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Original Research Article

Factors influencing adoption of improved fallow among agroforestry farmers in Gbonyin Local Government, Ekiti State, Nigeria

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In response to land degradation problem, different agroforestry practices has been adopted as an efficient strategy to solve problem of soil nutrient depletion. This study examined factors influencing adoption of improved fallow in Gbonyin local government, Ekiti state, Nigeria. A total of one hundred and sixty pre-tested structured questionnaires were administered to respondents to collect data in selected villages. The study revealed that 88.8 % of the respondents are men with majority of them (71.88 %) above 50 years old. 65.01 % of the respondents have at least secondary education, while 51.25 % operates subsistence farming with cassava, yam, maize and cocoyam as major crops. The study revealed that 97.50 % of the respondents retained trees such as *Milicia excelsa, Terminalia superba* and *Mansonia altissima* on their farmland, while *Gliricida sepium, Leucaena leucocephala* and *Vernonia amygdalina* were major trees planted for yam stakes, firewood and soil fertility improvement among others. The respondents' choice of trees for improved fallow is dictated by planting materials availability, soil nutrient improvement and ease of propagation among others. To further enhanced adoption of improved fallow in the study area, government should establish farm settlements in strategic areas were agroforestry famers can acquire land with tenancy right for specific period of time.

Key words: Adoption, improved fallow, agroforestry farmers, gbonyin, Ekiti State

INTRODUCTION

Declining soil fertility is a critical problem affecting agricultural productivity and human welfare in tropical Africa. The continued degradation of land on a large scale in some developing countries poses a serious threat to socio-economic development, environmental and food security (Ajake, 2012). Environmental problems such as soil erosion, soil compaction, groundwater funnel, rocky desertification are increasingly serious in some arable land areas (Shen and Wu, 2016). In Nigeria about 70 percent of the population lives in the rural areas and majority of these people are smallholder farmers that depend on agriculture for their livelihoods (Jamala et al., 2013). These farmers face many challenges such as low yield from cropland resulting from poor soil fertility due to continuous cropping without external fertilization and irregular and decline in amount rain fall due to climate change effect. As a result of these challenges, smallholder farmers' productive capacity remains very low and this has led to high level of poverty among rural farmers (Opio, 2001).

In recent times, different agroforestry options have been introduced by researchers. Examples of these agroforestry practices are alley cropping and improved fallow. These practices involve planting of fast growing multipurpose tree species that are capable of fixing nitrogen, producing easily decomposable biomass and are compatible with cereal and other companion crops (Kwesiga et al., 2003). Improved fallow has been defines as the deliberate planting of leguminous tree/shrub species with the primary purpose of fixing nitrogen as part of a crop fallows (Sanchez, 1999). Species such as *Sesbania sesban*, *Tephrosia vogelii*, C*ajanus*

Table 1. Distribution of respondents in the study area

Villages	No of respondents
Ijan-Ekiti	40
Aisegba-Ekiti	40
Imesi-Ekiti	40
Egbe –Ekiti	40
Total (4)	160

cajan, *Gliricida sepium*, *Leucaena leucocephala*, *Acacia angustissima* and *Tephrosia candida* are good examples of tree legumes that has been identified to possess certain qualities that make them suitable for different agroforestry practices (Mafongoya et al., 2003).

In response to land degradation problem, different agroforestry practices has been adopted as an efficient strategy to solve the problem of soil nutrient depletion. Adoption occurs when one has decided to make full use of a new technology as the best course of action for addressing a need (Sahin, 2006). The Choice of a practice in agroforestry is dictated by several factors which may include socio-economic, environmental and mental processes. These adoption factors are governed by sets of intervening variables such as individual needs, knowledge about the technology and individual perceptions about method to be used to achieve those needs (Thangata and Alavalapati, 2003). In Ekiti State, improved fallow is a practice that involves planting of fast-growing species such as *Gliricida sepium* and *Leucaena leucocephala* as yam stake by agroforestry farmer and left on the farm during the fallow period to enhance soil fertility regeneration process through nitrogen fixation and litter accumulation.

Investigation of why some technologies are more readily adopted than others requires key information about the socio-economic and biophysical interaction that affects farmer in making decision (Thangata and Alavalapati, 2003). Lack of awareness and poor knowledge are also critical problems faced by agroforestry farmers. It is however, important to note that the rate of replacement of loss nutrient in the soil does not depend only on the length of fallow time but also on litter quality. This is the area where improved fallow with fast grown legume is very relevant when it comes to soil nutrient restoration. The aim of this study therefore is to investigate factors that influenced the adoption of improved fallow among agroforestry farmers in the study area.

METHODOLOGY

Study Area

Gbonyin Local Government of Ekiti State, Nigeria is located between Latitude 7° 25' and 7° 35' North and Longitude 5° 20' and 5° 35' East with average elevation of 250 meters above sea level. The local government covers about 391 km^2 of land mass with population of about 148,000 (NPC, 2006). The area enjoys tropical climate with two distinct seasons, the rainy season between April and October and the dry season between November and March. Temperature ranges between 21 °C and 28 °C with high humidity. The south westerly wind and the northeast trade winds blow in the rainy and dry seasons respectively. The vegetation is tropical rain forest.

Sampling technique

A Purposive sampling technique was employed to select four villages from the local government area. The selected villages are almost equal in population with similar social amenities and level of farming activities. Fourty respondents were randomly selected for interview in each of the selected villages. The total number of respondents thus selected was one hundred and sixty (160) (Table 1). The study was conducted in 2017.

Data collection and analysis

Data were collected with the use of a pre-tested semi-structured questionnaire supplemented with oral interview. Administration of the questionnaires to the respondents was done through personal contact, this method allows for total retrieval of the questionnaire. Data collected from the study were analyzed using descriptive statistics expressed in frequencies and percentages and presented in tables.

RESULTS

Socio-economic characteristics and farming practice of respondents in the study area

Result on sex (Table 2) show preponderance of male respondents in the study area with 88.8 %. Age distribution shows that majority of the respondents are fairly old people as 71.88 % were over 50 years old. Respondent's marital status shows that 81.25 % of the respondents are married. While 8.75 %, 6.88 % and 3.13 % are singles, widows and divorcees respectively. Result on educational background shows that 65.01 % of the respondents have at least secondary education. The result also revealed that 89.38 % of the respondents' have household size ranging from 4 to > 10 members.

Table 3 shows that 63.75 % of the respondents were full time farmers, while 26.25 % were part-time farmers. Respondents' scale of farming revealed that 51.25 % practiced pure subsistence farming, while 48.75 % operate on commercial/subsistence scale of farming. Result on farming experience shows that 78.12 % of the respondents have farming experience of more than 5 years, while family members form highest source of labour in the study area. Respondents' farm size shows that 35.62 % and 37.50 % of the respondents have their farm size less than 5 hectares and 5-10 hectares respectively. Land ownership through inheritance has the highest percentage (74.38 %) followed

by purchase (15.62 %) with most of the respondents (81.25 %) having their farms located within 1-10 km away from homes.

Result on crop cultivated respondents shows that cassava, yam and maize has 11.08 % each followed by cocoyam pepper and tomatoes with 8.10 %, 7.27 % and 6.8.72 % respectively, while kolanut has the least value of 1.17 %.

Table 2. Socio-economic characteristics of respondents

Characteristics	Frequency	Percentage (%)
Sex		
Male	142	88.8
Female	18	11.2
Age		
30-40 years	24	13.12
41-50 years	51	15.00
51-60 years	64	40.00
>60 years	21	31.88
Marital status		
Married	130	81.25
Single	14	8.75
Divorced	05	3.12
Widow	11	6.8
Educational Background		
Primary	41	25.62
Secondary	73	45.63
Tertiary	31	19.38
No formal education	15	9.37
Household Size		
1-3	17	10.62
4-7	73	45.63
8-10	49	30.63
>10	21	13.12
Total	**160**	**100**

Ranking of tree species used for agroforestry practices

Result in Table 5 shows that 27 different tree species that grown naturally are retained by respondents on their farmland, with *Milicia excelsa* ranked 1st (9.38 %), *Terminalia superba* ranked 2nd with 8.43 %, while *Mansonia altissima,* and *Albizia zygia* ranked 3rd with 5.20 % each (Table 5). The result also shows that *Gliricidia sepium* ranked 1st among tree species planted by the respondents, this is followed by *Leucaena leucocephala, Vernonia amygdalina* and *Senna siemea* in the 2nd, 3rd, and 4th position respectively (Table 6).

Factors influencing adoption of improved fallow

Result on respondents' source of planting material in the study area shows that cutting from previous fallow has the highest percentage (34.18 %), while wildlings from seeds and private nursery accounted for 30.98 %, and 19.01 %, respectively (Table 7). Result in Table 8 shows respondents' reasons for retaining/planting of trees; the result shows that staking ranked 1st with 25.30 %, this is followed by firewood (22.65 %), soil fertility (22.47 %) and medicinal purposes in the second and third position respectively.

Table 9 shows factors that dictate the choice of tree retained /planted by respondents in the study area. The result shows that availability of planting materials ranked 1st with 16.79 %; this is closely followed by soil nutrient improvement (16.36 %) and ease of establishment (16.03) % in the second and third position respectively.

Table 3. Distribution of respondents by farming practices

Farming practices	Frequency	Percentage (%)
Farming Status		
Full time	102	63.75
Part time	58	26.25
Scale of farming		
Subsistence	82	51.25
Commercial/subsistence	78	48.75
Years of experience		
1- 5 years	11	6.88
6-10 years	24	15.00
11-15 years	34	21.25
16-20 years	45	28.12
21 and above	46	28.75
Source of labour		
Family members	109	68.12
Self	21	13.13
Hired labour	20	12.5
Group labour	10	6.25
Farm size		
< 5 hectares	57	35.62
5-10 hectares	60	37.5
11-15 hectares	29	18.13
16-20 hectares	10	6.25
>21 hectares	4	2.5
Land ownership		
Inheritance	119	74.38
Purchase	25	15.62
Rent	8	5.0
Gift	16	10
Farm distance		
< 1km	24	15.0
1 – 5km	46	28.75
6 – 10 km	84	52.5
> 10 km	6	3.75
Total	**160**	**100**

DISCUSSION

Observation from this study has shown preponderance of subsistence farming in the study area with majority of the respondents operating farm size of less than 5 to 10 hectares (Table 3). The subsistence level of farming observed in this

study could be traced to active involvement of high percentage of fairly old men in farming activities in the study area (Table 2). Similar observation has been reported by Ajewole (2013) that a unit increase in age will reduce the probability of large scale farming among agroforestry farmers. Also the dominancy of inheritance method of land ownership is another factor that could have influence small scale farming in the study area as this method; due to land

Table 4. Distribution of respondents by crops cultivated

Crops cultivated	*Frequency	Percentage (%)
Cassava	160	11.08
Yam	160	11.08
Maize	160	11.08
Cocoyam	117	8.10
Pepper	105	7.27
Tomatoes	97	6.72
Vegetables	91	6.30
Banana/plantain	80	5.54
Okra	76	5.26
Cocoa	70	4.85
Garden egg	57	3.95
Oranges	48	3.32
Oil palm	40	2.77
Melon	38	2.63
Pineapple	35	2.42
Cashew	31	2.14
Pigeon pea	22	1.52
Rice	20	1.38
Sweet potatoes	19	1.31
Kolanut	17	1.17
Total	1443	100

*Multiple responses

Table 5. Distribution of respondents by tree species retained

Scientific Name	*Frequency	Percentage (%)	Ranking
Melicia excels	110	9.38	1st
Terminalia superba	99	8.43	2nd
Mansonia altissima	61	5.20	3rd
Albizia zygia	61	5.20	3rd
Elaeis guineensis	59	5.00	5th
Pterygota macrocarpa	57	4.85	6th
Antiaris Africana	56	4.77	7th
Amphimas pterocarpoides	45	3.83	8th
Ceiba pentandra	44	3.75	9th
Alstonia boonei	43	3.66	10th
Triplochiton scleroxylon	41	3.49	11th
Irvingia gabonensis	40	3.41	12th
Parkia biglobosa	40	3.41	12th
Terminalia ivorensis	39	3.32	14th
Afzelia Africana	39	3.32	14th
Pycnanthus angolensis	36	3.06	16th
Blighia sapida	32	2.72	17th
Celtis zenkeri	32	2.72	17th
Khaya grandifoliola	31	2.64	19th
Nauclea diderrichii	31	2.64	19th
Chrysophylum albidum	29	2.47	21st
Caesalpinia bonduc	29	2.47	21st
Cordia millenii	27	2.30	23rd
Daniellia ogea	27	2.30	23rd
Ficus mucuso	26	2.21	25th
Terminalia glaucescens	22	1.87	26th
Entandrophragma cylindricum	17	1.44	27th
27	1173	100	

`*Multiple responses

Table 6. Distribution of respondents by tree species planted

Scientific Name	*Frequency	Percentage (%)	Ranking
Gliricida sepium	160	19.77	1st
Leucaena leucocephala	131	16.19	2nd
Vernonia amygdalina	116	14.33	3rd
Senna siamea	106	13.10	4th
Tectonia grandis	102	12.60	5th
Gmelina arborea	99	12.23	6th
Terminalia superba	95	11.74	7th
7	809	100	

*Multiple responses

Table 7. Distribution of respondents by source of planting material

Source of Planting Material	*Frequency	Percentage (%)	Ranking
Cutting from previous fallow	160	34.18	1st
Wildlings from seeds	145	30.98	2nd
Private nursery	89	19.01	3rd
Government nursery.	40	8.54	4th
Personal nursery	34	7.26	5th
Total	468	100	

*Multiple responses

Table 8. Distribution of respondents by purpose for retaining trees

Tree retention purpose	*Frequency	Percentage (%)	Ranking
Staking	143	25.30	1st
Firewood	128	22.65	2nd
Soil fertility	127	22.47	3rd
Medicinal purposes	78	13.80	4th
Timber	54	9.55	5th
Wind break	23	4.07	6th
Erosion control	12	2.12	7th
Total	565	100	

*Multiple responses

fragmentation among the family members only allows individual farmer access to very small portion of land.

The wide range of crops planted by farmers coupled with large volume of trees retained simultaneously on their farmland (Tables 4 and 6) suggests that farmers in the study area have long been practicing agroforestry in the form of agrisilviculture. In this practice farmers in the study area plant different kinds of crops simultaneously on the same piece of land to produce wide range of products thereby making maximum use of the available small land to provide food and other products for their immediate household needs. This assertion is in consonance with the findings of Aiyeloja and Ajewole (2006).

The planting of exotic leguminous trees especially *Gliricidia sepium* and *Leucena leucocephala* by farmers on their farmland during fallow as observed in this study, indicate farmers' appreciation and adoption of improved fallow in the study area. Similar observation has been reported by Matata *et. al*., (2008). The adoption and practice of improved fallow by agroforestry farmers as observed in this study could have been influenced by some factors ranging from social, economic and environmental as reported by Ajake (2012). High literacy level observed among the respondents with majority of them having at least secondary education is indeed a factor that has help in acceptability of improved fallow in the study area. This high level of educational background of the respondents could be an advantage for forest extension officer to explore while disseminating information to them on modern agroforestry practices for adoption. This submission is in line with that of Awolola and Ajibefun, (2012); Matata et al. (2008) who separately reported that educated farmers are more likely to access information better on modern production techniques.

Another factor that could have influenced the adoption of improved fallow in the study area is the prevalence of

Table 9. Distribution of respondents by factors dictating the choice of tree retained/planted

Choice of preferred species	*Frequency	Percentage (%)	Ranking
Availability of planting materials	156	16.79	1st
Soil nutrient improvement	152	16.36	2nd
Ease of establishment	149	16.03	3rd
Multiple products	144	15.50	4th
Adaptable to harsh weather	117	12.59	5th
Provision of shade for young crop	90	9.68	6th
Easy decomposition of litter	65	6.99	7th
Not prone to wind throw	48	5.16	8th
Palatable for animal fodder	18	1.93	9th
Total	939	100	

*Multiple responses

inheritance and purchase method of land ownership among the respondents. These methods usually give agroforestry farmers in the study area permanent tenancy right whereby they can afford to put the land under fallow as long as they desired without the fear of anybody encroaching into it. This assertion further corroborate the report by Thangata et al. (2002) that land availability improve agroforestry practices. Easy access to planting materials through cutting from previous farmland and wildlings from seed broadcast on the previous year farmland (Table 9) could have also favour the practice of improved fallow among agroforestry farmers in the study area. In this case farmers do not spend money on planting stock neither do they go far before getting their planting materials. This finding is in line with Ajayi (2007) who reported that availability, sufficient amounts of seedlings and good quality seed were factors that favour the widespread uptake of improved fallows.

Observed multiple benefits such as provisions of yam stake, firewood, soil fertility improvement among others offered by improved follow to the respondents in the study area are other factors that could have favour its adoption. This assertion is in agreement with the submission of Adewusi (2006) and Jamala *et. al*., (2013) who stated that agroforestry farmers do plant or retain trees on their farmland both for food, income, soil improvement, environmental amelioration and shade during harsh weather condition.

CONCLUSION AND RECOMMENDATION

The result from this study has revealed that agri-silviculture is the popular form of agroforestry system practiced in the study area. Under this system, observation revealed the wide spread adoption of improved fallow among agroforestry farmers in the study area. The study also revealed that respondents in the study area appreciates the importance of tree on their farmland as twenty seven (27) different tree species were retained while another seven (7) multipurpose tree species were planted; purposely for production of yam stakes, firewood, soil fertility improvement and many other services. The study also revealed that availability, ease of propagation, ability to improve soil nutrient through fixation of nitrogen from decomposed litter fall and ability to produce two or more product or services are some of the factors that determines the choice of trees used in improved fallow among agroforestry farmers in the study area. Since improved fallow system requires some level of farmers' tenancy right on agricultural land as observed in the study, government should make land available for farmers through establishment of farm settlements in strategic area in the state. Also opinion of farmers must be sort by government when designing policy relating to agroforestry to ensure their effective participation on practices that will proffer solution to land use problem.

Conflict of interests

The author declare that they have no conflicting interests.

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