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ASSESSMENT OF *Leucaena leucocephala (*Lam) DE WIT AGROFORESTRY TECHNOLOGY ADOPTION AMONG SMALLHOLDER FARMERS IN BENUE STATE NIGERIA

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ABSTRACT

This study was conducted to assess Leucaena leucocephala agroforestry technology adoption among smallholder farmers in Benue state. The stratified systematic random sampling technique was adopted for data collection. The state was stratified into three zones based on the senatorial districts. Respondents were stratified into three categories these were Extension agents, benefitting smallholder farmers (BSF) neighboring farmers (NF). structured questionnaire was used for data collection. Data collected were analyzed using descriptive statistic and a five-point Likert scale rating format. The study revealed that 53.3% benefitting smallholder farmers were females, 52.3% of neighboring farmers were males. Most (66.6%) of BSF were below 60 years, 74.7% of NF were below 50years. Furthermore, 51.7% of BSF had primary education while 59.3% of NF had secondary education. Hundred percent of smallholder farmers were females, 52.3% of neighboring farmers were males. All BSFs were aware of Leucaena leucocephala agroforestry technology, while 66.0% of neighboring farmers were not aware of the technology. Leucaena AF technology adoption was rated very high WMS=4.9. Farmers perceived that agroforestry significantly increase their farm output MWS=4.5, AF technology serve as fertilizer to crops on the farmland MWS=4.4 AF as staking materials MWS=4.6, windbreaks MWS=3.9, used as fuel wood MWS=4.3, treatment of disease MWS=3.8. it was shown that 60% of the farmers cultivate yam crop alongside Leucaena species, while 44.3% of farmers Combined animal and crops alongside Leucaena sp. There is the need for the Government of Benue state to renew Leucaena leucocephala agroforestry technology project in the study area; since neighboring farmers are willing to practice AF technology due to its numerous benefits. Also, there is the need for awareness creation and involvement of private or non-governmental organizations to intervene in funding and monitoring the success of this project in the study area.

Key words: awareness, benefitting smallholder farmers, farm output, monitoring, oring farmers

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INTRODUCTION

The introduction of *Leucaena leucocephala (Lam de Wit)* as an Agroforestry technology has gained global acceptance (FAO, 1995, Rusdy, 2020). *L. leucocepha* is native to South, central and North America, and exotic to Africa (Orwa *et al*, 2009). The species was introduced in Nigeria by the Institute of tropical agriculture (IITA) in the early 1970s for alley cropping and hedgerow (IITA, 1988). According to Kang *et al* (1981), maize-*Leucaena* alley cropping system was studied on a Nitrogen deficient sandy Apomu soil series (Psammentic Usthorthent) at Ibadan in the forest zone of southern Nigeria from 1976 to 1980 which *Leucaena* exhibited unique properties suitable for growing in alley cropping, by retaining important functions of a traditional bush fallow for nutrient recycling, source of

green manure, firewood, and staking material. Subsequent trials by Kang and Dugurna (1985) on maize and cowpea with *Leucaena* on a sandy soil in Southern Nigeria suggested that application of *Leucaena* pruning resulted in higher soil moisture retention, organic matter, exchangeable K, Ca, Mg, and also nitrate levels in the soil solution. Lal (1989) reported Hedgerows of *Leucaena* and other leguminous plants acting as windbreaks in field experiments conducted on a tropical Alfisol at Ibadan, Nigeria to evaluate the effects on soil moisture and crop yields of three agroforestry systems. The plant has been used in all the ecological zones of Nigeria to help address the differing ecological problems and needs (Papka, 1995). *Leucaena* agroforestry technology was introduced to Benue State by IITA through the Benue State Agriculture and Rural Development Authority (BNARDA) in 1989 for soil improvement and erosion control On-Farm Adaptive Research (OFAR, 1996). The species was tried under alley cropping in the three farming zones of Benue State: northern (Gboko), central (Otukpo) and eastern (Adikpo) zones. A total of fifty-nine (59) alley cropping trials was carried out in 1994 cropping season; 12 in Gboko, 30 in Otukpo and 17 in Adikpo respectively; with the objective to proof that pruning from leguminous shrubs could be used as alternative fertilizer and crop production (BNARDA's On-Farm Adaptive Research (OFAR, 1996). Based on the available information from BNARDA, it was evidenced that the introduced *Leucaena* agroforestry technology in Benue State has not been evaluated over the years. This study seeks to find the influence of this technology among smallholder farmers in Benue State; whether the project should be renewed for sustainable organic agriculture (agroforestry system) or not.

METHODOLOGY

The study was conducted in Benue State, Nigeria. The State lies within the lower river Benue trough in the middle belt region of Nigeria. The State is located on Longitude 7º 50'E and 10ºE and between Latitudes 6º 25' and 8º 25'N. The state occupies a landmass of 34,059 km^2 (Nyagba, 1995, Hula, and Ukpong, 2013). Benue State share boundary with five other states, North-east is bounded by Taraba State, Nasarawa State in the North; Southern part of the state shared boundary with Enugu, and Ebonyi in the Southwest, Cross River State in the southeast. In the west the state is bounded by Kogi State. The State also shared international Boundary with Republic of Cameroon on the south-east (Fig. 1). Benue State has 23 Local Government Areas. Agriculture forms the backbone of the Benue State economy, engaging more than 70 per cent of the working population. This has made Benue the major source of food production in the Nation. It Important cash crops include Soy-beans, Rice, Peanuts, Mango Varieties, Citrus etc. Other cash crops include Palm oil, Melon, African pear, Chili pepper, Tomatoes etc. Food crops include Yam, Cassava, Sweet potato, Beans, Maize, Millet, Guinea corn, Vegetables and so on. Benue State has a typical tropical climate with two distinct seasons: wet or rainy and the dry seasons. The annual rainfall is between 1200 mm -2000 mm (Hula, and Ukpong, 2013). Temperatures fluctuate between 23^0 C and 38^0 C in the year (Hula, and Ukpong, 2013). The vegetation is a mix of semi rainforest and Guinea Savannah grassland Benue State is located in the guinea savanna zone of the country (Dagba *et al*., 2016). It is one of the largest vegetation zones in the country, the vegetation of Benue state is characterized by predominantly fewer trees, more shrubs and predominantly tall grasses up to 2m tall (Dagba *et al*., 2016) Riparian forests are found in low land areas and river banks. Some of the species found in the area includes: *Khaya senegalensis* Daniellia *oliveri* , *Isoberlina doka*, *Parkia biglobosa*, *Prosopsis Africana*, *Vitellaria paradoxa Burkea africana*, *Pterocarpus erinaceus*, *Afzelia africana, Borassus aethiopum, Bombax costatum, Anogeissus leiocarpa Irvingia gabonensis* (Ikyaagba *et al.* 2020). while the topography is mainly undulating plains with occasional elevation of between 1,500 m and 3,000 m above sea level.

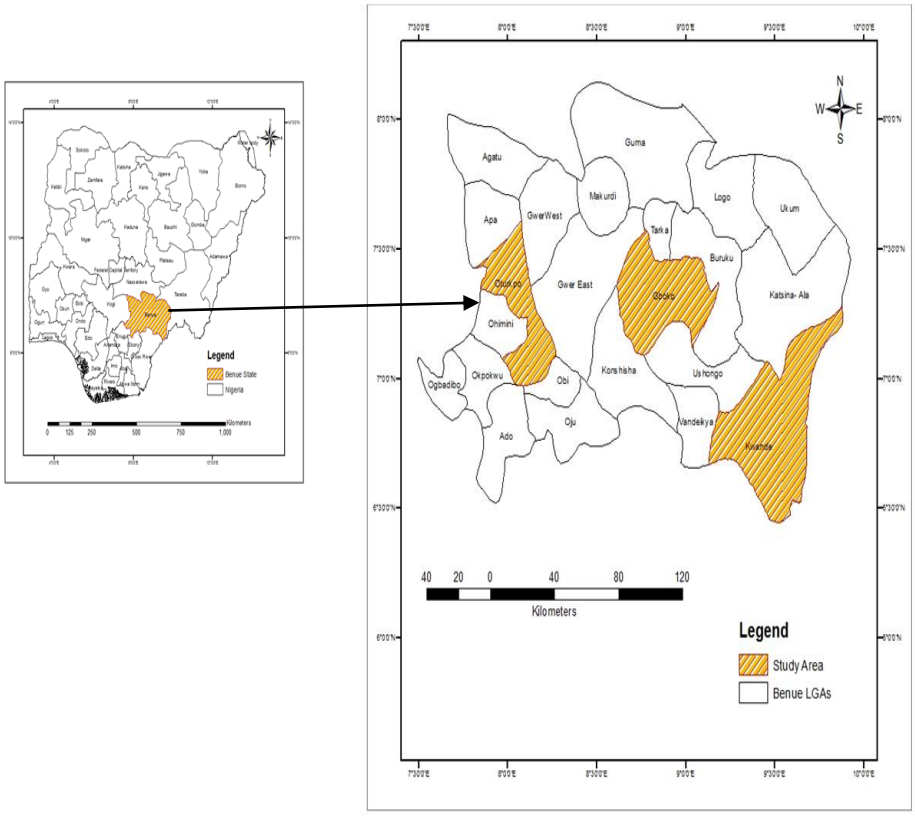

Figure 1: Map of Benue State showing the Study Area
Source: GADM (Database of Global Administrative Areas) Shape file using ArcGis

Sampling Design

The stratified and random sampling techniques were used for this study. The choice of this design was due to the fact that, all the research units were in form of strata. The area of the study was stratified into three senatorial districts of Benue State. The stratified systematic random sampling technique was adopted for data collection. The state was stratified into three zones based on the senatorial districts. Respondents were stratified into three categories these were Extension agents, direct adopters and indirect adopters; these set of respondents formed the strata due to their peculiar characteristics. Complete enumeration was carried out on each stratum (i.e. distinct respondents). Information on these target groups were collected from BNARDA head office in Makurdi. Primary and secondary data were used for this research; the data were collected through structured questionnaire using open data kits (ODK) on electronic software known as *Kobocollect Toolbox.* Respondents were interviewed directly, and their responses were captured directly on the smart phone. Time, location and pictures of the places and people interviewed were also captured where necessary by the device for clarity. The data collected were exported to excel spreadsheet for data analysis.

Data Analysis

Data collected were analyzed using descriptive statistic and a five-point Likert scale rating format as used by Dagba *et al.* (2016) was adopted to assess the knowledge of smallholder farmers about Agroforestry technologies in

Benue State. The weighting scale was derived from the following values with respect to knowledge of smallholder farmers about Agroforestry technologies; Seriously Agree (SA) = 5, Agree (A) = 4, Undecided (UD) = 3, Disagree (DA) = 2, Seriously Disagree (SDA) =1. The Likert rating Mean Score (MS) of the knowledge of smallholder farmers about Agroforestry technologies is expressed as

: $MS = \frac{\sum f}{n}$ …… (1)

Where: f = Summation of the five-point rating scale and n = Number of points

Therefore, for a five point Likert scale, MS is expressed as:

$$MS = \frac{1+2+3+4+5}{5}$$

$$MS = 3.0$$

The Likert Weighted Mean Score (WMS) of the knowledge of smallholder farmers about Agroforestry technologies is expressed as:

$$WMS = \frac{\sum_{i=1}^{n} f_i x_i}{N} \text{ …… (2)}$$

Where: f = frequency of farmers; x = Likert scale point; N=) Total Number of farmers

Using the interval scale of 0.05, the Upper Limit (UL) cut-off is MS+0.05 (3.0+0.05 = 3.05). The Lower Limit (LL) cut-off is MS - 0.05 (3.0-0.05 = 2.95). Based on these two extreme limits any variable with WMS below 2.95 (WMS<2.95) was considered 'Disagree'. Variable with MWS between 2.95 and 3.05, 'Moderate' any variable MWS greater than 3.05 (MWS>3.05), 'Agree'.

RESULTS

Socioeconomic Characteristics of Benefitting Smallholder Farmers of *Leucaena leucocephala* Agroforestry (AF) in Benue State, Nigeria

The socioeconomic characteristics of benefitting smallholder farmers as presented (Table 1) indicates (58.3%) of the respondents (farmers) were males. Most (53.3%) of respondents were between the age range of 51 – 60 years, similarly, most (63.3%) of them had one form of formal education or the other with majority (51.7%) attending primary education. Majority (81.7%) were married with good number (65.6%) of the farmers having family size of 6-10.

Socioeconomic Attributes of Neighboring Farmers in Benue State

Table 1 shows that majority (52.3%) of the neighboring small farmers were males. Similarly, (74.7%) were below 51 years. Furthermore, (89.6%) of the neighboring small farmers had one form of education of the other. majority (81.7%) of the respondents were married. The table also revealed that majority (47.3%) of neighboring small farmers in the study area had family size of 6-10 members

Socioeconomic Attributes of Agroforestry (AF) Extension Agents in the Study Area

The result of the study as presented in Table 6 indicates that majority (60%) of the extension agents were males while few (40%) were females. Furthermore, most (60%) of the agents were within the age range of 61 – 70 years, while few (40%) of the respondents were within the age range of 51-60 years. Majority (80%) of the extension agents had tertiary education, majority (70%) of the extension agents were retired officers.

Table 1: Socioeconomic Attributes of Farmers who Benefited on *L. leucocephala* AF Technology, Neighboring Farmers, Extension Agents in Benue State

Variables		Benefitting Farmers		Neighboring Farmers		Extension Agents	
		Frequency	%	Frequency	%	Frequency	%
Gender	Male	35	58.3	157	52.3	6	60
	Female	25	41.7	143	47.7	4	40
	<40	0	0	101	40.4	0	0
	41-50	2	3.3	103	34.3	0	0
Age category	51—60	32	53.3	50	16.6	4	40
	61-70	22	36.7	23	7.7	6	60
	70 above	4	6.7	0	0	0	0
Level of education	non formal	22	36.7	31	10.3	0	0
	Primary	31	51.7	58	19.3	0	0
	Secondary	5	8.3	178	59.3	2	20
	Tertiary	2	3.3	33	11.0	8	80
Occupation	Farming	61	101.7	295	98.3	0	**0**
	civil servant	0	0	1	0.3	3	30
	Retired civil servant	0	0	0	0	7	70
	Trading	0	0	4	1.4	0	0
	Single	0	0	22	7.3	10	100
Marital Status	Divorced	0	0.0	11	3.7	0	0
	Married	49	81.7	245	81.7	0	0
	widow(er)	11	18.3	22	7.3	0	0
	1-10	57	95.0	270	90.0	0	0
Family size Category							
	11-20	2	3.3	29	9.7	0	0
	21 Above	1	1.7	1	0.3	0	0
size of farm	0.1-1.0	3	5.0	21	7.0	0	0
	1.1-2.0	29	48.3	141	47.0	0	0
	2.1-3.0	21	35.0	103	34.3	0	0
	3.1-4.0	5	8.3	30	10.0	0	0

Awareness of respondents on *L. leucocephala* Agroforestry Technology in Benue State

Table 2 revealed that (100%) of the benefitting farmers were aware of AF Technology, while only (34.0%) of Neighboring Farmers were aware. All the (100%) the benefitting farmers were visited extension agents to educate them on the OFAR trial plantation. Furthermore, 100% of the benefitting farmers get their information on L. *Leucocephala* AF technology through extension agents involved in OFAR trial. Similarly, extension agents were all (100%) aware of L. *Leucocephala* AF technology in the Benue state with IITA as their main sources of information on AF technology. The result also revealed that, (100.0%) of the extension agents were involved in the implementation of *Leucaena sp* AF technology. Furthermore, (100%) of the agents reported that L. *Leucocephala* AF technology also known as OFAR trial was established in 1995 in different areas of the study area.

Table 2: Neighboring Farmers Knowledge and Awareness on *L. leucocephala* Agroforestry Technology in Benue State

Variables		Benefitting Farmers		Extension Agents		Neighboring Farmers	
				Frq	%	Frq	%
Are you aware of Agroforestry technology?	Yes	60	100.0	10	100.0	102	34.0
	No	0	0	0	0	198	66.0
Visited by extension staff	Yes	0	10	0	0	153	51.0
	No	60	100	0	0	147	49.0
Source of information	IITA	0	0	10	100.0	0	0
	Extension agent	60	100	0	0	44	43.1
	Association/group meeting	0	0	0	0	16	15.7
	Community meeting	0	0	0	0	11	10.8
	Traditional chief	0	0	0	0	1	1.0
	media	0	0	0	0	30	29.4
Which among the type of agroforestry technology do you know about?	*Leucaena sp*	60	100	10	100.0	81	79.41
	Leucaena sp /Vertiver grass	0	0	0	0	7	6.86
	Leucaena sp */Gliricidi*	0	0	0	0	14	13.73
Have you ever practiced any agroforestry technology before?	No	0	0	0	0	65	73.6
	Yes	60	100	10	100.0	37	26.4
Tree species ever practice as AF technology	*Leucaena sp*	60	100	10	100.0	37	100.0
	Leucaena/vertiver grass	0	0	0	0	0	0
	Leucaena/Gliricidia sp	0	0	0	0	0	0
Year of implemented OFAR trial of Leucaena AF technology	1989	60	100	10	100	65	63.7

Rating Level of Farmers Adoption of AF Technology in Benue State by Extension agents

As shown in Table3 Extension agents in the state rated all the AF technology high, *leucaena* species reported to have very high (WMS=4.9), while the adoption of *Vertiver* (WMS=1.7), *Gliricidia* sp (WMs=1.4) AF technologies were rated very low by Extension agents.

Perceived Benefits of AF Technology Experienced by the Smallholder Farmers in Benue State

The result on perception of smallholder farmers on benefits of AF technology in Benue state as presented in Table 5 indicates that, responding farmers perceived that agroforestry significantly increase their farm output (MWS=4.5). They agreed (MWS=4.4) AF technology serve as fertilizer to crops on the farmland. AF as staking materials (MWS=4.6), windbreaks (MWS=3.9) to protect farmlands other benefits of AF stated by respondents were used as Fuel wood (MWS=4.3), treatment of disease (MWS=3.8). However, they did not agree that (MWS=2.1) that it can be used for erosion control, cheap source of fodder (MWS=2.2), make mixed farming easy and as fencing demarcation (MWS=2.7).

Table 3: Rating the Level of Benefitting Famers Adoption of AF Technology in Benue State

Variables	Very high	High	Moderate	Low	Very Low	N	WS	cc	Decision
Leucaena Sp	9(45)	1(4)	0	0	0	10	49	4.9	very high
Vertiver grass	1(5)	0	0	3(6)	6(6)	10	17	1.7	very low
Gliricidia sp	0	0	2(6)	4(8)	4(4)	10	14	1.4	very low

Table 14: Perception of Smallholder Farmers on Benefits of AF Technology in Benue State

Benefits	SA	A	UD	D	SD	N	WS	MWS
Agroforestry increases my farm output	34(170)	25(100)	2(6)	0	0	60	276	4.5*
It serve as Fertilizer to my crops	24(120)	36(144)	1(3)	0	0	60	267	4.4*
use it as staking materials for farm	40(200)	17(68)	4(12)	0	0	60	280	4.6*
use it as windbreak to protect my farm	18(90)	25(100)	10(30)	8(18)	0	60	238	3.9*
use for erosion control in farm	17(85)	21(84)	14(42)	9(18)	0	60	129	2.1ns
used the plant to meet fuel wood needs	30(150)	22(88)	8(24)	1(2)	0	60	264	4.3
use it as Mulching material/ Green Manure	26(130)	30(120)	4(12)	1(2)	0	60	264	4.3
use for treatment of animal/birds diseases	23(115)	21(84)	6(18)	7(14)	0	60	231	3.8
use it as shed/shelter for domestic birds animals	23(115)	21(84)	11(33)	0	0	60	232	3.8
It provide cheap source of fodder	24(120)	22(88)	9(27)	6(12)	0	60	137	2.2
It makes mixed farming easy	27(135)	13(52)	5(15)	14(28)	2(2)	60	132	2.2
use it for fencing/boundary demarcation	25(125)	21(84)	9(27)	6(12)	0	60	164	2.7
use it for timber/furniture materials	17(85)	13(52)	11(33)	19(38)	0	60	208	3.4
Alternative sources of income/ It increased my income	18(90)	25(100)	8(24)	10(20)	0	60	234	3.8

Where: SA=strongly agree; A=agree; u=undecided; D=disagree; SD=strongly disagree
Source: field survey (2020).

DISCUSSION

Socioeconomic Characteristics of Smallholder Farmers on *Leucaena leucocephala* Agroforestry (AF) in Benue State, Nigeria

The study recorded high number of male respondents who were involved in adoption and practice of *Leucaena leucocephala* AF technology in the study area, this could be due the fact that agriculture practice in the area is dominated by male which is influence by land tenure system practice by the people (Idoma and Isma'il, 2014; Ivande *et al*., 2014). Majority of the respondents were young and agile people; this shows that majority of the respondents were active in farming activities. This presents a promising future for agroforestry practices in the study area. The study established that farming is no longer dominated by illiterate people as most of the respondents had formal education. This is an indication that enlightened and educated people are embracing agriculture in Benue State as their means of livelihood, and with their level of education, understanding *Leucaena leucocephala* AF technology was not difficult (Jara-Rojas *et al.*, 2020). This agrees with the submission by United States Agency for International Development, USAID (2010) that the more educated a farmer is the more chances that the farmer would adopt innovations.

The majority of farmers were married, this is common among Nigerian farmers, and scholars (Issa *et al.*, 2016, Ivande *et al.*, 2019) believed that married people dominate agricultural production activities in Nigeria. This is because they rely heavily on the farming activities to provide for their family members. Majority of the respondents were farmers, involved in farming activities as their primary occupation. This is a common attribute of the rural communities in Nigeria where majority of the people are farmers (Michael and Abdulqudus, 2021; Charles *et al.*, 2021). The family size recorded in this study is an affirmation that most of the farmers used the family members as labour force for farming, so the more members in the family the larger the size of the farm. With such number of household members, human labour could be easily achieved during land clearing and cultivation of crops in the area. Yusuf *et al.* (2016) submitted that due to increase in demand for labour in family farming, the larger the household size the more family labor is utilized. This result agrees with the results of Ojiako and Ogbukwa (2012) who reported the average household size of farmers to be 7 persons.

The study revealed that male dominated extension agents in Benue state, similar experience was reported by Olorunfemi *et al.*

(2019) in Kwara state, but it was contrary to the findings of Uzoechi *et al.* (2022) in south eastern Nigeria where female were dominant. While Olorunfemi, *et al.* (2019) and Uzoechi *et al.* (2022) reported domination of young active people among extension agents in their studies, this study reported more aged people indicating absent of recruitment in the system. The study established that there was high level of education among the agents in the area, this was in line with submisions of Olorunfemi, *et al.* (2019) and Uzoechi *et al.* (2022). This result implied that all the extension agents involved for L.*Leucocephala* AF technology in the study area were well trained and educated with vast experienced over a long period of time, who had retired from active service as at the time they were assessed for this research work (Timothy, 2015).

Knowledge of Smallholder Farmers on *L. leucocephala* Agro-Forestry (AF) Technologies in Benue State

The result also revealed that all the extension agents had vast knowledge on AF technology in the area. The OFAR trial of *Leucaena* AF technology in the area has been into existence for about 26 years with a wider coverage in all the 3 ecological zones of Benue State; with small holder farmers that belong to a group received *Leucaena* AF technology seedlings which were distributed by extension agents to encourage and boost the growth and development of AF technology in the whole part of Benue state. By the result of this finding and the report of extension agents, it took a very long time (from 1995) since *Leucaena* AF technology was introduced in Benue State; yet majority of the farmers in Benue state have not completely or fully have better knowledge of *Leucaena* AF technology and other related practices in Benue state. The study shows low level of knowledge of *L. leucocephala* AF technology among smallholder farmers in Benue state, as majority of the no neighbouring smallholder farmers were not aware of *L. leucocephala* AF technology in Benue state. This low knowledge of L. l*eucocephala* AF technology among the neighboring smallholder farmers in Benue state could be due to fact that the technology was still under trial and only pilot farmers' extension agents concentrated on giving information on the technology. But Aboh and Akpabio (2008) were of the opinion that weak connections between research organizations and extension could primary cause of low awareness. Similar experience was reported by Owooh (2013) in North Carolina, USA, Parwada *et al.* (2010) in Zimbabwe and Tokede *et al.* (2020) in Ibadan Oyo State, Nigeria

It could also be as a result of poor funding and follow up of the project in the study area; such is common among Nigeria and other developing countries, where projects are established and huge amount of capital is spent, but such project are easily abandoned or poorly monitored and evaluated. Also, lack of interest or skepticism that comes with innovation among rural farmers in the state could also be another factor which limited the smallholder farmers from having a better knowledge of AF technology system and other related AF practices which have many benefits to them and their environment at large. The result of this finding on awareness of farmers benefiting on L. *leucocephala* agroforestry.

Level of adoption of *Leucaena leucocephala* Agroforestry (AF) Technology by Smallholder Farmers in Benue State

There was higher level of adoption among the trial farmers than the neighbouring farmers. This could be due to the fact that; pilot farmers were exposed more to the benefits of AFT than the neighbouring farmers. This similar experience was reported by Parwada *et al.* (2010) in Zimbabwe. The study indicates that there is increased likelihood for farmers in the area to adopt Agroforestry technologies if they are well exposed to the benefits of AFT. Awe, *et al.* (2021) opined that adoption of Agroforestry technologies is determined by several factors including socioeconomic, environmental, and mental processes that are governed by a set of intervening variables such as individual needs, knowledge about the technology and individual perceptions about methods used to achieve those needs. Result on the level of adopting *Leucaena leucocephala* Agroforestry (AF) Technology by smallholder farmers in the study area indicates that, the smallholder farmers that have adopted the practice of AF technology had also been

practicing the system for a long period of time; with majority of the farmers being into the practice for not less than 10 years. This was an indication that AF system has been into existence for a long period of years; with the existence of this system of farming in the study area, the adoption level could be said is too low and the practicing of AF technology is very slow and call for urgent action to improve the rate of adoption of the system in the study area.

Extension agents that introduce *Leucaena* AF technology in Benue state rated level of adoption by benefitting farmer as very high. This shows that, there was clear understanding of AF technology by the few smallholder farmers who have adopted and practiced AF technology in the area. This result could be due to numerous benefits derived from AF technology, which the farmers have experienced or benefited within their early stage of adoption of the system in the area. Franzel *et al.* (2001) observed high adoption of agroforestry technologies by farmers. While in a separate study conducted by Ajayi, (2007) shows that adoption of these technologies is low. According to Phiri *et al.* (2004) and Keil *et al.* (2005) farmers that are involved in on-farm experimentation of agroforestry technologies with the researchers are more likely to adopt than those who are not.

Perceived Benefits of AF Technology Experienced by the Smallholder Farmers in the Study Area

Studies on perception of smallholder farmers on benefits of AF technology indicates that, the farmers perceived AF technology as playing significant role on their livelihood, by providing goods and services such as wind break, erosion control, soil stabilization, source of food, medicine and income in the study area (Parwada *et al.*, 2010, Ibrahim *et al.*, 2019). In this study the major benefit of AFT as listed by the farmers was staking of yams, this could be due to the fact that yam is the major crop of the farmers in the area. Among *Leucaena* litter components, leaf litter contributes more nutrients, especially nitrogen (N) than other litter components. Between The high biomass production, N content and decomposability of *Leucaena* leaves indicates its greater potential for use as green manure (Mwiinga *et al.*, 1994) to farm crops when combined alongside *Leucaena* species.

The result on benefits of AF technology to the farmers in the study area revealed that birds, goat, pigs, and sheep, among other animals were reared alongside *Leucaena* species. The high nutritive value of *Leucaena* species makes *it* the best forage supplement to increase animal production and fed elephant grass basal diets (Rusdy 2020). *Leucaena* in combination with grass pasture is one of the most persistent, productive and sustainable grazing system used in north Australia (Shelton and Dalzell, 2007). For these reasons, establishment of *Leucaena* can be a technology of choice for increasing a sustainable animal production from tropical grassland (Rusdy, 2020).

REFERENCE

Aboh, C. L. and I. A., Akpabio (2008): "Gender and Analysis of Common Agroforestr Practices in Akwa Ibom State, Nigeria", *Agricultural Journal*, Vol. 3 (3) pp.185-89.

Ajayi, O.C, F.K Akinnifesi, S and Gudeta, S Chakeredza, (2007): Adoption of renewable soil fertility replenishment technologies in southern African region: lessons learnt and the way forward. *Natural Resources Forum* 31(4):306–317.

Awe, F., Oguntoye, T.O. and Olatunji, B.T. (2021). Determinants of Farmers' Adoption of Agroforestry Technology in Ibarapa Area of Oyo State, Nigeria, *Journal of Agriculture and Food Sciences*.19(1): 189-200

Charles, A., Hussein, S., Laing, M., Admire, I., Shayanowako, T., Ugen, M. A., Manyasa, E. and Ojiewo, C. (2021): Assessment of sorghum production constraints and farmer preferences for sorghum variety in Uganda: implications for nutritional quality breeding, Acta Agriculturae Scandinavica, Section B — *Soil and Plant Science*, 71:7, 620-632,

Dagba, B.I., Igbaukum, E., Ancha, P. U. and Ikyaagba, E.T. (2016). Perceived Influence of

Socio- economic Factors of FADAMA III Farmers on Forest Resources Values in Benue State, Nigeria. *Journal of Environmental Science, Toxicology and Food Technology* 10(9):87-94

FAO (1995). Leucaena psyllid: a threat to agroforestry in Africa; Workshop Proceedings held in Dar-es-Salaam, United Republic of Tanzania 10-24 October 1994 *Organized by:* Tanzania Forest Research Institute (TAFORI) *In collaboration with:* Food and Agriculture Organization of the United Nations USDA Forest Service International Institute of Biological Control International Centre for Research in Agroforestry Sokoine University of Agriculture. 1-37pp

Franzel, S., Coe, R., Cooper, P., Place, F., and Scherr, S. J. (2001): Assessing the adoption potential of agroforestry practices in Sub-Saharan Africa. *Agricultural Systems*, 69(1-2), 37-62.

Hula M. A. and Ukpong I. E (2013), Exploring the relationship between farming practices and vegetation dynamics in Benue State, Nigeria. *World Journal of Agricultural Sciences.* 1 (7):232-240,

Ibrahim, A. O., Adedeji, A. S. and Meduna, P. N. (2019): Constraints Facing Agroforestry Practices Among Farmers in New Bussa, Nigeria; *Journal of Research in Forestry, Wildlife & Environment;* 11(3): 133-141.

Idoma, K. and Ismaail, M. (2014). The effects of Land Tenure practices on Agricultural output in Agatu Local Government Area of Benue State, Nigeria. *Journal of Development and Agricultural Economics* 6(5): 212-219

IITA (1988): Annual report. Retrieved from *www.googlebooks.org.ng* accessed August 4, 2018.

Issa, F. O. Kagbu, J. H. and Abdulkadir, S. A (2016): Analysis of Socio-Economic Factors Influencing Farmers' Adoption of Improved Maize Production Practices in Ikara Local Government Area of Kaduna State, Nigeria; *Agrosearch;* 16 (2): 15-24.

Ivande, P.D. (2014). Assessment of social and technological change in agriculture among the Tiv, in Nigeria, (Unpublished Ph. D. Thesis) submitted to the Department of Agricultural Extension, University of Nigeria, Nnsukka.

Jara-Rojas, R., Soraya R., Lisandro R., Fleming-Muñoz D. and Engler A., (2020): Factors Affecting the Adoption of Agroforestry Practices: Insights from Silvopastoral Systems of Colombia; *Forests*, 11, 648:

Kang, B.T., Wilson G.F.and Sipkens L. (1981): Alley cropping maize (Lea mays) and Leuceana (*Leucaena Leucocephala* Lam) in southern Nigeria. *Plant and soil* 63 (2): 165-179, Kang, B.T., Grimme H and Lawson. T.L. (1985). Alley cropping sequentially cropped maize and cowpea with *Leucaena* on a sandy soil in Southern Nigeria. *Plant Soil* 85: 267-277.

Kang, B.T., Dugurna, B. (1985): Nitrogen management in alley cropping systems. In Kang, B.T., van der Heide, J., ed., Nitrogen management in farming systems in humid and subhumid tropics. Institute of Soil Fertility, Haren, Netherlands. pp. 269-284.

Keil, A., Zeller, M., and Franzel, S. (2005): Improved fallows in smallholder maize production in Zambia: do initial testers adopt the technology? *Agroforestry Systems*, 64, 225-236.

Lal, R. (1989): Agroforestry systems and soil surface management of a tropical alfisol: *I: Soil moisture and crop yields. Agroforestry systems* 8 (1):7-29,

Michael, B.V. and Abdulqudus, A. I. (2021). Agriculture Remains Preferred Occupation in Rural Nigeria Despite Pandemic-Related Challenges*; International Crops Research Institute for The Semi-Arid Tropics (ICRISAT) Happenings News Letter*: 7pp.

Mwiinga, R. D., Kwesiga, F. R. and Kamara, S. (1994). Decomposition of leaves of six multipurpose tree species in Chipata, Zambia., *Forest Ecology and Management,* 64 (2-3): 209- 216.

OFAR (1996): On-farm Adaptive Research report. Agroforestry Unit. Benue State Agricultural Development Authority (BNARDA), Makurdi, February 1996 (Unpublished).

Ojiako, I.A. and Ogbukwa, B.C. (2012): Economic analysis of loan repayment capacity of small-holder cooperative farmers in Yewa North Local Government Area of Ogun State, Nigeria. *Afr. J. Ag. Res*., 7: 2051-2062.

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R. and Anthony, A. (2009) Agroforestry Database: a tree reference and selection guide version 4.0 Retrieved from (*http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp)* accessed November 5, 2018.

Owooh, B. K. (2013) "Assessment of The Adoption Of Agroforestry Technologies By Limited-Resource Farmers In North Carolina" (2013). Theses. 312

Papka, P.M. (1995): Status of *Leucaena* in Nigeria. *Leucaena* psyllid: a threat to agroforestry in Africa. Proceedings at Dar es Salaam, United republic Tanzania. 10-24 October, 1994. Retrieved from www.fao.org accessed November 8, 2018.

Parwada, C.; Gadzirayi1, C.T.; Muriritirwa, W.T and Mwenye, D. (2010): Adoption of agro-forestry technologies among smallholder farmers: A case of Zimbabwe; *Journal of Development and Agricultural Economics;* 2(10): 351-358.

Phiri, D., Franzel, S., Mafongoya, P., Jere, I., Katanga, R. and Phiri, S. (2004): Who is using the new technology? The association of wealth status and gender with the planting of improved tree fallows in eastern Zambia. *Agrofo*restry *System,* 79: 131-144.

Rusdy, M. (2020): Silvopastoral system using *Leucaena Leucocephala* for sustainable animal production in the tropics. Livestock Research for Rural Development. Volume 32, Article #57. Retrieved 9th April, 2024, *fromhttp://www.lrrd.org/lrrd32/4/murhu32057.html*

Shelton, M. and Dalzell, S. (2007). Production, economic and environmental benefi ts of leucaena pastures; *Tropical Grasslands* (2007) Volume 41, 174–190 174.

Tokede, A. M., Banjo, A. A., Ahmad, A. O., Akanni, O. F. and Olumide-Ojo, O. (2020) Perception of Farmers On Agroforestry Systems Adoption in Akinyeleloc Al Government Area, Ibadan, Oyo State, Nigeria; *Journal of Research in Forestry, Wildlife & Environment;* 12(3): 235-242.

United States Agency for International Development (USAID), (2010). ICT to Enhance Farm Extension Services in Africa. FACET *Briefing Paper*, Washington DC.35P

Uzoechi, O., Ogunlade, I. and Omotesho, K. F. (2022). Socio-Economic Characteristics Influencing Extension Agents' Competencies in South-East, Nigeria. *FUOYE Journal of Agriculture and Human Ecology* 6(1): 69--77

. Yusuf, H. A., Omokore, D. F., Akinola, M. O. and Omolehin, R. A. (2011) Socio-economic characteristics influencing farm household participation in gandu system in Charanchi Local Government Area of Katsina State Nigeria; *Journal of Agricultural Extension and Rural Development;* 3(12): 220-223.