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Challenges of Agroforestry Systems' Adoption by Farmers in the North Central Zone of Nigeria

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Abstract

The challenges of agroforestry systems' adoption by farmers in the North central zone of Nigeria, was carried out to address the following objectives; find out the perception of farmers on agroforestry technologies, identify the adoption level and ascertain why farmers discontinue agroforestry adoption. Data were collected from 722 agroforestry farmers out of 782 sets of questionnaire that were distributed. Frequency and percentages were used to describe socioeconomic characteristics of the respondents. Mean score and sigma score were used to analyze perception of farmers, adoption levels and comparison between vegetal cover and selected climatic variables. More that 75 percent of the respondents had little or no formal education. More than sixty percent of the respondents had farm size between 1.1 to 3 hectares. Adoption of the technology increased between 2008 and 2010 but decreased as it approached 2013. Inadequate knowledge of agroforestry (M=3.71) and lack of market (M=3.55) made many farmers to discontinue adoption. The paper stressed the establishment of small-scale industries that will utilize the fruits from the trees planted as raw materials to attract better market, scale up adoption of more fruit trees as fruit storage as identified as a major constraints to adoption.

Keywords: Challenges, Perception, Agroforestry, Adoption

1. Introduction

There is a continuous exploitation of forest reserve without adequate reafforestation thereby leading to soil degradation, desertification, and consequently global warming. Recent fluctuations in the elements of weather such as late arrival of rain, high temperature have been attributed to human activities such as deforestation (Igwebuike *et al;* 2001). One of the ways of mitigating the effect of weather variability is the adoption of agroforestry.

Agroforestry system is therefore a technology of global significance. It is a system where arable crops are planted alongside tree crops to complement soil nutrient supply and protect the environment but also act as sources of food, income and fuel for many rural farmers. In support of the global importance of agroforestry FAO STAT (2011) put conservative estimates of international trade of three products all over the world at whooping sum of US$ 140 billion in 2009, apart from firewood and fruit that are consumed domestically.

The introduction of agroforestry technology in Nigeria has received a lot of enthusiasm and hope from some rural communities. For instance, Stigter (2011) described the ICRAF project financed by International Finance on Agricultural Development (IFAD) in some parts of Edo State in Nigeria, Cameroon and Democratic Republic of Congo as a responsive measure that is reversing the economic status of the poverty ridden communities. He asserted that *Irvingia wonbolu* (dika nut/ Ogbono) *Dacryodes edulis* (black pear) *Citrus* species, *Chrysophyllum albidum* (star apple) were some of the fruit trees planted along with annual crops by farmers in Nigeria. Glenn (2005) also noted that in Embu district of eastern Kenya more than 300 farmers were planting tree legumes in fodder banks for use as an inexpensive protein supplements for the diary cow while in south east Asia similar success was been observed as hundreds of farmers in Southern Philippines were adopting contour hedgerow systems based on natural vegetative strips.

In another study, Adegbehin and Omijeh (1993) asserted that the most common agroforestry practices adopted by farmers in Niger State, Nigeria were agro-silvo pastroral and the scattered farm trees systems. They further stated that 99.5% of agroforestry crops planted were fruit/vegetable products while the remaining 0.5% was meant for other purposes. Aturamu and Daramola (2005) however stated that a negative but significant relationship was found between the adoption of agroforestry – based technologies and frequency of extension visits and cooperative membership. This implies that agricultural extension work has not positively influenced the adoption of agroforestry perhaps the extension workers have not disseminated much information on agroforestry technology adoption. Jabbar (2011) reported that tenure status affected the adoption of agroforestry technologies. He noted that about 57 percent of farmers who adopted agroforestry crops on extended family inherited land could not continue the adoption while about 68 percent who adopted agroforestry technologies on individual inherited land continued the adoption. He also observed that old age was the single most important factor that was responsible for discontinuing adoption of agroforestry while poor handling and poor growth were also genuine reasons while farmers could not continue the adoption of agroforestry technologies in Nigeria. This suggests that farmers are interested in adopting agroforestry but certain challenges are not in their favour and as such many discontinued the adoption of the technology.

The North Central Zone of Nigeria has the largest land mass for the growth of both forest and cereal crops. The vegetation cover is otherwise called the guinea savanna zone which forms a mix-up of forest and grass belt known as the middle belt of Nigeria. Wild fire often occurs in the dry season which may expose large expanse of land to both wind and water erosion or degraded fields and destruction of homes. The increase of heat wave frequency as a result of little or no grass cover during the dry season and over exploitation of the few trees may also result in climatic changes. The consequences of such changes may include low rainfall, excessive heat among others. Adoption of agroforestry systems by farmers in the study area may reduce the aforementioned hazards. The extension workers in the Agricultural Development Projects (ADPs) in the study area are expected to disseminate extension messages relating to all the technical components to the farming family. These components include forestry and agroforestry, women in agriculture and home economics and so on.

How responsive farmers are to the agroforestry components of the technical package need to be verified. What are the socio economic characteristics of the farmers? What are the perceptions of farmers on agroforestry? What is the adoption level? Do farmers who adopted agroforestry still continue the adoption? In the quest for solutions to the problem questions above, this study attempted to address the following specific objectives.

i. Describe the socio-economic characteristics of farmers in the study area.
ii. Find out the perception of farmers on agroforestry technologies.
iii. Identify the adoption level of agroforestry.
iv. Find out why farmers discontinued adoption of the technology.

2. Materials and methods

The study covers Kogi and Benue States in the North Central Zone (Guinea Savanna) of Nigeria. Kogi State with Lokoja township as its Headquarters has Yoruba, Ebirra and Igala as major tribes. Kogi State is popularly known as "the Confluence State" because of the location of its capital at the point where Rivers Niger and Benue meet. It has a population of 3, 278,487 according to 2006 census (FGN, 2007) as asserted by Saliu (2011). The State is located between Latitude $6^{o}30'$N and $8^{o}50'$N and Longitude $5^{o}51'$E and $8^{o}.00'$E. It has maximum temperature of 33.2^{o}C and average temperature of 22.8^{o}C. Notable crops grown in the State are maize, rice, yam, cowpea, cashew, citrus, oil palm, cocoa and kolanut, while livestock such as sheep and goat, poultry and cattle are kept in sizeable numbers.

Benue State lies between Longitude 7^{o} and 10^{o} E and latitude $6^{o}25'$ and $8^{o}8'$N of the equator. It has an estimated land area of 31,276.7Km^2. The State is bounded by Kogi State to the West, Taraba State to the North West, Enugu State to the South West and also a small part with the national boundary of the Republic of Cameroon. It has a total population of 4,219,244. The State is basically an agrarian community with rice, yam, millet and mango as the main crops while cattle, pig and poultry are kept in significant numbers.

Two Local Government areas were randomly selected from each of the three agroecological zones in each of Kogi and Benue States. Six Local Government areas each from Benue (Guma, Gwer-West, Apa, Agatu, Logo and Katsina-Ala) and Kogi (Ijumu, Idah, Dekina, Lokoja, Kogi and Omala) States were randomly selected. Then Ten percent (10%) of the contact farmers in the selected local government areas were randomly chosen to represent a sample size of 782 as revealed in the table 1. It is believed that 10% of the sample population

which represent 782 sample size is significant enough to generate valid and reliable data and findings.

Contact farmers are farmers selected for teaching and visit by agricultural extension workers of Kogi and Benue States. A total of 782 sets of questionnaires were served to farmers. In essence, the instrument of data collection was 782 sets of questionnaire for objectives one to four, and past record on element of climate in the study area such as temperature, rainfall etc for ten years for objective five.

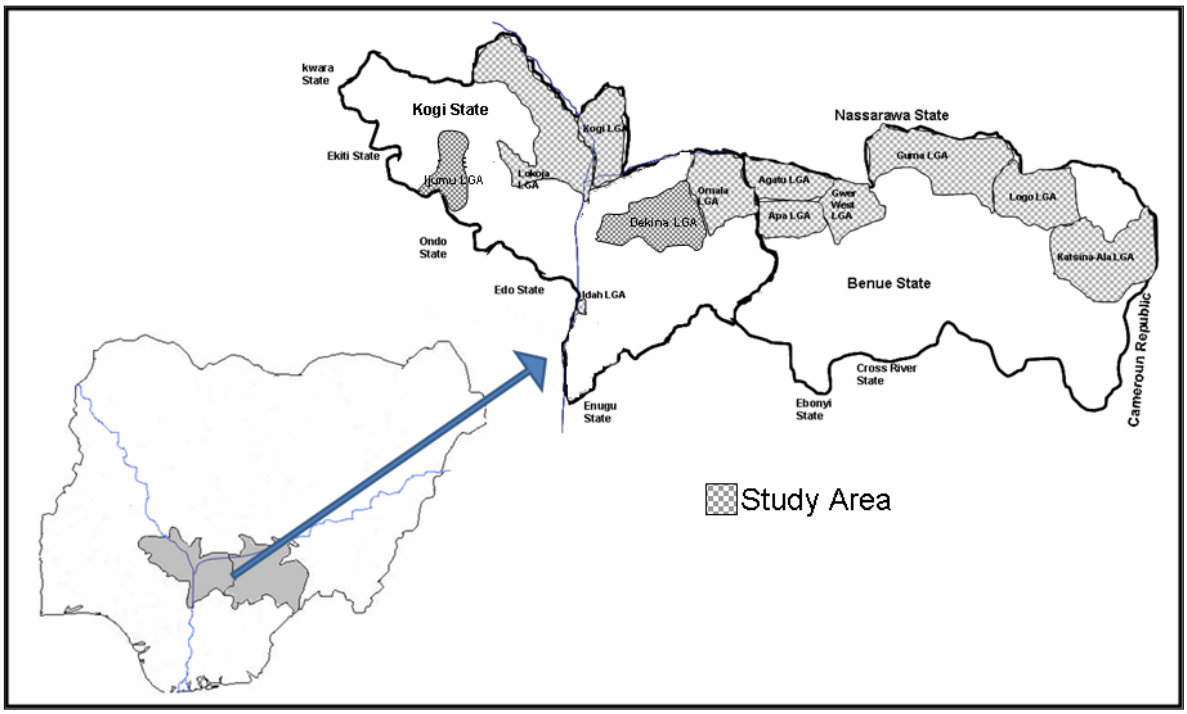

Figure 1. Nigeria Showing States and Specific Local Government Areas for the Study

Table 1. The selected contact farmers as respondents for the study

State	Local Government Area	Population of Contact Farmers	Sample size
Kogi	Kogi	650	65
	Lokoja	620	62
	Dekina	721	72
	Omala	679	68
	Ijumu	622	62
	Idah	631	63
	Subtotal	5923	52
Benue	Guma	671	67
	Gwar-West	678	68
	Apa	621	62
	Agatu	643	64
	Logo	591	59
	Katsina-Ala	702	70
	Subtotal	3906	390
	Grand Total	7,829	782

Source: KADP and BNADPOA Offices

Data generated from the administration of the questionnaire were subjected to descriptive statistics such as frequency, percentage, mean and graph. A five point likert type of scale was used to measure farmers' perception of agroforestry practices. The level of agreement was measured on a scale of strongly agree (5 points) agree (4 points) undecided (3 points) disagree (2 points) and strongly disagree (1 point). Also, a five type of likert scale was used to measure farmers' reasons for discontinuing adoption of the technology.

3. Results and discussion:

3.1 Socioeconomic Characteristics of the Respondents

Table 2 shows the socio-economic distribution of the respondents in the study area. The distribution includes age, household size, schooling year, and farm size. The average age of the respondents was 58.9. This implies that many of the respondents were gradually moving out of the economically productive age of 40 – 45 years. This disagrees with Jabbar (2011) who reported that old age was the single most important factor that was responsible for discontinuing adoption of agroforestry. It therefore means that even old farmers can adopt.

About 67.04 percent of the respondents had a household size of between 6 -10 which implies that a sizeable number of the respondents had a fairly high family size. One may deduce that any respondent with as high as 6-10 persons in a family may not have problem with the use of family labour to enhance adoption of agroforestry technology at a very high scale. This is in tandem with Saliu et al. (2010) who reported that 46 -36 percent of farmers who engaged in forest tree adoption had a fairly high family size of between 6 – 10 persons.

More than 75 percent of the respondents spent between 1 – 6 years in school. This implies that majority of the respondents received little or no formal education. The said respondents may therefore have little or no benefit from information in print media and as such information on agroforestry that is in print form may suffer setback and will not be appropriate to teach this set of farmers. This result is in accord with the opinion of Laogun (2011) who asserted that bulletin or leaflet is impersonal and not suited for teaching people with limited education.

Farm size of between 1.1 to 3 hectares was the popular size of agroforestry practiced by about sixty (60) percent of the respondents. This indicates that large scale agroforestry practice has not been popularly adopted.

3.2 Perception of Farmers on Agroforestry Practices

Table 3 indicates that out of the twelve research items on farmers' perception on agroforestry practices, eight items received positive disposition to agroforestry adoption while only four items were negative. That is, farmers perceived agroforestry adoption to protect their environment with a mean score of 4.22, plant crops and trees as love for green environment (3.44), planting of drought resistant trees as food for ruminant animals (4.24) while inclusion of the indigenous knowledge in the practice of agroforestry will enhance their adoption level (4.39). The right attitude as regard the fetching of fire wood being responsible for reduction in plant cover was agreed with by 3.44 mean score of the respondents while farmers' participation in the choice and practice of agroforestry will improve the adoption of the technology had a mean score of 2.83 since the mean score was less than 3.0, it means that participation in agroforestry was not identified as a problem. However, in a research conducted by Keiler et al., (2005), farmers who involved in on farm experimentation of agroforestry technologies were suggested to adopt the technology much faster and better. Many of the farmers (3.21) still perceived non adoption of agroforestry as not having any negative effect on their crops. A non significant mean score of 2.76 perceived that reduction in rainfall (climatic variability) does not have anything to do with agroforestry adoption. This implies that farmers who could not see positive reasons for adopting agroforestry might require additional effort to develop the right attitude to the technology. However, the result indicated that farmers were generally favourably disposed to agroforestry technology. This result is in agreement with the findings of Onweagba *et al*. (2010).

3.3 Trend of Agroforestry Adoption

Figure 2 depicts that adoption of agroforestry was embraced with increase in number of trees planted and size of land (ha) by farmers, between 2008 and 2009. There was however a downward slope as we approach 2013. This implies that many farmers must have discontinued adoption along the line. Oladele and Kareem (2003), Jabbar (2011) and Nnadi and Akwiwu (2007) reported cases of discontinuance of adoption in their various research works. This implies that discontinuance of adoption is a common phenomenon. However at a time when agroforestry adoption should be accelerating at a high rate it is a serious challenge to find out in this research that agroforestry adoption is assuming a downward trend.

Table 2. Socioeconomic Characteristics of the Respondents

Item	Frequency	Percentage	Mean
Age			
21 – 30	18	2.49	
31 – 40	85	11.77	
41 – 50	274	37.95	
51 – 60	238	32.96	58.9
61 – 70	85	11.78	
71 and above	22	3.05	
Subtotal	722	100.00	
Household size			
1 – 5	116	16.06	
6 – 10	484	67.04	7.7
11 – 15	94	13.02	
16 and above	28	3.88	
Subtotal	722	100.00	
Schooling year			
0	62	8.59	
1 – 6	542	75.07	
7 – 12	79	10.94	7.4
13 – 18	39	5.40	
Subtotal	722	100.00	
Farm size (ha)			
0.1 – 1	34	7.48	
1.1 – 2	196	27.15	
2.1 – 3	239	33.10	2.98
3.1 – 4	174	24.10	
4.1 – 5	59	8.17	
Subtotal	722	100.00	

Source: Field Survey August 2013 – Feb. 2014.

Table 3. Perception of Farmers on Agroforestry Practices

Research Items	RESPONSES					Mean Score
	SA	A	U	D	SD	
Agroforestry systems protect my environment against wind/water erosion.	457	81	81	92	11	4.22
The non adoptions of the systems do not have any negative effect on my crops.	118	230	81	268	25	3.21
Reduction in rainfall and high heat do not have anything to do with adoption of Agroforestry.	91	136	82	351	39	2.76
The fetching of charcoal for firewood will reduce plant cover.	162	311	119	26	23	3.44
I encourage my family to plant both crops and trees every year.	135	421	59	86	17	3.77
Government did not give me any opportunity to contribute to the solution on adoption of agroforestry.	108	148	98	256	107	2.83
Preservation of the ecosystem services can reduce disasters.	146	447	203	13	13	4.39
Reducing grazing pressure on land by animals can reduce desert formation.	372	207	108	23	12	4.22
Planting drought resistant plants can serve as emergency food for ruminant during drought.	380	201	87	41	13	4.24
Indigenous knowledge about type of trees to adopt will assist me to make the correct choice of trees	407	225	65	7	7	4.39

Source: Field Survey Aug. 2013 – Feb. 2014

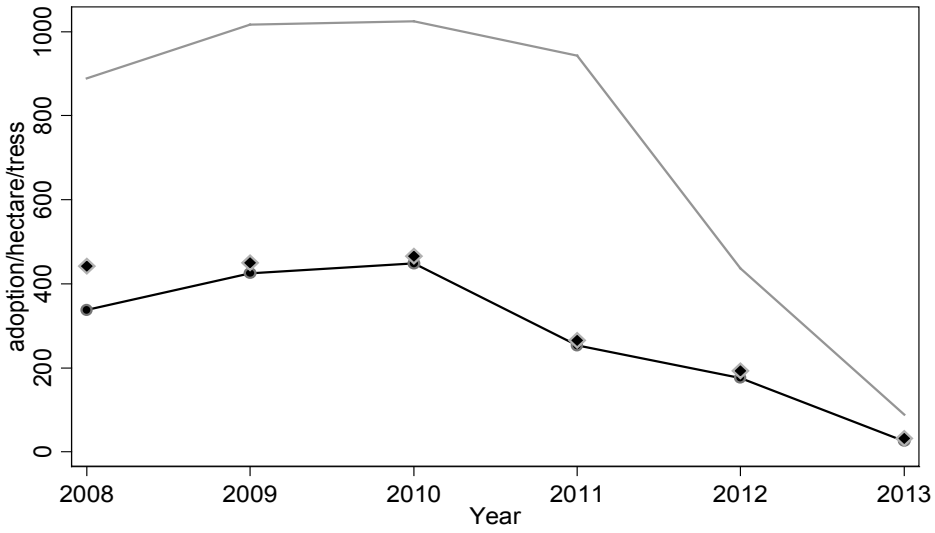

Figure 2: Trend of Agroforestry Adoption
Source Field: Survey Aug. 2013-Feb. 2014.

Table 4. Farmers' Reasons for Discontinuing Adoption of Agroforestry Practices.

Research Items	Responses					Mean Score
	SA	A	U	D	SD	
I discontinued the practice because I could not increase the planting on my limited individual land.	168	271	250	28	5	3.79
I stopped the adoption because the extended family land where I planted could not guarantee the sustainability.	36	201	251	195	39	3.00
I planted agroforestry trees as shared cropping with another farmer who could not continue with the term of sharing our crops.	49	167	283	210	13	3.04
Inadequate knowledge of agroforestry management discouraged to continue adoption.	160	249	264	40	9	3.71
I am getting old and there are no young ones to take care, so I stopped adopting.	74	341	258	35	14	3.59
The rural women are not encouraged to help the male farmers adoption and management of agroforestry.	58	224	338	82	19	3.30
Unavailability of good varieties of seedlings made me to stop adopting.	50	93	431	93	53	2.98
Fruits from fruit trees produced are wasting because of lack of storage or processing facilities.	70	190	420	27	15	3.38
Lack of market for agroforestry produce discouraged me to continuing adoption.	169	147	332	64	13	3.55

Source: Field Survey between Aug. 2013 – Feb. 2014.

3.4 Discontinuing Adoption of Agroforestry Practices among the Farmers in Study Area

Table 4 indicates that the inability to expand land for agroforestry by individuals had a mean score of 3.79, while some of the respondents with a mean score of 3.0 agreed with the fact that the extended family land could not guarantee the sustainability of his agroforestry adoption. This is consistent with the finding of Jabbar (2011). Old age (M = 3.59) and inadequate knowledge of agroforestry management (M = 3.71) were found to be responsible for the discontinuation of adoption of agroforestry technology. Inadequate accessibility to extension agent could limit the knowledge of farmers and also discourages adoption.

Nnadi and Akwiwu (2007) came up with a similar result that inadequate extension agents caused discontinuance of yam mini-sett technology. A significant number of farmers (3.30) perceived that inadequate involvement of women in the agroforestry technology adoption was responsible for discontinuance of adoption. This finding is in disharmony with Ajah *et al*. (2011) who asserted that women were highly involved in all agricultural production activities in southeast Nigeria. The nature of agroforestry which involves permanent crop on limited land could be responsible for restricted involvement of women in the agroforestry adoption.

Lack of market for agroforestry produce (M = 3.55) and wastage of fruits due to improper storage (M = 3.38) were also factors that could promote discontinuance of adoption among farmers.

However unavailability of good varieties of seedling scored just 2.98, which implies that good varieties of seedlings did not pose a serious threat to adoption of agroforestry technology. A study conducted by Simons (1997) also agreed with the finding that good seedlings do not pose serious problem to agroforestry adopters.

4. Conclusion and recommendations

Majority of the respondents were aware and were pleasantly disposed to the adoption of agroforestry practices. Many had adopted and then discontinued. Inadequate knowledge, limited land for expansion, cost of maintenance, poor storage and unattractive market price discouraged the farmers from sustaining adoption. Agroforestry adoption is assuming a downward trend in adoption level. Establishment of small scale industries that will utilize the fruits as raw materials for value addition, wastage reduction and spoilage but enhances constant demand that will command good market price, stimulate production and adoption of fruit trees along with arable crops should be embraced in the study area. This will indirectly promote afforestation, food security better standard of living and a well protected environment.

Education and persuasion of farmers to improve agroforestry adoption level should be stepped up by both governmental and non governmental organizations as practiced by Centre for Environmental Education (CEE) and supported by the Ministry of Environment and Forestry Government of India (Syed, 2015).

Deliberate plan should be put in place to encourage rural women participation in the technology adoption.

To reduce fruit wastage due to storage problems as identified in the study, there should be a well designed private public partnership arrangement that will ensure sustainable small scale industry that will utilize the fruit produced in the study area for beverages and improve on the adoption of fruit trees in the study area.

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۹ مرداد ۱۳۹۵ :پذیرش

چالش‌های پذیرش نظام جنگل‌زراعی توسط کشاورزان در منطقه مرکزی شمال نیجریه

سالیو، او، ج.، الوواگبمی، تی و آیفاتیهین، او. او
دانشگاه ایالتی کوگی، آنیگبا، ایالت کوگی، نیجریه

چکیده

هدف از این مطالعه ارزیابی چالش‌های پذیرش جنگل‌زراعی، بررسی نگرش کشاورزان در زمینه فناوری‌های جنگل زراعی، شناسایی سطح پذیرش و ارزیابی علت عدم ادامه پذیرش جنگل زراعی بود. داده‌ها از بین ۷۸۲ پرسشنامه توزیع شده که ۷۷۲ مورد آنها توسط کشاورزانی که مشغول فعالیت‌های جنگل‌زراعی بودند تکمیل شد، جمع‌اوری گردید. فراوانی، درصد و میانگین به منظور توصیف ویژگی‌های اقتصادی و اجتماعی به کارگرفته شد. بیش از ۷۵ درصد پاسخگویان تحصیلات پایین و یا فاقد سواد بودند. بیش از شصت درصد از کشاورزان دارای زمین بین ۱ تا ۳ هکتار بودند. پذیرش فناوری بین سال‌های ۲۰۰۸ تا ۲۰۱۰ روبه افزایش بوده و تا ۲۰۱۳ کاهش یافته است. دانش ناکافی در زمینه جنگل‌زراعی (M=3.71) و فقدان بازار (M=3.55) باعث شده که بسیاری از کشاورزانی مداومتی بر پذیرش آن نداشته باشند. در این مقاله بر ایجاد صنایع کوچک مقیاس که از میوه‌های حاصل از فعالیت‌های جنگل‌زراعی به عنوان ماده خام استفاده کنند و در جذب بهتر بازار نقش داشته باشتد تأکید شده است.

کلمات کلیدی: چالش‌ها، نگرش، پذیرش، جنگل‌زراعی