THE CONTRIBUTION OF IAR GROUNDNUT VARIETIES TO POVERTY ALLEVIATION AMONG FARMING HOUSEHOLDS IN THE NORTH WEST ZONE OF NIGERIA

BY

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS OF SCIENCE (M.Sc.) IN AGRICULTURAL ECONOMICS

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DECLARATION

I hereby declare that this Thesis titled "**THE CONTRIBUTION OF IAR GROUNDNUT VARIETIES TO POVERTY ALLEVIATION AMONG FARMING HOUSEHOLDS IN THE NORTH WEST ZONE OF NIGERIA**" was written by me and it is a record of my research work. It has not been presented before in whole or in part for a higher degree. All borrowed ideas have been duly acknowledged by means of references.

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CERTIFICATION

This Thesis, titled "**THE CONTRIBUTION OF IAR GROUNDNUT VARIETIES TO POVERTY ALLEVIATION AMONG FARMING HOUSEHOLDS IN THE NORTH WEST ZONE OF NIGERIA**" by Grace Zibah **REKWOT**, meets the regulations governing the award of degree of Master of Science (M.Sc.) in Agricultural Economics, Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research is dedicated to The Almighty God.

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ABSTRACT

This research was undertaken to investigate the contribution of IAR groundnut varieties to poverty alleviation among farming households in the North West Zone of Nigeria. Primary data were obtained through the use of well-structured questionnaire from a sample size of 347 comprising of 170 adopters and 177 non-adopters of IAR groundnut varieties. The data were analyzed using descriptive statistics, adoption index, logit regression, Z-Statistic and Foster-Greer-Thorbecke's (FGT) Weighted Poverty Index. The result shows that SAMNUT 24 was identified as the variety planted by a larger proportion (about 62%) of the pooled sample. Thirty eight percent (38%) of the groundnut farming households preferred SAMNUT 24 to other IAR groundnut varieties and a larger proportion of farming households adopted SAMNUT 24 with an adoption rate of about 35%.SAMNUT 24 had the highest intensity of adoption of 94%.The factors that significantly influenced the adoption of IAR groundnut varieties in the study area were found to be agro-ecology($p<0.01$), education ($p<0.05$), membership of cooperative societies ($p<0.1$), household income ($p<0.05$) and extension contact ($p<0.1$). The mean annual income of groundnut farming households (₦303,760.00) that adopted IAR groundnut varieties was higher than the mean annual income of non-adopters (₦196,946.30).The results of the (FGT) Weighted Poverty Index showed that the proportion of poor groundnut farming households who adopted IAR groundnut varieties was lower (19%) compared to the non-adopters(49%). The adoption of IAR groundnut varieties can be a panacea for poverty reduction and a veritable tool for increasing income of groundnut farming households. Therefore, the adoption of IAR developed groundnut varieties should be promoted by public, private and non-governmental organizations as IAR developed groundnut varieties will not only boost production and improve on the nation's financial standing (since groundnut is a cash crop) but also help to improve the income of the farmers, thereby aiding in alleviating rural poverty.

CHAPTER ONE

INTRODUCTION

1.1Background of the study

Nigeria's domestic economy is partly determined by agriculture which accounted for 40.9% of the Gross Domestic Product (GDP) in 2010 (CBN, 2011). Agriculture has been an important sector in the Nigerian economy in the past decades and is still a major sector despite the oil boom. Basically it provides employment opportunities for the teeming population, eradicates poverty and contributes to the growth of the economy. Despite these however, the sector is thus characterized by low yields, low level of inputs and limited areas under cultivation (Izuchukwu, 2011).

Groundnut industry in Nigeria used to be very robust with the famous magnificent groundnut pyramids in Kano but over the years, there has been a decline in groundnut production leading to the collapse of the pyramids. For example, the yield of groundnut increased slightly from 10,157 kg/ha in 1961 to 10,455 in 1985 and subsequently decreased to 10, 000 kg/ha in 2010. Recalling how Nigeria was once the world's leading groundnut exporter in the 1960s, with the crop accounting for about 70% of the country's total export earnings. Ikeazor (2012) stressed that by working with farmers to grow improved varieties of groundnuts that are more resistant to disease, export market demands, and better aflatoxin management to prevent contamination, Nigerian farmers would significantly boost groundnut production and sales in addition to creating employment and yielding significant income for the farmers especially in the Northern and the South Western part of the country. Groundnut is grown in 31 of the 36 states and FCT with Kano and Niger states

accounting for about 19.6% and 10.7% respectively, followed by Kaduna, Benue, Zamfara, Taraba, Bauchi, Borno, Katsina and Nasarawa States (Abate *et al*., 2011). These top 10 producing states account for nearly 80% of the total production of groundnut for Nigeria.

Agricultural growth partly depends more and more on yield-increasing technological change and it is believed that the adoption of new agricultural technology, such as the high yielding varieties (HYV) that led to the Green Revolution in Asia could lead to significant increases in agricultural productivity in Nigeria and stimulate the transition from low productivity subsistence agriculture to a high productivity agro-industrial economy (World Bank, 2008). Achieving agricultural productivity growth will not be possible without developing and disseminating cost effective yield-increasing technologies because it is no longer possible to meet the needs of increasing numbers of people by expanding the areas under cultivation (Kassie *et al.,* 2010). This is in line with Muzari *et al.* (2012) who opined that Agricultural technology development is an essential strategy for increasing agricultural productivity, achieving food self-sufficiency and alleviating poverty and food insecurity among smallholder farmers in sub-Saharan Africa

Agricultural technologies such as improved seed varieties can help reduce poverty through direct and indirect effects (David and Otsuka, 1994; de Janvry and Sadoulet, 2001; Moyo *et al*., 2007; Minten and Barrett 2008; Bercerril and Abdulai, 2009). The direct effects of technology on poverty reduction include productivity gains and lower per unit costs of production, which can raise incomes of producers that adopt technology. There are also a number of higher-order (indirect) benefits from technology adoption depending on the elasticity of demand, outward shifts in supply can lower food prices; and increased productivity may stimulate the demand for labour (Mendola, 2007). Because the poor tend

to supply off-farm labour, this may translate to increased employment, wages, and earnings for them. The poor have little or no land and they gain disproportionately from employment generated by agricultural growth and from lower food prices because they are usually net food buyers (Mendola, 2007). Higher productivity can, therefore, stimulate broader development of the rural economy through general equilibrium and multiplier effects, which also contribute to poverty reduction. Escaping poverty traps in many developing countries depends on the growth and development of the agricultural sector (World Bank 2008). Research and adoption of improved agricultural technologies is crucial to increasing agricultural productivity and reducing poverty, while sustaining the agro-ecosystems that support livelihoods.

Groundnut is one of the most popular commercial crops in Nigeria. Nigeria produces 41% of the total groundnut production in West Africa (Echekwu and Emeka, 2005).During 2000-2009,the groundnut areas grew annually 2.6% in Nigeria but the yield declined by 3.3% annually resulting in stagnation of groundnut production at 2.9 million tonnes (ICRISAT, 2011). Since 1990, ICRISAT and Institute for Agricultural Research (IAR) developed, tested, adapted and released 44 groundnut varieties (Ndjuenga *et al*., 2008). These varieties were tested in multi-location trials in partnership with ADPs and Sasakawa Global 2000 in many states including the North West zone of Nigeria. IAR has developed and released the following improved groundnut varieties; SAMNUT 1 (1960), SAMNUT 2 (1960), SAMNUT 3 (1970), SAMNUT 5 (1970), SAMNUT 6 (1970), SAMNUT 9 (1980), SAMNUT 10 (1980), SAMNUT 11 (1988), SAMNUT 16 (1988), SAMNUT 17 (1988), SAMNUT 18 (1988), SAMNUT 19 (1994), SAMNUT 20 (1994), SAMNUT 21 (2001), SAMNUT 22 (2001) and SAMNUT 23 (2001). SAMNUT 23, SAMNUT 22, SAMNUT

21, and SAMNUT 10 are the dominant varieties of groundnut being cultivated in Nigeria (Abate *et al*., 2011).

1.2 Problem Statement

Prior to Nigeria's independence in 1960, groundnut pyramids were a success story of the agricultural sector of the northern part of the country; though it suffered serious setback following the disappearance of the famous pyramids in Kano, groundnut farming is still one of the popular practice in the northern part of the country (Bashir, 2012). The production of groundnut in Nigeria fluctuated over the years from 1,565,000 tonnes in 1961 to 611,000 tonnes in 1985 and subsequently increased to 2,636,230 tonnes in 2010 (FAO, 2012). The production of groundnut in Nigeria has suffered major setbacks from the groundnut rosette epidemics and foliar diseases, aflatoxin contamination and lack of sufficient and consistent supply of improved seed varieties (Bashir, 2012). This has significantly affected productivity and led Nigeria to lose its shares in the domestic, regional and international markets. To regain its competitiveness, groundnut yield would have to increase substantially using yield enhancing varieties.

In a bid to address the problem of low productivity of groundnut, IAR has developed some varieties to increase the yield of groundnut farming households. It is worth noting that these efforts have led to the successful development of groundnut varieties with remarkable features of ensuring that groundnut farmers achieve high productivity leading to an appreciable increase in the income of the groundnut farmers and consequently reducing their poverty status.

Several empirical studies on groundnut production have been conducted in the study area but there exists research gap on the rate of adoption of IAR groundnut varieties among the farming households and the factors that influence the adoption of these varieties. This is important because only with a thorough understanding of these factors can further insight be developed concerning strategies to promote improved technologies. Also, the impact of adoption of groundnut varieties with particular emphasis on the income and poverty status of the groundnut farming households is yet to be empirically examined and therefore, it has become very imperative for a study of this nature to be carried out in order to fill the existing research gap on the contribution of IAR groundnut technologies to poverty alleviation among farming households.

In order to examine these issues raised, the following research questions were put forward:

i. What are the various types of IAR groundnut varieties cultivated in the study area?
ii. What is the most preferred IAR groundnut variety in the study area?
iii. What is the adoption rate of the various IAR groundnut varieties in the study area?
iv. What is the adoption level of the various IAR groundnut varieties in the study area?
v. What are the factors that influence the adoption of IAR groundnut varieties in the study area?
vi. What is the contribution of IAR groundnut varieties to the income of the groundnut farmers in the study area?
vii. What is the contribution of IAR groundnut varieties to alleviating poverty of the groundnut farmers in the study area?

1.3 Objectives of the study

The broad objective of the study was to assess the contribution of IAR groundnut varieties to poverty alleviation among farming household in North West Zone of Nigeria. The specific objectives of this study were to:

i. identify the various types of IAR groundnut varieties planted in the study area;
ii. ascertain the most preferred groundnut variety in the study area;
iii. determine the adoption rate of the various IAR groundnut varieties in the study area;
iv. determine the adoption level of the various IAR groundnut varieties in the study area;
v. determine the factors that influence the adoption of IAR groundnut varieties in the study area;
vi. assess the contribution of IAR groundnut varieties to the income of the groundnut farmers in the study area; and,
vii. evaluate the contribution of IAR groundnut varieties to alleviating poverty of the groundnut farmers in the study area.

1.4 Hypotheses

The hypotheses tested in this study were:

i. Adoption of IAR groundnut varieties has no significant effect on the income of the groundnut farming households.
ii. Adoption of IAR groundnut varieties has no significant effect on alleviating the poverty status of the groundnut farming households.

1.5 Justification of the Study

Assessing the impact of food legume technology adoption can assist in setting priorities, providing feedback to research programs, guide policy makers and those involved in technology transfer to have a better understanding of the way new technologies are assimilated and diffused into farming communities, and show evidence that clients benefit from the research products.

Nowadays, there is clear demand for greater institutionalization of impact assessment and impact culture to generate a better understanding of the complexities of the links between agricultural technology and poverty (Kassie *et al.*, 2010). There is an ever-increasing concern that it is becoming more and more difficult to achieve and sustain the needed increase in agricultural production based on extensification, because there are limited opportunities for area expansion and hence the solution to food problem would depend on measures that would help to increase yield through intensification (Negash, 2007).

It is hoped that the IAR groundnut varieties will bring relief to farming households that make use of the traditional methods by improving their productivity, income thereby reducing their poverty status. However, the assessment of the contribution of IAR groundnut varieties and the factors affecting their adoption cannot be understood in Nigeria without carrying out an empirical study of this nature and therefore, this study will help to assess the welfare effects (income and poverty) of adopting IAR groundnut varieties by the farming households. Thus, the outcome of this study will be beneficial to IAR researchers who would find the information relevant for further research on groundnut varieties in a bid to developing appropriate groundnut varieties that are better suited to

meeting the needs of farmers. Also, other stakeholders in the groundnut industry in Nigeria will find the outcome of this study relevant in understanding the adoption of improved groundnut varieties and its outcomes at the farmers level.

It is expected that the information gathered from this work will serve as a relevant resource material to policy makers towards ensuring appropriate formulation of agricultural developmental policies aimed at improving agricultural productivity, income improvement of farming households and effective poverty reduction among farming households through policies favourable to investment on research and promotion of improved agricultural varieties to farmers.

The result of this research work will assist extension agencies to design appropriate strategies for removing barriers to higher adoption of improved groundnut varieties providing effective extension service delivery so as to intensify adoption and also as a guide to extension agencies in forming a data base for continuous research on groundnut varieties aimed at improving the living standards of groundnut farming households and therefore, the findings from this research will serve as a frame work for further research on improved groundnut varieties in the area.

CHAPTER TWO

LITERATURE REVIEW

2.1 Groundnut Production Trend in Nigeria

Groundnut is an important food and cash crop, a major source of dietary oil and cash income for both urban and subsistence dwellers and its production in Nigeria occupies between 1.5 and 2 million ha of land (Olorunju, 1999). The country produces 5.9 percent and 27.7 % of the world and Africa's total production, respectively (Freeman *et al*., 1999). Production of groundnut declined from 1975 to 1985 and was lowest in 1982 (Schilling and Misari, 1992). The production level has however, shown a constant increase since 1986 starting from 0.7 million tons in 1986 to 2.9 million tons in 1997. The trend in groundnut production in Nigeria as shown in Figure 2.1 indicates that groundnut production decreased from 1, 565, 000 tonnes in 1961 to 611,000tonnes in 1985 and subsequently increased to 2, 636, 230 tonnes in 2010 (FAO, 2012).

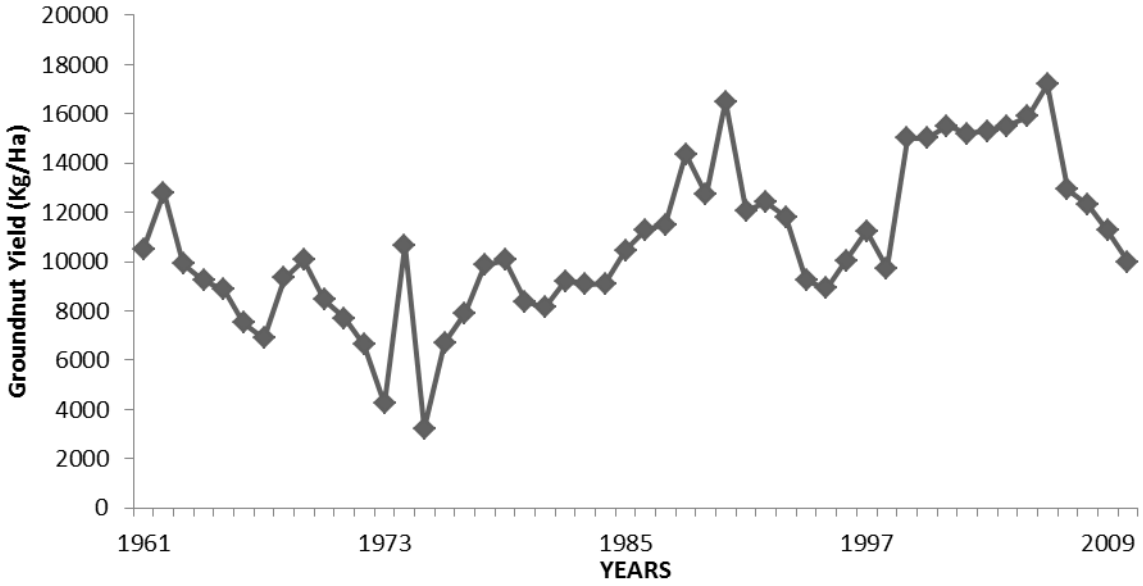


Figure 2.1: Groundnut Production Trend in Nigeria (Tonnes) (1961 – 2010)
Source: Computed From FAOSTAT (2012).

The yield of groundnut as indicated in Figure 2.2 increased slightly from 10,157 kg/ha in 1961 to 10,455 in 1985 and subsequently decreased to 10, 000 kg/ha in 2010. According to Olorunju and Joshua (1999) the yield of groundnut range from 800 to 2500 kg/ha but pod yields in farmers' fields range from 200 to 1500 kg/ha. The area harvested of groundnut production in Nigeria as shown

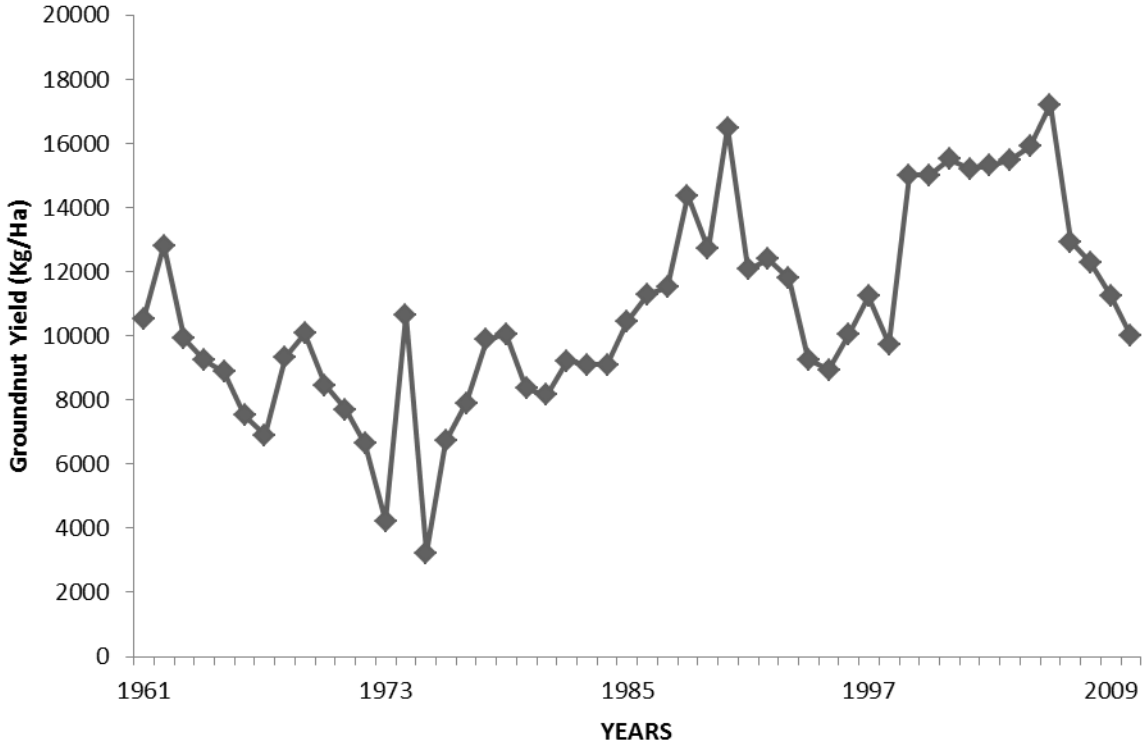


Figure 2.2: Groundnut Yield in Nigeria (Kg/Ha) (1961 – 2010)

Source: Computed From FAOSTAT (2012).

In Figure 2.3, the area cultivated decreased from 1,488,000 hectares in 1961 to 594,000 hectare in 1985 and thereafter increased significantly to 2,636,230 hectares in 2010 (FAO, 2012). Okolo and Utoh (1999) estimated that Nigeria's cultivated area under groundnut cultivation is about 1.0 to 2.5 million hectares annually and yield in the range of 500 – 3000 kg/ha.

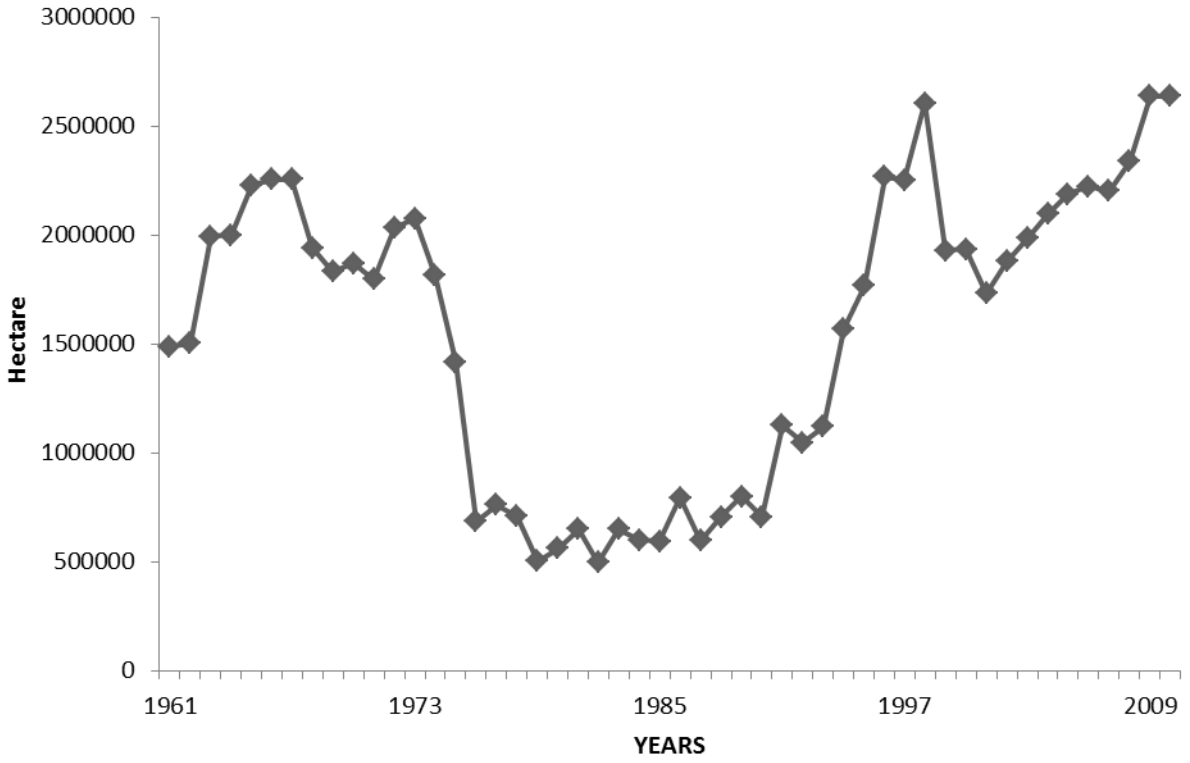


Figure 2.3: Area Harvested of Groundnut in Nigeria (Ha) (1961 – 2010)

Source: Computed From FAOSTAT (2012).

2.2 Adoption of Agricultural Technologies

According to Feder *et al.* (1985), adoption may be defined as the integration of an innovation into farmers' normal farming activities over an extended period of time. Rogers (1962) describes the adoption process as the mental process an individual passes from first hearing about an innovation to final adoption. When a new innovation is introduced, farmers go through periods of becoming knowledgeable about the new technology, to forming positive or negative attitudes toward the technology, and ultimately to deciding whether to adopt the technology or not. Numerous household, community, and institutional factors affecting farmers influence their decision process. Since Rogers' classic work on adoption, paradigms for explaining adoption decisions have revolved around three basic

models: the innovation-diffusion model, the technology characteristics-user's context model, and the economic constraints model. Much scholarly interest on adoption falls in two categories: rate of adoption, and intensity of adoption. It is usually necessary to distinguish between these two concepts as they often have different policy implications. Rate of adoption, the relative speed with which farmers adopt an innovation, has as one of its pillars, the element of 'time'. On the other hand, intensity of adoption refers to the level of use of a given technology in any time period (Bonabana-Wabbi, 2002).

The rate of adoption is usually measured by the length of time required for a certain percentage of members of a system to adopt an innovation. Extent of adoption on the other hand is measured from the number of technologies being adopted and the number of producers adopting them.The rate of adoption remains the key impact indicator of any applied breeding research and extension program, it shows the degree of acceptance, diffusion or rejection of new research outputs. The rate of adoption is here defined as the share of farm area utilizing the new varieties (Feder *et al.,* 1985). It is believed that this method of assessing adoption rate provides a better quantitative measure for forecasting yields and economic rates of returns to research and extension programs (Masters *et al*., 1996).

The innovation diffusion model is based directly on the work of Rogers. This model holds that access to information about an innovation is the key factor in determining the adoption decision. The use of extension, media, and local opinion leaders thus play a key role in this model. The appropriateness of the technology is assumed, and the constraint to adoption is access to information (Adesina and Zinnah, 1993). The technology characteristics model assumes that the characteristics of a technology, such as the agro-ecological,

socioeconomic, and institutional contexts, play the central role in the adoption and diffusion processes. Depending on the technology being investigated, various parameters may be employed to measure adoption. Measurements also depend on whether they are qualitative or quantitative. For instance in the study investigating the adoption of improved seed and fertilizer in Tanzania, Nkonya *et al.* (1997) estimated the intensity of adoption by examining the area planted to improved seed and the area receiving fertilizer. A study on adoption of new technologies in Ethiopian agriculture investigated the adoption of single-ox technology, pesticide and fertilizer use of which the dependent variable was the number of farmers using single-ox technology, pesticide and fertilizer (Kebede *et al.*, 1990).With regard to the relationship of technological attributes with farmers' adoption decision, Rogers, (1995) identified five characteristics of agricultural innovations, which are important in adoption studies. These include relative advantage, compatibility, complexity, trialability and observability. Rogers (1995) defines these characteristics as follows:

Relative advantage: Is the degree to which an innovation is perceived as better than the idea it supersedes.

Compatibility: the degree to which the farmer perceives an innovation to be consistent with his/her cultural values and beliefs, traditional management objectives, the existing level of technology and stages of development.

Complexity: the degree to which an innovation is perceived to be complex to understand and use by farmers.

Trialability: the degree to which the innovation could easily be tried by farmer on his/her farm **Observability:** the degree to which results of innovation are visible to farmers.

The participation of farmers and stakeholders in the technology development process is essential (Negatu and Parikh, 1999). In 1957, Griliches concluded that economic variables were the major determinants of technological change and adoption of innovations. In 1961, Mansfield also came to the conclusion that the adoption of innovations was determined by economics. The influence of economic thought on the adoption of innovations led Just and Zilberman (1983) to propose a theory of technology adoption under uncertainty using the expected utility framework. This model is an extension of the original Baron-Sandmo (1971) expected utility approach to producer behavior under uncertainty (Marra *et al.*, 2003). This model contends that economic constraints, such as access to capital or land, significantly affect the adoption decision. Thus, the decisions of the farmer are derived from the maximization of expected utility (or profit) subject to his inputs (land availability, labor, credit, etc.). The expected utility model is the most commonly used model for adoption studies of agriculture and agro forestry technologies (for examples of studies using this model see Mercer and Pattanayak, 2003; Negatu and Parikh, 1999).

When a new technology is introduced, adoption is not uniform; it differs across socioeconomic groups and over time. Adoption is slow at first, but with time, information, knowledge, and experience with the new technology grows and the rate of adoption increases. This process is known as diffusion of a technology. Diffusion is defined as the process of spread of a new technology within a region (Feder *et al.,* 1985). Diffusion occurs across persons while the adoption process is an individual decision process. Research on the adoption process often seeks to determine the characteristics of producers that influence their adoption decisions. Why some producers adopt the technology while others do not is modeled as a dichotomous choice of whether to adopt the new technology or not.

Regardless of the level of use, these studies record only the proportion of farmers that have adopted the new technology (Doss and Morris 2001; Feder *et al.*, 1985).

2.3 Trends in adoption of improved groundnut varieties in Nigeria

Groundnut Seed Project (GSP) promoted a range of high yielding groundnut varieties resistant to groundnut rosette disease (GRD) with market and farmer preferred traits through participatory variety selection (PVS), seed multiplication and delivery systems in 2003 (Ndjuenga *et al.,* 2008). Four states were targeted including Kaduna, Kano, Katsina and Jigawa. There has been an increase in area planted to modern varieties from 2004/05 to 2005/06, which dropped in 2006/07 as shown in figure 2.4. This drop may be explained by rainfall conditions that were not favorable to modern varieties. However, the cumulative number of farmers adopting modern varieties has been increasing steadily signaling farmers' interest in the new varieties (Figure 2.4). In addition, the uptake of modern varieties has already started in 1996 in Northern Nigeria with the ICRISAT groundnut improvement program. The dissemination was enhanced through Groundnut Germplasm Project (GGP) up to 2002. However, with GSP using on farm participatory methods for technology dissemination and exposure to modern varieties, the number of adopters almost tripled. From 2003 to 2007, a groundnut seed project funded by the Common Fund of Commodities (CFC) was implemented in the states of Kano, Kaduna, Katsina, and Jigawa with major objective to promote varieties and empower communities, seed companies in seed production and delivery of preferred varieties (Ndjuenga *et al.,* 2013). These efforts were further enhanced by the implementation of the Tropical Legumes II program in other villages in the same states from 2007 to 2010.

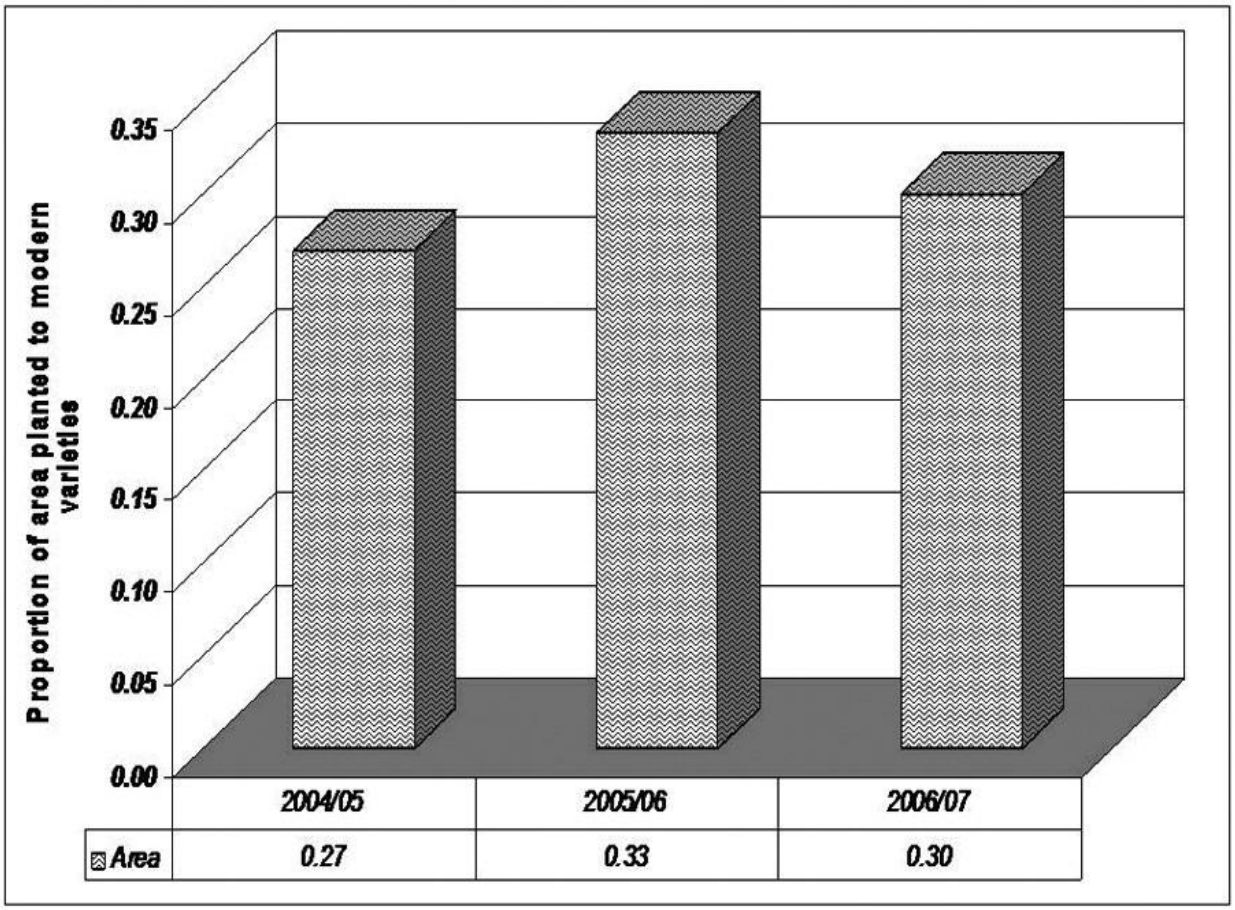


Figure 2.4: Proportion of area planted to improve groundnut varieties in Nigeria.

Source: Ndjuenga *et al.*(2008)

2.4 Factors Affecting the Adoption of Agricultural Technologies

Ebojie *et al.* (2012) in their study on Socio-economic factors influencing the adoption of Hybrid Maize in Giwa Local Government Area of Kaduna state, Nigeria pointed out that age, significant at 1%; income, significant at 5%; education, significant at1% and extension visits, significant at 1%; were the significant factors that influenced farmers adoption of Hybrid Maize in the study area. According to Odoemenem and Obinne (2010) intensity of extension contact, amount and use of credit, cooperative membership, all of which are institutional in nature, were found to be most important factors influencing the adoption of

improved cereal crop production technologies in their paper on assessing the factors influencing the utilization of improved cereal crop production technologies by small scale farmers in Nigeria.

Ayoola (2012) in a study on socio-economic determinants of the adoption of Yam minisett technology in the middle belt region of Nigeria found that age of the farmers, farm size, years of farming experience, amount of credit available and frequency of extension contacts were positively related to adoption and would probably increase adoption of the improved yam minisett technology. Nchinda *et al.* (2010) in their study on factors influencing the adoption intensity of improved yam (Dioscorea spp.) seed technology in the western highlands and high guinea savannah zones of Cameroon reported that factors such as age was significant at 1%, mixed cropping was significant at 1%, hired labour was significant at 5% and membership in farmers' organizations positively and significantly influenced the adoption intensity of minisett technology in the study areas at 1%. Kudi *et al*. (2010) found that household size, level of education, contact with extension agents, and access to credit and yield of the improved maize varieties were the factors that influence the adoption of improved maize varieties in a study on the analysis of adoption of improved maize varieties among farmers in Kwara State, Nigeria. Onyenweaku *et al.*(2010) in their study on determinants of fertilizer adoption by rice farmers in Bende Local Government Area of Abia state, Nigeria found out that farm size, type of ecosystem, tillage type, education, population pressure on land farmers' age and non-farm income were positive and significantly related to adoption and use intensity of chemical fertilizer, while field distance to the village, gender, access to credit and labour availability had an indirect relationship with adoption and use intensity of chemical fertilizer in the study area.

Saka and Lawal (2009) in their study on determinants of adoption and productivity of improved rice varieties in southwestern Nigeria found that land area cultivated to rice, frequency of extension contact and the yield rating of the improved rice varieties were significant determinants of farmers decision to adopt improved rice varieties. Eneji *et al.* (2009) identified education, access to credit and information as the significant factors influencing the adoption of agricultural technology in Bekwarra Local Government Area of Cross river state, Nigeria. Udoh *et al.*(2008) in their study on Socio-economic factors influencing adoption of yam minisett technology in South Eastern Nigeria revealed that the farmers level of education, awareness in yam minisett practices and risk of adoption were positive and highly significant in influencing adoption of yam minisett technology by the farmers. Agwu *et al.*(2008) in their study on Adoption of Improved Agricultural Technologies disseminated via radio farmer programme by farmers in Enugu State, Nigeria identified age, farming experience and social participation as the factors that significantly influenced adoption of improved agricultural technologies disseminated via radio farm programme. Akinola *et al.*(2007) in their study on determinants of adoption and intensity of use of balanced nutrient management system technologies in the northern Guinea Savanna of Nigeria reported that a number of factors such as access to credit, farmers' perception of the state of land degradation, and assets ownership were found to be significant in determining farmers' adoption decisions on BNMS-manure while off farm income was found to be significant in determining farmers' adoption decisions on BNMS-rotation. Omolehin *et al.* (2007) in their study on factors influencing adoption of chemical pest control in cowpea production among rural farmers in Makarfi Local Government Area of Kaduna state, Nigeria revealed that the adoption of chemical pest control in cowpea production was influenced by farmers age, marital status, educational qualification, the

desires of farmers for higher yields and the contact with extension activities. Oluwarotimi *et al.*(2007) used the probit model to capture the socio-economic factors influencing the adoption of Sawah rice production technology among rice growing farmers and they pointed out that membership of farmers association (t=2.91), educational level (t=1.65), length of residence in the village (t=2.11) and land ownership (t=1.91) were significant variables that influenced adoption and that all the significant variables were positively related to the probability of adoption except membership of farmers association that was inversely related to the probability of adoption of sawah technology. Asfaw *et al*. (1997) in Bako area reported that participation of farmers in extension activities (which is represented by farmers attendance at the field days) is the only variable which is found to significantly influence the adoption of improved maize variety. The same study showed that the adoption of fertilizer new technologies in Ethiopian agriculture. Pattanayak *et al.* (2003) recently evaluated 32 studies that estimated technology in maize production is influenced positively and significantly by the farmers' use of credit and by the level of formal education of farm household head. Kebede *et al*.(1990) conducted a study on adoption of new technologies in Ethiopian agriculture in Tegulet-Bulga district, Shoa province and found that education level of farmers had positive effect on the adoption of statistical models of the adoption of agro forestry, soil and water conservation technologies and found that adoption variables could be classified into five broad categories: household preferences, biophysical factors, resource endowments, economic incentives, and risk and uncertainty. Certain categories and factors were more likely to have statistically significant effects on the adoption choice. These included the categories of risk and uncertainty (78%), economic incentives (73%), biophysical factors (64%), and resource endowments (60%). In addition to these five categories of adoption determinants, the importance of taking into account farmer

perceptions is also discussed. These factors are discussed below as a sixth category of adoption determinants.

Category 1: Household Preferences

Household preference is a broad category measuring the influences of household specific characteristics such as risk tolerance, innovativeness, and household homogeneity. Measuring these factors is not straightforward; therefore, age, gender and education are often used as proxies for household preferences. The literature on Adoption of Agroforestry, Soil and Water Conservation Technologies suggests that households with a greater number of males and with a higher education level are more likely to adopt new technologies (Mercer and Pattanayak, 2003).

Category 2: Resource Endowments

Resource endowments are a measure of wealth. Measures of labor, livestock, savings, and asset holdings are all direct measures of resource endowments. The literature on Adoption of Agroforestry, Soil and Water Conservation Technologies shows that resource endowments have a consistent and positive influence on technology adoption (Mercer and Pattanayak 2003).

Category 3: Economic or Market-based Incentives

It is assumed that the adopting community will prefer a technology that increases net benefits to one that does not. Economic incentives for adoption can include reduced costs or better production from the new technology. However, the adoption literature has not done a good job of including direct measures of economic incentives. When economic incentives are included, the adoption decision is influenced by variables such as price of output or cost savings (Mercer and Pattanayak, 2003).

Category 4: Risk and Uncertainty

Short-term risk (commodity prices and rainfall) and long term risk (tenure insecurity) influence the adoption decision (Mercer and Pattanayak, 2003), as well as the uncertainty of an unfamiliar technology (Feder *et al.*, 1985). Information and learning are argued to be central to the adoption process. Producers initially experiment with an innovation on a trial basis. They seek information pertaining to the costs and benefits of the innovation from these trials and from other users' experiments. As they gather more information, the producers are able to increase their knowledge about the best use of the innovation and decrease their uncertainty about its potential benefits (Marra *et al.,* 2003). In general, the more risk averse a farmer is, the less willing he is to change the traditional practices and try new technologies.

Category 5: Biophysical Characteristics

Biophysical characteristics affect the production costs and returns to farmers and can therefore be considered economic determinants of adoption. Factors such as soil quality, steepness of land, and plot size influence what and how much can be grown on a piece of land. The literature on Adoption of Agro forestry, Soil and Water Conservation Technologies shows that the influences of many of the variables under this category on adoption are ambiguous, and thus vary depending on what type of technology is being introduced (Mercer and Pattanayak, 2003).

Category 6: Farmer Perceptions

Even though anthropologists and sociologists have argued qualitatively that farmer's subjective assessments of agricultural technologies influence adoption behavior, most adoption studies do not consider the impact of farmers' perceptions on the adoption choice (Adesina and Baidu-Forson, 1995). It is now believed that these perceptions of the new

technology significantly impact the adoption decision. Economists have accumulated evidence from consumer demand research showing that consumer demand for products is significantly affected by perceptions of the product (Adesina and Baidu-Forson, 1995). Farmers make rational decisions based on the appropriateness of an innovation to their needs.

2.5 Impact of Improved Agricultural Technologies on the Income and Poverty Status of Farming Households

Ambali *et al.* (2012) in a study on the effect of agricultural technology on income of cassava and maize Farmers in Egba division of Ogun state, Nigeria reported that revenue, gross margin and net farm income of improved technology adopters were ₦353, 085, ₦224, 069.13 and ₦195, 239.75 respectively and the total revenue, gross margin and net farm income for the traditional technology adopters were ₦260, 795, ₦190, 127.75 and ₦163, 083.75 respectively. These figures suggested that the adoption of improved technology have better returns to naira invested. The t-test of difference of mean attests to this and showed that a significant difference exists between the net farm incomes of the two categories of farmers at 1 percent. Dontsop-Nguezet, *et al.* (2011) in a study on impact of improved rice technology on income and poverty among rice farming household in Nigeria: A Local Average Treatment Effect (LATE) Approach revealed a robust positive and significant impact of NERICA variety adoption on farm household income and welfare measured by per capita expenditure and poverty reduction. Specifically, the empirical results suggest that adoption of NERICA varieties raises household per capita expenditure and income by an average of ₦4,739.96 and ₦63,771.94 per cropping season respectively, thereby reducing their probability of falling below the poverty line and this therefore,

suggest that intensification of the investment on NERICA dissemination is a reasonable policy instrument to raise incomes and reduce poverty among rice farming household, although complementary measures are also needed. Mignouna *et al.* (2011) in a study on contributions of agricultural improved technologies to rural poverty alleviation in developing countries: case of imazapyr-resistant maize in western Kenya reported that Imazapyr-resistant maize had succeeded in reducing Striga seed-bank significantly ($P<0.05$) hence raising productivity from 2.2 ton/ha (non-IRM) to 2.8 ton/ha (IRM) with significant returns to land (US $173/hectare) and labour (US $8/man-day), improving nutrition for resource-poor households. Also the net present value (US $21.7 million), benefit-cost ratio (4.77) and net benefits per capita (US $41 063) for IRM enterprise were attractive therefore, the use of IRM for Striga control is a promising option for farmers since this technology has been shown to be profitable compared with other maize varieties and has contributed positively in alleviating poverty in western Kenya. Tekwa *et al.* (2010) in a study on impacts of modern farm machinery and implements adoption on alluvial soil sugarcane (*Saccharrum officinarum*) farmers' income in Mubi, Northeastern Nigeria reported that farmers who adopted modern farm machinery recorded higher income than farmers who used traditional farm implements. Asfaw *et al.*(2009) in their study on poverty reduction effects of Agricultural technology: A Micro-evidence from Tanzania using propensity score matching and switching regression techniques, found out that adopting improved pigeon pea technology significantly increase consumption expenditure and reduce poverty. This confirms the potential role of technology adoption in improving rural household welfare as higher incomes from improved technologies translate into lower poverty. They emphasized that reaching the poor with better technologies however requires policy support for improving extension efforts, access to seeds and market outlets that

simulate adoption. Kassie *et al.* (2010) in a study on adoption and impact of improved groundnut varieties on rural poverty: evidence from rural Uganda reported that adoption of improved groundnut varieties is associated with increased crop income and contributed to moving farm households out of poverty and that this suggests that developing and promoting appropriate agricultural technologies can contribute to the achievements of the Millennium Development Goal of eradicating poverty and hunger in the developing countries. Asfaw and Shiferaw (2010) in a study on agricultural technology adoption and rural poverty shows that the application of an endogenous switching regression for selected East African countries found out that adoption of improved agricultural technologies has a significant positive impact on crop income. Omilola (2009) in a study on estimating the impact of agricultural technology on poverty reduction in rural Nigeria found out that technology adopters received a statistically significant and larger increase in agricultural income from irrigation than the non-adopters on average even in the presence of key factors that determine income and that Although there were disproportionately more poor people among the adopters than the non-adopters both before and after technology adoption, the technology adopters fared slightly better than the non-adopters in terms of poverty reduction. In other words, technology adoption led to a slight reduction in poverty headcount levels of the adopters and also narrowed their income gap and slightly improved the income of the poorest adopters over the non-adopters.

2.6 Review of Empirical Models

2.6.1 Theoretical Framework for Logit Model Application in Adoption

Logistic regression is a popular statistical technique in which the probability of a dichotomous outcome (such as adoption or non-adoption) is related to a set of explanatory

variables that are hypothesized to influence the outcome (Shideed and El Mourid, 2005). The application of logit model in agricultural technology adoption implies that a farmer would decide to adopt modern agricultural production technologies at a given point in time when the combined effects of certain factors exceed the inherent resistance to change in him/her (Akudugu *et al.*, 2012). This means the receipt of treatment (agricultural technology) is endogenous. The preference for the probability model (logit) to the conventional linear regression models, in analysing the factors influencing the decisions of farm households' to adopt modern agricultural production technologies is based on the fact that, the parameter estimates from the former are asymptotically consistent and efficient. The estimation procedure employed also resolves the problem of heteroscedasticity and constrains the conditional probability of making the decision to adopt technology to lie between zero (0) and one (1). Logit model is chosen over probit model in econometric analysis primarily because of its mathematical convenience and simplicity (Greene, 2008).

Several studies on adoption of agricultural technologies have employed the logit model. Ebojie *et al.*, (2012) employed Logit model to determine the factors influencing farmers' adoption of hybrid maize in Giwa local government area of Kaduna state, Nigeria. Saka and Lawal (2009), utilized the logit model to determine the factors that influence adoption and productivity of improved rice varieties in southwestern Nigeria. Petros (2011) also employed the logit model to identify the factors that influence adoption of conservation tillage technologies in Metema Woreda, North Gondar zone, Ethiopia. Swagata *et al*. (2008) in a study on factors affecting adoption of GPS guidance systems by Cotton producers made use of a binary logit model. Arellanes and Lee (2003) also employed the logit model in estimating the determinant of adoption of sustainable agriculture

technologies from the hill sides of Honduras. Following Maddala (1992), Green (2008) and Gujarati (2004) the logistic distribution for the adoption decision of agricultural technologies can be specified as:

$$P_i = \frac{1}{1 + e^{-z_i}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, Pi is a probability of adoption of agricultural technologies for the i^{th} farmer and ranges from 0 to 1. e represents the base of natural logarithms and Z_i is the function of a vector of n explanatory variables and expressed.

$$Z_i = \beta_0 + \sum \beta_i X_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:

β_0 = intercept

β_i= vector of unknown slope coefficients.

The relationship between P_i andX_i, which is non-linear, can be written as follows:

$$p_i = \frac{1}{1 + e^{\beta_0 + \beta_i X_{i+} \ldots\ldots\ldots + \beta_n X_n}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The slopes tell how the log-odds in favour of adopting the technology changes as independent variables change. If $P_i$is the probability of adopting given technologies, then 1-P_i represents the probability of not adopting and can be written as:

$$1 - P_i = \frac{1}{1 + e^{-z_i}} = P_i = \frac{e^{z_i}}{1 + e^{-z_i}} = P_i = \frac{1}{1 + e^{z_i}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Dividing equation (1) by equation (4) and simplifying gives:

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Equation (5) indicates simply the odd-ratio in favour of adopting the technologies. It is the ratio of the probability that the farmer will adopt the technology to the probability that he will not adopt it. Finally, the logit model is obtained by taking the logarithm of equation (5) as follows.

$$l_i = \frac{P_i}{1 - P_i} = Z_i = \beta_0 + \beta_i X_i + \cdots \ldots\ldots\ldots\ldots\ldots\ldots\ldots + \beta_n X_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where l_i is log of the odds ratio, which is not only linear in X, but also linear in the parameters: Thus, if the stochastic disturbance term $u_i$is taken into account, the logistic model becomes:

$$Z_i = \beta_0 + \beta_i X_i + \cdots \ldots\ldots\ldots\ldots\ldots\ldots\ldots + \beta_n X_n + u_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

This econometric model is estimated using the iterative Maximum Likelihood Estimation (MLE) procedure due to the nonlinearity of the logistic regression model. The MLE procedure yields unbiased, asymptotically efficient, and normally distributed regression coefficients (parameters).

2.6.2 Theoretical Basis of Foster, Greer and Thorbecke (FGT) Weighted Poverty Index

This model has been used in several studies on impact of agricultural technologies adoption on poverty status of farming households (Dontsop-Nguezet *et al.*, 2011; Asfaw *et al.*, 2010; Kassie *et al.*, 2010, Omilola, 2009; Mendola, 2007; Rahman, 1999).Usually, there are three steps involved in the measurement of poverty. These are choosing a quantitative welfare indicator, choosing a means of discriminating between the poor and non-poor (through the use of a poverty line), and aggregating this information into a poverty measure for a

particular population (Omonona, 2009).The three most widely used measures of income/consumption quantitative poverty analysis are the poverty headcount ratio, the poverty gap, and the squared poverty gap or poverty severity (Omilola, 2009). This is because these three poverty indexes satisfy many of the basic desirable properties of poverty measures, particularly the property of being additively decomposable with population share-weights. These three most widely used poverty indexes are usually expressed as members of a class of measures proposed by Foster, Greer, and Thorbecke (FGT; 1984).The General Foster, Greer and Thorbecke (FGT) poverty index ($P_{\alpha i}$) can be expressed as:

$$P_{ai} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{a} \dots\dots\dots\dots (8)$$

Where:

n = number of households in a group

q = the number of poor households

z = poverty line

y = the per capita expenditure (PCE) of the i^{th} household,

α = degree of poverty aversion (0, 1 and 2)

Poverty headcount index (α = 0)

$$P_0 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-yi}{z}\right)^{0} = \frac{q}{n} \dots\dots\dots\dots (9)$$

The poverty headcount index is the share of the population whose income or consumption is below the poverty line; that is, the share of the population that cannot afford to buy a basic basket of goods. The headcount ratio fails to account for the degree of poverty by

ignoring the extent of the shortfall of incomes of the poor from the poverty line (Omilola, 2009). For instance, the headcount ratio will remain the same when there is a reduction in the income of all the poor without affecting the income of the rich if the poverty line is relative. In other words, the headcount ratio will be unaffected by a policy that makes the poor even poorer since it is not sensitive to distribution of income among the poor.

Poverty gap index (α = 1)

$$P_1 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - yi}{z}\right)^1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (10)$$

The poverty gap index provides information regarding how far households are from the poverty line. This measure captures the mean aggregate income or consumption shortfall relative to the poverty line across the whole population. The poverty gap measure has an advantage over the headcount ratio in the sense that it will be increased when there is income transfer from poor to non-poor, or from poor to less poor who thereby become non-poor (Omilola, 2009). Although the poverty gap index takes both the incidence and depth of poverty into account, it is insensitive to inequality among the poor.

Poverty squared gap index (α = 2)

$$P_2 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - yi}{z}\right)^2 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (11)$$

The poverty squared poverty gap index takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor; that is, a higher weight is placed on those households further away from the poverty line. This measure takes account of the incidence of poverty, the depth of poverty, and the inequality among the poor. It rises when the number of poor people increases, or the poor

get poorer, or the poorest get poorer in comparison with other poor people. We might want to prefer the squared poverty gap measure to others, but in practice it is of interest to look at all three measures. It should be noted that these poverty measures take values between 0 and 1, with numbers close to 0 indicating little poverty and those closer to 1 suggesting high poverty (Omilola, 2009).

Poverty Line: Poverty Line is a measure that divides the poor from non-poor using the mean per capita household expenditure (NBS, 2012). One-third of it gives (separate) the extreme or core poor from the rest of the population while two-third of the mean per capita expenditure separate the moderate poor from the rest of the population.

2.6.3 Theoretical Basis of Adoption rate (adoption index)

Over the years, two methods of determining adoption rate have been established in literature; the first is based on expressing the number of farmers adopting a particular technology as a percentage of the total number of farmers under study (Floyd *et al*., 1999) and the second, expressing the land area put under a particular technology as a percentage of the total land area grown to the crop (Saka and Lawal, 2009; Ahmed and Sanders, 1991). While the former is said to be subjective in the sense that adequate consideration is not given to variation in size of holdings between adopters and non-adopters (Philip *et al*., 2000), the latter is more applicable to crop production with an additional advantage of providing for easy determination of the contribution of the technology to the production of the particular crop within the study area.

Using the number of farmers adopting a particular variety as a percentage of the total number of farmers under study, adoption rate can be measured using adoption index expressed as:

$$\beta_v = \frac{\sum_{i=1}^{n} \beta_{vi}}{\sum_{i=1}^{n} \beta} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (12)$$

Where:

β_v = Adoption rate for improved technology v

β_{vi} = Adoption of improve technology v by i^{th} farming households

β = Number of farming households (n)

i = 1, 2….........n

$\sum$ = Summation

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

The study area is the North-West geopolitical zone of Nigeria. The North West zone lies between latitudes 9^0 N and 14^0 N and longitudes 07^0 and 60^0 of the Green-Which meridian and comprises of Jigawa, Kano, Katsina, Kaduna, Zamfara, Sokoto and Kebbi states. However, the states covered in this study were Jigawa, Kaduna, Zamfara, Sokoto and Kebbi states respectively. According to the 2006census, the total population of the zone is estimated at 35.7 million with an average density of 103 persons per square kilometer. The projected population of the zone in 2013 is about 44.1million, based on an annual growth rate of 3.2%. The climate of the state is characterized by two distinct seasons; the rainy and dry seasons. The rainy season lasts from May to September with average rainfall of between 600 mm to 1000 mm. The mean annual rainfall ranges from 500mm to nearly 1200mm.High temperatures are normally recorded between the months of April and September. The daily minimum and maximum temperatures are 15^0Cand 35^0C. The vegetation is typically Savanna; the grass land ecology is distinguished by Sahel, Sudan and Northern Guinea Savanna. The climate of the area favours the production of crops such as maize, beans, groundnut, guinea corn, millet, cotton, yam, carrot, sugarcane, tomatoes, pepper, onions garden eggplant, lettuce, amaranthus and tobacco. The North west zone is also known for livestock production activities such as cattle, goat, sheep, poultry, fisheries e.t.c

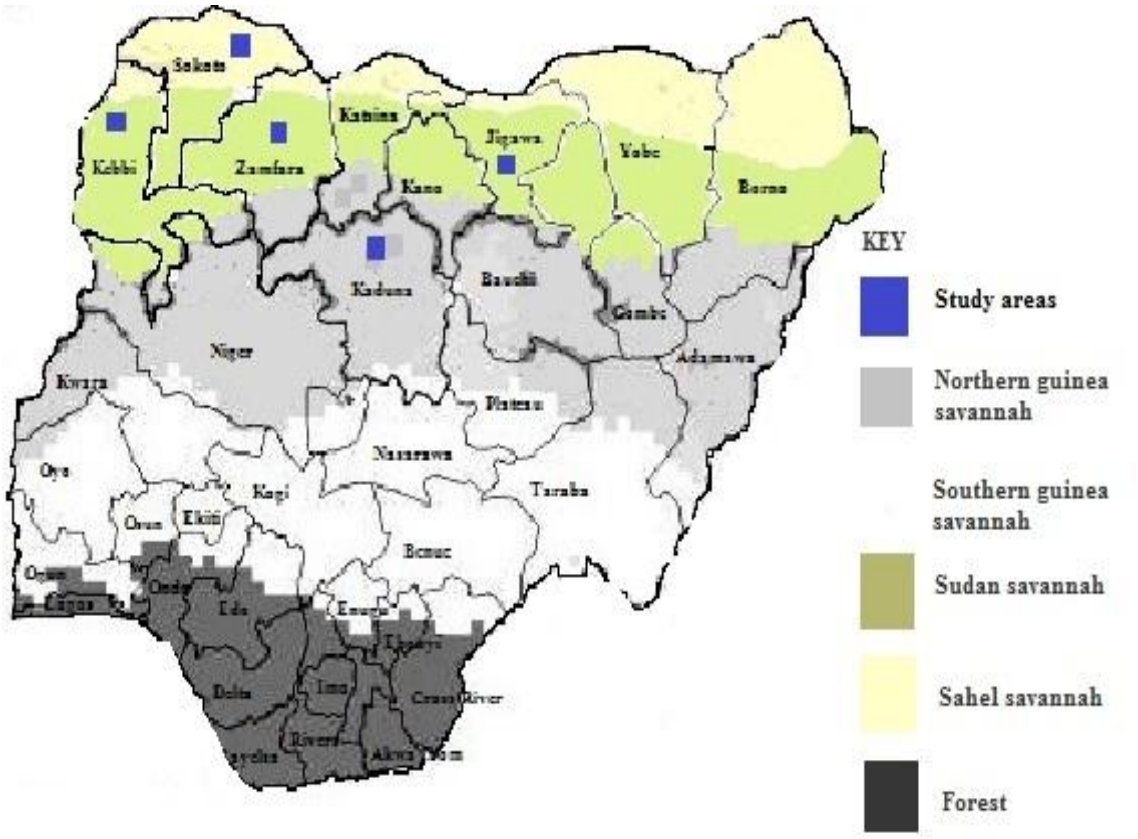


Figure 3.1: Map of Nigeria Showing the Study Area

Source: Adapted from Damisa *et al*. (2011).

3.2 Sampling procedure and Sample Size

Multi-stage sampling technique was employed in selecting the groundnut farming households in the study area (Jigawa, Zamfara, Sokoto, Kebbi and Kaduna States). For Jigawa State, the first stage was a purposive selection of 4 Local Government areas from the State (one Local Government from each of the four ADP zones in the State). These Local Government Areas (Dutse, Gumel, Kaugama and Sule-takarkar) were selected on the basis of being the most prominent groundnut producing areas of the State. Secondly, 8 villages (Kandi, Kudai, Gumel, Baikarya, Dalari lugu, Gararu, Sule-takarkar and Tsalle) were purposively selected (two from each Local Government) on the basis of their high

intensity of groundnut production activities. Thirdly, simple random sampling through the use of table of random numbers was employed in selecting 10% of the groundnut farming households to give a sample size of 227 which comprised of 110 adopters 117 non-adopters.

Table 3.1: Distribution of sample size of the respondents

States	L.G.A	Villages	Sample frame	Sample size
Jigawa	Duste	Kandi	340	34
		Kudai	260	26
	Gumel	Gumel	250	25
		Baikarya	330	33
	Hadeja	Kaugama	270	27
		Dalari lugu	300	30
	Sule-takarkar	Sule-takarkar	270	27
		Tsalle	250	25
Zamfara	Kaura Namoda	Banga	Nil	15
	Anka	Waramu		15
Sokoto	Wamako	Wamako	Nil	15
	Tambuwal	Tambuwal		15
Kebbi	Fakai	Uchiri	Nil	15
	Arewa	Gumude		15
Kaduna	Kaura	Kagoro	Nil	15
	Sanga	Fandan Karshio		15
Total				347

For the other States covered, the first stage wasthe purposive selection of two Local Government Areas from Zamfara (Kaura Namoda and Anka), Sokoto (Wamako and Tambuwal), Kebbi (Fakai and Arewa), and Kaduna (Kaura and Sanga) states respectively. These Local Government Areas were selected on the basis of being the most prominent groundnut producing areas of the States. Secondly, one village from each of the eight selected Local Government Areas were randomly selected to give eight villages (Banga,

Waramu, Wamako, Tambuwal, Uchiri and Gumude, Kagoro and Fandan karshio). Thirdly, purposive sampling was employed in selecting 15 groundnut farming households from each Local Government to give a sample size of 120 comprising of 60 adopters and 60non-adopters of IAR groundnut varieties. The use of purposive sampling was due to the unavailability of reliable sample frame for groundnut farming households in the sampled villages at the time of the survey. The total sample size for the study was 347 consisting of 170 adopters and 177 non-adopters.

3.3 Method of Data collection

The study made use of primary data. The primary data were obtained through the use of well-structured questionnaire administered to household heads using well trained enumerators. The data collected during the field survey were on socio-economic characteristics such as age, gender, marital status household size, farm size, income, access to credit, number of extension contacts, level of education of household heads and the household size. Data on IAR groundnut varieties adopted by the farming households were also collected as well as data on household expenditure (food and non-food expenditure) for estimating the poverty status of the households.

3.4 Analytical Technique

Descriptive and inferential statistics was employed in the analysis of data.

3.4.1 Descriptive statistics

This involved the use of frequency, percentage, mean, standard deviation and coefficient of variation to achieve objectives (i) and (ii) of the study.

3.4.2 Adoption rate index

This was used to achieve objective (iii) of the study. It was based on expressing the number of farmers adopting a particular variety as a percentage of the total number of farmers under study (Floyd *et al.*, 1999). It is expressed as:

$$\beta_v = \frac{\sum_{i=1}^{n} \beta_{vi}}{\sum_{i=1}^{n} \beta} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Where:

β_v = Adoption rate for IAR groundnut variety v

β_{vi} = Adoption of IAR groundnut variety v by i^{th} farming households

β = Number of groundnut farming households (347)

i = 1, 2….......n

$\sum$ = Summation

3.4.3 Index of Adoption level

This was used to achieve objective (iv) of the study. It is based on expressing the land area put under a particular technology as a percentage of the total land area grown to the crop (Shiferaw, 2010; Saka and Lawal, 2009; Ahmed and Sanders, 1991).

It is expressed as:

$$\beta_u = \frac{\sum_{i=1}^{n} \beta_{ui}}{\sum_{i=1}^{n} \beta} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Where:

β_u = Adoption level for IAR groundnut variety v

β_{ui} = Average land area put under a particular IAR groundnut variety (u) by i^{th} farming households

β = Average land area utilized for groundnut production by the farming households

i = 1, 2…….....n

$\sum$ = Summation

3.4.4 Logit Regression Model

Logit regression model was used to achieve objective (v) of this study. The probability of groundnut farmer adopting IAR groundnut varieties is determined by an underlying response variable that captures the true economic status of a farmer. The underlying response variable y* in the case of binary choice is defined by the multivariate Logit regression relation:

$Y^* = \Sigma x_i \beta_j + \mu$ ……(15)

Where: $\beta_j = \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9$

$X_i = X_{i1}, X_{i2}, X_{i3}, X_{i4}, X_{i5}, X_{i6}, X_{i7}, X_{i8}, X_{i9}$

The relevant logistic expressions are given as:

$$Prob(y* = 1) = 1 - F*(\Sigma X_i \beta_j) = \frac{e^{\Sigma X_i \beta_j}}{1 + e^{\Sigma X_i \beta_j}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

$$Prob(y* = 0) = F*(\Sigma X_i \beta_j) = \frac{e^{\Sigma xi \beta j}}{1 + e^{\Sigma xi \beta j}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17)$$

Where:

F = The cumulative distribution function for $\mu_{i,\ldots}$

The explicit Logit model is expressed as:

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + \beta_9 X_9 + u \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (18)$$

Where:

Y = adoption (1= adoption of IAR groundnut variety, 0 = non-adoption of IAR groundnut variety)

X_1 = Age of household head (years)

X_2=Agro-ecology (1= Southern guinea savannah, 2= Northern guinea savannah, 3= Sudan savannah and 4= Sahel savannah)

X_2=Farming experience (years)

X_3 = Education (years of formal schooling)

X_4 = Household size (number)

X_5 = Farm size (hectares)

X_6 = Amount of credit obtained (Naira)

X_7 = Membership of cooperative (years)

X_8 = Farm income (annual income from groundnut production in Naira)

X_9 = Extension contact (Number of contacts)

$\beta_1 - \beta_9$= The coefficients for the respective variables in the Logit function

u = error terms

3.4.5 Z – Statistic

This was used to achieve objective (vi) of this study. It is based on comparison of the means of two groups especially when the sample size is larger than 30. It was also used to test hypotheses i, ii and iii of the study. The Z-statistic is expressed as follows:

$$\mathbf{Z} = \frac{\overline{\mathbf{X_1}} - \overline{\mathbf{X_2}}}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \quad \text{.....(19)}$$

Where Z = calculated Z value

$\overline{\mathbf{X_1}}$ = Mean income of the farmers that adopt IAR groundnut varieties.

$\overline{\mathbf{X_2}}$ = Mean income of the farmers that did not adopt IAR groundnut varieties.

S_1= Standard deviation of the farmers that adopt IAR groundnut varieties.

S_2 = Standard deviation of the farmers that did not adopt IAR groundnut varieties.

n_1= Sample size of the farmers that adopt IAR groundnut varieties.

n_2 = Sample size of the farmers that did adopt IAR groundnut varieties.

3.4.6 Foster-Greer-Thorbecke's (FGT) Weighted Poverty Index

The Foster, Greer and Thorbecke (FGT) measures of poverty are widely used because they are consistent and additively decomposable (Foster *et al.*, 1984).This was used to achieve objective (vii) of this study. Poverty head count index, poverty gap index and squared poverty gap index was computed to measure the incidence, depth and severity of poverty among the groundnut farming households. A relative poverty line was constructed based on the Mean Per Capita Household Expenditure (MPCHHE) of the groundnut farming households. The General Foster, Greer and Thorbecke (FGT) poverty index ($P_{\alpha i}$) can be expressed as:

$$P_{ai} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{a} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (20)$$

When:

$$a = 0, \qquad P_0 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-yi}{z}\right)^{0} = \frac{q}{n} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (21)$$

i.e poverty incidence or head count

$$a = 1, \qquad P_1 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-yi}{z}\right)^{1} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (22)$$

i.e poverty gap or depth

$$a = 2, \qquad P_2 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-yi}{z}\right)^{2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (23)$$

i.e poverty severity

Where:

n = number of households in a group

q = the number of poor households

z = poverty line (2/3 Mean Per Capita Household Expenditure (MPCHHE) of the groundnut farming households)

y = the per capita expenditure (PCE) of the i^{th} household,

α = degree of poverty aversion (0, 1 and 2)

CHAPTER FOUR

RESULTS AND DISCUSSION

The results and discussion of findings of this study were presented in this chapter based on the objectives of the study. Typology of IAR groundnut varieties in the study area is section 4.1, typology of most preferred IAR groundnut varieties in the study area is section 4.2, rate of adoption of IAR groundnut varieties in the study area is section 4.3, adoption level of IAR groundnut varieties in the study area is section 4.4, factors influencing the adoption of IAR groundnut varieties in the study area is section 4.5, the contribution of IAR groundnut varieties on the income of groundnut farming households in the study area is section 4.6, the contribution of IAR groundnut varieties on the poverty status of groundnut farming households is section 4.7.

4.1 Typology of IAR groundnut varieties planted in the study area

Eight IAR groundnut varieties namely; SAMNUT 10, SAMNUT 14, SAMNUT 16, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were identified as the IAR groundnut varieties planted in the study area (pooled sample) as shown in the result presented in Table 4.1.There exist similarities as well as differences in the types and number of IAR groundnut varieties cultivated by farmers across the states in the study area. Literature revealed that 24 different groundnut varieties were released by IAR from 1970 to 2011 (Njeunga *et al.,* 2013).SAMNUT 24 was largely cultivated in Kaduna State as indicated by (80%) of the respondents followed by Kebbi State (70%), Jigawa State (61%) and Sokoto State (57%) respectively. SAMNUT 22and 23 were identified to be largely cultivated in Zamfara State as indicated by 57% of the respondents. The result implies that the most important IAR groundnut variety in Kaduna, Jigawa and

Sokoto States respectively was SAMNUT 24 and in Zamfara State it was SAMNUT 22 and SAMNUT 23.The least important IAR groundnut variety in Jigawa State was SAMNUT 18,Sokoto State was SAMNUT 22 while Zamfara, Kebbi and Kaduna States was SAMNUT 14 respectively.

From the result of the pooled sample, the most important IAR groundnut variety in the study area was SAMNUT 24 as indicated by 62% of the pooled sample of respondents and the least important was SAMNUT 16 as indicated by 2.3% of the pooled sample of respondents. This implies that SAMNUT 24, which was the most recently released IAR groundnut variety (released in 2011) as of the time this study was largely cultivated in the study area.

Based on the cultivation of IAR groundnut varieties as identified in the study area, this implies that the cultivation of IAR groundnut varieties can be enhanced through increased availability of the varieties to farmers as some farmers are very much interested in cultivating IAR groundnut varieties but do not have access to the varieties. Hence, non-accessibility to IAR groundnut varieties is a constraint limiting the cultivation of IAR groundnut varieties by some farmers in the study area. Therefore, increasing the accessibility of famers to IAR groundnut varieties through increased seed production and expansion of distribution channels to farmers using ADPs. Also, non-awareness of the existence of the varieties is another constraint that hindered cultivation of IAR groundnut varieties by some farmers. Hence, sensitization of farmers on the benefits of cultivating IAR groundnut varieties especially farmers who are hitherto not yet aware of the existence of IAR groundnut varieties can lead to an increase in the cultivation of IAR groundnut varieties. This is in line with Ndjuenga *et al.* (2008) who posited that farmers' awareness of

the existence of an improved technology is a criterion for evaluating the diffusion pathway plan or strategy. Also, Diagne and Demont (2007) opined that a farmer cannot adopt a technology without being aware of it. This is because exposure or awareness to modern technologies/varieties is one of the critical drivers and the first step to adoption of technologies.

Table 4.1: IAR groundnut varieties identified among groundnut farming households in the study area

State	IAR groundnut varieties	*Frequency	Percentage
Jigawa	SAMNUT 24	138	60.7
	SAMNUT 23	95	41.9
	SAMNUT 22	65	28.6
	SAMNUT 21	59	25.9
	SAMNUT 18	50	22.0
	SAMNUT 14	52	22.9
		*	
Zamfara	SAMNUT 24	14	46.6
	SAMNUT 23	17	56.6
	SAMNUT 22	17	56.6
	SAMNUT 21	12	40.0
	SAMNUT 16	8	26.6
	SAMNUT 14	6	20.0
	SAMNUT 10	14	46.6
		*	
Sokoto	SAMNUT 24	17	56.6
	SAMNUT 23	15	50.0
	SAMNUT 22	13	43.3
		*	
Kebbi	SAMNUT 24	21	70.0
	SAMNUT 23	14	46.7
	SAMNUT 22	15	50.0
	SAMNUT 21	10	33.3
	SAMNUT 18	10	33.3
	SAMNUT 14	9	30.0
		*	
Kaduna	SAMNUT 24	24	80.0
	SAMNUT 23	17	56.7
	SAMNUT 22	16	53.3
	SAMNUT 21	14	46.7
	SAMNUT 18	9	30.0
	SAMNUT 14	7	23.3
	SAMNUT 10	10	33.3
		*	
Pooled	SAMNUT 24	214	61.7
	SAMNUT 23	158	45.5
	SAMNUT 22	126	36.3
	SAMNUT 21	95	27.3
	SAMNUT 18	69	19.9
	SAMNUT 16	8	2.3
	SAMNUT 14	74	21.3
	SAMNUT 10	24	6.9
		*	

***Total frequency exceeded sample size due to multiple response**

4.1.1 Reasons for planting IAR groundnut varieties among farming households

The reasons for planting IAR groundnut varieties are presented in Figure 4.1. The possibility of cultivating IAR varieties twice in a production season as indicated by 27% of the groundnut farming households in the study area was the major reason for the cultivation of IAR groundnut varieties followed by 24% of the households who planted IAR groundnut due to its high yield, 18% of farming households cultivated IAR groundnut varieties as a result of its high oil content and as noted by Ndjuenga *et al*.(2008) varieties associated with high market value are those with high oil processing companies, high foliage was a reason for the cultivation of IAR groundnut varieties as indicated by 14% of the farming households who cultivated IAR groundnut varieties, resistance to pest and disease was indicated by 14% of farming households who planted IAR groundnut varieties and 11% of farming households cultivated IAR groundnut varieties as a result of its early maturing traits. This implies that households who cultivated IAR groundnut varieties had one reason or the other for cultivating IAR groundnut varieties other than local groundnut varieties.

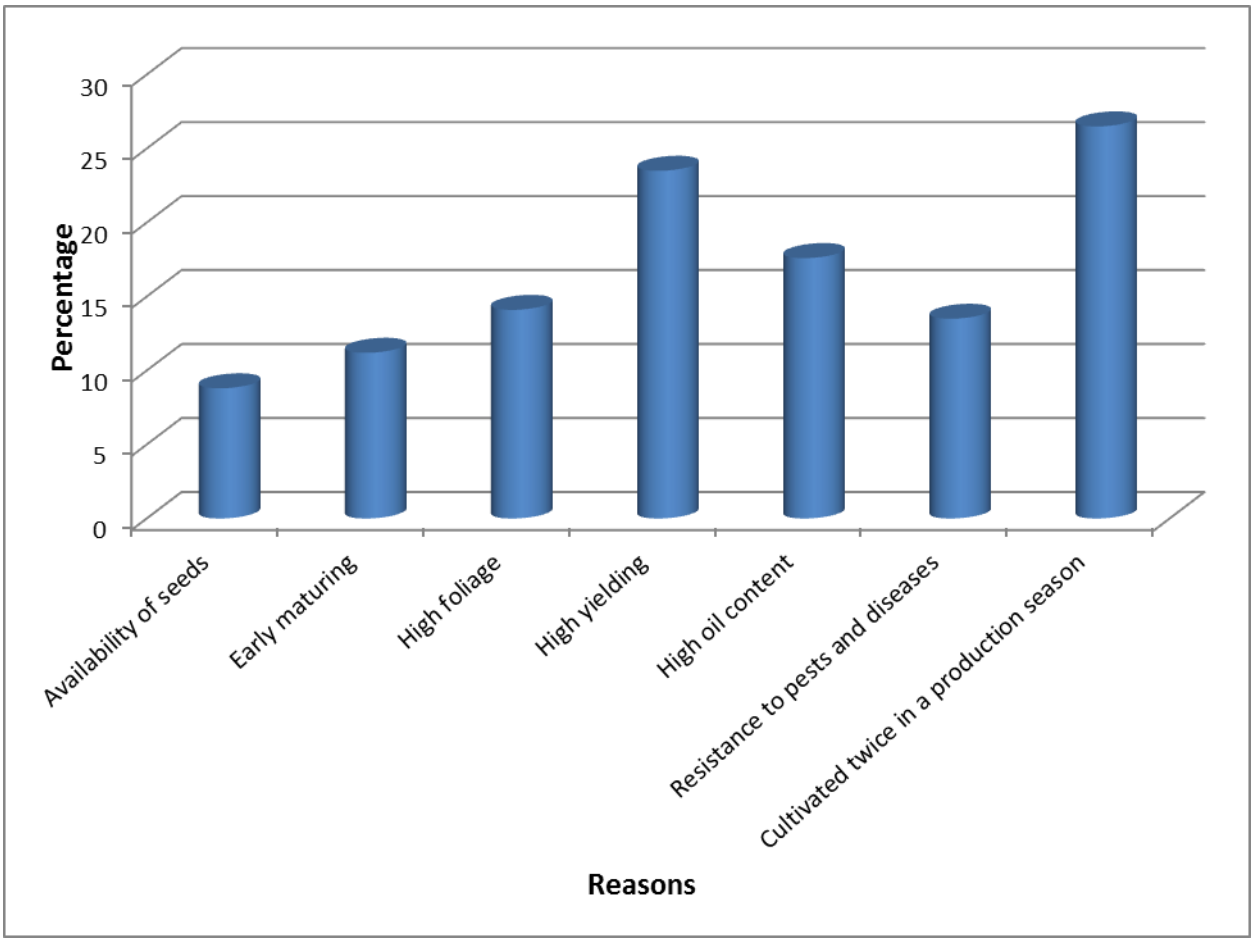


Figure 4.1: Reasons for cultivation of IAR groundnut varieties

4.2Typology of most preferred IAR groundnut varieties in the study area

SAMNUT 10, SAMNUT 14, SAMNUT 16, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted in the study area (pooled sample) as shown in the result presented in Table 4.2. However, the result shows that SAMNUT 24 (2011) was the most preferred IAR groundnut variety as indicated by a larger proportion (about 38%) of the groundnut farming households in the study area. The high preference for SAMNUT 24 is largely attributed to its high yield, high oil content and can be cultivated twice in a production season as indicated by the farmers

but is limited in having low foliage. This is in line with the finding of Govindaraj *et al*. (2009) who reported that though all the improved groundnut varieties (ICGS 76, TAG 24, ICGV 91114, Smruti, and Dh-86) were superior over the local variety, the feedback revealed that 79 % of farmers preferred ICGS 76 for its high yield and better crop. In addition, Ndjuenga *et al*. (2003) reported that of the nine improved groundnut varieties tested in Mali, farmers preferred Mossitiga because of its high drought tolerance, early maturity and high yield compared to the local variety. The high preference for SAMNUT 24 implies that it is a desirable variety whose preference can be increased if more farmers have access to the variety. The second most preferred groundnut variety is SAMNUT 23 as indicated by about 27% of the groundnut farming households that adopted IAR groundnut varieties. SAMNUT 23 is equally high yielding and has high oil content and high foliage but it can only be cultivated once in production season. The least preferred is SAMNUT 16, SAMNUT 16 in which only 1 groundnut farmer representing 1% of the adopters of IAR groundnut varieties indicated preference for the variety.

Between the sampled States of the study area, SAMNUT 14, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted in Jigawa State. SAMNUT 10, SAMNUT 16, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted in Zamfara State. In Sokoto State, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted as shown in Table 4.3.SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted in Kebbi state and SAMNUT 24, SAMNUT 23, SAMNUT 22, SAMNUT

21, SAMNUT 18, SAMNUT 14 and SAMNUT 10 were the preferred IAR groundnut varieties planted in Kaduna State.

Although, a larger proportion of the households across the sampled states preferred SAMNUT 24, there is still variability in the preference for IAR groundnut varieties by the groundnut farming households as other IAR groundnut varieties (SAMNUT 23, SAMNUT 22, SAMNUT 21, SAMNUT 18 SAMNUT 14 SAMNUT 16 and SAMNUT 10) were equally most preferred by other cross sections of the groundnut farming households in the study area.

Across the agro ecological zones of the study area as presented in Table 4.3, SAMNUT 24 was the most preferred in the Southern guinea savannah and Sudan savannah agro ecological zones as indicated by about 39% of the adopters of IAR groundnut varieties in each of the agro ecological zones. SAMNUT 23 was the most preferred variety in Northern guinea savannah while in the Sahel savannah agro ecological zone, SAMNUT 14 was the most preferred variety. This result implies that IAR groundnut varieties are better suited to some agro ecological zones as the preference for these varieties differs in the respective agro ecological zones. However, SAMNUT 24 is the most preferred IAR groundnut variety across the agro ecological zones. This agrees with the findings of Nautiyal *et al*. (2011) who posited that differential preference in varietal adoption pattern indicates farmers' preferred traits in a variety suitable for the particular agro ecological niche. For instance, farmers in low rainfall area preferred three varieties, ie, ICR 3 (100%), JAL 42 (75%) and JUG 16 (25%) while farmers in moderate rainfall area preferred only two, ie giving first preference to JAL 42 (100%) and second to ICR 3 (100%). Farmers in low rainfall area also preferred JUG 16. Hence, groundnut productivity could be enhanced by developing

varieties possessing suitable traits for each agro ecological niche varying in average rainfall or water availability.

Table 4.2: Most preferred IAR groundnut varieties planted in the study area

State	IAR groundnut varieties	Frequency	Percentage
Jigawa	SAMNUT 24	40	36.4
	SAMNUT 23	31	28.2
	SAMNUT 22	19	17.3
	SAMNUT 21	15	13.6
	SAMNUT 14	3	1.8
	SAMNUT 18	2	2.7
		110	
Zamfara			
	SAMNUT 24	6	40.0
	SAMNUT 23	4	26.6
	SAMNUT 22	1	6.6
	SAMNUT 21	2	13.3
	SAMNUT 16	1	6.6
	SAMNUT 10	1	6.6
		15	
Sokoto			
	SAMNUT 24	6	40.0
	SAMNUT 23	4	26.6
	SAMNUT 22	5	33.3
		15	
Kebbi			
	SAMNUT 24	7	46.6
	SAMNUT 23	4	26.6
	SAMNUT 22	1	6.6
	SAMNUT 21	2	13.3
	SAMNUT 18	1	6.6
		15	
Kaduna	SAMNUT 24	5	33.3
	SAMNUT 23	3	20.0
	SAMNUT 22	1	6.6
	SAMNUT 21	2	13.3
	SAMNUT 18	1	6.6
	SAMNUT 14	2	13.3
	SAMNUT 10	1	6.6
		15	
Pooled sample	SAMNUT 24	64	37.6
	SAMNUT 23	46	27.1
	SAMNUT 22	27	15.9
	SAMNUT 21	21	12.4
	SAMNUT 18	4	2.4
	SAMNUT 16	1	0.5
	SAMNUT 14	5	2.9
	SAMNUT 10	2	1.2
	Total	170	

Table 4.3: Most preferred IAR groundnut varieties based on agro ecologies of study area

IAR groundnut varieties	SGS Freq	NGS Freq	SDS Freq	SHS Freq
SAMNUT 24	10(38.5)	8(27.6)	31(38.7)	4(11.4)
SAMNUT 23	5(19.2)	10(34.5)	24(30)	7(20.0)
SAMNUT 22	5(19.2)	4(13.8)	11(13.8)	7(20.0)
SAMNUT 21	2(7.7)	6(20.7)	8(10)	5(14.3)
SAMNUT 18	1(3.8)	0(0.0)	3(3.75)	0(0.0)
SAMNUT 16	0(0.0)	0(0.0)	0(0.0)	1(2.9)
SAMNUT 14	2(7.7)	1(3.4)	3(3.7)	10(28.6)
SAMNUT 10	1(3.8)	0(0.0)	0(0.0)	1(2.9)
Total	26	29	80	35

NB: SGS = Southern guinea savannah NGS = Northern guinea savannah
SDS = Sudan savannah SHS = Sahel savannah
Values in parentheses are percentages

4.3 Rate of adoption of IAR groundnut varieties in the study area

The estimated adoption rate of the different IAR groundnut varieties cultivated by farming households in the study area is shown in Table 4.4.SAMNUT 10, SAMNUT 14, SAMNUT 16, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the IAR groundnut varieties adopted in the study area (pooled sample) as shown in the result presented in Table 4.4. The result shows that a larger proportion of farming households adopted SAMNUT 24 (pooled sample) with an adoption rate of (35%) which implies that 35% of the groundnut farming households in the study area adopted SAMNUT 24. This was followed by SAMNUT 23 which was adopted by about 26% of the groundnut farming households and the least is SAMNUT 16 which was found to be adopted by 4% of the groundnut farming households in the study area.

Across the sampled states of the study area, SAMNUT 14, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the adopted IAR groundnut varieties in Jigawa State with SAMNUT 24 having the highest adoption rate of 38% as shown in Table 4.4. SAMNUT 10, SAMNUT 16, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were adopted in Zamfara state with SAMNUT 16 having the highest

adoption rate of 40% as shown in Table 4.4. In Sokoto state, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were adopted. SAMNUT 24 had the highest adoption rate of 33% as shown in Table 4.4. SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the IAR groundnut varieties adopted in Kebbi state and SAMNUT 24 had the highest adoption rate of 30% as shown in Table 4.4 and SAMNUT 24, SAMNUT 23, SAMNUT 22, SAMNUT 21, SAMNUT18, SAMNUT 14, SAMNUT 10 were the IAR groundnut varieties planted in Kaduna state, with SAMNUT 24 having the highest adoption rate of 23%

The proportion of farmers using a technology is a social indicator of farmers' interest in the technology (Ndjuenga *et al.*, 2008) and therefore, the high adoption rate of SAMNUT 24 is an indication of farmers interest on it relative to other IAR groundnut varieties in the study area.

Table 4.4: Rate of adoption of IAR groundnut varieties in the study area

State	IAR varieties	*Adopters	Non adopters	Adoption rate
Jigawa	SAMNUT 24	86	141	37.8
	SAMNUT 23	73	154	32.2
	SAMNUT 22	62	165	27.3
	SAMNUT 21	51	176	22.5
	SAMNUT 14	42	185	18.5
	SAMNUT 18	24	203	10.6
Zamfara		*		
	SAMNUT 24	8	22	27.0
	SAMNUT 23	4	26	13.3
	SAMNUT 22	3	27	10.0
	SAMNUT 21	2	28	6.7
	SAMNUT 10	10	29	33.3
	SAMNUT 16	12	29	40.0
Sokoto		*		
	SAMNUT 24	10	20	33.3
	SAMNUT 23	6	24	20.0
	SAMNUT 22	4	26	13.3
Kebbi		*		
	SAMNUT 24	9	21	30.0
	SAMNUT 23	3	27	10.0
	SAMNUT 22	3	27	10.0
	SAMNUT 21	8	22	26.7
	SAMNUT 18	1	29	3.3
		*		
Kaduna	SAMNUT 24	7	23	23.3
	SAMNUT 23	4	26	13.3
	SAMNUT 22	2	28	6.7
	SAMNUT 21	3	27	10.0
	SAMNUT 18	1	29	3.3
	SAMNUT 14	2	28	6.7
	SAMNUT 10	6	29	20.0
		*		
Pooled sampled	SAMNUT 24	120	217	34.6
	SAMNUT 23	90	257	25.9
	SAMNUT 22	74	273	21.3
	SAMNUT 21	64	283	18.4
	SAMNUT 18	26	321	7.5
	SAMNUT 16	12	335	3.5
	SAMNUT 14	44	303	12.7
	SAMNUT 10	16	331	4.6
		*		

*** Total frequency exceeded sample size due to multiple response**

4.4 Adoption level of IAR groundnut varieties in the study area

The result in Table 4.5 shows that SAMNUT 24 (pooled sample) had the highest level or intensity of adoption of 94% which indicates that the groundnut farmers who adopted SAMNUT 24 allocated 94% of their total groundnut farm land to the cultivation of SAMNUT 24. This implies that SAMNUT 24 had the highest intensity or extent of adoption relative to all the other IAR groundnut varieties cultivated in the study area and a plausible explanation for this is that SAMNUT 24 possesses qualities desired by the farmers. This further suggests that given equal opportunities to all the IAR varieties by the farmers in the study area, SAMNUT 24 will be given a larger portion of the groundnut farming area in the study area. This result compares favourably with that of Shiferaw *et al.* (2010) who reported that the level of adoption of improved groundnut varieties in Uganda was very high as 59% of the households grow improved varieties. The IAR groundnut variety with the least adoption level was SAMNUT 16 that had an adoption intensity of 14% which indicates that the groundnut farmers who adopted SAMNUT 16 allocated 14% of their total groundnut farm land to the cultivation of SAMNUT 16.

Across the sampled states of the study area; SAMNUT 14, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the IAR groundnut varieties planted in Jigawa State with SAMNUT 24 having the highest adoption level of 81% as shown in Table 4.5. SAMNUT 10, SAMNUT 16, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were planted in Zamfara state with SAMNUT 23 having the highest adoption level of 100% as shown in Table 4.5. In Sokoto state, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were planted. SAMNUT 24 had the highest intensity of adoption of 100% as shown in Table 4.5. SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and

SAMNUT 24 were the IAR groundnut varieties planted in Kebbi state and SAMNUT 23 had the highest adoption level of 82% as shown in Table 4.5 and SAMNUT 24, SAMNUT 23, SAMNUT 22, SAMNUT 21, SAMNUT18, SAMNUT 14, SAMNUT 10 were the IAR groundnut varieties planted in Kaduna state, with SAMNUT 24 having the highest adoption level of 78%.

Table 4.5: Adoption level of IAR groundnut varieties in the study area

State	IAR varieties	Average land area for groundnut production (ha)	Average Land area cultivated for i^{th} IAR groundnut variety (ha)	Adoption level (%)
Jigawa	SAMNUT 24	3.69	2.43	81
	SAMNUT 23	3.75	2.22	71
	SAMNUT 22	8.50	2.00	27
	SAMNUT 21	7.00	1.35	21
	SAMNUT 14	9.00	4.00	67
	SAMNUT 18	4.66	1.33	19
Zamfara				
	SAMNUT 24	8.00	3.11	49
	SAMNUT 23	4.00	1.00	100
	SAMNUT 22	3.00	1.18	68
	SAMNUT 21	2.00	1.50	30
	SAMNUT 10	3.00	4.00	50
	SAMNUT 16	6.20	3.20	62
Sokoto				
	SAMNUT 24	3.00	1.00	100
	SAMNUT 23	4.00	1.00	25
	SAMNUT 22	4.36	3.71	87
Kebbi				
	SAMNUT 24	3.67	2.13	72
	SAMNUT 23	3.67	2.44	82
	SAMNUT 22	6.36	3.32	74
	SAMNUT 21	4.96	2.80	74
	SAMNUT 18	3.00	2.00	73
Kaduna	SAMNUT 24	3.00	2.00	78
	SAMNUT 23	3.50	1.00	33
	SAMNUT 22	11.37	2.25	39
	SAMNUT 21	5.22	2.80	71
	SAMNUT 18	4.23	1.50	45
	SAMNUT 14	2.31	2.10	50
	SAMNUT 10	2.57	2.00	67
Pooled sampled	SAMNUT 24	1.64	1.21	94
	SAMNUT 23	3.67	2.13	82
	SAMNUT 22	6.36	3.30	74
	SAMNUT 21	4.96	2.80	60
	SAMNUT 18	3.00	2.00	53
	SAMNUT 16	7.00	1.00	14
	SAMNUT 14	3.67	2.44	30
	SAMNUT 10	8.00	2.00	25

4.5 Factors influencing adoption of IAR groundnut varieties in the study area

The maximum likelihood estimates of the parameters of the logistic regression of factors influencing the adoption of IAR groundnut varieties are presented in Table 4.6. The log-likelihood statistic of -139.7271 is significant at 1% probability level and this indicates the joint significance of the independent variables included in the model. The overall percentage of the adoption of IAR groundnut varieties correctly predicted seems good at 67% in comparison to the 100% prediction of a perfect model.

The major drivers of adoption of IAR groundnut varieties in the study area were found to be, ecology, education, membership of cooperative societies, household income and extension contact. Age of household head, farming experience, credit, farm size and household size were found to be insignificant in influencing adoption of IAR groundnut varieties in Nigeria.

Agro-ecology was positively related to groundnut farming households adoption of IAR groundnut varieties and was significant at 1% probability level. The odd ratio of 0.003indicates that a unit increase in diversities of agro ecological zones will tend to increase the probability of the groundnut farming households adoption of IAR groundnut varieties by a magnitude of 0.003. A plausible explanation for this is that variation in agro-ecological zones determines the variety of seeds planted in the agro-ecological zones, as different varieties are better suited to different agro-ecological zones. This is in line with Kafle (2010) who noted that agro ecological variable is an important determinant of adoption of Improved Maize Varieties (IMV) in a study on the determinants of adoption of improved maize varieties in developing countries.

Education was positively related to groundnut farming households adoption of IAR groundnut varieties and was significant at 5% probability level. The odd ratio of 0.018 indicates that a unit increase in the educational level of the groundnut farming households will increase the probability of adoption of IAR groundnut varieties by a magnitude of0.018. Education enables one to access information needed to make a decision to practice a new technology. This is in agreement with (Kudi *et al*., 2011; Ambali *et al*., 2012) who in their respective studies found that education is a significant factor in facilitating awareness and adoption of agricultural technologies. This is consistent with literature that education creates a favourable mental attitude for the acceptance of new practices especially of information-intensive and management-intensive practices. The implication of this is that farm households with well-educated members are more likely to adopt modern agricultural production technologies than those without well-educated members.

Membership of cooperative societies was found to be positive and significant at 10% probability level with an odd ratio of 0.063which suggests that a unit increase in years of participation in cooperative societies by the groundnut farming households will increase the probability of the groundnut farming households adoption of IAR groundnut varieties by a magnitude of 0.063. A plausible explanation for this is that the membership of social organizations such as cooperative society enhances the interaction and exchange of ideas on agricultural technologies among farmers and thereby influencing the adoption decision of their members.

Household income was negatively related to the probability of groundnut farming household that adopted IAR varieties and was significant at 5% probability level. The odd ratio of 0.043 indicates that a unit increase in the income of the groundnut farming

households will have the tendency of reducing their adoption of IAR groundnut varieties by a magnitude of0.043. This implies that an increase in household income could stimulate the households to invest in other business ventures other than investing in the purchase of improved groundnut varieties or an increase in income could be channeled towards meeting pressing household needs instead of purchasing improved groundnut varieties. This finding is not in consonance with Bello *et al*. (2012) who posited a positive relationship between crops based technologies and income inJenkwe Development Area of Nasarawa State, Nigeria.

Extension contact was negatively related to the probability of groundnut farming household that adopted IAR groundnut varieties. The result was significant at 10% probability level with an odd ratio of 0.059 that indicates that a unit increase in extension contact will decrease the probability of the groundnut farming households adoption of IAR groundnut varieties. This result is against *a priori* expectation and a plausible explanation for this is that farmers do not have adequate access to extension services in the study area and this is in line with Ndjuenga *et al.*(2008) who discovered that compared to Jigawa, extension services (ADPs) of Kano and Katsina have been largely involved in on-farm trials and seed multiplication and distribution and this may explain why uptake of modern groundnut varieties is low in Jigawa compared to Kano and Katsina states. The implication is that access to extension services creates the platform for acquisition of the relevant information that promotes technology adoption and therefore, access to information through extension services reduces the uncertainty about a technology's performance hence may change farmer's assessment from purely subjective to objective over time thereby facilitating adoption.

The non-significance of age of household head and farm size in influencing adoption of IAR groundnut varieties agrees with the finding of Ndjuenga *et al.* (2008) who also found out that age of household head and farm size were not significant in influencing adoption of modern groundnut varieties in Nigeria in a study of early adoption of modern varieties of groundnut in West Africa. The implication of the positive sign of the coefficient of age is that an increase in the age of the farmers would increase the adoption behavior of the farmers for IAR groundnut varieties. With respect to the negative sign of the coefficient of farm size, it implies that an increase in the farm holding of the farmer would have the tendency of decreasing the likelihood of adoption of IAR groundnut varieties. Farming experience was positively related to groundnut farming households adoption of IAR groundnut varieties but was not significant. This finding agrees with Ayoola (2012) who discovered a positive relationship between adoption of yam minisett technology and farming experience in the Middle belt region of Nigeria. This is expected because more experienced farmers may have better skills and access to new information about improved technologies. It could also imply that knowledge gained over time from working in uncertain production environment may help in evaluating information thereby influencing their adoption decision. Amount of credit obtained was not significant in influencing adoption behavior of groundnut farming households. This implies that there is the tendency that farmers did not adopt IAR groundnut varieties because majority of them had no access to credit which would have enabled them to purchase inputs and pay for labour required in the adoption of these varieties and this is in line with the findings of Saka and Lawal (2009) who also establish that there was no significant relationship between adoption of improved rice varieties and credit. Also, Alarima *et al.* (2011) established that there was no significant relationship between adoption of Sawah rice technology and credit.

The non-significant relationship between adoption of IAR groundnut varieties and household size agrees with Akinola *et al.* (2007) who noted that household size was not significant in influencing adoption of balanced nutrient management systems technologies in the northern Guinea savanna of Nigeria. The negative sign on household size implies that large families decrease the probability of adoption of modern varieties. This may be explained by the fact that large families are more vulnerable than smaller families and may not want to take the risk of jeopardizing food security by using modern varieties.

Table 4.6: Logit regression estimates of factors influencing the adoption of IAR groundnut varieties

Variable	Coefficient	Standard error	T-value	Exp(B)
Constant	-1.301*	0.778	-1.673	0.094
Age	0.001	0.017	0.072	0.942
Agro-ecology	0.399***	0.132	3.026	0.003
Farming experience	0.024	0.018	1.361	0.174
Education	0.062**	0.026	2.359	0.018
Household size	-0.004	0.029	-0.123	0.902
Farm size	-0.031	0.033	-0.949	0.343
Credit	-0.452D-04	0.484D-04	-0.933	0.351
Cooperative society	0.535*	0.288	1.857	0.063
Household income	-0.100D-05**	0.494D-06	-2.025	0.043
Extension contact	-0.063*	0.033	-1.887	0.059
Log likelihood ratio test	-139.7271			
Pseudo R-square	0.11			
Percentage predictions	0.67			

NB: * P<0.1, ** P<0.05 and *** P<0.01

4.6 The contribution of IAR groundnut varieties to the income of groundnut farming households

The result of the Z test as presented in Table 4.7 shows that the calculated Z value (10.80) is greater than the table Z value of 1.64 at one tail and 1.96 at two tail respectively and it is

significant at 1% probability level. This implies that there is significant different between the income of groundnut farming households who adopted IAR groundnut varieties and those who did not adopt IAR groundnut varieties. The result of the Z statistic clearly shows that the difference between the annual income of the groundnut farming households that adopted IAR groundnut varieties and those who did not adopt is significant thereby implying that adoption of IAR groundnut varieties had an impact on the income of the groundnut farming households that adopted IAR groundnut varieties which contributed in enhancing the income of the farmers. This finding is in consonance with Ndjuenga *et al.*(2008) who found out that the average income from adopters ($204/ha) of modern groundnut varieties in Nigeria was estimated to be significantly higher by $123/ha for non-adopters in a study of early adoption of modern groundnut varieties in West Africa. Also, Kassie *et al*. (2010) posited that adopters of groundnut technology seemed to be better off than non-adopters as the average annual total household income per capita was UGX 522,284 (US$ 282) and UGX 476,148($257) for adopters and non-adopters, respectively in a study on Adoption and impact of improved groundnut varieties on rural poverty in Uganda.

From the result of the frequency distribution of the annual income of adopters and non-adopters of IAR groundnut varieties in Tables 4.8, 15%of the groundnut farming households that adopted IAR groundnut varieties fall within the highest annual income range of above ₦599, 000 while in the case of the non-adopters of IAR groundnut varieties, only 9% fall within the highest annual income range of above ₦ 599,000. Twenty three (23) % of the adopters of IAR groundnut varieties are within the lowest annual income range of ₦ 100, 000 - ₦ 199, 000 as opposed to 27% of the non-adopters of IAR groundnut

varieties. The mean annual income of groundnut farming households that adopted IAR groundnut varieties (₦303760.00) is higher than the mean annual income of non-adopters of IAR groundnut varieties (₦196946.30) which implies that the adopters of IAR groundnut varieties realized higher income than the non-adopters of IAR groundnut varieties. The standard deviation of the income of the groundnut farming households that adopted IAR groundnut varieties (387,732.6) is higher than that of farming households that did not adopt IAR groundnut varieties (199,563) which imply that there is a higher variability in the income of adopters of IAR groundnut varieties than the non-adopters.

Table 4.7: Result of statistical comparison between the income of adopters and non-adopters of IAR groundnut varieties

Variable income	**Adopters income**	**Non-adopters**
Mean	303760.00	196946.30
Known Variance	387830.50	199563.00
Observations	170.00	177.00
Hypothesized Mean Difference	0.00	
Z	10.80	
P(Z<=z) one-tail	0.00	
z Critical one-tail	1.64	
P(Z<=z) two-tail	0.00	
z Critical two-tail	1.96	

Table 4.8: Frequency distribution of the annual income of adopters of IAR groundnut varieties

Variable	Adopters		Non –adopters	
	Frequency	Percentage	Frequency	Percentage
100,000 -199,000	39	22.9	47	26.5
200,000 -299,000	32	18.8	42	23.7
300,000 - 399,000	29	17.1	30	16.9
400,000 - 499,000	19	11.2	28	15.8
500,000 – 599,000	25	14.7	14	7.9
> 599,000	26	15.3	16	9.0
Total	170	100.0	177	100.0
Minimum	171,000		150,000	
Maximum	1,466,000		1,200,000	
Mean	303,760		196,946.3	
Standard deviation	387,732.6		199,563	

4.6.1 Statistical comparison between the income of adopters and non-adopters of IAR groundnut varieties

The calculated z value (10.80) is greater than the table z value of 1.64 at one tail and 1.96 at two tail respectively as shown in Table 4.7 and it is significant at 1% probability level. This implies that there is significant different between the income of groundnut farming households who adopted IAR groundnut varieties and those that did not adopt IAR groundnut varieties and therefore, the null hypothesis is rejected and the alternative accepted. This suggests that IAR groundnut varieties contributes in enhancing the income of the adopters of IAR groundnut varieties and therefore, non-adopters of IAR groundnut varieties can increase their income level through adoption of IAR groundnut varieties.

4.7 The contribution of IAR groundnut varieties to alleviating poverty of groundnut farming households

The result of the poverty profile of groundnut farming households that adopted IAR groundnut varieties and farming households who did not adopt IAR groundnut varieties in the study area is presented in Table 4.9. From the estimates of FGT weighted class of poverty indices, the poverty line was estimated to be ₦463, 20.53. This means that farming households in the study area whose monthly food and non-food expenditure is below ₦463, 20.53 are considered poor

The poverty head count (poverty incidence) of farming households who adopted IAR groundnut varieties was (19%) while that of the non-adopters was (49%). This implies that the share of the population of groundnut farming households that adopted IAR groundnut varieties whose income and consumption falls below the poverty line is lower than that of farming households that did not adopt IAR groundnut varieties indicating that the proportion of adopters of IAR groundnut varieties that cannot afford to buy a basic basket of goods to meet the consumption needs of their households is lower than that of the non-adopters of IAR groundnut varieties. This finding is in line with Awotide *et al*. (2012) who discovered that the incidence of poverty was higher among the non-adopters (51%) than the adopters (46%) of improved rice varieties in Nigeria.

The depth of poverty (poverty gap index) of poor farming households who adopted IAR groundnut varieties (0.24) was lower than that of poor farming households who did not adopt IAR groundnut varieties (0.44).This indicates that the poor farming households who did not adopt IAR groundnut varieties are farther away from the poverty line than poor farming households who adopted IAR groundnut varieties and the implication is that it is

easier for the adopters of IAR groundnut varieties to move above the poverty line than the non-adopters who are far away from the poverty line.

Also, the degree of inequality (poverty severity) among the poor farming households who adopted IAR groundnut varieties given by the estimated severity of poverty (0.71) was equally lower than that of the poor farming households who did not adopt the varieties (0.88).This shows that the proportion of poor farming households who adopted IAR are better off as their poverty severity is lower than the poor farming households who did not adopt IAR groundnut varieties.

From the poverty profile of the adopters and non-adopters of IAR groundnut varieties, it can be deduced that the adopters of IAR groundnut varieties had a lower poverty status that the non-adopters of IAR groundnut varieties and this implies that adoption of IAR groundnut varieties have contributed in alleviating the poverty status of the adopters of the varieties which is in line with Kassie *et al*. (2010) who also found that adoption of improved groundnut varieties contributed to rural poverty alleviation in Uganda. Therefore, adoption of IAR groundnut varieties can be a panacea for poverty among groundnut farming households and hence, the fight against the menace of poverty among rural farming households who are into groundnut production can be fostered by encouraging adoption of IAR groundnut varieties among groundnut farming households. This result is consistent with other related studies on the impact of agricultural technologies on poverty (Mendola, 2007; Diagne *et al*., 2009; Mignouna *et al*., 2011; Omilola, 2009).

Table 4.9: Poverty profile of Adopters and Non-adopters of IAR groundnut varieties

Items	Adopters	Non-adopters
Poverty line(₦)	46320.53	46320.53
Poverty headcount	0.19	0.49
Poverty gap	0.24	0.44
Poverty severity	0.71	0.88
Poor (%)	19.00	49.00
Non-poor (%)	81.00	51.00
Number of observation	170.00	177.00

4.7.1 Statistical comparison between the poverty status of adopters and non-adopters of IAR groundnut varieties

The result of the Z test as presented in Table 4.10 shows that the calculated z value (6.55) is greater than the table z value of 1.64 at one tail and 1.96 at two tail respectively and it is significant at 1% probability level. This implies that there is a significant difference in the poverty status of adopters and non-adopters of IAR groundnut varieties. Therefore, the adoption of IAR groundnut varieties has contributed in alleviating the poverty status of farming households who adopted IAR varieties in the study area

Table 4.10: Result of statistical comparison between the poverty status of adopters and non-adopters of IAR groundnut varieties

Variables	Adopters poverty status	Non-adopters poverty status
Mean	6013.16	4980.62
Known Variance	316746162.60	153652857.00
Observations	170.00	177.00
Hypothesized Mean Difference	0.00	
Z	6.55	
P(Z<=z) one-tail	0.00	
z Critical one-tail	1.64	
P(Z<=z) two-tail	0.00	
z Critical two-tail	1.96	

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study investigated the contribution of IAR groundnut varieties to poverty alleviation among farming households in the North West Zone of Nigeria. The specific objectives were to identify the various types of IAR groundnut varieties planted in the study area, ascertain the most preferred IAR groundnut variety, determine the adoption rate of the various IAR groundnut varieties, determine the adoption level of the various IAR groundnut varieties, determine the factors that influence the adoption of IAR groundnut varieties and assess the impact of IAR groundnut varieties on the income and poverty status of the groundnut farmers. A multistage sampling technique was employed in the selection of groundnut farming households for the study. A sample size of 347 groundnut farming households comprising of 170 adopters and 177 non-adopters was used in the study. Primary data were employed in this study and the data were on socio-economic characteristics such as age, gender, household size, farm size, farm income, access to credit, number of extension contacts, level of education of household heads of groundnut farming households and also, their household size. Data on IAR groundnut varieties adopted by the farming households was also collected as well as data on household expenditure (food and non-food expenditure) for estimating the poverty status of the households. The combination of tools such as descriptive statistics, adoption index, Logit regression model, Z-statistic, and Foster-Greer-Thorbecke's (FGT) Weighted Poverty Index were used for data analyses.

The study showed that SAMNUT 10, SAMNUT 14, SAMNUT 16 SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were identified as the IAR groundnut varieties planted in the study area (pooled sampled) and SAMNUT 24 was

identified as the variety planted by a larger proportion (about 62%) of the groundnut farming households who planted IAR groundnut varieties in the study area. Between the sampled states of the study area, SAMNUT 14, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the identified IAR groundnut varieties in Jigawa State. SAMNUT 10, SAMNUT 14, SAMNUT 16, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were identified in Zamfara state. In Sokoto state, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were identified. SAMNUT 14, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were identified as the IAR groundnut varieties planted in Kebbi state. SAMNUT 10, SAMNUT 14, SAMNUT 18 SAMNUT 21,SAMNUT 22,SAMNUT 23 and SAMNUT 24 were identified in Kaduna state.

SAMNUT 10, SAMNUT 14, SAMNUT 16, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted in the study area (pooled sample). The most preferred IAR groundnut variety was SAMNUT 24 as indicated by a larger proportion (about 38%) of the groundnut farming households in the study area. Between the samples states of the study area, SAMNUT 14, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted in Jigawa State. SAMNUT 10, SAMNUT 16, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred in Zamfara state. In Sokoto state, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were preferred. SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the preferred IAR groundnut varieties planted in Kebbi state. SAMNUT 10, SAMNUT 14, SAMNUT 18 SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were preferred in Kaduna state.

SAMNUT 10, SAMNUT 14, SAMNUT 16, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the IAR groundnut varieties adopted in the study area (pooled sample). The result shows that a larger proportion of farming households adopted SAMNUT 24 with an adoption rate of (35%) in the study area. Between the sampled states of the study area, SAMNUT 14, SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the adopted IAR groundnut varieties in Jigawa State. SAMNUT 10, SAMNUT 16, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were adopted in Zamfara state. In Sokoto state, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were adopted. SAMNUT 18, SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the IAR groundnut varieties adopted in Kebbi state. SAMNUT 10, SAMNUT 14, SAMNUT 18 SAMNUT 21, SAMNUT 22, SAMNUT 23 and SAMNUT 24 were the adopted IAR varieties in Kaduna state.

The factors that were significant in influencing the adoption of IAR groundnut varieties in the study area were found to be agro-ecology ($p<0.01$,) education ($p<0.05$), membership of cooperative societies ($p<0.1$), household income ($p<0.05$) and extension contact ($p<0.1$). Age of household head, farming experience, credit, farm size and household size were found to be insignificant in influencing adoption of IAR groundnut varieties in the study area.

Findings from the research showed that the annual income of adopters and non-adopters of IAR groundnut varieties who fell within the highest income range of above ₦599,000 were 15% and 9% respectively indicating that a larger proportion of the adopters were in the highest income range compared to the non-adopters, while the annual income of adopters and non-adopters of IAR groundnut varieties who fell within the lowest annual income

range of ₦ 100,000 – ₦ 199,000 were 23% and 27% respectively and this implies that a larger proportion of the non-adopters were in the lowest income range compared to the adopters. The mean annual income of groundnut farming households that adopted IAR groundnut varieties was ₦303760.00 while the mean annual income of non-adopters of IAR groundnut varieties was ₦196946.30. The result of the Z statistic clearly shows the difference between the annual income of the groundnut farming households that adopted IAR groundnut varieties and those who did not is significant thereby implying that adoption of IAR groundnut varieties had an impact on the income of the groundnut farming households that adopted IAR groundnut varieties. The standard deviation of the income of the groundnut farming households that adopted IAR groundnut varieties was 387, 732.6 while farming households that did not adopt IAR groundnut varieties was 199, 563.

The result showed that the proportion of poor groundnut farming households who adopted IAR groundnut varieties and those who did not adopt was found to be 19% and 49%respectively using an estimated poverty line of ₦46320.53. The poverty head count (poverty incidence) of farming households who adopted IAR groundnut varieties was 19% while that of the non-adopters was 49%. The depth of poverty (poverty gap index) of poor farming households who adopted IAR groundnut varieties was 0.24 while that of those who did not adopt IAR groundnut varieties was 0.44. The poverty severity among the poor farming households who adopted IAR groundnut varieties was 0.71while that of the poor farming households who did not adopt the varieties was 0.88. The Z statistic shows a significant difference in the poverty status of adopters and non-adopters of IAR groundnut varieties implying that adoption of IAR groundnut varieties had an impact on the poverty status of the groundnut farming households that adopted IAR groundnut varieties.

5.2 Conclusion

The adoption of IAR groundnut varieties has contributed in increasing the income of groundnut farming households as well as alleviating the poverty status of the groundnut farming households and this suggests that the adoption of IAR groundnut varieties by groundnut farming households was very instrumental in enhancing the income and well-being of the groundnut farming households. The factors responsible for influencing the adoption of IAR groundnut varieties were farming experience, education and membership of co-operative societies, household income and extension contact and this implies that policy measures geared towards encouraging adoption of IAR groundnut varieties should take into proper consideration the factors significant in influencing adoption of IAR groundnut varieties.

5.3 Contribution to Knowledge

1. The most preferred IAR groundnut variety was SAMNUT 24 as indicated by about (38%) of the adopters of IAR groundnut varieties and the preference for SAMNUT 24 is largely attributed to its high yield and high oil content as indicated by the farmers. It can be cultivated twice in a production season, however it has poor foliage production. As such, it competes with SAMNUT 23 particularly if ecologies are to be taken into consideration. SAMNUT 23 is equally high yielding and has high oil content but it can only be cultivated once in a production season and has high foliage.

2. The adoption of IAR groundnut varieties has contributed in enhancing the income of adopters as their mean annual income of ₦303,760.00 was higher than the mean annual income of ₦196,946.30 for the non-adopters and the Z statistic of 10.80 by 54% indicated that the difference between their incomes is statistically significant at 1% probability level.

3. The adoption of IAR groundnut varieties has contributed in alleviating the poverty status of the groundnut farming households as the incidence of poverty of the adopters (19%) was lower than that of the non-adopters (49%) and the Z statistic of 6.55 indicated that there is a significant difference in the poverty status of the adopters and non-adopters of IAR groundnut varieties.

5.4 Recommendations

The following recommendations are based on empirical findings from this research:

1. The adoption of IAR developed groundnut varieties should be promoted by public, private and non-governmental organizations as these varieties will not only boost production and improve on the nation's financial standing (since groundnut is a cash crop) but also help to improve the income of the farmers, thereby aiding in alleviating rural poverty.

2. Arising from the significant influence of farmers association on adoption of IAR groundnut varieties, it is recommended that farmers should be encouraged to join co-operative societies so as to foster their interaction and exchange of ideas on IAR groundnut varieties towards facilitating adoption of the varieties.

3. Education was found to be positive and significant in influencing adoption of IAR groundnut varieties. In the light of this, it is recommended that efforts should be intensified on improving education of the farmers through effective extension as this will enhance the adoption of IAR groundnut varieties by the farmers in the study area.

4. SAMNUT 24 was found to be the most preferred IAR groundnut variety due to its high yield, high oil content and can be cultivated twice in a production season but its major limitation is that it has poor foliage. Hence, it is recommended that IAR groundnut breeders

should intensify efforts at improving upon SAMNUT 24 to address the problem of low foliage as farmers consider groundnut foliage relevant for feeding livestock.

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QUESTIONNAIRE

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, AHMADU BELLO UNIVERSITY, ZAIRA.

FARMERS RESEARCH QUESTIONNAIRE

TOPIC: THE CONTRIBUTION OF IAR GROUNDNUT VARIETIES TO POVERTY ALLEVIATION AMONG FARMING HOUSEHOLDS IN THE NORTH WEST ZONE OF NIGERIA

Agro-Ecological Zone ……....

1. Name of respondent……...
2. Phone number of respondent…….
3. Village/local government area/state……...
4. Marital status……..
5. Age of respondent……..
6. Household size……...
7. Level of education: No formal education ( ) Primary ( ) Secondary ( ) Tertiary ( ) Others ( )
8. Total number of years spent in school……..
9. What is your total land size …….. Ha
10. How long have you been in groundnut production……
11. Name the various IAR groundnut varieties you know……...

    ……

    ……
12. Which of the varieties do you prefer……
13. Give reasons for No. 12 above……..……

14. Which of the varieties do you plant?

……

……

……

15. Give reasons for planting or not planting the varieties (planting [ ] Not planting [ ])

……

……

……

16. Estimate the percentage of farmers that planted the type of IAR groundnut variety that you planted……
17. Do you know of any other variety being planted by other farmers? Estimate the percentage of the farmers that planted the variety in the last cropping season……..
18. Is the percentage increasing or reducing over the years? .....
19. Do you belong to any farming organization? (Name the organization if yes)……..
20. How many times did
    a. You visit any extension agent to seek for advice on groundnut production……
    b. Any extension agent visited you to give advice on groundnut production……..
    c. You attend farmer field school on groundnut production……
    d. You attend any workshop/conference or film shows on groundnut production……

20. Did you have access to credit in the last cropping season? Yes ( ) No ( )

21. If yes, what was the total amount obtained ₦…….

22. Quantity of input applied and output realized

Plot	Name of crop planted	Plot Size (Ha)	Seed (Kg)	Fertilizer (Brand)/(Kg)	Manure (Kg)	Agrochemicals (*l*)	Output (Kg)
1.							
2.							
3.							
4.							

23. Kindly indicate the hours of labour you employed in each farming activity in the cultivation of groundnut during the last cropping season.

Plot	Land preparation and planting		Weeding		Inorganic fertilizer application		Organic fertilizer application		Pesticide application		Harvesting	
	Family labour	Hired labour	Family labour	Hired labour	Family labour	Hired labour	Family labour	Hired labour	Family labour	Hired labour	Family labour	Hired labour
1												
2												
3												
4												

24. Cost of inputs applied

Plot	Name of Crop Planted	Seed(₦)	Fertilizer (Brand)/(Kg)	Manure (₦)	Labour (₦)	Agrochemicals (₦)
1.						
2.						
3.						
4.						

25. How many bags (100kg bag) did you sell last season? ..... bags

26. How much was the price per bag? ₦.....

27. What was your annual income from all sources last season? ₦.....

28. How much do you spend on feeding per week? .....

29. What percentage of the income from groundnut production adds to your general income and food security…….

30. How many times do you feed per day? …….

31. How many months are you food secured? ……

32. List the problems you faced in the production of the groundnut in the last production season

……

……

33. Kindly provide information on your households food and non-food consumption expenditure.

Item		Amount(₦)
Food	Monthly expenditure	
House rent	Monthly expenditure	
Electricity/water bills	Monthly expenditure	
School expenses (school fees, textbooks, writing materials e.t.c)	Annual expenditure	
Medical expenses	Annual expenditure	
Clothing expenses	Annual expenditure	
Communication expenses (G.S.M calls, recharge cards e.t.c)	Monthly expenditure	
Transportation expenses	Monthly expenditure	
Social expenses (wedding, naming ceremony e.t.c)	Annual expenditure	
Religion (offerings, contributions e.t.c)	Monthly expenditure	
Others……		