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FOOTNOTES should be avoided as much as possible. Acknowledgements should appear after Conclusion before the reference list.

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INFORMATION AND TRAINING NEEDS OF TRADITIONAL BIRTH ATTENDANTS IN SELECTED RURAL COMMUNITIES OF OYO STATE, NIGERIA

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ABSTRACT

This study investigated the information and training needs of Traditional Birth Attendants (TBAs) in selected rural communities of Oyo State. A multi-stage sampling procedure was used to select TBAs from the study area to give a total of 120 respondents that form the sample size for this study. Data on socioeconomic characteristics of respondents, sources of training available, services provided, constraints faced by TBAs and information and training needs of TBAs were obtained. Data were analysed using descriptive statistics, PPMC and chi square. Results of the study revealed that the mean age of respondents was 44.8 ± 9.9 years and 93.3% were married. Sources of training available to TBAs are from community health workers (98.3%) and skilled health workers (82.5%). Services rendered by TBAs are antenatal care (92.5%) breastfeeding lectures (87.5%) and referral services (43.3%). The mean score for constraints shows that management of severe bleeding (0.92), management of retained placenta (0.85) and insufficient information and training (0.54) were ranked as the major constraints. The result of the study also revealed that information and training needs on referral of sick baby, weight of the baby and advice on immunization (100%) were highly needed by all the respondents. Chi-square result shows that sex ($\chi^2=4.611$, $p<0.05$) and religion ($\chi^2=7.397$, $p<0.05$) were significantly related to the information and training needs. Also, age ($r=0.238$, $p<0.05$) and working experience ($r=0.236$, $p<0.05$) were significantly related to the information and training needs of the respondents. The study recommended that Policy makers on reproductive health issues must develop collaborative opportunities with TBAs and skilled health workers that encompass mutual trust and respect which will ensure sustainable health sector in the nation.

Keywords: Health services, Maternal mortality, Skilled birth Attendants, Traditional birth Attendants, Training

INTRODUCTION

The maternal mortality in Nigeria is one of the highest in the world, ranking second after India (Olonade, Olawande, Alabi and Imhonopi, 2019). Okereke, Ishaku and Unumeri *et al*, (2019) approximated that 90 percent of all maternal deaths and 80 percent of all still births occur in developing countries, largely because those countries lack trained midwives.

Maternal mortality caused by childbirth, unsafe abortion process and pregnancy complications are threat to agricultural development as it reduces labour in the agricultural sector and affects development of the economy, food and nutrition security as well as child and elderly care in the household (Adeleke, 2018). The health of mothers is very crucial because it has a bearing on the health of every members of the household, particularly that of children and aged persons (WHO, 2016). Education, poverty and lack of access to qualified health workers are some of the factors that have contributed to maternal and infant mortality rate in Nigeria especially in rural areas. (Piane, 2019).

A qualified health worker refers to highly skilled workers, in professions that usually require extensive knowledge including university level study leading to the award of a first degree or higher qualification (WHO, 2018). This includes physicians, midwives, registered nurses, pharmacists, physiotherapists, and others. Many countries especially in developing countries still have unqualified health workers to perform and deliver primary health care services. Therefore,

unqualified health workers like Traditional Birth Attendants (TBAs) can affect the health status and conditions of those countries, such as maternal and neonatal mortality rate if not impacted with basic training and information to improve their knowledge, skills and practices.

The World Health Organization defines a Traditional Birth Attendant (TBA) as a person, usually a woman who assists a pregnant woman at childbirth and acquired her skills in delivering babies by herself or working with other TBAs (WHO, 2018). They belong to the informal healthcare system and are commonly found in rural areas (Shah, Brieger, and Peters, 2011). The TBAs live in the same village with their clients, are well known and are trusted members of the community and seen to provide supportive and culturally acceptable care (Caulfield *et al*, 2016). They provide social support during the perinatal period and often go beyond the usual job of delivering babies (e.g., they also cook and clean) (Liambila and Kuria, 2014). This support creates a strong bond between the TBAs and their clients, which is cherished by rural women. In most rural communities, the services of TBAs are valued. This is because they speak local language, they are available, accessible at all hours, affordable, culturally acceptable and they share similar cultures with their client communities (Ebuehi and Akintujoje, 2012; Turinawe, 2016). Also, the shortage or few skilled birth attendants like doctors, nurses and midwives particularly their uneven distribution across region and communities in the country makes TBAs to be available in rural communities so as to fill the gap.



However, services of TBAs have been linked with high maternal death rates especially among women with low economic status who do not have access to skilled health care (Desai *et al.*, 2013). The situation is even grave in rural areas where the health care system is poor and overstretched in addition to the high poverty level. Many of their beliefs and practices pertaining to the reproductive cycle are dependent upon religion or mystic sanctions which are reinforced by rituals that are performed with traditional ceremonies (WHO, 2016). TBAs have been implicated in unsafe practices and the late referral of women who suffer from complications during pregnancy, labour and delivery in other settings (Okereke, Ishaku and Unumeri *et al.*, (2019).

Several reviews highlight evidence that TBAs, when trained, can contribute to maternal mortality reduction (Amutah-Onukagha *et al.*, 2017) and facilitate access to services (Piane, 2019) and that integration of TBAs with formal health systems can increase skilled birth attendance services (Byrne and Morgan, 2011). Riberio (2014) recommend TBA retraining and use by African countries, mainly based on arguments relating to the scarcity of skilled birth attendants, the lower cost of services by TBAs and community/traditional acceptance of the services.

In recent years, there has been increasing debates over the usefulness of TBAs in maternal health care (Sarker, 2016; Amutah-Onukagha *et al.*, 2017). Opponents of TBAs care are of the view that TBAs have done little to improve maternal health. They opined that TBAs have frustrated laudable efforts made by governments in Sub-Saharan Africa to reduce maternal mortality while proponent have expressed the need for a sustained partnership with TBAs as a strategy to improve access to basic maternity care in rural areas to achieve significant reduction in maternal mortality (Ebuechi and Akintujoye, 2012).

Some of the problems of TBAs are lack of proper and continuous training, lack of access to adequate facilities, shortage of essential medicines and other important medical supplies including delivery kits and equipment as well as limited physical infrastructure, lack of ability to deliver appropriate services, including those relating to emergency obstetric care. The TBAs are not monitored and supervised, therefore they do not know their limit and make every attempt whether they succeed or not. The TBAs are not hygienic in nature and their inability to provide immunization services against diseases can expose the mother and the baby to risks of infection, malformation and eventually results to death. The impact of these problems on global development is frightening to the extent that one of the main targets of the Sustainable Development Goals (SDGs) by 2030 is

the reduction by two-third in infant mortality and three-quarters in maternal mortality rate.

Therefore, one solution to addressing maternal and neonatal mortality is through educating and providing information to the untrained and trained birth attendants. In view of this, if TBAs are in tune with required skills and emerging practices in child delivery, this would largely minimize the maternal mortality rate especially amongst the rural populace. It is against this background that this study sought to empirically validate the information and training needs of TBAs in selected rural communities of Oyo state.

The general objective of the study is to investigate the information and training needs of Traditional Birth Attendants in rural communities of Oyo state, Nigeria. The specific objectives were to:

1. describe the socioeconomic characteristics of the respondents in the study area;
2. determine the sources of training available to TBAs;
3. identify the services provided by TBAs to rural dwellers;
4. identify the information and training needs of TBAs in the study area;
5. determine the constraints faced by TBAs in the study area.

The hypothesis of the study is as stated; there is no significant relationship between the selected socioeconomic characteristics of respondents and the information and training needs of traditional birth attendants.

METHODOLOGY

This study was carried out in rural communities of Oyo State. Oyo state is located in the southwest geopolitical zone of Nigeria and consists of 33 Local Government Areas (LGAs). It is situated in latitude 7° 24'N and Longitude 3° 52'E as well as altitude 234m above sea level. Oyo state was created in 1976 out of the old western region and covers a total of 27,249 square kilometers of land mass. It is bounded to the south by Ogun State, in the north by Kwara State, in the east by Osun State and in the west; it is partly bounded by Ogun and partly by the republic of Benin. The people of Oyo State are divided into four zones which are: Ibadan/Ibarapa, Oyo, Oke-ogun and Ogbomosho. The population of this study comprised of traditional birth attendants in the study area.

A multi-stage sampling procedure was used to select respondents for this study. At the first stage, 10% of LGAs in the 28 rural LGAs in Oyo State were randomly selected to give 3 LGAs which are Ido (10 wards), Iseyin (11 wards) and Akinyele (10 wards). At the second stage, 20% of the wards in each LGA were selected to give a total of 6 wards which are Ido/Onikede (14 villages) and Aba emo (12 villages) from Ido LGA, Ado awaye (24

villages) and Isalu I (14 villages) from Iseyin LGA and Ajibade/Alabata (10 villages) and Arulogun (20 villages) from Akinyele LGA. At the third stage, 10% of the villages in each ward were randomly selected to give a total of 15 villages. At the last stage, snowball sampling technique was used to identify TBAs from each village to give a total of 120 respondents that form the sample size for this study.

Sources of training were measured by asking respondents to respond 'Yes and No' to options like skilled health workers, books, apprenticeship with relations and so on.

Services provided by respondents were operationalised on a three-point Likert-type scale of always, sometimes and never for options like antenatal care, postnatal care, referral services, neonatal services and so on. Response options were scored as 2, 1 and 0, respectively.

Constraints faced by TBAs were measured on a three-point Likert-type scale of serious constraint, mild constraint and not a constraint for options like inadequate facilities/equipment, lack of referral services and so on. Response options were scored as 2, 1 and 0, respectively.

The Dependent variable for this study is information and training needs of TBAs which was classified into antenatal care, delivery care and postnatal care. It was measured on a three point Likert-type scale of seriously in need, slightly in need and not a need. A mean score of 40.6 was generated which was used to categorise the respondents into those having high and low information and training needs. Response options were scored as 2, 1 and 0, respectively.

Descriptive statistics such as; frequencies, percentages, mean and standard deviation and Inferential statistics like; Chi-square and Pearson Product Moment Correlation (PPMC) were used to analyse the data.

RESULTS AND DISCUSSION

Socioeconomic characteristics

The mean age of respondents was 44.8 ± 9.9 years as seen in Table 1. This implies that majority of the respondents were in their productive and active age. This is in line with the finding of Piane (2019) that most TBAs are middle-aged which could give them zeal and strength to perform their duties maximally. Also, Table 1 reveals that 64.2% of the respondents were Christians and 33.3% were Muslims. This corroborates the findings of Maryam, *et al* (2016) that in Nigeria there are varying religious beliefs which explain some of the disparities in the use of available reproductive health

services. The result in Table 1 further shows that most (93.3%) of the respondents were married. This suggests that most of the TBAs have responsibility for the provision of household needs. Table 1 shows that majority (93.3%) of the respondents were female. This implies that there were more female TBAs than male. This is in line with the findings of Adatara, Afaya, Baku, *et al* (2018) that most TBAs are women and often elderly. Table 1 further reveals that 23.3% of the respondents had primary education, 62.5% had secondary education and 10.8% had tertiary education. This means that most of the respondents could receive appropriate information and training that will help to manage their services effectively based on their level of education. This corroborates the findings of Ribeiro (2014) that some TBAs have education that might integrate them into the larger health care system and help them perform better. Majority (91.7%) of the respondents were engaged in TBAs services as their main occupation. This implies that most of the respondents work as birth attendants with few into trading and farming. The result in Table 1 also reveals that the mean value for respondents' working experience is 16.5 ± 9.5 years. This implies that the respondents had grater years of working experience which could be due to their ability of assisting women deliver at home in their community over the years. The result in Table 1 also shows the mean annual income of the respondents to be $\text{₦}32,016.67 \pm 17,518.29$. This implies that most of the respondents in the study area could be described as low-income earners. This is in line with the findings of Sarker, *et al* (2016) that TBAs provide affordable and accessible services as well as conduct delivery at home not necessarily for the monetary gains.

Sources of training available to respondents

Sources of training available to TBAs as presented in Table 2 reveals that majority (98.3% and 82.5%) of the respondents received training from community health workers and skilled health workers, respectively. Also, 63.3% read books, 58.3% were trained by relation. This implies that community health workers and skilled health workers were the most available sources of training for the TBAs. This corroborates the study of Aborigo, Allotey and Reidpath (2015) and Amutah-Onukagha *et al*, 2017 that initiation into TBA practice includes formal training by district health staff, sacred calling through dreams or visions and inheriting or apprenticeship from close relatives such as mothers.

**Table 1: Distribution of the respondents by socioeconomic characteristics**

Variables	Percent	Mean	SD
Age (years)			
20-29	3.3	44.8	9.9
30-39	21.7		
40-49	42.5		
50-59	24.2		
60-69	8.3		
Religion			
Christianity	64.2		
Islamic	33.3		
Traditional	2.5		
Marital status			
Married	93.3		
Widowed	6.7		
Sex			
Female	93.3		
Male	6.7		
Years of working experience			
3-11	35.0	16.5	9.5
12-20	39.2		
21-29	13.3		
30-38	12.5		
Educational qualification			
No formal education	3.4		
Primary education	23.3		
Secondary education	62.5		
Tertiary education	10.8		
Primary occupation			
TBAs	55.8		
Trading	18.3		
Farming	14.2		
Evangelist	11.7		
Annual income (₦)			
10,000-40,000	52.5	₦32,016.67	17,518.29
40,001-70,000	35.8		
70,001-100,000	11.7		

Source: Field survey, 2019

Table 2: Distribution of respondents by sources of training

Sources of training available	Yes (%)	No (%)
Books	63.3	31.7
Skilled health worker	82.5	17.5
Apprenticeship with relation	58.3	41.7
Pictures and charts	44.2	55.8
NGO	40.0	59.2
Health extension worker	59.2	40.8
Community health workers	98.3	1.7

Source: Field survey, 2019

Services provided by respondents

Result in Table 3 reveals that some services like antenatal care, breastfeeding lectures, and postnatal care (92.5%, 87.5%, and 67.5%), respectively were always provided by the TBAs, while referral services (43.3%) was sometimes provided by TBAs. This implies that services like antenatal care, breastfeeding lectures and postnatal

care were always provided by the respondents. Referral services were sometimes provided by some of the respondents which is in line with the findings of Mboho, Eyo and Agbaje (2012) that training of TBAs was shown to possibly increase the number of hospital referrals when complications occur in comparison to non-trained birth attendants, thus reducing maternal mortality rates.

Table 3: Distribution of respondents by services provided

Services	Always (%)	Sometimes (%)	Never (%)	Mean	SD
Antenatal care	92.5	7.5	0	1.92	0.26
Post natal care	67.5	29.2	3.3	1.64	0.55
Referral services	55.0	43.3	1.7	1.53	0.53
Infant welfare	50.8	24.2	25.0	1.26	0.84
Concoction to make mother & baby strong	35.8	10.0	54.2	0.82	0.93
Neonatal care	49.2	24.2	26.7	1.23	0.84
Breastfeeding lecture	87.5	5.0	7.5	1.80	0.56
Immunization for children	26.7	9.2	64.2	0.63	0.88
Family planning services and lecture	28.3	13.3	58.3	0.70	0.88
Treatment of infertility in women	30.8	15.8	53.3	0.78	0.89
Management of complications during delivery	26.7	20.8	52.5	0.74	0.86

Source: Field survey, 2019

Constraints faced by the TBAs

The mean score for constraints shows that management of severe bleeding (0.92), management of retained placenta (0.85), insufficient information and training (0.54) and referral to hospital (0.50) were ranked as the major constraints among the listed constraints as shown in Table 4. This implies

that TBAs may not be able to recognize danger signs which could lead to maternal mortality. This corroborates the findings of Lydia and Cephas (2018) who stated that problems could result from TBAs failure to recognize danger signs, inability to implement simple evidence-based interventions for complications and delayed referral.

Table 4: Distribution of respondents by constraints faced in service delivery

Constraints	Serious constraint (%)	Mild constraint (%)	Not a constraint (%)	Mean	Rank
Inability to handle normal delivery	0	12.5	87.5	0.13	10 th
Insufficient information and training	18.3	17.5	64.2	0.54	3 rd
Lack of referral to hospital	13.3	23.3	63.3	0.50	4 th
Management of severe bleeding	37.5	15.8	46.7	0.92	1 st
Management of retained placenta	34.2	16.7	49.2	0.85	2 nd
Unavailability of essential drugs and consumables	15.0	10.0	75.0	0.40	6 th
Inadequate facilities/equipment	15.0	10.8	74.2	0.41	5 th
Lack of privacy and psychological support	14.2	5.0	80.8	0.33	7 th

Source: Field survey, 2019

Information and training needs of respondents

The result in Table 5 shows that resuscitation, referral of sick baby, weight of the baby, advice on immunization, advice on birth spacing (100%) were needed by all the respondents, while treatment of infertility (16.7%), prevention and management of reproductive tract infection like sexually transmitted infection (15.8%) were slightly needed by the respondents. Less than one-third (31.7%) of the respondents were not in need of

knowledge about precautions and safety measures to be taken by pregnant women. This implies that information and training needs on antenatal care, delivery care and postnatal care were highly needed by the respondents and this corroborates the findings of Iyaniwura and Yusuf (2013) which stated that providing adequate health education and training to TBAs can help increase access to skilled birth attendant services through referrals.

**Table 5: Distribution of respondents by information and training needs**

Information and training needs	Seriously in need (%)	Slightly in need (%)	Not in need (%)	Mean	SD
Antenatal care					
Adequate knowledge about early registration of pregnant women	97.5	0.8	1.7	1.96	0.27
Referral of complicated issues to a comprehensive hospital for intensive care.	95.8	3.3	0.8	1.95	0.25
Identification of complication	98.3	0.0	1.7	1.97	0.26
Knowledge about precautions and safety measures to be taken by pregnant women	64.2	4.2	31.7	1.33	0.93
Delivery care					
Improved skill in conducting delivery	98.3	0.0	1.7	1.97	0.26
Inculcating cleanliness and safety practices in daily routine.	99.2	0.0	0.8	1.98	0.18
Management of severe bleeding	99.2	0.0	0.8	1.98	0.18
Management of retained placenta	98.3	0.8	0.8	1.98	0.20
Ability to handle proper delivery to prevent complications e.g., treatment of cord stump	98.3	0.8	0.8	1.98	0.20
Postnatal care					
Proper care of new born (warmth, infection control, exclusive breathing)	99.2	0.0	0.8	1.98	0.18
Adequate knowledge about taking constant record of baby's weight.	100.0	0.0	0.0	2.00	0.22
Resuscitation (use of mucous suction trap)	100.0	0.0	0.0	2.00	0.22
Referral of sick baby for intensive care	100.0	0.0	0.0	2.00	0.22
Training on immunization	100.0	0.0	0.0	2.00	0.22
Training on birth spacing	100.0	0.0	0.0	2.00	0.21
Training on introduction of complementary foods	100.0	0.0	0.0	2.00	0.22
Adequate training on circumcision of male babies	97.5	2.5	0.0	1.98	0.16
Treatment of infertility	82.5	16.7	0.8	1.81	0.41
Prevention and management of reproductive tract infection	83.3	15.8	0.8	1.83	0.40

Source: Field survey, 2019

Categorisation of respondents into high and low information and training needs

The result in Table 6 shows that there was a high (51.7%) need for training among TBAs in the study area. This implies that most of the respondents need more training and information on antenatal, delivery and post-natal services in order to improve their

effectiveness and reduce maternal and child mortality. This is in line with the findings of Agbo (2013) which reveals that providing quality maternal health training to TBAs will help them recognize their scope and limitations and possibly refer mothers and their infants for immunization, family planning, and emergency services as needed.

Table 6: Categorisation of respondents into high and low information and training needs

Information and training needs	f (%)	Min.	Max.	Mean	SD
Low (26.0-40.6)	58(48.3)	26.0	42.0	40.6	1.97
High (40.7- 42.0)	62(51.7)				

Source: Field survey, 2019

Relationships between selected socioeconomic characteristics and information and training needs of TBAs

Result from the test of relationship between socioeconomic characteristics of respondent and information and training needs is presented in Table 7. From the result, sex ($\chi^2 = 4.611$, $p < 0.05$) and religion ($\chi^2 = 7.397$, $p < 0.05$) were significantly related to the information and training needs of respondents. The implication of this is that sex and

religion could play significant roles in the information and training needs of traditional birth attendants. This is in line with Lydia and Cephas (2018) that religion has some influence on TBAs' belief systems as well as their practices and could possibly explain the concurrent utilisation of religious beliefs in the TBAs' practices with respect to pregnancy and delivery. This also implies that female TBAs are known to provide psychological support and counseling to women during pregnancy

and childbirth, which is in tandem with the finding of Miller and Smith (2017) that psychological support and counseling of women during pregnancy and childbirth is one of the reasons accounting for home births in developing countries.

The result on Table 8 also shows that age ($r=0.238$, $p<0.05$) and working experience ($r=0.236$, $p<0.05$) were significantly correlated to the

information and training needs of the respondents. This implies that age and working experience could help the TBAs to perform better in their occupation, as experience over the years is crucial to their performance, which means that the older and more experienced the TBAs are, the lesser their information and training needs.

Table 7: Test of relationship between socioeconomic characteristics and information and training needs of respondents (chi-square analysis)

Variable	Df	χ^2 value	p-value	Decision
Sex	1	4.611	0.032	Significant
Religion	2	7.397	0.025	Significant
Educational attainment	3	1.629	0.653	Not significant

$p > 0.05$, Source: Field survey, 2019

Table 8: Test of relationship between socioeconomic characteristics of respondents and information and training needs (correlation)

Variables	r-value	p-value	Decision
Age	0.238	0.009	Significant
Working experience	0.236	0.009	Significant
Level of income	0.063	0.492	Not significant

Source: Field survey, 2019

CONCLUSION AND RECOMMENDATIONS

The study concluded that TBAs rendered services more on antenatal and postnatal care. They were however seriously in need of information and training needs on antenatal, delivery and post-natal care. Efforts should be made by Government at all levels to collaborate with skilled health workers to give proper information and training to TBAs on reproductive health services through sources like lectures, seminars and workshops. The study also recommended that Policy makers on reproductive health issues must develop collaborative opportunities with TBAs that encompasses mutual trust and respect for each other. Collaboration with skilled health workers in rural communities can aid referral of complicated issues to health centres and hospitals and help ensure sustainable health sector in the nation.

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LEVELS OF ADOPTION OF NERICA RICE TECHNOLOGIES IN SOUTHWESTERN, NIGERIA

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ABSTRACT

This study examined levels of adoption of upland NERICA technologies in Southwestern Nigeria. A four-stage sampling procedure was used to select three states (Ekiti, Ogun and Ondo states) and four hundred and forty-four (444) rice farmers used in this study. A structured interview schedule was used to collect data on personal and enterprise characteristics, and adoption stages. Data were analysed using frequency, percentages, mean, and correlation at 0.05 significance level. The result revealed that the mean age was 49.60 years with majority (82.20%) being male and 63.50% of the growers cultivated 0.40-1.59 ha with mean yield of 0.60 t/ha and N231,295.38±182,372.02 revenue. Adoption level of upland NERICA technologies was low (56.3%) in the study area. The upland NERICA seed technology was at the trial stages of adoption. Level of adoption was significantly influenced by farm income ($r=0.40$; $p \leq 0.05$) and farming experience ($r=0.02$; $p \leq 0.05$). Adoption of NERICA was inadequate. The study recommended that government should provide modern communication infrastructure and build capacity of extension agents to deliver specific information at different adoption stages to farmers in order to upscale rice production.

Keywords: NERICA, adoption stages, rice technologies, adoption level

INTRODUCTION

Rice is an important crop for accelerating agricultural development in Nigeria. It is one of the crops currently recognised for driving the economy of the country. The current statistics indicate annual consumption rate as 6.50 million tonnes and the average production as 4.95 million tonnes leading to a shortfall of 1.55 million tonnes in production – consumption of rice annually in Nigeria (United States Department of Agriculture, USDA, 2018). This shortfall is being augmented by importation which constitutes a significant share of the agricultural imports. Food security of most importing countries is adversely affected by a sudden rise in food prices in international markets. There is the urgent need to increase production of rice to meet rising local demand as well as exporting capacity to drive economic growth. The increasingly limited room for expansion of cultivated crop as a result of population growth is paving way for advancement of technology which enhances crop yield per unit area.

One of the outcomes of technology advancement in recent times is New Rice for Africa, NERICA. There is a general consensus that adoption of high yielding technologies such as NERICA can greatly increase rice production. NERICA was developed deliberately with inbuilt attributes superior to the existing technologies. This was greatly achieved from the cross between Asian rice (*Oryza sativa* L.) and African rice (*Oryza glaberrima* Seud.) which combine the yield – related attributes and the adaptability to Africa geographical conditions of the two lines (Africa Rice Center, ARC, 2012). Farmers desire such attributes as high yielding, low inputs, drought tolerance and compatibility with their low income status to improve their livelihood. These traits are

specifically bred in NERICA varieties to combat the previous challenges attributed to raising rice production in upland rain-fed ecology.

Nigeria was a key player in the Multi-national NERICA Dissemination Project (MNRDP) which was initiated by African Rice Initiative in 2002, to improve access to NERICA varieties thereby enhancing rice production (Kane, Djiro, Sy, and Shane, 2012). Moreover, government partnered with states through the Anchor Borrowers' Programme (ABP) to make fund available, facilitate access to inputs and provide linkage between farmers and market channels to promote adoption of NERICA technologies (Central Bank Nigeria, CBN, 2016). The evaluation of the MNRDP conducted in 2010 revealed that adoption of NERICA varieties was below average in Nigeria (Africa Development Bank, ADB, 2014). Government's efforts at bridging the production–consumption gap appears not to be yielding the expected result. In essence, NERICA technology was inadequately adopted which follows the low adoption trend of most agricultural technologies in Nigeria. The reasons for low adoption of profitable agricultural technology remain a challenge in research. The variation in farmers' nature as it relates to their diverse farming systems tends to affect adoption decision process.

Although, studies on rates of adoption of NERICA varieties have been explicitly conducted in Nigeria (Tiamiyu, Akintola, and Rahji, 2009; Ojehomon, Adewumi, Omotesho Ayinde, and Diagne, 2012 and Awotide, 2015). However, intricacies surrounding low adoption of NERICA have not been clearly documented. Equally, information on levels of adoption of upland NERICA technologies is inadequate. The purpose of this study therefore, was to examine levels of adoption of upland NERICA technologies in



Southwestern, Nigeria. In line with the foregoing, the specific objectives of this study were to:

1. describe the personal characteristics of rice farmers in the study area;
2. examine the enterprise characteristics of rice farmers in the study area;
3. identify the stages of adoption of upland NERICA production technologies in the study area;

METHODOLOGY

The study was carried out in Southwestern Nigeria. The region lies between 3°E and 6°E of the longitude and latitude is between 6°N and 9°N. It has the second largest population out of the six geopolitical zones in Nigeria, comprising about 25 million people who are predominantly farmers (National Bureau of Statistics, 2011). The Southwestern region is one of the major players in rice production (Gyimah-Brempong, 2011).

The target population comprised all the rice farmers. Data collection was organised using a four-stage sampling procedure. Three states (Ekiti, Ogun, and Ondo states) were purposively selected from six states present in the region, for their participation in the MNRDP. Seventy per cent of Rice Growing LGAs (RGLGAs) were randomly selected from ten, five and four RGLGAs of Ekiti, Ogun and Ondo states, respectively, and 50% of the 68 Rice Growing Communities (RGCs) from each of the selected RGLGAs and 70% of the total sample frame of 634 were randomly selected. Explicitly, 184, 180 and 80 rice farmers were selected from Ekiti, Ogun, and Ondo states, respectively. Thus, a total of 444 rice farmers were used for this study. Information was sourced through the use of a structured interview schedule which was validated by judge method and adjudged reliable at $r=0.89$. The interview was conducted by the researcher and trained enumerators in a cross sectional survey. Level of adoption of upland NERICA technologies was measured based on adoption continuum of awareness, interest, evaluation, trial and adoption or use and were scored 1, 2, 3, 4 and 5, respectively. A list of eight recommended upland NERICA technologies such as NERICA seed technology; land preparation, seed treatment, planting method, spacing, weeding, fertiliser application and pests /diseases management was presented to the farmers and were asked to mark which of adoption continuum they were. Hence, a farmer that had adopted all the components of the upland NERICA technology package was scored 8. Using the mean, adoption level was established by categorising adoption index as farmers whose adoption scores ranged between the mean and the maximum score as having high adoption, while farmers with scores

below the mean were regarded as having low adoption. Descriptive statistics, such as frequency, percentages, and mean were used to describe selected personal and enterprise characteristics, adoption stages and levels of adoption. Inferential statistics as Pearson Product Moment Correlation, PPMC and Chi-square was applied to determine the relationship between selected personal characteristics based on the level of measurement.

RESULTS AND DISCUSSION

Table 1 shows the distribution of rice farmers according to selected personal characteristics. The age category of a large proportion (41.2%) the rice farmers was between 50-59 years with the average of 49.6 years. This age is regarded as productive age implying the possession of physical strength to carry out farming activities. This corroborates the finding of Ogundele and Okoruwa (2006) that rice farmers are of productive age. However, the average age of about 50 suggests a decline in productivity with weaning vigour and thus needs the inducement of the younger ones for improved productivity. Most (82.2%) of the rice farmers were male and only 17.8% were female suggesting more male than female in rice production. Awotide, (2015) reported similar results that rice production is male dominant. A large percentage (95.0%) of the rice farmers was married which described them as responsible individuals with family to care for. Majority of rice farmers (77.9%) had formal education leaving only 22.1% with no formal education implying the prevalence of high literacy level among the rice farmers. This finding agrees with the report of Awotide, (2015) where high level of literacy was found among the rice farmers in the Southwestern Nigeria. Many were Christians (59.2%) while (38.7%) were Muslims. It implies that rice production is popular among the two religions suggesting no religion barrier in NERICA adoption. Similarly, majority (64.2%) of the households had between 5 and 9 persons with an average of 6 people. This household size is considered to be fairly large. This finding is consistent with Ojo, Dimelu, and Okeke (2011) who reported a large household size of 7 members as being prevalent in Ekiti State. Farmers rely to a large extent, on household members for supply of farm labour due to their poor income status. Almost half (49.8%) belonged to farmers' groups while 49.1% were members of other social organisations. It implies that rice farmers are members of farmers' organisations which agrees with the report by Olajide and Oyebo (2014) that the new method of extension outreach emphasises the passing on of agricultural technologies to farmers in organised group.

Table 1: Distribution of respondents by personal characteristics N=444

Variable	Frequency	Percentage	Mean/Sd
Age (years)			
20 - 29 years	1	0.2	
30 - 39 years	45	10.1	
40 - 49 years	167	37.6	
50 - 59 years	183	41.2	
60 - 69 years	46	10.4	
70 - 79 years	2	0.5	49.60±8.10
Sex			
Male	365	82.2	
Female	79	17.8	
Level of Education			
No formal Education	98	22.1	
Primary School Education	192	43.2	
Secondary School Education	127	28.6	
Tertiary Education	27	6.1	
Religion Affiliation			
Christianity	263	59.2	
Islam	172	38.7	
Traditional	9	2.0	
Household size			
< 5	131	29.5	
5-9	285	64.2	
10-14	24	5.4	
15-19	4	0.9	5.73±2.38
*Social Organisations			
Rice farmers' groups	221	49.8	
Community associations	176	39.6	
Community security groups	56	12.6	
Cooperative Groups	141	31.8	

Source: Field survey, 2016; * Multiple responses were recorded

Rice farmers' enterprise characteristics

Table 2 shows the distribution of rice farmers by their enterprise characteristics. A substantial percentage (68.9%) of the rice farmers possessed between 11 and 30 years' experience in rice production. This implies that farmers are well experienced in rice production. Ainembabazi and Mugisha (2014) established that farming experience tends to improve knowledge about adoption of new technologies. Annually, 32.4% of the rice farmers earned less than ₦100,001.00 income in the study area. It suggests that rice farmers derive relatively low income from rice farming and may therefore be considered as poor. Financial capital is an important factor in enabling the adoption of new technology. Majority of rice farmers (63.5%) cultivated between 0.40 to 1.59 hectares describing them as small scale farmers. The finding corroborates the finding of Awotide (2015) that the production scale range of 0.1 to 5.9 ha was prevalent. Rice farmers with large farms have access to economy of scale which facilitates better production management and serves as incentive for adoption of new technologies. The yield recorded for the majority (80.2%) was below 1001kg/ha. This amounts to low yield compared to the NERICA yield potential of 2.5 to 3.0kg/ha in

upland ecologies. This corresponds with the finding of ADB, (2014) where low yield of 1-1000kg/ha was obtained for upland NERICA varieties.

Adoption stages of upland NERICA technologies

Table 3 shows the distribution of respondents by stages of adoption in the study area. The result revealed that NERICA production technologies such as land preparation (\bar{x} = 2.95), seed treatment (\bar{x} = 2.68), planting method (\bar{x} = 2.68), spacing (\bar{x} = 2.73), weeding (\bar{x} = 2.73) and fertiliser application (\bar{x} = 2.90), pests and diseases management (\bar{x} = 2.65) were at the evaluation stage with the mean score of almost 3.00 while only the NERICA seed (\bar{x} =3.69) was at the trial stage with the mean score nearly 4.00. This implies that farmers adopt NERICA technologies in different combinations suggesting the prevalence of technology component adoption among the rice farmers in the study. This might be attributed to the possibility that rice farmers find certain NERICA technologies suitable to their farming practices and adopt those ones. This finding is consistent with the reports by Laether and Sonde (1991) and Ogundele and Okoruwa (2006) that farmers adopt technologies in sequential order, adopting simple or



cheap technologies before moving to the more complex or expensive ones.

Table 2: Distribution of respondents by enterprise characteristics N=444

Variable	Frequency	Percentage	Mean/Sd
Farming experience			
1 to 10 years	135	30.4	
11 to 20 years	212	47.7	
21 to 30 years	81	18.2	
31 to 40 years	13	2.9	
>40 years	3	0.7	15.92±8.62
Farm income			
< 100001	144	32.4	
100001- 100000	119	26.8	
200001- 300000	73	16.4	
300001- 400000	53	11.9	
400001- 500000	21	4.7	
500001- 600000	19	4.3	
600001- 700000	5	1.1	
700001- 800000	3	0.7	
> 800000	4	0.9	231295.38±182372.02
Farm holding			
< 0.40	4	0.9	
0.40-1.59	282	63.5	
1.60-2.79	78	17.6	
2.80- 3.98	37	8.3	
3.99- 5.17	35	7.9	
> 5.17	8	1.8	1.25±0.97
Yield			
< 1001	356	80.2	
1001-2000	59	13.3	
2001-3000	16	3.6	
3001-4000	8	1.8	
4001-5000	5	1.1	601.82±977.77

Source: Field survey, 2016

Table 3: Distribution of respondents by stages of adoption of upland NERICA technologies N=444

NERICA technologies	Stages of adoption					\bar{x}
	A %	I %	E %	T %	A %	
Seed	11.30	4.30	19.40	34.20	30.80	3.69
Land preparation	44.60	5.60	1.80	6.10	41.9	2.95
Seed treatment	50.00	9.00	1.10	3.20	36.70	2.68
Planting method	52.70	1.80	4.10	7.20	34.20	2.68
Spacing	50.5	2.30	5.00	8.60	33.80	2.73
Weeding	50.90	3.80	3.40	4.70	37.20	2.73
Fertiliser application	45.70	5.20	2.00	7.70	39.4	2.90
Pests and diseases management	53.80	2.50	2.70	7.20	33.80	2.65

Notes: Multiple responses; A: Awareness; I: Interest; E: Evaluation; T: Trial; A: Adoption

Source: Field survey, 2016

Adoption of upland NERICA technologies

Table 4 shows the distribution of respondents by the adoption of upland NERICA technologies. The result revealed that 31.53% of the rice farmers adopted NERICA technologies suggesting low cultivation of upland NERICA in the study area. This finding agrees with ADB (2014) that cultivation of NERICA technologies was low in Nigeria. The estimated value for adoption recorded by ADB 2014 was 43.00% against the potential

adoption of 63.00%). The value of adoption of NERICA technologies estimated by ADB was 31.53% recorded in this study may further established the possibility that the farmer who adopted in the past may have discontinued to plant NERICA and reverted to cultivate the traditional varieties. This may be as a result of certain constraints such as lack of access to market, inputs, and insufficient information regarding the planting of NERICA varieties.

Table 4: Distribution respondents by adoption of upland NERICA technologies N=444

Adoption of NERICA Technologies	Frequency	Percentage
Yes	140	31.53
No	304	68.47

Source: Field survey, 2016

Levels of adoption of upland NERICA technologies

Figure 1 shows the distribution of rice farmers by the levels of adoption of upland NERICA technologies. Low level of adoption (56.3%) was observed at the study area. The low adoption probably explains the low yield recorded among the rice farmers (Table 2). The implication is that

adoption of upland NERICA is marginal compared to the high level of adoption expected. This finding agrees with the one reported by Adedeji, Nosiru, Akinsulu, Ewebiyi, Abiona, Jimoh (2013) that low level of adoption of upland NERICA technologies was observed among the paddy rice farmers in Kaduna State, Nigeria.

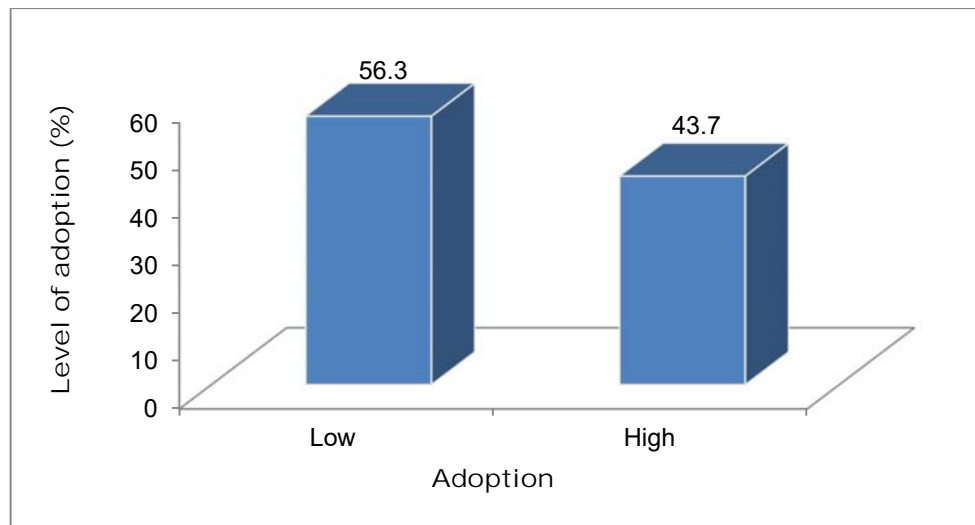


Figure 1: Distribution of respondents by levels of adoption

Source: Field survey, 2016

Hypothesis one

The result of the chi-square test between selected personal characteristics and levels of adoption is presented in Table 5. The result revealed that educational level ($\chi^2=49.44$; $p \leq 0.05$), religion ($\chi^2= 32.79$; $p \leq 0.05$) and membership of social organisation ($\chi^2=9.96$; $p \leq 0.05$) were significantly associated with levels of adoption of upland NERICA technologies. Faturoti, Emah, Isife,

Tenkoano, and Lemchi (2006) established a positive relationship between exposure to formal education and adoption. Religious affiliation is significantly related with adoption suggesting that religion has influence on adoption of NERICA technologies. Farmers who are members of social organisations would be more likely have high adoption level than farmers who are not.

**Table 5: Chi-square analysis of association between some selected personal characteristics and levels of adoption of upland NERICA technologies**

Variable	Chi square value	df	p-value
Religion	32.79	2	0.00
Level of Education	49.44	3	0.00
Membership of social Organisation	9.96	1	0.00

Source: Field survey, 2016.

Correlation analysis between selected personal characteristics and levels of adoption of upland NERICA technologies

Correlation analysis of selected personal characteristics of the rice farmers and levels of adoption is presented in Table 6. The result shows that farm income ($r = 0.40$; $p \leq 0.00$) was positive and significant, whereas years of farming experience ($r = -0.02$; $p \leq 0.00$) was negative and significantly related to levels of adoption. Higher profit as a result

of adoption tends to lead to more adoption. This agrees with the report by Marra, Pannell, and Abadi Ghadim, (2003) who established a positive relationship between income and adoption of technology. However, farming experience had inverse relationship with the level of adoption implying that more experienced rice farmer is likely be cautious in taking risks of adopting new technologies than less experienced farmer.

Table 6: Correlation between selected personal characteristics and levels of adoption of upland NERICA technologies

Variables	r-value	p-value
Farming Experience	-0.02**	0.00
Farm Income	0.40**	0.00

Source: Field survey, 2016

CONCLUSION

This study established that adoption of NERICA technologies was low, consequence upon the possibility that the rice farmers were at the verge of taking full adoption decision. Level of adoption was influenced by farm income and farming experience. The study concluded that the adoption of NERICA technologies was inadequate in the study area and recommended that government should provide modern communication infrastructure and regular training of extension agents to deliver quality and quantity information based on the rice farmers' need to increase adoption as well as rice production.

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EFFECTS OF RAINFALL AND TEMPERATURE ON RICE PRODUCTION IN NIGERIA

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ABSTRACT

The study was carried out to determine the effects of climate variability on rice production in Nigeria from 1970-2016. Secondary data were employed, years of study extended from 1970-2016 (47 years). Time series data were extracted from Nigerian Meteorological Agency (NIMET) and annual rice production was collected from National Bureau of Statistics. Results reveal that there were fluctuations over the period of study with alternating fall and rise. In the sub-period of 2010-2016, high mean rainfall of 799.10mm was recorded and a low mean rainfall of 641.97mm was recorded in the sub-period of 1980-1989 thereby resulting in average of 702.39mm over the period of study. High mean temperature of 26.77°C was recorded in the sub-period of 1980-1989 and low mean temperature of 21.05°C in 1970-1979 resulting in an average of 24.97°C over the period of study. High output of rice production of 5,381,609 tons was recorded in 2010-2016 and a low output of 2,610,975 tons in 1970-1979 with an annual percent change of -6.58 percent over the period of study. Coefficients of annual temperature and rainfall were positive and were both statistically significant at 1 percent level which implies a direct relationship between rice production and climate variables (rainfall and temperature). Rise in annual rainfall and temperature will lead to increase in rice production. The study recommended provision of varieties that can cope with moderate and high levels of rainfall and temperature.

Keywords: Climate change parameters, Climate variability, Rice Production.

INTRODUCTION

Agriculture is the root of Nigeria's economy because it is the leading source of livelihood in Nigeria; it is the largest sector of the economy and engages two thirds of the total labour force (Food and Agricultural Organization, 2019). The rice sector in Nigeria is one of the most important remarkable agricultural developments over the decades. Rice is the most consumed staple food by Nigeria's over 174 million people across states and geo-political zones (Terungwa and Yuguda, 2014). Rice is a crop that cuts across regional, religious, cultural, national and international boundaries with very high demand. It is mainly grown in four major production ecosystems which are broadly defined on the basis of water regions; Irrigated rice, Rain field low land rice, Upland rice and deep water rice (Olagunju, 2014).

Rice is normally grown in water-flooded fields in more than 95 countries and plays a vital role in feeding large sections of the Nigeria population. Rice needs a significant amount of water, estimated to be around 500 to 600 mm, and the optimal temperature for growth was reported to be between 22°C and 31°C, and requires 5 to 6 hours of sunshine per day (Wang, 2018). Agricultural sector is exposed to high level of vulnerability and impact caused by climate change. Climate change across Africa is exacerbated by low level of adaptation and mitigation (Intergovernmental Panel on Climate Change (IPCC, 2015: Montpellier Panel Report 2015).

Climate variability is predicted to have impact on agriculture, economy and livelihood of the populations of under-developed countries.

Rainfall variability from season to season greatly affects soil water availability to crops, and thus poses serious crop production risks.

Farming activities depend on favorable climate conditions and are at risk under changing climate (Porter, Xie, Challinor, Cochrane, Howden, Iqbal, Lobell, and Travasso, 2014). Agricultural production is at risk in countries where rainfed system of agriculture is predominantly practiced.

Since agriculture in Nigeria is largely rainfed, any variability in climate is guaranteed to impact its productivity in particular and other socio-economic activities generally, in the country. To reduce the undesirable effects of climate change, farmers in Nigeria resort to different agricultural technologies including crop combinations, changes in planting and harvesting dates, using improved seeds and chemical fertilizers, and soil fertility management techniques.

Rainfed system of agricultural production is liable to seasonal changes which on the long run affect farmer's standard of living. One of the major problems associated with rice production is drought which is caused by climate change. Drastic changes in rainfall patterns bring about unfavorable growing condition into cropping calendar thus modifying growing season which could subsequently reduce crop productivity. Since rice has become a strategic commodity in the Nigerian economy, it is important assess the effects of annual rainfall and temperature variability on its production with a view to improve production and as much as possible reduce rice importation in Nigeria.

The main objective of the study was to determine the effects of rainfall and temperature

variability on rice production. Specific objectives of the study were to;

- i. examine the trend in rice production,
- ii. assess the trend in annual rainfall pattern;
- iii. investigate the trend in annual temperature pattern; and
- iv. evaluate the effects of annual rainfall and annual temperature on rice production in Nigeria.

The hypothesis of the study stated in null form is; there is no significant relationship between rice production and changes in rainfall and temperature pattern.

METHODOLOGY

The study area is Nigeria. Secondary data were employed so sampling procedure do not apply to this study. Time series (mean and annual rainfall in millimeters and temperature in Degree Celsius from 1970 to 2016) were extracted from Nigerian Meteorological Agency (NIMET) and annual rice production data (1970-2016) were collected from National Bureau of Statistics (NBS). Annual rice production was measured in tons and coefficient of variation was measured in percentages. Standard deviation and mean of sub-periods for rice, rainfall and temperature were calculated to get the coefficient of variation for each sub-periods. Averages, standard deviations, annual percent change, coefficient of variation were used to analyze the dataset to explain the variables. Annual rice production (in tons) in the country was used as dependent variable, annual mean temperature and rainfall as the independent variables.

Multiple regression was employed to determine the relationship that existed between the dependent variable and the independent variables.

RESULTS AND DISCUSSION

Trend of change in rice production

This sub section presents the result of the trend in analysis of annual production of rice covered by the study (1970-2016). Results in Table

1 and Figure 1 show that average rice production per annum was fluctuating throughout the period of study with alternating fall and rise. Rice production increased from 458,500 tons in 1970-1979 sub-period to 1,617,132 tons in 1980-1989 sub-period and increased to 3,034,000 tons in 1990-1999 sub-period and increased again to 3,394,825 tons in 2000-2009 sub-period and finally rose to 5,381,609 tons in 2010-2016 sub-period. Average rice production per annum ranged from a lowest of 458,500 tons in 1970-1979 sub-period to highest of 5,381,609 tons in the 2010-2016 sub-period. Average rice production per annum over the study period was 2,610,975 tons. The fluctuation might have been caused by some production factors such as (climatic, environmental, cultural, institutional) factors.

The intra sub-period annual percent change rate was positive with 6.45 percent in 1990-1999 sub-period, 8.16 percent in 2000-2009 sub-period, 9.23 percent in 2010-2016 sub-period. However, there was a negative annual percent change of -4.33 percent in rice production in 1970-1979 sub-period and a lower negative of -2.89 in 1980-1989 sub-period. The average annual percent change rate over the period of study was negative with -6.58 percent which implies that average rice production was low during the period of study.

Coefficients of variation shows instability in the average rice production per annum with coefficient of variation ranging from 30.35 percent in 1970-1979 to 40.85 percent in 1980-1989 to 10.62 percent in 1990-2000 to 13.36 percent 2000-2009 and finally to 13.90 percent in 2010-2016 with an average of 63.92 percent. Coefficient of variation shows percentage of variation in the mean of each sub-periods which implies that the rates at which changes occur in each sub-periods differ from each other which may be due to (climatic, environmental, cultural and institutional) factors. This result correlates with the result of Ayinde, Ojehomon, Daramola, and Falaki (2013) which revealed that rice production trend of the study area is not stable.

Table 1: Trend in Rice production in Nigeria (1970-2016)

Sub-period	Average Rice Production (tons) Per annum	Annual percent change	Coefficient of Variation (%)
1970-79	458500	-4.33	30.35
1980-89	1617132	-2.89	40.85
1990-99	3034000	6.45	10.62
2000-09	3394825	8.16	13.36
2010-16	5381609	9.23	13.90
All Period	2610975	-6.58	63.92

Source: National Bureau of Statistics, 2019

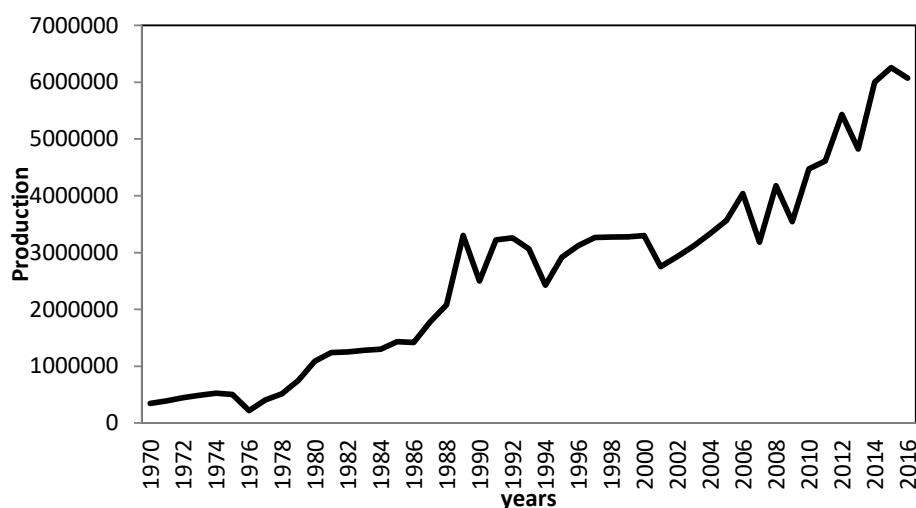


Fig 1: Nigeria Rice Production from 1970-2016

Source: National Bureau of Statistics, 2019

Trend of change in annual rainfall pattern

This sub section presents the result of the trend in analysis of rainfall in Nigeria from 1970-2016. Results in Table 2 and Figure 2 show that average annual rainfall was fluctuating throughout the study period with alternating rise and fall. Rainfall fell from 679.59mm in 1970-1979 sub-period to 641.97mm in 1980-1989 sub-period but rice production increased and rainfall later increased to 693.17mm in 1990-1999 sub-period with a higher increase in rice production, rainfall increased again to 727.11mm in 2000-2009 sub-period with a lower increase in rice production, rainfall finally increased to 799.10mm in 2010-2016 sub-period with a high increase in rice production. The average annual rainfall per annum ranged from a lowest of 641.97mm in 1980-1989 sub-period to highest of 799.10mm in 2010-2016 sub-period. Average annual rainfall per annum over the period of study was 702.39mm.

The intra sub-period annual percent change rate of rainfall was positive in all the sub-periods

with 9.43 percent in 1970-1979 sub-period, 9.90 percent in 1980-1989 sub-period, 9.72 percent in 1990-1999 sub-period, 8.32 percent in 2000-2009 sub-period, 15.08 percent in 2010-2016 sub-period. The average annual percent change rate over the period of study was 1.67 percent.

Coefficient of variation shows instability in average rainfall per annum with coefficients of variation ranging from 8.98 percent in 1970-1979 sub-period to 8.44 percent in 1980-1989 sub-period to 7.58 percent in 1990-1999 sub-period to 7.87 percent in 2000-2009 sub-period to 5.15 percent in 2010-2016 sub-period with an average of 10.25 percent over the period of study. Coefficient of variation shows the percentage of variation in the mean of each sub-periods.

This result is in line with the result of Akinsanola and Ogunjobi (2014) which reported that there was rainfall anomaly over all the stations in the study area.

Table 2: Trend in Nigeria Rainfall Pattern (1970-2016)

Sub-period	Average Production Per annum	Rice (tons)	Annual percent change	Coefficient of Variation (%)
1970-79	679.59		9.43	8.98
1980-89	641.97		9.90	8.44
1990-99	693.17		9.72	7.58
2000-09	727.11		8.32	7.87
2010-16	799.10		15.08	5.15
All Period	702.39		1.67	10.25

Source: Nigerian Meteorological Agency, 2019

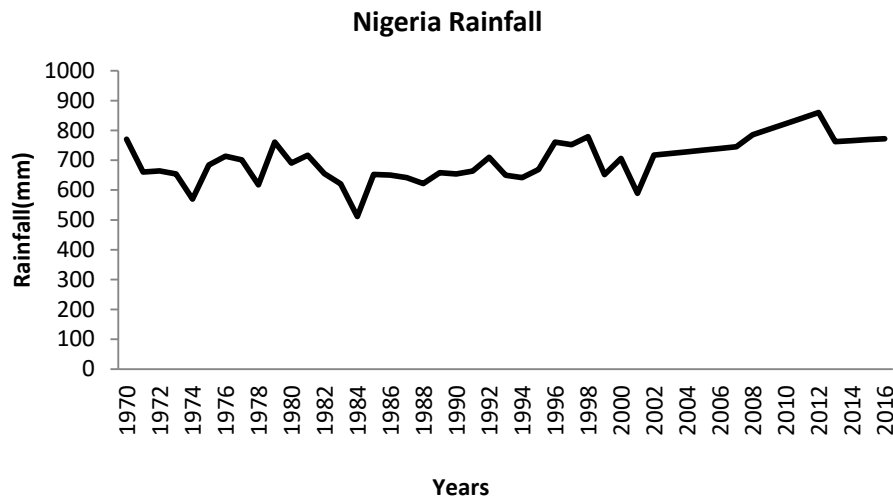


Fig 2: Nigeria Rainfall Pattern from 1970-2016

Source: Nigerian Meteorological Agency, 2019

Trend of change in annual temperature pattern

This sub section presents the trend of change in analysis of temperature in Nigeria from 1970-2016. Results in Table 3 and Figure 3 show that average annual temperature was fluctuating throughout the period of study with a fall and rise from 21.05°C in 1970-1979 sub-period to 26.14°C in 1980-1989 sub-period which increases rice production, temperature increased again to 26.77°C in 1990-1999 sub-period which led to a higher increase in rice production, temperature fell to 25.87°C in 2000-2009 sub-period which led to a lower increase in rice production and finally fell to 25.03°C in 2010-2016 sub-period with a high increase in rice production. Average temperature per annum ranges from a lowest of 21.05°C in 1970-1979 sub-period to highest of 26.77°C in 1990-1999 sub-period. Average temperature per annum over the period of study was 24.97°C.

The intra sub-period annual percent change rate of temperature was positive in all the sub-

periods with 8.50 percent in 1970-1979 sub-period, 8.77 percent in 1980-1989 sub-period, 10.05 percent in 1990-1999 sub-period, 11.23 percent in 2000-2009 sub-period, 11.45 percent in 2010-2016 sub-period. The average annual percent change rate of the study period was positive with 1.29 percent.

Coefficient of variation shows instability in the average annual temperature per annum with coefficients of variation ranging from 5.68 percent in 1970-1979 sub-period to 4.24 percent in 1980-1989 sub-period to 1.86 percent in 1990-1999 sub-period to 4.63 percent in 2000-2009 sub-period to 10.23 percent in 2010-2016 sub-period with an average of 10.34 percent over the period of study. Coefficient of variation shows the percentage of variation in the mean of each sub-periods. This result agrees with the result of Ayinde, Muchie and Olatunji (2011) which revealed that there is variation in the temperature variable in the study area.

Table 3: Trend in Nigeria Temperature pattern (1970-2016)

Sub-period	Average Production Per annum	Rice (tons)	Annual percent change	Coefficient of Variation (%)
1970-79	21.05		8.50	5.68
1980-89	26.14		8.77	4.24
1990-99	26.77		10.05	1.86
2000-09	25.87		11.23	4.63
2010-16	25.03		11.45	10.23
All Period	24.97		1.29	10.34

Source: Nigerian Meteorological Agency, 2019

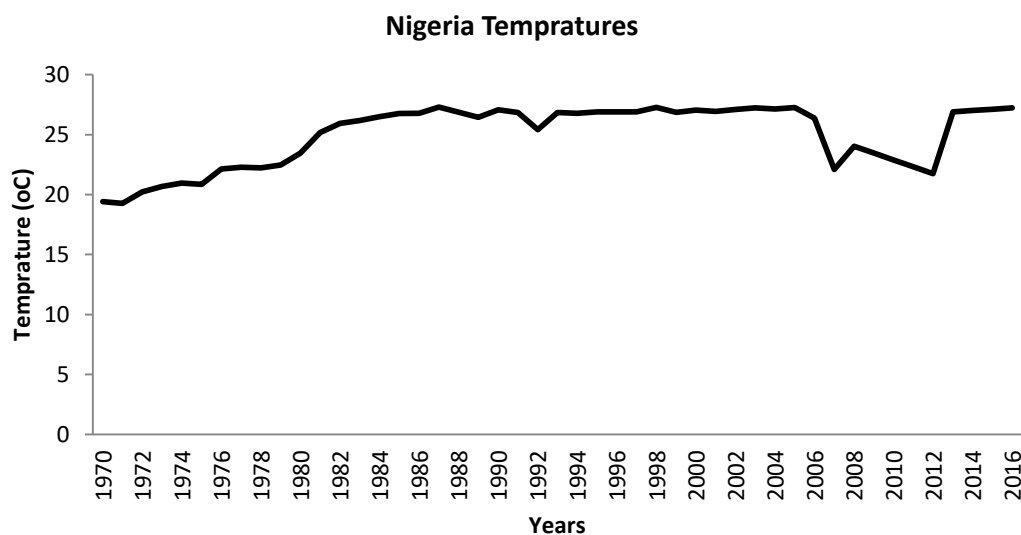


Fig 3: Nigeria Temperature Pattern from 1970-2016

Source: Nigerian Meteorological Agency, 2019

RESULTS OF REGRESSION ANALYSIS

This sub section presents the result of multiple linear regression analysis. Results in Table 4 show that the coefficient of determination (R^2) for regression of rice with rainfall and temperature is 0.669. R^2 indicates that rainfall and temperature accounts for more than sixty-six percent of the factors that determine production. The F-value is statistically significant at 1 percent level which indicates that data are fitted well.

The coefficient of annual rainfall was positive and statistically significant at 1 percent level and the coefficient of temperature was also positive and statistically significant at 1 percent level. The results show there was a direct

relationship between annual rainfall and rice production. Rise in annual rainfall and temperature will lead to increase in rice production which will in turn lead to substantial increase in farmer's income from rice production.

In summary, these results show that annual rainfall and temperature positively affect the output of rice. This result is in consonance with the result of Ayinde, et al., (2013) which revealed that the higher the minimum temperature, the higher the rice production in the study area. It also correlates with the result of Adedeji, Tiku, Waziri-Ugwu and Sanusi where increase in rainfall leads to increase in rice production in the study area.

Table 4: Regression Result of Rice with Rainfall and Temperature

Variable	Coefficients	Standard error	t value	p value
(Constant)	-1.7400000	2.133000	-8.159	0.000
Rainfall	15371.820	2025.779	7.588	0.000
Temperature	369184.179	56531.045	6.531	0.000

R-squared 0.669

F – Statistics 44.517

The study concluded that climate variation exists in Nigeria. Variation in climate affected rice production. From the result of the regression analysis, it can also be concluded that the higher the rainfall and temperature, the higher the output of rice. This is because climate variables have a positive relationship with rice production. Rise in annual rainfall and temperature will lead to increase in rice production and will also lead to significant increase in farmer's income from rice production.

Based on the result of the trend and regression analysis, the following recommendations

were made in order to improve rice production in Nigeria

- That breeders should help to develop rice seeds varieties that can grow well under varying climatic conditions.
- Also, breeders should help to develop rice seeds varieties that can grow well under high temperature and high rainfall.

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FARMERS' KNOWLEDGE ON POST-HARVEST MANAGEMENT OF TOMATOES IN KOGI AND NIGER STATES, NIGERIA

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ABSTRACT

More than half of tomatoes produced in Nigeria waste away due to improper post-harvest management practices. This scenario always forced farmers to sell at the point of production only for them to buy back at exorbitant prices few months after harvesting. This study assessed farmers' knowledge on post-harvest management of tomatoes in Kogi and Niger States, Nigeria. Multi-stage sampling technique was used in the selection of 340 respondents for the study. Data were collected from primary source using structured questionnaire. Descriptive statistics such as frequency, percentages and mean were used for data analysis. Results showed that 81.2% of the respondents were male with mean age of 42.6 years. Other farmers 75.0%, farmers' forum 67.1% and friends 51.2% were the major sources of awareness on post-harvest management. Less than half 40.9% and 34.7% of the respondents had medium and high knowledge on post-harvest management of tomatoes respectively. Efforts should be made extension agents through training in order to improve knowledge on post-harvest management.

Keyword: Farmers' knowledge; Post-harvest practices; Tomatoes

INTRODUCTION

Tomatoes (*Lycopersicon esculentum*) play important role in supplying human with vitamins and minerals needed for growth and development. The production of tomatoes in Nigeria is mostly carried out on large scale in Northern Nigeria due to suitable agro-climatic condition that favoured its production in large quantities. Tomatoes are either used fresh or processed into paste. Unfortunately, they are not only seasonal but also highly perishable and deteriorate due to lack of proper knowledge on post-harvest practices that would have prolonged its shelf lives. Mohammad, Hionu and Olayemi (2012) estimated that more than 50% of tomatoes produced in Nigeria get wasted due to inadequate post-harvest management. This scenario most times forced farmers to sell their produce immediately after harvesting, only for them to buy it back at an exorbitant price few months after harvesting. The potential increase in income and greater livelihood security will not be achieved if farmers' always sell surplus at the point of production (Saran, Roy and Kitinoja 2012).

Post-harvest management plays significant roles in value addition to tomatoes. It enhances tomato production by reducing post-harvest losses to the barest minimum, improves nutrition, adds value by opening new marketing opportunities, generates new jobs and enhance other related economic sectors for viable growth (Azad, Ali and Islam 2014). Post-harvest management has ability to meet food requirement of the rural households through reduction in post-harvest losses (Abeleira, Pérez, Ferrer, Sánchez and Figueroa 2008). It has been observed that despite the increase in tomatoes production, the post-harvest management in tomatoes and other vegetable present a dismal picture and is mostly comprised of traditional techniques practiced by growers, traders and the

processors resulting in deterioration of physical and nutritional qualities of harvested crops (Oni and Obiakor, 2012). The losses experienced in agricultural products which is due to their perishability in nature affect farmers' output and economic development of Nigeria. Fresh agricultural products deteriorate easily as a result of reduction in moisture content. Agricultural products mostly vegetables and fruits require proper post-harvest management in order to prevent post-harvest losses. The aim of this study was to assess farmers' knowledge on post-harvest management of tomatoes in Kogi and Niger States. The specific objectives were to:

1. describe the socio-economic characteristics of the respondents in the study areas;
2. identify sources of awareness on post-harvest management of tomatoes and
3. assess farmer's knowledge level on post-harvest management of tomatoes.

METHODOLOGY

Kogi State is one of the State where this research was carried out. It is located in the Guinea savannah ecological zone of Nigeria. It consists of 21 Local Government Areas (LGAs), with latitude of 6° 33' and 8° 44' N and longitude 5° 22' and 7° 49' E. Kogi State has a total population of 3,278,487 in (NPC, 2006) and with growth rate of 3.2%, the State has estimated population of 4,636,071 in 2017. The State has land area of about 30,354.74 square kilometers (Kogi State Ministry of Information working document, 2016). Niger State is the second State where this research was conducted. In terms of land mass, it is the largest state in Nigeria. It covers a total land area of 74,224 km² thus accounting for about eight percent of Nigeria's land area. About 85% of its land area is good for arable crop production (Niger State Ministry of Information,

2012). It is located within longitude 3° 30' and 7° 20' East and latitude 8° 20' and 11° 30' North, with a population of about 3,950,249 (NPC, 2006) and with a growth rate of 3.2%, the State has an estimated population of 5,586,000 in 2017 (Niger State Geographical Information System, 2015).

Multi-stage sampling procedure was employed for this study in both States. The first stage involved random selection of three (3) out of four (4) Agricultural zones in Kogi State, the Agricultural zones selected were (Zone A, Zone B and Zone C) while all the three (3) Agricultural zones in Niger State (Zone I, Zone II and Zone III) were all selected. The basis of selection was due to high concentration of tomato farmers in these selected zones. The second stage involved random selection of one (1) Local Government Area from each of the zones making a total number of six (6) LGAs from both States. The third stage involved random selection of four (4) communities each from the selected LGAs making a total of twenty four (24) communities. The fourth stage involved the use of proportional sampling to select 10% of the tomatoes producers from the sampling frame of 3343 persons which gave a total of 340 respondents.

Primary data were collected using structure administered questionnaire through personal interview. Descriptive statistics such as frequency distribution, percentage and mean were used to analyse objective i ii and iii. The knowledge of farmers on post-harvest management of tomatoes was determined by computing a knowledge score based on the farmers' responses against 15 statements on post-harvest management practices. Each of the statements carried a full weight of one (1) for each of the right response, while wrong response was zero (0). Thus, knowledge score of a farmer ranged from 0 to 15, where 1-5=very low knowledge, 6-10 medium knowledge and 11-15=high knowledge.

RESULTS AND DISCUSSION

Socioeconomic characteristics

Table 1 presents the results on the socio-economic characteristics of the respondents. It is shown that majority of the respondents (82.5%) and (80.0%) in Kogi and Niger States respectively were male. The pooled results indicate that 81.2% of the respondents were male. This findings show that majority of the respondents are male. Similar study by Javed (2013) on farmers' knowledge on post-harvest practices of vegetables revealed that majority of sampled respondents were male. The mean age of the respondents in Kogi State according to Table 1 was 42.8 years which is slightly above that of Niger State was 42.4 years. The pooled results indicated a mean age of 42.6 years. This implies that farmers in both States are still within their active age, young, and this may influence their readiness to try new innovation, acquire new skills

and knowledge on every aspects of post-harvest management which is expected to have positive effect on their income and livelihood. This agrees with Barnabas, Pelemo and Ajibola (2019), who reported that majority of the farmers in Kogi State were still in their active and productive age.

The mean farming experience in Kogi State according to Table 1 was 28.9 years, while that of Niger was 26.2 years. The pooled mean farming experience of the respondents was 27.4 years. This implies that farmers from both States have high experience and are well exposed in farming which might have equipped their knowledge and skills on post-harvest management. More so, many years in farming might grant farmers opportunities to get familiarised with every aspect of post-harvest practices that would reduce the menace of post-harvest farm losses and challenges that come with post-harvest handling. However, this was contrary to findings by Muhammed *et al.* (2012) who stressed that majority of farming households in Kano State, Nigeria had moderate farming experience in post-harvest management of tomatoes.

Table 1 shows that larger proportion 91.2% of the respondents from Kogi State had at least one form of formal education which is higher than the 73.9% of the respondents in Niger State. The pooled results on the other hand shows that 82.3% of the respondents had formal education. This findings contradicts the research work by Mohammed, Umar, Olaleye Tyabo, Tsado and Pelemo (2018) who reported that majority of farming populace in Niger State, Nigeria had non-formal education. The distribution of the respondents according to farm size in Table 1 shows that the mean farm size of farmers' in Kogi State was 3.30 hectares while that of Niger State was 2.37 hectares. The pooled farm size of the respondents according to Table 1 was 2.8 hectares. The findings means that farmers from both States are small scale farmers and mostly subsistent producing mainly for consumption and sales. This finding is in line with that of Aliber and Hart (2016) who opined that majority of farmers in rural Sub-Sahara African countries are subsistent in nature.

The distribution of the respondents according to annual income in Table 1 shows that the mean income of the respondents in Niger State was N 277,213, which was greater than that of Kogi State N 116,887. Also, the mean pooled results of the respondents was N 341,589. The findings from both States indicated that respondents earned reasonable income that could assist them in procuring post-harvest materials. However, farmers with high income are not always constraint financially in seeking for new techniques, skills and knowledge that will enhance their income and livelihood. They tend to try new ideas that will enhance their output and standard of living (Dimelu, Enwelu, Attah and Emodi 2014). Table 1 further



shows that the mean annual non-farm income in Niger State was N124,694 while that of Kogi State was N116,887. Also, the pooled of non farm annual income of the respondents was N121,020. This is

considerably low compared to income from farming activities and this could negatively affect adoption of post-harvest management.

Table 1: Distribution of farmers according to their socio-economic characteristics

Variables	Kogi State (n=160) Percentage	Niger State (n=180) Percentage	Pooled (n=340) Percentage
Sex			
Male	82.5	80.0	81.2
Female	17.5	20.0	18.8
Age (years)			
≤30	21.2	17.2	19.1
31-40	20.6	25.0	22.9
41-50	35.6	37.2	36.5
51-60	17.5	18.9	18.2
>60	5.0	1.7	3.2
Mean	42.8	42.4	42.6
Farming experience (years)			
1-10	10.6	8.3	9.4
11-20	18.1	26.7	22.6
21-30	25.0	33.3	29.4
31-40	25.6	21.7	23.5
>40	20.6	10.0	15.0
Mean	28.9	26.2	27.4
Highest educational level			
Non-formal	8.8	26.1	17.9
Primary	28.1	29.4	28.8
Secondary	40.0	28.9	34.1
Tertiary	23.1	15.6	19.1
Farm size (hectares)			
≤1.0	12.5	25.6	19.4
1.01-2.0	25.6	38.3	32.4
2.01-3.0	26.2	20.0	22.9
3.01-4.0	18.1	7.8	12.6
4.01-5.0	5.0	2.2	3.5
>5.0	12.5	6.1	9.1
Mean	3.30	2.37	2.80
Annual farm income (N) (naira)			
≤ 50000	8.1	5.6	6.8
51000-100000	16.2	12.2	14.1
101000-150000	15.0	13.3	14.1
151000-200000	15.6	11.1	13.2
201000-250000	8.8	9.4	9.1
>250,0000	36.2	48.3	42.6
Mean	414012	277213	341589
Annual non-farm income (N)			
≤ 50000	26.9	27.6	27.3
51000-100000	14.1	31.6	23.9
101000-150000	14.1	10.2	11.9
151000-200000	5.1	4.1	4.5
201000-250000	2.6	2.0	2.3
>250,0000	37.2	24.5	30.1
Mean	116887	124694	121020

Sources: Field survey (2018)

Sources of awareness on post-harvest management of tomatoes

Results in Table 2 shows that other farmers ranked 1st as the major sources of awareness on post-harvest management of tomatoes in Niger State, which was followed by farmers forum which ranked 2nd and community meetings ranked 3rd. The farmers in Kogi State indicated that other farmers ranked 1st as the major source of awareness on post-harvest management of tomatoes, this was followed by friends which ranked 2nd and farmers forum that ranked 3rd. The pooled distribution of the farmers according to sources of awareness on post-harvest management revealed that other farmers, farm forum ranked 1st and 2nd respectively, while the least sources awareness according pooled results were field day and written information that ranked 11th

and 12th respectively. The findings imply that other farmers, farmers' forum and friends are the major sources of awareness on post-harvest management in the study area. These findings agreed with Tsado, Ajayi, Tyabo, Pelemo and Adebayo (2018), who stressed that other farmers and friends were the major sources of information on the improved rice varieties in Niger State, Nigeria. Similar findings by Ajani and Onwubuya (2012) revealed that other farmers and extension agent were the major sources of information on indigenous maize storage among farmers in Anambra State, Nigeria. Also, Elemasho, Alfred, Aneke, Chugali and Ajiboye, (2017) reported that other farmers were the major sources of awareness on post-harvest management in River State, Nigeria.

Table 2: Distribution of farmers by sources of information on awareness of post-harvest management of tomatoes

Sources of awareness*	Kogi State (n=160)		Niger State (n=180)		Pooled (n=340)	
	Percentage	Rank	Percentage	Rank	Percentage	Rank
Friends	68.8	2 nd	35.6	4 th	51.2	3 rd
Field days	10.0	10 th	11.1	10 th	10.6	10 th
Parents	10.7	9 th	12.2	9 th	11.5	9 th
Mass media	34.4	5 th	30.6	6 th	32.4	5 th
Extension officers	38.8	4 th	35.6	4 th	37.1	4 th
Ministry of agriculture	22.5	6 th	16.1	8 th	19.1	7 th
ADP	18.8	7 th	16.7	7 th	17.6	8 th
Farm forum	61.2	3 rd	72.2	2 nd	67.1	2 nd
Others farmers	73.1	1 st	76.7	1 th	75.0	1 st
Exhibition	3.8	12 th	11.1	10 th	7.6	12 th
Community meeting	14.4	8 th	37.8	3 rd	26.8	6 th
Written information	10.0	10 th	7.8	12 th	8.8	11 th

Sources: Field survey, 2018

*Multiple responses

Farmers' knowledge on post-harvest management of tomatoes

Table 3 indicated that 50.0% of the respondents in Niger State had medium knowledge on post-harvest management of tomatoes while 35.0% had high knowledge. The pooled results showed that 40.9% of respondents had medium knowledge on post-harvest management of tomatoes, while 34.7% had high knowledge on post-harvest management. The pooled results revealed that only few of the respondents had high on post-

harvest management of tomatoes. This scenario is not that good as it could results to post-harvest losses. Moreover, high and medium knowledge of farmers on post-harvest management of tomatoes could assist in combating post-harvest lossess. It is also expected that proper and good knowledge on sorting, grading, diseases and pest control and others post-harvest practices are expected to boost farmers output and eliminate post-harvest farm losses while low knowledge could serve as hinderance to farmers from adopting post-harvest management.

Table 3: Knowledge of farmers on post-harvest management of tomatoes

Variables	Score range	Kogi State (n=160) Percentage	Niger State (n=180) Percentage	Pooled (n=340) Percentage
Low knowledge	1-5	5.0	9.4	10.3
Medium knowledge	6-12	47.5	50.0	40.9
High knowledge	11-15	47.5	35.0	34.7

Sources Field survey (2018)

CONCLUSION AND RECOMMENDATIONS

Tomato production in the study area was dominated by young male farmers with limited formal education. The major sources of awareness on post-harvest management of tomatoes were other farmers, farmers' forum and friends. Moreover, less than half of respondents had medium and high knowledge on post-harvest management of tomatoes. It is recommended that farmers should be enlightened and trained by extension agents and other well learned farmers on the benefits attached to post-harvest management in order to boost their knowledge. Also, efforts should be made by tomatoes farmers to diversify into other income generating activities in order to augment their non-farm income

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SUPPORT ZONE COMMUNITIES' PERSPECTIVES ON THE POTENTIAL BENEFITS OF ECOTOURISM IN OLD OYO NATIONAL PARK, NIGERIA

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ABSTRACT

Ecotourism benefits to local communities are germane to support for conservation. This study determined the perspectives of the residents of support zone communities on Old Oyo National Park on the potential benefits of ecotourism. It was a questionnaire survey involving 150 residents of the support zone communities (rural and urban communities) of the Park. Data obtained were subjected to descriptive, independent t-test, chi square, and Pearson's correlation analysis. Results indicated that 60.9% and 69.5% of respondents in rural and urban communities respectively were male, the mean age for rural communities' residents was 42.1 while it was 38.4 for urban communities. In addition, 42.9% and 40.7% had non-formal and primary education respectively in rural communities while 35.6% and 33.9% had primary and secondary education in urban communities. Economic development, social development, community capacity building, and environmental potential benefits of ecotourism were perceived very high by the respondents while cultural benefits were perceived high. In all, environmental protection benefits of ecotourism were rated highest while the least were cultural benefits. For the environmental benefits of the park to be sustainable, support for conservation of cultural, historical and biodiversity resources of the park by rural communities, who are the custodians of these resources, social development of the rural areas through continuous and sustained interventions should be improved upon.

Keywords: National park, Community development, Environmental protection, Ecotourism

INTRODUCTION

Tourism is fast becoming the engine for the growth of the global economy, with unique contributions to GDP and employment. According to Sundufu *et al.* (2012), one of the most common uses of protected areas is tourism. Ecotourism has been regarded as a form of tourism that is expected to boost conservation and socioeconomic development in the rural communities of developing economies, like those of many African countries (Mawere & Mubaya, 2012). Ecotourism is defined as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (The International Ecotourism Society, 2015). Ecotourism, as well as nature-based tourism, contributed significantly to the increase in global tourism and its impact on economic development. From the 1990s, ecotourism has been growing 20%-30% per year (Honey, 2010).

Fiagbomeh (2012) opined that ecotourism is the appropriate one to provide the necessary livelihood benefits or incentives among livelihood activities that have the potential to provide one. According to United Nations World Tourism Organisation (2012), many of the 50 million international tourists visiting Africa each year are driven by the continent's unparalleled wildlife and scenery. These tourists spend in the local economy, sustain jobs and provide an incentive for conservation, making tourism a powerful engine for sustainable development.

Most research studying local residents' perceptions and attitudes towards tourism development and the factors that may influence their

perceptions and attitudes is essential in achieving a host community's support for tourism development (Choi & Murray, 2010). According to Diaz and Gutierrez (2010), given that several of the impacts converge in the dimensions or categories, it is possible to observe the most important impacts-dimensions by groups or segments. Moreover, each group or segment of residents shares common interests which will affect their attitude toward tourists. Thus, positive and negative social, cultural, and economic impacts are closely linked (Castillo Canalejo, Núñez Tabales and Sánchez Cañizares, 2016). Despite largely agreeing on what theoretical steps are needed to achieve sustainable ecotourism, such as supporting local economies, generating revenue for conservation, etc., the practical accomplishment of these goals have been more controversial (Sarti, 2016), and empirical evidence supporting these assertions is limited (Holladay & Ormsby, 2011).

This study investigated the support zone communities' perspectives on the potential benefits of ecotourism in Old Oyo National Park, Nigeria. The specific objectives were to:

- i. describe the socio-demographic characteristics of the residents of the support zone communities of Old Oyo National Park;
- ii. ascertain the respondents' awareness of ecotourism activities in the Park;
- iii. determine the rural and urban residents' perspectives on the potential benefits of ecotourism in their communities

The study hypothesised that:



- i. There is no significant difference between rural and urban residents' perspectives on the potential benefits of ecotourism development
- ii. There is no significant relationship between the selected socio-demographic variables and residents' perspectives on potential benefits of ecotourism development.

METHODOLOGY

The study was conducted in communities located in four administrative and protection ranges of Old Oyo National Park, Oyo State, Southwest Nigeria. The ranges are Tede, Marguba, Sepeteri, and Oyo-Ile. The Park derives its name from the ruins of Oyo-Ile (Old Oyo), the ancient political capital of Yoruba Empire. The Park has a total land mass of 2,512km² and situated in northern part of Oyo State on latitude 8° 15' and 9° 00'N and longitude 3° 35' and 4° 42' E. The Park has an average annual rainfall of about 3,000mm. Ambient temperature is high ranging from 23-32 degree Celsius at lower altitudes.

The study population was the residents of support zone communities in the four administrative ranges of the Park. The communities were purposively selected based on their closeness to the Park and tourists' entry point to the park. The urban communities, where the selected administrative range offices are located and through which tourists enter the park include Tede, Sepeteri, Igboho, and Igbeti. In total, seven (7) communities from 27 communities present in Tede range were selected, eight (8) were selected from 12 communities in Marguba range, eight (8) were selected from 17 communities in Sepeteri range and eight (8) were selected from 30 communities in Oyo Ile range. Thus, 31 communities were selected from 86 communities bordering the four selected ranges of the park. Due to unavailability of the total population of each of the communities sampled, convenience sampling method was adopted. Thus, respondents that were willing to participate in the study were selected. In all, 150 respondents were elected from the communities that lie within 0-15km from the park.

Data were obtained through the use of questionnaires administered to individuals selected in each community. The questionnaire comprised the socio-demographic characteristics of the respondents and the residents' perspectives on the potential benefits of ecotourism in the park. The internal consistency reliability of the instrument was ascertained using the Cronbach's Alpha procedure. The Cronbach's Alpha reliability coefficient for the perspectives on potential economic development benefits of ecotourism was 0.82, 0.77 for perceived

social development, 0.80 for cultural preservation, 0.77 for community capacity building, and 0.86 for environmental protection.

The dependent variable for the study is residents' perspectives on the potential benefits of ecotourism development which was measured by providing the respondents with a set of perceptual statements and this was assessed on a 5-point scale of strongly agree, agree, undecided, disagree and strongly disagree, scores of 5,4, 3, 2,1 were assigned respectively. The data collected were analysed and presented descriptively using SPSS version 23. Hypotheses were tested using Independent T-test, Chi-square, and correlation tests.

RESULTS AND DISCUSSION

Socio-demographic characteristics

Of the respondents ((Table 1), male represents 60.9% and 69.5% in rural and urban communities respectively, this is consistent with previous studies by Ogunjinmi, Onadeko and Aiyeloja (2012), Ogunjinmi, Onadeko, Inah and Osunsina (2014) and Mensah (2016). The mean age for rural and urban communities' residents was 42.1 years and 38.4 years respectively, this implies that they are relatively young and were in their active age. This result is in agreement with Mutanga, Vengesayi, Gandiwa and Muboko (2015) and Abeli (2017). Furthermore, 42.9%% and 40.7% had non-formal and primary education respectively in rural areas while 35.6% and 33.9% had primary and secondary education in urban communities, which implies that residents in urban areas are more educated than their rural counterparts. This result is consistent with Abeli (2017). In terms of income, the mean income of respondents from rural areas was N144,066 while it was N225,763 for participants from urban communities. Thus, the mean income of the respondents from rural areas was lower than that of the urban areas. This shows that the rural respondents were low income earners. The findings are in line with Abeli (2007) and Mutanga *et al.* (2015). Furthermore, the mean years of residency in the selected communities for respondents from rural areas was 13.7 years while that of the urban areas was 23.9 years, this conforms to Mensah (2016). Findings further reveal that 14.3% of the respondents from the rural areas were aware of ecotourism activities in the park. On the other hand, 96.6% of the respondents from urban areas were aware of ecotourism. This implies that the awareness of ecotourism by urban residents was very much higher than the rural residents. The low level of awareness of ecotourism by rural residents has the potential of limiting their involvement and benefits from ecotourism as well as their support for conservation activities in the park.

Table 1: Socio-demographic profile of respondents

Variable	Rural (n=91)	Mean/Mode	Urban (n=59)	Mean/Mode
Gender				
Male	60.9	Male	69.5	Male
Female	39.6		30.5	
Age (years)				
15-24	5.5	42.1	3.4	38.4
25-54	75.8		93.2	
55-64	12.1		3.4	
65 and above	6.6		0.0	
Education				
Non-formal	42.9	Non-formal	11.8	Primary
Primary	40.7		35.6	
Secondary	14.3		33.9	
Tertiary	2.2		18.6	
Annual Income (Naira)				
0-50,000	26.3	144,066	8.5	225,763
51,000-100,000	30.8		16.9	
101,000-150,000	8.8		13.6	
151,000-200,000	18.7		27.1	
>200,000	15.4		33.9	
Length of residency (years)				
1-5	31.8	13.7	15.3	23.9
6-10	24.2		15.3	
11-15	12.1		6.8	
16-20	16.5		6.8	
21 and above	15.4		55.8	
Awareness of ecotourism				
Yes	14.3	No	96.6	No
No	85.7		3.4	

Residents' perspectives on the potential benefits of ecotourism in Old Oyo National Park

The residents' perspectives on the potential benefits of ecotourism to their communities is presented in Table 2. On the potential of ecotourism to propel economic development, 68.7% and 28.0% strongly agreed and agreed that ecotourism will promote local economic development, 63.3% and 32.7% strongly agreed and agree that it will promote local industry development and 56.0% strongly agreed and 39.3% agreed that it will increase the income of local residents. For social development, 54.0% strongly agreed and 28.7% agreed that ecotourism will increase economic opportunities for local residents, 60.7% strongly agreed and 29.3% agreed that it will raise the fame of local communities, 53.3% strongly agreed and 36.7% agreed that ecotourism will improve local infrastructure and quality of life, 11.3% strongly agreed and 25.3% agreed that it will increase the prices and cost of living while 12.7% strongly agreed and 24.7% agreed that ecotourism will disrupt daily lives of the residents. With regard to cultural preservation of potential benefit of ecotourism, 50.0% strongly agreed and 32.7% agreed that it will promote protection of local cultural heritage, promote protection of diversity of local cultural activities (32.7% strongly agreed and 22.0% agreed), and will destroy local communities' culture

(21.3% strongly agreed and 25.3% agreed). In terms of community capacity potential building of ecotourism, 50.0% strongly agreed and 28.7% that it will enhance the cohesion of communities and that it will improve the ability and quality of local residents (55.3% strongly agreed and 34.7% agreed). For environmental potential benefits of ecotourism, 66.7% strongly agreed and 24.7% agreed that ecotourism will protect and improve local natural environment while it will improve local residents' awareness on protection of environment (71.3% strongly agreed and 22.7% agreed). From these findings, environmental protection functions of ecotourism were adjudged the most perceived potential benefit while cultural preservation was rated least. These agree with Ramseook-Munhurrin and Naidoo (2011) and Mensah (2016). However, least benefit reported by Ramseook-Munhurrin and Naidoo (2011) and Mensah (2016) was economic benefit. The findings of cultural preservation is in conformity with Atsepoyi, Pai and Masters (2015). Overall, the perceived environmental protection, economic development, community capacity building, and social development benefits of ecotourism were very high while that of cultural preservation was high. This is consistent with the findings of Mohammadi, Khalifah and Hosseini (2016), Abeli (2017), and Acquah, Nsor, Arthur and Boadi (2017).

Table 2: Residents' perspectives on the potential benefits of ecotourism development

Perception statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Economic development					
Ecotourism will promote local economic development	68.7	28.0	2.0	0.7	0.7
Ecotourism will promote local industry development	63.3	32.7	2.7	0.7	0.7
Ecotourism will increase the income of local residents	56.0	39.3	0.7	2.7	1.3
Social development					
Ecotourism will increase employment opportunities for local residents	54.0	28.0	12.0	2.0	4.0
Ecotourism will raise the fame of local communities	60.7	29.3	8.0	0.7	1.3
Ecotourism will improve local infrastructure and quality of life	53.3	36.7	8.7	0.7	0.7
Ecotourism will increase the price and the cost of living	11.3	25.3	24.7	10.0	28.7
Ecotourism will disrupt daily lives for residents	12.7	24.7	16.0	12.7	34.0
Cultural preservation					
Ecotourism will promote protection on local cultural heritage	50.0	32.7	9.3	2.0	6.0
Ecotourism will promote protection on the diversity of local cultural activities	32.7	22.0	16.7	6.0	22.7
Ecotourism will destroy local community folk culture	21.3	25.3	18.7	10.7	24.0
Community capacity building					
Ecotourism will enhance the cohesion of community	50.0	28.7	15.3	2.0	4.0
Ecotourism will improve the ability and quality of local residents	55.3	34.7	6.7	1.3	2.0
Environmental protection					
Ecotourism will protect and improve local natural environment	66.7	24.7	6.7	0.7	1.3
Ecotourism will improve local residents' awareness on protection of environment	71.3	22.7	4.0	1.3	0.7

Differences between rural and urban residents' perspectives on the potential benefits of ecotourism in Old Oyo National Park

The independent t-test was conducted to determine if there is no significant difference between rural and urban communities' perspectives on potential benefits of ecotourism. Results reveal that there was significant difference between rural and urban residents' perspectives on the potential social development ($t=-3.24$, $p<0.01$) and environmental protection benefits ($t=2.14$, $p<0.05$) of ecotourism in the park. The residents of the urban communities had a higher perceived social development potential benefits of ecotourism than the residents of the rural communities surveyed. In contrast, the residents of rural communities had a higher perceived environmental potential benefit of

ecotourism than the residents of the urban communities. In addition, there was no statistically significant difference between the rural and urban residents' perspectives on the potential economic development benefits ($t=1.08$, $p>0.05$), cultural preservation benefits ($t=-1.06$, $p>0.05$), and community capacity building benefits ($p>0.05$) (Table 4). This is in conformity with the findings by Acquah *et al.* (2017). The reason for the difference could be that social facilities are more concentrated in the urban centres than the rural areas. Facilities such as roads, electricity, water and other infrastructure provided by government are important for tourist visitation. On the contrary, environmental benefits of ecotourism are much more pronounced in the rural areas than the urban centres and thus the differences between rural and urban centres.

Table 4: Differences between rural and urban residents' perspectives of the potential benefits of ecotourism development

Perspectives on potential benefits of ecotourism	t- value	Mean difference	df	p-value
Economic development	1.08	0.32	148	0.281
Social development	-3.24	-2.87	148	0.001**
Cultural preservation	-1.06	-0.37	148	0.291
Community capacity building	1.20	0.29	145.76	0.262
Environmental protection	2.14	0.48	148	0.034*

*P<0.05, **P<0.01

Relationship between the selected socio-economic variables and residents' perspectives on the potential benefits of ecotourism development

Among the selected socio-economic variables, only length of stay was significantly correlated ($r=0.21$, $p<0.01$) with residents' perspectives on potential benefits of ecotourism. However, age and income are not significantly correlated ($p>0.05$) with their perspectives on the potential benefits of ecotourism. Community type is also significantly related to the residents' perspectives on the potential benefits of ecotourism ($\chi^2=62.58$, $p<0.01$).

Gender, education, and awareness of ecotourism are not significantly related to residents' perspectives on the potential benefits of ecotourism ($p>0.05$) (Table 5). This implies that among the selected independent variables, length of stay in the community and community type are the two variables that are significantly related to perceived potential benefits of ecotourism. This is in consonance with the findings of Han, Fang, and Huang (2011) on the relationship between age, years stayed in the community and perception of ecotourism. Awareness of ecotourism in the park could be an eye opener to the residents on the benefits of ecotourism to their communities.

Table 5: Relationship between the selected socio-economic variables and the residents' perspectives on the potential benefits of ecotourism

Variable	r-value	p-value
Age	0.153	0.061
Income	0.076	0.354
Length of stay	0.211	0.010
	χ^2 value	
Community type	62.582	0.001
Gender	28.782	0.581
Education	105.052	0.185
Awareness of ecotourism activities	133.473	0.265

*P<0.05, **P<0.01

CONCLUSION

Educational attainment of residents of rural communities was lower than that of the urban, with a far-reaching implication on rural residents' ability to understand the purpose and goals of establishing the park and its activities. With lower income of the rural residents, this could put pressure on the park in order for the inhabitants to enhance their income from park resources in the form of illegal hunting and poaching of wildlife and other resources which could impact negatively on the sustainability of the park resources. Lack of awareness and participation in ecotourism could prevent the multiplier effects of tourism and conservation in the park.

Although Old Oyo National Park is noted for historical and cultural resources, the cultural preservation potential benefit was adjudged to be the least by the respondents, thus, the awareness of the cultural preservation potential benefit of the park, compared to other benefits is at variance to one of the major goals of establishing the park, i.e., the

preservation of historical sites and monuments of the Old Oyo Empire from where the park derives its name. The findings further suggest that the social development potential benefit is perceived higher by the urban residents while on the other hand, the rural residents see the environmental protection as the major benefit. This suggests that social development in the rural areas was low and thus far-reaching effects on the support that could be accorded to conservation. In other words, concentration of social amenities in the urban areas, neglecting the rural areas could impede local support for conservation activities of the park. Consequently, for the environmental benefits of the park to be sustainable, support for conservation of cultural, historical and biodiversity resources of the park by rural communities, who are the custodians of these resources, social development of the rural areas through continuous and sustained interventions should be improved upon.

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EFFECTS OF SHIRORO DAM IRRIGATION FARMING ON LIVELIHOOD SHOCKS AMONG RURAL HOUSEHOLDS IN NIGER STATE, NIGERIA

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ABSTRACT

Dry season farming in Shiroro Dam (SD) project serves as a resilience to avert climate change, environmental, socio-economic and production shocks among rural households in Nigeria. The project is expected to have some impact on the livelihood of surrounding communities. The study assessed the effects of SD dry season farming on livelihood shocks among rural households in Niger state, Nigeria. Primary data were collected with the aid of structured questionnaire. A multistage sampling procedure was used to select 165 farming households from 291 Shiroro Dam project participants. Descriptive statistics, net farm income, regression models and shock index were used to analyze the data. Results indicated that majority of SD farming household heads were male (90.9%), married (93.3%) with mean age (\bar{X}) and farming experience of 49 and 19 years respectively. The mean net farm income in dry season farming amounted to ₦88,907.05 which account for 45.5% of total income realized from all livelihood activities throughout the year. The result of the coefficients of irrigation income (0.634), rain-fed income (0.006), fishery income (0.129) and agricultural wage labor (-0.050) were statistically significant factors influencing earning accrued to farming households. Result also revealed that socio-economic and institutional variables were major determinants in the decision and intensity to cope with production shocks. Thus, the study recommended farmers should strengthen their cooperative associations and collaborate with extension agents to harness production and marketing information, and other critical resources that will assist them in preventing and coping with production shocks, climate change and other environmental challenges.

Keywords: Livelihood activities, production shocks, rural households, Shiroro dam project, Nigeria

INTRODUCTION

Nigeria's food supply and demand is made up of local production dominated by smallholder farmers and partly imports from other countries. However, as a developing country with high dependence on importation of staple food such as rice, fish and finished agricultural products, efforts to break this trend and improve self-sufficiency in food production and reduce demand-supply gaps have always been met with a number of problems (Oladimeji, Abdulsalam, Damisa, Ajao and Sidi, 2013). One of such predicaments is agricultural shocks comprising production and marketing shocks. Choularton, Frankenberger, Kurtz and Nelson (2015) define shocks as external short-term deviations from long term trends that have substantial negative effects on farmer's current state of well-being, level of assets, livelihoods, safety or their ability to withstand future shocks. It is also resultant negative outcome caused by climate change, extreme adverse natural events such as droughts, storms, flood, and erosion and market-related events including fuel, food, input and output price fluctuations, volatilities and price hikes (Food and Agricultural Organization FAO, 2016). In addition, rural farming households are exposed to varying and unpredictable elements of nature, such as uncertainty in biological processes related to weather, diseases, pests, and infertility (Oladimeji, Galadima, Hassan, Sanni, Abdulrahman and Egwuma, 2019) which may also cause shocks. Hence, the complex nature of weather and climate

as well as physical and environmental factors exposed farmers to shocks.

Shocks in agriculture are not only of natural disaster or weather related such as rainfall or temperature variability, but also related to changes in market demand and supply (Ngenoh, Kebede, Bett and Bokelmann, 2018) as well as human induced such as land dispute, theft and herdsman farm invasion. Most of these shocks may have negative effects on their production systems, food markets and local economies, all of which have direct effects on crop yields, livestock performance, food and livelihood security and this may aggravate poverty. In addition, shocks received from adverse effect of agricultural production impact on household income and welfare and in extreme, may cause illness and eventual death of affected farmers.

Ngenoh *et al.* (2018) examined the determinants of agricultural production and marketing shocks among indigenous vegetable smallholder farmers in Kenya. Using two-part model computational approach, the results showed that institutions and access-related variables were the main significant factors informing smallholder farmers' decision to cope with shocks. Seyi, Olapade-Ogunwale and Raufu (2011) used Probit analysis to determine the relationship between socio-economic characteristics and shocks of rural households in Oyo state, Nigeria. The results revealed that a large share of households experience multidimensional shocks, which are determined by ecological, socio-economic and demographic factors. While the impacts of shocks on poverty and

coping strategies have been widely studied in developing countries (Heltberg and Lund, 2009; Mabuza, Ortmann, Wale and Mutenje, 2016; Ngenoh *et al.*, 2018), the decision and extent of factors influencing shocks in agricultural production and irrigation nexus are rare in literature and has not been thoroughly analysed. Hence, the broad objective of this study was to assess the effects of Shiroro dam irrigation farming on livelihood shocks among rural households in Niger state, Nigeria. The specific objectives include to: (i) describe the socio-economic and institutional status of farmers; (ii) identify and describe types and magnitude of livelihood shocks and value of crop loss; (iii) estimate the share of Shiroro dam crop irrigation in farmers' livelihood diversification; (iv) analyse costs and returns of livelihood diversification to irrigation farming and compare to rain-fed farming; (v) estimate factors influencing income accrued to SDF; (vi) estimate the factors that influence decision and intensity of coping with livelihood shocks and (vii) describe strategies adopted to mitigate livelihood shocks.

METHODOLOGY

This study was conducted in Niger state, north central Nigeria. Specifically, the populations of Shiroro and Muya LGAs which are the main beneficiaries of Shiroro irrigation farming activities are projected in 2021 to be 333,251 and 146,304 persons respectively using recommended 3.2% growth rate on the population of the two LGAs in 2006 census (NPC, 2006). The climate, edaphic features and hydrology of the state permit the cultivation of most of Nigeria's staple crops and allow sufficient opportunities for livestock rearing, artisanal fisheries and aquaculture production.

Primary data were collected in 2019 farming season, with the aid of a structured questionnaire and trained field enumerators for the study. A multistage sampling procedure involved purposeful selection of two LGAs: Shiroro and Muya out of the 25 LGAs in Niger state because of location of Shiroro dam. With the assistance of extension agents of Niger state Agricultural Development Program (NSADP) during reconnaissance survey, 21 villages adjacent to the Shiroro dam were listed and 13 villages were purposefully selected due to intensity of households' involvement in Shiroro dam farming. The villages selected were Chiri, Zumba, Kwata, Shiroro, Shakwana, Kam, Galadimakogo, Guni, Tungalemu, Tungaalhaji, Gwada, Bakko and Dangunu. The list of farming households in each village was compiled and 165 Shiroro dam farmers were randomly selected from 291.

Descriptive statistics, net farm income (NFI), multiple and two-step regression models were used to analyze the data. NFI analysis was used to measure the benefit accrued to Shiroro Dam

Farmers from irrigation farming. The model is mathematically expressed following Abdulazeez, Abdulrahman and Oladimeji (2019) as follows:

$$TR = Q * P_y \quad (1)$$

$$TC_{ij} = TVC_{ij} + TFC_{ij} \quad (2)$$

$$\pi = TR - TC \quad (3)$$

Where: TR = total revenue (Naira/ha); TC = total costs (Naira/ha); TFC = total fixed cost (Naira/ha); TVC = total variable cost (Naira/ha), π = net return; P_i = average price of output i (₦/kg) and Q_i = quantity of output i (kg/ha).

Multiple regression models were used to determine factors influencing profit of SDF. The Cobb-Douglas function is explicitly specified as follows:

$$\ln Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + u_i \quad (4)$$

Where: Y is the SDF profit per ha. X_1 = irrigation income (₦); X_2 = remittance and gifts (₦); X_3 = livestock worth (₦); X_4 = non-farm income (₦); X_5 = fishery income (₦); X_6 = rain-fed income (₦); X_7 = agricultural wage labor; β_0 = constant; $\beta_1 - \beta_7$ = parameter to be estimated.

The determinants of decision and intensity to cope with livelihood shocks were accomplished using two-step regression models as originally proposed by Cragg (1971) adopted in agricultural project participation and technology adoption studies such as Matthews., Newman and Henchion (2003), Idowu, Ojiako and Ambali (2013) among others. According to Greene (2012), two-step regression otherwise known as double hurdle model can be used to determine the decision of whether to engage in irrigation to minimize livelihood shocks that may emanate from crop rain-fed farming and other farming activities. Therefore, the first step was accomplished by MLE Logit regression model. The dependent variable was binary choice. Yes or participate in farming in Shiroro dam =1 and 0 otherwise. In this case the total sample size was 165 randomly selected farmers.

On the other hand, Tobit regression model determines the extent of coping with livelihood shocks by participation in Shiroro dam. The dependent variable was measured as livelihood shocks index calculated by dividing the amount realized from irrigation farming by the total livelihood income from all sources (McPeak, 2004; Beegle, Dehejia and Gatti, 2006; Heltberg and Lund, 2009; Choularton *et al.*, 2015). The sample size was 128, that is, the number of Shiroro dam farmers that engaged in irrigation in Shiroro dam.

Logistic regression model which expressed the decision to livelihood diversification (P_i) is given as:

$$Z_1 = \beta_0 + \beta_1 X_1 + \dots + \beta_{12} X_{12} + u \quad (5)$$

$Y_i = 0$ or 1. It is a binary answer, that is, experiencing livelihood shocks =1 and zero otherwise). β_0 = constant term, $\beta_1 - \beta_{12}$ = coefficients, u_i = error term with zero mean (\bar{X}) and constant variance. The

independent variables fitted in the model were operationalized in subsequent results.

Tobit regression which determines extent of coping with livelihood shocks is expressed as:

$$Y_i = \beta_0 + \beta_1 X_1 + \dots + \beta_{12} X_{12} + u \quad (6)$$

Where: Y_i is livelihood shocks index measured by dividing irrigation income by the total livelihood income from all sources. It should be noted farmers that experience livelihood shocks in the last three years were sampled. The independent variables fitted in the model were operationalized in subsequent results.

RESULTS AND DISCUSSION

Socioeconomic and institutional status of Shiroro Dam Farmers (SDF)

Socioeconomic and institutional status of SDF is presented in Table 1. The mean age (\bar{X}) and farm experience of the farmers were estimated to be

49 and 19 years respectively. Farmers within this age range are believed to be in their active ages, implying that the farmers are capable of high productivity and are likely to utilize new technologies. In addition, many years of experience implies that farmers will be able to make sound decisions that are technically feasible as regards to resources allocation and management of their economically worthwhile farm operations. The mean household size was estimated as 8 persons per farmer, an indication that there is a likelihood of reduced cost of labor, as adequate family labor will be available for farming operations *ceteris paribus*. The coefficient of variation of distance to market (68.0%), non-farm income (92.4%), credit utilised (152.1%) and extension contacts (88.4%) were high indicating there is high variability and deviation in these parameters.

Table 1: Summary statistics of variables used in shocks determinants regression model

Variables	Min.	Max.	\bar{X}	δ	CV (%)
Age	21	79	49	7.5	15.3
Farming experience	6	63	19	1.7	8.9
Level of education	0	15	8.5	3.9	45.9
Household size	3	32	7.8	2.5	32.1
Farm size	0.4	11	0.5	0.5	94.2
Cooperative membership	0	15	6.7	2.2	32.8
Distance to markets	0.3	17	2.5	1.7	68.0
Total farm income ('000)	22.9	765.2	183.6	52.9	28.8
Non-farm income ('000)	5.9	118.6	11.8	10.9	92.4
Credit accessed ('000)	0	250.0	36.8	56.0	152.1
Extension contact per season	0	5	1.0	0.8	88.4
	F	%			
Sex: Male	150	90.9			
Marital status: married	154	93.3			
Irrigation: traditional	94	57.0			
total observation	165				

Source: Computed from field survey data, 2019. Note δ denote standard deviation and \bar{X} denote mean

Types and magnitude of livelihood shocks and value of crop loss among SDF

Figure 1 depicts types and magnitude of livelihood shocks and level of assets impaired among SDF. Results show that flooding is most prevalent shock experienced by majority of farmers (94.5%) with average value of crop loss of 64.5%. This was followed by drought with proportion of farmers affected being 77.6% and 57.2% crop loss. These two agricultural shocks, flooding and drought imposed more damages because the duos are natural disasters compared to erosion (49.2%) which is

predictable and preventable. Others livelihood shocks include fuel hikes (42.8%), pilfering (31.9%), herdsman farm invasion (23.3%), price fluctuation (17.4%), and diseases and pests (12.8%). Although crop shocks are transitory and are a plausibly exogenous source of variation at the household level (Beegle, Dehejia and Gatti, 2006), if persistent and recurrent in the same families over time, might pick up unobserved household characteristics rather than identifying an exogenous source of variation.

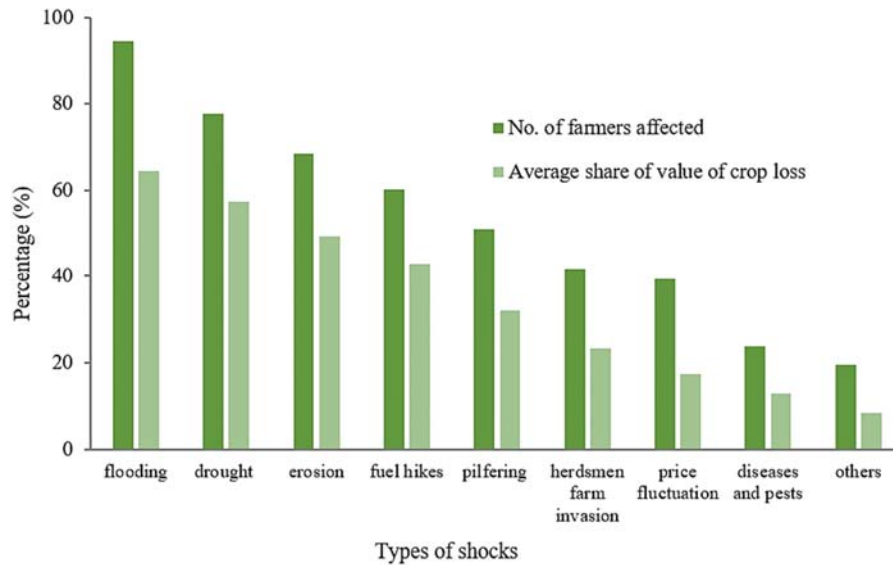


Figure 1: Distribution of types and magnitude of livelihood shocks

** Multiple Responses allowed

Share of Shiroro dam crop irrigation in farmers' livelihood diversification

The shares of incomes from different livelihood activities are summarized by sectors in Figure 2. Although all activities were important sources of livelihood income for the SDF sampled, farming activities were the most important source of livelihood sum up to 72.1%, comprising of the share of income from Shiroro dam irrigation and rain-fed farming amount to 57.4% and 45.5% of farm income and total income respectively. Off-farm incomes

play a lesser role as a source of livelihood with a proportion of 14.7% from the pooled activities. The result demonstrated that income from Shiroro dam can significantly make impact on the livelihood of the farmers in the study area when livelihood shocks such as erosion and flooding occurs. This is comparable to the study of Eneyew, Alemu, Ayana and Dananto (2014) that irrigation use has a positive impact on households' livelihood from crop in rural area of Ethiopia.

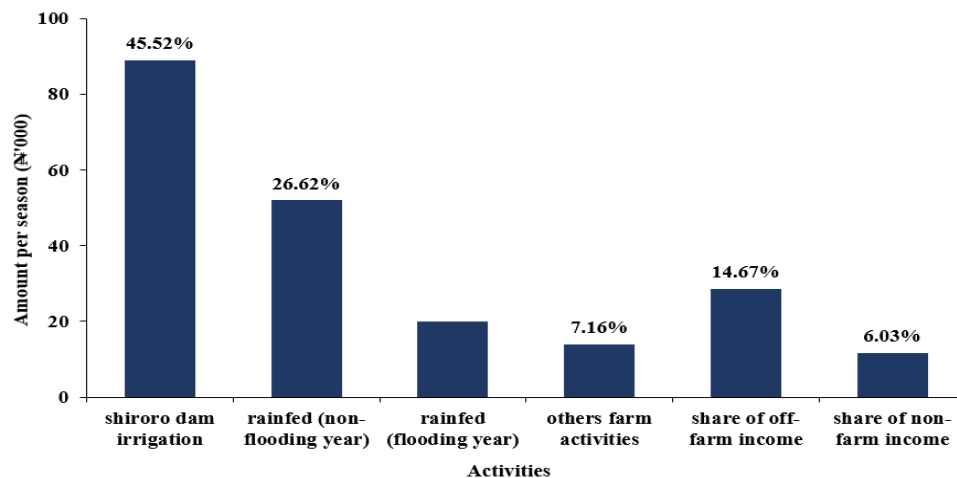


Figure 2: Summary of livelihood activities and income earnings by SDF per season

Costs and returns of livelihood diversification to Shiroro dam farming versus rain-fed farming system

The results of estimate of the cost incurred and benefit accruing from Shiroro dam farming activities and rain-fed during flood and non-flood

farming season are compared and presented in Table 2. The net margin per ha in irrigation farming amount to ₦88,907.0 compared to rain-fed farming without flooding (₦52,002.1) and rain-fed with flooding (₦19,876.9). This shows that dry season irrigation plays a significant role in alleviating

livelihood shocks emanating from flooding during the raining season. In addition, irrigation acts as succor and livelihood strategies to farming household during the off-farm season. This agrees

with findings of Oladimeji and Abdulsalam (2014) on dry season irrigated farming in Asa river of Kwara state, Nigeria.

Table 2: Estimate benefits of using Shiroro dam and rain-fed for farming practices

Variables (₦)	Shiroro dam ₦ha ⁻¹	Rain-fed (non-flooding year) ₦ha ⁻¹	Rain-fed (flooding year) ₦ha ⁻¹
output (tons)	1,894.5	1,363.9	513.1
total revenue	232,996.4	186,225.5	169,309.0
total variable cost , TVC	83,754.0	110,001.0	121,000.0
total fixed cost (TFC)	60,335.4	24,222.5	28,432.1
total costs, TC	144,089.4	134,223.5	149,432.1
gross margin	149,242.4	76,224.5	48,309.0
net margin/ha	88,907.0	52,002.0	19,876.9
return on investment (ROI)	1.6	1.4	1.1
gross ratio	0.6	0.7	0.9

Note TVI denote Total value of irrigated facilities; crop output was converted into maize output using grain equivalent weight (GEW)

Regression analysis of factors influencing income accrued to Shiroro dam farmers

Results in Table 3 indicated that the postulated explanatory variables explained about 72.1% in the variations of factors influencing income accrued to SDF in the study area. The F-test also revealed that the model was statistically significant at 1% hence the model has a good fit. The coefficients of irrigation income (0.634), livestock

worth (-0.231), fishery income (0.129), rain-fed income (0.006) and agricultural wage labor (-0.050) were statistically significant variables influencing income accruing to SDF. The significant and positive coefficients on irrigation, fishery and rain-fed incomes carried *a priori* signs which support the hypothesis that these variables play a significant role in amount accrued to farmers in livelihood diversification strategies.

Table 3: Regression analysis of factors influencing income accrued to SDF

Variable	β	SE	P > Z /
Constant	0.338***	0.093	0.0012
irrigation income	0.634***	0.192	0.0026
remittance and gifts	0.04e-5	0.039e-5	0.6731
livestock worth	-0.231**	0.104	0.0372
non-farm income	0.001	0.0012	0.8218
fishery income	0.129**	0.053	0.0205
rain fed income	0.006***	0.002	0.0029
agricultural wage labor	-0.050*	0.027	0.0832
no of observation=165	R ² =0.721	F-value=18.1	

Note: β denote coefficient; SE = standard error; * * *, * * and * denote significance at 1, 5 & 10 % respectively.

A unit increase in any of the variable whose coefficient is positive implies an increase in income by corresponding units. It implies that amount earned from any of these positive and significant variables also play a momentous role in preventing and ameliorating livelihood shocks. However, the negative coefficients of livestock (-0.231) and agricultural wage labor (-0.050) implies that these variables play a lesser role in livelihood diversification of Shiroro dam farmers and will lead to a decrease in livelihood income earned by 0.231 and 0.050 units, respectively.

Factors that influence decision and intensity of coping with livelihood shocks

The MLE estimates of factors that determine the decision to cope with shocks are

presented in Table 4. The logistic regression results showed that the marginal effects of age (0.045), marital status (-0.239), household size (-0.087), distance to markets (0.078) and credit accessed (-0.284) were the main significant factors influencing Shiroro dam farmers' decision to cope with livelihood shocks. The marginal effects of age and access to markets play a prominent role in decision to cope with agricultural shocks. This implies that households who are young and active are likely to have access to market information on modern farm technologies, high-value market chains farm produce, input acquisition and are more likely to increase their extent of coping strategies to livelihood shocks. This is in line with the study of Ngenoh *et al.* (2018). Furthermore, access to high-



value market chain enables farmers to plan their production efficiently and effectively, and even facilitates access to financial credit from formal institutions, boosting their ability to cope with production shocks.

However, statistically significant but negative marginal effects of marital status (-0.239), household size (-0.087), and credit utilized (-0.284) for farm activities implies that farmers are less likely to withstand agricultural shocks considering large

household size and inability to access credit for farm production. This finding supports the argument that credit access enables farming households to accumulate assets, and invest in new farming technologies that gives them a solid basis for coping with production shocks as observed by McPeak (2004). This is because access to credit services relaxes liquidity constraints and thus enhances the adoption of appropriate technology that would reduce the impacts of production shocks.

Table 4: MLE Logit regression model of the decision to cope with agricultural shocks

Variable	β	dy/dy	t-value	$P > Z $
Age	0.396***	0.045	3.67	0.000
Marital status	-0.005*	-0.239	-1.69	0.084
Level of education	0.2e-4	0.9e-4	0.67	0.417
Household size	-0.637**	-0.087	-2.14	0.028
Farm size	-0.008	-0.290	-1.14	0.127
Cooperative	0.004	0.135	0.80	0.291
Distance to market	0.186*	0.078	1.92	0.063
Irrigation income	-0.2e-6	-0.41e-3	-1.05	0.145
Information on shocks	0.321	0.270	0.37	0.621
Non-farm income	0.4e-8	0.98e-6	1.11	0.138
Credit accessed	-0.277***	-0.284	-2.80	0.002
Extension contact	0.008	0.118	1.33	0.106
Constant	-0.003***	-0.067	-3.00	0.001
Diagnostic statistic	n = 165	prob > $\chi^2=0.00$		
Log likelihood = -73.06	R ² =0.329	LR χ^2 (12)=52		

Note: ***, ** and * denote significance at 1, 5 & 10 % probability level respectively. β denote coefficient, dy/dx is marginal effect

MLE estimates of the intensity / extent / level of coping with agricultural shocks

The Tobit regression results of the parameter estimates of intensity of coping with agricultural shocks are presented in Table 5. The results reveal that the coefficients of household size (0.401) and information on agricultural shocks (0.512) were negative and statistically significant at 1% level of probability. The negative coefficients implied a unit increase in these variables will lead to decrease in the probability of coping with livelihood shocks. On the contrary, age (0.328), irrigation income (0.502), credit accessed (0.2e-6) and extension contact (0.0090) were positive and significant at 1% level of probability except credit accessed at 5% level. These significant variables determine the intensity of coping with production shocks among Shiroro dam households. This implied that the positive and significant variables

increased the probability of coping with production shocks. That is a unit increase in any of these positive and significant variables will lead a corresponding increase in intensity / extent / level of coping with agricultural shocks. Ngenoh *et al.* (2018) opined that access to extension services, explicitly field visits, is a powerful tool that can be used to encourage farmers to change and build their resilience and capacity to deal with agricultural shocks. In addition, frequent interactions between farmers and extension agents expose farmers to modern farming technologies and disaster controls, and hence stimulate communication and reflections on their associated benefits. Oladimeji and Abdulsalam (2014) observed that modern irrigation technologies save water and are therefore efficient and effective at combating the negative effects of agricultural shocks when compared to traditional types.

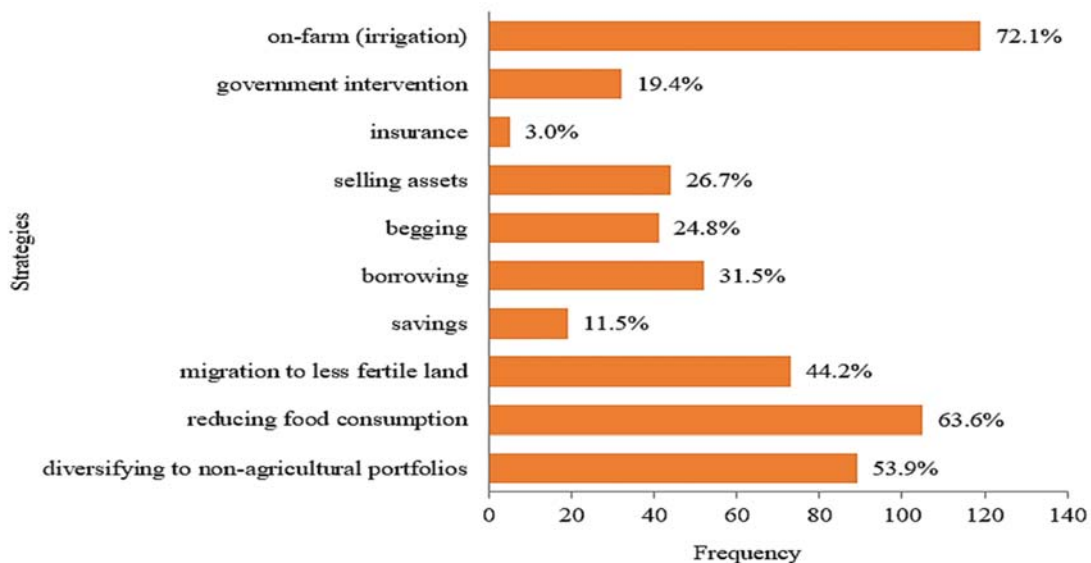
Table 5: MLE Tobit regression estimates of the extent (intensity) of coping with shocks

Variable	β	SE	t-value	P > Z
Age	0.328***	0.094	3.49	0.000
Marital status	-0.111	0.862	-0.13	0.421
Level of education	0.01e-6	2.00e-08	0.5	0.106
Household size	-0.401***	0.155	-2.59	0.002
Farm size	0.299	0.189	1.58	0.108
Cooperative	-0.1e-4	0.15e-4	-0.67	0.176
Distance to market	0.267***	0.064	4.17	0.000
Irrigation income	0.502***	0.172	2.92	0.001
Information on shocks	-0.512***	0.201	-2.55	0.002
Non-farm income	-0.3e-8	0.29e-8	-1.03	0.125
Credit accessed	0.2e-6**	0.09e-6	2.22	0.025
Extension contact	0.009***	0.003	3.01	0.000
Constant	0.213**	0.097	2.20	0.021
Log likelihood=112.03	R ² =0.302	n=128	prob > chi ²	=0.000
LR Chi ² (12)=77.09				

Strategies adopted to mitigate livelihood shocks

Figure 3 depicts strategies adapted in mitigating livelihood shocks by Shiroro dam farmers. The results show that majority of the coping strategies used by Shiroro dam farmers were informal. These include on-farm irrigation (72.1%), reducing food consumption (63.6%), diversifying to non-farm income earning (53.9%) and migration to less fertile land (44.2%). Other less strategies employed by farmers such as savings (11.5%), selling assets (26.7%) and borrowing (31.5%) have

short and long-term effects of these coping strategies (depletion of available resources), especially among those households that have low consumption growth, limited savings, and limited access to non-exploitative credit. Only 3% of sampled farmers insured their farm. This implies that Shiroro dam farmers should embark on irrigation to mitigate livelihood shocks due to variance of weather most especially flood and drought rather than reducing consumption or sale their assets.


Figure 3: Strategies adopted to mitigate livelihood shocks

Note: *Multiple Responses

CONCLUSION AND RECOMMENDATIONS

Flooding, drought and erosion were the most critical livelihood shocks experienced by Shiroro Dam Farmers in agricultural production activities. The study established that Shiroro dam irrigation as the most important livelihood source in the area. The study revealed factors that influence

decision to cope with livelihood shocks were in variance with those that affect intensity of coping with shocks. It is suggested that Shiroro dam farmers should strengthen their cooperative organization to harness credit facilities, insurance scheme, extension services, market information and government intervention to minimize natural



disaster. Cooperative will helps Shiroro dam farmers to access critical services and resources needed to implement relevant and appropriate livelihood coping strategies to deal with shocks. Farmers should also prioritize dry season irrigation to minimize shocks associated with flooding, drought and other natural disaster.

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PUBLIC AGRICULTURAL EXTENSION AGENTS' KNOWLEDGE OF THE CONCEPT OF E-EXTENSION IN OGUN STATE, NIGERIA

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ABSTRACT

Agricultural extension practice worldwide has shifted towards the use of information communication technologies (ICTs) for agricultural information sourcing and delivery but its integration in this part of the world is still very minimal. This study assessed extension agents' knowledge of the concept of e-extension in Ogun State Agricultural Development Programme. A total of 51 agricultural extension agents were randomly selected from the sample frame 59 extension agents using Taro Yamane's formula. Primary data were obtained through a structured questionnaire from extension agents. Data were analyzed using descriptive statistics, Chi-square and linear regression. Results reveal that the mean age, years of work experience and monthly income of the respondents were; 36.6 years, 8 years and N88,137.25k respectively. Majority (74.5%) of the respondents were male, 72.5% were married while 64.7% had a Bachelor of Science. The main e-extension services the respondents were aware of were; short messaging service (96.1%), emails (88.2%) and farmers' contact center (86.3%). Most (86.3%) of the extension agents were knowledgeable about the concept of e-extension with meetings and training ($\bar{X}=1.82$ respectively) being the major sources of information about e-extension. Sources of information on the concept of e-extension ($\beta=0.162$, $p=0.019$) and level of education of the extension agents ($\beta=-0.578$ $p=0.030$) significantly influenced knowledge of the concept of e-extension. It was concluded that the respondents were knowledgeable about the concept of e-extension with a recommendation that the Nigerian agricultural technology transfer policy should emphasize the use of e-extension services coupled with more training on integrating this concept into the extension service delivery systems.

Keywords: Knowledge; E-extension; Agricultural Extension Agents.

INTRODUCTION

Agriculture has been the backbone of Nigeria's economy for decades and is still an important sector despite the boom witnessed in the oil sector. As a matter of fact, many countries depend solely on agriculture for sustenance and as the main source of revenue (World Bank, 2014). Challenges militating against agricultural development are numerous, not because of the lack of improved technologies but because of inadequate and untimely dissemination of information on these improved technologies (Sokoya, Onifade, and Alabi, 2012).

Omotayo (2005) observed that agricultural extension depends largely on information exchange between farmers and a broad range of other actors particularly the front line extension workers that are the direct link between farmers and other actors in the agricultural knowledge and information system (AKIS). Considering the importance of information towards agricultural development, the role of agricultural extension in agricultural development is pertinent and to improve agricultural extension, the traditional means of disseminating information such as face to face, farm visits, group discussions, personal letter and the use of contact farmers should be modified. Oladele (2006) opined that information communication technologies can enhance the integration and efficiency of agricultural systems by opening new communication pathways.

According to Omotayo (2005), the use of information communication technologies (ICTs) tools in extension has become necessary in view of users' demand for effective and appropriate

agricultural extension service delivery. The advent of ICTs has given rise to e-extension which Renwick (2012) described as the delivery of extension services using web tools, which allow online sharing, collaboration and networking. Ramjattan, Ganpat, and Chowdhury (2017) opined that e-extension, as a modern mode of communication, can be used to improve the effectiveness and efficiency of extension services. Farmers' access to reliable, timely and relevant information on improved technologies is often limited due to challenges in extension service delivery such as immobility of extension agents, low extension to farmer ratio, and poor funding which negatively impacts on extension activities. According to OGADEP (2017) the ratio of extension agents to farm families has drastically reduced to 1:1019 in Ogun State which is against the recommended 1:200-300 by the Ministry of Agriculture in 2002. Also, weak research-extension-farmers linkage another challenge faced by extension agents in delivering relevant and timely information to the would-be users. Eneyew (2013) reported that the lack of strong research-extension-farmers linkage causes disruption in technology flow and low adoption rates, increased time lags between development and adoption of new technology, reduced efficiency in the use of resources, unnecessary competition and duplication of efforts, and increased cost of agricultural research and extension activities.

In the light of these prevailing challenges that have constrained effective access of farmers to extension service, the use of e-extension could open up new opportunities in service delivery. This study

therefore assessed public extension agents' knowledge of the concept of e-extension services in Ogun State Agricultural Development Programme. The specific objectives of this study were to:

1. identify the types of e-extension services the agents were aware of;
2. ascertain respondents' level of knowledge on the concept of e-extension;
3. identify the sources of information on e-extension; and
4. ascertain the factors associated with respondents knowledge of the concept of e-extension.

The hypothesis of this study is stated in null form that: There is no significant relationship between selected socio-economic characteristics of extension agents and their knowledge of the concept of e-extension.

METHODOLOGY

This study was carried out in Ogun State, Nigeria. Ogun State is located in the Southwest zone of the country with a total land area of 16,980.55 square kilometers. It is situated between latitudes 7.0°N and 3.35°E, and predominantly inhabited by the Yoruba ethnic group. Public agricultural extension service is mainly provided in the state by Ogun State Agricultural Development Programme (OGADEP) which is segmented into four operational zones (Abeokuta, Ilaro, Ijebu and Ikenne.). The population of this study, therefore, comprised of extension agents in OGADEP. The sampling frame was 59 agricultural extension agents who were on the staff list of extension personnel in OGADEP at the time this study was conducted. Taro Yamane's formula adopted from Kalpana (2011) was used to sample 51 agricultural extension agents from the sampling frame. Sampling size computation using Taro Yamane formula is indicated as follow:

$$n = \frac{N}{1 + N(e)^2}$$

Where, n = Number of respondents, N = Population Size, e = Error (5%)

Primary data were obtained through a structured questionnaire administered to 51 extension agents in OGADEP. Awareness of e-extension services by the respondents' was measured using a dichotomous variable of aware (1) and not aware (0), knowledge about the concept of e-extension was measured using a dichotomous variable of true and false statements scored 1 and 0 respectively for positive knowledge statements and reverse scoring order for negative statements. Major sources of information about e-extension were measured using a 3-point rating scale of Always, rarely and never scored 2, 1 and 0, respectively. Hypothesis 1 was tested using Chi-square and Pearson's Product Moment Correlation while factors

associated with the use of e-extension was tested using linear regression.

Linear Regression: Linear regression analysis indicates the line of best fit between dependent variables and independent variables. According to Argyrous (2005), it is simply the task of fitting a straight line through a scatter plot of cases that "best-fits" the data.

The following equation shows the multiple linear regression model for this study:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + \dots b_eX_e + \epsilon$$

Y = Respondents' knowledge of the concept of e-extension services.

b_0 = This is the value of Y when all of the independent variance equal to zero.

b_1 through b_7 = estimated regression coefficient (Each regression coefficient represents the change in Y relative to a unit change in the respective independent variables)

ϵ = The models' error term (Also known as residual)

X_1 = Age (Years)

X_2 = Sex (Male = 1 and female = 2)

X_3 = Religion (Christianity = 1, Islam = 2)

X_4 = Marital Status (Single = 1, engaged = 2 and married = 3)

X_5 = Years of work experience (Years)

X_6 = Awareness of e-extension services (Aware = 1, not aware = 0)

X_7 = Sources of information on the concept of e-extension services (Number of sources)

X_8 = Education level (NCE = 1, OND = 2, B.Sc = 3 and M.Sc = 4)

RESULTS AND DISCUSSION

Socioeconomic characteristics

Results in Table 1 reveal that the mean age, years of work experience and monthly income of the respondents were 36.60 ± 8.34 years, 8.17 ± 8.16 years and $N88,137.25k \pm N70,857.96k$ respectively. This indicates that many of the extension agents are middle aged which could influence knowledge of the concept of e-extension because of the associated technicalities with the concept. This result is in line with the findings of Adeola and Ayoade (2011) who reported that many of the extension agents in Oyo State Agricultural Development Programme (OYSADEP) were middle aged (27-41 years). Majority (74.5%) of the respondents were male, 72.5% were married, 66.7% were Christians, while all (100.0%) had tertiary education. This implies that extension agents in Ogun State Agricultural Development Programme (OGADEP) are predominantly male and literate. This result is in consonance with the findings of Thomas and Laseinde (2015), who reported that most of the extension agents in OYSADEP were male and literate.

Table 1: Distribution of extension agents by socio-economic characteristics (n = 51)

Variable	Frequency	Percentage	Mean±SD
Age(years)			
23 – 30	10	19.6	36.60±8.34years
31 – 38	28	54.9	
39 – 46	04	7.8	
47– 54	07	13.7	
55 and above	02	3.9	
Sex			
Male	38	74.5	
Female	13	25.5	
Marital status			
Single	12	23.5	
Engaged	02	3.9	
Married	37	72.5	
Religion			
Christianity	34	66.7	
Islam	17	33.3	
Educational level			
NCE	01	2.0	
OND	01	2.0	
HND	09	17.6	
B. Sc	33	64.7	
M. Sc	07	13.7	
Work experience (Years)			
1 – 8	37	72.5	8.17± 8.16 years
9 – 16	04	7.8	
17 – 24	07	13.7	
25 – 30	03	5.9	
Income (N)			
20000-90000	37	72.5	N88,137.25k±N70,857.96k
90001-160000	07	13.7	
160001-230000	02	3.9	
230001-280000	05	9.8	

Source: Field survey, 2019

Awareness of e-extension services by the respondents

Results in Table 2 reveal that short messaging service (SMS, 96.1%), emails (88.2%), farmers' contact center (86.3%), and interactive voice response (IVR, 72.5%) were some forms of e-

extension services respondents were aware of. This implies that the aforementioned e-extension services are the prominent services the respondents were aware of and the reason might be attributed to their popularity in this part of the world (Nigeria).

Table 2: Distribution of the respondents by awareness of e-extension services (n=51)

S/N	E-extension services	Frequency	Percentage
1	Short Messaging Service (SMS)	49*	96.1
2	Emails	45	88.2
3	Farmers' Contact Center	44	86.3
4	Interactive Voice Response (IVR)	36	72.5
5	Blogs	26	51.0
6	Teleconferences	25	49.0
7	Unstructured Supplementary Service Data (USSD)	24	47.1

Source: Field survey, 2019.

Note: * Multiple responses

Respondents' knowledge of the concept of e-extension

Some of the test questions and percentages of the correct options are presented in Table 3. Furthermore, results in Table 4 reveal that 86.3% of

the respondents scored above the mean value (\bar{x} =7.5) thereby having high knowledge about the concept of e-extension while 13.7% scored below this mean value implying a low level of knowledge



about the concept of e-extension. This indicates that most of the respondents sampled were knowledgeable about the concept of e-extension and this could influence its possible integration into the agricultural extension service delivery system. This

result is similar with the findings of Isiaka, Lawal-Adebawale, and Oyekunle (2009) who reported that extension agents in Southwest Nigeria were knowledgeable about ICTs.

Table 3: Distribution of respondents by knowledge of the concept of e-extension (n=51)

Statements on the concept of e-extension	Right options (%)
A farmer using a mobile phone to make call or send text message to an extension agent or another farmer on how to apply fertilizer on his maize farm is an example of e-extension.	98.0
Accessing agricultural research papers and research blogs on the internet constitutes e-extension.	90.2
An extension agent using Skype to demonstrate artificial insemination method to a farmer is an example of e-extension	78.4
Using mobile phone as electronic dairy and reminders for monthly meetings and trainings constitutes e-extension.	94.1
Posters, transparencies, bulletins, magazines, newspapers and hand bills are all examples of e-extension.	43.1
E-extension maximizes the use of Information Communication Technologies (ICTs) to attain a modern agriculture.	90.2
Disseminating and receiving agricultural information via email is an example of e-extension.	92.2
Using agricultural related apps on mobile phones constitute e-extension.	98.2
E-extension creates an electronic and interactive bridge between agricultural stakeholders.	96.1
Examples of e-extension web tools include websites, networking software, online sharing tools such as emails, blogs, and surveys, video conferencing, instant messaging, community-based tele centers and mobile phone apps.	94.1
Face-to-face communication without any electronic device constitutes e-extension.	41.2
E-extension allows one to reach your client anytime, anyplace, and anywhere.	94.1
E-extension is the delivery of extension services using the internet or latest Information Communication Technologies (ICTs), which allow networking, online sharing and collaboration.	88.2
E-extension supports delivery of information in diverse styles such as text, audio, audio-visual, image, motion pictures, instant messaging and applications.	92.2
Mobile phone for sending and receiving SMS (short message service) among farmers and between farmers and extension agents is an example of e-extension.	92.2

Source: Field Survey, 2019

Table 4: Categorisation of respondents' knowledge of the concept of e-extension (n=51)

Categorisation	Frequency	Percentages
High Knowledge	44	86.3
Low Knowledge	07	13.7

Source: Field Survey, 2019

Mean = 7.5

Sources of information on e-extension by the respondents

The sources of information on e-extension as indicated by the extension agents in Table 5 were meetings and trainings ($\bar{x} = 1.82$ respectively) which

were ranked first, internet ($\bar{x} = 1.80$) which ranked third as well as social media ($\bar{x} = 1.76$). This implies that the aforementioned were the major sources of obtaining information on e-extension by the respondents.

Table 5: Distribution of respondents by sources of information on e-extension by the respondents (n=51)

Sources of information on e-extension	Mean	Rank
Meetings	1.82	1 st
Trainings	1.82	1 st
Internet	1.80	3 rd
Social Media	1.76	4 th
Seminars	1.66	5 th
Radio	1.66	5 th
Workshop	1.64	7 th
Colleagues	1.60	8 th
Television	1.60	8 th
Conferences	1.47	10 th
Newspaper	1.23	11 th

Source: Field Survey, 2019

Factors associated with respondents' knowledge of the concept of e-extension

Result in Table 6 reveals that the F-value of 1.694 was not significant at 0.05% level and R^2 of 0.244 implies that the independent variables explained 24.4% contribution to respondents' knowledge of the concept of e-extension service in the regression model. The Table further reveal that sources of information on the concept ($\beta = 0.162$, $p = 0.019$) and their level of education ($\beta = -0.578$, $p =$

0.030) had significant effect on their knowledge of the concept of e-extension. This implies that the respondents' sources of information and their level of education could predict respondents' knowledge of the concept of e-extension service. There was a negative effect of education on knowledge which is contrary to a prior expectation which may be attributed to the skewed nature of the distribution as indicated in Table 1 as most of the respondents indicating that they possess bachelor degrees.

Table 6: Factors associated with the use of e-extension and respondents' knowledge of the concept of e-extension

Variables	β	Standard Error	t-value	p-value
Age	-0.050	0.054	-0.936	0.355
Sex	-0.436	0.453	-0.961	0.342
Religion	-0.188	0.410	-0.458	0.649
Marital status	0.130	0.259	0.504	0.617
Years of working experience	0.034	0.050	0.676	0.503
Awareness of e-extension services	-0.079	0.129	-0.616	0.541
Sources of information on the concept	0.162	0.067	2.430	0.019*
Educational level	-0.578	0.257	-2.250	0.030*
Constant	14.550	2.356	6.175	0.000
R^2 value	0.244			
F-value	1.694			
P-value	0.128			

Source: Field Survey, 2019

Note: * Significant at 5%

Test of relationship between socio-economic characteristics of the respondents and their knowledge of e-extension services

Results of Chi-square analysis in Table 7 reveals that there were no significant associations between sex ($\chi^2 = 1.288$, $p = 0.256$), marital status ($\chi^2 = 0.407$, $p = 0.816$), religion ($\chi^2 = 0.083$, $p = 0.774$), as well as educational level ($\chi^2 = 2.037$, $p = 0.729$) of the respondents and knowledge of the concept of e-extension services. This implies that respondents' sex, marital status, religion and

educational level do not influence knowledge of the concept.

Correlation test as presented also in Table 7 reveals that there were also no significant relationships between respondents' age ($r = 0.082$, $p = 0.570$), years of experience ($r = 0.087$, $p = 0.542$), annual income ($r = 0.071$, $p = 0.622$) and knowledge of the concept of e-extension services. This implies that irrespective of the respondents' age, annual income and years of experience they were still knowledgeable about the concept of e-extension services.

**Table 7: Test of relationship between socio-economic characteristics of the respondents and their knowledge of e-extension services**

Socio-economic characteristic	Chi-square	df	p-value
Sex	1.288	1	0.256*
Marital status	0.407	2	0.816*
Religion	0.083	1	0.774*
Educational level	2.037	4	0.729*
	r-value		p-value
Age	0.082		0.570*
Years of work experience	0.087		0.542*
Income	0.071		0.622*

Source: Field Survey, 2019

Note: * Not Significant at 5%

CONCLUSION AND RECOMMENDATION

Extension agents in OGADEP were knowledgeable about the concept of e-extension. It is recommended that Nigerian agricultural technology transfer policy should emphasize the use of e-extension services and relevant stakeholders in agricultural extension delivery should facilitate an extension system that is ICT driven. Furthermore, public extension personnel should be exposed to more trainings on how to practically integrate the concept into the extension service delivery systems.

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FARMERS' ENGAGEMENT IN TOMATO POSTHARVEST HANDLING ACTIVITIES AND RATE OF LOSSES IN KADUNA STATE, NIGERIA

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ABSTRACT

Tomato is an important fruit vegetable which provides numerous nutrients to the body. Despite the level of production, postharvest loss is frightening at the rate of 30-50% annually as a result of poor handling. The previous studies have not investigated the level of engagement in tomato handling. Therefore, this study investigated the level of engagement of farmers on tomato postharvest handling activities. Multistage sampling procedure was used to select 231 respondents. Structured questionnaire was used to obtain data on farmers' socio-economic characteristics, level of engagement in tomato postharvest handling activities and rate of losses, while descriptive (Frequency distribution, mean and standard deviation) and inferential (PPMC) statistical tools were used for analysis. Majority of tomato farmers (94.8%) were found to be male with 15 years of farming experience (63.6%). Larger proportion (41.6%) had 1-2 acres of tomato farm and majority (54.1%) produced less than 5000kg of tomato annually. Most (65.4%) had low engagement level in postharvest handling of tomato and majority (58.9%) incurred high rate of losses. There was significant relationship between years of experience ($r = -0.163$, $p < 0.05$), farm size ($r = 0.279$, $p < 0.05$), quantity of tomato produced ($r = 0.272$, $p < 0.05$) and losses incurred. Significant relationship also existed between level of engagement ($r = -0.163$, $p < 0.05$) and the rate of losses incurred. The study therefore recommends that government and other NGOs should assist tomato farmers with processing and storage facilities. Also extension agents should organise workshop and training for farmers on modern techniques of postharvest handling of tomato to improve their level of engagement in order to reduce the rate of losses incurred.

Keywords: Level of engagement, Postharvest handling activities, Tomato postharvest losses, Tomato farmers

INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the most widely grown vegetables in the world and an important component of the daily diet, consumed both in its fresh and paste forms. It is a good source of Vitamins A and C and other essential minerals and cultivated over vast area of land in the world. Tomato losses of up to 50% is recorded in fresh tomato between the harvesting and consumption stages of the distribution chain in tropical countries (Mashav, 2010). About thirty-two percent of food produced globally was lost and not eventually consumed by intended people due to the problem of inadequate postharvest handling activities which eventually results in greater losses (FAO, 2014). Mostly, fruits, vegetables and root crops are much less hardy and are quickly perishable if not properly handled along the supply chain of food distribution and these losses have enormous undesirable economic and ecological effects (FAO World Bank, 2010). Therefore, reducing the food losses and waste could be one of the important global approaches for realizing a sustainable food future. In Africa, the losses are even higher between 30 and 50% which occur mainly along the supply chain, where fruits and vegetables losses are estimated to be fifty percent or more and this estimate is increasing because losses occur at every stage of the supply chain (FAO, 2011)

There are numerous factors that contribute to losses of tomato which include environmental conditions (heat, drought, and mechanical damage during harvesting) and inappropriate postharvest

handling activities (unsuitable packaging materials, poor pre-cooling methods, poor sorting and grading techniques, inadequate storage facilities and poor methods of transportation and marketing). Fresh tomato fruits are vulnerable to postharvest losses immediately after harvest, because they are highly perishable with high moisture content, have short shelf-life and highly prone to fungal and microbial attacks and are very challenging to store for a long period without incurring losses (Ewekeye, Oke, Quadri, Isikalu, Umenwaniri and Durosimi, 2013).

Nigeria ranks 16th among the leading producers of tomato in the world and has the proportional benefits and prospect to top the world in both production and exports. The production of tomato in Nigeria in 2010 was about 1.8 million metric tonnes, which accounts for almost 68.4 percent of West Africa, 10.8 percent of Africa's total output and 1.28 percent of world output (Weinberger and Lumpkin, 2007). Regrettably, Nigeria still experiences ineptitude in serious inputs, inadequate improved technology, poor yield and productivity and high level of postharvest losses. The demand for tomato and its byproducts surpasses the supply as a result of losses incurred annually. Almost forty percent of tomato is lost to inadequate handling activities, leaving a short fall of 1.22 million metric tonnes for man's use. In addition, about fifty percent of the local tomato produced in Nigeria rot because of inadequate storage and processing facilities, which has prompted many farmers to stop producing tomato (Daniel, 2016). More so, postharvest losses of food has been a great

challenge to food security in Nigeria, nonetheless increased yield has been found to be possible but inefficient handling activities has become a major problem (Arowojulo, 2000). It is therefore pertinent to examine the relationship between level of engagement in various postharvest handling activities of tomato among farmers in Kaduna State and the rate of losses incurred by farmers, in order to proffer solutions for adequate food security. Specifically, the study;

1. Described the socio-economic characteristics of tomato farmers in the study area.
2. Ascertained the level of engagement in postharvest handling activities by the respondents.
3. Determined the rate of postharvest losses of tomato incurred by the respondents in the study area.

The following are the hypotheses of the study

H₀₁: There is no significant relationship between the respondents' socio-economic characteristics rate of postharvest losses incurred.

H₀₂: There is no significant relationship between respondents' level of engagement in postharvest handling activities and rate of losses incurred.

METHODOLOGY

The study was conducted in Kaduna State, North Western zone of Nigeria. Agriculture is the main stay of the economy of Kaduna state with about 80% of the people actively engaged in farming. Cash and food crops are cultivated and the produce include: yam, cotton, groundnut, tobacco, maize, beans, guinea corn, millet, ginger, rice and cassava. Over 180,000 tonnes of groundnut are produced in the state annually (NigeriaGalleria, 2017). The sector is dominated by wet season planting and an irrigated dry season planting. Most farmers produce cereal crops such as maize, sorghum, millet and rice during the rainy season. The State is also an important producer of fruits and vegetables that are supplied to Southwest Nigeria. The study population comprised all farmers in Kaduna states, Nigeria.

Multi-stage sampling procedure was adopted to select respondents for this study. Local government areas (LGAs) that produce more of tomato were purposively selected. Purposive sampling technique was also used to select 20% of LGAs prominent in tomato production to give a total of two LGAs. Thereafter, 10% of the wards were randomly selected to give a total of two wards (Jere and Galma). Lastly, 10% of the registered tomato farmers in each ward were randomly selected to give a total of 231 respondents. Respondents were presented with forty-four items on postharvest

handling activities. These were sub - divided into seven main groups; Harvesting, Precooling, Sorting and Grading, Packaging, Storage, Processing and Transportation. Respondents' extent of engagement in postharvest handling activities was measured on a three scale point of always, occasionally and never and were scored 2, 1 and 0 respectively. The maximum score obtainable was 88 while the minimum was 0. Scores of each of the respondent were summed to obtain a composite score for postharvest handling activities engaged in. The mean value of 22.69 was then used as benchmark to categorize into high and low such that those below the mean score were assumed to have low level of engagement in the activities and those within and above mean score was assumed to have high level of engagement in postharvest handling activities. The rate of losses was measured by deducting the sum of quantity of tomatoes sold, quantity consumed, and quantity given out as gifts from the main quantity of tomato produced by individual farmers per annum.

RESULTS AND DISCUSSION

Socioeconomic characteristics

The result from Table 1 reveals that a little above the average (51.5%) of tomato farmers were within age range of 41 to 50 years with the mean age of 47.8 years. This suggests that tomato farming is dominated by young people, who are considered to be in their productive and active years. They will thus be capable of undertaking any economic activities to adequately cater for their families and possibly others. This agrees with the findings of Joel, Girei, Jongur and Umaru (2016) in a study carried out in Adamawa state where the mean age of farmers was 47.5 years.

The results (Table 1) further reveals that majority of tomato farmers (94.8%) were found to be male. This signifies that men dominated tomato farming activities in the study area. This could be linked with the major roles men play in crop production most especially fruits and vegetables because of direct ownership of land required for farming in which men have higher advantage than women. This finding is in line with that of Ojo, Ibrahim and Muhammad, (2009). A larger percentage (89.2%) of the farmers were married. This is suggestive of the need to make more money to meet up with numerous family responsibilities. The findings corroborate the report of Suleiman and Jafar (2010) who stated higher percentage of respondents in a related geographical locality in Northern Nigeria were married. Table 1 also shows that larger proportion (43.7%) of farmers had primary school certificate as their highest level of education attained, while few (28.6%) had above primary education as their highest level of education. This suggests that the respondents' level of education is very low.

The results from Table 1 further shows that few (41.6%) farmers had between 1 – 2 acres of tomato farmland. The total number of acreages cultivated by the farmers denotes that food production in Nigeria is characterized mainly by small scale farmers. This is consistent with the findings of Daudu, Chado and Igbashal (2009) in a related study in terms of farm size. The result (Table 1) reveals that little above half (54.1%) of farmers produced tomato of between 5001 and 10,000kg in the year 2016, while only 1.3% produced above 20,000kg. The low production could be attributed to the outbreak of *Tuta absoluta* (Leaf miners) in the Northern part of Nigeria. The result from Table 1 shows that larger proportion (56.3%) of farmers

earned income of between ₦50, 001 and ₦100, 000 annually, while 9.5 percent earned above ₦150, 000 annually. This implies that majority of the respondents were low income earners which can influence the way they handle tomato. The distribution of respondents according to the farming experiences as shown on figure 1 reveals that majority (63.6%) of farmers had 15 years of experience in average. This implies that tomato farming is an age long profession of the respondents in the study area. This agrees with the report of Ajayi *et al* (2010), who stated that larger proportion (68.9%) of farmers had the same years of farming experience.

Table 1: Distribution of respondents' socio-economic characteristics

Variable description	Tomato Farmers (n=231)		
Age (Years)	F	%	Mean
≤ 30	3	1.23	47.8± 7.8
31 – 40	42	18.18	
41 – 50	119	51.52	
51 – 60	56	24.24	
≥ 61	11	4.76	
Sex			
Male	219	94.81	
Female	12	5.19	
Marital status			
Single	10	3.33	
Married	206	89.18	
Widowed	15	6.49	
Educational level attainment			
Primary school	101	43.72	
Secondary school	60	25.97	
Tertiary education	6	2.60	
Non-formal	64	27.71	
Size of tomato farm (acres)			
≤ 1	65	28.14	4.2±28.5
1.0 – 2	96	41.56	
> 3	70	30.30	
Quantity produced (kg)			
≤ 5000	48	20.77	53.06±37.45
5001 – 10000	125	54.11	
10001 – 15000	30	12.98	
15001 -20000	25	10.83	
> 20000	3	1.30	
Income from farming / Year (N)			
≤ 50,000	49	21.21	101,936.3± 82,956.2
50001 – 100,000	130	56.28	
100,001 – 150,000	30	12.98	
≥ 150,001	22	9.52	

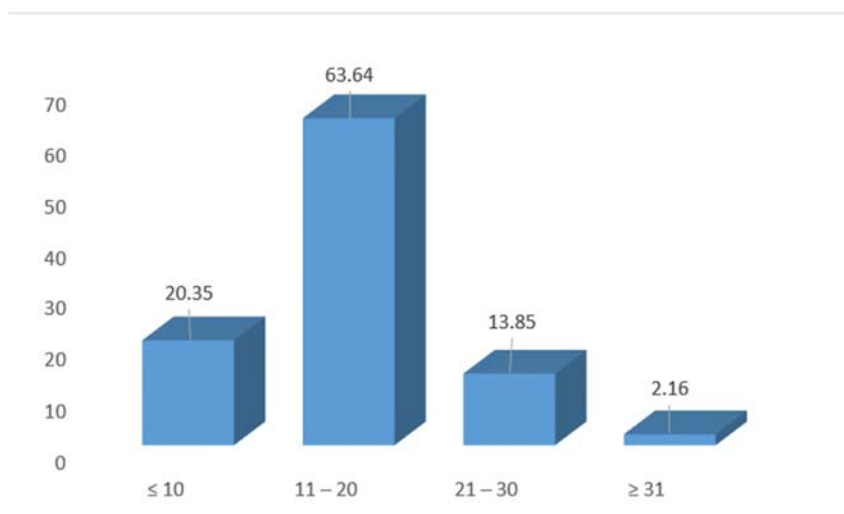


Figure 1: Respondents' years of farming experience

Tomato farmers' level of engagement in postharvest handling activities

The result from Table 2 shows that farmers were highly engaged in; harvesting tomato at the cool period of the day ($\bar{x} = 1.98$), while the level of engagement was low in the use of sharp knives for harvesting tomato ($\bar{x} = 0.06$) and cutting of fingernails before harvesting tomato on the farm ($\bar{x} = 0.10$). This is line with Olayemi, Adegbola, Bamishaye and Daura (2012) in a related study. The respondents' low level of engagement in various postharvest handling activities contributed greatly to high rate of losses incurred. The result (Table 2) further reveals that respondents' level of engagement were low in; spreading of freshly harvested tomato under the trees immediately after harvesting to remove excess heat ($\bar{x} = 0.24$), spreading of fresh tomato on a verandah at home ($\bar{x} = 0.05$) and keeping harvested tomato in a well-ventilated shops to remove excess heat ($\bar{x} = 0.04$). This implies that as a result of low level of engagement in precooling activities, the respondents incurred high rate of tomato losses. More so, respondents' level of engagement were low on these activities (sorting and grading); sorting of tomato according to different sizes before packaging ($\bar{x} = 0.81$), sorting and grading of tomato based on the colour (ripeness) ($\bar{x} = 0.67$).

On the packaging activities of tomato, it was revealed that the level of engagement was low in packaging fresh tomato with the use of collapsible slatted wooden box ($\bar{x} = 0.06$) and Packaging fresh tomato with the use of use of Nestable plastic crates ($\bar{x} = 0.26$), while they were highly engaged in the use of use of woven baskets for packaging tomato ($\bar{x} = 1.97$). The result from Table 2 further reveals that farmers' level of engagement was low in storage

of fresh tomato in the cold room ($\bar{x} = 0.06$), storing fresh tomato in the refrigerator ($\bar{x} = 0.05$), preserving fresh tomato using pot - in- pot method ($\bar{x} = 0.03$). However, the result (Table 2) shows that level of engagement in piling of tomato baskets in the truck during transportation was very high ($\bar{x} = 1.88$) which leads to high rate of losses, while their engagement level was low in transportation activities that will reduce the rate of losses; Transporting of fresh tomato during the cool period of the day ($\bar{x} = 1.22$) and transporting with the use of cool van ($\bar{x} = 0.29$). It was observed that farmers' level of engagement was low in the processing activities that ensure reduction in the rate of losses; Slicing and Sun drying ($\bar{x} = 1.08$). They were not engaged at all in use of hybrid dryer and multipurpose dryer ($\bar{x} = 0.00$).

The rate of postharvest losses incurred by tomato farmers

The distribution on the losses incurred by the respondents from Table 3 shows that 58.9% of farmers incurred high rate of tomato losses while only 41.1 percent incurred low rate losses. The high rate of losses incurred could be linked to their low level of engagement in various postharvest handling activities required for tomato. This is in agreement with Ladapo (2010) in a related study determining the postharvest losses of plantain among farmers and wholesalers in Southwestern Nigeria, where it was reported that farmers incurred high rate of losses than the marketers. This implies that farmers in the study area need to be educated to be highly engaged in various postharvest handling activities in order to ensure reduction in the rate of postharvest losses of tomato among the producers.

Table 2: Distribution of tomato farmers' level of postharvest handling activities of tomato

Postharvest handling activities parameters	Tomato Farmers (n = 231)			
	Frequency of engagement			
	Always	Occasionally	Never	
Harvesting activities	%	%	%	Mean
Harvesting of tomato in the cool part of the day	95.7	2.6	1.7	1.98
Use of sharp knives for harvesting fresh tomato	4.3	1.30	94.4	0.06
Cutting of sharp fingernails before harvesting	0.9	17.7	81.4	0.10
Precooling activities				
Spreading tomato under the trees immediately after harvesting	3.9	31.2	64.9	0.24
Spreading the tomato on a verandah at home	8.7	2.6	88.7	0.05
Keep harvested tomato in a well-ventilated shops to remove excess heat	5.2	8.7	86.1	0.04
Sorting and Grading Activities				
Sorting of tomato according to different sizes before packaging	13.0	42.4	44.6	0.81
Sorting and grading of tomato based on the colour (ripeness)	7.5	52.0	41.1	0.67
Packaging Activities				
Packaging fresh tomato with the use of collapsible slatted wooden box	4.3	2.2	93.5	0.06
Packaging fresh tomato with the use of use of woven baskets	97.4	2.2	0.5	1.97
Packaging fresh tomato with the use of use of Nestable plastic crates	0.5	23.7	75.8	0.26
Storage Activities				
Storing fresh tomato in the cold room	0.5	5.2	94.3	0.06
Storing fresh tomato in the refrigerator	0.5	4.3	95.2	0.05
Preserving fresh tomato using pot - in- pot method	0	0	100	0.03
Transportation Activities				
During the cool period of the day	26.8	69	3.9	1.22
Use of cool van	1.3	26.4	72.3	0.29
Piling baskets of tomato in the truck	91.3	6.1	2.3	1.88
Processing Activities				
Slicing and Sun drying	16.0	72.3	11.7	1.08
Use of hybrid dryer	0	0	100.0	0.00
Use of multipurpose dryer	0	0	100.0	0.00

Table 3: The rate of losses incurred among tomato farmers

Rate of losses incurred	Tomato farmers n= 231)	
	F	%
Low rate of losses	95	41.13
High rate of losses	136	58.87
Mean	12.51	
SD	8.90	
Minimum	0.60	
Maximum	74.60	

PPMC analysis of relationship between selected enterprise characteristics and losses incurred

The result from Table 4 shows that there was a significant relationship between farmers' years of experience ($r = -0.163$, $p < 0.05$), size of tomato farm ($r = 0.279$, $p < 0.05$), quantity produced ($r = 0.272$, $p < 0.05$) and the rate of losses incurred. This suggests that years of experience, size of tomato farm and quantity produced have significant influence on the rate of tomato losses among farmers in the study area. The positive relationship between

the quantity produced and the high rate of losses indicated that the more the tomato is produced the higher the rate of losses incurred. More so, the larger the farm size the more the rate of losses incurred. These losses could be as a result of inadequate processing centers around the production centers and storage facilities where fresh tomato could be either processed or stored for future use in order to militate against losses of the tomato to achieve food security.

**Table 4: Correlation analysis between tomato farmers selected personal and enterprise characteristics and rate of losses incurred**

Variables	r- value	p-value
Age	0.050	0.467
Household size	0.095	0.168
Years of experience	-0.163	0.032
Income from tomato	0.081	0.240
Income from other sources	0.006	0.929
Size of tomato farm(acres)	0.279	0.042
Quantity produced / bought last year (kg)	0.272	0.045

Note: r = correlation coefficient, p = significance level

Relationship between levels of engagement in postharvest handling activities of tomato and the rate of losses incurred among farmers

The result from Table 5 shows that there was significant relationship between farmers' ($r = -0.163$, $p < 0.05$) level of engagement in various postharvest handling activities of tomato and the rate of losses incurred. The negative relationship

between level of engagement and rate of losses implies that the more the tomato farmers engage in various postharvest handling activities of tomato, the less the rate of losses to be incurred and vice-versa. This implies that to reduce the rate of losses of tomato, the respondents need to be highly engaged in various postharvest handling activities of tomato in the study area.

Table 5: Correlation analysis between respondents' level of engagement in postharvest handling activities and the losses incurred

Variables	r – value	p – value
Level of engagement in postharvest handling activities and losses incurred	-0.163	0.037

Note: r = correlation coefficient, p = significance level, Sig = Significant

CONCLUSION AND RECOMMENDATION

The tomato farmers incurred high rate of postharvest losses in tomato, probably due to their low level of engagement in postharvest handling activities. The rate of tomato losses incurred tend to decrease with small farm size and low quantity and increase with large farm size and high quantity of tomato produced. Therefore, tomato farmers should be enlightened and more engaged in the use of modern ways of postharvest handling activities to reduce the rate of postharvest losses of tomato.

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PERCEPTION OF TELEVISION ADVERTORIAL ON PROMOTION OF HOME-GROWN RICE AMONG CONSUMERS IN OYO STATE, NIGERIA

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ABSTRACT

Promotion of home-grown rice is a major focus of the current government through advertorial. However, the perception of rice consumers on these advertorials is yet to be ascertained. Therefore, the study investigated consumers' perception of television advertorial promoting home grown rice. Questionnaire was administered on a randomly selected sample of 135 rice consumers in Oyo state, and data generated were analysed using percentage, mean frequency distribution and Pearson's Product Moment Correlation (PPMC). Findings from the study revealed that the respondents had a mean age of 40 years and 99.3% possessed a television set. Most (60.0%) of the respondents spent about 1-2 hours watching television per day. Majority (82.0%) of the respondents had high level of knowledge on television advertorial promoting home grown rice. Also more than half of the respondents (58.5%) had favourable perception of the advertorial. In addition, respondents' knowledge ($r=0.025$; $p < 0.05$) significantly related to their perception of the advertorial. The respondents had favourable perception towards television advertorials promoting home grown rice. However, there is need for the content of television advertorial promoting home grown rice to be improved upon to meet the needs of the respondents.

Keywords: Home grown rice, rice consumers, television advertorials.

INTRODUCTION

Rice is one of the crops being promoted under the Federal Government of Nigeria's Agriculture Promotion Policy (2016-2020) given its growing importance and prominent role among staple food crops in Nigeria. Adewumi, Olayanju and Adewuyi (2007) observed that rice production and processing are profitable ventures in Nigeria. The country has a history of indigenous rice production and high demand (Johnson, Takeshima, and Gyimah-Brempong, 2013). Thus, it is not surprising that rice has emerged as a major staple food crop in Nigeria, given its demand in all the six geopolitical zones and across all socio-demographic groups (Gyimah-Brempong, Johnson and Takeshima, 2016). The increasing domestic demand for rice in Nigeria has been attributed to consumer preferences, increasing incomes and rising urban population, among others (Nwanze, Mohapatra, Kormawa, Keya, and Bruce-Oliver, 2006).

Home grown rice ("Bida Rice", "Ofada Rice", "LAKE Rice" or "Abakaliki Rice") in Nigeria and other indigenous brand names in other countries have a lot to offer when it comes to health benefits and contain un-adulterated nutrients which is good for the body and overall health. Home grown "unpolished or brown" rice contains lots of nutrients compared to the polished rice, and these nutrients include carbohydrate, protein, high fibre, fats, vitamins and minerals such as folic acid, phosphorus, vitamin B1 (thiamine), vitamin B3 (niacin), magnesium, selenium, manganese and iron.

It is believed that home grown rice do not cause any kind of allergic reaction, unlike the polished rice. It helps in reducing chronic illnesses such as infertility, accelerated ageing, gastrointestinal problems etc., which is gotten from genetically modified foods, due to the chemicals used in the processing, which are mostly present in

the food. Local/brown rice contains diverse ranges of nutrients, which help in improving the skin tone, help in the treatment of many skin and hair conditions such as psoriasis and hair loss. Its content of ferulic acid also makes it an anti-ageing property which is good for the skin (Finelib.com, undated). Since several efforts made by government cannot address low patronage of home grown rice, there is strong need for the television advertorials on promotion of home grown rice among rice consumers in Oyo state, Nigeria.

The word advertising came from the Latin word 'advertere' which means "to turn the mind toward". The American Marketing Association (2016) recommends the definition of advertising as any paid form of non-personal presentation and promotion of ideas, goods and services by an identified sponsor". The AMA points out "that advertising is a tool of marketing along with the product and its packaging, price, distribution and personnel selling. Definitely advertising is openly and overtly subsidized information and persuasion, and its task is to present and promote for more than merchandise. Therefore promotion is 'non-personal', It is directed "to whom it may concern". If advertising is effective, it is because the audience is receptive to it.

According to Kenton (2021), firms advertise in order to increase demand to the point where economies of scale are achieved. The advertiser may wish initially to build primary demand for the group as a whole, anticipating that he will benefit to build proportionally from the overall growth of the market. However, most Nigerian advertisers primarily advertise to create brand awareness that would eventually lead to brand preference and subsequently to a decision to purchase. Primary advertisement can only work in developed countries where it is done by a group of

sellers who typically compete against each other (Nnabuko, 2008). In another of his contributions, Oyedokun, Adalakun and Akinyemi (2015) also claims that a company advertises to increase the demand of its products and hence stimulate sales.

Television is one of the most powerful and influential medium of communication around the world. As a result of its powerful effect, most advertisers rely on television for advertisement of their products and services to attract the viewers as they are their target audience in most of the cases. Advertising in the media has become a powerful communication tool in passing messages about the products and services to both viewers and potential customers in the society.

The current administration has been making several efforts since its inception to improve agricultural production; home grown rice production inclusive. Some of the strategies employed are the formulation of policies in favour of local products, creation of Agriculture Promotion Policy (2016-2020) and deliberate steps that will bring down the price of home grown rice to combat the unhealthy status of imported rice being dumped in the country. These are in addition to unavailing ban that was placed on importation of rice, the creation of awareness on the need and importance of consuming home grown rice by employing media such as television advertorials (like that of Saka and Zebrudaya on the National Television), newspapers and the likes.

Adekoya (2011) revealed that advertising influences consumer buying behaviour, which means it helps to increase favourable perception towards a product. Basically, two television advertorials on home grown rice were aired on different television stations in Nigeria. The first one is a form of comedy and short drama featuring Saka and Zebrudaya as the central characters. It portrayed the good taste and other advantages of eating and patronizing local rice. The second one which is a television jingle, is a Ministry of Agriculture and Rural Development Advertorial on the promotion of locally produced commodities including home grown rice. The advertorials were usually aired early in the morning between 8am and 10am and later in the evening during network news of Nigerian Television Authorities (NTA). The two advertorials were broadcasted in NTA, Trybe Television and African Magic Yoruba. The former advertorial was considered for this study.

It is pertinent to note that most studies on the home grown rice in Nigeria have humbled focus on investigating the perceptions of television advertorial on home grown rice by rice consumers in Oyo state, despite the recent effort of the government to promote its consumption through the sensitization of its populace using television advertorial. Sowunmi, Omigie and Daniel (2014) determined the consumers' perception of Ofada rice,

while Onu (2018) examined consumers' preference for imported and Nigerian rice and Ogunleke and Baiyegunhi (2019) x-rayed the effect of households' dietary knowledge on local (ofada) rice consumption. However, there is dearth of information on how television advertorial has improved perception of consumers about local rice which is crucial for satisfactory patronage. Hence, this study investigated the perception of television advertorial on promotion of home grown rice among rice consumers in Oyo state, Nigeria.

The general objective of this study is to examine the perception of television advertorials on promotion of home grown rice among rice consumers in Oyo State Nigeria. The specific objectives are to:

1. Describe the socio-economic characteristics of the respondents.
2. Ascertain the level of knowledge of the respondents on television advertorial promoting home grown rice.
3. Determine respondents perception on television advertorial promoting home grown rice in the study area

The hypothesis tested for the study was stated in null form as follows: There is no significant relationship between respondents' knowledge and their perception of television advertorial promoting home grown rice

METHODOLOGY

Oyo State is one of the states in south-western Nigeria, with its capital at Ibadan. It is bounded in the north by Kwara State, in the east by Osun State, in the south by Ogun State and in the west partly by Ogun State and partly by the Republic of Benin.

The population of the study comprised rice consumers in Ibadan Metropolis. A multi-stage sampling procedure was used for this study. Simple random sampling was used to select 10% of the 33 local government areas in Oyo State. Therefore, Ibadan North, Ibadan Southwest and Akinyele local government areas were selected. There are 12 wards in each of Ibadan North, Ibadan Southwest and Akinyele local government areas and 20% of the wards were randomly selected making a total of 6 wards. Ibadan North Ward 4, Ibadan North Ward 12, Ibadan Southwest Ward 7, Ibadan Southwest Ward 9, Akinyele Ward 10 and Akinyele WARD 12 have 10, 6, 8, 11, 12, and 10 communities, respectively. One community each was selected from each of the wards, which signifies 10% of the wards. Lastly, a total of 135 respondents were selected from the communities using convenience sampling technique. Quantitative data were collected through the use of interview schedule.

Respondents' knowledge of the television advertorial on home grown rice was measured through eleven knowledge questions. Right and



wrong answers were scored 1 and 0, respectively. The mean score generated from the total scores computed for each of the respondents which was 9.6 was used as bench mark for determining respondents that have high and low knowledge of the television advertorials on home grown rice. Also, the respondents' perception of the television advertorial was measured with seventeen perception statements with response options of strongly agree, agree, undecided, disagree and strongly disagree and were assigned 5, 4, 3, 2 and 1, respectively for positively worded statements and reverse order for negatively worded statements. The total score for each respondent was computed and the generated mean score of 62.70 was used to categorise the respondents into those that have favourable and unfavourable perceptions of the television advertorial on home grown rice.

RESULTS AND DISCUSSION

Respondents' socio-economic characteristics

In Table 1, the mean age of the respondents was 40.1 years which implies that majority of the respondents are still in their active and productive

ages, which can meaningfully contribute to agricultural development in the area. This finding is corroborated by the findings of Badiru (2013) that alluded to 43.99 as the mean age of respondents in an earlier study conducted in the study area. Furthermore, results show that 10.4% of the respondents had farming as their major occupation, 24.4% had trading as their major occupation, 38.4% were artisans and 30.4% were either civil servants or private establishment workers. This suggests that majority of the respondents were either entrepreneurs or civil servants. Results in Table 1 also reveal that majority (99.3%) of the respondents owned television sets in their homes. This suggests that majority of the respondents have more access and are more likely to be exposed to information disseminated through the television. Also, result shows that majority (81.5%) of the respondents often watched television while 18.5% of the respondents rarely watched television. This suggests that the television is an effective tool in reaching people in the study area due to its abundance and its popularity among viewers.

Table 1: Distribution of the respondents by socio-economic characteristics

Variables	Frequency	Percentage	Mean
Age			
≥25	4	3.7	40.18
26-35	49	36.3	
36-45	40	29.6	
46-55	28	20.7	
55 and above	13	9.6	
Major occupation			
Farming	14	10.4	
Trading	33	24.4	
Artisan	47	34.8	
Civil servant/Private	41	30.4	
T. V Ownership			
No	1	0.7	
Yes	134	99.3	
Frequency of watching T. V			
Rarely	25	18.5	
Often	110	81.5	
Hours of Watching T.V daily			
Less than 1hr	19	14.1	
1-2 hours	81	60.0	
Above 3 hours	35	25.9	

Source: Field survey (2019)

Respondents' knowledge about television advertorial promoting home grown rice

Table 3 shows that a larger percentage of the respondents (60.7%) had high knowledge of the

television advertorial promoting home grown rice. This implies that the respondents have useful information that can aid their decision on the consumption of home grown rice.

Table 2: Distribution of knowledge of respondents (n=135)

S/N	Test of knowledge	Right
1	The T.V. advertorial on home grown rice contains information on good taste of the rice	91.9
2.	The final scene of the advertorial portrayed good processing of the rice	79.3
3.	In the advertorial the characters demanded for home grown rice	94.1
4.	The television advertorial is sponsored by the federal government	94.8
5.	The television advertorial is promoting the rice revolution programme	95.6
6.	The two major scenes of the advertorial is about characters demanding for home grown rice	90.4
7.	In the advertorial, one of the characters made mention of the home grown rice as a healthy food	78.5
8.	The television advertorial is in form of a drama	77.0
9.	In the first scene of the advertorial, the character who asked if the rice was home grown rice is Saka	91.1
10.	The character whom said customer “dada nii” in the advertorial is Anabel David	73.3
11.	In the advertorial the character Zebrudaya made mention of the good taste of the rice	94.1

Table 3: Distribution of Knowledge level of respondents

Knowledge level	Knowledge score groups	Frequency	Percentage
Low	Less than 9.6	53	39.3
High	9.6 and above	82	60.7

Respondents’ perception of the television advertorial promoting home grown rice

Results in Table 4 indicate that the most of the respondents (93.4) agreed to the statement that the advertorial need to address the price of home grown rice. Also, the respondents (80.7%) disagreed that the characters in the advertorial do not play their roles well. However, 40.0% of the respondents agreed that the advertorials had contributed to increase in the consumption of home grown. On a general note, the respondents had favourable perception on almost all the statements on the television advertorials. This is an implication that the respondents have good impression about the television advertorials on home grown rice.

The result in Table 5 revealed that 58.5% of the respondents were favourably disposed to advertorials promoting home grown rice. This implies that the respondents believed that the television advertorials promoting home grown rice are of significant benefit to them. Hence, there is high tendency that the respondents will patronize and also encourage others to promote home grown rice. Furthermore, the respondents will be willing to

watch similar advertorials. This is in contrary with finding of Lodziana-Grabowska (2016) which revealed 63% of consumers had unfavourable perception about the reliability of content of television advertorials.

Relationship knowledge and the perception of the respondents on the television advertorial promoting home grown rice

The test shows that there was significant relationship between respondents’ knowledge ($r=0.025$; $p < 0.05$) and their perception of the television advertorial promoting home grown rice. This indicates the knowledge of the respondents influenced their perception of the television advertorials promoting home grown rice. As a result, the more the respondents are knowledgeable about the television advertorial on home grown rice, the more their favourable perception about the television advertorial will improve. This is in line with finding of Israel and Oguche (2018) which affirmed that relationship exist between students’ knowledge and perception of social media advertising.

**Table 4: Distribution of respondents by perception of the television advertorial promoting home grown rice**

S/N	Statements	SA	A	D	SD
1.	Advertorial promoting home grown rice are not of significant benefit to me	12.6	8.1	38.5	32.6
2.	The advertorial is a good way of promoting home grown rice	54.1	30.4	10.4	10.4
3.	The information from the advertorials are irrelevant	7.4	8.9	60.0	11.9
4.	The advertorial has contributed to increase home grown rice consumption	23.0	17.0	28.9	6.7
5.	The advertorial has helped to educate consumers on the good taste of home grown rice	31.9	32.6	19.3	3.0
6.	The packaging of the advertorial is poor in my own view	11.9	8.1	48.9	23.7
7.	The information obtained from the advertorial are not enough	49.6	23.0	16.3	4.4
8.	The characters used for the advertorial are suitable	68.1	21.5	4.4	1.5
9.	The advertorials promoted the consumption of home grown rice	47.4	33.3	9.6	3.7
10.	The advertorial is boring due to incessant repetition	3.7	3.0	35.6	52.6
11.	The advertorial needs to address issue of price of home grown rice	70.4	23.0	2.2	0.0
12.	The message of the television advertorial are easy to grasp	41.5	45.2	5.2	1.5
13.	The television advertorial never needed to contain information on the health benefit of home grown rice	7.4	5.2	45.2	37.8
14.	The benefit derived from home grown rice does not worth the time invested in it	9.6	5.2	48.9	23.0
15.	The advertorial on home grown rice does not really support the rice revolution programme	5.2	5.9	54.8	25.2
16.	The characters in the television do not play their roles well	7.4	5.9	47.4	33.3
17.	The advertorial contains information needed by consumers	66.7	21.5	4.4	7.0

Source: Field Survey 2019

Table 5: Respondents' level of perception

Perception	Frequency	Percentage
Unfavourable	56	41.5
Favourable	79	58.5

NB: Mean = 62.70, Minimum = 43 and Maximum = 77

Table 5: Results of Pearson Product Moment Correlation (PPMC) showing relationship knowledge and the perception of the respondents on the television advertorial promoting home grown rice.

Variable	r-value	p-value
Knowledge	0.025	0.000*

*Significant at $p < 0.05$

CONCLUSION AND RECOMMENDATIONS

Consequent upon empirical evidences from this study, it can be concluded that the respondents were in their active and productive ages, and can meaningfully contribute to agricultural development especially in the promotion of home grown rice. Also, they were knowledgeable about television advertorial promoting home grown rice and were favourably disposed to television advertorial

RECOMMENDATIONS

Based on the empirical findings, discussions and conclusions drawn from this study, the following recommendations are made:

1. In view of the percentage of television stations broadcasting television advertorials promoting home grown as earlier affirmed in this study, the extension agents should encourage privately owned television stations and networks to promote home grown rice, since its target audience is relatively large. This will help in sustaining and increasing advertorials on

home grown rice. This is buttressed further by the fact that there is for more people to be knowledge and formulate encouraging opinions about home grown rice.

2. There is a strong need for the content of television advertorials promoting home grown rice to be improved upon to meet the needs of the respondents, as majority of them earlier affirmed in this study that their perception towards these advertorials is that it does not contain enough information. Therefore, television stations should adopt more participatory approach to involve agricultural communication experts in the planning and execution of such agricultural advertorials.

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UTILISATION OF INDIGENOUS PRACTICES FOR THE CONTROL OF ARMYWORM AMONG MAIZE FARMERS IN OYO STATE, NIGERIA

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ABSTRACT

Armyworm pest infestations are not without economic, environmental and social burdens for maize farmers. Control measures have also posed a serious challenge because of its resistance to major chemicals available in Nigerian market. Indigenous practices as a measure to control the pest among maize farmers in Oyo state was therefore investigated. The study used four-stage sampling procedure to select 121 respondents using Agricultural Development Programme (ADP) structure. Questionnaire and In-depth Interview (IDI) were used to elicit information on respondents' socioeconomic characteristics, sources of information, maize farmers' utilisation of indigenous methods, effectiveness of the indigenous practices and constraints to the use of indigenous knowledge for armyworm control. Data were analysed using descriptive and inferential statistics at α 0.05. Respondents' mean age was 57.1 ± 12.4 . They were predominantly male (73.6%), married (66.9%), had a household size of 6.9 ± 2.8 persons and earned an annual income of above ₦500,000 from maize production. Majority (87.6%) attained one form of formal education or the other and more than half (57.8%) had at least 20 years farming experience. Aged experienced farmers were ranked as highest sources of information ($\bar{x}=1.91$) and Indigenous practices mostly utilized in the study area were neem leaves ($\bar{x}=1.33$) and Siam weed ($\bar{x}=1.32$) soaked in water to spray infected plants. Constraints to utilisation included high labour intensity involved in the preparation ($\bar{x}=2.07$), scarcity of resources ($\bar{x}=2.00$) and secrecy of indigenous practices used ($\bar{x}=1.82$). Respondents perceived the use of Neem leaves ($\bar{x}=1.33$), Siam weed ($\bar{x}=1.32$) and Palm sheaves ($\bar{x}=0.93$) to be more effective in the control of armyworm. Utilisation of indigenous practices had significant relationship with year of farming experience ($r=0.083$). Effort should be made by researchers and extension agents to repackage and document indigenous practices for adoption among maize farmers in the study area.

Keywords: Indigenous practices, Armyworm, Pest control, Maize cultivation, Cultural practices

INTRODUCTION

Maize is the second most important cereal crop worldwide after wheat (Awata *et al.*, 2019). Maize is a staple food of great economic importance in sub-Saharan Africa and Nigeria, and has now risen to its commercial crop status on which many agro-based industries depend on as a source of raw material (Tajamul *et al.* 2016). It is an important food and annual crop that is cultivated in all agro-ecological zones of Nigeria and extensively grown across the world. Africa produces 6.5% of maize worldwide, while Nigeria, which produces nearly 8 million tons annually, is the largest producer in Africa (Oni and Odekunle, 2015). It is one of the important grains in the country, not only on the basis of the number of farmers engaged in maize cultivation, but also in its economic value (Coster and Adeoti, 2015). It is considered to be the miracle seed for Nigeria's agricultural and economic development (Onuk *et al.*, 2010). The demand for maize will double in the developing world by 2050, and maize is predicted to become the crop with the highest production globally and in the developing world by 2025 (Cairns *et al.*, 2012). However, maize production has been declining in recent times, partly as a result of armyworm (*Spodoptera frugiperda*) infestation in the country (IAPPS, 2016). Armyworm attacks many crops, but shows a strong preference for maize (FAO, 2017).

It was first detected in Central and Western Africa in early 2016 (Benin, Nigeria, Sao Tome and

Principe, and Togo) and in whole of mainland Southern Africa (except Lesotho and the Island States), in Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Gambia, Ghana, Guinea Bissau, Niger, Senegal, and Ethiopia, Burundi, Kenya, Rwanda, South Sudan, Uganda, and it is expected to spread further, probably beyond the African continent. Its modality of introduction, along with its ecological adaptation across Africa is still speculative (FAO, 2017). The effects of armyworm infestation go far beyond reducing crop yields in a season. The vast majority of farmers in Sub-Saharan Africa are smallholder family farmers, who often depend on production to maintain household food and nutrition security, as well as household livelihoods. There are tens of millions of smallholder family maize farmers across Sub-Saharan Africa, farming the majority of the 35 million hectares of maize produced annually in the region. For the most part, the farmers face very significant risks with little risk transfer mechanisms and marginal economic viability of their production systems, putting them at great risk to the added shock of armyworm infestation.

The introduction of significant use of pesticides, especially in maize-based cropping systems risks both the economic viability of these systems and poses a significant threat of putting smallholder farm families on an unsustainable "pesticide treadmill" (FAO, 2017). This control measure posed a serious challenge because of

armyworm resistance to major chemicals available in Nigerian market coupled with residual effects on the environment in the long run (Huang, *et al.* 2014). Furthermore, improper handling and application of the chemicals can predispose humans to health hazards such as cancer (Weichenthal *et al.*, 2010).

In view of the foregoing, an alternative pest control measures that is sustainable and environmentally friendly will be a better option for consideration. Farmers can use indigenous practices such as bio-pesticides or simple plant extracts, which can be prepared at home and sprayed on the maize to keep away the pest. This consideration otherwise called indigenous practice involves combination of knowledge and practices established through past experiences and observations that are held and used by people (Masango, 2010). It is informal knowledge, skills and practices that are not obtained through formal education but rather through the local heritable ways in rural areas (Lodhi and Mikulecky, 2010). It is knowledge which has been accumulated by people over generations by observation, experimentation and experience (Ofor *et al.*, 2010). Among farmers, there is awareness of wide range of plant species with pesticide effects and various materials, devices which could be used to trap, chase or destroy pests or keep pests away from crops (Okwute, 2012). Indigenous knowledge on insect pests is considered vital because it was found to be essential at providing food security and survival of users of such knowledge, long before the intervention of synthetic pesticides (Lodhi and Mikulecky, 2010). It can serve as the basis through which appropriate technology can be generated by research institutes that will be socially acceptable, economically viable and environmentally friendly. This knowledge can be used to produce simple, cheap, traditional technology that can produce immediate results and could be integrated into existing cropping systems. However, the utilisation of indigenous knowledge is being challenged, as majority of farmers have turned to modern agriculture that involves use of synthetic pesticides. This study was therefore carried out to empirically assess maize farmers' indigenous practices for the control of armyworm.

The general objective of this study was to assess maize farmers' indigenous practices for the control of armyworm in Oyo State, Nigeria. The specific objectives were to describe the socio-characteristics of maize farmers, identify maize farmers' sources of information on indigenous practices for control of armyworm, determine the indigenous practices utilized by maize farmers for control of armyworm, ascertain perceived effectiveness of the indigenous practices utilized and identify maize farmers' constraints to use of indigenous practices for control of armyworm. The hypotheses were: there is no significant relationship between maize farmers' socio-economic

characteristics, constraints to use of indigenous practices and indigenous practices for control of armyworm.

METHODOLOGY

The study was carried out in Oyo State which is one of the 36 states of Nigeria. Oyo is located between latitude 7°2' and 9°1' North of the equator and between longitude 2°5' and 4°3' east of the Greenwich Meridian. The mean annual rainfall ranges from 56 inches in the south and 46 inches in the north. Multistage sampling procedure was used to select respondents for the study. Two out of the four ADP zones were randomly selected in the first stage (Ibadan/Ibarapa and Oyo zones), after which thirty percent of the 9 and 5 blocks in Ibadan/Ibarapa and Oyo zones respectively were randomly selected to give a total of 5 blocks (3 and 2 blocks respectively). Thirty percent of the 8 cells in each selected block were randomly selected to give a total of 10 cells. Ten percent of the registered maize farmers in the selected cells were randomly selected to give a total of 121 respondents.

The measurement of the variables of the study was done as follows:

- i. Sources of information on indigenous practices for control of armyworm were measured using a 3-point scale of always, sometimes and never. These were scored 2, 1, and 0, respectively. The maximum and minimum score was 16 and 0, respectively. Mean scores were generated and used to rank the sources of information in order of importance.
- ii. Utilisation of indigenous practice methods for armyworm control was measured using a 3-point scale of always, occasionally and never. These were scored 2, 1, and 0, respectively. The maximum and minimum score was 40 and 0 respectively. Mean scores were generated and used to rank the methods in order of importance.
- iii. Perceived effectiveness of the indigenous practices utilized – An In-depth Interview (IDI) was conducted with four leaders of maize farmers' group to ascertain the perceived effectiveness of the indigenous practices utilized. Responses were subjected to descriptive analysis to arrive at the perceived effectiveness of the indigenous practices utilized.
- iv. Constraints to use of indigenous practice for armyworm control was measured using a 3-point scale of severe, mild and not a constraint. These were scored 2, 1, and 0, respectively. The maximum and minimum score was 21 and 7, respectively. Mean scores were generated and used to rank the constraints in order of severity.



RESULTS AND DISCUSSION

Socioeconomic characteristics

Results of the analysis of the socio-characteristics of the respondents as shown in Table 1 indicate that more than half (54.6%) of the respondents were between the ages of 50 – 69 years. The mean age of 57.1 years indicates an ageing group of farmers, but aged farmers are often considered the custodians of indigenous knowledge which is passed down from generation to generation. Owolabi and Okunlola (2015) observed that most farmers receive information on indigenous knowledge from aged farmers. It is worthy to note that age determines the level of farmers' involvement in farming activities (Taiwo and Kuponiyi, 2013). Majority (73.6%) of them were males. This gives a reflection that males were more involved in agriculture in the study area. Binuomote *et al* (2017) similarly noted that males are more involved in farming than female as they possess the energy required to meet the demands of agricultural

activities. The educational attainment was high, with 87.6% of them having attained one form of formal education or the other and 44.6% having had tertiary education. This high literacy level is expected to make the respondents appreciate the risks armyworm poses to maize production and hence take measures to mitigate them. More than half (57.8%) had farming experience of at least 20 years, with the mean farming experience of 27.6 years. This indicates that most of the farmers are to an extent, experienced in maize farming, which according to Ogaji (2010), and has the probability of influencing their interest and knowledge about farming and indigenous practices. More than half (52.9%) of the respondents earned an annual income of above ₦500,000 from maize production, pointing out that their farm income were reasonably profitable. This might make them take measures to prevent any damage that can be caused by pests such as armyworm.

Table 1: Distribution of respondents by socio-characteristics

Variable	Category	Frequency	Percentage	Mean	Standard deviation
Age	30-39	9	7.4	57.1	12.39
	40-49	27	22.3		
	50-59	29	24.0		
	60-69	37	30.6		
	70 and above	19	15.7		
Sex	Male	89	73.6	27.56	19.56
	Female	32	26.4		
Education	No formal education	15	12.4		
	Primary school	21	17.4		
	Secondary school	31	25.6		
	Tertiary	54	44.6		
Religion	Christianity	50	41.3	6.9	2.82
	Islam	65	53.7		
	Traditional	6	5.0		
Marital status	Single	6	5.0		
	Married	81	66.9		
	Divorced	4	3.3		
	Widow(er)	30	24.8		
Years of farming experience	< 10	20	16.5	27.56	19.56
	10-19	31	25.6		
	>20	70	57.8		
Household size	≤6	60	47.1	6.9	2.82
	7-12	48	40.2		
	>12	13	10.2		
Income (annually)	<250000	22	18.2		
	250001-500000	35	28.9		
	500001-750000	17	14.1		
	>750000	47	38.8		

Source: Field survey, 2017

Sources of information on indigenous practices

Table 2 shows the different sources through which the respondents receive information on indigenous practices. Aged farmers (\bar{x} =1.91), fellow farmers (\bar{x} =1.50) and farmers' groups (\bar{x} =1.49) were vital sources of information on

indigenous practices available to the respondents. Aged farmers are often considered the custodians of indigenous practices as they are passed down from generation to generation, usually by word of mouth. Owolabi and Okunlola (2015) noted that most farmers receive information on indigenous practices

from their grandparents some of whom are aged farmers. Farmers often belong to farmers' groups because of the benefits they can derive from such

groups, as for instance they are important in relaying latest information on farming practices to farmers.

Table 2: Distribution of respondents based on sources of information on indigenous practices

Sources of information	Mean	Rank
Aged farmers	1.91	1 st
Fellow farmers	1.50	2 nd
Farmers group	1.49	3 rd
Radio	1.07	4 th
Television	0.93	6 th
Extension workers	0.95	5 th
Researchers	0.84	7 th
Cooperative society	0.66	8 th

Source: Field survey, 2017

Indigenous practices Utilised for control of armyworm

Table 3 shows that the indigenous practices mostly employed by the maize farmers in the study area were neem leaves soaked in water ($\bar{x}=1.33$), Siam weeds soaked in water ($\bar{x}=1.32$) and palm sheaves burned to ashes and mixed in water ($\bar{x}=0.93$). This is premised on the fact that farmers employ different indigenous practices depending on how convenient it is to them. It was found out during

the course of the study that though indigenous practices are effective in controlling pests such as armyworm, they however do not have a fast action and any potential damage a farmer is trying to prevent may have been inflicted on crops before they become effective. Bio-pesticides, which are plants extract can be instrumental as part of an Integrated Pest Management (IPM) approach that is normally used for short-term pest control against the armyworm (Pretty and Bharucha, 2015).

Table 3: Distribution of respondents based on the extent indigenous practices utilisation

IK methods in study area	Preparation and application	Mean	Rank
Neem leaves soaked in water	Grinded neem leaves are soaked in water for at least one day, after which the mixture is filtered. The filtrate is then sprayed on maize plants.	1.33	1 st
Siam weeds soaked in water	Grinded siam leaves are soaked in water for at least one day, after which the mixture is filtered. The filtrate is then sprayed on maize plants.	1.32	2 nd
Palm sheaves (<i>Aran ope</i>) burned to ashes and mixed in water	Ash from palm sheaves is soaked in water for a while after which the mixture is filtered. The filtrate is then diluted and sprayed on maize plants.	0.93	3 rd
Fruitless pawpaw leaves soaked in water	Pawpaw leaves are grinded and soaked in water for at least one day, after which the mixture is filtered. The filtrate is then sprayed on maize plants.	0.78	4 th
Dry ashes mixed in water	Ash from any material is soaked in water for a while after which the mixture is filtered. The filtrate is then diluted and sprayed on maize plants.	0.73	5 th
Sun flower (<i>Ewe sepeleba</i>) soaked in water	The whole sun flower plant is grinded before it is soaked in water. After a while the mixture is filtered and used to spray maize plants.	0.67	6 th
Locust beans (<i>Irupete</i>) soaked in water	The paste of locust beans is soaked in water for some days. The mixture is filtered and used to spray maize plants.	0.60	7 th
Red pepper (<i>Rodo</i>) soaked in water	Grinded pepper fruits are soaked in water for some time. The mixture is thereafter filtered and used to spray maize plants.	0.36	8 th
Red pepper and tobacco leaves mixed with neem leaves soaked in water	Grinded pepper fruits are soaked in water for some time. The mixture is thereafter filtered and used to spray maize plants.	0.29	9 th

Source: Field survey, 2017

Perceived effectiveness of indigenous Practices utilized

An In-depth Interview (IDI) account with male and female maize farmers' group leaders

revealed that neem solution is widely used because of its effectiveness. One of the interviewees put it this way:



"I soaked the leaves in water for three days, after which the solution was sieved to remove the leaves. The extract/solution was then applied to the affected maize plants with the use of a knapsack sprayer. The action was very effective as I did not notice any subsequent damage to the leaves of the maize plants. Also, the population of the worm was totally wiped out" (IDI, Maize Farmers Leader Ibadan/Ibarapa zone 2017).

Other interviewees opined that:

"The use of neem extract comes with no cost implications, which makes it convenient for farmers to use. The solution is quite effective when the worm is still at the early stage of development i.e. larva stage. However, when the worm has gone beyond the larva stage, the solution will not be able to completely destroy it. After spraying with the solution, the worm may be incapacitated for some days but will reappear subsequently" (IDI, Maize Farmers Leader Oyo zone 2017).

This submission is in tandem with the assertion of Organic Farmer (2018) that asserted that most pesticides in the market cannot control the pest if it is at the first and third stage (eggs, pupae or third

instar). Therefore, it is not advisable for farmers to go for expensive chemical pesticides because the chemical pesticides cannot control the pest at egg or pupae stage.

Constraints to the use of indigenous practices

Results in Table 4 show that the most serious constraint to the use of indigenous practices by the respondents was that it is labour intensive ($\bar{x}=2.07$). This finding aligns with Onoh *et al* (2012) who identified the labour intensive nature of indigenous practices as a limiting factor to its use. Lack of resources ($\bar{x}=2.00$), secrecy of indigenous practices ($\bar{x}=1.82$) were other major constraints to the use of indigenous practices. Poor awareness ($\bar{x}=1.79$), according to Nnadi *et al* (2013), relates to, among other things, farmers' inability to estimate the efficacy of prepared indigenous practices formulations. Generally, when farmers consider that the limitations to the use of a particular technology are high, they will most likely look out for alternatives measures.

Table 4: Distribution of respondents by constraints to use of indigenous practices

Constraints	Mean	Rank
Labour intensive	2.07	1 st
Lack of resources	2.00	2 nd
Secrecy of Indigenous practices	1.82	3 rd
Poor awareness	1.79	4 th
Climatic factors	1.72	5 th
Modernization	1.61	6 th
Religion	1.37	7 th

Source: Field survey, 2017

Relationship between respondents' socio-characteristics, constraints and indigenous practices for control of armyworm

Tables 5a and 5b show that maize farmers' farming experience ($r=0.08$), age ($r=0.08$), and religion ($\chi^2=5.98$) were significantly related to indigenous practices utilized for control of armyworm. This implies that farmers who possess more years of farming experience are not only expected to be aware of the different indigenous practices that can be used for controlling armyworm, but also the

procedure for their formulations and hence their utilisation. This takes into consideration of an earlier finding of this study which identified aged farmers, who possess ample years of farming experience, as the custodians of indigenous practices. Meludu and Adesina (2014) in a similar study documented favourable disposition of maize farmers to the use of indigenous practices, which was premised on age and years of farming experience. Also, the maize farmers' beliefs serve as a helpful tool for utilisation of indigenous practices.

Table 5a: Correlation analyses between respondents' selected socio-characteristics, constraints and utilisation of indigenous practices for armyworm control

Variable	r-value	p-value
Age	0.08	0.04*
Farming Experience	0.08	0.04*
Constraints	-0.06	0.54

Source: Field survey, 2017. *significant @ ≤ 0.05

Table 5b: Chi-square analyses between respondents' selected socio-characteristics and utilisation of indigenous practices for armyworm control

Variable	χ^2	Df	p-value
Sex	0.15	1	0.70
Marital status	8.11	4	0.09
Religion	5.98	2	0.05*

Source: Field survey, 2017. *significant @ ≤ 0.05

CONCLUSION AND RECOMMENDATIONS

Based on the results from the study, neem soaked in water was the mostly used indigenous practice for controlling armyworm pests due to its perceived effectiveness. The methods used were however associated with constraints such as by high intensity of labour involved in its preparation, scarcity of resources to meet the required application and secrecy of indigenous practices by custodian to divulge information, which in most cases are not documented.

Relevant stakeholders' assistance to mass produce and properly store perceived effective indigenous pesticides will go a long way to promote easy access and wide scale practice needed to mitigate incidence of armyworm infestation among maize farmers. Sensitization programmes through extension agents at the grass root to document and modify indigenous practices would be a potential avenue to achieving environmentally sound agriculture and maintain the ecosystem. Also, publication inform of bulletin would preserve the indigenous practices gradually going into extinction.

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