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Social Capital and Poverty Coping Strategies of Rural Women in Song Local Government Area of Adamawa State, Nigeria

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Abstract

The burden of rural household poverty is more on women and female-headed households than male-headed ones. The objective of this study is thus to determine the poverty coping strategies of rural women in Song Local Government Area (LGA) of Adamawa State. Disproportionate and systematic sampling technique was used to select 35 rural women each from the six districts of the study area to give 210 respondents for the study. Interview schedules were used to elicit information from the sampled rural women but only 189 of the schedules were useable. Data were described using frequencies, percentages and means, and hypotheses were tested with chi-square, PPMC and ANOVA. Results show that the women were predominantly young (69.8%), married (53.4%) and were more involved in religious group (65.6%) than in occupational (7.9%) and credit groups (9.0%). Many (65.1%) of these women were barely doing well in their income generating activities. Poor storage and processing facilities were ranked first and second among the challenges faced by the women. Their poverty coping strategies were selling of livestock, gathering and selling of NTFPs and reducing household consumption. Social capital accumulation or group participation was found to be a strategy used to cope with poverty. It is recommended that rural women should put same interest they have in religious groups into their occupational and credit groups.

Key words: Social capital, Poverty reduction, Coping strategies, Rural income generating activities

INTRODUCTION

Poverty is defined as a state of long-term deprivation of well-being, a situation considered inadequate for a decent living (Barry, 2010). It is the lack of necessities such as food, clothing, shelter, medical care and safety. The problems of the poor include social inferiority, isolation, physical weakness, vulnerability, powerlessness and humiliation (Roslan et al., 2010). The poor are exposed to risk, limited opportunities to income generation, misery, crime, untimely death, fear, depression and suicide. The essence of poverty is inequality.

In Nigeria, poverty is widespread and severe in respect of access to standard education, economic skills, safe water, balanced nutrition, decent housing, good health care facilities and security services. The reality of the Nigerian poverty situation according to Okunmadewa (2001) is that more than 40 percent of Nigerians live in conditions of extreme poverty spending less than ₦320 ($2) per day. The Northern part of Nigeria is the most impoverished region of the country. National Bureau of Statistics (2010) concluded that five northern states are the poorest in the country with Sokoto state leading the pack with 86.4% poverty rate, followed by states like Bauchi (83.7%), Katsina (82.0%), Adamawa (80.7%) and Kebbi with 80.5%.

According to Oyesola and Ademola (2012), the burden of rural poverty is more on women and therefore female-headed households tends to be poorer than male-headed ones. This is basically because of the roles assigned to women by the social and religious institutions prevalent in Nigeria. Many of these norms plug women deep into poverty. Some of these are religious seclusion, marginalized access to income

generating resources and opportunities, and the imposed child and home nurturing responsibilities. Other factors that could be responsible for poverty among women include their concentration in low-paid job, limited education, discrimination by many employers of labour, and poor state of health.

Mahmood (2000) states that the socioeconomic (income level, educational level, occupational level and asset ownership) determinants of women's livelihood are low. Consequently, in order to cope with their gender roles, women do labour intensive work like crop cultivation, livestock rearing, fishing, agro-processing, petty trading, net making, mat weaving, food preparation, rice pounding and dress making (Murray *et al*., 2001). Besides all these, the National Bureau of Statistics (2012) expresses that 74.2% of the populations of Adamawa state are living below the poverty line of 1.25 to 2 dollar per day. The objective of this study is therefore to determine the poverty coping formation (120 points) was the most preferred ment Area (LGA) of Adamawa state. The research questions are:

1. What are the personal characteristics of rural women in Song LGA?
2. What is their social capital level?
3. What are their income generating activities?
4. What challenges do they face in their income generating activities?
5. What are their coping strategies employed to combat poverty?

The following null hypotheses were tested in the study:

Ho₁ - There is no significant relationship between selected personal characteristics and poverty coping strategies of the rural women

Ho₂ - There is no significant relationship between the social capital and poverty coping strategies of the rural women

Ho₃- There is no difference in the poverty coping strategies employed by the rural women in the six districts of Song LGA

METHODOLOGY

Song Local Government is one of the twenty one Local Government Areas in Adamawa State, Nigeria. It comprises of six districts namely; Song, Suktu, Waltadi, Sigire, Ditera and Zumo. Geographically, Song Local Government area is situated in the eastern part of the state; it shares boundaries with Gombi and Fufore LGAs to the south, Maiha LGA to the east, Girei and Hong LGAs to the north, and Shelleng and Demsea LGAs to the west. Song Local Government is surrounded by rocky hills and has a verse agricultural land. The people of Song local government are predominately farmers. Thetarget population for this study is rural women in all the six districts of Song Local Government Area of Adamawa state. The 2012 estimated population of the women in the study area is 66,157. Disproportionate and systematic (5th household) sampling technique was used to select 35 rural women each from the six districts to give 210 respondents for the study. Interview schedules were used to elicit information from the 210 rural women sampled but only 189 of the schedules were useable. Data were described using frequencies, percentages and means, and hypotheses were tested with Chi-square, PPMC and ANOVA.

RESULTS AND DISCUSSION
Personal characteristics of the respondents

Result of analysis in Table 1 shows that most (69.8 %) of the rural women were between 28 and 43 years of age, and their mean age was 35 years. This implies that these women are young, agile and economically active. More than half (53.4 %) of these women were married while 21.6% of them were widowed. This implies early marriage among this population and perhaps untimely deaths of men in the area. This is more so because an average family had 3 males and 3 females in the area. Only 24.3% had no formal education, implying that their level of literacy and numeracy is good enough to help their enterprises. Majority (69.8%) of the women were Christians, implying that they could engage in wide range of enterprises that would not be expected in the northern parts of Nigeria because of its Islamic domination. This is also explained by the fact that only 1.5% were Hausas while many (56.61%) were Yurgurs. Measure of ethnicity is pertinent because Alison and McArearcy (2013) stated that poverty and ethnicity are linked - there is a higher level of poverty among minority ethnic group than among majority ethnic group.

Table 1: Distribution of the rural women by their personal characteristics

Socioeconomic variables	Freq	%	Mean
Age (in years)			
< 27	31	16.4	35
28- 43	132	69.8	
> 43	26	13.8	
Marital status			
Married	101	53.4	
Single	26	13.8	
Separated	66	3.2	
Divorced	15	7.9	
Widowed	41	21.7	
Males in the household			
1 -5	156	82.5	3
> 5	33	17.5	
Females in the household			
1 -5	162	85.7	3
> 5	27	14.5	
Educational level			
Non formal	46	24.3	
Primary	81	42.9	
Secondary	42	22.2	
Tertiary	20	10.6	
Religion			
Christian	132	69.8	
Islam	52	27.5	
Traditional	5	2.7	
Ethnicity			
Yurgur	107	56.6	
Mboi	33	17.5	
Fulani	40	21.2	
Lahah	6	3.2	
Hausa	3	1.6	

Respondents' social capital endowment

World Bank (2000) states that the poor have bonding needs, they require more bridging and linking to connect them to external actors and policy maker. information in Table 2 indicates that 65.6% of the women participated in religious groups, 19.6% o held a leadership position in the groups and the mean years of participation was six. Also, 58.7% of the women participated in gayya (informal work-exchange) groups, 9.0% of them held a leadership position in the groups and the mean years of participation was four. Only few (9.0%) of the women participated in cooperative groups, 4.2% of them held a leadership position in the cooperative groups and the mean years of participation was four. Lastly, 7.9% of the women participated in processing groups, 0.5% held a leadership position in the processing groups and the mean years of participation was four. This result suggests that these women participated more in religion and work-exchange groups than occupational and credit groups. This result is in agreement with the findings of Adeyeye (2004) that rural dwellers have not mastered how to use their social networks to improve their economic life. This is however an improvement because these rural women have solved their labour insufficiency by participating in informal work exchange groups.

Table 2: Distribution of the rural women's social capital

Group	Participation*	Mean years of participation	Leadership
Religious	124(65.6)	6	37(19.6)
Cooperative	17(9.0)	4	8(4.2)
Gayya	111(58.7)	4	17(9.0)
Processing	15(7.9)	4	1(0.5)

*Multiple responses

Respondents' income generating activities

According to available information in Table 3, piggery (20.1%) is the first primary activity and the second income earner (₦ 3,313) among the rural women in Song LGA of Adamawa State, Nigeria. Brewing of local alcoholic drinks (13.8%) was the second primary occupation, while cultivation of semseed (10.6%) was the third and the first income earner (₦ 3,446). However, only few (15.3%) of them were

involved in the cultivation of semseeds as profitable as it is. The fourth primary activity was petty trading (10.1%), while maize and groundnut cultivation and fetching firewood ranked fifth (6.9%). The activities that were least practiced as primary activities were pottery, fruit and barbara nut cultivation. The activities with the least level of involvements were pottery (2.6%), hairdressing (3.2%), guinea fowl keeping (10.6%), barbara nut (11.1%) and semseed (15.3%) cultivation. Table 3

also shows that there is only one planting season in the area because almost all cultivations were done in the wet season, showing a high need for irrigation farming. This agrees with Besley and Ghatak (2009) that the economic potentials of agrarian natural resources are not been optimized in most part of the world. The average monthly income for each income generating activities of the women was ₦ 1302, this reveals that these women were low income earners, especially when compared to the average family composition of 3males and 3females. This shows their level of poverty despite their multiple involvements in income generating activities.

Table 3: Distribution of the rural women's income generating activities

Activities	Involvement*	Primary Activity	Rank	Season of Involvement			Mean Monthly Income ₦
				Dry	Wet	Both	
Maize	96(50.8)	13(6.9)	5th	-	95(50.3)	1(0.5)	718.87
Guineacorn	53(28.0)	5(2.6)	11th	-	53(28.0)	-	622.12
Semseed	29(15.3)	20(10.6)	3rd	-	30(15.9)	-	3446.43
Groundnut	70(37.0)	13(6.9)	5th	-	70(37.0)	-	1388.73
Beans	82(43.4)	9(4.8)	9th	-	83(43.9)	-	900.00
Barbara Nut	21(11.1)	1(0.5)	15th	-	20(10.6)	-	188.89
Rice	44(23.3)	2(1.1)	13th	-	44(23.3)	-	1013.17
Chicken	57(30.2)	10(5.3)	8th	-	-	57(33.2)	1005.09
Guinea fowl	20(10.6)	6.(3.2)	10th	-	-	20(10.6)	1435.00
Duck	54(28.6)	5(2.6)	11th	-	-	55(29.1)	902.50
Pigs	76(40.2)	38(20.1)	1st	-	-	73(38.6)	3313.16
Hairdressing	6(3.2)	2(1.1)	13th	-	-	6(3.2)	842.86
Pottery	5(2.6)	1(0.5)	15th	-	-	5(2.6)	1525.00
Brewing	80(42.3)	26(13.8)	2nd	-	-	80(42.3)	1452.60
Trading	66(34.9)	19(10.1)	4th	-	-	64(33.9)	1483.82
Firewood	73(38.6)	13(6.9)	5th	-	-	73(38.6)	1502.75
Fruits	70(37.0)	1(0.5)	15th	5(2.6)	11(5.8)	53(28.0)	717.12

*Multiple responses

Level of income generating activity

Majority (65.08%) of the rural women had a low level of income generating activity as shown in Table 4, which is a norm in most rural areas of Nigeria in the opinion of Fasoranti (2007). as reported earlier in this study this may be due to the fact that many of them were not involved in activities that ensure more income and rather engage in activities with little net returns. Also, farming in one planting season is a major setback.

Table 4: Distribution of the rural women's level of income generating activity

Level	Freq	%
High	66	34.92
Low	123	65.08

Challenges faced in income generating activities

Table 5 reveals that poor storage facility was ranked first with mean score of 2.044highest among the challenges facing these rural women in their chosen income generating activities. This encouraged spoilage of products and to avoid this, products were being sold at poor prices in order to get rid of them before spoilage. Accompanying this challenge is poor processing facility with a mean score of 2.042; many products could have been given longer shelf life if processed to add value and eventually sold at good prices. This corroborates Weber and Jensen (2004) that concluded that inadequate storage and processing facilities in agrarian rural communities deepens the scourge of poverty for farming households. Also, because of the limitation of physical strength in women, they sought for labourers which were not readily accessible, making shortage of labour (2.018) the third challenge. Lack of access to credit was the fourth challenge and not surprising because of the result in table 2 that shows that many of them were not participating in credit groups. Other challenges were inadequate input (5th), lack of access to land (6th), inadequate extension services (7th) and lack of information (8th). This shows that women still have limited access to major input resources in this area.

Table 5: Distribution of the rural women's challenges in their activities

Challenges	Felt *	Mean	Rank
Lack of information	49(2.9)	1.646	8th
Lack of access to land	24(12.7)	1.958	6th
Lack of access to credit	140(74.1)	2.014	4th
Inadequate extension services	33(17.5)	1.912	7th
Poor storage facility	112(59.3)	2.044	1st
Poor processing facility	71(37.6)	2.042	2nd
Shortage of labour	56(29.6)	2.018	3rd
Inadequate input	155(82.0)	2.013	5th

*Multiple responses

Poverty coping strategy

Sale of livestock was the number one poverty coping strategy among the rural women in the study area. The livestock were kept as a form of financial security in trouble times as also documented in Yusuf (2008). Secondly, crop production was done by almost all the women, even by those that were not primarily farmers in order to meet some household food demands. Thirdly, gathering and selling of Non Timber Forest Products (NTFPs) was also another coping strategy done to meet emergency cash needs. Other poverty coping strategies were not monetary, for example gayya was the fourth strategy adopted because participating in this work-exchange activity meets their labour needs and palliate poverty. Another important monetary poverty coping strategy is the 8th one, which is the sale of labour. These women would go out of their ways to offer their physical strength to serve as labourers for some other people. This could be humiliating and breed social inferiority according to Okuneye (2000), both of which are poverty indicators. Reduction of household consumption that ranked 9th alongside handcraft is another important non monetary strategy to cope with little resources.

Table 6: Distribution of the rural women's poverty coping strategies

Activities	Involved *	Rank	Dry	Wet	Both
Monetary					
Shelling of groundnut	73(38.6)	6th	17(9.0)	3(1.6)	53(28.0)
Trading	78(58.7)	5th	-	-	78(41.3)
Sale of labour	44(23.3)	8th	1(0.5)	18(9.5)	25(13.2)
Sale of NTFP	106(56.1)	3rd	1(0.5)	11(5.8)	94(49.7)
Contribution from Fadama	10(5.3)	17th	-	1(0.5)	10(5.3)
Sale of livestock	160(84.7)	1st	-	3(1.6)	156(82.5)
Crop production	145(76.7)	2nd	-	132(69.8)	10(5.3)
Sale of nunu	28(14.8)	12th	1(0.5)	-	27(14.3)
Pottery	1(0.5)	18th	-	-	1(0.5)
Hand craft	35(18.5)	9th	3(1.6)	1(0.5)	31(16.4)
Migration job	31(1.4)	11th	1(0.5)	2(1.1)	28(14.8)
Sale of boiled or roasted maize	26(13.8)	13th	-	18(9.5)	7(3.7)
Sale of boiled cassava	16(8.5)	16th	-	13(6.9)	3(1.6)
Frying and selling yam	70(37.0)	7th	1(0.5)	5(2.6)	64(33.9)
Non-monetary					
Reduced household consumption	35(18.5)	9th	1(0.5)	7(3.)	26(13.8)
Gayya	81(42.9)	4th	-	63(33.3)	18(9.5)
Migration	13(6.9)	17th	-	-	13(6.9)
Intensive resource use	21(11.1)	15th	-	1(0.5)	20(106)
Reduction of household size	26(13.8)	13th	-	10(5.3)	16(8.5)

*Multiple responses

Relationship between selected personal characteristics and poverty coping strategies of the rural women

The chi-square test of association report in Table 7 shows that there was an association between each of age (p=0.030), religion (p=0.008), ethnicity (p=0.025) and poverty coping strategies. This implies that strategies employed to cope with poverty varies across age categories, religion and ethnicity. The more religious the women were, the more they had to adopt poverty coping strategies because the more religious they

were, the poorer they were. This corroborates the findings of Barry (2010) that poor societies are more religious and vice versa. On the other hand, there was no association between each of marital status (p=0.301), household size (males in the household plus females in household, p=0.495),

level of education (p=0.305) and poverty coping strategies. This shows that strategies employed to cope with poverty among the rural women do not vary across marital status, household size and level of education.

Table 7: Test of association between personal characteristics and poverty coping strategies

Personal characteristics	Chi-square value	Df	p- value	Decision
Age	7.040	2	0.030	S
Marital status	4.866	4	0.301	NS
Household Size	0.466	1	0.495	NS
Educational level	3.625	3	0.305	NS
Religion	9.674	2	0.008	S
Ethnicity	11.369	4	0.025	S

Significant (S) at p≤0.05 and Not significant (NS) at p>0.05

Table 8: PPMC test of relationship between social capital and poverty coping strategies

	r- value	p- value	Decision
Relationship between social capital and poverty coping strategies	0.185	0.013	Significant

Significant (S) at p≤0.05 and Not significant (NS) at p>0.05

Relationship between the social capital and poverty coping strategies of the rural women

PPMC result of analysis between social capital and poverty coping strategies on Table 8 shows that there was a significant relationship (r=0.185, p=0.013) between the two variables. This positive correlation implies that the higher the social capital, the higher the poverty coping strategies. This means that group membership and participation equip these rural women with methods and practices that help in mitigating the scourging effect of poverty. This is in tandem with findings of Roslan *et al* (2010), who stated that for every unit increase in social capital, the poverty level is reduced by 18.3%.

Difference in the poverty coping strategies among the rural women in the six districts of Song LGA

The ANOVA test of difference between the poverty coping strategies among the rural women in the six districts of Song LGA shown in Table 9 reveals that there was no significant difference between the poverty coping strategies of women across the districts of Song Local Government Area of Adamawa State. This implies that these women do not employ different strategies to cope with poverty. The result is in tandem with the conclusion of Zimmerman *et al* (2003) that the indices or externalities of poverty is same in all societies because it always comes than to low asset and consumption bases. This uniformity in poverty coping strategies in the area could therefore infer that a uniform poverty reduction intervention is required across the districts.

Table 9: ANOVA test of difference between the poverty coping strategies

	Sum of square	Df	Mean square	F	Sig	Decision
Poverty coping strategies	2.984	6	0.497	2.052	0.061	NS

Significant (S) at p≤0.05 and Not significant (NS) at p>0.05

CONCLUSION

It is concluded that the rural women in Song Local Government Area of Adamawa State, Nigeria were predominantly agile but less involved in occupational and credit groups. The

highest income earner among their activities was cultivation and sale of semseed. However, they could only cultivate crops in the wet season. The average income per month on each of their income generating activities was low. Many of

these women were barely doing well in their income generating activities because of challenges such as poor storage and processing facilities. In order to cope with low income and meet pressing demands, they sold their livestock, gathered and sold NTFPs and reduced household consumption. Their choice of these strategies varied with their age, religion and ethnicity. Also, social capital accumulation or group participation was found to be another strategy used to cope with poverty. Lastly, despite the differences among the women in the six districts of Song LGA, there poverty coping strategies were not different.

RECOMMENDATIONS

It is recommended that cultivation and sale of semseed should be encouraged with incentives. Other high income earner activities should be introduced to the women since they have the agility required to engage in more income generating activities. These rural women should be encouraged to participate more in occupational and credit groups. Also, irrigation programme should be intensified in the LGA in order to allow for at least two planting seasons. There is also a need for an intervention in the areas of storage and processing units in the area. In addition, any poverty reduction intervention purposed for the LGA should differ across age categories, religion and ethnicity but not across the districts.

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Nigeria Manpower Needs and Opportunities in Freshwater Fish Seed Production

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Abstract

Aquaculture is presently recognized as having a steady growth in Nigeria, however, the sustainability of its contribution to food security is hinged on availability of quality fish seed from hatcheries for stocking. Unfortunately, most hatcheries in the country are managed by quack whose actions or inactions kill people interest in aquaculture business. Therefore, a major constraint to steady contribution of aquaculture sub sector to the economic growth of the country is lack of adequately skilled manpower especially in the area of fish seed production. For aquaculture to ultimately provide the much needed employment and wealth for sustainable economic growth, adequately equipped, skilled and experienced manpower must be available. Urgent need arises for skilled personnel in the area of Broodstock development and management, Fish Seed Production, Geneticists and Ecologists to continually boost fish production. These will lead to arrays of opportunities for employment generation, food security and economic transformation. This paper therefore reviews the manpower need and opportunities in freshwater fish seed production in Nigeria.

Keywords: Aquaculture, Broodstock, Geneticists, Ecologists, Employment.

INTRODUCTION

Aquaculture has been accepted the world over as a mean for increasing fish production. In Nigeria, a large proportion of both urban and rural populations lives beside the lakes, rivers, reservoirs, swamps, floodplains, lagoons, wetlands and estuaries, all of which are important ecosystem for fisheries and aquaculture. (Ita, 1993).This, therefore, offers tremendous opportunity for fish culture. With the expected increase returns from aquaculture, the number of fish farmers is increasing. Faturoti (2010) stated that aquaculture has been clearly demonstrated to be an economically viable, private enterprise in Nigeria, with 2,642 fish farms inventoried. Despite the popularity enjoyed by aquaculture practice and its great market potentials in Nigeria, the production is yet to meet up with local fish demand. One major causal to this trend is lack of access to adequate amount of viable seed for stocking. Charo and Orirere (2000) x-rayed the constraint to intensification and expansion of fish culture in Nigeria to inadequate supply of quality fingerlings and juveniles for stocking of ponds, cages and pens, due principally to inadequate number of hatcheries occasioned by lack of

qualified manpower. Also, Atanda (2006) stressed that fish farmers in most part of the country (especially in the northern region), are perpetually in need of hatchery-produced fish seed for their farm. This factor had limited their production and hence returns from their investment capabilities.

Aquaculture - a multi-disciplinary endeavour, had over the years in Nigeria, been characterized by serious deficiencies of adequately trained personnel capable of identifying and addressing challenges in aquaculture production projects (Fagbenro *et al.*, 2003). Insufficient number of such personnel remains a major constraint to the growth of this subsector and had manifested more in fish hatchery unit of the industry. There are many fish hatcheries in the country which have folded-up, due to poor management. Many small-scale farmers failed to profitably operate their fish farm as a result of dearth of good quality seed. Even in areas where fingerlings are produced in sufficient quantities, the genetic viability of such seeds is perceived as another major constraint to expansion of freshwater fish culture. This could also be an offshoot of insufficient and/or inadequate manpower to select good parent stock and lack / inadequate research into the genetic

viability of the local and exotic breed used for artificial propagation. The dearth of manpower is therefore reflected in the area of fish breeding and genetics which are so crucial to boosting fingerlings production.

It has been observed that shortage of skilled manpower constrains developing countries from implementing most of their developmental programmes effectively. No country can realize its full economic potential without adequately harnessing its human resources. Hossain *et al.*(2008) noted that in the developing and developed countries where aquaculture plays a vital role in promoting production of aquatic organisms, alleviating poverty, ensuring environmental compatibility, replenishing and improving the natural stocks, increasing socio-economic improvement through integrated development approach, developing and managing the aquatic resources, maintaining gene banks and preserving the diversity of fish stocks, human resource development (HRD) remain inevitable for optimum and sustainable practice within the system. Hence, Nigeria, with her large population and array of seasoned fisheries professionals, prospective investors and entrepreneurs in the African sub-region should blaze the trail in provision of sufficient fish breeders and geneticists. This paper was therefore, borne out of the need to draw attention to the critical issue of demand and supply of skilled manpower in freshwater fish seed production.

Nigeria's manpower needs in freshwater fish seed production

In Nigeria, freshwater fish seed production through artificial propagation has become popular and helpful in aquaculture development. The total seed production and supply from all sources amounts to 55 million fingerlings. This is far less than the requirement of about 500 million per annum to satisfy the immediate needs of the market (Atanda, 2007). However, aquaculture (table fish) production increased from 30,000metric tones in 2000/2001 to 80,000metric tones in December, 2006 (Areola, 2007).This growth is commendable and attributable to various interventions by governmental and non-governmental organizations but still fall short of the nation aquaculture potential of 2.5 million metric tonnes per annum (FAO, 2007).

It is appalling to note that many of the so-called manpower involved in catfish breeding in the country are either untrained or poorly trained who within a week or two weeks of training, assume the responsibility of producing fingerlings for farmers. This implies that quackery is been promoted in the industry with relish to the detriment of the unsuspecting investors who end up paying dearly for this oversight. Seed quality according to Food and Agriculture Organisation (FAO, 2007) is an essential attribute to optimizing the potential of aquaculture production (better yield and returns) and is related to the quality of the brood stock used which can only be identified by an adequately trained personnel. Therefore, sustainable aquaculture requires reliable supply of good quality seed for pond stocking which can only be guarantee through fish hatchery managed by skilled/trained personnel.

Nigeria aquaculture industry is dominated by the culture of two fish species and their hybrid. These are the African mud catfish- *Heterobrancus sp., Clarias sp.,* their hybrid and Tilapia whereas over 20 species of freshwater fish can be cultured. This implies that sufficient intervention is required in the area of research and extension services to develop these other freshwater fish species to increase consumer choices and consequently enhance the returns for the fish farmers.

Although, the few fish geneticist available in the country have developed some other species of improved quality through hybridization, these are yet to be commercialized because the techniques of handling require highly skilled individuals to avoid inbreeding and further genetic complications. Dunham *et al.* (2001) noted that well trained fishery and aquaculture geneticists are needed to ensure that genetic research and genetic development are appropriate for the commercial sector, applied properly and disseminated efficiently to achieve maximum benefit.

The overriding challenges to aquaculture development remain the production of quality fish seed for stocking. FAO (2007) identified genetic profile and good hatchery management as the two main factors affecting seed quality. This could only be avoided by addressing the issue of skilled manpower in fish genetics as well as in hatchery management. The development of breeding and hatchery technology, genetic improvement and domestication are important for securing the supply of quality fish seeds of major aquaculture species. This will ensure that aquaculture production advances at the same speed with the increasing need of a growing population. Hence, the high demand for freshwater fish seed in Nigeria's growing aquaculture industry has called

for adequately equipped skilled personnel in fish breeding and hatchery management.

Opportunities in freshwater fish seed production

There is an increasing need for skilled personnel to serve the aquaculture industry in the area of Broodstock development and management, Fish Seed Production which statistics have shown to be in serious short supply, Ecologist to study the biology and adaptability of other freshwater fish species for culture and Geneticist to continually develop improve varieties and conserve the local strains.Fish seed is an essential input for fish farming, and the supply of quality fish seed is key to the profitability and expansion of fish farming business. Fingerlings production remains a gold mine that is yet to be effectively and optimally exploited in Nigeria. It is a gateway to employment generation and food security. Many hatcheries in Nigeria find it difficult to breed all year round due to lack of viable brood stock. Fish breeding therefore, remain a major un-tapped area of immense opportunities available to skilled manpower only.

CONCLUSION

Skilled manpower is definitely a challenge today, especially in freshwater fish seed production. Inadequate skilled manpower in fish breeding, genetics, and hatchery management has seriously led to poor quality fish seed, poor production performance consequently; loss of capital and much needed sustainable investment in the sub-sector. Nigeria aquaculture sub sector has recently made some strides through increased seed production engineered by private sector. However, the gain recorded in this sector may be unsustainable and consequently food security threatened if concerted effort is not made toward ensuring availability of adequately trained and equipped skilled manpower in the area of freshwater fish seed production.

Also, the high demand for freshwater fish seed in Nigeria's growing aquaculture industry has called for well trained personnel. Fingerlings production has the potential to be an important income and employment generator in the country. Opportunities exist for commercial scale production of both fish seed and brood stock. The passage of relevant laws aim at professionalizing Fisheries will go a long way to sanitize the industry, promote Best Management Practices (BMP) and enhance investor confidence in the industry. Above all it will complement the Federal Government drive to alleviate poverty, generate employment and conserve our Foreign Exchange.

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Genetic Characterization of Four Strains of *Oreochromis Niloticus* Using the Rapidly Amplified Polymorphic DNA (Rapd).

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Abstract

The genetic characterization of four strains of Oreochromis niloticus was carried out using Randomly Amplified Polymorphic DNA (RAPD). Three samples each of four strains of grown O. niloticus in Nigeria, viz; local mixed sex strain, commercially available mixed sex strains from China and a farm in Ibadan, and hormonal sex reversed all male population were used. Genomic DNA was isolated from the flesh tissues of the strains of O. niloticus using the Cetyl Trimethyl Ammonium Bromide (CTAB) method. The banding pattern was transformed into numerical values and statistical analysis was done using Unweighted Pair-Group Method Using Arithmetic Averages (UPGMA) to calculate the Nei's similarity coefficients. Canonical classification was also carried out.Out of the twenty five RAPD markers used, 10 were informative on agarose gel, of with 58% polymorphisms. A total of seventy seven bands were amplified. From the cluster analyses, the local strains were shown to be genetically distinct but the other 3 showed various levels of similarities. The Nei's genetic distance among the populations was 47%. Apart from the local strain, others showed greater similarities with variability of 37% among themselves. Within strain diversity were 15%, 32%, 25% and 33% for the local strain, tilapia from commercial farm, China strain and the hormonal sex reversed respectively. The distinctness of the local strain and the narrow variability within its membership showed that the population is not as genetically divers as the other three strains. The future of tilapia stock improvement will rely on appropriate stock choice, development of sound management techniques and selective breeding.

Keywords: Genetic characterization, RAPD, variability, Genomic DNA, *O. niloticus*

INTRODUCTION

Tilapia is now the second most cultured group species after the carps (FAO, 2008). Their favourable attributes include: high tolerance of poor water quality and crowding, good performance on commercial catfish feed, high degree of disease resistance, and mild flavoured, white flesh. Large-scale commercial culture of tilapia is limited almost exclusively to the culture of three species: *Oreochromis niloticus, O. aureus, and O. mossambica*. Of the three species, the Nile tilapia, *O. niloticus*, is by far the most commonly cultured species. Tilapias are yet to reach their full aquaculture potential because of the problems of precocious maturity and uncontrolled reproduction, which often results in the overpopulation of production ponds with stunted fish. Several approaches have been developed to tackle the problem of tilapia. One of such is population control using methods such as

monosex culture, sex reversal by androgenic hormones, cage culture, tank culture, the use of predators, high density stocking, sterilization, intermittent/selective harvesting, and the use of slow maturing tilapia species, among others, as have been reviewed by Mair and Little (1991) and Fagbenro, (2002). There is however dearth of information on genetic diversity characterization of local tilapia strains in Nigeria. However, In order to improve the aquaculture fish production in Nigeria, it is imperative that the stocks to be cultured are characterized by the use of molecular genetic markers. The knowledge of genetic structure of populations is also essential for the implementation of management programmes (SoleCava, 2001). This research is aimed to shed light on the genetic diversity of four strains of farmed Nile tilapia in Nigeria.

MATERIALS AND METHOD

Site

The experiment was conducted at the University of Ibadan fish farm.

Experimental fish

The Four strains of *Oreochromisniloticus* used for the genetic characterization were obtained from three sources. The first strain was the indigenous tilapia population from the University of Ibadan fish farm. This population has never been improved genetically through any conscious efforts of man. The second strain was a mixed sex populations from a commercial fish farm in Ibadan. These breeds have been improved upon genetically. The third strain was a mixed sex tilapia population from China. This strain has also been genetically improved and the seeds imported from China. The fourth strain was hormonal sex reversed all male populations from a reputable hatchery in Lagos.

Sample preparation

Three replicates of each fish populations were taken. This made a total of twelve specimens. Scales were removed and discarded from each fish with individual new razor blades while flesh parts were put in labeled sample bottles for immediate refrigeration. The labeling was done as follows: Local strain's samples 1.1, 1. 2, and 1.3; the mixed sex populations from a commercial farm in Ibadan farm were 2.1, 2.2 and 2.3; the mixed tilapia populations from China were 3.1, 3.2 and 3.3 while the hormonal sex reversed all male tilapia were 4.1, 4.2 and 4.3.

Genomic DNA extraction

The genomic DNA of fish tissues were isolated using CTAB method, Stewart and Nura (1993).

Statistical Analysis

The banding pattern was transformed into numerical values, where the presence of a band was scored as 1 and absence of a band was scored as 0. The binary value was transferred for analysis using UPGMA method Rohlf *et al*., (2000). The cluster analyses were performed for the molecular data by Un-weighted Pair-Group Method Using Arithmetic Averages (UPGMA) (Sneath and Sokal, 1973). The dendrogram was generated with the SAHN subroutine of NTSYS-PC to yield the similarity coefficient between the genotypes (Rohlf, 1993). The data was also run on differential function analyses for canonical discrimination.

RESULTS

RAPD markers

Out of 25 markers used, 10 RAPD primers were informative and 9 SSR primers were not informative while 6 primer pairs gave no amplification. Seventy-seven alleles were generated from the markers. Nineteen of the alleles generated were monomorphic while 58 were polymorphic. Table 1 gives the names of the primers, the sequence and the fragment sizes obtained from each primer used they generally ranged from150bp to 5000bp lower and upper range respectively.

Table 1: List of the primers used and their sequences

S/N	Primer Name	Sequence	Fragment size
1	OPAD 09	TCGCTTCTCC	200bp - 2500bp
2	OPC 09	CTCACCGTCC	200bp - 3500bp
3	OPAE 04	CCAGCACTTC	200bp - 2500bp
4	OPAE 05	CCTGTCAGTG	250bp - 2500bp
5	OPAE 09	TGCCACGAGG	250bp - 3000bp
6	OPAF 07	GGAAAGCGTC	250bp - 3500bp
7	OPAF 08	CTCTGCCTGA	250bp - 3500bp
8	OPAF 09	CCCCTCAGAA	200bp - 4500bp
9	OPAF 11	ACTGGGCCTC	200bp - 3500bp
10	OPAF 12	GACGCAGCTT	200bp - 3000bp

Dendrogram showing diversity coefficients within and among strains
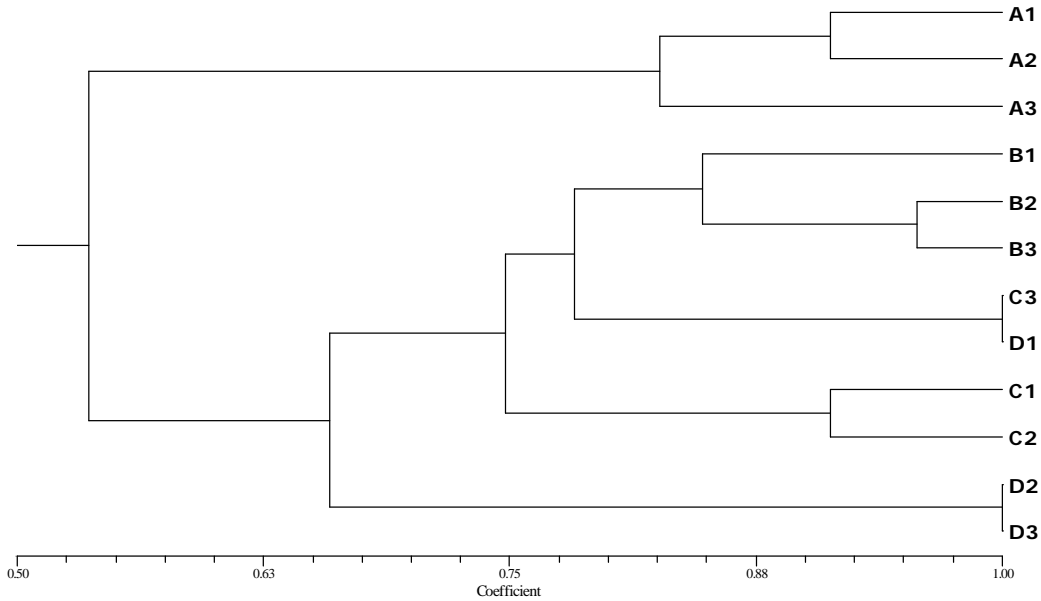
Figure 1: Dendogram for fish samples

Key:
A1-A3 - The local strain
B1-B3 - The mixed sex from commercial farm
C1-C3 - The mixed sex from china
D1-D3 - The hormonal sex reversed

The result of the hormonal sex reversed shows overall diversity of 0.67 to 1.00. This gives respective similarity coefficients of 0.15, 0.31, 0.25 and 0.33.

These values were the calculated Nei's genetic similarity matric of the data scoring for the electrophoresis gel given in table 2 below.

Similarity coefficient and Darwin trees

This showed the actual similarity values among the various individual in the experiment. It further illustrates the dendogram.With this table the similarities between individuals across the populations is seen. This is given in Table 3 below. The Darwin trees further groups the individual across the strains but this time from a defined root. Fig.1 and 2 illustrate this.

Differential Function Analyses

The analyses for the Eigen values and the Wilk's Lamda (Tables 4 and 5), which were run to know if the populations were of the same base species or not showed no significant difference. This means that the populations were same species and not differentiated enough to form sub species

Table 2: Data scoring for electrophoresis gel

		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3
	cc1	1	1	1	1	1	1	1	1	1	1	0	0
	cc2	1	1	1	1	1	1	1	1	1	1	0	0
	cc3	1	1	1	1	1	1	1	1	1	1	1	1
	cc4	1	1	0	0	0	0	0	0	0	0	0	0
	cc5	0	0	0	0	0	0	1	1	0	0	0	0
	cc6	1	1	1	1	1	1	1	1	1	1		1
	cc7	0	0	1	1	1	1	0	0	1	1	0	0
	cc8	0	1	1	1	1	1	0	0	1	1	0	0
	cc9	0	0	0	0	1	1	1	1	1	1	0	0
	cc10	0	0	0	1	1	1	1	1	1	1	0	0
	cc11	0	0	0	0	0	0	0	0	1	1	0	0
	cc12	0	0	0	0	0	1	1	1	1	1	1	1
L													
	cc13	1	1	1	1	1	1	1	1	1	1	1	1
o	cc14	0	0	0	1	1	1	1	1	1	1	1	1
c	cc15	1	1	1	1	1	1	1	1	1	1	1	1
i	cc16	1	0	1	0	0	0	0	0	0	0	0	0
	cc17	0	0	0	1	1	1	1	1	1	1	1	1
	cc18	0	0	0	0	1	1	0	1	0	0	0	0
	cc19	0	0	0	1	1	1	1	1	0	0	0	0
	cc20	1	1	1	1	0	0	0	1	0	0	0	0
	cc21	0	0	0	0	0	0	0	0	1	1	0	0
	cc22	0	0	1	0	0	0	0	0	0	0	0	0
	cc23	1	1	1	0	0	0	0	0	0	0	0	0

Table 3: Similarities coefficient of fish DNA samples

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3
1.0000000											
0.9130435	1.0000000										
0.8260870	0.8260870	1.0000000									
0.6086957	0.6956522	0.6956522	1.0000000								
0.4782609	0.5652174	0.5652174	0.8695652	1.0000000							
0.4347826	0.5217391	0.5217391	0.8260870	0.9565217	1.0000000						
0.5217391	0.5217391	0.4347826	0.7391304	0.7826087	0.8260870	1.0000000					
0.5217391	0.5217391	0.4347826	0.7391304	0.7826087	0.8260870	0.9130435	1.0000000				
0.4347826	0.5217391	0.5217391	0.7391304	0.7826087	0.8260870	0.7391304	0.6521739	1.0000000			
0.4347826	0.5217391	0.5217391	0.7391304	0.7826087	0.8260870	0.7391304	0.6521739	1.0000000	1.0000000		
0.6086957	0.6086957	0.5217391	0.6521739	0.6086957	0.6521739	0.7391304	0.6521739	0.6521739	0.6521739	1.0000000	
0.6086957	0.6086957	0.5217391	0.6521739	0.6086957	0.6521739	0.7391304	0.6521739	0.6521739	0.6521739	1.0000000	1.0000000
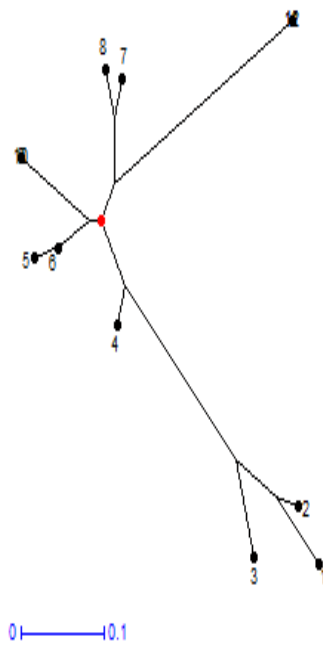
Figure 1: Darwin's radii graph
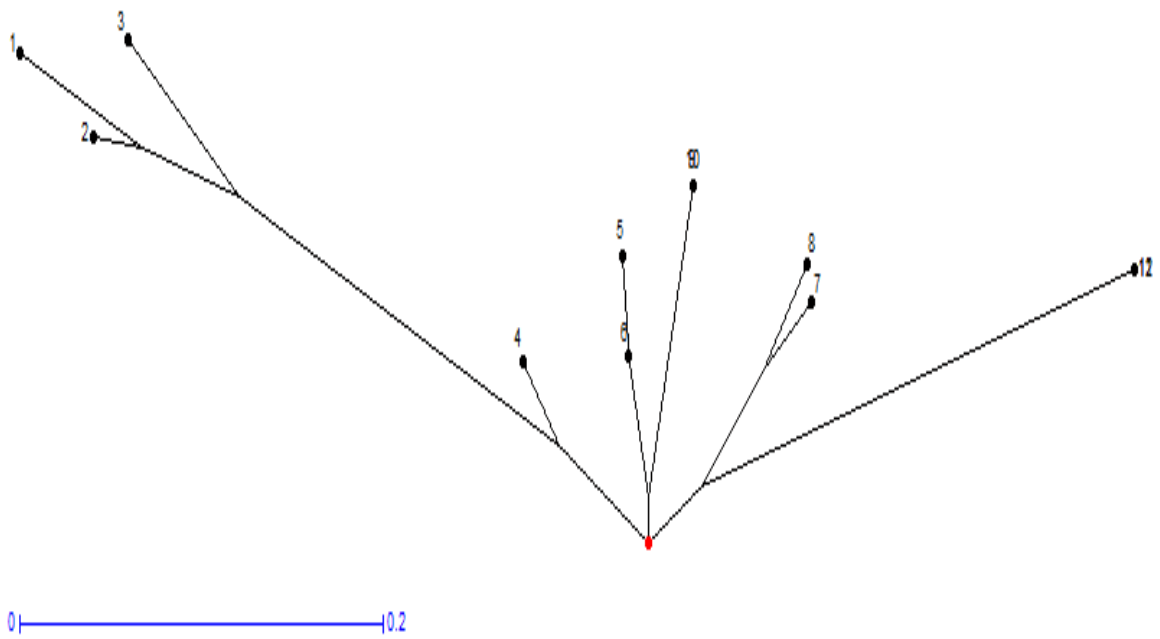
Figure 2: Darwin's hierarchy

Table 4: Eigen values showing Canonical Correlation

Function	Eigen value	% of variance	cummulative %	Canonical Correlation
1	11.4759(a)	76.5	76.5	0.959
2	2.000(a)	13.3	89.8	0.816
3	1.525(a)	10.2	100	0.777

@ 0.95 degree of variation: No significant difference

Table 5: Wilks' Lambda diversity within strains

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 3	.011	25.017	21	.246
2 through 3	.132	11.137	12	.517
3	.396	5.094	5	.404

DISCUSSION

Inter strain genetic diversity

The study demonstrated that multiple genotypes were found among the studied strains of *O. niloticus*. The distinctness and poor variability within the members of the local strain may be an indication of poor gene flow. This is an indication of a wide genetic distance between the various strains. Among the other three, the degree of variability is high enough to suggest that there is gene flow within these populations. In this situation gene flow is defined as the exchange of genetic traits between populations through movement of individuals (Stiling, 1996). From the analyses done, of the three strains with higher levels of similarities, the china tilapia and the hormonal sex reverse exhibited the most genetic similarities across the strains. However, the Differential Function Analyses done to know if the strains were sufficiently differentiated into subspecies, the Eigen values and Wilk's Lambda shows no significant differences at 0.95 levels of significant (tables 4 and 5). This showed that the strains were not subspecies but a single species of fish.

Genetic diversity within strain

The coefficient of variation within the local strain showed low diversity, with diversity index of 15. This is quite a very narrow range that may not portend too much prospect for the species. This is because this result shows low level of genetic variability within the stock and according to Sousa *etal*., (2011); genetic variability in a population is important for biodiversity because without variability, it becomes difficult for a population to adapt to environmental changes and therefore makes it more prone to extinction. This may in the least reduce vigour in the population since they keep breeding among themselves. The

intra strain diversity indices of the mixed sex from Durante, the China group and the hormonal sex reversed which indices of .31, 0.25, and 0.33 respectively showed marked increase in genetic variability over the local strain. This higher genetic mixture within those populations maybe responsible for the observed improvement in performance in terms of faster growth rate, more efficient feed utilization, better fillet quality, more attractive colouration among other desirable qualities. Since heterozygosity is reduced in inbred or local populations, the large variability of these populations must be representative of populations that is exhibiting gene flow (Stiling 1996). The distinctness of the local strain and the various levels of similarities shown by the rest may also have to do with their geographical history. The distribution of species or populations and their genetic structure depends not only on biological and environmental but also on historical factors (Agnèse *etal* 1997), these climatic changes (Maley, 1991) could explain the genetic structure of some fish populations in West Africa (Adépo-Gourène et al., 1997).

Implications for future breeding and stock management programmes

The study revealed a low level of genetic diversity among the local cultured strain on the university of Ibadan fish farm. This may not have been the case when they were first introduced to the farm decades ago. Continuous used of same or few parent stocks can deplete genetic variability within any cultured stock. This has been studied by various researchers and found to be of significant effect on productivity and sustainability. Pullin and Capili, (1988) discovered that despite many positive culture attributes, many Asian tilapiine stocks (in particular O. niloticus) are characterized by high

levels of inbreeding and have experienced declines in levels of genetic diversity resulting from the use of small founder populations. Widespread introgression of O. mossambicus alleles into some cultured stocks (particularly O.niloticus) and poor stock management practices have also been highlighted as potential causes for reductions in performance of some stocks in culture (Hulata et al. 1986, Guerrero and Tayamen 1988, Appleyard and Mather 2002.).

CONCLUSION

In animal breeding, it is expected that a cross between two animals originating from two populations with a large genetic distance between them will result in maximum heterosis or hybrid vigour. Then the exchange of genes between populations determines the relative effects of selection and genetic drift (Balloux and Lugon-Moulin, 2002). Genetic variation is the raw material in a species and populations, which enables them to adapt to changes in their environment. Through selective breeding by generation and generation, some economic traits could be improved and stabilized, and as a result, new strains could be created. In history, many good breed were generated by selective breeding (Lou 1999; Hines 1976). The improving of traits is contributed by the natural factors and human factors that may induce mutations, but the selection itself will not create new genes. Selection may change the allele frequencies, which may cause the changes of traits. Finally, some favourable traits could be accumulated and strengthened (Li *etal*., 2008). The implication of this is that the local strain should not be used alone for breeding purposes but careful selection should be done with other strains or populations to improve desirable qualities.

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Interrelationships among Water Quality Parameters in Recirculating Aquaculture System

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Abstract

The study was conducted to investigate the relationships among important water quality parameters in Recirculating Aquaculture Systems (RAS) and hence predicts equation for determining some of the parameters in RAS. Wastewater was obtained from integrated pond of the University of Ibadan Fish farm and passed through bio-filtration treatment at different drying times: 24, 72 and 144hours. The filtrates that were analyzed for using standard procedure included Temperature, pH, Dissolved oxygen, Total ammonia-nitrogen, Nitrite-nitrogen and Nitrate-nitrogen. Statistical analysis (Correlation and Regression) was used to determine the relationships among the water quality parameters and predict equation. Some of the water quality parameters were significantly interdependent. Temperature had significant relationship with all the dependent parameters but with low co-efficient of determination except with DO where the co-efficient of determination is high (R^2=0.502) and prediction equation D.O=26.469-0.784T. Temperature and pH used together had significant relationship with strong co-efficient determination (0.514 and 0.405) in relation to DO and Nitrite-nitrogen respectively with prediction equations D.O=20.547-0.787T+0.821pH and NO2-N=0.478+0.035T-0.188pH. Though temperature is a good predictor of other water quality parameters, it is encouraged to use Temperature and pH for a more reliable prediction.

Keywords: Bio-filtration, Nitrogenous wastes, Physico-chemical, Water re-use system.

INTRODUCTION

The development of Recirculating Aquaculture System (RAS) has contributed immensely to the growth experienced in Nigeria aqua-cultural sector as it encouraged urban and peri-urban aquaculture. This is due to its perceived advantages which includes reduction in land and water quantity requirements as well as feasibility of locating production very close to markets (Dunning *et al*., 1998), most especially in the production of fish seed (Fingerlings and juveniles). The epileptic power supply situation in Nigeria has made its use for grow-out production questionable due to the high cost of alternative power supply.

A major challenge to aquaculturists is maintaining system water quality suitable for the crop throughout the culture process. In recirculating aquaculture system, deterioration of the water quality constitutes a major

disadvantage, if the treatment of water within the system is not properly controlled. It can have adverse effect on the growth of the fish, increase the chance of disease infestation, stressing of the stocked fish and so many other problems that are associated with water quality which may eventually lead to poor health for the fish and ultimately loss of the entire production (Timmons *et al*. 2002). There are different factors affecting water quality in RAS and the most important among them, being the source of the water, the level of recirculation, the species of fish cultured and the type of waste water treatment process within the system (Sanni and Forsberg 1996, Losordo *et al*., 1999). The use of RAS requires frequent monitoring of water quality because degradation of water quality can result in loss of the whole stock within a short period of time. According to Akinwole and Adeola (2012), water quality criteria are scientific and technical

information provided for a particular water quality constituent in the form of numeric data or narrative description of its effect on the sustainability of water for a particular use or on the health of aquatic ecosystems. Water quality is determined by various physico-chemical and biological factors, as they may directly or indirectly affect its quality and consequently its suitability for the distribution and production of fish and other aquatic animals (Nwakwo, 1998). Although, there are many water quality parameters in an aquatic environment, only a few normally play an important role (Boyd 1979). In RAS, the major water quality problems experienced can be associated with low dissolved oxygen and high concentrations of fish metabolic waste in the culture water (Sanni and Forsberg 1996). Waste metabolites productions that are of major concern include Total Ammonia Nitrogen (TAN), un-ionised ammonia (NH_3-N), nitrite (NO_2-N) and nitrate (NO_3-N) (Hagopian and Riley 1998). Maintenance of good water quality is important in all aquaculture systems in order to ensure survival, fast growth and high yield while that of re-circulating system requires more diligence owing to high level of loss that can arise within a very short period of time as a result of deterioration in water quality and upset in water chemistry. Fish farmers are expected to measure, record and manage the water quality all through the growing season, as this will serve as guide for managing the fish culture systems so that conditions that can adversely affect the growth of fish can be avoided (Akinwole and Adeola, 2102). The commonly measured water quality parameters that are important to fish culturists especially in recirculating tanks includes Temperature; pH, Salinity, Disolved Oxygen and Nitrogenous wastes (Ammonia, Nitrite and Nitrate). These parameters are measured with different methods and techniques such as titrimetric procedure requiring chemical reagents, bottles and glass wares which include beakers, burette and conical flasks, D.O bottles, calorimeters as well as use of meters like digital thermometer, pH meter, D.O. meter, spectrophotometer and portable test kits. Whichever method is used the measure of this water quality parameters are usually technical, time demanding and associated with high cost that may be unbearable for peasant farmers dominating the farming community in Nigeria. According to Akinwole and Adeola (2012), the development of theoretical or numerical analysis that tends to utilize easily measured

parameters like pH and Temperature to estimate the level of other important water quality parameters will be appreciated. This will ease the problems of averagely trained fish farmers in terms of time and money for the analysis and purchase of test kit. This study therefore investigated the relationship among important water quality parameters and hence predicts equation for estimating some of the water parameters in recirculating aquaculture system.

MATERIALS AND METHODS

The experiment was carried out between January and March 2013 in the laboratory of the Department of Aquaculture and Fisheries Management, University of Ibadan, Ibadan. Waste water was collected from the integrated pond of University of Ibadan Fish farm and run through a bio-filtration treatment and water that supposed for fish culture tank was collected for the analysis.

Description of biofilter units

The filter housing is made of150mm diameter, 3mm thick, and 1,200mm highPolyvinylchloride (PVC) pipe. The bottom is made of solid PVC end plug piece drilled with 20mm holes. A plastic funnel was attached to the bottom end of the housing to collect the filtrate into a plastic container placed under the funnel and a wooden frame was constructed to hold the filter housing. The housing was filled with 40mm diameter gravel up to 150mm height in line with Akinwole (2005) and polypropylene bioblock was cut to fit into the housing unit up to height of 600mm with volume $0.00924m^3$ was used as biofilter media.

Aquaculture wastewater

Aquaculture effluents wereobtained from University of Ibadan, Fish farm integrated pond. Thewastewater samples was collected between 0800 to 0900 hours of the day using four pieces of twenty five litres plastic containers for each batch. The pond contain 1, 120 pieces of *Clarias gariepinus* of14 weeks, 857 strands of rice of 17 weeks and 10 pigs of 28 weeks whose pens are located adjacent to the pond and its waste flushed into the pond once in a week. The fish are fed sinking pellets of 28% Crude protein twice daily and volume of water in the pond was $150.84m^3$

Experimental procedure

The biofilter media was inoculated using the wastewater from the aquaculture system before

applying for treatment after 24 hours (drying time) of inoculation. The wastewater samples were poured into an open container (bowl) to allow more dissolution of oxygen at the water-air interface in order to increase the dissolved oxygen content so as to enhance the performance of the aerobic bacteria. 5 litres of the wastewater was measured out and poured into the filter column. The filtrate was collected in plastic container and 100cl of the filtrate was collected for the analysis of the selected water quality parameters. The experiment was repeated for three drying times; 24 hours, 72 hours and 144 hours drying time and each of the experiment were done in triplicates.

Water quality analysis

The filtrates were examined for the following parameters; Dissolved oxygen (DO), Total Ammonia Nitrogen (TAN), pH, Temperature, Nitrate-nitrogen and Nitrite-nitrogen. Temperature was measured with mercury in glass thermometer, the thermometer was inserted into the water sample and left for two minutes before the reading was taken. DO was determined using winklers method in line with Mackereth (1963), pH was measured using a HANNA probe pH meter. Total ammonia nitrogen (TAN) was determined colourimetrcally using Merck (2011) test kit, Nitrite-nitrogen (NO_2-N) was determined using Merck (2010) test kit. Nitrate-nitrogen (NO_3-N) was determined colourimetrically using HAGEN (2008), test kit. Procedures for analysis was done according to standard methods (APHA1995).

Statistical and data analysis

Mean and standard deviation of theselected water quality parameters were determined in both the influent and the filtrate, Pearson correlation analysis was used to determine interdependence among the water quality parameters in the filtrates, single linear and multi-linear regression analysis was used to determine the interrelationship among the water quality parameters and hence predict equation. The regression equation is expressed as Y= a + bX where Y is dependent variable, X is independent variable, a = intercept and b = slope of the regression. Temperature and pH which are easier and less difficult to measure compare to other were used as the independent variables while the D.O, TAN, Nitrite-nitrogen and Nitrate-Nitrogen that are more difficult to measure were used as dependent variable. The statistical analysis was done using IBM SPSS version 20.

RESULTS AND DISCUSSION
Water quality parameters

The water quality parameters reported in the filtrates were temperature (27.35±0.83 ^{0}C), DO (5.04±0.91 mg/L), pH (7.32±0.12), TAN (0.47±0.13 mg/L), Nitrite-nitrogen (0.05±0.06 mg/L) and Nitrate-nitrogen (7.22±12.79 mg/L) as shown in Table 1. All the water quality parameters reported in the filtrates were normal for fish culture and within the range recommended Akinwole and Adeola (2012). The difference between the values of influents and filtrates though are very small but it showed that the biofilter performed as it is evident in reduction of TAN and increase in Nitrate-nitrogen.

Table 1.Mean Values±SD of selected water quality parameters and ranges for fish culture

Parameters	Mean value in influent	Mean value in filtrate	*Optimum level for fresh water fish culture
Temperature ^{0}C	27.33±0.50	27.35±0.83	26-32
Dissolved oxygen (mg/L)	3.67±0.50	5.04±0.91	>5.0
pH	7.60±0.17	7.32±0.12	6.5-8.5
TotalAmmonia-nitrogen (TAN) mg/L	0.80±0.00	0.47±0.13	<8.0
Nitrite-nitrogen (mg/L)	0.06±0.07	0.05±0.06	<1
Nitrate-nitrogen (mg/L)	6.67±10.00	7.22±12.79	< 250

* Adapted from Akinwole and Adeola (2012)

Interdependence among water quality parameter during the study period

According to data in Table 2, temperature had significant correlation with DO (r = -0.709), Nitrite-nitrogen (r = 0.494) and Nitrate-nitrogen (r = 0.398) .The Dissolved oxygen had significant

correlation with Nitrite-nitrogen (r =-0.665) and Nitrate-nitrogen (-0.621). The pH only had a significant relationship with Nitrite-nitrogen (r = -0.388), while TAN had no significant correlation with any of the parameters, Nitrite-nitrogen also showed a significant correlation with Nitrate-

nitrogen (r = 0.481). The correlation with DO was strong but negative; this indicated that increase in temperature may lead to decrease in dissolved oxygen. This is in line with the report of Fakayode (2005) and may be due to reduction in dissolution of oxygen at the air-water interface as the temperature increases. The temperature also had positive correlation with Nitrite-nitrogen and Nitrate-nitrogen, this can be associated with increase in decomposition of Ammonia-nitrogen at high temperature and hence increase in the oxidation product of the decomposition which is the Nitrate-nitrogen and the intermediate product which is Nitrite-nitrogen (Al-Hafedh *et al*. 2003).

The Dissolved oxygen had significant, strong but negative relationship with Nitrite-nitrogen and Nitrate-nitrogen, this suggested that increase in dissolved oxygen may lead to decrease in Nitrate nitrogen and Nitrite-nitrogen. pH had significant but negative correlation with Nitrite-nitrogen, this is indicated that increase in pH may lead to decrease in Nitrite-nitrogen and can be linked to the fact that nitrifying bacteria are pH sensitive and at a level above 8 will be inhibited (Michael *et al*. 1995) and not be able to remove any toxic nitrogenous waste, hence decrease in nitrite-nitrogen which is an intermediate product of TAN degradation. Nitrite-nitrogen has significant and positive relationship with Nitrate-nitrogen and this can be associated with the fact that they are both biodegradation products of TAN (Summerfelt and Sharrer 2004).

Table 2. Interdependence among water parameters during the period of study

	Temperature	D.O	pH	TAN	Nitrite-nitrogen	Nitrate-nitrogen
Temperate	1	-0.709[**]	0.026	0.324	0.494[**]	0.398[*]
D.O	-0.709[**]	1	0.090	-0.289	-0.665[**]	-0.621[**]
pH	0.026	0.090	1	-0.006	-0.388[*]	-0.099
TAN	0.324	-0.289	-0.006	1	0.115	-0.066
Nitrite-nitrogen	0.494[**]	-0.665[**]	-0.388[*]	0.115	1	0.481[**]
Nitrate-nitrogen	0.398[*]	-0.621[**]	-0.099	-0.066	0.481[**]	1

Interrelationship among the selected water quality parameters

The regression analyses showed the interrelationship among the water quality parameters.In the simple regression (Table 3),temperature had significant interrelationship with all the dependent variables with R^2 value of 0.502, 0.105, 0.244 and 0.158, for DO, TAN, NO_2-N and NO_3-N respectively. The co-efficient of determination was only strong with dissolved oxygen where the prediction equation was DO = 26.469 – 0.784T (Table 3). The pH only had significant relationship with Nitrite-nitrogen where the co-efficient of determination (R^2) was 0.150 and the prediction equation was NO_2-N = 1.378 - 0.182pH (Table 3). In the multi-linear regression, the predictors (Temperature and pH) showed significant relationship with DO and Nitrite-nitrogen, the DO had R^2 of 0.514 with prediction equation D.O = 20.547 - 0.787T + 0.821pH and Nitrite-nitrogen had R^2 of 0.405 with prediction equation of NO2-N = 0.478 + 0.035T - 0.188pH (Table 4). The study revealed that temperature alone is a good predictor in recirculating system contrary to Akinwole and Adeola (2012), who reported that the single predictor was not significant in earthen pond and concrete tank, temperature had a significant interrelationship with all the dependent variables (DO, pH, TAN, Nitrite-nitrogen and Nitrate-Nitrogen) though the Co-efficient of determinations were relatively low except with dissolved oxygen where $R^2 = 0.502$.

The pH cannot be used as a single predicting variable in recirculating system because it has no significant relationship with the dependent variables (DO, Total ammonia nitrogen, and Nitrate-nitrogen) except with Nitrite-nitrogen. The multi-linear regression showed significant relationship with DO and Nitrite-nitrogen with relatively fair co-efficient of determination (R^2), this is in agreement with Akinwole and Adeola (2012), who also reported higher R^2 for the multiple predictors.

Table 3. Interrelationship among water quality parameters (Simple linear regression)

Y	X	Prediction equation	Coefficient of determination (R^2)	F value
Dissolved oxygen mg/L	Temperature ^0C	D.O=26.469-0.784T	0.502	34.324*
Dissolved oxygen mg/L	pH	D.O=0.065+0.680Ph	0.008	0.276
Totalammonia-nitrogen (NH_4-N) mg/L	Temperature ^0C	NH_4-N=0.897+0.050T	0.105	3.979*
Total ammonia-nitrogen (NH_4-N) mg/L	pH	NH_4-N=4.744-0.288pH	0.002	0.083
Nitrite-Nitrogen(NO_2-N) mg/L	Temperature ^0C	NO_2-N=-0.879+ 0.034T	0.244	10.991*
Nitrite-Nitrogen (NO_2-N) mg/L	pH	NO_2-N=1.378-0.182pH	0.150	6.016*
Nitrate-nitrogen (NO_3-N) mg/L	Temperature ^0C	NO_3-N=-161.166+6.157T	0.158	6.400*
Nitrate-nitrogen (NO_3-N) mg/L	pH	NO_3-N=83.736-10.458pH	0.010	0.335

* Regression is significant at $P<0.05$

Table 4. Interrelationship among water quality parameters (Multi-linear regression)

Y	X	Prediction equation	Coefficient of determination (R^2)	F value
Dissolved oxygen (D.O)(mg/L)	Temperature ^0C & Ph	D.O=20.547 - 0.787T + 0.821pH	0.514	17.459*
Ammonia-nitrogen (NH_4-N) mg/L	Temperature ^0C & pH	NH_4-N=-0.785+ 0.050T -0.016pH	0.105	1.935
Nitrite-Nitrogen (NO_2-N) mg/L	Temperature ^0C & pH	NO_2-N=0.478+0.035T-0.188pH	0.405	11.230*
Nitrate-nitrogen (NO_3-N) mg/L	Temperature ^0C & pH	NO_3-N=-77.709+ 6.202T -11.572pH	0.170	3.388

*Regression is significant at $P<0.05$

CONCLUSION

The study revealed that some water quality parameters in the recirculating system are interdependent and also have strong interrelationships. Temperature was revealed to be of high importance because of its tendency to affect so many other parameter and ability to give information on other important water quality parameters whose measure may be time taking and a bit difficult. However it is more reliable and encouraged to use temperature with pH in predicting equation for Dissolved Oxygen, Total Ammonia-nitrogen, Nitrite-nitrogen and Nitrate-nitrogen for a high level of reliability because a single variable may be sometime deceptive. Finally it is worthy of note that this method is not suggested to replace standard analytical methods but can serve for preemptive purpose.

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Comparative Analysis of Technical Efficiency of Small Holder Fadama II and Fadama III Cassava Farmers in Imo State

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Abstract

This study was conducted in Imo state, Nigeria. Multi stage random sampling technique was used to select 240 respondents (120 Fadama II and 120 Fadama III cassava farmers). Instrument of data collection was well structured set of questionnaire. The study employed percentages, frequencies and Cobb-Douglas stochastic production model as analytical tools. Results show that the mean technical efficiency of Fadama II and Fadama small holder cassava farmers was $\overline{X}$ =0.76 and $\overline{X}$ = 0.81 respectively. For Fadama II small holder cassava farmers, Peculiar determinants of technical efficiency were membership to cooperative society, household size and farm income while, access to credit and household size were peculiar significant determinants of Fadama III small holder cassava farmers technical efficiency. Constraints to cassava production includes: inadequate access to formal sources of capital (25% and 40.0% for Fadama II and III farmers respectively), lack of mechanized equipment (36.67 and 28.3% for Fadama II and III farmers respectively) and agro-chemicals (43.34% and 33.33 for Fadama II and III farmers respectively). It is recommended that the Fadama project should assist resource poor farmers to procure credit facilities. Government should establish adult education centres to improve literacy level as it influenced technical efficiency of both small holder cassava farmer groups.

Keywords: Technical efficiency, Fadama II, Fadama III, Small holder farmers

INTRODUCTION

Over half of the world's cassava (*Manihotesculenta*) is cultivated in the humid and sub-humid tropics of sub-Saharan Africa where it is the most important food crop grown mainly by small-holder farmers. Nigeria is currently the largest producer of cassava in the world, with an annual output of about 45 million tones of tuberous roots (FAO, 2008).Cassava is a root and tuber crop which performs well across a wide ecological spectrum. It therefore benefits farmers across broader swath of ecological zones. Cassava is likewise, less expensive to produce. It tolerates poor soil, adverse weather, pests and diseases more than other major staples. The cash income from cassava proves more egalitarian than the other major staple because of cassava's low cash input cost compared with other major staples (Nweke, 2004).

These outstanding features of cassava have prompted the federal government to initiate and execute policies and programmes aimed at increasing production technologies. The aim of these programmes and increment in cassava input is to tap the potentials of the cassava crop, which has remained largely unappreciated and un-harnessed. The second National Fadama Development Project (NFDP II) started in 1998 with the main objective of increasing the income of the Fadama users through the expansion of farm and non-farm activities with high value added output. The second National Fadama Development Project adopted a demand driven approach where by users of Fadama resources are encouraged to develop participatory and socially inclusive local plans.

The third National Fadama Development Project (NFDP III) which is a follow-up on the National Fadama II Project aims at also increasing the income of Fadama user groups by directly delivering resources to the beneficiary rural communities. It seeks to empower them through

collective decision-making on how to effectively and efficiently allocate and manage resource for their livelihood. The central objective of NDFP III was to raise rural productivity and income in Fadama areas. The strategy includes investing in public infrastructure, asset acquisition through matching grants and advisory services and improving mechanisms to avoid and resolve conflict among Fadama resource users (FMARD, 2003).

Despite the disproportionate agricultural roles played by the national Fadama Development project, it is not clear if the technical efficiency of each participant in general and Fadama cassava user groups in particular was fully realized. According to (Asumugha and Aniedu (1999), numerous problems such as inadequate capital base, land fragmentation, poor resource availability continues to hinder the production of cassava within the country. Cassava is produced mostly by small holders of marginal or sub-marginal lands of the humid and sub-humid tropics, such small holder systems as well as other aspects of production and use often create problems, including unreliability of supply, uneven quality of products, low producer prices and an often costly marketing structure (Plucknett *et al*, 2002).

Imo State was one of the states that implemented both the second and the third phase of the national Fadama development project. It then becomes imperative to comparatively analyze the technical efficiency of the cassava farmers who participated in the second and third phase of the Fadama project in the state. The specific objectives were to describe the socio-economic characteristics of Fadama II and Fadama III cassava farmers in relation to their technical efficiencies, estimate the technical efficiency of Fadama II and Fadama III cassava farmers in the study area; estimate the determinants of technical efficiency among Fadama II and Fadama III cassava farmers in the study area; estimate and analyze efficiency differences between Fadama II and Fadama III cassava farmers in the study area and identify farmers perceived constraints to effective cassava

production among Fadama II and Fadama III cassava farmers in the study area.

MATERIALS AND METHODS
Study area

The study was carried out in Imo state Nigeria. The state lies between longitudes 6^0 54^1 and 7^0 7^0 East of the Greenwich meridian and Latitude 5^0 44^1 and $5^0 54^1$ North of the equator. The state has a land area of 5,100 sq.km with a population of over 3,927,563 people of which over 1,951,092 are females and 1,976,471 males (NPC, 2006).

Sampling procedure and sample size

Multistage sampling procedure was used in the selection of respondents who either participated in Fadama II or Fadama III project phase but not in both. In stage one, two agricultural zones Owerri and Orlu were randomly selected. The sampling frame which contained 134 and 181 names of fadama II and Fadama III cassava farmers was obtained from the Fadama offices located within the headquarters of Agricultural Development programme (ADP) in each selected zone. From the sampling frame 120 Fadama II and 120 Fadama III cassava farmers were randomly selected. This gave a total of 240 respondents.

Data used for this study was from primary source through a field survey using semi structured questionnaire. The same set of questionnaire was used to elicit information from both groups. The data generated was mostly demographic and those related to input/output coefficients and their prices. Data were analysed using descriptive (frequency, percentages and means) and inferential statistics (maximum likelihood estimation of the cobb-Douglas stochastic production function).

Model specification

The stochastic frontier model adopted in this study is the variety of Yao and Liu (1998) and Ogundele (2003). The model specified output (y) as a function of inputs (x) and error term (E_i).

The empirical model of the stochastic production frontier is shown as:

$$In\ Y_i = \alpha_0 + \alpha_1 InX_{1ij} + \alpha_2 InX_{2ij} + \alpha_3 InX_{3ij} + \alpha_4 InX_{4ij} + \alpha_5 InX_{5ij} + \alpha_6 InX_{6ij} + V_{ij} - U_{ij} \quad \text{.................. (1)}$$

Subscripts I and j refers to the ith farmers and jth observation respectively
Y = total farm output (kg)
X_1 = farm size (ha)
X_2 = quantity of cassava stem (kg)

X_3 = labour (mandays)
X_4 = quantity of fertilizer (kg)
X_5 = quantity of herbicide (litre)
X_6 = depreciation (₦)

V_{ij} = a random error term with normal distribution $N(0, \delta2)$

U_{ij} = a non- negative random variable associated with technical efficiency of the enterprises involved. It accounts for inefficiency and under control of the farmer.

In = natural logarithm

$\alpha_0 - \alpha_1$ = parameters estimated

α_0 = intercept

From the above model (equation 1), the determinants of technical efficiency were estimated as follows:

$\mu_1 = F(Z_1\ Z_2\ Z_3, Z_4, Z_5, Z_6, Z_7, Z_8,)$

μ_1 = technical efficiency

Z_1 = age of the farmers (years)

Z_2 = education level of the farmers (years)

Z_3 = farming experience (years)

Z_4 = farm size (ha)

Z_5 = access to credit (₦)

Z_6 = membership of cooperative society (Yes =1, No =0)

Z_7 = householdsize (number)

Z_8 = improved technology (yes=1, no=0)

Estimation of the above was accomplished through estimation of the technical efficiency as specified in Coelli (1996).

RESULT AND DISCUSSION

Socio-economic characteristics of the respondents

Table 1 reveals that more than half of the respondents (55.0% of NFDP II and 58.3% of NFDP III small holder cassava farmers) were females. This implies that the Fadama project was non gender discriminatory and targets the less disadvantaged in the society. A further implication of the result is that females in the area were more involved in cassava production than the males who concentrate effort more on yam production. Table 1 also shows the distribution of respondents' age. It shows that 42.5% and 35.0% of the NFDP II and NFDP III small holder cassava farmers were within the age range of 31 and 40 years respectively, while 45.00% of the Fadama II and Fadama III respectively were within the range of 41 and 50 years. This implies that majority of the respondents fell within the age range of 31 and 50 years, which is an active age. This is a productive age group which can absorb the shocks involved in farming (Chukwu, 2007). The marital status distribution of respondents as shown in table 1 indicates that majority (78.3% of NFDP II and 71.7% of Fadama III small holder cassava farmers) were married. Nwaru (2006) posits that family stability

creates conducive environment for good citizenship training, development of self and entrepreneurship which are very important for efficient use of resources.

Data on household size in Table 1 shows that 30.0% and 35.0% of the Fadama II and Fadama III small holder cassava farmers respectively had a household size of 1-5 persons while majority (70.00%) and a high percentage (65.00%) of the Fadama II and Fadama III small holder cassava farmers respectively had household size of 6 – 10 persons. The result indicates that the household size is large; this will help the farmers not to spend much money hiring labourers. This result is in agreement with Ezeh *etal (*2012) who state that large households tend to use family members as sources of labour.

Table 1 further reveals that 45.0% of Fadama II small holder cassava farmers had farm income that ranged from ₦4,000 - ₦7,999 while, 46.67% of the Fadama III small holder cassava farmers had income that also ranged from ₦4,000 - ₦7,999 monthly. This shows that production is at a subsistent level and little of the output is sold. Hence, the farmers are utilizing a low capital base. As further shown in table 1 50.0% of Fadama II small holder cassava farmers had farm size that ranged from 0.1 – 1.0 hectare and 41.6% range from 1.1 – 2.0 hectares. For the Fadama III small holder cassava farmers, 63.3% have farm size that ranged from 0.1 to 1.0 hectare and 30.0% had farm size that ranged from 1.1 – 2.0 hectares. This shows that Fadama II cassava farmers have more land holding than Fadama III cassava farmers. The implication is that Fadama II cassava farmers will have relatively more output since land is a major economic input in agriculture.

Estimated production functions of Fadama II smallholder cassava farmers

Maximum likelihood estimates of the specified Cobb-Douglas stochastic production function for Fadama II small holder cassava farmers in Imo state is presented in (Table 2). The result shows that the coefficients of the variables have the expected positive signs. However, the coefficients of farm size was significant at 1.0% probability level, while the coefficient of cassava stem cuttings and fertilizer were significant at 5% alpha level.

Specifically, The estimated coefficient of cassava cutting is positive (0.4943) and implies that for every one percent increase in the quantity of cassava stem cuttings, would lead to 0.4934

percent increase in the output of Fadama II small holder cassava farmers. This is in consonance with Akanni and Dada (2012) that the larger the quantity of input, the higher the output and the less inefficient a farmer becomes.

The estimated coefficient for farm sizewas positive (0.3506) and implies that every one percent increase in farm size, would lead to 0.3506 percent increase in output of cassava. This is in consonance with Effiong and Nwachukwu (2005) and Nwachukwu and Onyenweaku, (2007) that the larger the farm size, the less inefficient a farmer becomes.

In consistent with classical production theory, quantity of fertilizer used had a positive coefficient and statistically significant at 90% confidence level. With an elasticity of 2.158, the enterprise operates in stage one of the classical production function and by implication, increase in quantity of fertilizer used should be encouraged. This indicates that an increase in fertilizer usage, increased significantly cassava output of Fadama II small holder farmers. This result highlights the importance of fertilizer in increasing crop yield as low fertilizer usage tends to decrease agricultural growth. This result is consistent with the findings of Belbase and Grabowski (1985) whose study established that production and quantity of feed are directly related.

Table 1: Socio-economic characteristics of the Fadama II and Fadama III smallholder cassava farmers in Imo state

	Fadama II Cassava Farmers		Fadama III Cassava farmers	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage**
Gender				
Male	54	45.00	50	41.66
Female	66	55.00	70	58.33
Age				
21 – 30	10	8.33	12	10.00
31 – 40	51	42.50	42	35.00
41 – 50	54	45.00	54	45.00
51 – 60	5	4.17	12	10.00
Marital status				
Single	8	6.67	6	5.00
Married	94	78.33	86	71.67
Widowed	18	15.00	28	32.33
Household size				
1 – 5	36	30.00	42	35.00
6 – 10	84	70.00	78	65.00
Farm income (₦)				
1000 – 3999	10	8.33	12	10.00
4000 – 7999	54	45.00	56	46.67
8000 – 11999	36	30.00	28	23.33
12000 – 15999	20	16.67	24	20.00
Total	120	100	120	100

Table 2: Maximum likelihood estimation of the Cobb-Douglas Stochastic frontier production function for Fadama 11 smallholdercassava farmers.

Variable	Parameter	Coefficient	Standard Error	T - Value
Constant	α_0	6.702	0.442	15.157***
Farm size	α_1	0.351	0.091	6.114***
Cuttings	α_2	0.494	0.248	1.993*
Labour	α_3	0.122	0.154	0.728
Fertilizer	α_4	0.088	0.021	4.206***
Agro chemicals	α_5	0.028	0.0143	0.198

*** Significant at 1.0%; * Significant at 10.0%

Estimated production functions of Fadama III small holder cassava farmers

The Maximum Likelihood Estimates (MLE) of the Stochastic frontier production parameters of Fadama III cassava farmers are presented in Table 4.8. The table shows that of the five production factors, farm size and labour input were highly significant at 1.0% risk while quantity of fertilizer used level was significant at 10.0% and this, have high influence on the value of cassava output among Fadama III small holder farmers.

The estimated coefficient for farm size was negative (-0.6551) and implies that every one percent increase in enterprise size, would lead to 0.6551 percent decrease in the value of cassava output. This is at variance with Effiong and Nwachukwu (2005) and Nwachukwu and Onyenweaku (2007) that the larger the larger size, the less inefficient a farmer becomes. However, this suggests efficiency in the use of land rather than expansion of cultivated areas as a necessary

requisite that could increase the level of efficiency in production (Anyiro and Oriaku, 2011).

Consistent with classical production theory, the quantity of fertilizer used had a positive coefficient (2.58) and statistically significant at 90% confidence level. With an elasticity of 2.58, the enterprise operates in stage one of the classical production function and by implication, increase in quantity of fertilizer used should be encouraged. This result is consistent with the findings of Belbase and Grabowski (1985) whose study established that production and quantity of feed are directly related.

Labour input had a coefficient of -0.7192 and high t-value (17.051). Its implication is such that increase in labour input reduces technical efficiency. Given the production elasticity of -0.7192, the Fadama III cassava farmers in the study area are either misallocating or over utilizing labours. This finding contradicts Iwueke (1987) and Ezeh (2006) that farm operations especially in Nigeria are labour intensive.

Table 3: Maximum likelihood estimation of the Cobb-Douglas Stochastic frontier Production Function for Fadama 1I1 Small Holder Cassava farmers in Imo state.

Variable	Parameter	Coefficient	Standard Error	T - Value
Constant	α_0	6.702	0.442	15.157***
Farm size	α_1	-0.655	0.047	-14.052***
Cuttings	α_2	0.112	0.154	0.728*
Labour	α_3	-0.719	0.042	-17.051
Fertilizer	α_4	2.158	1.143	1.889*
Agro chemicals	α_5	0.135	0.1016	1.327

*** Significant at 1.0%; * Significant at 10.0%

Determinants of technical efficiency of Fadama II small holder cassava farmers

The determinants of technical efficiency of Fadama II small holder cassava farmers in Imo state is as shown in Table 4. The result of the analysis shows that the coefficients of age (-3.116), education (0.1267), farm size (0.0105) and household size (-6.701) were statistically significant at varied risk levels. While, the coefficient of education and farm size was positively signed, the coefficient of age and household size was negative.

Specifically, Farmer's age showed a negative relationship (-3.116) with technical efficiency. This result agrees with that of Ajibefun and Daramola (2003), Kasim and dada (2012) andOluyole *et al (2011)* which suggest that increasing age would lead to decrease in efficiency since aging farmers would be less energetic to work in the farm. But this result

disagrees with those of Belbase and Grabowski (1985), Kalirajan and Shand (1985), Bravo-Ureta and Pinheiro (1997) whose results showed age to be positively related to technical efficiency.

The coefficient (0.1267) of Education shows a positive and significant relationship with technical efficiency. This indicates that the technical efficiency of Fadama II small holder cassava farmers increased with increase in level of education. Education enhances the acquisition and utilization of information on improved technology by farmers (Idiong, 2006; Onyeaweaku *etal*., 2004) and this significantly increases efficiency (Rahman and Hasan, 2008).

The positive significant coefficient (0.0105) of the extent of cultivation (farm size) among Fadama II small holder cassava farmers could be attributed to the fact that size of farm determines its output. That is, the larger the farm the more the number of farm inputs that would be employed on

such farm and vice versa. The hectarage of a farm dictates the scale of farm productions. It determines the magnitude of efficiency and productivity (Akpan *et al*, 2012). As farm size increases, the level of output increases.

On the other hand, the coefficient of household size (-6.701) had a negative significant impact on technical efficiency of Fadama II cassava farmers. An increase in the farmer's household size could exert considerable pressure on the relatively finite Fadama land area meant for cassava cultivation, as part or whole might be converted to alternative land uses (Ogunniyi, 2008). This would reduce available land for cassava cultivation. Hence technical efficiency of the farmer will be reduced as good proportion of potential revenue will be lost. Also, increased family size could increase the quantity of farm produce consumed by the family in addition to increased family consumption expenditure. All these factors tend to reduce farmer's income, farm investment and eventually technical efficiency in farm resource utilization.

From the analysis of technical efficiency model, it could be inferred that increase in household size and age increases technical inefficiency among Fadama II small holder cassava farmers in the study area; while increase in other significant variables in the model reduce technical inefficiency. The diagnostic statistics have coefficients that are all statistically significant. The coefficient of total variance (δ^2) was 1.950 while the variance ratio (Y) is 0.992. Variance ratio measures the ratio of the variance of farm specific amount of labour-used (mandays) to the total variance. This means that 99.2% of the variation in the output of cassava among the Fadama II farmers was attributed to technical inefficiency. The total variance of 1.950 is statistically significant and as such, indicates a good fit and the correctness of the specified distributional assumption of the composite error term. This confirms the presence of one sided error term in the specified model (Yao and Liu, 1998 Udoh and Akintola, 2001). Thus this further validates the appropriateness of the specified stochastic model and the choice of maximum likelihood estimation.

Table 4: Determinants of Technical Efficiency of Fadama 11 Small holder Cassava farmers

Variable	Parameter	Coefficient	Standard error	T - value
Age	Z_1	-3.116	1.138	2.734**
Level of education	Z_2	0.127	0.615	2.061*
Farm experience	Z_3	0.655	0.347	0.188
Farm size	Z_4	0.011	0.003	3.289***
Access to credit	Z_5	-0.063	0.187	-0.332
Cooperative society	Z_6	0.655	0.442	14.051***
Household size	Z_7	-6.701	0.442	-5.157***
Improved technology	Z_8	0.490	0.340	1.440
Farm income	Z_9	2.790	1.069	2.608**
Diagnostic statistics				
Total variance	δ^2	1.950	0.068	2.227*
Variance Ratio	Y	0.992	0.170	5.879***
L R Test		0.167		
Log Likelihood Function		-5.980		

*** Significant at 1.0%; ** Significant at 5.0%; * Significant at 10.0%.

Determinants of technical efficiency of Fadama III small holder cassava farmers:

The determinants of technical efficiency of Fadama III small holder cassava farmers are presented in Table 5. The result of the analysis shows that age, education, access to credit and household size were statistically significant at varied risk levels.The coefficient of age (-0.2036) was negatively signed and significant at 5.0% risk level. This supports the argument that farmers

become less efficient as they get older. This could result not only from efficiency loss as farmers get old but also because younger farmers tend to be more open and likely to be exposed to methods and techniques that were not captured by variables included in the analysis. This result agrees with that of Ajibefun and Daramola (2003), Ezeh et al (2012), Onyenweaku *et al* (2004) and Onyenweaku and Nwaru (2005) which implied that increasing age would lead to decrease

in technical efficiency since aging farmers would be less energetic to work in the farm. But this result disagrees with those of Belbase and Grabowski (1985), Kalirajan and Shand (1985), Bravo-Ureta and Pinheiro (1997) whose results showed age to be positively related to technical efficiency.

Education shows a positive coefficient (1.2671) which was significant at 5.0% risk level. This implies that increase in educational attainment had positive bearing on Technical Efficiency. Generally, it is believed that education increases human capital and contributes positively to change farmers' attitudes towards use of modern technology. The result shows that Fadama III small holder cassava farmers that are literate are more efficient. This result agrees with Onyenweaku and Nwaru (2005), Onyenweaku *et al,* (2004), Onu *et al,* (2000), Amaza and Olayemi (2000), whose results showed education and technical efficiency to be positively related.

Farmer's credit access gave a coefficient of 2.159 indicating a positive relationship with technical efficiency. The implication of this result is that for each naira increase in farm credit accessed by Fadama III small holder cassava farmers an increased yield is obtained. This figure was significant at 5.0% risk level. This result agrees with Fantu et al (2011) whose result showed farm credit to be positively related to technical efficiency.

Household size was found to be positive (6.112) and highly significant at 1.0% level of significance. This suggests that larger households may utilize family labour which helps in reducing labour cost and creates formidable basis for improved technical efficiency (Mubmik and Flinn, 1998). However, this result agrees with Ezeh et al (2012) and disagrees with the findings of Nwachukwu and Onyenweaku (2007), Onyenweaku and Nwaru (2004) and Bravo-Ureta and Pinheiro (1997), which showed household size and technical efficiency to be negative and significantly related.

The coefficient of farm size (-0.063) had a negative significant impact on technical efficiency of Fadama III small holder cassava farmers. This implies that as farm size increases technical efficiency of Fadama III small holder cassava farmers decreases. This result implies that smallholder cassava farmers could be more efficient in resource allocation and management of small farms which are less complex than management of large farms that require advanced farm management knowledge, which could be lacking among small holder farmers. Furthermore, the significant influence of farm size relates to capturing variation in efficiency that arises from differences in scale (Okoruwa *etal,* 2006; Edeh and Awoke, 2009).

The diagnostic statistics have coefficients that are all statistically significant at 99% confidence level. The coefficient of total variance (δ^2) is 0.907 while the variance ratio (Y) is 0.927. Variance ratio measures the ratio of the variance of farm specific technical efficiency to the total variance. This means that 92.7% of the variation in output among the poultry feed producers were due to the disparities in technical efficiency. The total variance of 0.907 is statistically significant and as such, indicates a good fit and the correctness of the specified distributional assumption of the composite error term.

Table 5: Determinants of technical efficiency of Fadama III small holder cassava farmers' production

Variable	Parameter	Coefficient	Standard error	T – value
Age	Z_1	-0.204	0.091	2.249**
Level of education	Z_2	1.267	0.615	2.062*
Farm experience	Z_3	0.254	0.086	-0.295
Farm size	Z_4	-0.063	0.024	-2.585***
Access to credit	Z_5	2.159	1.143	1.889*
Gender	Z_6	0.053	0.039	0.135
Cooperative society	Z_7	0.021	0.104	0.206
Household size	Z_8	6.112	0.403	15.155***
Improved technology	Z_9	-0.026	0.116	-0.229
Diagnostic statistics				
Total variance	δ^2	0.907	0.053	1.722*
Variance Ratio	Y	0.927	0.049	18.867***
L R Test		16.669		
Log Likelihood Function		35.518		

*** Significant at 1.0%; ** Significant at 5.0%; * Significant at 10.0%.

Technical efficiency estimates of Fadama II small holder cassava farmers in Imo state

Table 6 presents the distribution of technical efficiency estimates of Fadama II small holder cassava farmers in Imo state. The Cobb-Douglas stochastic frontier estimates shows that the mean technical efficiency value was 0.76 for the sampled Fadama II small holder cassava farmers in the state. This shows that there is about 0.24 inefficiency gaps. Hence, farmers employing resources above the production frontier are technically efficient in cassava production while those operating below the frontier are considered technically inefficient. Additional output of cassava is still technically necessary so as to be on the frontier. The result shows that 47.50% of the Fadama II small holder cassava farmers operate between 0.61-0.80, a further 39.17% of the cassava farmers in the study areas operate within technical efficiency range of between 0.81 - 1.00. The estimates are skewed to the right, implying high level of efficiency. The minimum efficiency is 0.13 which indicates gross underutilization of resources while the maximum technical efficiency in cassava output is 0.97. In other words, the best technically efficient Fadama II small holder cassava farmers operated almost on the frontier.

Table 6: Distribution of technical efficiency Estimates of Fadama II small holder cassava farmers in Imo state, Nigeria

Technical Efficiency Range	Frequency	Percentage (%)
0.01-0.20	16	3.33
0.21-0.40	0	0.00
0.41-0.60	0	0.00
0.61-0.80	57	47.50
0.81-1.00	47	39.17
Total	120	100.00
Maximum Technical Efficiency	0.97	
Minimum Technical Efficiency	0.13	
Mean Technical Efficiency	0.76	

Technical Efficiency Estimates of Fadama III small holder cassava farmers in   Imo state

Table 7 shows the distribution of technical efficiency estimates of Fadama III small holder cassava farmers in Imo state. The mean efficiency estimate among Fadama III cassava producers in the state was 80.7% (0.807). The range is: Minimum, 0.38 (which indicates gross underutilization of resources) – Maximum, 0.96. Only 1.7% had a low technical efficiency estimate in the study area while 6.7% had a moderately

high estimate of >0.40 to 0.60. Fadama III cassava farmers with very high efficiency estimate of 0.81-1.0 constituted the majority (66.7%) in the study area. The estimates are skewed to the right, implying high level of efficiency. In other words, the best technically efficient cassava farmers operate almost on the frontier.

Given that about 99.17% of the Fadama III small holder cassava farmers have efficiency indices above average (0.50), the frontier cassava farmers therefore are more or less output maximizers while the non frontier cassava farmers represent only 1.67%. To bridge the wide gap between the technical efficiency levels of the best and the worst cassava farmers, the average Fadama III farmer needs a cost saving of 19.3% to become the best efficient poultry feed producer. This is in agreement with earlier literature (Ogunyika & Ajibefun, 2004) who observed that the mean technical efficiency of Fadama III farmers in Nigeria have been 1.00.

Therefore, it can be conclude that Fadama III cassava farmers in Imo state are technically more efficient in cassava production than Fadama II cassava farmers based on the fact that the mean technical efficiency for Fadama III small holder cassava farmers (0.807) is greater than that of Fadama II small holder cassava farmers (0.760).

The minimum technical efficiency value of 0.20 obtained for Fadama II cassava farmers shows that some of the farmers (Fadama II) are quite far from the frontier region, while the mean value of 0.760 shows that there is about 0.24 (24%) inefficiency gap among Fadama II cassava farmers compared to 19.0% inefficiency gap among Fadama III cassava farmers.

Table 7: Distribution of Technical Efficiency of Fadama III small holder cassava farmers in Imo state, Nigeria

Technical Efficiency Range	Frequency	Percentage (%)
0.01-0.20	0	0.00
0.21-0.40	2	1.67
0.41-0.60	8	6.67
0.61-0.80	30	25.00
0.81-1.00	80	66.67
Total	120	100.00
Maximum Technical Efficiency	0.96	
Minimum Technical Efficiency	0.3	
Mean Technical Efficiency	0.81	

Elasticity of production and return to scale of Fadama II and Fadama III small holder cassava farmers in Imo state

Table 8 reveals the elasticities of production of Fadama II and III small holder cassava farmers in Imo state. The table shows that the elasticities of Fadama II and III cassava farmers were greater than 1 (1.07 and 2.34 respectively). This is the case in which each additional unit of input results to a more total product than the preceding unit (Onyebinama, 2000). In this case, the cassava farmers of both Fadama II and III were operating in stage one of the classical production function. This was obtained from the coefficient of production factors.

Table 8: Distribution of production elasticities for both Fadama II and III small holder cassava farmers in Imo state

Variables	Fadama II farmers	Fadama III farmers
Farm size	0.35	0.66
Cutting	0.49	0.11
Labour	0.12	-0.72
Fertilizer	0.09	2.16
Agro chemicals	0.03	0.13
Sum of elasticities	1.07	2.34

Perceived production constraints of Fadama II and III small holder cassava farmers in Imo state

Table 9 shows the distribution of Fadama II and III farmers according to perceived problems encountered in cassava production in Imo state. As regards farmers' access to and control over productive resources, the results show that 26.7% of Fadama II and 11..67% of Fadama III farmer

had problems of limited land, formal sources of capital (25% and 40.0% for Fadama II and III farmers respectively), lack of mechanized equipment (36.67 and 28.3% for Fadama II and III farmers respectively) and agro-chemicals (43.34% and 33.33 for Fadama II and III farmers respectively) such as fertilizers, herbicides and pesticides while none of them had absolute control over these resources. With respect to the respondents' access to infrastructural facilities, most of them (28.33% and 16.67% for Fadama II and III farmers respectively) did not have access to reliable public transportation and storage facilities. Nearly all the infrastructural facilities were not available. Where they were available, the respondents did not have access to them. Meanwhile, inadequate and irregular supervisory extension workers (21.67 and 18.33% for Fadama II and III farmers respectively) also pose serious constraints to Fadama II and III cassava production in the area. The result implies that although Fadama farmers contribute significantly to agricultural production in Nigeria, they are least likely to benefit from agricultural extension services, agricultural credit schemes and technologies that would improve their productivity. This has been as a result of barriers exerted by cultural, social, biological and religious factors (Nwaru, 2003; Ajibufun, 2002). In fact, there is a strong case for arguing that without credit and complementing public infrastructure (roads, bridges, electricity, schools), it is difficult to see how small holder cassava farmers could generate incomes that can sustain an adequate livelihood and improve on productivity (Durno and Stuart 2005; Hoddinott, 1998; Anyiro and Oriaku, 2011; Ezeh *et al*, 2012).

Table 9. Production constraints of Fadama II and III cassava farmers in Imo state

Variables	Fadama II farmers		Fadama III farmers	
	Frequency *	%	Frequency*	%
Limited land	13	21.67	7	11.67
Lack of fertilizer	10	16.67	8	13.33
Lack of credit facilities	15	25.00	27	40.00
Distance from farm to market and marketing channel	18	30.00	16	26.67
Irregular supervisory visit	13	21.66	11	18.33
inadequate labour	24	40.00	13	21.66
Unavailability of improved cassava stems	19	31.66	15	25.00
Lack of Agro chemical	16	26.67	12	20.00
Lack of mechanized equipment	22	36.67	17	28.33
Inadequate reliable public transportation	17	28.33	10	16.67

*Multiple responses recorded

CONCLUSION

The mean technical efficiency of Fadama II cassava farmers in the study area is (0.76) and the mean technical efficiency of Fadama III cassava farmers is (0.81) implying that Fadama III cassava farmers were technically more efficient. Although Fadama III cassava farmers were technically more efficient than Fadama II cassava farmers, optimum efficiency status have not been fully realized. Age, level of education, farm size, membership to cooperative society, Household size, Farm income were significant determinants of Fadama II cassava farmers technical efficiency. On the other hand, Age, level of education, farm size, access to credit and household size were significant determinants of Fadama III cassava farmers technical efficiency.

RECOMMENDATION

Based on the findings of this study, the following recommendations suffice:

1) The study shows that level of education was a significant determinant of both fadama farmer groups. Hence, there is need to establish adult education centers in the state that will teach farmers to adopt technical efficiency enhancing innovations.

2) The Fadama project should assist the resource poor cassava farmers to procure credit facilities to facilitate the expansion of their production base as this will help increase farmers revenue.

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Cocoa Farmers' Participation in Farmer Field School Approach in Abia State, Nigeria

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Abstract

The study analyzed cocoa farmers' participation in Farmer Field School Approach in the three cocoa producing Local Government Areas of Abia State namely; Bende, Ikwuano and Umuahia North. Purposive and multistage random sampling technique was used in selecting 240 cocoa farmers (120 Farmer Field School Cocoa farmers and 120 non Farmer Field School Cocoa farmers). Instrument for data collection was through a structured questionnaire and were analyzed with descriptive statistics and tobit regression analysis. Results indicate that farmers were actively involved in the training of cocoa technologies in agrochemical application with mean ratings of ($\bar{x}$ =3.77), pruning techniques ($\bar{x}$ =3.75), fertilizer application ($\bar{x}$ =3.60), cocoa marketing ($\bar{x}$ =3.58), plantation establishment ($\bar{x}$ =3.50), cocoa bean storage ($\bar{x}$ =3.40), nursery establishment, and nursery establishment and cocoa bean processing ($\bar{x}$ =3.20) respectively. The tobit regression estimates of extent of farmers' participation in the programme reveals that household size, education farming experience, labour use and attendance to trainings were critical determinants to farmers participation. The result of paired "t" test showed that farm size, farm output and farm income of beneficiary Farmer Field School Cocoa Farmers were significantly higher than the non Farmer Field School Cocoa Farmers at 1.00% level of probability. Bad road network ($\bar{x}$ =3.59), price fluctuation of dried cocoa beans ($\bar{x}$ =3.47), inadequate land ($\bar{x}$ =3.31), inadequate incentives ($\bar{x}$ =3.22) and location of school ($\bar{x}$ =3.13), were identified constraints to farmers participation in the programme. Policies aimed at providing rural infrastructures, subsidy on farm inputs and review of Land Use Act of 1990 were advocated for effective farmers' participation and increased cocoa production.

Keywords: Participation, Cocoa, Farmers, Field School, Approach

INTRODUCTION

Agricultural development which involves improved land use techniques, mechanisation of production process, crops and animal improvements, better pest and diseases of crops and animal control techniques, crops and animal nutrition, conservation of natural resources, and modern methods of agro information delivery are part of the broad process of socio-economic changes which take place at farm levels and other levels of the society (Agbamu, 2006). Cocoa is grown in fourteen states of Nigeria, which include Abia, Akwa Ibom, Cross River, Delta, Edo, Ekiti, Ogun, Ondo, Osun, Oyo, Kogi, Kwara, Adamawa, and Taraba states (STCP, 2006). In Nigeria an average small scale farmer generates less than 5 bags of dried cocoa beans (estimated at 300kg per hectare) per season, considering return on investment and production capacity (Oluyole, 2005). For crops such as cocoa, this has been grown in West Africa (including Nigeria) since the early 1900s. Nigeria produces about 250,000 metric tonnes of cocoa (Adesina, 2012). Nigeria as developing country had long ago commercialized her cocoa production and was rated the second highest producer of cocoa in world ranking until 1971, when its export declined from 21, 6000 to 15000 metric tonnes in 1986 thus, reducing the country's market share to about 6% and to the fifth largest world producer of cocoa with about 385,000 metric tonnes per annum, an increase of 215,000 metric tonnes from the year 2000 (Erelu, 2008). By these ratings Nigeria competed favourably with other front liners in cocoa industry like Ivory Coast, Indonesia and Ghana. Prior to the oil boom of the

mid 70's cocoa was one of the highest foreign exchange earners in Nigeria and for a long time the crop has been generating substantial foreign earnings for the country (Onwumere and Alimba, 2010).

The cocoa sector still offers a large sizable number of people employments both directly and indirectly (Oluwale, 2004). Cocoa serves as a source of foreign exchange and employment (Olayemi, 1973; Abang, 1984; Folayan *et al*., 2006). Cocoa is used for drinks such as chocolate, for candies, cosmetics, soap and pharmaceuticals. Cocoa and its processed product like chocolate contain flavanol, which has a cardiovascular health benefit (Schroeter *et al*., 2006; Taubert *et al*., 2007). Similarly, Davison *et al*., (2010) reported that flavanol rich cocoa lowers human blood pressure. One of the major ways that cocoa farmers receive information is through extension services. However, in most cocoa producing countries, cocoa extension services/agents are inadequate (David *et al*., 2006).Information is important in generating and disseminating agricultural technologies. Adequate information is an integral part of agricultural development. The quality of information required has the potentials of improving efficiency in all the spheres of agriculture, the associated issue of food security, the need to increase yield, the need to improve quality and the need to avoid costly mistakes (Ebewore and Emuh, 2013). The farmers need to participate in agricultural development programmes because, the beneficiaries, through involvement, develop greater responsiveness to new method of production, technologies and higher services offered. In the last twenty years, many efforts have been made in trying to change research and development in agriculture to better involves farmers, (LEISA, 2006). According to Hellin *et al*., (2006), the most effective way for participatory research processes to benefit a greater proportion of farmers is by close coordination and collaboration with organizations that are better placed to link farmers and researches due to their relatively long-term contact with farmers. These organizations focus on development, they ensure that research results reach greater number of farmers and that in the process more farmers are empowered (Ajani and Onwubuya, 2010).

In the early seventies, Nigeria operated many agricultural programmes. Despite all these programmes, the performance of agricultural sector has continually fallen below expectation, and the output from agricultural sector especially cocoa, is not making a significant impact on the nation's economy. Low productivity in cocoa has been blamed on poor farmer maintenance practices, planting low yielding varieties and incidence of pest and diseases (Anon and Abekoe, 1999). To revamp cocoa and declining trend in production, the country has taken bold step by setting up the National Development Committee (NCDC) on 2nd December, 1999. The committee was to promote cocoa production through designing and implementation of programmes involving new planting stock and rehabilitation of old plantations (STCP, 2006).

In order to fill this technology dissemination gap, government through the National Cocoa Development Committee has adopted the Farmer Field School Approach as a vehicle for farm extension delivery. Farmer Field School Approach (FFSA) is a participatory training approach that can be considered both as an extension tool and a form of adult education. It focuses on building farmers capacity to make well-informed crop management decision through increased knowledge and understanding of the agro-ecosystem. Farmer Field School participants make regular field observations and use their findings, combined with their own knowledge and experience, to judge for themselves, what, if any, action needs to be taken (David *et al*., 2006).

In view of the stated facts this paper tends to analyze extent of farmers' participation in cocoa production through Farmer Field School Approach in Abia State. Specific Objectives were to; describe socio-economic characteristics of cocoa farmers' in the study area, ascertain levels of cocoa farmers' participation in Farmer Field School technologies, determine the influence of socio-economic factors on the extent of cocoa farmers participation in the programme, compare the effect of the programme between participating and non participating cocoa farmers' cocoa farmers' farm size, farm output and farm income and ascertain farmers constraints to participating in the programme.

Hypotheses

$H_{O1:}$ Socio-economic variables such as age, household size, education, farm size, labour use, farming experience, farm income, chemical use and attendance to trainings do not influence cocoa farmers' participation in the programme.

Ho_2: There is no significant difference between participating farmers farm size, farm output and farm income.

METHODOLOGY

Bende, Ikwuano and Umuahia North and Ikwuano Local Government Areas (LGA's) were purposively chosen because they were the major cocoa producing areas in the state. Multistage random sampling technique was used in selecting participating cocoa farmers. First, two (2) Farmer Field Schools each were randomly selected out of the four (4) schools that make up the LGA's; **Bende-** (Okpooenyi and Isiala schools), **Ikwuano-** (Iberenta and Itunta schools) and **Umuahia North-** (Okweyi and Azueke schools). This gave a total of six (6) Farmer Field Schools. Finally, twenty (20) participating cocoa farmers each were randomly selected from the selected schools to give a total of one hundred and twenty (120) farmers. Also, one hundred and twenty (120) non Farmer Field School cocoa farmers (FFSC) were selected from the areas were the participating farmers were chosen to give a grand sample size of two hundred and forty thousand (240) farmers.

Data were collected on farmers' socioeconomic characteristics, participation in Farmer Field Schools, influence of socio-economic factors on the participation of cocoa farmers in the programme, effect of participating in the programme on cocoa farmers' farm size, farm output and farm income and constraints they faced in their participation in Farmer Field Schools. Participation in Farmer Field School was measured on eight – item scale comprising types of training conducted amongst cocoa farmers in Farmer Field School in Abia State. Occasionally, Seldom, Never and were scored as 4, 3, 2 and 1 respectively. Constraints to farmers' participation in Farmer Field School were also measured in eight – item statement comprising list of possible constraints. It was operationalised ; high, moderate, low and no constraint as scores of 4,3,2 and 1 were assigned respectively. Objectives 1, 2 and 5 were analyzed with descriptive statistics such as frequency counts, percentages and mean scores, objectives 3 and 4 were achieved with tobit regression analysis and paired "t" test respectively.

Model specifications

The tobit regression analysis is expressed thus;
Since the level of participation of cocoa farmers, cannot be negative (the threshold is zero) the dependent variable can be written using an index function approach.

$I_i = B^T X + e_i$ ------------- (1)

$Y_i = O$ if $I_i = T$ ----------- (2)

$Y_i = I$ if $I > T$ ------------- (3)

Where,

Y represents a limited dependent variable, which simultaneously measures the decision to participate in the technologies and intensity of participation.

I^x is an underlying talent variable that indexes participation.

T is an observed threshold level

X is the vector of independent variables affecting participation.

β_i is a vector of parameters to be estimated

e_i = error term.

If the non variable T becomes a continuous function of the independent variables and O otherwise for t he generated case, the value of log likelihood function is given as, empirical model are presented below;

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9 + e_i)$

Y = level of participation in technologies (measured by numbers of participation scores of the respondents)

X_1 = Farmers age (in years)

X_2 = Household Size (Number)

X_3 = Educational status (measured by the number of years a farmer spent in school)

X_4 = Farm Size (Hectares)

X_5 = Labour Use (Man days)

X_6 = Years of farming experience

X_7 = Farm income (table amount in Naira a farmer realized from his farm)

X_8 = Chemical Use (Litres)

X_9 = Attendance to Trainings (Number of times)

e_i = Error term

The paired treatment test is explicitly stated in accordance with Nwaobiala, (2013)

$$t = \frac{x_1 - x_2}{\sqrt{\frac{S^2_1}{n1} + \frac{S^2_2}{n2}}} \quad \dotsb \dotsb \dotsb \dotsb \dotsb (4)$$

$n_1 + n_2$ - 2 degrees of freedom.................... (5)

Where "t" = Student "t" statistic

$\overline{X}_1$ = Sample mean for FFSC farmers

$\overline{X}_2$ = Sample mean for Non FFSC farmers

S^2_1 = Sample variance for FFSC farmers

S^2_2 = Sample variance for Non FFSC farmers

n_1 = Sample size for FFSC farmers

n_2 = Sample size for Non FFSC farmers

RESULTS AND DISCUSSION

Socio-economic characteristics of cocoa farmers in the study area

Table 1 shows the socio economic characteristics of both farmer groups. The result shows that the mean ages of FFSC farmers were 49.50years as against 51.67% of Non FFCS farmers. Also, FFSC farmers and Non FFSC farmers had mean farming experience of 18.50 years and 19 years respectively. Farming experience had been shown to enhance the participation and adoption of improved farming techniques, thereby increasing output (Nwaobiala and Onumadu, 2010). The Table also reveals that the mean farm size of FFSC farmers was 4.5 hectares while, the Non FFSC farmers had 4 hectares. This result conforms to the findings of (Onwumere and Alimba, 2010). The mean annual farm income of FFSC farmers and Non FFSC farmers were N1.556m and N1.124m respectively.

Table 1: Mean distribution of selected socio-economic characteristics of Farmer Field School Cocoa Farmers and Non Farmer Field School Cocoa Farmers in the study area. (N= 120 FFSCF and N= 120 Non FFSCF)

	FFSC FARMERS	NON FFSC FARMERS
Variables	Mean	Mean
Age (years)	49.50	51.67
Farming Experience (years)	18.50	19.00
Farm Size (Hectares)	4.50	4.00
Annual Farm Income (N)	1.556(M)	1.124 (M)

M= Million

Levels of cocoa farmers' participation in Farmer Field School

The result in Table 2 shows the levels of farmers' participation in the programme technologies in the study area. The Table indicates that a moderate proportion of cocoa farmers ascribed training in chemical application (fungicide, herbicide among others) (29.12%) with mean rating of 3.77 as technology they occasionally participated. Also, training in pruning techniques (34.83%) and fertilizer application (23.33%) with mean ratings of 3.75 and 3.60 respectively were technologies farmers were actively involved. Williams *et al.*, (1998) affirmed that application of fertilizer and Diuron against black pod infestation has proved to be effective. Pruning of cocoa branches and fertilizer application are important techniques in cocoa production that enhances cocoa output (Obatunde *et al.*, 2003). Furthermore, the cocoa farmers participated in training on marketing of cocoa dried beans (28.33%), plantation establishment (35.83%) and storage technologies (25.83%) with mean ratings of 3.58, 3.50 and 3.40 respectively. Finally, a moderate proportion of cocoa farmers 26.67 % and 21.67% always participated in processing and nursery technologies with mean ratings of 3.0. This implies that the farmers were actively involved in the technology, since the mean is greater than 3.0. This result confirms that all the technologies disseminated by Farmer Field School facilitators were yield enhancing which increases cocoa production in the study area.

Factors influencing cocoa farmers' participation in Farmer Field School in Abia state

Data on Table 3 shows the tobit regression estimates of the determinants of farmers' participation in the programme technologies in Abia State, Nigeria. The Chi^2 (χ^2) is highly significant at 1.00% level of probability, indicating goodness of fit of the regression line. The coefficient for household size (0.8026) was positively signed and highly significant at 1.00% level of probability. This implies that increase in household size will lead to a corresponding increase in intensity of participation in Farmer Field School. Nwaru, (2004) reported that large household sizes are expected to enhance labour availability especially where the household members are of labour age especially in cocoa production that requires more labour.

The coefficient of education (0.5761) was positive and significant at 5.00% level of probability. This implies that as education increases the probability of participating in the programme increases. This is in agreement with *a prior expectation*. Generally education is thought to create a favourable mental attitude for the acceptance of new practices especially of information intensive and management practices (Caswell *et al.*, 2001 and Onyenweaku *et al.*, 2010). The coefficient of labour (0.1897) was

positively signed and highly significant at 10.00% level of probability. This implies that increase in labour will lead to increased participation in Farmer Field School. This is expected and in accordance with a*priori* expectation.

The coefficient for farming experience (0.3171) was positively signed and highly significant at 1.00% level of probability. This is in agreement with *aprior expectation*. The positive sign implies that as farming experience increases, the tendency for farmers' participation in the programme technologies increases. The positive effect of farming experience is thought to stem from accumulated knowledge obtained from years

of observations and experimenting with various technologies (Bonabana-Wabbi and Taylor, 2008).

Attendance to trainings made positive effect (0.3308) on participation and is highly significant at 1.00% level of probability. This result is in consonance with the findings of Nwaobiala and Onumadu, (2010), where they found positive relationship between training and participation in Rural Extension project.

Therefore, the null hypothesis of factors influencing farmers' participation in the programme is hereby rejected.

Table 2: Levels of participation of cocoa farmers in Farmer Field School in Abia state

FFS Training Cocoa Technologies	Always	Often	Occasionally	Seldom	Never	TFFS	Mean
Training in Nursery Establishment/Techniques	85(17)	128(26.67)	132(36.67)	28(11.67)	13(10.83)	386	**3.20**
Training in Plantation Establishment	130(21.67)	140(35)	129(35.83)	20(8.33)	6(5)	425	**3.50**
Training in Agro Chemical Application	165(27.50)	164(34.17)	105(29.17)	16(6.67)	3(2.5)	453	**3.77**
Training in Pruning Techniques	165(27.50)	172(35.83)	90(25)	20(8.33)	4(3.33)	451	**3.75**
Training in Fertilizer Application	180(30)	112(23.33)	99(27.50)	32(13.33)	7(5.83)	430	**3.60**
Training in Cocoa Bean Storage	155(25.83)	116(24.17)	90(25)	36(15)	12(10)	409	**3.40**
Training in Cocoa Bean Processing	160(26.67)	92(19.17)	66(27.50)	50(20.83)	18(15)	386	**3.20**
Training in Cocoa Marketing	170(28.33)	128(26.67)	93(25.83)	32(13.33)	7(5.83)	430	**3.58**

Table 3: Tobit regression estimates of determinants of cocoa farmers' participation in Farmer Field School technologies in Abia state, Nigeria

Variables	Parameters	Coefficients	Standard Error	t-ratio
Age	X_1	0.1021	0.1279	0.84
Household Size	X_2	0.8026	0.2853	2.83***
Educational status	X_3	0.5761	0.2340	2.50**
Farm Size	X_4	3.8870	4.4647	2.81***
Labour Use	X_5	0.1807	0.1091	1.74*
Farming experience	X_6	0.3171	0.0643	4.93***
Farm income	X_7	0.0794	0.0651	1.22*
Chemical Use	X_8	-0.0002	-0.0003	-0.53
Attendance to Trainings	X_9	0.3308	0.5655	3.62**
Constant		45.8295	13.679	3.36***
LR Chi^2	χ^2	55.68***		
Prod. Chi^2		0.01		

*, ** and *** significant at 10.00%, 5.00% and 1.00% respectively.

Comparing the effect of Farmer Field School participation on Farm size, Farm output and Farm income

Farm sizes:

The farm sizes of the farmer groups were statistically analysed and compared (Table 4). The mean farm sizes of FFSC farmers were 4.87 hectares while that of the Non FFSC farmers was 3.54 hectares. The difference in mean farm size between the two farmer groups was 1.33 hectares. The result of calculated "t" test was 5.36 which are greater than the tabulated "t" of 3.58, is statistically significant at 1.00% level of probability. This result is not surprising, because the cocoa field school farmers expanded their enterprise by planting improved varieties of cocoa seedlings.

Farm output:

The output of both farmer groups were statistically compared and analysed. The result shows that the mean output of FFSC farmers was 20,656.53kg (2.65 tons), while the Non FFSC farmers were 12,576.85kg (1.26 tons). The mean difference was 8,079.68kg. The result of calculated "t" test (5.41) was greater than tabulated "t" (3.58) and is significant at 1.00% level of probability. This implies that the output

of beneficiary farmers were significantly higher than the non beneficiary farmers. This may be attributed to access to yield enhancing technologies by the beneficiary cocoa farmers

Farm incomes:

Farm incomes generated from the sales of seed yams by both farmer groups were statistically compared. The mean annual farm income for the beneficiary farmers was N3.639, 268 while, the Non beneficiary farmers had N2, 316,685. The difference in mean annual farm income between the two groups of farmers was N1322, 583. The result shows that the calculated "t" was 6.22 which are greater than tabulated "t" of 3.58 is highly significant at 1.00% level of probability. It therefore shows that the REP farmers had more income than the Non REP farmers. The result is in agreement with the findings of Nwaobiala, (2010) where farm incomes of Agip - Green River Project (GRP) farmers were significantly higher than the Non GRP farmers in the Niger Delta Regions of Nigeria.

Therefore, the null hypothesis of no significance difference between farm size, farm output and farm income of both farmer groups is hereby rejected.

Table 4: Paired T- test result for the difference in farm size, farm output and farm income of FFSC Farmers and Non FFSC Farmers (120 = FFSC Farmers and 120 = Non FFSC Farmers)

Group Pairs	Group Mean	Standard Deviation	t-calculated	t-tabulated
FFSCFFS	4.87			
NFFSCFFS	3.54			
Pair 1: FFSCFFS – NFFSCFFS	1.33	2.72	5.36***	3.58
FFSCFFO	20656.53			
FFSCFFO	12576.85			
Pair 2: FFSCFFO – NFFSCFFO	8079.68	16353.34	5.41***	3.58
FFSCFFI	3639268			
FFSCFFI	2316685			
Pair 3: FFSCFI – NFFSCFI	1322583	212468.4	6.22***	3.58

*, ** and *** significant at 10.00%, 5.00% and 1.00% level of probability respectively.

Where,
FFSCFFS = Farmer Field School Cocoa farmers farm size
NFFSCFFS = Non Farmer Field School Cocoa farmers farm size
FFSCFO = Farmer Field School Cocoa farmers farm output
NFFSCFO =Non Farmer Field School Cocoa farmers farm output.
FFSCFI = Farmer Field School Cocoa farmers farm income.
NFFSCFI = Non Farmer Field School Cocoa farmers farm income.

Constraints to participation of cocoa farmers in Farmer Field School

The constraints to participation of cocoa farmers in the programme are shown in Table 5. The results indicate that 77.50% of cocoa farmers complained of bad road network with mean of 3.59 as a major constraint. Asiabaka (2008) identified inadequate land and rural infrastructure (roads) as major constraints to farmers' participation in Nigeria agricultural programmes. Also, a good proportion of farmers (70.83%) and 53.33% claimed that price fluctuation of processed cocoa bean and inadequate land with mean ratings of 3.47 and 3.31 respectively were constraints. Inadequate incentives (57.50%) such as defraying transportation costs to training venues, fertilizers and agrochemicals and among others and location of school (52.50%), with mean ratings of 3.22 and 3.13 respectively were also perceived constraints to effective participation of farmers in Farmer Field School Approach in the State. Eremie (2006) assert that incentives to farmers' increases participation and ownership of their investments.

Table 5: Constraints to Cocoa Farmers' Participation in Farmer Field School in the study area

Constraint Items	High Constraint	Medium Constraint	Low Constraint	No Constraint	Mean
Bad Road Network	372(77.50)	15(4.17)	44(36.67)	--(--) 431	**3.59***
Location of School	252(52.50)	33(9.17)	90(37.50)	1(0.83) 376	**3.13***
Infrequent Visits by Facilitators	136(28.33)	120(33.33)	45(12.50)	20(16.67) 321	**2.67**
Inadequate Incentives	276(57.50)	54(15)	6(13.33)	10(8.33) 386	**3.22***
Poor Awareness of the Programme	176(36.67)	69(19.17)	84(35)	11(9.17) 340	**2.83**
Non Follow-up of Recommended Practices	84(17.50)	96(26.67)	48(20)	68(56.67) 296	**2.46**
Bad Perception on Past/ Similar Programme	196(40.83)	57(15.83)	68(28.33)	18(15) 339	**2.82**
Price Fluctuation	340(70.83)	27(7.5)	46(19.17)	3(2.5) 416	**3.47***
Inadequate Land	256(53.33)	69(19.17)	58(24.17)	14(11.67) 397	**3.31***

Decision Rule 3.0 and above is Constraint
Less than 3.0 is no Constraint
High Constraint (5), Constraint (4), Moderate Constraint (3), Low Constraint (2), No Constraint (1)
Values in parentheses are percentages.

CONCLUSION AND RECOMMENDATIONS

The study had revealed that Farmer Field School Approach played a complementary role in extension delivery and technology dissemination in the State. The high level of participation had shown that the technologies transferred were beneficial to cocoa farmers by increasing their farm size, farm output and farm income. The study showed that household size, education, farming experience, labour use and attendance to trainings were factors that influenced to farmers participation in the programme.

The study therefore recommends that;
1. Review of the Land Use Act of 1990 in Nigeria will facilitate access to land by landless peasantry who produce bulk of the agricultural produce.
2. The programme should subsidize farm inputs such as fertilizer, improved cocoa seedlings and herbicides and ensure timely supply of

these inputs taking cognizance of the fact that farming is time bound.

3. Rural infrastructure facilities such as good feeder roads, electricity and pipe borne water, among others need to be provided by relevant agencies to curb youth rural-urban migration. These facilities would help to adding value to cocoa processing and in turn increased pricing.

4. Since education had positive influence on cocoa farmers' participation, deliberate policy should be enacted to strengthen access to education to farmers. In order to achieve this, adult education centres should be located in the rural areas to complement Farmer Field School Approach stated objectives.

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Consumers' Perception and Preference for Organic Leafy Vegetables in Ibadan North Local Government Area, Oyo State

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Abstract

In Nigeria current consumption pattern of organic produce is still very low and unsustainable. It is becoming apparent that efficiency gains and technological advances alone will not be sufficient to bring organic products consumption to a sustainable level, but consumer's perception and preference for organic products creates another challenge to sustain organic consumption. Hence, this study assessed consumers' perception, and preference for organic leafy vegetables. Primary data was obtained through interview schedule administered on a random sample of 129 respondents in Ibadan North LGA. Descriptive statistics was used to analyze respondents' perception and preference for organic vegetables. Results reveal that 69percent of respondents were females with mean age of 31years and average household size of 5. Quality was found to be the major factor that guided consumer's choice of purchasing point as claimed by 72.1 percent of the respondents. About one-third (65.1 percent) of respondents perceived organic vegetables to be more nutritious than conventional vegetables, 72.9 percent perceived it to be tastier, while 81.4 percent perceived it to be healthier. Results further show that 96.9 percent of the respondents prefer organic vegetables to inorganic vegetables. Most respondents prefer organically produced vegetables;however quality of vegetables is relatively more important to consumers. It is recommended that campaigns should be intensified to educate consumers on the importance of organic vegetables and how to identify certified organic vegetables for distinction in markets so as to build consumers' confidence over time.

Key words: Leafy vegetables, Organic product, Perception, Consumer preference

INTRODUCTION

Organic products can be identified as products that come from organic production processes or from organic farming. The United States Department of Agriculture defines organic production as a farming system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives to the maximum extent feasible or farming systems that relies on crop rotation, residues, animal manure, legumes, green manure, off-farm organic wastes, and the aspects of biological pest control measures, soil productivity and tilt, to supply plant nutrients and to control insects, weeds and other pests (Alvares*et a*l., 1999).

Organic agriculture is a production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved (UNCTAD-FAO-IFOAM, 2008).Organic agriculture is one of the most promising options in meeting the challenge of alleviating poverty, increasing incomes and enhancing trade, while at the same time preserving the environment. It is a promising trade and sustainable development opportunity and a powerful tool for achieving the Millennium Development Goals (MDGs), particularly those related to poverty reduction and the environment. Organically produced foods also must be produced without the useof antibiotics, synthetic hormones, genetic engineering and other excluded practices, sewage sludge, or irradiation. Cloning animals or using their products would be considered inconsistent with organic practices. Organic foods are minimally processed without

artificial ingredients, preservatives, or irradiation to maintain the quality of the food.

Vegetables are crop plants that require little or no processing before they are eaten usually characterise by high water content. They include below the ground vegetables (*carrot, potato, radish, beetroot, onion, garlic, yam sweet potato, and celeriac),* above ground vegetables (leaves, flowers, stalks, pod, vegetable fruits vine, fungi)**.** They are consumed for their nutritive values such as; low fat, high fibre, high vitamins, and mineral contents.
The importance of vegetables as food and raw material for industries shows its place in economic growth. Its consumption in Nigeria in the past decades has been on the increase and currently is estimated to about 22 - 47.58 kg/person/year (Hart *et al.* 2005). While *Talinumfruticosum* (water leaf) is noted as one of the most profitable vegetables in the southern Nigeria (Nya*et al.* 2010), *Corchorusolitorius* (Ewedu) soup is one of the most popular traditional soups in the western part of Nigeria, mostly eaten by the Yoruba's but it is being appreciated by other ethnic groups, like the Igbo's and Hausa's.

With regards to organic agriculture, organically produced leafy vegetables are vegetables grown with the exclusion of synthetic chemicals through sustainable agricultural practices. All activities involved in the entire production process are observed in accordance with principles guiding the farming practice to ensure care, and fairness to both producers and the consumers in terms sales price, ecological conservation, and uncompromised healthy condition of the consumers, the farmer (producers), and the environment (Adeoluwa, 2010).

Synthetic chemicals being used in conventional agricultural production are the major chemicals that are purposely applied to the environment with the aim to enhance agricultural productivity. Repeated use of these chemicals leads to biodiversity loss and environmental degradation. Most pesticides are not easily degradable, they persist in the soil, leach to groundwater and surface water and contaminate wide environment. Depending on their chemical properties they can enter the organism, bio - accumulate in food chains and consequently influence also human health. Overall, intensive pesticide application results in several negative effects in the environment that cannot be ignored (Pesticides Action Network, 2010). Organic food

production and consumption is increasing on all continents, with much of the increase occurring in developed countries. However, there is little emphasis and attention on the production of organic products in Nigeria. The current consumption level of this produce is still very low and insignificant. Thus, consumer's values for organic products creates challenges to sustain organic consumption since prices of these organic products are generally higher than those of the inorganic products as a result of increased cost of production. Consumers' perception and preferences for organic products could determine the demand for these organic products.

Sequel to the underlying problem, this study aims to assess consumers' awareness, perceptions and preference towards Organic vegetables.

Literature review
Most studies identify consumer preference for organic and inorganic alternative to be a function of several attributes. Many identify main attributes to be quality, price, and knowledge of certification and health risk of what they consume. Studies have shown that most consumers prefer organic vegetable types to the inorganic types. This preference is however revealed based on perception of organic products. Organic products are perceived to be healthier, tastier, and fresher than the conventional products. Bhatta*et al.* (2009), identified consumers' preference for attributes in purchasing vegetables. The study identified that 68% of respondents always think quality while buying vegetables from market. Similarly, 45% always give preference in buying organic vegetables .It further emphasize that periodicity of consumers who sometimes think quality of vegetables and give preference to organic vegetables is lower to former group. Karmal*et al.* (2009) reported a comparative preference amongst organically grown crops. The study elicits that consumers have more preference for organic vegetables relatively to other organically grown crops and the main reason for their preference are health which is 75%, taste and palatability (18%) and good appearance and freshness (7%). This shows that health was most important .Furthermore, Dipeolu *et al.* (2009) elicit that in Ogun State, most respondents believes that organic vegetables is healthier, of better quality and tastier. organic vegetables was perceived by 63.15% as being healthier, 42.7% as being tastier, 57.9% perceived better quality while 42.4%, and 28.9%

perceived that it has no harmful effect and that it is more expensive respectively.

METHODOLOGY

The study was conducted in Ibadan North Local Government area, Oyo state. Ibadan North Local government was purposely selected for study due to farmers' adoption of organic farming in the local government area. For this study, primary data was obtained through administration of well-structured questionnaires. This was used to obtain information about the respondents' socioeconomic characteristics, consumption pattern, perception about organic products, buying preference for organically produced leafy vegetables. 129 respondents were selected randomly from the Local Government Area. Descriptive analysis of frequencies and percentages was used to assess the level of awareness, perception and preference for organic vegetables in this study.

RESULTS AND DISCUSSION

Result from the analysis of the collected data indicated that 69 percent of the respondents were female, 31 percent were male, while about 50.4 percent of the sampled respondents were married, 26.7 percent were single, 4.7 percent were widowed, and 1.6 percent were divorced. The dominant religion in the area was Christianity, practiced by 61.2 percent of the respondent total size, while 37.2 percent practiced Islamic religion, and 1.6 percent practiced traditional religion. Most of the sampled respondents (59.7 percent) had tertiary education, 27.9 percent had up to secondary education, while 12.4 percent of the respondents had only primary education.

The respondents' average monthly income was ₦ 33,155, revealing that a lot of the respondents were low income earners. Furthermore, the mean household size of respondents ranging between 1 and 12 persons per household was 5 persons per household.

Respondents' behaviour for vegetable purchase decision

From the result of the analysis in Table 2, the major purchase points indicated by the respondents included markets (69 percent) hawkers (20.9 percent) and farmers (10.1 percent). This implies that a good number of the respondents prefer getting their vegetables from the market. On respondents' consideration for purchasing points, 72.1 percent of the respondents claimed that quality determine their purchasing

point, 16.3 percent claimed it was price, while 11.6 percent claimed closeness. This is similar to the result of a study by Bhatta*et al*. (2009) that 68 per cent of respondents always think quality when buying vegetables from the market. Therefore, quality was the major factor that informs consumer's choice of purchasing point.

Also important is what consumers looked out for in purchasing vegetables. Even though some respondents considered more than one factor in purchasing vegetables, This result indicates that the major attributes considered in the purchase of leafy vegetables was freshness as indicated by 49.6 percent of the respondents Other considerations included price and taste as prompted by 22.5 percent and 17.8 percent of the respondents respectively. This implies that most of the respondents looked out for freshness in vegetables before purchase; this may be as a result of low shelf life or high perishability of leafy vegetables. It can therefore be concluded that consumers place so much value on quality attributes of leafy vegetables in the study area.

Table 1: Socioeconomic distribution of respondents

Variables	Frequency	Percentage
Age (years)		
≤24	41	31.8
25-35	49	38
36-50	34	26.4
≥51	5	3.9
Gender		
Female	89	69
Male	40	31
House hold size		
≤ 3	38	29.5
4-6	68	52.7
≥7	23	17.8
Marital status		
Married	65	50.4
Divorced	2	1.6
Widowed	6	4.7
Level of Education		
Primary	16	12.4
Secondary	36	27.9
Tertiary	77	59.7
Income(₦)		
≤24000	68	52.7
25000-49000	31	24
50000-74000	14	10.9
75000-99000	5	3.9
≥100000	11	8.5

Table 2: Distribution of respondents by vegetables purchase decision

Variables	Frequency	Percentage
Major Purchase point		
Farmer	13	10.1
Hawkers	27	20.9
Market	89	69.0
Major factor that informs Purchase point		
Quality	93	72.1
Price	21	16.3
Closeness	15	11.6
Most valued Attributes in leafy vegetables		
Price	29	22.5
Taste	23	17.8
Freshness	64	49.6
Source	13	10.1

Consumers' perception and preference

Table 3 shows that 65.1 per cent of the respondents perceives organically produced leafy vegetables to be more nutritious than the conventionally produced ones, 7.0 per cent of the respondents disagree that it is more nutritious, and 27.9 per cent are not sure if it is more nutritious. This implies that most consumers perceive organic vegetables to be more nutritious than conventional vegetables. This is likely to affect their willingness to pay.

For taste parameter, 72.9 per cent of respondents perceive organic leafy vegetables to taste better than the conventional vegetables, 7 per cent disagreed that it taste better, and 20.1 percent were uncertain of the superior tastes of organic vegetables. This implies that most respondents perceive that organic vegetables taste better than conventional vegetables. Similarly, 81.4 per cent of respondents perceive consumption of organic vegetables to be healthier than inorganic vegetables, while 3.1 percent disagreed and 15.5 percent were undecided This result reveals that most people in the study area perceive the vegetables to be very healthy. A comparative analysis of the result shows that most respondents perceive organic vegetables to be healthier relatively more than they perceive it to taste better and to be more nutritious than the conventional vegetables. This corroborates the position of Dipeolu *et al.* (2009) that asserts that most respondents perceive organic vegetables to be healthier relatively than other choices.

In addition, most of the respondents prefer organic vegetables to conventional vegetables, implying that a very high percentage of the consumers prefer organic vegetables, and will give up a lot of other things to be able to pay for organic vegetables.

Table 3: Distribution of respondents based on perception and preference for organic leafy vegetables

Variables	Frequency	Percentage
Organic Vegetables is More Nutritious		
Agree	84	65.1
Disagree	9	7.0
Uncertain	36	27.9
Tastier		
Agree	94	72.9
Disagree	9	7.0
Uncertain	26	20.2
Healthier		
Agree	105	81.4
Disagree	4	3.1
Uncertain	20	15.5
Do you Prefer organic vegetables?		
Yes	125	96.9
No	4	3.1

CONCLUSION AND RECOMMENDATION

The major purchasing point of leafy vegetables for respondents in the study area is the market. However, the major determinant of purchase point for vegetables is quality while freshness is the most valued quality attribute in purchasing vegetables. In addition, compared to other attributes, quality of leafy vegetables is relatively more important to consumers probably because of its low shelf life. From the study it can be concluded that respondents perceived organic vegetables to be healthier, tastier and more nutritious than the conventional vegetables. Hence they prefer it to the conventional vegetables. It is recommended that campaigns should be intensified to educate consumers on importance of organic vegetables and how to identify certified organic vegetables for distinction in markets. Also, farmers should ensure that production of organic vegetables is quality oriented.

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Awareness and Uptake of the National Farm Inputs and Food Production Policy among Arable Crop Farmers in Ogun State, Nigeria

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Abstract

Many of the agricultural policies of the government have fallen short of the ends they were set up to attain, given that many of the policies were either not up-taken or their uptakes were relatively slow to match the rate of population growth and the consequential increase in food demand. Awareness and uptake of agricultural policy among arable crop farmers in Ogun state was therefore investigated.A total of 120 arable crop farmers were surveyed. Data were analyzed using frequency counts, percentages and mean. Majority (83.3%) were male while 60.8% had primary education and 9.2% had no formal education. Majority (75%) were aware of farm inputs policy of the government. While uptake of policies on credit facilities (89.2%) and farm machineries (79.2%) was low, it was low for uptake of extension services (73.3%), agrochemicals (66.7%) and improved seeds (65.8%) was high. Important constraints to the uptake of agricultural policies were inadequate funds, stiff bureaucracy of the government and inconsistent government policies. Respondents location (χ^2 = 4.837) and membership of group (χ^2 = 4.174) were significantly related to uptake of farm and inputs production policy of the government. There is high level of awareness but low uptake of farm input and food production policyof the government among arable farmers in the study area. Government should therefore provide adequate subsidy on production inputs and removal of bureaucratic procedures so as to ensure a better uptake of her agricultural policies.

Key words: Farminputs policy, Awareness, Constraints, Policy uptake, Arable crop

INTRODUCTION

Agriculture is one of the most important sectors of the Nigerian economy. This is because it contributes more than 30% of the total annual Gross Domestic Product (GDP), employs about 70% of the labour force, accounts for over 70% of the non-oil exports and most importantly, provides over 80% of the food needs of the country (Adegboye, 2004). Agriculture provided adequate food for the Nigerian populace both in quality and quantity during the era before the independence in 1960 (Adegboye, 2004).

Helleiner (1996) showed that in Nigeria, between 1950 and 1960, food production was at a subsistence but sufficient level. The economy was experiencing rapid growth of 45% annually, between 1958 and 1963; the driving force being a booming trade in agricultural commodities export,

growing annually at 5.5%. The first decade of Nigerian independence (1960 – 1970) opened the way to food shortages as a result of declining agricultural production and increasing population growth rate. The increase in population at a rate considerably higher than the rates of increase in food production has continued to widen the gap between domestic food supply and domestic demand. This disparity has led to rising food prices (85% – 125% increases in many Nigerian cities) and declining foreign exchange earnings from agricultural exports.. The interaction of these factors has led to food insecurity and the idea of self-sufficiency is becoming more difficult to achieve due to declining agricultural production and inefficient food marketing system (Helleiner, 1996).

Arable crops are mainly food crops and are produced for home consumption. Prior to the civil war, the country was self-sufficient in food, but importation of food increased substantially after 1973. The most important food crops are yams and cassava in the south and sorghum (guinea corn) and millet in the north. In 1999, production of yam was 25.1million tons (67% of world production), cassava 33.1million tons (highest in the world and 20% of global production), cocoyam (taro), 3.3million tons, sweet potatoes, 1,560,000 tons. The 1999 production estimates for major crops were as follows (in thousands of tons); sorghum, 8,443; millet, 5,457; corn, 5,777; rice, 3999; peanuts, 2,783; palm oil, 842; sugar cane, 675; palm kernel, 565; soybeans, 405; and cotton lint, 57. Many fruits and vegetables are also grown by Nigerian farmers (Idachaba, 2006).

Sustainable agricultural development is propelled by agricultural policy. Nigeria's agricultural policy is the synthesis of the framework and action plans of government designed to achieve overall agricultural growth and development. According to ARCN (2008), the first national policy on agriculture was adopted in 1988 and was expected to remain valid for about fifteen years, that is, up to year 2000 The policy aims at the attainment of self-sustaining growth in all the sub-sectors of agriculture and the structural transformation necessary for the overall socio-economic development of the country as well as the improvement in the quality of life of Nigerians.

The main features of the policy include the evolution of strategies that will ensure self-sufficiency and the improvement of the level of technical and economic efficiency in food production. This is to be achieved through the introduction and adoption of improved seeds and seed stock, husbandry and appropriate machinery and equipment etc. A number of agricultural development institutions were set up and special programmes and projects were launched in order to achieve these aims, some of them include: National Accelerated Food Production Programme, NAFPP (1973); Agricultural Development Programme, ADP (1975); Operation Feed the Nation, OFN (1976); River Basin Development Authorities, RBDA (1977); National Seed Service, NSS (1977); Green Revolution, GR (1979); Directorate of Food Road and Rural Infrastructure, DFRRI (1986); National Agricultural Land Development Authority, NALDA (1992); National Fadama Development Project, NFDP (1992); Nigerian Agricultural Cooperatives and Rural Development Bank, NACRDB (2000); National Agricultural Development Fund, NADF (2002); Commodity Marketing and Development Companies, CDMC (2003).

According to Ihimodu (2004), empirical records of many of these programmes and projects are not impressive enough to bring about the expected transformation of the sector. The food self-sufficiency ratio has fallen from 98% in early 1960s to less than 54% in 1986. In 1990, 18% of the population (14.4million) was estimated to be critically food insecure and this has increased to 36% (32.7millions) in 1992 and further increased to 40.7% in 1996. Idachaba (2004) argued that over 40% of Nigeria's estimated population of 133million people is food insecure. Food security has been described as an important aspect in consideration of the sustainability of the wealth of the Nation. This is in view of its role as a critical factor in economic development, peace and stability (Akanji, 1993, Adegboye 2004).

Despite the various efforts and deliberate actions by the Nigerian government through several policies to improve agricultural productivity and food security within the nation, there seems to be no significant change or improvement in food production and food sufficiency within the country. Idachaba (2006), argued that many of these programmes have failed to attain their objectives or have fallen short of the ends they were set up to attain given the fact that many of the agricultural policies were either not adopted or their adoptions were relatively slow to match the rate of population growth and the respective increase in food demand.

As a result of this problem, there has been stagnation in the development of agriculture and innovations; this has consequently failed to improve agricultural production among small scale farmers who are the major producers of food crops. The poor rate of uptake of agricultural policies among farmers has also led to insufficient food and income being generated among rural farmers thus affecting farmer's welfare. As a result of the afore-mentioned problems, the attainment of the Millennium Development Goals of poverty eradication and food security may be in serious threat if the trend is not reversed.

According to OECD (2005), a typical example of a successful agricultural policy implementation is the "Agricultural policy reforms in China". Agricultural reform has been a major pillar of the fundamental economic reforms undertaken by China since 1978, resulting in a gradual transition

from a centrally planned economy towards a socialist market economy. The commune system was replaced by one where individual families have access to land. Then, rural industries started to expand and absorbed a large part of farm labour. The reforms have achieved a sharp rise in agricultural production together with a dramatic fall in poverty and a significant improvement in the amount and quality of food available.

The foregoing therefore amplifies the inevitability of widespread practice of agricultural policies among our farmers for the rapid development of the agricultural sector. The understanding of the dimensions of policy uptake and the associated constraints would therefore contribute, to a great extent, towards policy development and the welfare of the teaming Nigeria rural population. It is against this background that this study was carried out.

The general objective of the study was to investigate the awareness and uptake of agricultural policies among arable crop farmers in Ogun State, Nigeria. Specific objectives include to:
 1. determine the personal characteristics of the farmers,
 2. ascertain the level of awareness of arable crop farmers of the agricultural policies of the government,
 3. identify the extent of agricultural policies uptake among the arable crop farmers; and
 4. investigate the constraints to policy uptake among arable crop farmers in the study area

METHODOLOGY

The study was carried out in Ogun State, Nigeria. Ogun State is a state in South-west Nigeria and has her capital in Abeokuta. Majority of the residents of Ogun state engage mainly in subsistence agriculture as a primary means of livelihood. The population of the study comprised of all arable crop farmers registered with the Agricultural Development Programme of Ogun State.

A multistage sampling procedure was used to select respondents for this study. Two (2) of the four (4) ADP zones (Abeokuta and Ikenne) representing 50% of the total zones were selected using simple random sampling technique. In each of the selected zones, 50% of the blocks and 10% of the cells was selected using simple random sampling technique. A list of farmers was obtained from each of the selected cells and 10% of them were selected to give a total of 120 farmers (75 farmers from Abeokuta zone and 45 farmers from

the Ikenne zone). Interview schedule containing open and close ended questions was used to collect the data for this study.

Respondents' awareness of agricultural policies was measured by asking them to respond to a list of awareness statements freely. Respondents who responded rightly were awarded score of 1 and wrong answers were scored 0. A total score was obtained for awareness based on the scale. Respondents who scored below the mean value had low level of awareness, while those whose awareness score equals or greater than the mean had a high level of awareness. Respondents reacted to the listed constraints on a three point scale of "severe constraint", "mild constraint" and "not a constraint", scores of 2, 1, and 0 were awarded to them respectively. The mean score for each constraint was calculated and this was used to rank them, so that the highest mean score means the most severe constraints. Uptake of agricultural policies was operationalised in terms of extent to which farmers access their inputs through government sources (which are vehicles of her policies). Respondents reacted by indicating their sources for a list of agricultural inputs for arable crop production as: government (3), open market (2) and other sources (1). Each source of agricultural inputs was also sub-divided into another 3 point scale of regularly (2), occasionally (1) and never (0). The mean score of each policy category was determined and respondents were categorized into high (for scores of mean and above) and low (for scores below mean) in terms of their uptake of agricultural policies. Frequency counts, percentages, mean, ranking and charts were used to summarise the data.

RESULTS AND DISCUSSION

Table 1 show that the mean age of the arable crop farmers was 42 years. Majority (62.4%) of the farmers were between 31 – 50 years of age, only 4.1% of respondents were above 60 years of age. This implies that many of these farmers were within active and productive age range. The implication could be that productivity would be high as farming activities are left in the hands of those who are more active. About 83.3% of the respondents were male, while 16.7 percent were female, implying that male participation in arable crop production in the study area is more pronounced than that of the female. This is consistent with several findings which revealed the prominence of the male folks in farming activities in Nigeria (Ogunlela and Mukhtar, 2009;

Eunice, 2012). Majority (77.5%) of the respondents were married which agrees with the findings of Soyebo (2005) that crop farming is very much practiced among married people to make ends meet and cater for their children.

The table also shows that 61.7% of the farmers were Christians, 34.2% were Muslims while only 4.2% were traditional worshippers. This suggests the predominance of Christianity in the study area when compared with other religions. Agricultural extension messages can be disseminated more effectively with the supports of Christian and Islamic religious leaders, being the two major religious groups in the study area. Religious beliefs have been identified to influence adoption of agricultural policies of the government (Morris and Hausman, 2007). About 60.8% of the farmers had primary education with about 90.8% having a minimum of primary education. This represents a fair literacy level in the rural area. Generally, high level of literacy is expected to encourage adoption of improved practices and policies. This is in consonance with the assertion of Adekoya, Fadairo and Ogunele (2011).

About 59.1% of the farmers had family size of more than five, while 40.8% had family size between 1 and 5 members. The average family size was 6 persons per household. This suggests that the farmers had more people to cater for or an adequate supply of family labour for agricultural practices. This agrees with the view of FAO (2005) that family labour is mostly used in agriculture in the developing countries. The family size is a crucial determinant of the available labour for the farming activities especially in the sub-Saharan Africa, which is predominantly family labour-dependent and labour-intensive at the subsistence level. This helps in reducing the cost of labour and consequently, cost of production as reported by Nsikak, Okon and Akpabio (2011).

The mean farm size of the respondents in the study area was 1.5 hectares with 81.6% of the farmers cultivating farm lands less than or equal to 2 hectares. Only 14.1% cultivated lands between 3 – 5 hectares and 2.5% cultivated farm size of 6 – 7 hectares. This result suggests that majority of farmers in the study area cultivate small land area. This finding agrees with that of Yusuf, Omokore, Akinola and Omolehin (2011) that small farm holdings constitute most of the farming activities in Nigeria.

The table further reveals that majority (76.7%) of the respondents belonged to a group or cooperative society. This means that they can come together and pull resources to address problems they may not be able to as individuals. Membership of groups may influence the adoption behaviour of the farmers as argued by Adeyeye (1986) and Ladele (1990) who reported high level of adoption of agricultural innovation among co-operators.

Also, 84.2% of the respondents received extension services in their previous cropping season. This suggests that the public extension service in Nigeria is still effective in terms of farmers' coverage despite its numerous challenges and criticisms. The wide coverage is expected to impact positively on the farmer's awareness of the various agricultural policies of the government.

Table 1: Distribution of respondents based on their personal characteristics

Age (years)	Frequency	%	Mean
21 – 30	20	16.6	42
31 – 40	40	33.3	
41 – 50	35	29.1	
51 – 60	20	16.6	
61 – 70	5	4.1	
Sex			
Male	100	83.3	
Female	20	16.7	
Marital status			
Single	8	6.7	
Married	93	77.5	
Widowed	8	6.7	
Divorced	10	8.3	
Separated	1	0.8	
Religion			
Christianity	74	61.7	
Islam	41	34.2	
Traditional worshipper	5	4.2	
Educational status			
Non-formal educational	11	9.2	
Adult literacy	1	0.8	
Primary education	73	60.8	
Secondary education	24	20.0	
Tertiary education	11	9.2	
Family size			
1 – 5	49	40.8	6
6 – 10	69	57.5	
11 – 15	2	1.6	
Farm size (ha)			
< 1	27	21.7	1.5
1 – 2	73	60.9	
3 – 5	17	14.1	
6 – 7	3	2.5	
Membership of farm group/ cooperative	92	76.7	
Received extension/advisory service	101	84.2	

Respondents' awareness of the government's farm inputs and production policy

Table 2a shows that majority of the arable crop farmers were aware of most of the government's policies on farm input and food production. For instance, most of the farmers indicated awareness of the government's policies on fertilizers (93.3%), credit (92.5%), agrochemicals (91.7%), improved seeds (90.0), tractor services (65.0) and promoting farmers' organization (55.8%). The result suggests that government's policies are not too ambiguous in interpretation as to be easily understood by the rural populace. It is also an indication of the effectiveness of the agricultural extension services being delivered to the farmers in the study area. The finding however is against the argument of Osemeobo (1992) who opined that the past policy summersault witnessed in Nigeria is underlined by a disconnect in terms of policy understanding and awareness between the policy formulators and the intended beneficiaries. On the other hand, majority of respondents were not aware of policies aimed at stabilizing price of agricultural commodities (25.0%) and to reduce conflict between crop and livestock farmers (20.8%). The foregoing suggests that farmers are more interested in policies that are more related to their production such as fertilizers and credits compared to others such as price stability and conflict resolution. It is however an indication of poor understanding of the roles marketing plays in the value chain of agricultural production. This perhaps explains the reason why the middlemen in Nigeria have continued to succeed in ripping off the largest chunk of reward that should go to the farmers. Low awareness of government policies on farmers-agro-pastoralist conflict resolution suggests that this policy has not translated into implementation in the study area.

On the overall, Table 2b shows that there is high level of awareness of agricultural policies of the government among the respondents. This is expected to influence their uptake of these policies positively other things being equal.

Table 2a: Distribution of respondents based on their awareness of farm input and production policy of the government

Awareness	Frequency	%
I am aware of what government is doing to promote access of farmers to fertilizers	112	93.3
I am aware of what government is doing to promote access of farmers to improve seeds	108	90.0
I am aware of government is doing to promote access of farmers to agrochemicals	110	91.7
I am aware of what government is doing to promote access of farmers to credit	111	92.5
I am aware of what government is doing to promote access of farmers to tractors services	78	65.0
Are you aware of what government is doing to stabilize price of agricultural commodities	30	25.0
Are you aware of what government is doing to promote farmer's organization	67	55.8
Do you know what government is doing to reduce conflict between crop and livestock farmers	25	20.8
Are you aware of what government is doing to disseminate information to farmers	108	90.0

*Multiple responses

Table 2b:Categorization of respondents based on their level of awareness of farm inputs and production policies

| Awareness categories	Scores	Frequency	Mean
Low	9 – 14	30 (25.0)	15
High	15 – 18	90 (75.0)	

*Figures in parentheses are percentages

Extent of uptake of selected farm inputs and food production policies among respondents

Figure 1 shows that uptake of policies on innovation dissemination through public extension services (73.3%), agrochemicals such as fertilizers and pesticides (66.7%), and improved seeds (65.8%) were high among majority of the respondents. Only policies on farm machineries (79.2%) and credit (89.2%) were poorly uptaken by majority of respondents. Given the high level of awareness recorded for

these policy instruments on Table 2a, the poor uptake of credit policy by the farmers suggests that they have poor access to this opportunity. This is further corroborated by the findings on Table 3 which reveals that bureaucracy involved in benefiting from government's policy ranks high among the constraints faced by the farmers. Also, the low uptake of policy on farm machineries suggests that farming activities among the respondents are on the low scale, since large scale farming relies on use of farm machineries. Furthermore, the high uptake of

policies on innovation dissemination, agrochemicals and improved seeds among the farmers implies the relevance of these policies among the small scale peasant farmers in the study area. It is also an indication that the benefits of these policies trickled down to the intended beneficiaries. This finding is contrary to the argument of Idachaba (2006) that the seemingly well-articulated and well designed policies in Nigeria ended up producing policy mistakes, unintended policy consequences and unintended beneficiaries.
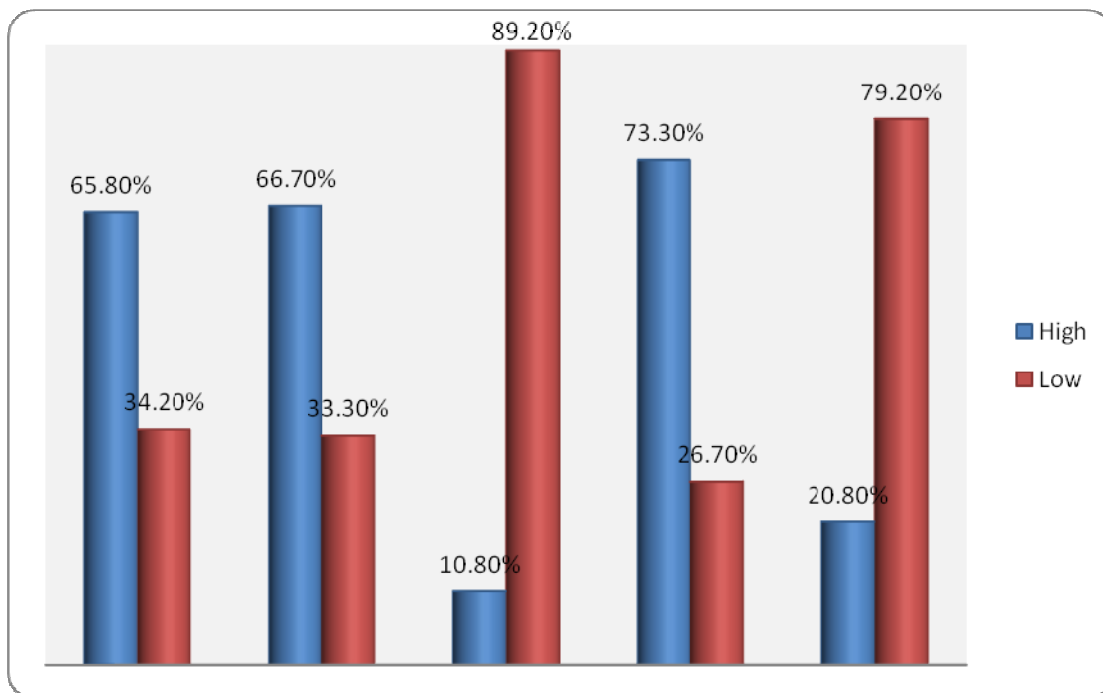
Figure 1: Level of Policy Uptake among Respondents

Constraints to Uptake of farm inputs and production policy

Table 3 presents the constraints faced by respondents in the uptake of agricultural policies. The weighted mean scores of the constraints presents them in order of severity. The table shows that inadequate funds (mean=2.88) stiff bureaucracy of the government (mean=2.82) and inconsistency of government policy (mean=2.70) were the most severe of the constraints faced by the arable crop farmers in enjoying the benefits offered by the government's food production policy. On the other hand, lack of adequate extension workers (mean=1.90) and poor technical know-how as it relates to practice of technologically inclined policies (mean=1.72)

ranked as less severe constraints among majority of the respondents.

The finding that inadequate fund was the major barrier faced by the respondents in uptaking agricultural policies agrees with the assertion of Drost *et al.* (1996) that farmers experience financial barriers to the use of sustainable agricultural practices, hence are not able to adopt most modern production technologies because they are relatively poor. Therefore, provision of adequate subsidy on production inputs and removal of bureaucratic procedures that hinders farmers' access to credit from government sources should be ensured by the government in order to ensure a better uptake of her policies.

Table 3: Distribution of respondents based on the constraints faced in uptakingagricultural policies

Constraints	Mean	Rank
Stiff bureaucracy of the government	2.82	2
Inadequate funds	2.88	1
Inadequate extension agents	1.90	7
Low technical know-how on the part of the extension agents	1.72	8
Inconsistency of the government policies	2.70	3
Lack of credible sources of information on agricultural policies	2.00	6
Fraud	2.10	5
Theft	2.60	4

Relationship between respondents' personal characteristics and their uptake of farm inputs and production policy

Table 4 shows that respondents location (p=0.036) and membership of group (p=0.050) were significantly related to their uptake of farm and inputs production policy of the government while, sex, marital status, religion, education, age, family size and farm size (p>0.05) were not significantly related to policy uptake among the farmers. This finding suggests that the geographical location of respondents and their participation in group affects their extent of uptake of agricultural policies. One can therefore infer that the extent of policy uptake observed in this study may not be a true picture of uptake among farming communities in some other areas of the country. In this vein, the argument of Idachaba (2006) that well-articulated and well-designed policies in Nigeria ended up producing policy mistakes, unintended policy consequences and unintended beneficiaries may not be totally debunked. Furthermore, the findings suggest that farmers who do not belong to groups and associations may not benefit from the farm inputs policy of the government. This finding is consistent with several similar studies that established a positive relationship between adoption of innovation and membership of group/cooperatives (Ladele, 1990; Adekoya, Ogunele and Fadairo, 2009).

On the other hand, the finding is contrary to a priori expectation that education would affect uptake of policy. The result is inconsistent with the findings of Rahman (2007) and Okoedo-Okojie and Onemolease (2009) which showed that variables such as age and farm size influence the adoption behavior of farmers. The result however agrees with the argument of Friesen and Palmer (2002) and Angba (2000) that increasing farm size does not necessarily result in increased adoption of technology.

Table 4a: Chi – square analysis of farmers' personal characteristics and policy uptake

Variables	d.f	χ^2 value	p-value
Location	1	4.837	0.036*
Sex	1	0.175	0.801
Marital status	4	3.155	0.532
Religion	2	3.833	0.147
Membership of farm group/ cooperative	1	4.174	0.050*
Educational status	4	6.661	0.155
Received extension/advisory service	1	2.189	0.205

*Significant at p $\leq$ 0.05

Table 4b: PPMC analysis of farmers' personal characteristics and policy uptake

Variables	N	r – value	p-value
Age	120	0.133	0.147
Family size	120	0.121	0.189
Farm size	120	0.036	0.696

CONCLUSION AND RECOMMENDATIONS

The study concluded that there is high level of awareness of farm inputs and food production policyof the government among arable farmers in the study area. In addition, uptake of policies on innovation dissemination through public extension

services, agrochemicals such as fertilizers and pesticides, and improved seeds were high among majority of the respondents. Only policies on farm machineries and credit were poorly uptaken. The study recommended that:

1. Efforts should be made by the government and the extension workers to create better awareness on the roles that market plays in the value chain of agricultural production among arable crop farmers.
2. Provision of adequate subsidy on production inputs and removal of bureaucratic procedures that hinders farmers' access to credit from government sources should be ensured by the government in order to ensure a better uptake of her policies.

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Determinants of Farmers' Participation in Off-Farm Activities in Iwo Local Government Area of Osun State

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Abstract

Income constraint has been the major problem faced by farmers in rural areas for many years. This has significantly reduced agricultural production and the standard of living of farmers. In this study, factors responsible for farmers' participation in off-farm employment activities, various off-farm activities engaged, the extent of participation and the share of off-farm income in the total income of farmers were examined. A stratified random sampling technique was used in the selection of 90 respondents from Iwo local government area of Osun state. Descriptive statistics such as frequencies and percentages were used to describe the socioeconomic characteristics of farmers while binary logistic regression was used to determine the factors that influence farmers' participation in off-farm activities. The study reveals that majority of farmers (63.3%) participated in one form of off-farm activities or the other. The average farm income was found to be ₦46,911.11±28,321.8 per annum and the average off-farm income was ₦80,935.56±36,007.9 per annum. The study provides evidence that, off-farm income contributed more than farm income to the total income of farmers accounting for 63.3 % of their total income. The off-farm activities in the study area included paid employments as well as self-employments. Results further show that the average farm size cultivated in the study area was approximately 1.77±1.3 hectares and the average number of years of formal education of farmers was 6.04±4.7 years. Age, household size, remittance and the local area characteristics were found to be significant as determinants of participation in off-farm income activities. In conclusion, despite farming being the major occupation of all the respondents, majority of them were involved in one form of off-farm activities or the other. Intervention programmes and incentives should be channelled to low income farmers to encourage sustainable engagement in farming.

Keywords: Off farm activities, Average farm income, Off-farm income, Remittances, Local area characteristics

INTRODUCTION

In recent decades, off-farm activities have become prevalent as important source of income for farming households in Nigeria, thus, an important component of livelihood strategies among rural households in most developing countries. Several studies have reported a substantial and increasing share of off-farm income in total household income (Babatunde *et al*, 2010). Reasons for this observed income diversification include declining farm incomes and the desire to insure against agricultural production and market risks (Lanjouw *et al*, 2001). That is, when farming becomes less profitable and more risky as a result of population growth and market failures, households are pushed into off-farm activities leading to "distress-push" diversification. In other cases,

however, households are rather pulled into the off-farm sector, especially when returns to off-farm activities are higher or less risky than in agriculture, resulting in "demand-pull" diversification. The population of every economy is divided into two categories, the economically active and the economically inactive. The economically active population (labor force) or working population are the population that is willing and able to work, including those actively engaged in the production of goods and services (employed) and those who are unemployed. Whereas, unemployed refers to people who are willing and are capable of working but are unable to find suitable paid employment; the next category, the economically inactive population refers to people who are neither working nor

looking for jobs. These include full-time students, those below the legal age for work, old and retired persons.

The FAO (2008) defined off-farm activities as the participation of individuals in remunerative work away from a home plot of land. As a result of the continuous need to increase livelihood opportunities and generate additional income, rural farming households are involved in various off-farm income fetching activities. This is done in order to sustain their families and for further investment in farm plots such as purchase of input and farm equipment. In Australia, a study showed that the proportion of farm household with at least one member employed in the non-farm sector increased from 21 per cent in 1982-1983, to 29 percent in 1994-1995 (Lim Applegate, 2002). In North America, non-farm earnings assisted young couples in financing their farm investment requirements (Lim-Applegate *et al,* 2002). Other studies noted that risk-averse farmers resort to non-farm employment as a risk management strategy (Hisham *et al,* 2004). Off-farm income has been found to have a great potential in reducing poverty in rural areas. In most countries, poverty levels are higher in rural areas than in urban areas. Due to the fact that the extent and severity of poverty are greater in rural than in urban areas, providing opportunities for productive employment and decent work for rural workers is a major development challenge (World Bank, 2008).

Statement of the Problem

Poverty is one of the most serious challenges confronting rural households worldwide, especially those in developing countries and sub-Saharan Africa in particular. Off-farm activity is an alternative strategy and has the potential to improve the income and well-being of rural households. Development policies for the rural sector have always targeted improving farm productivity to combat rural poverty. Despite this bias, there is growing evidence in developing countries that there is more to the rural sector than farming (Reardon, 1997 cited in Omofare, 2011). Although global poverty has generally reduced in the last 40 years, progress in sub-Saharan Africa has been slow and uneven. The number of people reported as living on less than a dollar a day (the internationally agreed definition of absolute poverty) has doubled over the past 20 years (World Bank, 2005). This has left many questions as to the best strategies that should be used to deal with the problem, spurring numerous research

interests and massive donor funds to be used. Poverty is often viewed as a predominantly rural phenomenon. About 75 percent of the world's poor are believed to work and live in rural areas (World Bank, 2008), and it is estimated that, by the year 2020, 60 percent of the world's poor will still be rural. A study on non-farm income diversification and poverty among farm households by Adewunmi *et al,* (2011) in Southwest Nigeria showed that the incidence of poverty was as high as 76.4% among rural farming households. This is probably due to small size of holding, tenancy, lack of irrigation facilities and low yield. The rural sector has the vast majority of the poor, accounting for more than 70% of the total population of 6,602,224,175 (World Bank, 2007). The rural households in sub-Saharan African countries usually have to cope with both poverty and income variability to shift from subsistence agriculture to a more pluriform society where farm and non-farm opportunities are available (Ahmed *et al,* 2012). Federal office of Statistics, FOS (2004) revealed that between 1980 and 2004 in Nigeria, rural poverty were higher than urban poverty and the majority of the rural poor derive their livelihood from subsistence agriculture. Diversification of income sources has been put forward as one of the strategies households employ to minimize household income variability and to ensure a minimum level of income (Ahmed *et al,* 2012). Owing to the fact that the major occupation of rural communities is farming and the rural community thus constitute the basis for agricultural production in any economy, the need for sourcing for alternative income source cannot be over emphasized as agricultural production is plagued by many uncertainties and agricultural produce consistently face price fluctuation which leads to serious reduction in farmer's income (Gani *et al,* 2011). In order to have a better understanding of this relationship, there is need to provide answers to the following questions: What are the various off-farm employment activities available in the study area? What is the extent of participation in off-farm activities? What is the contribution of off-farm activities to the total income of farmers in the study area? What are the factors that determine the participation of rural households in off-farm activities?

Literature review

In the face of continuous decline and stagnation in agricultural production, studies have shown that farmers engage in various off-farm

activities as a way of increasing total household income and reduce shocks, price and production risks in agriculture. Also, development in rural areas might have directly opened up opportunities for farmers to participate in off-farm employment and hence increasing their potential to raise household income from off-farm activities (Roslan *et al*, 2011).The term off-farm activities is not the same as non-farm employment. The FAO (2008) defined off-farm activities as the participation of individuals in remunerative work away from a home plot of land. Remunerative work here can include employment in the agricultural and non-agricultural sectors of the rural economy. Several studies (Norsida *et al*, 2000; Roslan *et al,* 2011) have shown that off-farm activities encompass activities both in the non-farm and farm sectors. Therefore in the real sense of it, all remunerative activities in the rural non-farm sector including manufacturing, services, trading, commerce, transportation, mining, tourism, vocational activities are in addition to agricultural related activities outside farmers' home plot are collectively referred to as off-farm activities.

Given the enormous diversity that characterizes the rural off-farm economy; different categories of households facing different sets of constraints and opportunities opt for different types of different rural non-farm activities. Reardon *et al* (1997), suggest that when relative return are higher in the rural non-farm than agriculture and return to agriculture are relatively more risky, pull factors are at work. Conversely, when farm output is inadequate and opportunity for consumption smoothing, such as credit and crop insurance are missing, or when input market are absent or fail and the households need cash to pay for farm inputs, push factors are at work. Under such conditions, wages or income are likely to be lower in the rural non-farm economy. There often exists a positive correlation of rural non-farm activities with higher income levels of rural families, higher potential for diversification of income sources and higher productivity in agricultural activities. Recent research has also shown a positive correlation between a higher diversification of non-farm activities and income and the level of education, quality of and access to infrastructure, objectives and organization of services, opportunities created by local, regional and national government policies and access to credit and financial services (Davis, 2003). Adewunmi *et al* (2011) found that income received from the non-farm livelihood

sources contributed an average of 67.1% of the total income while farm activities contributed 32.9%.

RESEARCH METHODOLOGY

This study was carried-out in Iwo local government area of Osun state, Southwest of Nigeria. Iwo was purposively selected as the study area out of the thirty Local Government Areas (LGAs), because the area is predominantly agrarian. The headquarters of the Agricultural Development Programme (ADP) in Osun state and the state FADAMA coordination office is in Iwo local government and comprises Ayedire, Ola-oluwa, Isokan, Ayedaade and Irewole zones. One farm settlement was cited in the area at Patara. According to the 2006 population census in Nigeria, the population head count of Iwo local government area of Osun state stood at 120,919 and covers an area of 245sqkm with a derived savanna with low rainfall at the beginning of the year which determines the type of crops grown in the area. The people are primarily of the Yoruba descent and majority of them are Muslims. The town's primary economic activity is agriculture while the major crops grown are cocoyam, yam, maize, cassava, okra, tomatoes, sweet potatoes and pepper. The major tree crop grown is palm which is used for making palm oil. Some textile activities are also engaged in as income earning activities in the town. Iwo accounts for about 1.2 million tonnes of the total volume of maize produced in the state and as such, it's a very important agricultural zone considered for the food security of the state. 5555 ha of land is cultivated for maize, 7612 ha for cassava and about 1275 ha of land is cultivated for other crops

Sampling technique and sources of data

A well-structured questionnaire was used to collect data. Iwo local government area of Osun state consists of more than 40 villages and there are registered and contact farmers in each village. The area was divided into five strata. These strata were not necessarily homogenous. Two villages were then randomly selected from each stratum making a total of 10 villages being sampled. Through simple random sampling data were collected from 100 respondents, 20 from each stratum. However, the data used in analysis was from 90 respondents, the rest were discarded due to incomplete responses. Data were collected on both quantitative and qualitative factors that determine their participation in off-farm employment. These factors include individual characteristics such as age, education, marital

status, sex. Household characteristics such as household size, remittance, farm size, farm income, off-farm income etc. and the local area characteristics-whether the area can be classified as agricultural or agricultural with some industrial activities.

Analytical techniques

Descriptive statistics was used to describe the socioeconomic characteristics of respondents and their status in off-farm activities. For the purpose of determining the effect of the various characteristics- individual, household, and the local area characteristics on the probability of participating in off-farm activities, the logit regression model was used. This approach has been used by various authors including Norsida *et al* (2000), Salimonu *et al* (2006) and Roslan *et al* (2011) to estimate the determinants of farmer's

and rural household's participation in off-farm activities.

Logit Model

In order to estimate the decision of the farmer (head of the household) to participate in off-farm activities, a binary choice model based on maximum likelihood method was used. Dummy dependent variable of 0 and 1 was used with the value of 1 for the farmer (head of the agricultural household) who participated in off-farm activities and the value of 0 for those who did not participate. Given the value of the independent variables, the estimated value for the dependent variable could be interpreted as the probability to participate in off-farm activities, (Gillespie *et al*, 2011). The logit of a number p between 0 and 1 is given by the formula:

$$logit(p) = \log(p) - \log(1 - p) \tag{1}$$

The logistic function of any number β is given by the inverse logit:

$$Logit - 1(\beta) = \frac{1}{1 + \exp(-\beta)} = \frac{\exp(\beta)}{1 + \exp(\beta)} \tag{2}$$

If p is the probability, then 1/1-p is the corresponding odds and the logit of the probability is the logarithm of the odds; similarly the difference between the logit of two probabilities is the logarithm of the odds ratio.

The logit model used in this study is specified as follows:
The model stated implicitly as:

$$Y_i = f(X_1, X_2, X_3 \ldots \ldots \ldots X_n \tag{3}$$

$$P\{Y_i = 1 \text{ or } \frac{Q}{x} = \frac{1}{(1 + \exp - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n)} \tag{4}$$

$$\ln\left[\frac{P}{(1-P)}\right] - \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_n X_n \tag{5}$$

Where
Y = participation status (participate =1; not participate = 0). Participation in off-farm activities is expressed as probability function (P/1-P), with P as the probability of participating and 1-p as probability of not participating in off-farm activities. Equation 5 was estimated and used to examine the probability of the respondents to participate in off-farm activities or otherwise. It is worth mentioning here that the sign of estimated parameter is already sufficient to conclude whether the independent variable has a positive or negative impact on the dependent variable. In addition, the magnitude of the impact could be determined with the odds ratio. The following independent variables were hypothesized as determinants of participation in off-farm activities in the study area.

X_1 = Gender of the household head (Dummy =1 if male, 0 if female)
X_2 = Number of years of education (continuous)
X_3 = Age of respondents in years (continuous)
X_4 = Marital Status (Dummy=1 if married, 0 otherwise)
X_5 = Household size (Continuous)
X_6 = Remittance (Naira)
X_7 = Farm income (Naira)
X_8 = Belong to a local group or cooperative (Dummy = 1 if yes and 0 if otherwise)
X_9 = Farm size (hectares)
X_{10} = Local area characteristics (Dummy = 0 if area is predominantly agricultural and 1 if area is agricultural with some industrial activities)
X_{11} = Average time it takes to get to the nearest town (in hours)

RESULT AND DISCUSSION
Respondents' socioeconomic characteristics

Table 1 shows that majority (41.1%) of the farmers were between ages 38-47 and the average age of farmers in the study area was estimated to be 45.4 years which is similar to that obtained by Apata *et al* (2010) who found the mean age of farmers in Ondo and Ekiti to be 43.55 and 46.97 years respectively. Majority of the respondents (67.8%) were married with an average household size of 5 which contradicts results from several studies such as Salimonu (2012) and Apata (2010). The study further shows that majority (48.8%) of the farmers had only primary education. The average number of years of formal education for the study area was estimated to be 6.04 years. Also, most of them (98.9%) cultivated between 1 ha to 5 ha of land and the mean farm size was estimated to be 1.77 ha which is in consonance with results from many studies (Babatunde *et al*, (2010) and Salimonu 2006) which found that farmers in most parts of Nigeria on the average cultivate less than 2 ha of land.

Table 1: Distribution of respondents based on their socioeconomic characteristics

Characteristics	Frequency	Percentage
Gender		
Male	55	61.1
Female	35	38.9
Age		
28-37	19	21.1
38-47	37	41.1
48-57	23	25.6
58-70	11	12.2
Marital status		
Single	8	8.9
Married	61	67.8
Divorced	9	10
Widowed	7	7.8
Separated	5	5.6
Household size		
1-3	18	20
4-6	56	62.2
7 and above.	7	7.8
Educational level		
No education	23	25.6
Primary	44	48.8
Secondary	16	17.8
Tertiary	7	7.8
Farm size		
1-5	89	98.9
5.1-10	1	1.1

Income sources of farmers

Table 2 shows the various activities and the contribution of off-farm income to the total income of farmers in the study area. Results reveal that apart from farming as primary occupation, 63.3 percent of the farmers participated in one form of off-farm income generating activities or the other. This constitute income from remittances, construction works, civil service, security, charcoal production/sales, sawmill and sales of firewood, buying and selling of food/non-food items, tailoring, cloths/basket weaving, grinding and grating, bicycles and motorcycle repairs, commercial motorcyclists, private companies, weaving of hair and barbing hair. Table 2 shows that off-farm income contributed a total of 63.3 percent to the overall income of the farmer on the average. This figure agrees with though somewhat lower than Adewunmi et al (2011) who found that off-farm income contributes about 67.1 percent to the total income of farmers in southwest Nigeria but is in contrast with Salimonu (2012) who found that farmers earn 45.9 percent of their income off-farm. The farm income on the other hand accounted for 36.7 percent of the total income. The result in table 2 on the average also shows that remittances contributed a share of 16.8 percent, civil service 10.9 percent, commercial motorcyclist 8.7 percent, construction works 5.3 percent and others 21.6 percent to the total income. Results further indicate that the average farm income for farmers was ₦46, 911.11 per annum and the average off-farm income was ₦80, 935.56. This result suggests that there is a steady decline in the contribution of farm income to the total income of farmers. This may be as a result of the higher remuneration associated with off-farm activities and the relatively lesser drudgery in most off-farm activities. The implication of this is that farmers allocates more time to off-farm activities and earn more stable income. This may be to the detriment of agricultural production if production and price uncertainties remain major bottlenecks to farm income generation.

Determinants of participation in off-farm activities

The regression result presented in table 3 shows that the LR (Likelihood-Ratio) of 56.98 is statistically significant at (P<0.01), which implies that the model has a good fit for the data. The constant or intercept 6.696 of the regression line is significant at (P<0.01) and this represents the autonomous participation index for all the farmers in the study area. Four out of the eleven explanatory variables used in the analysis were significant at different level. These variables included age (-0.198), household size (0.573),

remittance (-2.43E-05) and the local area characteristics (2.458). All the significant variables had the expected sign in line with a priori expectation. This sign shows the effect of the various variables on the participation in off-farm activities. Age had a negative sign; this implies that as the age of the farmer increases, the probability of participating in off-farm activities decreases.

The coefficient of age was estimated to be -0.198 and the marginal effect shows that one percent increase in age leads to a 3.692 percent decrease in the odds of participation in off-farm activities. This is in line with Norsida *et al* (2000) and Gillespie *et al* (2011) who found age to have a significant negative effect on rural households' participation in off-farm activities. The household size had a positive sign with a coefficient of 0.573 which implies that as the household size increases, the tendency of the farmer to participate in off-farm activities increases. The result of the marginal analysis implies that if the household size is increased by one more person, the odds of participation in off-farm activities will increase by 0.948 percent. This corresponds with the finding of Roslan *et al* (2011) that household size is a significant factor positively influencing engagement in off-farm income activities. Remittance as expected had a negative sign with a

coefficient of -2.43E-05. The marginal analysis also shows that if the remittances received by farmers increase by one percent, the odds of participating in off-farm activities will decrease by 0.272 percent. This result is in consonance with Roslan *et al* (2011) who also found that income from remittance has a significant negative effect on the participation of off-farm income generating activities but in contrast with Salimonu (2012) who found that income from remittances had a significant positive effect on the participation in off-farm activities. This result is probably because farmers with high remittances coupled with their farm incomes can meet most household expenditures and face less pressure to seek extra means of generating income. The local area characteristics (area being agricultural with some industrial activities) with a coefficient of 2.458 had a significant positive effect on participation as a percentage increase in industrial activities in the study area increased the odds of participation by 0.273 percent. This underscores the importance of development of rural infrastructures and industry to encourage active rural participation in economic activities which has a great potential to improve their household income and standard of living.

Table 2 Sources of income and the percentage share of the households' total Income

Description	Total income per year (₦)	Mean income (year)	Standard deviation	Percentage contribution to total income
Total income	11,506,200	127,846.67	35527.6	
Total farm income	4,222,000	46,911.11	28321.8	36.7
Total off-farm income	7,284,200	80,935.56	36007.9	63.3
Remittance	1,934,600	21,495.56	31,302.0	16.8
Construction	612,000	6,800.00	68,433.0	5.3
Civil service	1,260,000	14,000.00	126,885.3	10.9
Security	312,000	3,466.66	27,372.8	2.7
Charcoal production/sales	474,000	5,266.67	42,170.5	4.1
Sawmill and sales of firewood	132,000	1,466.67	26,330.3	1.2
Buying and selling of food/non-food items	528,000	5,866.67	34,118.1	4.6
Tailoring	318,000	3,533.33	15,578.7	2.8
Cloths/basket weaving	84,000	933.33	7,679.2	0.7
Grinding and grating	234,000	2,600	18,337.2	2.0
Bicycles and motorcycle repairs	156,000	1,733.33	33,713.9	1.4
Commercial motorcyclists	996,000	11,066.67	68,986.2	8.7
Private company	144,000	1,600	25,298.2	1.3
Hair making	36,000	400	3,794.7	0.3
Barbing of hair	96,000	1,066.67	10,119.3	0.8

Table 3   Determinants of Participation in Off-farm Income Activities

Variables	Coefficients	t-values.	P(/z/)	Marginal effects
Constant	6.696	3.01*	0.003	
Age	-0.198	-3.41*	0.001	-3.692
Gender	-0.386	-0.54	0.588	-0.099
Marital status	0.494	0.61	0.543	0.115
Household size	0.573	2.05**	0.041	0.948
Level of education	-0.033	0.41	0.682	-0.072
Membership of cooperative	0.839	1.14	0.256	0.214
Farm size	-0.316	-0.36	0.720	-0.269
Farm income	-7.62E-06	-0.22	0.829	-0168
Remittances	-2.43E-05	-1.92***	0.055	-0.272
Average time to the nearest town(mins)	-4.34E-04	-0.02	0.986	-0.005
Local area characteristics	2.458	3.20*	0.001	0.273

LR (Likelihood-Ratio)= 56.98*

Log likelihood function = -30.652

Degree of freedom = 11

Pseudo R^2 = 0.482

* Significant at P<0.01**, **** Significant at P<0.05**, ***** Significant at P< 0.1.

CONCLUSION AND RECOMMENDATIONS

The share of off-farm income in the total income of farmers was higher than farm income. This implies that farmers could consider participation in off-farm activities a necessary tool for improving their living standards, stabilizing their household income and spreading of income risk. This therefore calls for an integrated policy approach that takes care of farmers' quest for income diversification through engagement in off-farm participation. This indeed would have a multiplier effects on farmers' growth potentials in the primary occupation hence their sustainability. Enabling policy environment that improves farmers' income through farming activities is therefore advocated for. This could be inform of training on improved methods of production where farmers can re-invest the income from off-farm activities.

It is also found in the study that participation decreases with age. This implies that the youths participated more than the older farmers. The energetic youths are therefore disappearing gradually from the farming activities. Motivating youth programmes that would retain the young in the farming business are also therefore called for. This could be achieved through regenerating the collapsed farm settlement scheme, mechanized farming and market access. The current Agricultural Transformation Agenda of the Federal Government should also devise a feed-back mechanism through which the farmers' voice would be heard as an evaluation technique.

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Newspapers' Readership among College of Agriculture Students in Oyo State

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Abstract

Development practitioners are constantly in search of appropriate media to reach specific target groups in the development process. Newspapers are relatively more suitable for the literates. This study therefore investigated the readership of newspapers among college of agriculture students in Oyo state. A total of 162 respondents were randomly selected and administered with questionnaire on areas such as newspapers reading status, types of newspapers read, frequency of reading of newspapers, preferred newspaper segment, information sourced and constraints to readership of newspapers. Descriptive statistics, chi-square and PPMC were used to analyse the collected data. Results show that many of the respondents (64.8%) read newspapers with The Punch being most read (39.1%). Many respondents (43.8%) read weekly, while news segment was the most preferred (40 points) by the respondents. Also, educational (120 points) and agricultural information (117 points) topped the list of information sought by the respondents while cost was the most limiting factor (85.8%) in the readership of newspapers. Respondents' sex ($X^2 = 13.25$, $p \leq 0.05$), sponsorship ($X^2 = 15.58$, $p \leq 0.05$) and level of study ($r = -0.22$, $p \leq 0.05$) were significantly related to frequency of reading. Information targeted at students will be more likely received if packaged in the news form while access to newspapers could be improved by stocking of college libraries with newspaper copies for free reading.

Key words: Readership, Newspaper segment, Reading status, Preferred segments

INTRODUCTION

Development in the present age is technology-driven. New technologies and more efficient ways of doing things are being discovered faster than they are being adopted. The gap created between technology development and adoption is partly due to information deficit (Nwachukwu, 2003). Therefore, development practitioners all over the world are consistently searching for appropriate media for the dissemination of useful development-related information. Media studies have shown that various segments of the population respond to media types differently (Abdulraheem, Adisa and La'aro, 2012) and as such, media for development are chosen with the belief that they have characteristics which are appealing to the targeted audiences.

Among the media of communication, the newspaper has a perennial presence. It is one of the oldest media of communication which still

abides with us in spite of the development and evolution of the media. Norris (2000) opined that in spite of the decade-long prediction of the impending demise of the newspapers in the United States premised on its dwindling readership among the youth and loss of advertising sales which are due to the emergence of the electronic media, their continued popularity and technological adaptation to new forms of production and distribution cannot be underestimated. The situation in Nigeria is similar to the above (Abdulraheem *et al*, 2012). This may be due to the fact that newspapers are durable and are referential in scope as messages found in them can be revisited whenever they are needed unlike the radio and television which are transient in nature and cannot be referred to unless recorded.

According to Oladele (2009), newspaper provides up-to-date information on local, state, national, and world affairs. It gives the most current analysis and criticism on executive and

legislative decision-making; the latest in music, theatre, television, and fine arts; and even columns and comics to make people laugh. *The Economist* described a newspaper as a package of content—politics, sport, share prices, weather and so forth—which exists to attract eyeballs to advertisements (Communications management, 2011).

Newspapers can be used to support agricultural development and its related issues could influence the public understanding of and participation in the agricultural policy process (Lightfoot, 2003). They can provide information regarding agricultural issues and events to the non-farming public, which now use this information to gain knowledge about and make decisions regarding agricultural issues facing the agriculture industry. Agricultural related issues in newspapers may be captured as agricultural news; features or interviews while information related to new programmes and interventions in the area of agriculture are also covered by newspapers and can thus be brought to the attention of all stakeholders.

Students of agriculture have a major stake in agricultural development in Nigeria since they constitute the future of the sector. They are therefore expected to keep abreast of relevant information that could enhance their job prospects as well as lead to the development of the sector. Being literate, one would expect that a major hurdle in the use of newspapers as media of communication; literacy has been crossed. However, this assumption cannot be taken for granted. Hence, this study attempted to investigate the readership of newspapers among college of agriculture students in Oyo state with a view to ascertaining the appropriateness of the medium in reaching the future generation of agriculturists. According to Readership Institute (2013), newspaper readership is about how newspaper readers behave. This can be summarised into time, frequency and completeness. It is in line with this need that the following specific objectives were set to;

1. examine the newspaper reading status of the respondents
2. ascertain the types of newspapers read
3. investigate the frequency of reading newspapers
4. identify the preferred newspaper segments among the respondents
5. ascertain the preferred information sourced by the respondents
6. identify the constraints faced by students in accessing and reading newspapers
7. examine the relationship between personal characteristics and frequency of reading newspapers

METHODOLOGY

The study was carried out in Federal College of Agriculture; Ibadan which happened to be the origin of formal agricultural training in Nigeria. Simple random sampling technique was used to select 30 percent of students in each of the five departments and at all the levels (ND I, ND II, HND I, and HND II) to arrive at a sample size of 162 respondents. Questionnaires were used to obtain data on socio economic characteristics of the respondents such as age, sex, marital status, educational level, sponsorship, type of information interested in, preferred segment, constraint in reading newspapers and readership of newspaper among the students.

Respondents were asked to state their actual age in years while information on sex of respondents was elicited as either male or female. Marital status was measured as single or married. Level of education was measured as ND I, ND II, HND I and HND II. Respondents were also asked to state whether they get their allowance monthly, weekly or daily while sponsorship was measured by asking if students were sponsored by their parent, guardian or self.

Respondents were also asked to specify the type of daily newspaper they preferred to read on a checklist provided. The respondents were also asked to rank the following information types to determine their preference: agricultural news, political scenario of Nigeria, social news, Entertainment (sports, fashion and arts), education, health, science (technology and environment), religion or business. The frequency of such was also asked as always, occasionally, and rarely.

The respondents were asked to rank the following newspaper sections to determine their preference: News, Editorials, Columns, Comics, Forecast, Interviews, or Critics. Frequency of readership was also elicited as always, occasionally and rarely while constraints were measured using the degree of severity on a-three point scale of very severe, moderately severe and not severe.

Descriptive statistics such as frequency counts and percentage distribution were used to summarise personal characteristics of respondents. Inferential statistics such as Chi-

Square and Pearson Product Movement Correlation (PPMC) were used to test the hypotheses of the study.

RESULTS AND DISCUSSION
Personal characteristics

According to Table 1, the mean age of the respondents was 22.0±3.4 years. More than half of the respondents (50.6%) were between 21-25 years of age, a considerable proportion (37.7%) was between 16-20 years, 10.5% were between 26-30 years while few (0.6%) were between 31-35 years and 0.6% were also between 41-45years. This implies that majority of the respondents are young, vibrant and they constitute active section of the community. This is in line with expectation, as the study was about students, majority of who are youth.

The respondents' distribution by sex shows that most (63.6%) of the respondents were males while 36.4% were females. This implies that male enrolment in the college is higher than that of female students. This may be due to the technical nature of the courses being offered in the college which are traditionally considered as male-related courses.

Majority (95.7%) of the respondents was found to be single while only 4.3% were married. This is not surprising as majority of the respondents were young and still in school.

It was also found that majority (64.2%) of the respondents was Christians and 34.6% were Muslims while only 1.2% of the respondents were traditional worshippers.

The breakdown of the respondents based on level of study reveals that 38.9% of the respondents were in ND I, 24.7% of the respondents in NDII, 17.3% of students in HND I and 19.1% in HND II. This shows a decline in enrolment of the students as they progress in classes. This may be due to demands from Universities and other higher institutions or due to students' attrition from institution due to some other reasons.

The distribution of the respondents based on sponsorship shows that most of the respondents (87.0%) were sponsored by their parents, 6.8% were sponsored by their guardian while 6.2% were self-sponsored. This may make newspaper reading status dependent on the economic status of the parents of the students who are responsible for the sponsorship of majority of the respondents.

Table 1: Distribution of respondents based on personal characteristics

Variable Category	Frequency	Percentage
Age: 16-20yrs	61	37.7
21-25yrs	82	50.6
26-30yrs	17	10.5
31-35yrs	1	0.6
41-45yrs	1	0.6
Marital status		
Single	103	95.7
married	59	4.3
Religion		
Christianity	104	64.2
Islam	56	34.6
Traditional	2	1.2
Level of study		
ND I	63	38.9
ND II	40	24.7
HND I	28	17.3
HND II	31	19.1
Sponsorship		
Parent	141	87.0
Guardian	11	6.8
Self	10	6.2

Newspapers' reading status

Table 2 shows that majority of the respondents (64.8%) read newspapers while 35.2% of the respondents do not read newspapers. This agrees with Aliagan (2011) that majority of the respondents in a newspaper readership survey were youth in the age range of 20 – 30 years. This implies a large newspaper reading status among the respondents and suggests that newspapers could be a veritable tool for information dissemination among the youth. However, the proportion of the students who do not read newspapers still calls for concern considering the important role of newspapers in information dissemination and total development of the mind.

Table 2: Distribution of respondents based on newspaper reading status

Reading status	Frequency	Percentage
Yes	105	64.8
No	57	35.2

Types of newspaper read

Table 3 shows that The Punch was the most read newspaper (39.1%) among the respondents. Nigerian Tribune and The Nation also had considerable proportions of readers of 20.9% and 13.3% respectively. Others include; Vanguard (6.7%), The Sun (5.7%), Guardian (4.8%) and Complete Sport (3.8%). Meanwhile, Daily Trust,

The Sport and Alaroye had (1.9%) each. This result is in line with the findings of Aliagan (2011) that majority of the respondents of his study ranked The Punch newspaper first among the newspapers sampled. This suggests that important information disseminated through The Punch newspapers will likely be received by a considerable number of the students.

Table 3: Distribution of respondents according to newspaper they read

Types of newspaper	Frequency	Percentage
The Nation	14	13.3
Nigerian Tribune	22	20.9
The Punch	41	39.1
The Sun	4	3.8
Complete Sport	5	4.8
Vanguard	7	6.7
Guardian	6	5.7
Daily trust	2	1.9
The sport	2	1.9
Alaroye	2	1.9
Total	**105**	**100**

Newspapers' reading frequency

Table 4 shows that majority of the respondents (43.8%) read newspaper on a weekly basis while a considerable proportion of the respondents (29.5%) read them daily. Meanwhile, quarterly readers constitute 15.2% of the reading population while monthly readers constitute 11.5% of the respondents' population. These findings reveal that majority of the respondents (71.5%) were not daily readers of the newspapers. This implies that relevant information disseminated on daily newspapers may not be received by the majority of the respondents on time until a week has passed or such information had become stale. This underscores the importance of archiving newspapers in the school libraries for future reading and referencing by students who did not read such papers when it was freshly circulated.

Table 4: Distribution of respondents according to frequency of reading newspaper

Reading period	Frequency	Percentage
Daily	31	29.5
Weekly	46	43.8
Monthly	12	11.5
Quaterly	16	15.2
Total	**105**	**100**

Preferred newspaper segment

Results in Table 5 show that news was the most preferred segment (40 points) among the

respondents. Entertainment (37 points) and sports (36 points) segments equally ranked high in the order of preference among the respondents. This is in line with the findings of (Aliagan, 2011) which rated news as the number one item read by respondents in the newspapers. This suggests that the news segment could be a viable medium for passing intended development related messages across to the respondents.

Table 5: Distribution of respondents according to the segment of newspaper they read

Segment	Score	Rank
News	40	1st
Entertainment	37	2nd
Sport	36	3rd
Interview	31	4th
Forecast	31	5th
Comics	30	6th
Column	30	7th
Critics	6	8th
Editorial	5	9th

Distribution of respondents according to preferred information

Table 6 shows that educational information (120 points) was the most preferred information type among the respondents. Meanwhile agricultural information (117 points) also recorded high preference among the respondents while entertainment information (102 points) ranked third among other information types. The findings imply that educational and agricultural information relevant to the academic disciplines of the students motivated them to read newspapers, while entertainment also ranked high among the respondents' preferred information types. Hence, the newspapers will continue to be a useful source for the academic, recreational, and information needs of Nigerian students (Ola and Ojo, 2005).

Table 6: Distribution of respondents based on preferred information type

Information type	Score	Rank
Agriculture	117	2nd
Social	80	7th
Educational	120	1st
Health	83	4th
Business	42	9th
Religion	62	8th
Science	81	6th
Entertainment	102	3rd
Political	83	4th

Constraints to newspaper readership

Results in Table 7 show that although cost (85.8%) and objectivity (82.1%) were generally considered to be constraints limiting the readership of newspapers among the students, time (52.5%) and cost (43.2%) were found to be very severe constraints which limited readership of newspapers among most of the students. These imply that cost is an important factor limiting readership of newspapers among the students. The issue of cost may be due to the fact that the respondents were students who rely on their parents and guardians for money and have other pressing needs to spend money on, while time may be a constraint due to the effect of new media like twitter and short message services of breaking news which are currently being used to broadcast news.

Table 7: Distribution of respondents based on constraints to newspaper readership

Constraint Category	Not a constraint	Constraint Moderate	Constraint Very severe
Objectivity	17.9	47.5	34.6
Writing style	24.7	42.0	33.3
Time	18.5	29.0	52.5
Cost	14.2	42.6	43.2

Test of relationship between selected personal characteristics and frequency of reading of newspapers.

As shown in Table 8a and b, Chi-square and PPMC analyses reveal that selected personal characteristics such as sex ($\chi^2 = 13.25$, $p \leq 0.05$), sponsorship ($\chi^2 = 15.58$, $p \leq 0.05$) and level of study ($r = -0.22$, $p \leq 0.05$) were significantly related to frequency of reading. However, religion ($\chi^2 = 10.83$, $p \geq 0.05$), marital status ($\chi^2 = 13.25$, $p \geq 0.05$) and age ($r = -0.22$, $p \geq 0.05$) were not significantly related to frequency of reading.

These results indicate that sex, sponsorship and level of study of the respondents have implications on frequency of reading newspapers. The finding that sex and sponsorship have implications on frequency of reading newspapers agreed with Norris (2000) that sex and economic background are predictors of newspaper readership as men read newspaper more than women and the more affluent read newspapers more than the poor. The negative correlation between the level of study and frequency of reading newspaper implies that the higher the level of study, the lower the frequency of reading newspaper. This might be due to the fact that,

those in higher level of study gave more time to their studies than those in lower level of study because they are about to graduate. The lack of significance in the relationship between age and frequency of reading newspaper among the respondents may be due to the low variability in the ages of the respondents who are students and mostly in the same age bracket**.**

Table 8a: Chi-square analysis of selected personal characteristics and frequency of reading of newspapers

Personal Characteristics	Chi-square	p-value	Decision
Sex	13.249	0.001	S
Religion	10.834	0.068	NS
Marital status	13.378	0.051	NS
Sponsorship	15.584	0.004	S

Table 8b: PPMC analysis of selected personal characteristics and frequency of reading of newspapers

Personal Characteristics	r-value	p-value	Decision
Level of study	-0.221	0.005	S
Age	-0.040	0.615	NS

CONCLUSIONS

This study revealed that newspapers were read by many of the respondents on a weekly basis. The Punch had the largest reading population among the respondents and the news segments of the newspapers are the most preferred segments. Meanwhile, educational and agricultural information are highly sought by the respondents and cost is the most limiting factor to readership. Male students sponsored by their parents and those in lower levels of study have higher frequency of reading of the newspaper.

Relevant information targeted at the students could be packaged as news items in the Punch newspapers for enhanced readership among students while school libraries should set up special corners where students can have free access to newspapers at their leisure in order to reduce the constraints of time and cost faced by the students.

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Effect of Aqueous *Tetrapleura tetraptera* (African Porridge Fruit) on Carcass Characteristics and Organ Weights of Broiler Chickens

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Abstract

This study was carried out to determine the effect of Aqueous Tetrapleura tetraptera on carcass value and organ weights of broiler chickens. One hundred and fifty day old Arbor acre broiler chicks were randomly allotted to five treatments having 30 birds each, each group had five replicates with six birds each. Treatment 1 (the control) had no additive, treatment 2 had antibiotics, treatments 3, 4 and 5 had 3ml, 6ml and 9mls of Tetrapleura tetraptera extract respectively in their water. Results indicate that percentage carcass weights of the broilers were significantly influenced by the addition of extracts of Tetrapleura tetraptera in their diets for breast muscle range from (22.81-28.42) and wings from (11.12-12.80) % of Dressed Weight (DW) respectively. It also shows that there were significant differences (p≤0.05) in the data recorded for liver (3.25-4.24) and gizzard(4.70-5.73) % of DW respectively. This study demonstrated that 3ml/litre Tetrapleura tetraptera aqueous inclusion for broilers was the most effective as it significantly influenced some carcass characteristics and organ weights as indicated above.

Keywords: Broilers, *Tetrapleura Tetraptera,* Organ weights, Carcass characteristics.

INTRODUCTION

Nigeria is a country with a teeming population and this population is continuously on the rise. This increase had led to the high demand for the available animal and poultry products in all parts of the country. Among the cheapest and highly affordable protein source for this teeming population is the poultry meat. Poultry, particularly chickens are very important and has been recognized as an important genetic resource among the avian species. However orthodox drugs such as antibiotics, antihelminth, coccidiostat and vitamins are some of the popular medicine for preventing and treating various pathogenic diseases which affect the health of farm animals. The side effect of these drugs to farm animals especially in some areas where drug adulteration is prevalent has made many animal health experts begin to think of alternative, less harmful and accessible drugs for livestock disease prevention and treatment (Dipeolu *et al*., 2000).

Tetrapleura tetraptera is a plant that belongs to the family *mimosaceae,* it is locally called "aridan" in Yoruba land and "oshosho" in Ibo. It is generally found in the lowland forest of tropical Africa. The plant species has the potential of providing alternative drug therapy because it has some antibiotics property (Jithendran, 1997). The adverse effects posed by drugs particularly antibiotics in livestock production is assuming a worrisome dimension in public health so that many countries are currently banning the use of drugs because of public health implication (Ibrahim *et al.,* 1997). The use of alternative drug therapy in animal health is necessary due to the fact that pathogenic organism are becoming resistance to antibiotics drug therapy, therefore the use of these medicinal plant becomes necessary (Adewunmi *et al.* 2001). Thus the objective of this study was to observe the effect of extracts of *Tetrapleura tetraptera* on carcass quality and organ weights of broilers.

MATERIALS AND METHODS

One hundred and fifty Day-old (Abor-Acre) broiler chicks were randomly allotted to five treatments replicated five times, with each replicate having six birds (thirty birds per treatment) in a completely randomized design. The replicate birds were separated in pens and reared on a deep litter system, with feed and water

provided *ad-libitum*. The birds were weighed on arrival and this was subsequently carried out on a weekly basis for a period of eight (8) weeks. Five iso-nitrogeous and iso-caloric starter and finisher diets were compounded (Table 1) and fed to the birds throughout the trial period. Plant extracts and antibiotics were administered via drinking water. Experimental treatments were designated as follows: treatment1 (control – no antibiotic/extract); treatment 2 (antibiotics); treatment 3 (3ml//litre*T. tetraptera* extract); treatment 4 (6ml/litre*T. tetraptera* extract) and treatment 5 (9ml/litre*T. tetraptera* extract).

Table 1: Gross composition of experimental diets fed to broilers

Ingredients	Starter	Finisher
Maize	55.50	56.00
Soybean meal	26.50	14.50
Groundnut cake	15.00	13.00
Wheat offal	-	12.50
Fish meal	0.35	0.35
Bone meal	2.00	1.00
DCP	1.00	1.00
Broiler premix	0.25	0.25
Methionine	0.15	0.15
Salt	0.25	0.25

Carcass characteristics determination

At 8 weeks of age, 24 birds were selected randomly from each replicate and they were deprived of feed and water overnight after which they were weighed and exsanguinated. Evisceration was done manually after de-feathering and weighing. Each carcass was cut into primal parts and each part weighed accordingly. The dressed carcass weight was used to determine the dressing percentage as

Dressing weight percentage %

$$= \frac{\text{weight of dressed carcass}}{\text{weight of live birds}} \times 100$$

Internal organ weight determination

Evisceration was done manually after de-feathering and weighing. Each internal organ of interest was harvested and weighed accordingly.

The organ weights were determined as percentages of the dressing weights.

Preparation of plant extract

Tetrapleura tetraptera fruits were purchased from a local market in Ibadan. The fleshy parts were cut into pieces and oven dried at 500^{C} until it was crispy enough for milling. Twenty grams of the milled *Tetrapleura tetraptera* was dispensed in 200ml of water (ratio 1:20) with subsequent stirring for 30 minutes and allowed to stand for 2 hours before filtering it using muslin cloth. The filtrate was then allowed to pass through filter paper. The filtrate was dispensed in water at varying concentrations of 3mls/litre, 6mls/litre and 9mls/litre respectively.

Statistical Analysis

The data obtained were subjected to Analysis of Variance (ANOVA) and significant means were separated using the Duncan New Multiple Range Test.

RESULTS AND DISCUSSION
Live weights

Live weights of broilers in this study showed no differences in their weights, however birds offered 3ml/litre of *Tetrapleura tetraptera* extract had a 4% increase in weights compared with those on antibiotic treatment.

Carcass characteristics

Table 2 shows the results for carcass characteristics of broilers given *T. tetraptera* extracts.

There were no significant differences (p>0.05) in values obtained for live weights, dressed weights, thighs, drumsticks and back weights. There was however significant influence of the treatments on breasts and wing weights (p<0.05).

Table 2: Carcass characteristics of broiler administered varying levels of *Tetrapleura tetraptera* treaments

Parameters (%)	T1(control)	T2(antibiotic)	T3(3ml)	T4(6ml)	T5(9ml)	SEM
Live Wt(LW, g)	1637.60	1620.00	1700.00	1410.00	1520.00	125.09
DW(% of LW)	65.18	66.05	67.65	71.15	67.93	5.97
Breast(%of DW)	27.17[ab]	24.20[ab]	28.42[a]	22.81[b]	25.53[ab]	5.61
Thigh(%of DW)	15.61	14.99	16.46	14.09	17.39	3.30
Drumstick(%of DW)	15.14	14.90	14.27	13.32	15.39	2.07
Wing (%of DW)	12.80[a]	12.22[a]	12.36[a]	11.12[b]	12.43[a]	1.68
Back (%of DW)	23.59	24.49	22.83	23.41	23.80	1.66

[a, b] – means in the same row with different superscripts are significantly different

Keys: Live Wt = Live Weight   DW = Dressed Weight

Table 3: Organ weights of broilers administered varying levels of *Tetrapleura tetraptera* extracts treatments

Parameters	T1(control)	T2(antibiotic)	T3(3ml)	T4(6ml)	T5(9ml)	SEM
Liver	3.84[ab]	3.83[ab]	4.24[a]	3.47[b]	3.25[b]	0.99
Gizzard	5.73[a]	5.48[ab]	5.09[ab]	4.70[b]	5.31[ab]	1.03
Heart	0..77	0.73	0.76	0.74	0.93	0.20
Pancreas	0.43	0.45	0.42	0.46	0.43	0.04
Spleen	0.22	0.22	0.24	0.28	0.29	0.07

[a, b] – means in the same row with different superscripts are significantly different

SEM – standard error of mean

Internal organ weight

Results presented in Table 3 show that *Tetrapleura tetraptera* extract had significant effect on liver and gizzard weights of broiler ($p<0.05$). Liver weights were significantly lowest on T5 (9ml/liter) and highest on T3 (3ml/liter). Heart, pancreas and spleen did not differ significantly as a result of the additive

DISCUSSION

According to Javed *et al*. (2009), it was observed that aqueous extract of *Berberis lycium* and *Withania somnifera* at the rate of 10 ml of drinking water produce positive results in broiler chicks. Nweze *et al.* (2011) reported that the dressed carcass weight was significantly ($p<0.05$) reduced in the broilers fed diets without *Tetrapleura tetraptera*. Dressing out percentage was also lowest in the diet without *Tetrapleura tetraptera.* However in this study the birds with the lowest weights were those who received 6mls/litre of the extract. According to Amouzmehr, Anvar *et al*. (2012) application of two herb extracts, garlic and thyme, had no significant effect on performance and percentage of carcass components; thigh, breast, abdominal fat, and carcass weight. Nweze *et al*. (2011) observed that the inclusion of *Ocimum gratissimum* at 1% in broiler diets generally improved body weight gain, dressing percentage and significantly ($p<0.05$) promoted higher dressed weights and carcass quality. Dressed weight which was numerically lower in the control and antibiotic treatment compared with 3mls/liter of *Tetrapleura tetraptera* correlated with the report of Nweze (2011) who observed that dressed weight was lowest in the broilers fed diets without *Tetrapleura tetraptera* inclusion. Organ weights of broilers were significantly influenced by addition of extracts of *T. tetrapleura* in the diets for liver and gizzard. At 3mls/liter larger liver weights were observed, which is in agreement with Al-Kassie (2009) who observed that the addition of the extracts of Thyme and cinnamon significantly improved liver weights and reduced abdominal fat content. They also observed effect of spice extracts on heart and gizzard weights. These results also agree with the work of Langhout (2000), who showed that oil extracts could stimulate the digestion system in poultry, improve the function of liver and increase the pancreatic digestive enzymes. Hernandez *et al*. (2004) however found no significant differences for proventriculus, gizzard, liver and pancreas weights, when extracts of oregano, cinnamon and pepper were included in the diets of broilers.

CONCLUSION

It was observed that at 3ml/litre *Tetrapleura tetraptera* significantly improved breast weights. Organ weights were also significantly improved with the inclusion of *Tetrapleura tetraptera* extracts in the diets of broilers. Therefore, the extracts of *Tetrapleura tetraptera* compared favorably with antibiotics when administered to broilers and can be used to replace antibiotics at 3ml/litre.

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