existing agroforestry practices becomes necessary in the face of increasing population and limited land resource. Rural people have been submitted to have a wealth of indigenous knowledge (Hoskins, 2004) and have incorporated trees in production systems in areas where they lived for an extended period of time (Sene, 1985; Hoskins, 1985; Niamir, 1989)

The people in the study area had evolved various types of agroforestry practices through the use of local knowledge, and painstaking trial and error over a period of time. However, their perception of agroforestry (Table 8) was still cloudy and needed to be urgently addressed. Thus, for improvement on this land use option, there is need to find answers to such questions as: what multipurpose trees to use?; how many trees are needed? and; how best they could be arranged and managed. These will involve complex issues both biophysical and socio economic, and could only be solved by bringing practitioners and technologists together; the former to provide indigenous knowledge and experience, and the latter to tap the wealth of scientific understanding that could help the development of appropriate and functional technologies.

RECOMMENDATION

1. Agroforestry should form part of an integrated rural development programme that would meet more of the farmers' basic needs.
2. As a step toward integrated rural development, the promotion of agroforestry should be institutionalized, to complement the existing agricultural and forestry agencies, such as the agriculture/forestry research institutes and the agricultural credit institutions.
3. Technical assistance is needed to facilitate the spread of agroforestry practices and adequate information is necessary to keep farmers abreast of current trends and development in agroforestry technologies.
4. There is also the need for provision of economic incentives by the forestry department to farmers participating in agroforestry practices. Such incentives should include the provision of viable seeds and seedling through government nurseries, regeneration and exploitation tools and equipment that are beyond the reach of peasant farmers.
5. There is the need for further research and up-to date review of knowledge and idea among agroforestry practitioners and technologists. This would aid constant exchange of information which could promote the development and dissemination of technology.

6. Government should provide soft loans and insurance schemes to farmers willing to practice agroforestry as a means of encouraging them and cushioning the effect of long gestation of tree crops.

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