Greener Journal of Agricultural Sciences
Vol. 9(2), pp. 242-249, 2019
ISSN: 2276-7770

DOI Link: http://doi.org/10.15580/GJAS.2019.2.052419097
http://gjournals.org/GJAS

Contribution of Agroforestry for Livelihood Improvement in Wamakko Local Government Area, Sokoto State, Nigeria

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ARTICLE INFO

Article No.: *052419097*
Type**:** *Research*
DOI: *10.15580/GJAS.2019.2.052419097*

Submitted: *24/05/2019*
Accepted: *28/05/2019*
Published: *13/06/2019*

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Keywords: *Agroforestry; livelihood; Socio-economic characteristic*

ABSTRACT

The study assessed the contribution of agroforestry for livelihood improvement in Wamakko Local Government area of Sokoto State. Four (4) districts were purposively selected for the study based on the dominance of agroforestry practices in the study areas. Two villages were randomly selected from each of the selected districts. From each village, 30 farmers were conveniently selected given a total sample size of 240 respondents. Structured questionnaire were administered, retrieved and analysed.Data were analyzed using descriptive statistics. Results of the study indicated that, majority (70.8%) of the farmers were within the age bracket of 15 to 30 years and 78.3 percent were married and they had attended at least one form of formal education or the other. Furthermore, 79 percent source information about climate change from family and friends, while 52.1 percent stated that high temperature was the main climate change experience they had. Majority (wms=3.87) of the farmers stated that dispersed tree on cropland was highly practiced. To encourage agroforestry practice, incentives through the distribution of improved tree seedlings would assist greatly.

INTRODUCTION

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Carney, 1998). Climate change is a major challenge for agriculture, food security and rural livelihoods for billions of people including the poor in most developing countries (Carney, 1998).

During the past 30 years, agroforestry has progressed from being a traditional practice with great potential to the point where development experts agree that it provides an important science-based pathway for achieving important objectives in natural resource management and poverty alleviation (Lin, 2010). Despite its ubiquitous use by smallholder farm families, there is inadequate awareness about the potential of agroforestry to benefit millions of households trapped in poverty. We need a global 'agroforestry transformation' to mobilize science and resources to remove the socio-economic, ecological and political constraints to widespread application of agroforestry innovations. Building on three decades of work with smallholder farmers in Africa, Asia and Latin America, coupled with strategic alliances with advanced laboratories, national research institutions, universities and non-governmental organizations (NGOs) across the globe, the World Agroforestry Centre and its partners are poised to foster such an agroforestry transformation (Lin, 2010).

Trees play a crucial role in almost all terrestrial ecosystems. They provide a wide range of products and services to rural and urban people. As natural vegetation is cleared for agriculture, trees are integrated into productive landscapes – this practice is known as agroforestry. Agroforestry is practiced by millions of farmers and has been a feature of agriculture for millennia (Lin, 2010). It encompasses a wide range of working trees that are grown on farms and in rural landscapes and includes the generation of science-based tree enterprise opportunities that can be important in the future. Among these are: fertilizer trees for land regeneration, soil health and food security; fruit trees for nutrition and income; fodder trees that improve smallholder livestock production; timber and fuel wood trees for shelter and energy; medicinal trees to combat disease, particularly where there is no pharmacy; and trees that produce gums, resins or latex products (Garrity, 2004). Many of these trees have multiple uses, each providing a range of benefits. An estimated 1.2 billion rural people currently practice agroforestry on their farms and in their communities, and depend upon its products (World Bank, 2000). Their tree-based enterprises help ensure food and nutritional security, increase their income and assets, and help solve their land management problems. Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems, there are both ecological and economical interactions between the different components (Schoeneberger, 2009).There are many types of agroforestry systems that are employed in a number of regions of the world and at different levels of complexity (Montagnini and Nair, 2004). Silvi-pastoral systems are agricultural systems where trees are planted within a pasture field to provide feeds and shade as well as food and fuel for the farmer. Another type of agroforestry is the intercropping of crops within hedgerows of trees called agrosilvicultural system to provide windbreaks/shelterbelts for the crops and increase the soil stability of the region. Mixed-use forests are a type of agroforestry that allows for multiple crops to be produced in a small physical land area, increasing the temporal and structural diversity of the ecosystem, and the net benefits or negatives are largely based on the design of the system. The range of agroforestry systems possible can potentially allow for many different types of adaptation under a range of conditions (Schoeneberger, 2009). However, levels of co-benefits depend on the amount of diversity integrated into the system, as more diversity within the agroforestry system will lead to greater co-benefits.

According to Rogers (2003), adoption occurs when one has decided to make full use of the new technology as a best course of action for addressing a need. Adoption is determined by several factors including socio-economic variables such as individual needs, knowledge about the technology and individual perceptions about methods used to achieve those needs (Thangata&Alavalapati, 2003).

METHODOLOGY

Study Area

The study was carried out in Wamakko Local Government Area of Sokoto State. Wamakko is 10 km west of Sokoto city. The LGA was created in 1991. The LGA has Ten (10) Districts: Dundaye, Wamakko, Gumbi, Gumburawa, Gedawa, Kalambana, Wajeke, Arkilla, Gwiwa, and GidanBubu. The study area is located on latitude 13°-13°2′16″N and longitude 5°-5°5′37″E (NGIA, 2016). It is bordered to the north by Tangaza Local Government, to the south by Bodinga and Yabo Local Government Areas, west by Silame Local Government, and to the east by Sokoto and Kware Local Government Areas. It has an area of 697 km² and a population of 208,250 (NPCN, 2011). The major occupation of the people are farming, fishing and trading. The main ethnic groups are Hausa and Fulani, other Nigerian tribes also reside and live peacefully with the indigenes of

Wamakko Local Government Area (Roger, 2006; SSMIYSC, 2013).

Sampling Procedures and Sample Size

Four (4) districts were purposively selected out of ten (10) districts in Wamakko local government area, for the study based on the dominance of agroforestry practices in the study areas. The districts selected are Dundaye, Gumburawa, GidanBubu and Wamakko. Two villages were randomly selected from each of the selected districts making eight (8) villages. From each village, 30 farmers were conveniently selected given a total sample size of 240 respondents.

Data Collection

Two hundred and forty (240) structured questionnaires were administered, retrieved and analysed. Data collected were on the socio-economic characteristics of the respondents, usefulness of agroforestry practices and level of adoption of agroforestry in the study area.

Data Analysis

Data collected were analyzed using both descriptive statistics (frequencies and percentages). Statistical Package for Social Sciences (SPSS) Version 20.0 was used for the analysis.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Farmers

From table 1, the majority (70.8 %) of the farmers fell within the ages of 15 to 30 years. In addition to this, 29.2 percent fell within the ages of 31 years and above in the study area. This implies that the majority of the agroforestry farmers were within the active age to provide labour force; younger farmers participated more than older ones in the farming activities. This is supported by Ogungbile*et al*. (2002) who stated that younger farmers are more likely to adopt an innovation than older farmers because of strength, better education and more exposure to new ideas.

Gender

All of the farmers involved in agroforestry practice were men. Men who were mostly the household heads had more access to land and participated more in outdoor activities than women. The predominance of men in agroforestry practice was due to the cultural and traditional practices which restricted women from farming activities. This finding agreed with Ango*et al.* (2011) who reported that majority of rural populace in the northern part of the country engage in farming, while the female folk partake only in rearing of children, domestic and other house chores and processing of agricultural produce.

Marital Status

Majority of the farmers (78.3%) were married while 21.7 percent of them were single. This could mean that the married individuals were more committed to their responsibilities and worked very hard to earn a living because of the responsibilities they shoulder. The finding is supported by Olarinde*et al.* (2008) who reported that one of the most important factors which determine technical efficiency of a business is the marital status of the individual.

Family Size

A total of 78.3 percent of the farmers had family size of 1 to 10 persons, this implies that the small family size could be as a result of small income and poverty. Also the labour was limited because of the small size of the family, this is in agreement with Adamu (1997) who stated that the plot of land which rural populace possess are mostly small in size because of the nature of inheritance in which the children share the land left behind when their parent die. On the other hand, 8.8 percent of the farmers had family size of between 16 persons and above. Other studies indicated that large family size is expected to enable farmers to take up labour intensive activities (Anley*et al.,* 2007; Birungi, 2007 and Nyangena, 2007).

Table 1: Distribution of Farmers According to their Socio–Economic Characteristics

Variables	Frequency	Percentage (%)	Variables	Frequency	Percentage (%)
Age (years)			**Level of Education**		
15-20	49	20.4	Quranic	61	25.4
21-25	72	30.0	non formal	36	15.0
26-30	49	20.4	Primary	41	17.1
31- above	70	29.2	Secondary	32	13.4
Total	240	100.0	Adult	32	13.3
Gender			Tertiary	38	15.8
Male	240	100.0	Total	240	100.0
Marital status			**Farming experience**		
Single	52	21.7	1-5	75	31.3
Married	188	78.3	6-10	85	35.4
Total	240	100.0	11-15	38	15.8
Family size			16- above	42	17.5
1-5	84	35.0	Total	240	100.0
6-10	104	43.3	**Farm size (ha)**		
11-15	31	12.9	1-4	92	38.3
16- above	21	8.8	5-9	65	27.1
Total	240	100.0	10-14	52	21.7
			15- above	31	12.9
			Total	240	100.0

Source: Field survey, 2015.

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Educational Status

Most of the farmers have attained and obtained one form of formal education or the other and this would help farmers in adopting any technology introduced to them. This is in agreement with Obinne (1991) who reported that education influence the adoption of new innovations, ideas and techniques in business operations. It is also noteworthy that 36 farmers (15%) did not have formal education and as such it might be difficult for them to adopt modern technique, innovations or new ideas in farming activities.

Farming Experience

Most of the farmers had many years of experience in Agroforestry practice, this implies that the more experienced a farmer is, the more efficient he is supposed to become and vice versa, This is in agreement with Onubuogu *et al.* (2013) who reported that farmers with more experience would be more efficient and have better knowledge on climatic conditions.

Size of Land Holding

Majority (86.2%) of the farmers had land size which fell within 1 and 9 hectares, 6.3 percent had land size that fall within 10 and 14 hectares, while 7.5% had land size that fell within 15 hectares and above. This implies that the majority of farmer had large plot for their agricultural activities. This is not in agreement with Adamu (1997) who stated that the plot of land which rural people possess is mostly small in size because it has to be shared among the heirs of deceased owners.

Table 2: Distribution of Farmers According to the Usefulness of Agroforestry Practices

Variables	VH	H	L	VL	WMS	MR
Usefulness of agroforestry practices						
Provision of food (fruits vitamins)	204 (85.0)	34 (14.2)	2 (0.8)	0 (0.0)	3.84	1st
Increase in soil nutrients	91 (37.9)	118 (49.2)	30 (12.5)	1 (0.4)	3.25	4th
Provision of fuelwood	179 (74.6)	57 (23.8)	4 (1.7)	0 (0.0)	3.73	2nd
Provision of timber	49 (20.4)	69 (28.8)	95 (39.6)	27 (11.3)	2.59	7th
Protection against wind and storms	113 (47.1)	107 (44.6)	19 (7.9)	0 (0.0)	3.39	5th
Provision of income	156 (65.0)	76 (31.7)	6 (2.5)	2 (0.8)	3.61	3rd
Protection of soil from erosion	60 (25.0)	114 (47.5)	62 (25.8)	3 (1.3)	2.97	6th,

Source: Field survey, 2015.

Likert scale-VH=very high, H= high, L= low, VL= very low, WMS= weighted mean Score and MR= mean rank.

Table 3: Distribution of Farmers According to the Contribution of Agroforestry to livelihood improvement

Variables	Frequency	Percentage (%)
Income generation		
Crop production	106	44.2
Livestock production	31	12.8
Tree production	47	19.6
Sales of timber	28	11.7
Bark of the tree	28	11.7
Total	**240**	**100.0**
Food		
Fruits	200	83.3
Seeds	19	7.9
Leaves	21	8.8
Total	**240**	**100.0**
Feed		
Fruits	88	36.7
Seeds	66	27.5
Leaves	86	35.8
Total	**240**	**100.0**
Medicine		
Roots	50	20.8
Leaves	34	14.2
Bark of the tree	154	64.2
Seeds	2	0.8
Total	**240**	**100.0**
Raw materials		
Timber	239	99.6
Leaves	1	0.4
Total	**240**	**100.0**
Protection from trees		
Provision of shade	133	55.5
Serves as wind break	88	36.6
Purifies air	19	7.9
Total	**240**	**100.0**

Source: Field survey, 2015.

Usefulness of Agroforestry Practice

Majority of the farmers (wms =3.78) stated that agroforestry practice was highly useful in the provision of food and it was ranked first, this implies that most of the agroforestry practices are done purposely for products from trees such as fruits and seeds. Similar finding by Aggarwal and Mall (2000) reported that agroforestry trees have many uses in our environment ranging from provision of services such as purification of air, production of food, fruits, fuel, timber, gums and other products, they also ensure conservation of soil, while provision of timber was ranked the least (wms = 2.59). This could be due to the fact that in rural areas, trees are usually cut down or harvested for fuel wood before the trees matured as such it makes it difficult for timber production, also because of lack of timber-based industries in the study areas. This finding did not agree with Glover and Elsiddig (2012) who reported that agroforestry trees are grown in order to produce wood which is cut into lumber (sawn wood) for use in construction of buildings, bridges, track ways, poles for power lines, carts, farm implements, boats, etc.

Income Generation

A total of 44.2 percent of the farmers generated income through crop production, this implies that majority of the farmers depend on agriculture for their livelihood. Similar finding by Parry et al. (2007) reported that agriculture is the main livelihood system of most of our people and along with allied sectors like livestock and fisheries, contributes to the livelihood standard, though 11.7 percent generate income through sales of timber. This is as a result of trees on farm lands which are used for construction. Similar finding by Pandit and Thapa (2004) reported that, growing of trees on farmlands contributes to household income.

Source of Credit

Majority (57.1%) of the farmers did not have any source of credit and depended on no one for credit, this implies that farmers try to work with income obtained from the sales of farm produce. This agrees with the finding of Parry et al. (2007) who reported that more than 60 per cent of the populations are directly or indirectly relying on agriculture as a source of income in rural areas. Only 1.7 percent of the farmers stated that they sourced credit from private individuals. This could be as a result of their small scale or subsistence level of farming as such they needed private source of credit to support the family. This finding disagrees with Palm et al. (2005) who reported that agroforestry practice can also support wildlife and provide another source of income.

Parts of the Tree Used for Food

About 83.3 percent of the farmers used fruits as food. This implies that farmers may obtain fruit from trees on their farm for food either processed or fresh. This is in consonance with Padoch et al. (2008) who documented that fruits have been a low-cost staple food source, while 7.9 percent stated that they used seed as food, this is because some of the trees in rural areas produce edible seed which are used for food. This finding is supported by World Bank (2000) who reported that many trees bear edible nuts which can loosely be described as being large, oily kernels found inside a hard shell. These include coconuts (*Cocos nucifera*), Brazil nuts (*Bertholletia excelsa*). They have high nutritive value and contain high-quality protein, vitamins and minerals as well as dietary fiber.

Parts of the Tree Used for Feed

A total of 36.7 percent of the farmers stated that they use fruits as animal feeds, this could be due to the fact that farmers use fruits from tree either directly or processed as animal feeds, while 27.5 percent use seeds for preparing animal feeds. Similar finding by Neupane and Thapa (2001), reported that some products of tree species grown on farmland are the main sources of animal feeds.

Parts of the Tree Used for Medicine

Majority (64.2%) of the farmers used bark for medicine, this may be true in rural settlement where people make use of the bark of tree to treat certain sicknesses such as malaria and typhoid fever, this agrees with Lichterman (2004) who reported that, the bark of some trees such as willow tree contains large amounts of salicylic acid, which is the active metabolite of aspirin. Willow bark has been used for millennia for medicine as an effective pain reliever and fever reducer. Also, Muriuki*et al.* (2012) reported that many trees are cultivated to provide medicine from bark, leaves, roots, etc., which are sold to provide income and are used for self- treatment, supporting the health of communities. Some 0.8 percent of farmers used seeds for medicine. This could be so because some seed of trees contains medicinal properties. Similar findings found that many of the seed of common trees and weeds that populate human settlements, such as *Balanites aegyptiana* and *Acacia nilotica* have medicinal properties (Lichterman, 2004).

Parts of the Tree Used as Raw Materials

Majority (99.2%) of the farmers stated that timber is used as raw materials, this may include stems of trees used in local construction. This finding is in agreement with Shepherd *et al.* (2003) who reported that wood has been an important, easily available material

for construction since humans started building shelters. Only 0.4 percent said leaves are used as raw materials. This holds to the fact that some farmers are very poor to purchase timber as such they use leaves to cover their small muddy huts.

Protection from Trees

About 54.2 percent of farmers stated that trees protect them by the provision of shade. This could be the reason why some of the farmers plant trees on their farms so that during the day when heat is high they will go under the tree and have some shade. This is in agreement with Sileshi *et al*. (2007) who opined that trees and shrubs in agroforestry systems can contribute to better microclimate by providing shade and windbreak in farms and homes. Even though 7.9 percent stated that trees protect them by purifying the air. This is because trees produce oxygen during photosynthesis thereby purifying the air in an environment. This finding is in agreement with Lin (2007) who reported that, tree on farm bring about favorable changes in the microclimatic conditions by purifying air, influencing radiation flux, air temperature and wind speed.

CONCLUSION

Many of the farmers maintained trees in their farmland in form of agroforestry practices, and collect fuel wood, and fodder from these trees for their sustenance. This type of management system has contributed to the improvement of soil fertility in the study area. Agroforestry practice is strongly adopted in the study area.

RECOMMENDATIONS

Based on the findings, the study recommends several ways in which policy and regulatory practices can be improved to support farming communities in the practice of agroforestry. The following recommendations are hereby made:

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1. Many smallholder farmers do not have the knowledge and skills to manage agroforestry, therefore government should find a way of educating and training the farmers.
2. Government should distribute improved tree seeds and seedlings suitable for agroforestry freely to every farmer who shows interest to go into agroforestry practice. This will also encourage other farmers to adopt the practice.

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Cite this Article: Gwimmi, DP; Umar, I; Nafiu AK; Atiku, M; Ambursa AS; Sokoto MB; Wele, HK (2019). Contribution of Agroforestry for Livelihood Improvement in Wamakko Local Government Area, Sokoto State, Nigeria. Greener Journal of Agricultural Sciences 9(2): 242-249, http://doi.org/10.15580/GJAS.2019.2.052419097**.**