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Oyewole A L ● Oyewole S O ● Isola B F ●
Aina-Oduntan O A



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Maiduguri, Nigeria

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EFFECT OF AGROFORESTRY PRACTICES ON FOOD SECURITY STATUS OF FARMERS IN OGUN STATE, NIGERIA

OYEWOLE A L^a • OYEWOLE S O^{b*} • ISOLA B F^b • AINA-ODUNTAN O A^b

^aDepartment of Agriculture and Extension Management, Federal College of Forestry, Ibadan, Nigeria

^bForestry Research Institute of Nigeria, Forest Hill, Jericho, Ibadan, Nigeria

*Corresponding e-mail: shola4delord@yahoo.com

Phone: +234706-397-0476

ABSTRACT: Agroforestry is one of the sustainable approaches that could help to achieve food security objective without degrading the environment. This study evaluates adoption of agroforestry and its impact on food security status of farmers in Ogun State of Nigeria. A multi-stage sampling technique was used to select 196 maize intercrop farmers. Primary data were collected using structured questionnaire and analysed using descriptive statistics, food security scale and probit regression analysis. The mean food security score among the adopters of agroforestry was 0.5 and significantly lower ($P < 0.05$) compared to the estimated mean score obtained for non-adopters of agroforestry. Majority (93.94%) of agroforestry adopters were food secure while only 9.68 are food secure among non-adopters of agroforestry, the identified socio-demographic factors influencing food security status among the respondents were sex, age, education and farm size. The decision to adopt agroforestry among the farmers in the study area were influenced by socioeconomic factors such as sex, marital status, age, farm size, experience in farming and membership of association. The study revealed that efforts at reducing food insecurity should consider agroforestry option with policy strategy that will facilitate access to farmland and integrated approach that promotes education as well as agroforestry training among farm households.

Keywords: Agroforestry, Adoption, Food security, Farmers, Ogun State, Nigeria

1. INTRODUCTION

Food is the most basic of human survival need (Chiappero-Martinetti, 2014). However, the population of the undernourished people still constitute a major problem in most parts of the world. According to Food and Agriculture Organization (2015), about 795 million people in the world remained undernourished with greater population located in the developing countries. The U.S Government Global Hunger and Food Security

Initiative report (2016) further revealed that nearly 800 million people around the world are chronically undernourished, two billion are micronutrient deficient, and 159 million children under five are stunted, robbing them of opportunities to reach their full potential and limiting economic growth in their countries. This is the implication of emerging trends such as urbanization, migration, dietary changes and climate change which require new approaches and a new commitment of resources and effort.

Global food demand which is expected to increase by 60% by 2050 can only be met by increasing agricultural production by 70-100% through the engagement of smallholder farmers (FAO, 2015). Several efforts are geared globally in ensuring improved world food supplies but food insecurity still remains prevalent, particularly in the global southern nations of Asia and Africa, and in Nigeria, malnutrition has resulted in death of many of its citizens. In tackling this, agroforestry, a strategy to increase yields, productivity, food security and resilience to climate impact is an option.

Agroforestry, defined as a land use system in which trees and shrubs are grown in association with crops or animals in the same land unit, has the potential to arrest land degradation and rural poverty through its service and productive functions such as cultivation of fruits for income and nutrition security, supply high quality fodder for livestock, wood for household energy, timber/poles for construction and income generation (Jama *et al.*, 2006). Many research have revealed that agroforestry practices has the ability to slow or reverse land degradation, sink carbon from the environment and provide ecological and economic benefits to the rural communities. Apart from the soil reclamation potential of the trees, they also provide ecosystem services and functions in addition to the products and services that motivated farmers to plant or preserve them (Adene and Oguntade, 2016; Cooperate Nigeria, 2011).

Considering the rise in food shortages and imminent change in climate, the system of agroforestry has continued to experience a surge in interest from the academic, research and development communities, as a cost-effective means to enhance food security, while at the same time contributing to climate change adaptation and mitigation. Recently, there has been a reported increase in the practice and adoption of agroforestry by farmers as demonstrated by Coulibaly (2016). Although, this adoption has not been widespread in many parts of Africa especially Nigeria, due to a number of reasons related to the perceived feat of agroforestry practices, the political and socioeconomic environment, farmers' disposition towards trees on their farms as well as inadequate policy-support (Ibnouf, 2015).

Agroforestry is the only response that is desirable to growing pressures on land and resources intensification (Muschler, 2015). There is an urgent need for ecological friendly food production. Agroforestry has a role to play in the direct provision of tree foods such as fruits and leafy

vegetables and by supporting staple crop production. It could also raise farmers' incomes through the sale of tree products and surplus staples as well as provision of fuel wood for cooking. It is also needed for the sustainability of ecosystem services (Adepoju *et al.*, 2018). Considering the great importance of agroforestry, it is essential to investigate its impact on food security status of farmers. This study therefore seeks to explore agroforestry adoption and its impact on food security status of small holder farmers in Ogun state.

2. METHODOLOGY

2.1. Study Area

The study was conducted in selected agricultural zone of Ogun State with maize farmers as target respondents. Ogun State lies approximately between latitude 3° 30' N and 4° 30' N and longitude 6° 30' E and 7° 30' E (Ambali *et al.*, 2012). The State has two distinct seasons with short dry season which lasts for four months from November to February. It lies within humid tropical agro-ecological zone. The area supported agricultural production with maize as one of the main crops by the farmers.

2.2. Sampling Procedure and Sample Size

The respondents of the study were 196 farmers which were selected through a multistage sampling procedure. In the first stage purposive method was employed to select two agricultural zones based on agricultural development classification. These zones are Abeokuta and Ilaro. The second stage selection was based on random method. Selection of one agricultural block from each of selected zones was made and four cells were selected from each block. Proportional sampling was used to select the farmers after the determination of sample size using a simplified formula provided by Kabatesi and Mbabazi (2016). Using 5-point likert scale rating the sampled farmers were grouped into adopter and non-adopters of agroforestry practice for the purpose of estimating the impact of agroforestry practice on food security status. The study made use of primary data and this were collected through the use of structured questionnaire.

2.3. Analytical Techniques

Descriptive statistics such as frequency count and percentages were used to analysis the socio-demographic characteristics of the respondents.

2.3.1. Food security scale

The food security scale was developed by Freedom From Hunger (FFH), an international development organization and have been used in similar studies (Gabriela and Manfred 2007; Ibrahim *et al.*, 2009). This study made use of 12 items (Appendix 1) covering all the dimensions of food security (availability, accessibility, utilization and stability). The respondents were classified into food security groups as food secure, moderately food secure and non-food secure.

2.3.2. Probit regression model

Factors influencing adoption of agroforestry were identified using probit model. The probit model assumed that response variable Y_i is a binary with only two possible outcomes (Adoption =1 and non adoption =0) and the vector of independent variable X_i which assumed to influence Y_i . The probit model takes the form:

$$\Pr(Y_i = 1/X_i) = F(\beta^i X_i) = \theta(\beta^i X_i)$$

Where Pr denotes the probability, Y_i is the binary choice variable representing adoption and θ is The Cumulative Distribution Function (CDF) of the standard normal distribution. β is a vector of unknown parameters. X_i represents a vector of explanatory variables.

The factors explanatory variables assumed to influence adoption of agroforestry are

X_1 = Sex

X_2 = Age (years)

X_3 = Marital status

X_4 = Education (Number of years in formal schooling)

X_5 = Farm size (hectare)

X_6 = Experience (years)

X_7 = Household size (number in the household)

X_8 = Membership of social organization (years of membership)

3. RESULTS AND DISCUSSION

3.1. Socioeconomic Characteristics of the Farmers

The results presented in Table 1 showed the socio-demographic characteristics of the farmers. It was revealed that male farmers formed the majority of the respondents (70.9%). Less than one third 29.08% were female. Most (78.57%) of the respondents were married. About 34% of the respondents were within 21-30 years. Those above 60 years that could be classified as non working

group were 1.02%. The percentage age of farmers who are above 60 years and could be classified as non working population were just 1.02%. The average age of 36years is an indication that the respondents were youth and still in active age group. This is a good indication for agricultural production especially agroforestry practice. Age is an important socioeconomic factor to determine how active and productive a farmer could be (Amaza *et al.*, 2009). The respondents had one form of education or the other. About 39% had tertiary education. Those without formal education constitute 10.2%. This is a sign of high literacy among the respondents. The respondents could be classified as medium scale farmers with average farm size of 7.1 hectares considering farmers classification by Ojuekaiye (2001), who regarded small scale farmers as those cultivating farm size between 0.1-6.0 hectares. Majority (60.20) of the farmers had household size ranged between 6-10 people per household. The result further showed that the average household size was 5 members per household. This is a good indication for family labour especially if household member fall within the working age group. The average farming experience among the farmers was 20 years. The implication of this is that farmers are familiar with production practices and have been producing agricultural crops for a long time. The result revealed a good extension activity in the area as 78.6% had contact with extension during the farm production year considered in the study.

Table 1: Farmers socio-demographic characteristics

Variable	Frequency	Percentage
Sex		
Male	139	70.92
Female	57	29.08
Marital Status		
Married	154	78.57
Single	42	21.43
Age (years)		
21-30	68	34.69
31-40	67	34.18
41-50	52	26.53
51-60	7	3.57
>60	2	1.02
Mean	36	
Education		
No formal education	20	10.20
Primary education	6	3.06
Secondary education	93	47.45
Tertiary education	77	39.29

Table 1 Cont'd

Farm size (hectare)		
1.1-5.0	94	47.96
5.1-10.0	37	18.88
>10	65	33.16
Mean	7.1	
Experience (years)		
1-10	68	34.69
11-20	78	39.80
>20	50	25.51
Mean	14	
Household size		
1-5	76	38.78
6-10	118	60.20
>10	2	1.02
Mean	5	
Extension contact		
Yes	153	78.06
No	43	21.94
Total	196	100.00

3.2. Food Security Status of the Respondents

3.2.1. Proportion of adopters and non adopters of agroforestry by food security score

The result presented in Table 2 showed the distribution of respondents based on food security score by the adopters and non-adopters of agroforestry. The greater percentage of respondents among agroforestry adopters were found in the score of zero. Those above the bench mark of one to be classified as food insecure constitute 26.7%. On the other hand, none of the respondents among non-adopters of agroforestry were found in the score of zero. Those found in the score of one which represent the food secured farmers were 6.45 percent. The respondents in this category were distributed up to score of nine in the food security scale of twelve points. The mean score among the adopters of agroforestry was 0.5 and significantly lower ($P < 0.05$) compared to the estimated mean score obtained for non adopters of agroforestry. The implication of this finding is that agroforestry improves food security status of the respondents. Agroforestry is considered a climate-smart agricultural practice that can significantly improve food security through diversification of food sources, additional income and improves resilience of the production system, thereby improving food availability, food accessibility, utilization and food production system stability (Adepoju *et al.*, 2018). Achieving food security among farming households is one of the socioeconomic benefits of agroforestry aside poverty alleviation.

Table 2: Proportion of respondents by food security score

Food security score	Adopters (Agroforestry)	Non adopters (Agroforestry)
0	121(73.33)	-
1	34(21.61)	2(6.45)
2	-	2(6.46)
3	3(1.82)	-
4	2(1.21)	2(6.46)
5	1(0.64)	6(19.35)
6	3(1.82)	2(6.45)
7	-	5(16.13)
8	1(0.61)	7(22.58)
9	-	5(16.13)
Total	161(100.00)	31(100.0)
Mean	0.50	6.19
z-statistics	12.89***	

Figures in parentheses are percentages *** = $P < 0.05$

3.2.2. Proportion of respondents by food security status

The result presented in Table 3 showed the distribution of respondents by food security status. Majority (93.94%) of agroforestry adopters were food secure. Those in the category of moderately secured household were 3.64%. Only 2.42% were not food secure. The result was contrary in the case of non-adopters. About 45.16% were not food secure. Those that were food secure constitute 9.68%. The disparities between the adopters and non-adopters could be attributed to the practice of agroforestry. Adepoju *et al.* (2018) opined that Agroforestry is a practice that is sustainable and can support food security, climate change mitigation and adaptation. In addition to reducing greenhouse gases by capturing carbon, agroforestry systems could improve resilience to climate variability and extreme conditions that can reduce the productivity of crop. This study is in line with earlier reports that agroforestry is source of food and could enhance household food security (Abdulhamid *et al.*, 2017))

Table 3: Proportion of respondents by food security status

Food security score	Adopters (Agroforestry)	Non adopters (Agroforestry)
Food secure	155(93.94)	3(9.68)
Moderately food insecure	6(3.64)	14(45.16)
Food insecure	4(2.42)	14(45.16)
Total	165(100.0)	31(100.0)

Values in parentheses are percentages

3.3. Factors Influencing Agroforestry Practice among Farmers

The result of probit model presented in Table 5 showed the factors influencing the practice of agroforestry in the study area. The determining factors of agroforestry include sex, marital status, age, farm size, experience in farming and membership of association. The influence of these factors supports the report of various findings that socioeconomic variables have a great role to play in farmers decision to adoption agroforestry practice (Oino and Mugure, 2013; Akinwalere, 2017; Kinyih *et al.*, 2020). The coefficient obtained for the size of land was positive and significant at 1% probability level. This suggests that the larger the farm size, the probability that farmers would adopt agroforestry practice. It means that farmers with large farms practice the system more than those with smaller farms (Oyewole *et al.*, 2015). The estimated coefficients obtained for sex and marital status were significant and exert negative influence on adoption of agroforestry. These indicate that male farmers who are married have more tendency to adopt agroforestry than female farmers. The parameter estimated for Membership of association was positive and significant at 5% level of probability indicating that the likelihood of adopting agroforestry would increase due to participation in social organization by the farmers. Membership of social organization could expose the farmers' sources of information that could arouse the awareness and their interest in planting trees with crops (Akinwalere, 2017).

Table 5: Factors influencing adoption of agroforestry

Variable	Coefficient	Standard Error	T-value
Constant	12.746	7.573	1.68*
Sex	-4.002	2.103	-1.90*
Marital status	-3.694	1.758	-2.10**
Age	0.229	0.184	1.24
Education	1.192	0.951	1.25
Farm size	1.505	0.823	1.83*
Experience	0.421	0.217	1.94*
Household size	0.110	0.445	0.25
Membership of association	1.529	0.661	2.31**
Log likelihood	-18.78		
Pseudo R ²	133.59***		
LR Chi-square	0.78		

*** = P<0.01

**= P<0.05

*=P<0.10

4. CONCLUSION AND RECOMMENDATIONS

1. Adoption of agroforestry improves food security status of the respondents.
2. Less than one tenth of the adopters of agroforestry were not food secure while about half of non adopters of agroforestry were not food secure.
3. Decision to adopt agroforestry was influenced by age, farm size, farming experience, membership of social organization and marital status.
4. Efforts at reducing food insecurity should consider agroforestry option with policy strategy that will facilitate access to farmland and integrated approach that promotes education as well as agroforestry training among farm households.

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APPENDIX 1

Food security scale construction

SN	ITEM	Yes (1)	No (0)
1	I (we) couldn't afford to eat balanced meal In the last 12 months		
2	In the last 12 months did you or other household member cut the size of your meals or skip meals because there was not enough or money to buy food?		
3	In the last 12 months, were you and your household member worried that your food will run out before you have food or money to buy more		
4	In the last 12 months, were you hungry but did not eat because you could not afford enough food		
5	In the last 12 month did you have to eat same food daily because you did not have varieties of food		
6	In the last 12 month did you ever eat less than you felt you should because there was no food		
7	Did you or any adult household stop eating for a whole day because there was no food		
8	Did you rely on few kinds of low-cost food because you do not have money		
9	Did you ever comment that the food you bought did not have money to get more		
10	Did you or any adult household member lose weight during the past 12 months because you did not eat enough food		
11	I could not feed my children with balanced and enough meal because there was no enough food		
12	Which of the following describes your household food consumption during the past 12 months? (a) always have enough of what is required () (b) Enough but not always what is required() (c) sometimes enough food (d) often not enough food()	2-4 = 1	