AN ASSESSMENT OF THE CONTRIBUTION OF URBAN AND PERI-URBAN MAIZE PRODUCTION TO THE FOOD SECURITY OF THE FARM HOUSEHOLDS IN KADUNA STATE, NIGERIA

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS OF SCIENCE IN AGRICULTURAL ECONOMICS

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY
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AHMADU BELLO UNIVERSITY
ZARIA, NIGERIA

NOVEMBER, 2015

DECLARATION

I hereby declare that this dissertation titled "**An Assessment of the Contribution of Urban and Peri-urban Maize Production on the Food Security of the Farm Households in Kaduna State, Nigeria**" was written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma in any institution. All borrowed ideas have been acknowledged in the text and a list of references has been provided.

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CERTIFICATION

This Dissertation titled "**An Assessment of the Contribution of Urban and Peri-urban Maize Production to the Food Security of the Farm Households in Kaduna State, Nigeria**" by Mohammed MAINA meets the regulations governing the award of a Degree of Master of Science in Agricultural Economics, Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

I dedicate this dissertation to Almighty Allah (SW) and to my late father, Maina Musa Mohammed for all the love and proper upbringing. May his soul rest in perfect peace, Ameen.

ACKNOWLEDGEMENT

I wish to thank my lecturers at the faculty who were more than generous with their expertise and precious time. A special thanks to Dr. M. A. Damisa and Prof. S. A. Sanni, my supervisors for their countless hours of reading, encouraging, and most of all patience throughout the entire process. Special thanks go to Prof. Z. Abdulsalam and the members of staff of the department of agricultural economics for their continued support.

A special feeling of gratitude to my loving parents, Maina Musa Mohammed and Zara Maina Musa whose words of encouragement and push for tenacity still ring in my ears. My wife Zainab Y. Iliyasu and children Maina Musa Mohammed (Khalifa), Fatima Mohammed Maina (Anisa) and Yusuf Mohammed Maina (Amir) who have never left my side and are very special. I also dedicate this project to my brothers Aliyu, Abubakar, Ibrahim, Abdullahi, Suleiman, Umar and sisters Fatima, Hassana, Ummi and Salma who supported me throughout the process. I wish to also thank my friend Yusuf Musa and my colleagues in the department for their wonderful support.

Finally I would like to thank the staff of Department of Agricultural Economics and Rural Sociology for their support during my course work. Special thanks also go to Malam Suleiman Salihu for his excitement and willingness to provide support and assistance.

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ABSTRACT

This study was conducted in 2014 to assess the contribution of urban and peri-urban maize production on the food security of farm households in Kaduna State, Nigeria. A multi-stage sampling technique was used to select 156 farmers. Primary data were used in the research and were collected with the aid of a structured questionnaire. Descriptive Statistics was used to; describe the socio-economic characteristics of the urban and peri-urban farmers, determine the level of contribution of maize to household farm income, describe the constraints faced by the urban and peri-urban maize farmers. Stochastic frontier production analysis was used to determine the production efficiency of the urban and peri-urban maize farmers, logit regression model was used to determine the food security and its determinants while food security line was used to determine the impact of urban and peri-urban maize production on the food security status of the maize farmers. The results showed that the mean age of the farmers was 48 years and more than half (53.2%) of the maize farmers had no formal education. 80% of the farmers had up to 5 people intheir households, while 89.6% of the farmers had no access to finance. 82% of the farmers had no contact with extension services.The log-likelihood function implied that inefficiency exist in the data. There was 23% random variation in the yield of the farmers which was due to inefficiency. The average technical efficiency of the farmers was 0.83 implying that, they are able to obtain 83% of potential output from a given mixture of production inputs. Thus, in the short-run, there is minimal scope (17%) of increasing the efficiency, by adopting the technology and techniques used by the best farmer. Estimated coefficients of all the parameters of production function (seeds, fertilizer, agrochemicals and labour) were positive with the exception of agrochemicals. Factors affecting efficiencies of maize production were educational level, household size and age. The contribution of maize amounted to 68% of the total household income. 54% of the urban and peri-urban farmers were food secure. The major constraints identified were labour (81%), access to funds (62.8%), lack of access to improved hybrid seeds, poor education and access to extension services. It is recommended that the farmers should diversify their sources of income and register with cooperative societies which may be necessary for them to access funds. Agro-based industries and non-governmental organizations should be encouraged to support research and production of maize. Inputs such as fertilizer, improved hybrid seeds should be made available in good time to support urban and peri-urban maize production.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Nigeria's domestic economy is partly determined by agriculture which accounted for 40.9% of the Gross Domestic Product (GDP) in 2010 Central Bank of Nigeria (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).

Food crops such as maize, sorghum, rice, millet, cowpea and melon are crops that contribute to food security to meet the consumption needs of the household, and as a source for livestock feeds. Its production is therefore important in meeting the food need of the poor rural household in Nigeria. Maize production in Nigeria was fully established and is integrated as important aspect of farming system, and it remains a major determinant of the cropping pattern of the predominantly peasant farmers, especially in the Northern Nigeria (Ahmed, 1996). Nevertheless, it is grown everywhere both under irrigation and under rain-fed condition in Nigeria, with over fifty million farmers growing it every year and over ninety million people employed in its processing and usage (Onyibe, 2012).

Urban and Peri-Urban maize production is becoming more prevalent world over and Kaduna State in particular, this might be premised on the fact that Kaduna is dominated

by civil servants and it was the capital of Northern Nigeria. Many of the civil servants have settled in Kaduna even after retirement as the state has a good and conducive weather. Because of the growth in population, increase in poverty level and diminishing purchasing power, a lot of households have ventured into urban farming to get more food supplements and additional income to the family.

Urban and Peri-Urban farming has been receiving attention from planners and the fact that population is growing and more land will be required for development, there are conflicts on the land as to whether it will be left for farming or used for developmental purposes. Urban and peri-urban are used synonymously but they are two different concepts in the sense that urban agriculture takes place within the boundaries of a city or town, while per-urban agriculture comprises of farming activities that takes place within 30 – 40 kilometer radius of the urban areas. These areas under peri-urban agriculture have both rural and urban outlooks. peri-urban area is identified to be about 30 – 40 km from urban centers with longer distances along major roads and much shorter, where the road network is limited (Adam 2001; Eresteine*t al.,* 2004; Drechsele*t al.,* 2007).

Kaduna State is rapidly expanding due to a lot of factors, some of which rural-urban migration, its average standard of living and proximity to Abuja, the Federal Capital Territory. Adewuyi (2008) asserts that peri-urban areas are transition zones between urban and rural areas. Consequently, these areas are under intense pressure for change in their land use and land cover. This is visible in Kaduna town as the North and South local Government Areas have merged to become one, while other local government areas like Igabi and Chikun also make up part of state capital.

Urban and peri-urban agriculture (UPA)can offer wide-ranging benefits (Pasquini, 2006). It can contribute substantial amounts to the proportion of food consumed in the city. Sweet (2009), for example, has estimated that 15–20% of the world's supply of vegetables and meat is produced in urban areas, and FAO (2008) estimated that 800 million urban dwellers are actively engaged in UPA, 200 million providing food for markets (FAO, 2008). UPA is practiced for a variety of reasons, for crisis management when markets are not working, as a strategy to overcome cash shortages or even for commercial purposes. As well as improving food security and nutrition, and creating employment for the jobless (Lynch *et al*., 2006), UPA can offer a range of environmental benefits, including improved waste recycling, and additional health benefits such as improved physical and psychological health due to increased physical activity (Lock and van Veenhuizen, 2007).

Urban and Peri-Urban Agriculture is the production, processing and distribution activities within and around cities and towns, whose main motivation is personal consumption and/or income generation, which compete for scarce urban resources of land, water, energy, and labour that are in demand for other urban activities. Urban and Peri-Urban Agriculture also include small and large scale activities in horticulture, livestock keeping, fodder and milk production, aquaculture and forestry (Gundel, 2006). Peri-Urban Agriculture takes place in the urban periphery where there are a lot of changes in terms of development and population growth, and also the prices of the land itself.

Agriculture in the urban areas has been taking place in the face of daunting challenge of rapid urban development, where the available lands for agricultural purposes are depleted due to infrastructural development. This however has not deterred the zeal and production

abilities of the urban and peri-urban maize famers as they still find a way to perform their farming activities within and around the metropolis to produce food for their families and for sale.

Urban agriculture is meant to address the problem of food insecurity facing those living in the urban areas but the population of urban areas is increasing due to rural-urban migration and the able bodied farmers go to the cities in search of white collar jobs thus, increasing the number of mouths to feed in the urban centers. According to FAO (2010), the security benefits of engaging in urban agriculture materialize mostly through better access to additional and more nutritious food. Indeed, urban households engaged in farming activities tend to consume greater quantities of food, sometimes as much as 30% more.

1.2 Problem Statement

The International Food Policy Research Institute opined that "One way to help ward off hunger among low-income households of the future may be through 'Urban Agriculture', the farming of small plot of land available in urban environments or on the perimeter of the city" (IFPRI, 1996). Eqziabler*et al.* (1994), stressed the importance of urban agriculture for many reasons, including provision of employment, food supply, supplementing income and producing important nutrition not normally available to low-income households. Urban Agriculture, defined as production in the home or plots in urban or Peri-urban areas, is more widespread and important than generally thought. Some believe that it is not only potentially significant source of income, food, energy and micro nutrients for family members but that it can also benefit the environment by providing a way to use solid waste and water.

Cities in Sub-Saharan Africa (SSA) are growing faster. With 3.7%, the current annual urban growth rate is almost double the world wide average, and by 2030, half of Africa's population will be urban (UN, 2008). Apart from the socio-economic implications, this rapid urbanization is posing major challenges to environmental protection and the supply of adequate shelter, food, water, and sanitation (Drechsel and Dongus, 2010). Urbanization is an inevitable consequence of socio-economic development, but in many countries, it is proceeding at such a fast rate that it is outpacing the growth of services and development. Urbanization also influences all aspects of food production and consumption, specific aspects of food security applicable to urban context include; the necessity to purchase most of the food needed by households, and greater dependence on the market system and on commercially processed food. Wage employment and monetary income are therefore the main prerequisites for achieving food security. The production of maize in the study area undergo major setback from the constant cultivation of arable farmland year in year out without proper soil management, this is due to rapid population growth, expensive and inadequate labour resulting to young farmers migrating to cities for better job (Oladele, 2003).

Kaduna is rapidly undergoing physical development and expansion, with remarkable changes in its land-use and urban landscape. These changes may be largely adduced to its proximity to the federal Capital Territory, Abuja (Abbas, et al., 2010), better job opportunities and raising standard of living (Adewuyi and Baduku, 2012). These situations were derived largely from human activities such as agriculture, mining, construction, industrialization, deforestation, urbanization and so on. This growth overtime, has placed significant pressure on the city's suggesting that health and social (crime) implications exist from overcrowding. Without a doubt, land speculation,

subdivision inefficiencies and gentrification, are all associated with compact development. Yet there are other challenges, including the urban food security implications of in-fill which has direct bearing on the sustainability of cities – food wise - that are not being envisioned, debated nor investigated (Sambo and Ahmed, 2012). This study therefore explored how farm household maize production in the urban and peri-urban areas of Kaduna, Nigeria has contributed in the capacity of urban settlements to supplement their food needs and be food secured

Based on this, this research work came up with the following research questions to help in arriving at a conclusion on the food security level of the urban and peri-urban farmers;

i. What are the socio-economic characteristics of the urban and peri-urban farmers in the study area?

ii. What is the production efficiency of the urban and peri-urban maize farmers in the study area?

iii. What is the level of contribution of maize to household farm income?

iv. What is the food security status and its determinants for maize farmers?

v. What is the impact of urban and peri-urban maize production on food security status of the maize farmers?

vi. What are the constraints encountered in urban and peri-urban agriculture?

1.3 Objectives of the Study

The broad objective of the study was to analyze the impact of urban and peri-urban maize production on food security status of farmers in Kaduna State. The specific objectives were to:

i. describe the socio-economic characteristics of urban and peri-urban farmers in the study areas;

ii. determine the production efficiency of urban and peri-urban farmers in the study areas;

iii. estimate the level of contribution of maize to household farm income;

iv. assess the food security status and its determinant of maize farmers;

v. determine the impact of urban and peri-urban maize production on the food security status of maize farmers;

vi. describe the constraints faced by urban and peri-urban maize farmers in the study areas;

1.4 Justification of the Study

This study provides valuable information on urban and peri-urban agriculture and its contribution to food security and to help farmers and policy makers to consider supporting urban agriculture with legislative backing. The study also contributes meaningfully in the understanding of urban and peri-urban agriculture and why some urban residents are participating in urban and peri-urban maize production in particular. Recommendations was made on the spatial distribution of the urban and peri-urban maize farmers and their level of contribution to food security in other to pave way for

policy makers to support urban farming with adequate legislation so that it will be integrated into urban development plans.

1.5 Hypotheses

i. There is no significant impact of technical efficiency on food security status of maize farmers.

ii. There is no significant relationship between socio-economic characteristics and food security status of maize farmers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Maize Production in Nigeria

Maize (Zea mays) is a member of the grass family (gramineae). It originated from South and Central America. It was introduced to West Africa by the Portuguese in the 10th century. Maize is one of the important grains in Nigeria, not only on the basis of the number of farmers that engaged in its cultivation, but also in its economic value. Maize is a major important cereal crop being cultivated in the rainforest and the derived savannah zones of Nigeria. Maize has been in the diet of Nigerians for centuries. It started as a subsistence crop and has gradually become more important crop. Maize has now risen to a commercial crop on which many agro-based industries depend on as raw materials (Iken and Amusa, 2004).

Maize is highly yielding, easy to process, readily digested and cost less than other cereals. It is also a versatile crop, allowing it to grow across a range of agro ecological zones (IITA, 2001). It is an important source of carbohydrate and if eaten in the immature state, provides useful quantities of Vitamin A and C. Maize thrives best in a warm climate and is now grown in most of the countries that have suitable climatic conditions.

Maize (*Zea mays, L.*) is one of the main cereal crops which constitute stable food in many region of West Africa and that of the world at large. It is also most important cereal food crop in Nigeria. Globally it is ranked to wheat and rice on its importance. Maize is becoming the miracle seed for Nigeria's agricultural and economic development. It is a basic staple diet for large population groups particularly in developing countries (FAO and ILO, 1997).About 80% of it is consumed by man and animals while 20% is utilized

in variety of industrial processing for production of starch, oil, corn sweetener, ethanol and alkaline (Jean, 2003).

2.2 Socio-Economic Characteristics of Farmers

Socio-economic characteristics play significant role in the farmers' lives in the sense that they influence willingness to accept changes which contributed significantly in raising farm productivity and ultimately their standard of living. Some of the most commonly used socio-economic variables includes age, sex, marital status, level of education, household size, farm size, farming experience, land acquisition, labour, access to credit, member of cooperative, extension contact and other estimated economic variables like income, output and standard of living. Sharma *et al*. (2003) reported in a study of Indian farm households revealed that all were male-headed with an average family size did not vary significantly across the regions where the study was conducted. Likewise, average age of household heads was above 40 years old. However, average age of commercial farmers was lower compared to other farm size categories which indicate that younger farmers have strong preference for production activity.

According to Emmanuel *et al*. (2006) a study in Ghana indicates that farmers participating in irrigation project had some type of formal education and not all of them are illiterate. In survey of pigeon pea production systems utilization and marketing in semi-arid lands of Kenya, the average age of farmers in both locations was 46.5 years with over 40% having attended at least 4 years school and average family size was 8.6 people (Mergeai*et al*., 2001). Muhammed-Lawal*et al*. (2009) also reported that 82.73% of the youth in agriculture are male. Chikezie*et al*. (2012) revealed in his findings of factors constraining rural youth involvement in cassava production that majority of the

youths in Onu-Imo local government area of Imo State were at the productive age where their energies could be harnessed and utilized for productive venture in agriculture especially cassava production. From his findings 9.17% of the respondents were less than 20 years, 43.33% and 33.33% were between 21–25 years and 26–30 years, respectively, while only 14.17% of the respondents were more than 30 years of age. He also revealed that 81.67% of the respondents were male, while 18.33% were female.

According to Adewale*et al*. (2005) gender is no barrier to active involvement in cassava production activities. However, Oladeji*et al*. (2003) observed that it is generally believed that males are often more energetic and could readily be available for energy demanding jobs like cassava farming. Respondents' education revealed that 52.50%, 38.33% and 4.17% had primary, secondary and higher education respectively. While only 5% of the respondents had no formal education. In terms of farming experience, his study showed that 66.67% of the respondents had been in cassava farming for less than 10 years, 20.83% and 12.50% had been in cassava farming for between 11 – 25 years and more than 25 years respectively.

The farming experience shows that farmers will be able to make sound decisions as regards resources allocation and management of their cassava farms. Furthermore, the size of the farm cultivated is a function of population pressure, family size and financial background of the farmers. One major characteristic of small-scale farmers is fragmented land holding. Their results show that 63.33% of the respondents farmed on less than one hectare, while 33.33% and 3.34% farmed on between 1 - 2 hectares and more than two hectares respectively. According to Nsoanya and Nenna (2011) they revealed that majority of farmers (60%) were aged between 31 – 40 years, with a mean average age of

37.5, indicating that the cassava producers were relatively young. They also indicate that majority (85%) were females while only few (15%) were males. This shows that women play a significant role in the production of cassava in the area even though they are not allowed to own lands especially by inheritance for cultural reasons. This finding supports Adisa and Okunade (2005) and Akinnagbe*et al.* (2008) who asserted that women are the backbone of Agricultural sector, and being responsible for 80% of food production. A recent study on gender and cassava commercialization in Nigeria showed that as cassava is commercialized, households in cassava producing areas invest more on the education of their children (Kormawa and Asumugha, 2003). Nweke*et al*. (2002) identified five important gender relevant issues related to cassava. He stated that both men and women make significant contributions of their labour to the cassava industry, with each specializing in different tasks; men work predominantly on land clearing, ploughing and planting, while women specialize in weeding, harvesting, transporting and processing. Secondly, both men and women play strategic, but changing roles in the cassava transformation process. Thirdly, as cassava becomes a cash crop, men increase their labour contribution to each of the production and processing tasks. The introduction of labour saving technologies in cassava production and processing has led to a redefinition of gender roles in the cassava food systems. Finally, women who want to plant cassava are usually constrained by the lack of access to new cassava production technologies and other resources. Ayoade *et al*. (2011) in their study on "Impact of the National Special Programme for Food Security (NSPF) on Poverty Alleviation among Women in Oyo State" revealed that most of the participants (71.08%) had between 1 - 5 people in each of their households and 28.91% had between 6 -10 people, while 25.51% of the non-participants had between 1 - 5 people in each of their households, 69.10% had between 6 - 10 people in their households and 5.4% had between 11 - 15 people. They also show

that all the respondents reported increase in their farm size, output and income. This implies that the participants' involvement in NSPFS has enabled them to expand their farm size as well as increase their output and income. An increase in level of participation decreases the intensity of poverty more than its probability was also indicated in their study. In the same vein, Kudi*et al*. (2008) in their study "Analysis of the Impact of National Fadama Development Project II (NFDP II) in Alleviating Poverty among Farmers in Giwa Local Government Area of Kaduna State" posited that farm size, labour (family and hired) and fertilizer are the most important factors of production and efficiencies are positively and significantly correlated with years of irrigation farming, number of visit by extension agents, level of education, household size and ownership of water pump. Therefore, NFDP II programme had increased the income, enhanced access to farm inputs at subsidized rate and increased training and knowledge of participants in the study area.

Chikaire*et al.* (2011) in their study on "Landholding Inequality among Smallholder Farmers in Imo State, Nigeria" found that greater degrees of inequality in land holding exist in the study area. This is as a result of differences in access to farm land. Farm land ownership structure shows wide variations in the size of holdings in the study area. Majority of holdings however, tend to be in small sizes. The distribution of farms by size of holdings in the study area shows that majority falls within 0.25 - 2 hectare. Data from the field revealed that among these groups are the widows who acquired land by rent especially, farmers with small family size and new entrants in farming business. Mohammad *et al.* (2011) in their study "Assessment of Factors Influencing Beneficiary Participation in Fadama II Project in Niger State, Nigeria" revealed the following socio-economic characteristics of respondent in the study area that 54.7% of the respondents

were within age bracket of 45-59 years while 26.6% and 16% were within age brackets of 30-44 years and 60 years and above respectively. In respect with marital status, 66.7%, 13.3% and 9.3% of the respondents were married, widows and divorced respectively while 46.7% of the beneficiaries possessed primary school education, 22.7% had secondary school education while 9.3% had tertiary education. On cooperative membership experience, majority (70.7%) of the respondents had 3-4 years of experience. This implies that cooperative society is not new among the respondents and level of participation can be categorize into different stages such as problem identification, decision making, project implementation and project evaluation. Oruche*et al.,* (2012) in their study of "Impact of the National Special Programme for Food Security on Livestock Farmers" showed that sources of income of the farmers in the study area was predominant from personal savings which was common to both participants and non-participants. Cooperatives and banks recorded low percentages with 0.8 and 10 percent respectively. This could simply be due to low income earning of the farmers, inability of meeting the demands of the banks such as provision of collateral or could also be due to the high interest rate.

2.3 Economic Impacts and Profitability of Urban and peri-urban Agriculture

Drechsel*et al*., (2005) estimate that backyard gardening is widely practiced by approximately 20 million urban dwellers in West Africa, mostly for subsistence. Market gardeners are mainly located in the open spaces in West Africa, and change crops according to seasonal supply and demand, and market prices. A key issue, especially for the market gardeners (the more entrepreneurial farmers) is whether the intensification strategies are sustainable, especially concerning their impact on environment and health. Intensification is sought through cultivating high-value crops, increase in productivity on

the same area of land (like rooftop gardening), and by maximizing the use of available resources, including wastewater (Prain, 2006).

Kessler (2003) analysed different farming systems in four West African capitals (Lomé, Cotonou, Bamako and Ouagadougou). The study revealed that differences in crops and inputs of the different farming systems are derived from different economic strategies adopted by the farmers. Mixed vegetable farming with watering cans and/or with pumps cultivate short- and long-cycle vegetables such as lettuce, cabbage, carrots and onions. The short-cycle crops are grown to ensure returns on inputs and salaries, while the long-cycle crops are used to maximize benefit and investment in infrastructure, or private or family life. The annual profit ranges from US$20 to US$700, depending on the management capacities and farm size.

Traditional vegetable farmers (mainly women) produce mainly short-cycle crops for home consumption and sale. They prefer short-cycle crops with regular cuttings (twice a month) to ensure regular income and high returns. They cannot afford to cultivate long-cycle crops such as carrots, which require several months' investment. But with low inputs these farmers are able to generate a monthly income, which adds up to an annual benefit of US$170 to US$200. Ornamental plant and/or flower producers – mostly full-time farmers – achieve an annual benefit of US$400 to US$5 000. Rain-fed staple crop farmers mainly produce for home consumption.

In Nigeria, Ezedinma and Chukuezi (1999) compared the returns of commercial vegetable production in Lagos with commercial floriculture in Port Harcourt. Commercial vegetable entrepreneurs engage in vegetable production as an off-season

income-generating activity. By contrast, commercial floriculturists usually combine this with other well-paid occupations. Both production systems are profitable ventures since entrepreneurs get a net return of approximately 61-65 kobo on every naira invested (100 kobo is one naira). However, commercial floriculture requires larger variable investment costs than commercial vegetable production, where capital outlay is relatively small because of its temporary nature.

Danso*et al*., (2002) carried out a costs and returns analysis in urban vegetable growing systems in Kumasi, Ghana. Manual irrigation needs to be carried out with high frequency, which makes irrigation time-consuming and expensive (13 percent of total cost, excluding family labour, and 38 percent of time). Weeding was rated as the most expensive activity by the farmers, on average accounting for approximately 23 percent of the total cost. Comparing net incomes of different farming systems showed that irrigated urban vegetable farming reaches an annual income of US$400 to US$800, which is two to three times the income earned on average in rural farming. Typical farm sizes range around 0.1 ha in Kumasi, Ghana.

2.4 Spatial distribution of urban and peri-urban farmers

Variation in farming practices followed by the farmers in different spatial locations produce different socio-economic and environmental implications (Bhatta*et al*., 2009). Recently there has been a tremendous increase in the utilization of GIS into analysis of socio-economic phenomena (Schreier and Brown, 2001; Evans and Moran, 2002; KC, 2005; Codjoe, 2007; Bhatta*et al*., 2009). Collecting socio-economic data in the spatial

context and maintaining the original location specific information could reveal patterns in the data, which would otherwise be missed (Brown, 2003).

Socio-economic differentiation along the spatial gradient arises owing to the distances between fields, markets, access to information and location for off-farm opportunities. Biophysical settings of the resources and the socio-economic characteristics of the farm families can be influenced by their spatial position (KC, 2005). Location specific information for an entire region is best handled by computerized information system with the use of GIS. GIS software provides tools for the display and analysis of spatial information (Starr and Estes, 1990). It stores geographic data, retrieves and combines this data to create new representation of geographic space, provides tools for spatial analysis and performs simulations to help expert users organize their work in many areas including transportation, agriculture development and environmental information system (Rigaux*et al*., 2002). This research is based on the concept of spatial assessment of farm practices and socioeconomic attributes of farm families by integrating micro-survey in GIS environment and evaluating these aspects spatially in the regional level. Production of food in the city has a long history, both in the developed (in the form of allotment gardens) and developing world.

The traditional view of food production is that it is essentially a business of rural areas. In many developing areas however, non-built up urban lands, especially those lying along the courses of urban drainage systems, are sometimes seen as locations for the production of some agricultural products that are in high demand by urban dwellers (such as vegetables). Several research workers have shown that a significant proportion of a city's food requirements in developing countries are supplied from within the urban boundaries,

because within those areas substantial amount of wastewater (mainly from homes and industries) is available in urban drains for irrigating lands along the urban drainage courses. According to Mbiba and Van Veenhuizen, (2001), in the early 1990s, there has been increasing recognition amongst the scientific and development community of the rising importance of wastewater-based food production in city areas, particularly in those parts of the world that have been characterized by economic collapse.

In cities of many arid and semi-arid areas, this is sometimes the only major source of irrigating urban lands being used for food production and fortunately for such areas, there are no prohibitions of disposal of wastewater in urban rivers. Wastewater disposal in rivers has several benefits including maintaining adequate environmental flows and boosting the water volume for downstream users. Treated effluent can be used for irrigation under controlled conditions to minimize health risks arising from pathogenic and toxic pollution of the agricultural produce, soils, surface and ground water. The growing demand of water for irrigation has produced a marked increase in the reuse of treated and/or untreated wastewater worldwide.

The use of industrial or municipal wastewater in agriculture is a common practice in many parts of the world (Urie 1986; Feigin*et al*., 1991; Blumenthal *et al*., 2000; Ensink*et al*., 2002; WHO 2006; Sharma *et al*., 2007). Rough estimates indicate that at least 20 million hectares in 50 countries are irrigated with raw or partially treated wastewater (Scott *et al*., 2004; Hussain*et al*., 2001). The major objectives of wastewater irrigation are that it provides a reliable source of water supply to farmers and has the beneficial aspects of adding valuable plant nutrients and organic matter to soil (Liu *et al*., 2005; Horswell*et*

al., 2003). With careful planning and management, the positive aspects of wastewater irrigation can be achieved (WHO, 2006).

2.4.1 Non–spatial factors

Wang and Luo (2005) indicate that household socio-economic characteristics such as ethnicity, education, age, sex, unemployment rate and income are some of the non-spatial factors that could affect accessibility. A food access disparity study by Wang and Dai (2011) revealed that low-income, carless and linguistically isolated families (cultural barrier) in rural areas have a disadvantage in spatial food access. Further, the study also reveals that urban areas have more advantage in spatial access to food including neighborhoods with more socioeconomic disadvantages. However, no car ownership, living below the poverty line and low income are the non-spatial barriers that affect food accessibility and affordability of households in these socioeconomically disadvantaged neighbourhoods in the urban areas.

Bashir *et al*., (2012) assessed the food security conditions of rural landless households in twelve districts in the Punjab province in Pakistan by the use of a binary logistic regression analysis. Their study found that the monthly income of households, livestock assets and education level of household heads positively impacted on household food security level. On the education, it found that household head with education up to middle (8yrs) and intermediate (10-12yrs) school levels were more food secure. However, the age of household head and the increasing household size had inverse relationships with household food security. The authors argue that income appears to be the most important determinant of food accessibility since food security relies heavily on having more access to food and having access to food finally depends on an individual's

purchasing power to command enough food that is needed. The results from the study of Bashir *et al*., (2012) confirms earlier studies by Idrisa*et al*., (2008), farming households in North-part of Nigeria who reported that households with low level of education, larger family sizes and low levels of income were mostly affected by food insecurity. A study by Modirwa and Oladele (2012) on household food security among male and female headed households engaged in farming in the rural part of the Eden district in the Western Cape of South Africa. The study aimed identifying the factors affecting the food security level of the households. Poor access to markets, storage facilities, land tenure systems and lack of credit were the major factors that affected household food security. These factors were reported by both male and female headed households in the study area. Socioeconomic disadvantage is a factor which refers to seven variables: female-headed household, ethnic minorities, household crowdedness, poverty, lack of transportation mobility, low levels of home ownership and income.

2.5 Urban Agriculture and Health Risks

Urban agriculture being the cultivation of crops and raising of animals within the city boundaries will involve the use of chemical such as fertilizers, pesticides, and herbicides, and that can cause health related concerns. The implications of farming amongst people is that it will involve the use of substances that can contaminate the soil or air human breath and these chemicals have the possibility of contaminating the water meant for drinking, and when manures are used, they can cause pollution problems.

According to Lock and Zeeuw (2001), city authorities have often been reluctant to accept urban agriculture because of perceived health risk. Nevertheless, in most cities in developing countries, urban agriculture is practiced in a substantial scale, despite

prohibitive laws and regulations. Hence, rather than general laws prohibiting urban agriculture, which are largely ineffective, policies are needed that actively manage the health risk related to urban agriculture. They further added that, "The main health risks associated with urban agriculture can be grouped into the following categories: a. Contamination of crops with pathogenic organisms (e.g. bacteria, protozoa, viruses or helminths), due to irrigation by water from polluted streams, or inadequately treated wastewater or organic solid waste products; b. Human diseases transferred from disease vectors attracted by agricultural activity; c. Contamination of crops and/or drinking water by residues of agrochemicals; d. Contamination of crops by uptake of heavy metals from contaminated soils, air or water; e. Transmission of diseases from domestic animals to people (Zoonosis) during animal husbandry, processing or meat consumption; f. Human diseases associated with unsanitary post-harvest processing, marketing and preparation of locally produced food; g. Occupational health risks for workers in the food-production and food-processing industries.

Kereita (2007) mentioned that, wastewater use in irrigation poses health risk to both farmers and mostly consumers as untreated wastewater has high level of pathogenic micro-organisms such as bacteria, viruses, helminthes and protozoa which causes excreta-related diseases. Brown (2008) confirmed that, the risk of soil, atmospheric and water contamination of urban farming sites can be a real concern to the urban agriculturalist. The use of vacant development lots or public open spaces may contain contaminants that require expensive amelioration. In certain circumstances this may be rectified by bringing in soil, using compost and implementing raised beds (Garnett, 1996). Urban agriculture also runs the risk of atmospheric pollution due to the potential to be located near busy roads or within industrial precincts. The use of composted organic waste may also risk bacterial pollution and attract rodent pests if not prepared properly

(Nelson 1996). These risks and the innovative solutions required are part of the pitfalls and possibilities with which an urban farmer may have to contend, and reflects the dynamic and flexible nature of farming in the city.

Lee-Smith and Prain (2006) confirmed that, there are widespread concerns that accompanying health hazards may undermine nutritional and social development benefits. The major health hazards associated with urban agriculture and its products are (1) chemical, involving direct or indirect contact with chemicals; (2) physical, such as injury from tools or equipment; (3) biological, involving direct or indirect transmission of harmful organisms; and (4) psycho-social, related to anxiety and stress. Urban wastewater and solid wastes contain high levels of plant nutrients that could improve soil fertility in areas beset by poor soil quality, like Sub-Saharan Africa. Urban producers have in fact used these nutrients since the days of the earliest human settlements. Yet urban areas discharge large amounts of these nutrients haphazardly, creating high health risks, an unpleasant environment, and environmental damage. It is therefore important to note that aside from the benefits of urban agriculture, there exist some environment and public health challenges, which the relevant authorities involve in urban agricultural planning, must take into consideration and carefully look at the advantages and disadvantages.

2.6 Consequences of Land Degradation on Farmland in the Peri-Urban and Urban areas

Land degradation is a long recognized environmental issue, which straddles both the physical and social sciences. Land degradation has been acknowledged in policy cycle through Agenda 21 and the signing of the United Nations Convention to Combat Desertification (UNCCD) in 1994. Land degradation is a contested term with various meanings, located as it is in various contexts. Historically, land degradation has been a

contentious issue (Niemeijer&Mazzucato, 2002; Scoones and Toulmin, 1998; Warren, 2002). The causes and consequences vary from region to region, mainly in terms of localized intensity, as well as programs to solve problems of land degradation, which also vary regionally as a function of ecosystem characteristics, culture, economics, and political will. However, some cases of similarities in causes and consequences have being reported to exist (Reynolds, 2001).

The dual role of humanity in both contributing to the causes and experiencing the effects of global change processes emphasizes the need for better understanding of the interaction between human beings and the terrestrial environment. This need becomes more imperative as changes in land use become more rapid. As a result, understanding the driving forces behind land degradation in various ecological zones and developing models to stimulate these changes are essential to predicting the effects on global environment. Reynolds & Stafford Smith (2002) broadly classify into three groups, factors responsible for land degradation. These are: meteorological, ecological and human factors. The combination of the meteorological and ecological factors forms the bio-geophysical factor while the human factors are the socio-economic factors.

Nicholson(2002) reported that, climate and land surface are inextricable linked. Land degradation can therefore be evaluated within the context of the climate background. Climatic variables such as temperature and rainfall determine land surface character to a first approximation; the characteristics of the surface in turn, affect fluxes of energy, moisture, and particulates that modulate meteorological processes. Also, rainfall is the limiting factor in vegetation growth, the character of the rainfall, that is, its distribution in

time and space has the ultimate influence on vegetation growth and the health status of the environment.

Humans are the dominant force in global environmental change. Socio-economic factors are clearly major drivers of land degradation (Abubakar, 2000; Olofin, 2000; Okin, 2002; UNEP, 1997). Milton and Dean (1995) listed the socio-economic factors to include, over estimation of carrying capacity, market forces, state subsidies and increasing land values. Adewuyi (2008) and Okin (2002), land use is a major factor of soil erosion and land degradation. Crop cultivation and grazing are major land uses that have attracted a lot of condemnation for contributing to land degradation (Puigdefabregas and Mendizabel 1998). Studies like Albaladejo, Martinez-Mena, Roldan, and Castillo (1998) recorded significant decreases in both soil organic carbon content and stable aggregate and an increase in bulk density from areas subjected to heavy grazing.

Prince (2002) enumerated the following bio-geophysical process as consequences of land degradation which was also corroborated by other studies (Ali, 2003; de Sherbini, 2002; Idoko, 2004). They include the following: loss of soil structure and cohesion, soil crusting, soil compaction, soil erosion by ablation, gulling, sheet erosion, accumulation of soil at the base of perennial and permanent structures, local deposition in outwash farms, increased complexity of the landscape, dune formation, addition of sediment to water bodies, loss of productivity of crop lands, pasture and wood lands, dust storms, increased atmospheric aerosol loading, loss of surface roughness, increased albedo, decreased convection, reduced rainfall and changed atmospheric circulation.

Other scholars reported that land degradation also causes for example alteration of ecosystem services locally and globally, deforestation, loss of biodiversity, habitat loss and species endangerment (FAO, 2000; Olofin, 1997; WRI, 1997); changes in hydrological and climatic cycle (Olofin, 1997; Shonekan, 2004) reduced agricultural yield (Anderson, 1990; Mallo, 1998; Ramankutty& Foley,1999; Sisk, 1998; Thebaud, 1995); socio-economic welfare (Mariko, 1991; Mortimore, 2000; Singh , Shi, Zhu, and Foresman 2000). Mazzucato and Niemeijer, (2000). The causes of land degradation are as diverse as its consequences to man. Although they appear unlimited, in effect however they are basically grouped into environmental (ecosystem), economic, political, security, health, trade, education and the general well-being of the people.

2.7 Urban and Peri-Urban Agriculture and Food Security

Urban and peri-urban agriculture is a term used to describe the production of agricultural products in the urban and peri-urban environment, depending on the farming activities the farmer wishes to engage in he/she will require a land that will suit his farming style. Three major types of urban agriculture have been identified as urban shifting cultivators, household gardeners, and urban market producers, all of which play distinct roles and contribute to urban market (Adeyemo and Kuhlmann, 2009). Gundel (2006) mentioned that, Urban and Peri-Urban Agriculture (UPA) is the production, processing and distribution activities within and around cities and towns, whose main motivation is personal consumption and/or income generation, which compete for scarce urban resources of land, water, energy, and labour that are in demand for other urban activities. Urban and Peri-Urban Agriculture also include small and large scale activities in horticulture, livestock keeping, fodder and milk production, aquaculture and forestry. Mougeot (2002) added that, urban agriculture is

an important supply source in developing country food system. It represent a critical food security value for poor urban households providing cheap, simple and flexible tool for productively using open urban spaces, generating employment and income, adding value to agricultural product.

Urban agriculture plays an important role in providing supplementary food diet to the urban dwellers and ensures that they obtain the required amount of food needed for decent living. According to UNDP (1996), urban agriculture plays a vital role in the sustenance and food security (availability and access to food) of most cities, contributed impressively 15% of total world food production and over one third of the city dwellers are found to engage in city farming worldwide (Ango*et al.*, 2011). Kiwata*et al.*, (2010) added that the overall cost of supplying, distributing and accessing food is likely to increase as the number of households that are food insecure is growing. Unlike in rural areas where most households derive their food requirements from agricultural production, food security in urban areas is market dependant and most households procure their foods from the market. Urban agriculture also makes a contribution to the food security of the poor, particularly in urban slums. Even in large, congested cities, the urban poor often have a home garden or raise small animals as part of a coping strategy (Gundel, 2006).

Cities in Sub-Saharan Africa (SSA) are growing faster. With 3.7%, the current annual urban growth rate is almost double the world wide average, and by 2030, half of Africa's population will be urban (UN, 2008). Apart from the socio-economic implications, this rapid urbanization is posing major challenges to environmental protection and the supply of adequate shelter, food, water, and sanitation (Drechsel and Dongus, 2010). Urbanization is an inevitable consequence of socio-economic development, but in many countries, it is proceeding at such a fast rate that it is outpacing the growth of services and

development. Urbanization also influences all aspects of food production and consumption, specific aspects of food security applicable to urban context include; the necessity to purchase most of the food needed by households, and greater dependence on the market system and on commercially processed food. Wage employment and monetary income are therefore the main prerequisites for achieving food security.

Agriculture has gone through a lot of changes in Nigeria, ranging from regime changes and from one policy trail to another. All these changes were meant to boost agricultural production and bring about food security. Agricultural production in cities and its boundaries is mostly affected by infrastructural development and tenure issues because there is no legislation backing same. The level of expansion in terms of building residential and public construction is limiting the lands available for urban agriculture, and also it's associated health issues. According to Cole *et al*., (2008), Anachronistic legislation prohibiting agricultural activities of different kinds continued to be on the books of many African cities, keeping open opportunities for harassment and corruption on the side of the authorities and insecurity on the side of the producers. Those seeking to change the legal administrative framework towards more enabling regulations and by-laws needed greater evidence of the positive contribution of urban agriculture to poverty alleviation and assurances that it was not a major pathway for health hazard.

Adedeji and Ademiluyi (2009) stated that, to address the issues of land ownership, urban planners and decision makers are being faced with the problem of recognizing the importance of urban agricultural production to the sustainability of cities and surrounding areas, to such planners, the term "agriculture" and "urban planning" are relatively mismatched. As such, urban agriculture is often informal, and tends to be shifted to

outskirts of cities, far away from markets and infrastructure without analyzing the economic, environmental and interrelation with other sectors. Urban agriculture can, in principle have an impact on urban food security. At the household level, urban agriculture can be a source of income, can provide direct access to a larger number of nutritionally rich foods (vegetables, fruits, meat) and a more varied diet, can increase the stability of household food consumption against seasonal or other temporary shortages, and can increase the time mothers spend for their children, as opposed to non-agricultural activities that are more likely to be located further away from the home (Maxwell, 2003; Maxwell *et al.*, 1998; Arnar-Klemesu, 2001; Egal*et al*., 2001).

The benefit derivable from urban agriculture does not just stop at food security alone, but also increases income earning opportunities and job creation. Arena and Mbata (2008) buttressed the statement by saying that the benefits of urban agriculture extend beyond better nutrition, poverty reduction and jobs for the poor. Agricultural methods make most out of scarce land, water and industrial by-products as well, but the challenge of supplying nutritionally adequate and safe food to city dwellers is substantial. Accomplishing this task under conditions of growth and congestion demands that policy makers seize opportunities for integrating resource management and planning efforts, understanding potential leakages between rural and urban areas, and anticipating changing needs of a country's citizen in both rural and urban setting. In some cases, benefits from urban agriculture will clearly outweigh potential negative consequences such as environmental pollution or competition over scarce resources. In this case, policy makers should actively promote urban agriculture and find ways to integrate it in urban land-use planning. Providing guidance or training on good production techniques, for

example, could minimize risks such as health hazards, water contamination, and food security concerns (FAO, 2010).

2.8 Food Security: Concept and Definition

The concept of food security has been on the international agenda as far back as 1948, when the Universal Declaration of Human Rights affirmed that everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food. Article 11 of the International Covenant on Economic, Social and Cultural Rights went further, in 1966, when it affirmed the right of everyone to be free from hunger. This right to food is even characterized as a "fundamental right" and is acknowledged as the primary economic right of a human being. This global concern heightened after the 1974 World Food Conference, when diminishing world food supplies and large-scale food shortages triggered responses in the international community that focused on increasing domestic agricultural production and creating international grain reserves. Food security was identified with commercial food prices and physical food availability, rather than with demand and consumption, especially by the poor and vulnerable.

According to FAO (1996), food security exists when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Furthermore, there are four dimensions of food security: availability, stability, safety, and access. The first dimension relates to the general availability of sufficient amount of food. Food stability requires that food can be accessed at all times. Food safety is linked to the quality of

food while the final dimension, access to food, is associated with the resources that an individual or household possesses to obtain food required for a healthy diet.

The attainment of food security level has become a source of concern to governments not only in Nigeria but all over the world, so that citizens can have access to sufficient, safe and nutritious food. It is in view of this that the CBN (2007) according to its annual report, the FAO signed an agreement with the Nigerian government for a Unilateral Trust Fund Project worth USD45.million with the aim of attaining food security in the broadest sense and alleviate poverty under the National Program for Food Security (Omotor, 2009). The food security problem is growing at an alarming state, with majority of rural people migrating to urban areas and therefore compounding the food security treats. The major problem is how to identify and measure the food security status of the teaming migrants and ascertain how food insecure they are. This is part of the reasons why there is the need to develop a database that will contain all the information of food insure persons. According to USAID (2008), the basic objective of a Food Security Information System (FSIS) is to gather and analyze the information to make decisions, and supply this information in a usable format to the relevant stakeholders in a timely fashion. Decision makers working in poverty reduction, food security and related areas generally ask the following question, which should be answered by the FSIS:

- Who are the poor and insecure population?
- How many are they?
- Where do they live?
- Why are they poor and/or food insecure?
- Will there be a food insecurity issue?

- If so, when, where, who will be affected and why?
- What are the best ways to address the short term needs?
- What are the best ways to address the long term development needs and prevent future crises?

These indicators are associated with various sectors, and one of the inherent complexities of food security analysis and monitoring is the need for combining and obtaining access to information from wide range of sectors and sources.

2.9 Causes of Food Insecurity

The causes of food insecurity go beyond food availability and are intertwined with various variables, many of which deal with the food access pillar of food security. In the ten studies summarized below, food insecurity in Nigeria has been found to be associated with age of household heads in directions, female-headed households, and per capita non-food expenditure, educational status, income, dependency ratio, household size (Omonoma*et al*., 2007 and Oluyole 2001). Research applied across Nigeria and a variety of non-country specific contexts has found similar results. In developing regions, rural children are almost twice as likely to be underweight than children in urban households (United Nations, 2012). Poor children are almost three times as likely as underweight as are children in the wealthiest percent of households (United Nations, 2012). While risk factors for food insecurity are more easily analyzed, the causal reasons for food insecurity are complex. Poor agricultural production, linked with policies, has constrained food security in Nigeria. Agricultural productivity issues include poor agricultural pricing policies, low fertilizer use, limited access to inputs, low access to agricultural credit, low and unstable investment in agricultural research, poor funding and coordination of agricultural extension, land tenure system and land degradation, drought, and poor market

access and market efficiency (Dayo, 2009 and Okuneye, 2011). Other recent works by has revealed other constraints of agricultural productivity in Nigeria to include; poor conceptualization and inefficient implementation of programs; early cessation of rainfall after several interruptions during the season which causes significant crop losses and reduced yields; poor rural roads and attendant high transportation cost; the increasing unattractiveness of the agricultural and rural sector to the youths who prefer "white collar" jobs in cities; the continued dependence on subsistence farming; the cultural structure of communal living and inter dependence which causes unwholesome burden to the working populace; the HIV/AIDS pandemic which is depleting the working population; ethnic and communal conflicts; farmers investing funds in unproductive areas like offsetting debts, building more houses, marrying more wives; disregard of farmers needs and desires by government in the formulation of agricultural policies; farmers educational low profile; the devastating effect of avian influenza (bird flu) on poultry industry which led to a drastic fall in demand for poultry products and prompted a decline in the production of maize; and bad governance been at the fulcrum of all (Jerome, 2012).

Economic policies, particularly in the agricultural sector, play a central role in determining the food security of a nation because they help dictate adequate supply and accessibility of food, as well as citizens' ability to obtain food. Nigeria's policies surrounding agriculture in national development have changed considerably throughout history (Ugwu and Kanu, 2011).

The affected policies and strategies used to address food security issues have equally changed over time (Ugwu and Kanu, 2011). The rising cost of food prices in Nigeria have roots in policies and programs of past governments (Okuneye, 2001). The 1960 to

1969 era was a period of minimum government intervention in Nigeria (Ugwu and Kanu, 2011). The later phase from 1970 to 1985 was a period of maximum government in the agricultural sector (Ugwu and Kanu, 2011) Since the Structural Adjustment Program (SAP) was introduced in Nigeria in 1986, the nation has experienced a gross neglect of the food production sector (Okuneye, 2001). Despite the objectives of SAP and the key policies implemented as a result of these objectives, the agricultural sector did not register significant overall growth (Ogwu and Kanu, 2011). New millennium agricultural policies were implemented in May 1999 (Ogwu and Kanu, 2011). Despite agricultural growth of 6.8% between 2002 and 2006, food security remains a major concern due to the subsistence nature of Nigeria's agriculture (Ogwu and Kanu, 2011).

A substantial factor behind policy reforms' inability to truly address food security lies in poor planning and implementation on the part of political actors (Gardner, 2012). Interest groups and political lobbying and lack of initiative or implementation of effective policies under food security further (Gardner, 2012). Furthermore, insecurity of investment is another common factor responsible for the ineffectiveness of policies and regulations (Ogwu and Kanu, 2011).

2.10 Logit Regression Model

Logistic regression was first proposed in the 1970s as an alternative technique to overcome limitations of ordinary least square (OLS) regression in handling dichotomous outcomes (Peng and So 2002), it became available in statistical packages in early 1980s. Logistic regression model has been widely employed in agricultural research where the objective is to predict the decision of a farmer outside the model of making a choice regarding the adoption of a new variety/technology or another given the farmers characteristics. Some of the agricultural research conducted using this model among

others includes: Ebojie*et al.*, (2012) employed the model to determine the factors influencing farmers' adoption of hybrid maize in Giwa local government area of Kaduna state, Nigeria. The researchers found out that age, income, education and extension visit were socioeconomic factors that influenced farmer's adoption of Hybrid Maize in the study area. This findings is consistent with the outcome of Saka and Lawal (2009), in their study of factors that influence adoption and productivity of improved rice varieties in southwestern Nigeria and there discovery was that land area cultivated to rice, frequency of extension contact and the yield rating of the improved rice varieties were significant determinants of farmer's decision to adopt improved rice varieties. They also pointed out level of education is expected to influence farmers' adoption of agricultural innovations and decision on various aspects of farming. In case of Okoruwa and Ogundele (2006) they examined technical efficiency differentials in rice production technologies in Nigeria and their report was that none of the socio-economic variables had significant effect on the technical efficiency of technology of farming. They also reported that this might be as a result of technical inefficiency of the farmer and as well as other natural and environmental factors which could not be captured in the model. These factors include land quality, weather, labour quality, and disease and pest infestation and so on.

Despite the popularity of logistic regressions modeling and the ease with which researchers are able to apply this technique using statistical software, confusion continues to exist over terms, concepts, modeling, approaches and interpretation. A recent review of 52 articles published between 1999 in three higher education journals, revealed lack of standards in the practice and reporting of logistic regression (Peng*et al*., 2014). Specifically inconsistency was found in the ratio of observations to predictors, modeling

approaches, assessment of regression models, examinations of interaction among predictors and presentations of results.

The level of completeness and accuracy of supplementary analyses was uneven across studies. logistic regression results have been reported in terms of logit, odds, odd ratio, relative risk, predicted probability, marginal probability (also called marginal affect partial effect, or partial change), and change in predicted probability (delta-P). These terms are not equivalent; thus, their meanings are not interchangeable (Peng and So, 2002).

Following Gujarati (2004) the logistic distribution for the probability estimation of these factors follows a binary choice model and as such, the model is presented below can be specified as:

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

Where, Pi is a probability P is the probability of events occurrence 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.

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

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:

$$P_i = \frac{1}{1 + e^{\beta_0 + \beta_i X_i + \dots\dots\dots\dots\dots\dots\dots + \beta_n \beta_n}} \dots\dots\dots\dots\dots\dots\dots\dots (3)$$

The slopes tell how the log-odds in favour of making a choice rather than other as independent variables change. If P_i is the probability of an event occurring, than it is follows that I-P_i represent the probability of it not occurring and it can be written as:

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

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

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

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.

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

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:

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

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).

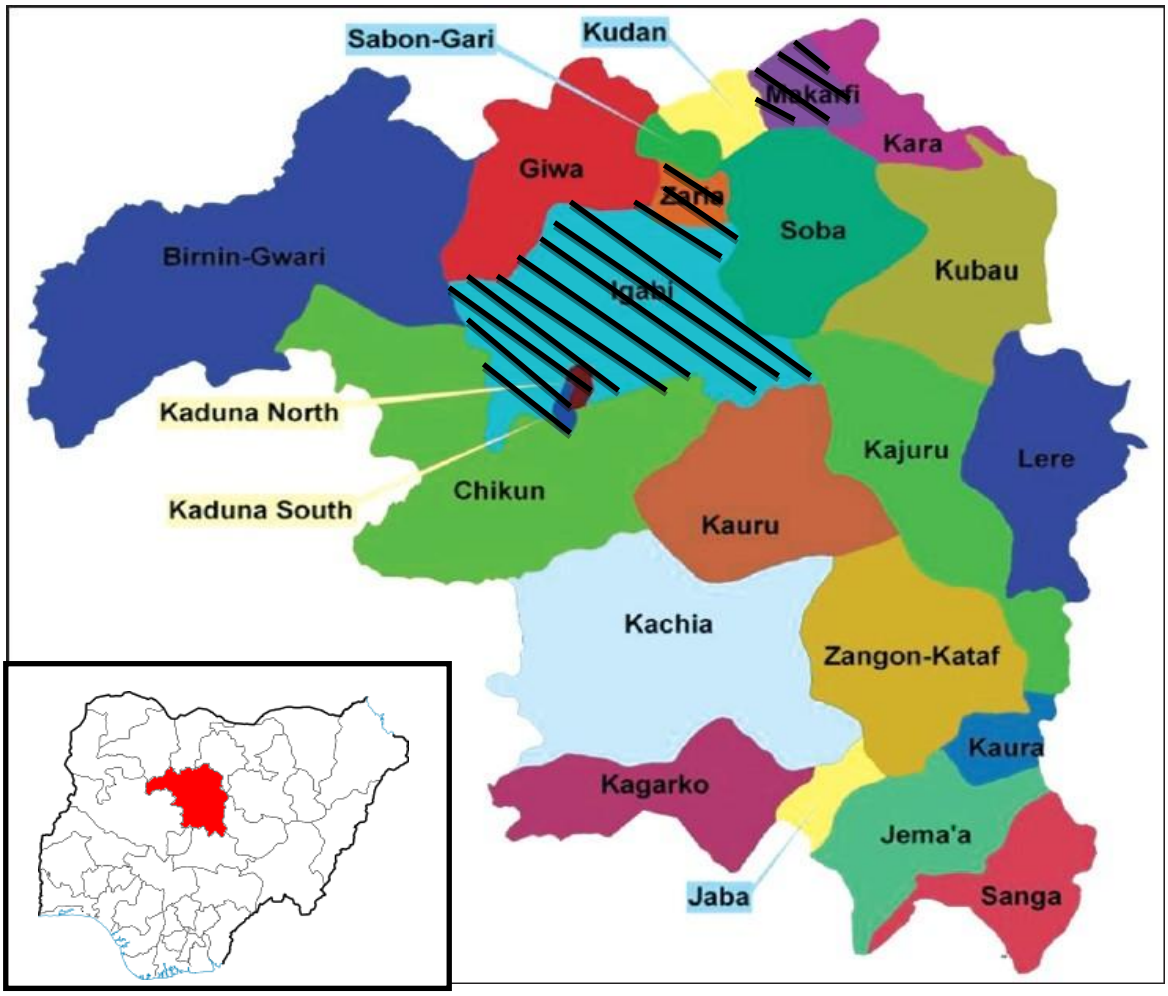
CHAPTER THREE

METHOOLOGY

3.1 The Study Area

The study area is Kaduna State. The state lies between latitude 09º 02¹ and 11º32¹ North and longitude 96º 15¹ and 08º 60¹ East of the Greenwich meridian. The state occupies about 46,016 square kilometers which represent about 5 percent of the Nigerian land mass of 923,768 square kilometers in the central region of Nigeria. The state is made up of 23 Local Government Councils and with a population of 6,133,503 people in 2006 (NPC, 2006). Based on that figure, the projected figure of the state at 3.18 percent growth rate is put at 7, 474,369 people as at 2013 projections. The State's population structure shows that, majority of the citizens currently live in urban and semi-urban towns like Kaduna, Zaria, Kafanchan, Kagoro, Zonkwa, BirninGwari, Makarfi and ZangonKataf. Kaduna State has Northern Guinea Savanna in the North and Southern Guinea Savanna in the South, with a soil mixture of fine sand and clay which has been described and sandy loam in nature. The average annual rainfall and humidity are 1,272.5mm and 56.64% respectively while the average daily minimum and maximum temperatures are 15.1 and 35.18 degrees Celsius, Kaduna State Development Plan (2013). The physical properties of the soil are moderately good and allow continuous cropping of a wide variety of crops such as maize, rice, sorghum, cassava, cowpea, soya beans, ginger, and cotton.

MAP OF KADUNA STATE



3.2 Sampling Size and Sampling Technique

A multistage sampling technique was used in selecting respondents for this study. The first stage was purposive selection of the five (5) local governments on the basis of their urban nature and they are; Kaduna North, Kaduna South, Igabi, Makarfi and Zaria Local Government Areas. Secondly, ten villages were purposively selected, Two from each local government area based on their intensity of urban and peri-urban maize production. Finally, a simple random sampling was employed in selecting farmers from each of the villages. Ten percent (10%) of the sample frame (1548) was used as the sample size. In all, 156 farmers were randomly selected.

Table 1.1: population and sample size of farmers

LGA	Villages	Sampl eframe	Sample size (10%)
KadunaSouth	Kakuri	165	17
	Nasarawa	154	15
Kaduna North	Malali	142	14
	UngwanSarki	130	13
Zaria	Zaria	126	13
	Jushe	120	12
Igabi	Mararaba	240	24
	Gadargayam	115	12
Makarfi	Makarfi	221	22
	Dogarawa	135	14
Total		**1548**	**156**

* Source: Kaduna State Agricultural Development Project (KADP), 2013

3.3 Data collection

Primary data were used for this study. These were collected with the aid of structured questionnaire. The information were collected on (a) farmer's socio-economic characteristics such as age, household size, educational status, amount of credit received, numbers of extension contact, years spent on the cooperative and farming experience. (b) Production information; level of inputs used and output in maize production. (c) Constraints faced by the farmers in maize production and information on household expenditure.

3.4 Analytical Techniques

The analytical tools of analysis used include: Descriptive statistics, Food security index, and stochastic frontier production function, logit regression model and t-test statistics.

3.4.1 Descriptive statistics.

Descriptive statistics was used to achieve objective (i), (iii) and (vi) of the study. It involves the use of measures of central tendency such as mean, frequency distribution and percentages to describe the socio-economic characteristics of maize farmers in the study area, i.e. objective (i), determine the level of contribution of urban and peri-urban agriculture to household income objective (iii) and the constraint confronting the maize production, objective (iv).

3.4.2 Stochastic frontier production analysis.

The stochastic frontier production function was used to achieve objective ii. It was specified implicitly as:

$$Y_i = f(x_i.\beta) + e_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 8$$

$$e_i = v_i - u_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 9$$

Where:

Y_i = quantity of output of the i^{th} farm,

x_i= vector of the inputs used by the i^{th} farm,

β = a vector of the parameters to be estimated,

e_i = composite error term,

v_i= random error outside farmer's control and

u_i =technical inefficiency effects.

Stochastic Frontier Production Function Model used in the study is specified explicitly as:

$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + (Vi-Ui)$ **……10**

Where,

ln = the natural logarithm,

Y = output of maize (kg/ha),

β_0 = constant term,

β_1- β_3 = regression coefficients,

X_1 = quantity of seed (kg),

X_2 =quantity of fertilizer (kg),

X_3 = total labour used (man days),

X_4 = quantity of agrochemical (litres)

Vi = random variability in the production that cannot be influenced by the farmer.

U_i = deviation from maximum potential output attributable to technically inefficiency.

$U_i = \delta_0 + \delta_1 1n Z_1 + \delta_2 \ln Z_2 + \delta_3 \ln Z_3 + \delta_4 \ln Z_4 + \delta_5 \ln Z_5 + \delta_6 \ln Z_6$ **…… 11**

Where:

U_i = inefficiency effects,

Z_1 = age of farmer (years),

Z_2 = household size (number),

Z_3 = formal education (years),

Z_4 = source of capital (₦),

Z_5 = access to extension services (number of extension contact/period),

Z_6 = membership of cooperative society (years),

δ_0 = constant and

δ_1-δ_6 = Parameters to be estimated.

3.4.3 Food security Index

This **w**as used to achieve objective (v) of this study. In assessing food security at the household level, we first asked the household heads to make their own assessment of food security. We then proceeded and calculated food security for all the households and then classified them as food-secure or food-insecure households accordingly. The study will used the cost-of-calories (CoC) method proposed by Foster *et al.*, (1984) to determine the food insecurity line. This method yields a value that is usually close to the minimum calorie requirements for human survival. The process involves defining a minimum level of nutrition necessary to maintain healthy living. This minimum level is referred to as the "food insecurity line" for the study area, below which households are classified as food insecure, subsisting on inadequate nutrition. Calorie adequacy was estimated by dividing the estimated calorie supply for the households by the household size adjusted for adult equivalents using the consumption factor for age–sex categories.

Therefore, using this method, the food insecurity line is given as

$$LnX = a + bC \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Where X is the adult equivalent food expenditure (in Naira) and C is the actual calorie consumption/adult equivalent of a household (in kcal). The calorie content of the recommended minimum daily nutrient level (L) by Gohl (1981) was used to determine the food insecurity line (S) using the equation:

$S=e^{(a+bL)}$ …….(13)

Where,

S = the cost of buying the minimum calorie intake (food insecurity line)

a& b = parameter estimates from equation 1

L = recommended minimum daily energy (calorie) level (2250 kcal)

Based on the S calculated, households will be classified as food secure or food insecure, depending on which side of the line they fall.

3.4.4 Logit Regression Model.

Logit regression model was used to achieve objective (iv) of this study. The probability of determinant of food security of the farmer 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:

The relevant logistic expressions are given as:

$$Prob(y*=1) = 1 - F*\left(\Sigma X_i \beta_j\right) = \frac{e^{\Sigma X_i \beta_j}}{1+e^{\Sigma X_i \beta_j}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots 14$$

$$Prob(y * = 0) = F * (\Sigma X_i \beta_j) = \frac{e^{\Sigma xi\beta j}}{1 + e^{\Sigma xi\beta j}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 15$$

Where:

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

The explicit logit model is expressed as:

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_9 X_9 + u \ldots\ldots\ldots\ldots\ldots 16$$

Where:

Y = Food security (1= food secured, 0 = not food secured)

X_1 = Age of household head (years)

X_2 = Education (years of formal schooling)

X_3 = Household size (number)

X_4 = Amount of credit obtained (Naira)

X_5 = Extension contact (Number of contacts)

$\beta_1 - \beta_5$= The coefficients for the respective variables in the logit function

u = error terms

3.4.5 Test of Hypotheses

To enable us test for hypothesis on efficiency, two different models were estimated in this study. The first model was traditional response function in which the inefficiency effects

are not present. It is a special case of the stochastic frontier production function model in which the total variation of output from the frontier is zero, i.e. $\gamma = \delta u^2/\delta^2 = 0$. Model two was general model where there is no restriction and thus variation from the production frontier is not zero, i.e. $\gamma = \delta u^2/\delta^2 \neq 0$. The models were compared for the presence of technical inefficiency effects using the generalized log likelihood ratio test.

The generalized log-likelihood ratio test is defined by the test statistic, chi-square (X^2) and is specified as follows: $LR = - 2[\ln(L(H_o) - L(H_A)$; where $L(H_o)$ and $L(H_A)$ are the values of the likelihood function under the null and the alternative hypotheses respectively. H_o is the null hypothesis $\gamma = 0$. It is the value of the likelihood function for the frontier model and H_A the alternative hypothesis is that $\gamma \neq 0$for the general frontier model. If H_o is true, this test statistics is usually assumed to be asymptotically distributed as a chi-square random variable with degree of freedom equal to the number of restrictions involved (i.e. number of parameters excluded in the unrestricted model). However, difficulties arise in testing H_o: $\gamma = 0$ because $\gamma = 0$ lies on the boundary of the parameter space for γ, in which case if H_o: $\gamma = 0$ is true, the LR statistic has asymptotic distribution which is a mixture of chi-square distributions (Coelli and Collins, 2002). The generalised likelihood ratio test of size α is "Reject H_o : $\gamma = 0$ in favour of H_A $\gamma > 0$ if LR exceeds X^2 (2α)" (Coelli, 2000).

3.5. Measurement of independent variables

i.Age: The age of the respondents is the number of years he/she has spent in this life. Studies had shown that young age group are mostly involved in agricultural production activities and adopt technology faster than the older age group.

ii. Labour: Labour is the effort or strength exerted to accomplish work done. It could be family or hired labour. Availability of labour is important in agricultural activities because it enhances the level of production and it is measure in man-hour per day.

iii. Education level: Education is generally considered an important variable that could enhance farmer's acceptance of new technologies. Ogunbameru (2001) posited that education will likely enhance the adoption of modern farm technologies by youth and thereby sustaining a virile farming population. The more educated farmers are, the more likely they adopt technology. Level of education is measured by number of years spent in formal schooling.

iv. Farming experience: Farming experience is an experience gain with age while carrying out farming operations. Since the major occupation of the respondents is farming, the length of time in farming can be linked with the age of the farmers. As the age increases among the farmers, their years of experience also increase. This variable is measured in number of years the respondent has being into maize production.

v. House-hold size: This is the number of people in a given household. Ojuekaiye (2001) defined household size as the number of people eating from one pot. It implies that the consumption unit is also the production unit. The larger the family size the more favorably disposed will be the members to adopt the recommended maize production technology.

vi. Farm size: This refers to area or portion of land that is put into maize production. In other words, it is the total area of the farm land measured in hectares operated by the respondents in the study area.

vii. Access to credit: Credit is a very strong important factor that is needed to acquire or develop farm enterprise (Ekong, 2003). Its availability could determine adoption of recommended maize production technologies and the extent of production capacity. This will be measure interns of naira.

viii. Co-operative membership: Co-operative groups are organized for the promotion of special interest or meet certain needs that cannot be achieved by the individual efforts. They contribute to the dissemination of new ideas, practices and products as well as in sourcing for loan and farm input (Chikezie*et al*., 2012). Farmers that belong to a co-operative society are likely to adopt new technology easily than those not in any co-operative. This will be measure in years of participation in cooperative association.

ix. Extension contact: Agricultural extension service constitutes a driving force for any agricultural development. The relationship between agricultural extension agent and the farmer is an important determinant in improving yield of maize as well as in ensuring food security (Chikezie*et al*., 2012). The more number of visits of an extension agent to the farmers the greater the chance for them to adopt innovation. It will be measured in terms of number visits made by an extension agent.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Age Distribution of Urban and Peri-urban Maize Farmers

The result in Table 4.1 shows that about 71% of maize farmers are in their active and productive age and within the age range of 21-50 years, with mean of 48 years. The implication of this finding is that large proportion of the crop farmers in the study area were adults and can adequately be regarded as active, agile and physically disposed to farming activities. This implies that farmers in the study area are within the productive stage. Age is an important determinant of socio–economic status of a population since people wear in energy as they advance in age. Therefore, this generally aged maize farmer could have negative implications on the future of maize cultivation in the study area. This is because these older people may not be willing to adopt innovations in agriculture; usually, they argued that their forefathers practiced farming successfully without modern innovations. However, it is important to note that the older a farmer becomes, the better his understanding of the social, climatic and economic factors that affect farming and thus more experienced.

Table 4.1: Age distribution of maize farmers

Age (years)	Frequency	Percentage
21-50	111	71.1
51-60	28	18.0
61-70	14	9.0
>70	3	1.9
Total	**156**	**100**

Mean = 48, Minimum= 21 and Maximum =78

4.1.2 Educational level of urban and peri-urban maize farmers

Illiteracy is one of the factors militating against agricultural development in Nigeria. The study revealed that more than half (53.2%) of the maize farmers had no formal education, while about 41% managed to acquire primary and/secondary education. Usually, such low literacy level is not enough to provide any white collar job. Their educational status as it is however is enough to provide is them with the ability to read and write, handle and interpret messages relating to their farm operation in the instruction manuals on input and machinery uses, and also enable them to appreciate extension services. Education is a major determinant of the Nation economy. This agrees with the findings of Sullumbe (2004) which states that "The level of formal education attained by an individual goes a long way in shaping his personality, attitude to life and adoption of new and improved practice".

Table 4.2: Distribution of maize farmers according to their level of education

Education (years)	Frequency	Percentage
No formal education	83	53.2
Primary education	45	28.8
Secondary education	18	11.7
Tertiary education	10	6.5
Total	**156**	**100**

4.1.3 Distribution of urban and peri-urban maize farmers according to household size

The household is the major source of farm labour in small-scale agriculture, though most farm operations in the study area are gender specific. The contributions of women cannot be over emphasized especially during harvesting, threshing, winnowing and bagging.

About 80% of the farmers have up to 5 people in their household, while about 11% percent had between 6 and 10 persons. The average house hold size is 4 persons; this comprises those that were up to working age. The extended family system still exists in the study area. The reason for keeping large family is to provide more farms hands. On the whole, large scale farmers have larger family members above the average. This agrees with Muhammad *et al*., (2011) that large household size depicts common characteristics of rural households particularly in Northern Nigeria where polygamy is mostly practiced and family labour is utilized for farming activities.

Table 4.3: Distribution of maize farmers according to their family size

Family size (number)	**Frequency**	**Percentage**
1-5	124	79.5
6-10	17	10.9
11-15	12	7.7
16-20	3	1.9
Total	**156**	**100**

Mean = 4, Minimum= 1 and Maximum =18

4.1.4 Amount of credit obtained by urban and peri-urban maize farmers

The results presented in Table 4.4 indicate that the majority 89.6% of farmers had no access to credit to finance their maize production activities while those who had access to credit ranges between ₦10,000 -₦40,000 which represent about 3.7% of the farmers with the minimum and maximum amount of ₦10,000 and ₦100,000 respectively. However, a large number of farmers had no access to funds to finance their crop production activities, which in turn reduce their level of profit. The result revealed that commercial banks are

less patronized for financial support for farming in the study area. It could be concluded that respondents in the study area do not enjoy credit facility from financial institutions, which may be as a result of lack of awareness, low literacy level, interest rate and bureaucracy. These of course have hampered production to a large extent. Annon, (2009) asserted that loan is a crucial input as it is used to establish and expand farm sizes. Ekong (2003) asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. According to Tijani*et al*.,(2006), access to credit provides the farmer with a means of expanding and improving his farm. It also determines the ease with which he adopts new practices and technologies in his enterprise.

Table 4.4: Distribution of maize farmers according to credit obtained

Variable	Frequency	Percentage
No access to credit	139	89.1
₦10,000- ₦40,000	6	3.8
₦40,001- ₦80,000	7	4.5
₦80,001-₦120,000	4	2.6
Total	**156**	**100**

Mean = ₦5,500, Minimum= ₦0 and Maximum =₦120,000

4.1.5 Numbers of extension contact of urban and peri-urban maize farmers

The result presented in Table 4.5 revealed that about 82% of maize farmers in the study area had no contact to extension service. The maximum extension services observed was 7 times with a minimum of 1 time and with average of 1 time per year extension service in maize productions and the ultimate aim of extension services is to enhance farmers'

ability to efficiently utilize resources through the adoption of new and improved methods used in rice production instead of using traditional methods which are inefficient, resulting to low yield. This low extension contact could be attributed to extension agent-farmers' ratio in the study area. According to Obwona (2000), extension service is very essential to the improvement of farm productivity and efficiency among farmers.

Table 4.5: Distribution of maize farmers according to extension visit

Extension Contact (Numbers)	Frequency	Percentage
No contact	127	81.5
1-3	15	9.6
4-6	12	7.6
7-9	2	1.3
Total	**156**	**100**

Mean = 1, Minimum= 0 and Maximum =7

4.2 Production Efficiency of Urban and Per-urban Maize Farming

4.2.1 Estimated technical efficiency of urban and peri-urban maize farmers

The model specified was estimated by the maximum likelihood (ML) method using frontier 4.1 software developed by Coelli (1995). The ML estimates and inefficiency determinants of the specified frontier are presented in Table 4.6. The study revealed that the generalized log likelihood function was -154.585. The log likelihood function implies that inefficiency exist in the data set. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the functional form that is, Cobb-Douglas used in this estimation is an adequate representation of the data. The value of gamma (γ) is estimated to be 23% and it was highly significant at

($p<0.01$) level of probability. This is consistent with the theory that true γ-value should be greater than zero. This implies that 23% of random variation in the yield of the farmers was due to the farmers' inefficiency in their respective sites and not as a result of random variability. Since these factors are under the control of the farmer, reducing the influence of the effect of γ will greatly enhance the technical efficiency of the farmers and improve their yield. The value of sigma squared ($\boldsymbol{\sigma^2}$) was significantly different from zero at 5% level of probability. This indicates a good fit and correctness of the specified distributional assumptions of the composite error terms while the gamma γ indicates the systematic influences that are unexplained by the production function and the dominant sources of random error. This means that the inefficiency effects make significant contribution to the technical inefficiencies of maize farmers.

However, the estimated coefficients of all the parameters of production function (seed, fertilizer, agrochemical and labour) were positive and significant at 1% level of probability except agrochemical which is statistically not significant and hence play a major role in maize production in the study area. The average technical efficiency for the farmers was 0.83 implying that, on the average, the respondents are able to obtain 83% of potential output from a given mixture of production inputs. Thus, in a short run, there is minimal scope (17%) of increasing the efficiency, by adopting the technology and techniques used by the best maize farmer.

The estimated coefficient for seed was 0.501 which is positive and statistically significant at 1% level. The estimated 0.501 elasticity of seed implies that increasing seed by 1% will increase maize output by less than 1% which means, all things being equal the output is inelastic to changes in the quantity of seed used. The significance of seed quantity is however, due to the fact that seed determines to a large extent the output obtained. If correct seed rates and quality seeds are not used, output will be low

even if other inputs are in abundance. This is in line with the findings of Shehu*et al* (2010) who observed that the estimated coefficient of seed and labour inputs were positive as expected and significant at 1% level which implies that the more seed is applied and the more labour employed the better the output of maize. The production elasticity of output with respect to quantity of fertilizer was 0.076 which is positive and statistically significant at 1% level. This implies that a 1% increase in fertilizer will increase maize output by 0.08%. Fertilizer is a major land augmenting input because it improves the quality of land by raising yields per hectare. This study is in agreement with the findings of Maurice (2004) and Oladiebo and Fajuyigbe (2007).

Table 4.6: Results of Maximum Likelihood Estimates of Stochastic Frontier Production Function of maize production

Variables	Parameters	Coefficients	Std. error	T-Value
Production Variable				
Constant	β_0	3.1857	0.5626	5.662***
Seed	β_1	0.5009	0.0854	6.090***
Fertilizer	β_2	0.0761	0.0301	2.527***
Agrochemical	β_3	0.031	0.082	0.376
Labour	β_4	0.6084	0.1627	3.740***
Inefficiency Variable				
Constant	Z_0	-0.3494	0.6330	-0.552
Age	Z_1	-0.024	0.098	-2.487**
Education	Z_2	-0.193	0.094	-2.053**
Household size	Z_3	-0.0545	0.0397	-1.375
Extension contact	Z_5	0.1521	0.2531	0.599
Amount credit borrowed	Z_6	0.00002	0.00006	1.000
Diagnostic Statistic				
Sigma-squared	(σ^2)	0.9067	0.3061	2.962***
Gamma	(γ)	0.2343	0.0316	7.394***
Log likelihood function	*L/f*	-154.585		
LR test		17.816		
Total number of observation		156		
Mean efficiency		0.83		

*****P < 0.01**
****P < 0.05**
***P < 0.10**

The coefficient of labour was 0.61 which is positive and statistically significant at 1% level. This showed that labour is an important variable in maize farming in the study area. This is in line with several studies by Umoh (2006) and Okike (2000) which show the importance of labour in farming, particularly in developing countries where mechanization is rare on small scale farms. In the study area, human power plays a crucial role in virtually all farming activities. This situation has variously been attributed

to the practice of split-plot cropping on small scattered land holdings and lack of affordable equipment (Umoh, 2006).

The estimated result of the inefficiency model is contained in Table 4.6. Generally, a negative sign on a parameter means that the variable reduces technical inefficiency, while a positive sign increases technical inefficiency. The results show that all the technical inefficiency variable except age and education were not statistically different from zero.

The coefficient of age in the inefficiency model is negative and statistically significant at 5% level of probability. This indicates that an increase in the age of maize production decreases technical inefficiency. This is line with findings of Ojo and Ajibefun (2000) and Usman (2009). Opined that older farmers shows that farmers will be able to make sound decisions as regards resources allocation and management of their farms.

Years of education showed a negative relation with technical inefficiency and are significant at 5% level for maize farmers. The negative coefficient of education reveals that a high level of education results in a reduction in technical inefficiency of maize farmers. Anon (2006) noted that education is one of the socio–economic variables that greatly affect farmers' decision to accept and adopt modern farm technologies. Also, Kalirajan and Shard (2004) observed that education sharpens managerial input and leads to a better assessment of the importance and complexities of good decisions in farming. It also implied that education widens the scope of farmer'shorizon towards adoption of technological innovation, thereby moving him away from traditional practices to adopt technological concepts

4.2.2 Test of Hypothesis I

An independent samples t-test was conducted to analyze the impact of efficiency on food security. The t-test indicated that there was significant difference between maize farmers' efficiency and its food security. The result showed that technical efficiency score is negatively associated with food security and statistically significant at $p< 0.05$. The calculated t-value was 11.61 and exceeds the critical value (t-critical two tail) of 1.96. This implies that the more technically efficient the farmers are in their farm operations the less food insecure they tended to be. This is because improvement in agricultural productivity improves returns to the household from agricultural activity (Asogwa*et al*., 2011). Such an increase in household efficiency would lead to reduction in food insecurity of the household. Improving the productivity of rural farm households, therefore, should play a key role in a broad-based economic growth strategy and food insecurity reduction for Nigeria. Asogwa*et al*. (2012) observed that improvement in the farm productivity of the smallholder farmers in Nigeria brought about improvement their income generation and consequently poverty reduction.

Table 4.7: The result of t-test showing the impact of efficiency on food security of maize farmer

	Efficiency	***Food security***
Mean	0.809	0.336
Variance	0.136	0.474
Observations	156	156
t Stat	11.610	
t Critical two-tail	1.96*	

4.3 Contribution of Maize to Household Farm Income in the Study Area.

The main economic activity in the study areas is crop production. The summary of the contribution of maize to household farm income is presented in Table 4.8. The net household farm income is derived from the total net revenues from maize and other crops produced by maize farmers for the year under consideration. The relative contributions of the various farm income sources are shown in Table 4.8.

The study revealed that about 32% of the sample farmers cultivated other crops apart from maize. The contribution from maize amounted to about 68% of total household farm income. This in line with findings of Christopher and Yusoff (2011) who asserted that the importance of maize production to food security especially in Nigeria is of significant importance for continued sustenance of improved agricultural productivity. This followed by sorghum with about 26%, rice 5% and millet 2% contribution to total household farm income in the study area. This finding provides enough evidence for the maize farmers to reallocate some resources from other crops production to maize production if only they view profitability and efficient utilization of resources as their main goals.

Table 4.8: Contribution of Maize to household Farm Income in the Study Area

Income source	Amount (₦)	% contribution
A. Net maize revenue	368,126.9	67.99776
B. Net income from other crops		
B Sorghum	142,068.26	26.24183
B Rice	25277.75	4.669125
B Millet	8524.10	1.574511
C. Net farm income for other crops ($B_1+B_2+B_3$)	173,253.97	
D. Total net household ıcome (CD)	**541,380.9**	**100**

4.4 Food Security Status of Urban and Peri Urban Maize Farmers

The result presented in Table 4.9 shows the summary of food security indices of the respondents. Households were categorized into food secure and food insecure groups based on their per capita food expenditure. This method has been applied in several studies, whose main focus is to determine the food security status of households (Omonona and Agoi2007: World Bank, 2005). The food insecurity line is defined as two-third of the mean per capita food expenditure of the total households studied. The estimated food security line was ₦4,315.5. Therefore, household whose per capita expenditure fall below ₦4,315.5 are designated as food insecure while households whose mean per capita food expenditure equals or is greater than ₦4,315.5 are food secure. The results in Table 4.8, showed that about 54% of urban and peri-urban maize farming households were food secure while about 46% were not food secure. The food insecurity gap and food surplus index which measure the extent of deviation from the food security line, showed that the food secure households exceeded the food security

line by 47%, while 64% of food insecure households fell below the poverty line. Also, the mean per capita expenditure for all households' was₦8945.21 and ₦2413.01, for food secure and food insecure households' respectively. This empirical finding agrees with the results of (Amaza*et al*. 2009: Olagunju*et al*. 2012).

Table 4.9: Food Security Status of Urban and Peri-Urban Maize Farmers

Food security index	**Food secure**	**Food insecure**
Number of household	85	71
Percentage of household	54.49	45.51
Head count ratio (H)	0.545	0.455
Food insecurity gap/Surplus index	1.32	0.51
Mean Monthly Per capita expenditure	₦8945.2	₦2413.01

1

4.5 Factors Influencing Food Security Status of Urban and Per-Urban Maize Farming Households.

To determine factors influencing food security status of farming households, socioeconomic characteristics of households were regressed on their food security indices and result presented in Table 4.10. The result showed seven variables: household income, education, output, extension contact, cooperative membership, farm size and credit as relevant in significantly influencing food security status of farming households in the study area. With the exception of age which showed negative relationship with food security and not statistically significant.

The estimated coefficient of total annual income has positive influence on food security status of farming households. The variable has the expected sign and is statistically significant at 10% level of probability. This indicates the higher the income of households, the greater the probability of being food secure. This could be expected because, increased in income all things being equal, means increased access to food. This result is consistent with Babatunde*et al* (2007); Adenega and Adewusi (2007); Arene and Anyaeji (2010) who revealed positive and significant relationship between household income and food security.

The coefficient of years of formal education is statistically significant at 10% level and carries a negative sign, thus suggesting that the higher the educational level of the household head, the more food secure (or less food insecure) the household tends to be and vice versa. This is as expected, since the level of education should positively affect the income earning capacity and level of efficiency in managing the household's food resources. This result implies that households who have household heads with relatively better education are more likely to be food secure than those headed by uneducated (illiterate) household heads. The result coincides with the theoretical evidences that educational improvement could lead to awareness of the possible advantages of modernizing agriculture and improve the quality of labor. It is similar with the findings of Ramakrishna, and Assefa, (2002) and Haile, (2005).

The coefficient of quantity of output production was found to be positive and statistically significant at 5% level of probability. The positive sign of the variable indicates that the higher the output levels of household, the greater the likelihood of food security. The result of this study is in line with Babatunde*et al* (2007), who obtained the same result

among the rural farming households in the North-Central Nigeria. Further, Ojogho (2010) noted that lower output level of the household increases food insecurity status of arable farmers of Edo State, Nigeria.

The coefficient of access to extension services is statistically significant at the 5% level and has a negative relationship with the food insecurity status of a household. This implies that households with access to agricultural extension services tended to have less food insecurity than those that did not have such access and vice versa. This is because contact with extension services tends to enhance the chances of a household having access to better crop production techniques, improved inputs, as well as other production incentives that positively affect farm productivity and production and thus household food security status. Asogwa*et al* (2012) observed that high level of technical inefficiency among small-holder farmers in the rural and peri-urban areas of Nigeria were highly attributable to low availability of extension services and information about technical aspects of crop technologies.

The coefficient of membership of farmer association is statistically significant at 10% level and carries a positive sign. This implies that households whose heads were members of cooperative societies or other farmers' organizations had higher tendency of being food secure than those households whose heads were not members. This can be closely linked to the beneficial effects of their membership, in terms of production and other welfare enhancing services that these societies and organizations often offer.

The coefficient of farm size is negatively sign and statistically significant at the 5% level of probability, meaning that farm size exhibits a negative relationship with the food insecurity status of a household. That is, households with larger farm sizes tend to be

more food secure than those with smaller sizes, and vice versa. As a household's farm size increases, food insecurity tends to decline. Reddy (2004) Observed that greater efficiencies in the use of resources are associated with the large farms than the small farms. They pointed out that the smallness of holdings deters the use of mechanization and does not allow the use of modern inputs due to lack of purchasing power in the hands of small farmers. Desli (2003) noted that in reality, small scale producers are not always efficient. This results in low productivity and low income, and consequently incidence of food insecurity among the farm households.

The coefficient of access to credit was found to have positive influence on food security status of households and met the a priori expectations. This could be expected since credit serves as consumption smoothing mechanism which gives households temporal relief against the effects of food insecurity. The result of the study implies that household that received credit had greater chances of being food secure compared to those who did not have credit, all things being equal. The result of the study is in line with the findings of Pappoe (2011), who found that access to credit improves the food security status of farming households among bio-fuel producers.

Table 4.10: Determinants of food security status among urban and peri-urban maize farming households

Variables	Coefficients	Standard error	T-value
Constant	23.935	25.600	0.933
Age	-26.335	25.640	-1.027
Income	2.196	1.159	1.895*
Educational status	-0.474	0.274	-1.729*
Output	1.105	0.452	2.445**
Extension contact	-0.417	0.182	-2.291**
Cooperative association	0.306	0.149	2.064**
Farm size	0.392	0.195	2.010**
Amount of credit received	0.650	0.286	2.273**

****P < 0.05, *P < 0.10, R^2=0.682 and R^2 adjusted = 0.581**

4.5.2 Test of Hypothesis II

As shown in Table 4.11, the generalized likelihood-ratio test at 1% level of significance rejects the first null hypothesis that there is no significant relationship between socioeconomic characteristics and food security status of maize farmers. This suggests that the variables in the Cobb-Douglas stochastic production model are not zero, hence has significant relationship. This implied that there is significant relationship between socioeconomic characteristics and its food security.

Table 4.11: Log-likelihood ratio test (LR)

Null hypotheses	ln(H_O)	λ	*Critical value	Decision
Production function model				
H_0: $\beta_{ij} = 0$	-82.67	0.84	107.29	Reject H_0
Inefficiency model				
H_0 $\lambda = 0$	-121.78	0.93	32.21	Reject Ho

* **Critical value is significant at P < 0.01**

4.6 Production constraints faced by maize farmers

The problems faced by maize farmers in the study area were ranked according to their severity as stated by the farmers (Table 4.12). About 81% the respondents identified high cost of labour as very severe. Although family labour was used, but hired labour was mostly employed. Scarcity is usually characterized by high cost of input variables of production; therefore the high cost of labour could imply unavailability of labour. Hence the amount charged per man-day was high. This explains the reason behind the high cost of labour and agrees with Olayiwola (2008) who opined that high cost of labour and shortage of capital are considered to be the greatest constraints.

Fund was also cited as very severe constraints to maize production (62.8%) in the study area. This may account for the reason most respondents are small- scale farmers. Also, the stringent conditions and bureaucratic bottleneck of credit institutions shy farmers away from obtaining loans to finance their farm operations. Credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. It agrees with findings of Nasiru, (2010) who noted that access to micro-credit could have prospect in improving the productivity

of farmers and contributing to uplifting the livelihoods of disadvantaged rural farming communities. It also agree with Idachaba (1989); Olayemi (1996) and Omonona and Agoi (2007) who reported that poor accessibility to credit facilities, storage and marketing facilities, production inputs are important factors causing food insecurity in Nigeria. The some coping strategy employed by the farmers was through personal savings and borrowing from friends to finance their production.

Another problem considered as being very severe by the respondents is lack of access to improved hybrid maize seed. This is perceived by about 47% of the respondents. This may be due to non-awareness, poor education and poor access to extension services-which was also considered as very severe problem by about 58.85% respondents. This finding is in line with Zulu (2004), opined that most farmers havelittleornoaccesstoimprovedseedsand continuestorecycleseedsthathavebecomeexhaustedaftergenerationsofcultivation.

In Nigeria today, the ratio of extension to famers is about 1: 25,000 (Paul Mari Bdliya, 2009). This is unacceptable if we are to attain the food security for the populace. Other problems identified as being very severe in maize production are inadequate recommended agrochemicals, while poor pricing of maize products and problems of pest and diseases are identified as not severe.

Table 4.12: Production constraints faced by maize farmers

Constraints	*Frequency	Percentage	Rank
High cost of labour	126	80.8	1st
Lack of credit	98	62.8	2nd
Lack of access to improved seed	73	46.8	3rd
Inadequate extension services	54	34.6	4th
Inadequate recommended agrochemicals	6	3.8	5th
Poor pricing of maize products	4	2.7	6th
Pest and diseases	3	1.9	7th

* Multiple responses was allowed

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study focused on the assessment of the contribution of urban and peri-urban maize production on the food security of farm households in Kaduna State, Nigeria. The primary data were collected from 156 respondents using structured questionnaire. The statistical tools used to analyze the data were descriptive statistics, stochastic frontier production function, cost of calorie method and logit regression model. The result of the analysis shows that 71% of the respondents fall within the age range of 21- 50years, more than half (53%) of the farmers do not have formal education, about 80% of the respondents had household size ranged from 1-5 people. The majority of the farmers (89.6%) finance their production through personal savings while about 82% of the respondents had no extension contact in the study area.

The stochastic frontier production function was estimated for technical efficiency. It was observed from the study that the mean technical efficiency for the 156 sampled farmers in the study area was 0.83. This implies that on the average, output fall by 17% from the maximum possible level due to inefficiency. The estimated coefficients of all the parameters of production function (seed, fertilizer, labour and agrochemical) were positive and significant at 1% level of probability and hence play a major role in urban and peri-urban maize production in the study area except agrochemical which is negative and statistically not significant.

The study revealed that about 32% of the sample farmers cultivated other crops apart from maize. The contribution from maize amounted to about 68% of total household farm

income. This followed by sorghum with about 26%, rice 5% and millet 2% contribution to total household farm income in the study area.

The result of food security status of maize farmers indicates majority (54.49%) of farming households were food secure while 45.51% were not food secured. The head count ratio of food secure households was found to be 0.545 and food insecure households were also found to be 0.455. The food insecurity gap/surplus gap index was found to be 1.32 for food secure while 0.51 to be food insure.

To determine factors influencing food security status of farming households, socioeconomic characteristics of households were regressed on their food security indices and result showed four variables: household income, access to credit, farm size, education, cooperative membership, extension and output as relevant in significantly influencing food security status of farming households in the study area.

Finally, among the constraints identified in the study area were high cost of labour, lack of credit, lack of access to improved hybrid maize seed and inadequate extension services were major constraints faced by the farmers in the study area.

5.2 Conclusion

This study concludes that majority of the farming households (54.4%) were found to be food secure. Results revealed that an increase in household income, having access to credit as well as increase in the quantity of maize output improve the food security status of farming households in Kaduna State. Given that maize is an important staple food in

Nigeria, any attempt to increase its productivity would be a right step towards the resolution of food insecurity. Apart from ensuring a food security, increased maize production will provide more employment opportunities for the unemployed citizens' long term in the country.

5.3 Contribution of the Study to Knowledge

1. The study revealed that urban and peri-urban maize farmers in the study area achieved technical efficiency of 83 percent.

2. The study revealed that about 54.4% of the households were classified as food secure while 45.5% were classified as food insecure in the study area.

3. The study revealed that about 32% of the sample farmers cultivated other crops apart from maize. The contribution from maize amounted to about 68% of total household farm income in the study area.

5.4 Recommendations

From the findings of this study, the following recommendations are made:

i. Income was found to significantly influence food security; rural households should be educated on the need to diversify their source of income from agriculture. This will ensure regular incomes for the households.

ii. Cooperative membership was a significantly determinant of food security, participation of poor rural households' in cooperative societies may be necessary

for them to be able to acquire the necessary funds required. Besides, agencies of government such as the National Directorate of Employment should be made to go and give training to rural households on small scale enterprises.

iii. The major problems encountered in maize production are high cost of labour, lack of credit, lack of access to improved hybrid maize seed and inadequate extension services. This constraint constitutes serious impediments to maize production and need to be addressed adequately before maize production can be improved in the study area. It is recommended that agro based industries and non-governmental organization should be encouraged by the local government to support research and production of maize products for commercial purposes.

iv. Food insecurity coping strategies adopted by the farming households have short term effect. Therefore, there is the increase the volume of food production as well as improve on access to income generating activities that are more sustainable.

REFERENCES

Abbas, I., I. Adama, Y., A. andUkoje, J., A. (2010). Street Mapping Using Remotely Sensed Data and GIS Technique. *Research Journal of Applied Sciences, Engineering and Technology* 2(2): 191-197.

Abubakar, S.M. (2000).Assessment of Land Degradation under Different Agricultural Land Use Types in Parts of Katsina State, Nigeria. In: Falola, J. Afolabi; Ahmed, K; Liman, M.A; and Maiwada, A (eds) , Proceedings of the National Workshop on Land Administration and Development in Northern Nigeria, Kano, Department of Geography, BUK, Kano: 91-106.

Adedeji, O.H, and Ademiluyi, I. A. (2009). Urban Agriculture and Urban Land Use Planning: Need for a Synthesis in Metropolitan Lagos, Nigeria. *Journal of Geography and Regional Plannig.* 2(3): 043-050.

Adenegan, K. O. and Adewusi, O. A. (2007). Determinants of Food Security Status of Rural Households Living with HIV/AIDS in Southwestern Nigeria. *African Journal of Biomedical Research*, Vol. 10, pp. 9 – 18. Retrieved from http://www.aessweb.com/pdf-files/3%20(1)%2039-61.pdf on 20/05/15

Adewale, J. G, Oladejo, J. A. and Ogunniyi, L. T. (2005). Economic Contribution of Farm Children to Agricultural Production in Nigeria: A case study of Ekiti State. *Journal of Social Science*.10(2):49 – 152.

Adewuyi, T.O. (2008). Land Degradation in the Peri-Urban Area of Kaduna Metropolis, Nigeria. Ph.D Dissertation, Department of Geography, Bayero University, Kano, Nigeria.

Adewuyi, T., A. &Baduku, A., S. (2012). Recent Consequences of Land Degradation On Farmland in the Peri-Urban Area of Kaduna Metropolis, Nigeria. *Journal of Sustainable Development in Africa* 14(3): 179-193.

Adeyemo, R and Kuhlmann, F. (2009). Resource Use Efficiency in Urban Agriculture in Southwestern Nigeria. *Tropicultura*. 27(1):49-53.

Adisa, B. O. and Okunade, E. O. (2005). Women in Agriculture and Rural Development. In: Adedoyin, S. Fola (eds) Agricultural Extension in Nigeria, AESON. ARMTI Ilorin: 69 -77.

Ajadi, B.S, Adeniyi. A, and Afolabi M. T. (2011). Impact of Climate onUrban Agriculture: Case Study of Ilorin City, Nigeria. *Global Journal of Human Social Science.* 1 (1): 1-11

Akinnagbe, O. M, Agwu, A. E. and Igbokwe, E. M. (2008). Agricultural Extension Policy for Enhancing Women Participation in Sustainable Agricultural Development in Nigeria. In: Developing Agricultural Extension Policy for Nigeria Proceedings of the 13th Annual National conference of AESON 8 – 11 April, 2008.

Alberto, Z, and Luca, T. (2010). Urban Agriculture, Poverty, and Food Security:Empirical Evidence from a Sample of Developing Countries. *Food Policy*. 35: 265–273.

Ali, K.A. (2003). The Effects of Gully Erosion in Abakpa Area Kaduna Metropolis, Kaduna State, Unpublished B.Sc. Thesis, Geography Department, NDA, Kaduna.

Amaza, P, Abdoulaye T, Kwaghe, P, Tagbaru A. (2009). Changes in House Food Security and Poverty in PROSAB area of Southern Borno State, Nigeria. International Institute of Tropical Agriculture (IITA). Ibadan, Nigeria: 14-36.

Anderson, A. (1990). Smokestacks in the Rainforest: Industrial Development and Deforestation in the Amazon Basin. *World Development.* 18 (9):1191-1205.

Ango, A.K, Abdullahi, A.N, and Abubakar, B.B. (2011). Role of Socio EconomicParameters in Determining the Efficacy of Urban Agriculture in Providing Food Security in BirninKebbi Metropolitan Area, Kebbi State, North Western Nigeria. *International Journal of Agricultural Science and Social Science*. 1(6): 185-192.

Anozie, R.O, M.O. Okoronkwo and E.C. Onyemairo (2008). Adoption of Improved Maize Variety (Oba Super) by Farmers in Ishiagu, Ivo LGA, Ebonyi State. Proceedings of 42nd Annual Conference of Agric-Society of Nigeria: 813.

Arene, C.J, and Mbata, G.I.O. (2008). Determinant of Profitability and Willingness to Pay for Metropolitan Waste Use in Urban Agriculture of the Federal Capital Territory, Abuja, Nigeria. *Journal of tropical agriculture, food, environment and extension*. 7(1):41-46.

Armar-Klemesu, M. (2001).Urban Agriculture and Food Security, Nutrition and Health. Thematic chapter paper 4. In:Baker, N. et al. (Eds), Growing cities Gowing food: Urban Agriculture on the policy Agenda. DSE, Fefdafing.

Asogwa, B. C., &Umeh, J. C. (2012). Food Insecurity Determinants Among Rural Farm Households in Nigeria. Proceedings in International Conference on Ecology, Agriculture and Chemical Engineering (ICEACS 2012), Phuket (Thailand), December 18th - 19th, 2012

Ayoade, A. R, Ogunwale, A. B, and Adewale, J. G. (2011). Impact of the National Special Programme for Food Security on Poverty Alleviation among Women in Oyo State, Nigeria. *African Journal of Food, Agriculture, Nutrition and Development*. 11(4):564-582

Babatunde, R. O. Omotosho, O. A. and Sholotan, O. S. (2007). Factors Influencing FoodSecurity Status of Rural Farming Households in North Central Nigeria. *Agricultural Journal*, 2(3): 351 – 357.

Balarabe, A. Ahmed, B, and Chikwendu, D.O. (2006). Analyses of Price and Income Elasticities for Cereal Food Crops in an Urban Town of Kaduna, Kaduna State. *Agroserach*. 8(1):59-65.

Bashir M.K., S. Steven and R. Pandit. (2012). The Determinants of Rural Household Food Security in the Punjab, Pakistan: An Econometric Analysis. Working Paper 1203, School of Agricultural and Resource Economics, University of Western Australia, Crawley. Retrieved fromhttp://ageconsearch.umn.edu/bitstream/122526/2/working%20paper%201203.pdf.on 8/10/2015

Bhatta, G. D, W. Doppler and K.B. KC, (2009). Potential of Organic Agriculture in Nepal. *Journal of Agriculture and Environment*. 10:1-11.

Blumenthal, U, Peasey, A, Ruiz-Palacios, G, and Mara, D. D. (2000). Guidelines for Wastewater Reuse in Agriculture and Aquaculture: Recommended Revisions Based on New Research Evidence. Task No. 68, Part 1. Retrieved from persistent URL: http://www.lboro.ac.uk/well/resources/well-studies/fullreports-pdf, on 15-01-2013

Brown, S, (2003). Spatial Analysis of Socio-Economic Issues: Gender and GIS in Nepal. *Mountain Research and Development*. 23(4):338-344.

Central Bank of Nigeria (CBN), (2011). Annual Report. CBN, Abuja, Nigeria.

Chikaire, J, Atala, T. K, Akpoko, J. G, Nnadi, F. N. and Jamilu, A. A. (2011). Landholding Inequality Among Smallholder Farmers in Imo State, Nigeria: Implications for Agricultural Development and Rural Livelihood. *Journal of Nature and Science*. 9(11):12-20.Retrieved from http://www.sciencepub.net/nature, on 10-07-2012

Chikezie, N. P, Chikaire, J, Osuagwu, C. O, Ihenacho, R. A, Ejiogu-Okereke, N, Oguegbuchulam, M. N. and Obi, K.U (2012). Factors Constraining Rural Youths Involvement in Cassava Production in Onu – Imo Local Government Area of Imo State, Nigeria. *Global Advanced Research Journal of Agricultural Science.* 1(8):223-232.

Codjoe, S. N. A, (2007). Integrating Remote Sensing, GIS, Census and Socioeconomic Data in Studying the Population-Land Use/Cover Nexus in Ghana: A Literature Update. *Africa Development.* 32(2):197-212.

Coelli, T.J. (1995). Estimators and Hypothesis Tests for a Stochastic: A Monte Carlo Analysis, *Journal of Productivity Analysis*, 6, 247-268. Retrieved from link.springer.com/article/10.1007%2FBF01076978 on 22/10/15

Cole, D., Lee-Smith, D. and Nasinyama, G.W. (2008). Healthy City Harvests: Generating Evidence to Guide Policy on Urban Agriculture. Lima, Peru: International Potato Centre &Makerere University Press. Retrieved from http://www.ruaf.org/sites/default/files/UK%20Foresight%20-

The%20role%20of%20urban%20agriculture%20in%20building%20resilient%20cities%20in%20developing%20countries.pdf on 12-10/2015

Danso G, Cofie O, Annang L, Obuobie E. and Keraita B. (2004). Gender and Urban Agriculture: The case of Accra, Ghana. *Urban Agriculture Magazine* 7:5-7

Dayo, P., Nkonya, E., Pender, J and Oni, O.A. (2009). Constraints to Increasing Agricultural Productivity in Nigeria: A Review. Nigeria Strategy Support Programme (NSSP) Background Paper No. NSSP 006. IFPRI, Abija, Nigeria. 62pp

De Sherbinin, A (2002) A Guide to Land Use and Land Cover Change (LUCC) Centre for International Earth Science Information Network, New York, Columbia University, Palisades. *CIESIN Thematic Guides.* Retrieved from http://sedac.ciesin.columbia.edu/binaries/web/sedac/thematic-guides/ciesin_lucc_tg.pdf on 08/10/2015

De Zeeuw H, Guendel, S. and Waibel, H. (2000). The Integration of Agriculture in Urban Policies. Inn. Bakker, M. Dubbeling, S. Guendel, U. SabelKoschella& H. de Zeeuw, eds. 2000. Growing Cities, Growing Food, Urban Agriculture on the Policy Agenda. DSE, Feldafing: 161-182

Dresher A, and Laquinta D. (1999) Urban and Peril-Urban Agriculture. A New Challenge for the UN Food and Agricultural Organization (FAO) Internal Report, Rome.

Drechsel, P, and S. Dongus (2010). Dynamics and Sustainability of Urban Agriculture: Examples for Sub-Saharan Africa. *Sustainability Science*. 5 (1): 69-78. Retrieved from http://www.springlink.com/content/910602842356q0/fulltext.pdf of 15/9/2014

Ebojei, C.O., Ayinde, T.B and Akogwu, G.O. (2012).Socio-Economic Factors Influencing the Adoption of Hybrid Maize in Giwa Local Government Area of Kaduna State, Nigeria. *Journal of Agricultural Science*, 7(1): 23 – 32.

Ekong E. E. (2003). Rural Sociology: An Introduction and Analysis of Rural Nigeria,Uyo: Dove Educational Publication.

Emmanuel, O, Raphael, K. and John, T. (2006).Irrigated Urban Vegetable Production in Ghana: Characteristics, Benefits and Risks. International Water Management Institute, Center for Social and International Relation Printing Division, Accra, Ghana: 18-21.

Ensink, J. H, van der Hoek, W, Matsuno, Y, Munir, S, and Aslam, M. R. (2002). Use of Untreated Wastewater in Peri-Urban Agriculture in Pakistan: Risks and Opportunities. Research Report 64, Colombo: International Water Management Institute (IWMI).

Eqziabher D, Lee-Smith D.G, Maxwell P.A, Mammon L.T.A, Mougeot and Swain C.J. (1994). Cities Feeding People: An Examination of Urban Agriculture in East Africa International Development Research Centre, Ottawa, Canada.

Evans, T. P. and E. F. Morans, (2002). Spatial Integration of Social and Biophysical Factors Related to Landscape Change. *Population and Development Review*, Supplement to Vol 28.

Ezendinma C. and Chukuezi C. (1999). A comparative Analysis of Urban Agriculture Enterprises in Lagos and Port Harcourt, Nigeria. *Environment and Urbanization.* 11(2):135-144.

Food and Agriculture Organization of the United Nations, (1996). Report of the World FoodSummit. Rome, Italy

Food and Agricultural Organization of the United Nations, (2010). Fighting Poverty and Hunger. Economic and Social Perspectives. *Policy Brief* No. 10.

Food and Agricultural Organization of the United Nations, (2000.) The Challenges of Sustainable Forestry Development in Africa: Twenty-First FAO Regional Conference for Africa, Yaoundé, Cameroon, 21-25 February 2000, FAO, Rome.

Food and Agricultural Organization of the United Nations (2001). A Briefing Guide for the Successful Implementation of Urban and Peri-Urban Agriculture in Developing Countries and Countries of Transition. Revision 2, Handbook Series. Volume III. Rome.

Feigin, A, Ravina, I, and Shalhevet, J. (1991). Irrigation with Treated Sewage Effluent: Management for Environmental ProtectionBerlin: Springer-Verlag, pp.224, DM 228.00

Ghaffari, A., H.F. Cook and H.C. Lee, (2000). Integrating climate, soil and crop information: A land suitability study using GIS. Proceedings of the 4th International Conference on Integrating GIS and Environmental Modeling (GIS/EM4): Problems, Prospects and Research Needs, September 2-8, 2000, Banff, Alberta, Canada, pp: 1-14.

Gujarati, D. N. (2004). Basic Econometrics. Fourth Edition, McGraw-Hill, New York.

Gündel, S. (2002).Peri-urban and urban livestock keeping in East Africa - a coping strategy for the poor? Scoping study July 2002. Natural Resources International Limited, Aylesford, UK. 31 pp. http://r4d.dfid.gov.uk/PDF/Outputs/RNRRS/Synthesis_study_on_urban_and_peri-urban_agriculture_P1.pdf. Retrieved on 08-10-2015

Haile, M. (2005) 'Weather Patterns, Food Security and Humanitarian Response in Sub-Saharan Africa', Philosophical Transactions: Biological Sciences 360 (1463): 2169-2182. Retrieved from http://www.ncbi.nlm.nih.gov › NCBI › Literature › PubMed Central (PMC) on 20/10/15

Horswell J, Speir TW, van Schaik AP (2003). Bioindicators to Assess Impacts of Heavy Metals in the Land Applied Sewage Sludge. *Soil Biology. Biochemistry*., 35: 1501–1505.

Hussain, I, Raschid, L, Hanjra, M. A, Marikar, F, and Van der Hoek, W. (2001). A Framework for Analyzing Socioeconomic, Health and Environmental Impacts of Wastewater Use in Agriculture in Developing Countries. Working Paper 26. Colombo: International Water Management Institute (IWMI).

Idoko, A.O. (2004). Causes and Effects of Gully Erosion in the Ribadu, Cantonment, Kaduna, NDA, Kaduna, Unpublished B.Sc Thesis, Geography Department. NDA, Kaduna.

International Food Policy Research Institute (1996). Urbanization and Agriculture in the Year 2020, News and Views, April.

International Institute of Tropical Agriculture (2002). Competiveness Workshop Oportunity in Nigeria. Bokanga, IITA Ibadan.

Izuchukwu, O. (2011). Analysis of the Contribution of Agricultural Sector on the Nigerian Economic Development. *World Review of Business Research*. 1(1): 191 – 200.

Jonathan, C., Alice, H., and Daniel, T. (2010).Urban Food Production and Household Food Security in Southern African Cities. *Urban Food Security Series No. 4.*

Joshi, P. K., S. Pande, M. Asokan, (1999). Socioeconomic Dataset and Use of GIS. In: Pande S, Johansen C, Lauren J, Bantilan FT Jr, Editors. GIS Analysis of Cropping Systems. New York: ICRISAT and Cornell University. 55-63.

Kalirajan, K.P. and R.T. Shand (2001). Technology and Farm Performance: Paths of Productive Efficiencies over Time', *Agricultural Economics*. 24(3): 297–306.

Kareita B. (2007). Irrigated Urban Agriculture and Public Health Dilema: Challenges and Initiatives to Address Safety Concerns in Ghana. Denish Research Network for International Health. Being a paper delivered at the department of International Health, Immunology and Microbiology, University of Copenhegan, Oster Farimagsgade.

Kessler A. (2002). Economic Strategies of Different Plant Production Farming Systems of Urban and Peri-Urban Agriculture in West Africa. Urban Agriculture Magazine No 7. August, 2002. Economics of Urban Agriculture. Leaden, the Netherlands, RUAF.

KC, K. B, (2005). Combining Socio-Economic and Spatial Methodologies in Rural Resources and Livelihood Development: A Case from Mountains of Nepal," Wekersheim: UniversitätHohenheim, MargrafVerlag, Germany. Retrieved from http://www.ccsenet.org/journal/index.php/jas/article/viewFile/6163/6214 on 12/10/2015

Kiwata, S, Boon, E, and Devuyst, D. (2010). Urban Agriculture in Low Income Households of Harare: An Adaptive Response to Economic Crises. *J Hum Ecol*. 32(2):85-96.

Kormawa, P. M. and Asumugha, G. (2003). Gender Impacts of Small Farmers' Commercialization in Nigeria: Case Studies of Cassava, Ginger and Fresh Milk Enterprises. Report submitted to the FAO-RAF, Management, Marketing and Rural Finance Service (AGSP), Gender and Development Service (SDWW).

Kudi,T. M, Usman, I, Akpoko, J. G. and Banta, A. L.(2008). Analysis of the Impact of National Fadama Development Project II (NFDP II) in Alleviating Poverty Among Farmers in Giwa Local Government Area of Kaduna State, Nigeria. *Ozean Journal of Applied Sciences*.1(1). Retrieved from http://www.usa-journals.com/wp-content/uploads/2013/09/Olaolu_Vol110.pdf on 9/10/2014

Lee-Smith, D &Prain, G (2006). Urban Agriculture and Health, in Hawkes, C &Ruel, MT (eds) Understanding the Links Between Agriculture and Health, 2020 Focus no. 13, Brief 34 G. Prain and D. Lee-Smith 13 of 16, IFPRI, Washington,DC, www.ifpri.orghttp://www.ifpril.org/2020/focus/focus13.asp Retrieved on 08-10-2014.

Liu,W. H, Zhao, J. Z, Ouyang, Z.Y, Solderland, L, and Liu,G. H. (2005b). Impacts of Sewage Irrigation on Heavy Metal Distribution and Contamination in Beijing, China. *Environmental International*. 32: 805–812.

Lock, K. & van Veenhuizen, R. (2007). Editorial. Urban Agriculture Magazine,no 3. Health and Urban Agriculture. Leusden, The Netherlands, RUAF.

Lock, K. & de Zeeuw, H. (2001). Mitigating the Health Risks Associated with Urban and Peri-Urban Agriculture; Results of the E-conference, Urban and Peri-urban Agriculture on the Policy Agenda. *Urban Agriculture Magazine*, no 3. Health and urban agriculture. Leusden, RUAF.

Marie, T. R, James, L. G, Saul, S. M, Daniel, M, Arne, O, Patrice, E, Purnima, M, Alison, S, and Lawrence, H. (1998). Urban Challenges to Food and Nutrition Security: A Review of Food Security, Health, and Caregiving in the Cities. *FCND discussion paper*.NO. 51.

Mallo, I.Y.Y. (1998). Soil and Financial Loss Owing to Excavations and Gully on the Land Surfaces of Kaduna City, Northern Nigeria. JOSAMS. 5:83-95.

Maurice, D.C. (2004). Resource Productivity in Cereal Crops Production among Fadama Farmers in Adamawa State, Nigeria. Unpublished M.Sc. Thesis submitted to the Department of Agricultural Economics and Extension, University of Maiduguri, Nigeria.

Maxwell D. (2003). Urban Food Security in Sub-Saharan Africa. In M. Koc, R. MacRae, L.J.A. Mougeot andJ.Welsh, eds. For Hunger-proof Cities: Sustainable Urban Food system,. Ottawa, Canada, IDRC. 26-29

Mbiba B, Van Veenhuizen R (2001). The Integration of Urban and Periurban Agriculture into Planning. *Urban Agric. Mag*. 4: 1– 6.

Mergaei, M, Silim, S. N. and Baudion, J. P. (2001). Improved Management Practices to Increase Productivity of Traditional Cereal/Pigeon pea. Intercropping System in Eastern Africa. Status and Potential of Pigeon Pea in Eastern and Southern Africa. In: Silim, S. M., Mergaei, G. and Kimani, P. M. (eds) Proceedings of a Regional Workshop, Nairobi, Kenya, 12 – 25, and 73 – 83.

Michelle, N. (2004). Urban Agriculture on the Rooftop. Retrieved from libarynth.org/_media/roofgarden_thesis.pdf on 15/05/2012

Milton, S.J, Dean, W.R.J. (1995). South Africa's Arid and Semiarid Rangeland: Why are They Changing and Can They be Restored? *Environmental Monitoring Assessment.* 37, 245-264. Retrieved from http://link.springer.com/article/10.1007%2FBF00546893 on 9/10/2015.

Mougeot, L.J.A. (2002) Urban Agriculture: Definition, Presence, Potential and Risks. Available at http://www.ruaf.org/reader. Retrieved on 09-10-2015

Modirwa, S. &Oladele, O.I. (2012). Food Security Among Male and Female-Headed Households in Eden District Municipality of the Western Cape, South Africa. Journal Human Ecology, 37(1):29-35.

Muhammed-lawal, A, Omotesho, O. A. and Falola, A. (2009). Technical Efficiency of Youth Participation in Agriculture. A Case Study of Youth-in-Agriculture Programme in Ondo State; South-West Nigeria. *Nigeria Journal of Agriculture, Food and Environment.* 5(1): 20 – 26.

Mustaschke, T. (2009). Rapid Urbanization and Food Security: Using Food Density Maps to Identify Future Food Security Hotspots. Global Perspective Studies Unit, Food and Agriculture Organization of the United Nations.

National Population Commission (2006). Nigeria's National Census NPC, Abuja.

Nicholson, Beryl (2002). Micro-Enterprise in a "Modern" Economy: an Underrated Factor in the Albanian Transition, Premières Rencontres des étudesBalkaniques en France "Etudes Balkaniques: état des Savoirs et Pistes de Recherche" Paris, 19 et 20 décembre.

Niemeijer, D, Mazzucato, V. (2002). Soil Degradation in the West African Sahel: How Serious is it? *Environmen*t 44(2):20-31.

Nsoanya, L. N. and Nenna, M.G. (2011). Adoption of Improved Cassava Production Technologies InAnambra-East Local Government Area Of Anambra State Nigeria. JORIND, Vol. 9(2): 36–43. Retrieved fromwww.ajol.info/journals/jorindon 26/05/2012

Nweke, F. I, D. S. Spencer, and Lynam, J. K. (2002). The Cassava Transformation*:* Africa's Best Kept Secret. Michigan State University, East Lansing, Michigan. 273.

Obwona M (2000). Determinants of Technical Efficiency Differentials Amongst Small and Medium Scale Farmers in Uganda: A Case of Tobacco Growers. A final report presented at AERC bi-annual workshop at Grand Requency Hotel, Nairobi, Kenya.

Ogunbameru B0 2001 Practical Agricultural Communication, Graphic Publishers, Nigeria, pp. 13 — 14.

Ogundele, O., &Okoruwa, V. (2006). Technical Efficiency Differentials in Rice Production Technologies in Nigeria. *African Economic Research Consortium* , Paper 154, Nairobi.

Ojo S.O and Ajibefun I.A (2000). Effects of Training on Labour Productivity and Efficiency in Oil Palm Production in Ondo State. *Nigeria Journal of Sustainable Agriculture and Environment*. 2: 275-279.

Ojogho, O. (2010). Determinants of Food Insecurity among Arable Framers in Edo State,Nigeria. *Agricultural Journal*, 5(3): 151-156.

Ojuekaiye, E. O. (2001). Economic Analysis of Cassava Production in Three Local Government Areas of Kogi State. MSc Thesis, Department of agricultural Economics and Rural Sociology, ABU, Zaria

Okeke, D. (1993). Global Role of Soybean. Keynote Address Delivered at the World Soybean Research Conference, Thailand, Feb. 21.

Okike I. (2000). Crop - Livestock Interaction and Economic Efficiency of Farmers in the Savannah Zones of Nigeria . Unpublished Ph.DThesis ,University of Ibadan

Okin, G.S. (2002). Toward a Unified View of Biophysical Land Degradation Processes in Arid and Semiarid Lands. In: Reynolds JF, Stafford Smith (eds) Global Desertification: Do Humans Cause Deserts?, Workshop Report 88, Dahlem University Press, Berlin: 95-110

Okolo, D. A. (2006). Agricultural Development and Food Security in Sub-Saharan Africa; The Case of Nigeria, FAO Working Paper No, 5.

Okuneye, P. A, (2001). Rural Poverty Assessment and Control in Africa" An Invited Specialization Course Paper Presented at the United Nations IDEP, Dakar, Senegal, June 19-22, 2001

Oladeji, J. O, Oyedokun, A. O. and Bankole, M. B. (2003). Youth Activities and Constraints to Community Development in Akoko – North, Ondo State, Nigeria. *Journal of Agricultural Extension*.13 (1). Retrieved from http://www.gjournals.org/GJAS/GJAS%20Pdf/2012/October/Chikezie%20et%20al.pdf on 9/10/2015

Oladiebo, J.O and Fajuyigbe, A.A. (2007).Technical Efficiency of Women Upland Rice Farmers in Osun State, *Nigeria Journal of Human Ecology.* 22(2):93-100. Retrieved from www.krepublishers.com/...2007...2007.../JHE-22-2-093-07-1403-Olade on 20/10/15

Olayiwola. O.O (2008). Extent of Adoption of New Cassava Technology, Impact on Yield, Cost and Identified Constraints to Adoption of New Technology in Ibadan Metropolis, Oyo State, Nigeria. Retrieved from www.abhinavjournal.com/images/Commerce.../Aug12/10.pdf on 12/10/2015

Olofin, E.A. (1997). Consequences of Environmental Degradation on Man and Habitat, Workshop on Environmental Education, BUK, Nigeria, June 1997.

Olofin, E.A. (2000). Environmental Hazards and Sustainable Agricultural Development in Northern Nigeria. In: Falola JA, Ahmed K, Liman, MA, Maiwada A (eds) Proceedings of the National Workshop on Land Administration and Development in Northern Nigeria,. Department of Geography, BUK, Kano: 107-113

Olagunju, FI, Oke JT, Babatunde RO, Ajiboye A. (2012). Determinants of Food Insecurity in Ogbomosho Metropolis of Oyo State, Nigeria. PAT; 8(1):111–124.

Omotesho O.A, M.O. Adewumi, A.Muhammad- Lawal, and O.E. Ayinde (2006). Determinants of Food Security Among The Rural Farming Households in Kwara State, Nigeria. *African journal of general agriculture.* 2 (1): 15. Retrieved from http://iiste.org/Journals/index.php/DCS/article/viewFile/12196/12549 on 12/10/2015

Omonona, B. T. and Agoi, G. A. (2007). An Analysis of Food Security Situation AmongNigerian Urban Households: Evidence from Lagos State, Nigeria. *Journal of central European agriculture.* 8 (3): 397-406.

Omotor, D. G. (2009). Food Security and Nutition Trend in Nigeria. *MPRA Paper* No. 22669.

Onyenweaku, C.E. and Nwaru, J.C. (2005). Application of a Stochastic Production Frontier to the Measurement of Technical Efficiency in Food Crop Production in Imo State". *The Nigerian Agricultural Journal* 36: 1 – 12.

Oruche, E.N., Atala T.K., Akpoko J.G. and Chikaire J, (2012): "Impact of the National Special Programme for FoodSecurity on Livestock Farmers in Ideato South Local Government Area of Imo State, Nigeria". *Greener Journal of Agricultural Sciences*. 2(6): 251-258. www.gjournals.org. Retrieved on 24-06-2014

Paddison R, Findlay A. M and Dawson J. (1990). Retailing in Less-Developed Countries. In Findlay et al (eds): 3-15 Retrieved from http://www.abhinavjournal.com/images/Commerce_&_Management/Aug12/10.pdf on 12/10/2015

Pappoe, A. (2011). Effect of Biofuel Production on Household Food Security in the Central Region of Ghana. Unpublished Thesis submitted to the Department of Agricultural Economics and Agribusiness, Universityof Ghana. http://www.iiste.org/Journals/index.php/RHSS/article/viewFile/4930/5013 on 12/10/2015

Prain, G, (2006). Participatory Technology Development for Sustainable Intensification of Urban Agriculture in R.vanVeenhizen, 2006. Cities Farming for the Future: Urban Agriculture for Green and Productive Cities. Leusden, RAUF/IDRC/IIRR

Prain, G, and Lee-Smith, D, (2010). Urban Agriculture in Africa: What Has Been Learned? African Urban Harvest, DOI 10.1007/978-1-4419-6250-8_2.

Prince, S.D. (2002). Spatial and Temporal Scales for Detection of Desertification in Reynolds, J.F, and Stafford Smith (eds), Global Desertification: Do Humans Cause Deserts? Workshop Report 88, Berlin, Dahlem University Press: 23-40.

Puigdefa'bregas, J, Mendizabal, T. (1998). Perspectives on Desertification: Western Mediterranean. *Journal of Arid Environmental*. 39: 209-224.

Ramankutty, N, and Foley, J.A. (1999). Estimating Historical Changes in Global Land Cover. Croplands from 1700 to 1992, Global Biogeochemical Cycles 13(4): 997-1027.

Ramakrishna, G and Asseffa, D (2002). An EmpericalAnanlysis of Food Security in Ethopia: The case of North Wello. *African Development*. 27(1-2): 127-143. Retrieved from www.africabib.org/rec.php?RID=Q00036360 on 20/10/15

Reddy SS, Ram PR, Sastry TVN, Devi IB (2004). Agricultural Economics. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd. http://www.krepublishers.com/02-Journals/JHE/JHE-35-0-000-11-

Web/JHE-35-3-000-11-Abst-PDF/JHE-35-3-173-11-2185-Penda-S-T/JHE-35-3-173-11-2185-Penda-S-T-Tt.pdf on 12/10/2015

Reynolds, J.F. (2001). Desertification. In: Levin S (ed) Encyclopedia of Biodiversity, Academic, San Diego. 2:61-78

Reynolds, J.F, Stafford Smith (2002). Global Desertification; Do Humans Cause Deserts? Berlin: Dalhem Workshop Report 88, Dalhem University Press. 437pp

Rigaux, P., M. Scholl and A. Voisard, (2002). Spatial Database with Application to GIS. Morgan Kaufmann Publishers, An Imprint of Elsevier, San Francisco.

Sabine Gundel (2006). A Synthesis of Urban and Peri-Urban Agricultural Research Commissioned by the RNRRS Program 1995-2006.

Saka, J.O and Lawal, B.O (2009). Determinants of adoption and Productivity of Improved Rice Varieties in South-western Nigeria. *African Journal of Biotechnology* 8(19) : 4923-4932.

Sambo B.E and Ahmed. A (2012). Feeding the Cities: Town Planning Practice and Food Security Implication on the Sustainability of Urban Settlements – An Introspective Study of Kaduna Metropolis. *Journal of Sustainable Development and Environmental Protection* 2(2):78 Retrieved from http://www. ierdafrica.org.ng/journal5/Feeding_the_Cities.pdf on 12/10/15

Schreier, H. and S. Brown, (2001). Scaling Issues in Watershed Assessments. *Water Policy*, 3:475-489.

Scoones, I, and Toulmin, (1998). Soil Nutrient Budget and Balances: What Use for Policy. *Agriculture, Ecosystems and Environment*. 71(1):255-268.

Sharma, P. V, Staal, S, Delgado, C. and Singh, R. V. (2003). Policy, Technical, Environment and Implication of Scaling-up of Milk Production in India. Annex in Research Report of International Food policy Research Institute (IFPRI), Food and Agriculture Organisation. Livestock Industrialization Project Phase II, Washington D.C., IFPRI.

Sharma, G, (2006). Organic Agriculture in Nepal: An Analysis in to Status, Policy, Technology and Psychology. In: Sharma, G. and P. B. Thapa (eds.) Proceedings of National Workshop on Organic Agriculture and Farming System, Nepal Permaculture Group, Kathmandu, Nepal.

Sharma, R. K, Agrawal, M, and Marshall, F. (2007). Heavy Metal Contamination of Soil and Vegetables in Suburban Areas of Varansi, India. Ecotoxicology and Environmental Safety, 66:258–266. Doi:10.1016/j.ecoenv.2005.11.007

Shehu, J.F., Iyortyer, J.I., Mshelia, S.I and Jongur, A.A.U. (2010). Determinants of Yam Production and Technical efficiency Among Yam Farmers in Benue State, Nigeria, *Journal of Social Sciences*.24(2):143-148

Smith, L., Obeid, A., Jensen, H. (2000). The Geography and Causes of Food Insecurity in Developing Countries. Agricultural Economics 22: 199-215. Retrieved from http://cyberleninka.ru/article/n/analysis-of-food-security-status-of-farming-households-in-the-forest-belt-of-the-central-region-of-ghana#ixzz3pCEAbeMl on 22/10/15

Starr, J, and F. Estes, (1990). Geographic Information Systems: An Introduction. Englewood Cliffs, Prentice Hall. New Jersey.

Shonekan, E. (2004). Road Map for Sound Environmental Practices, Nigeria, Thisday (Lagos, Nigeria), 28 July, 2004: 31.

Sick, T.D. (1998). Perspectives on the Land Use History of Northern Nigeria: A Context for Understanding our Changing Environment. USGS, Biological Resources Division, Biological Science Report: 104.

Tijani, A. A. (2006). Analysis of the technical efficiency of rice farms in Ijesha Land of Osun State, Nigeria. Agrekon, Vol 45, (2) (June) p.126.

Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region,"Economic Geography, vol. 46, supplement: Proceeding. International Geographic Union. Commission on Quantitative methods. 234-240. Retrieved from http://www.jstor.org/stable/14314 on 12/10/2015

Ugwu DS, Kanu IO (2012). Effects of Agricultural Reforms on the Agricultural Sector in Nigeria. *Journal for African Study Development*. 4(2):51-59. Retrieved from http://www.academicjournlas.org on 12/8/2015

Umoh GS (2006). Resource Use Efficiency in Urban Farming: An Application of Stochastic Frontier Production Function. *International Journal of Agric. Biotechnology*. 8:38-44.Retrieved from www.iiste.org/Journals/index.php/JEDS/article/viewFile/25815/26662 on 20/10/15

United Nations Development Programme (1996). Urban Agriculture; Food, Jobs and Sustainable Cities. New York UNDP. World Health Organization (WHO) (2006). Guidelines for The Safe Use of Wastewater, Excreta and Greywater: Wastewater Use in Agriculture (Volume II). Retrieved from persistent URL: http://www.who.int/water_sanitation_health/wastewater/gsuweg2/en/index.html. On 02-02-2012

United Nations Environmental Programme (1997). World Atlas of Desertification, 2nd edition, London, Edward Arnold.

Urie, D. H. (1986). The Status of Wastewater Irrigation of Forest. In D. W. Cole, C. L. Henry, and W. L. Nutter (Eds.), The Forest Alternative for Treatment and Utilization of Municipal and Industrial Wastes. Seattle: University of Washington Press.

United State Agency for International Development (2008). Improving Food Security Monitoring and Vulnerability AssessmentCapabilities.

Usman, S. (2009).Analysis of Farm Plan and Resource -use Efficiency of Sesame Production in Jigawa State,Nigeria. Unpublished M.Sc. Thesis submitted to the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria.

Wang Fahui and Dai, Dajun (2011). Geographic Disparities in Accessibility to Food Stores in South Western Mississippi. Environment and Planning B: Planning and Design. Vol.38. Pp659.

Wang, J. S., H. Luo, (2005). Short-Term Safety Evaluation of Processed Calcium Montmorillonite Clay (NovaSil) in Humans. Food AdditContam 22(3): 270-9. Retrieved from www.ncbi.nlm.nih.gov/pubmed/16019795 on 10/10/15

Warren, A. (2002). Land Degradation is Contextual. Land Degradation and Development. 13: 449-459.

World Bank (1995). World Development Reports, 1995. Oxford University Press, Oxford.

World Bank (2005). Introduction to Poverty Analysis. Washington DC.

World Health Organization (2006). Guidelines for the Safe Use of Wastewater, Excreta and Greywater: Wastewater Use in Agriculture (Volume II). Retrieved from persistentURL: http://www.who.int/water_sanitation_health/wastewater/gsuweg2/en/index.html on 03-02-2012

World Resources Institute (1997). The Last Frontier Forest: Ecosystems and Economics on the Edge. Washington, D.C. Retrieved from www.wri.org/wri/ffi/lff-eng/ on 03-2-2012

Yemisi, I. O, and Aisha A. M. (2009). Gender Issues in Agriculture andRural Development in Nigeria: The Role of Women. *Humanity & Social Sciences Journal*. 4 (1): 19-30

Yusuf, S.A, A. O. Adesanoye and D. O. Awotide (2008). Assessment of Poverty AmongUrban Farmers in Ibadan Metropolis, *Nigeria. J. Hum. Ecol*. 24(3): 201-207

Zezza, A. and Tasciotti, L. (2008). Does Urban Agriculture Enhance Dietary Diversity? Empirical Evidence from a Sample of Developing Countries. FAO.*Food Policy* 35:265-273

APPENDICES

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, FACULTY OF AGRICULTURE, AHMADU BELLO UNIVERSITY, ZARIA.

RESEARCH QUESTIONNAIRE FOR RESPONDENTS

THE IMPACT OF URBAN AND PERI-URBAN MAIZE PRODUCTION ON FOOD SECURITY OF DWELLERS IN KADUNA STATE

Dear Respondent,

This questionnaire will be used by a student of the Department of Agricultural Economics and Rural sociology, Ahmadu Bello University, Zaria. Please, fill as appropriate. All information will be treated with confidentiality and strictly for the purpose of research. Thanks for your co-operation.

Village/Community……L.G.A…….....

SOCIO –ECONOMICS CHARACTERISTICS

1. Name of farmer……

2. Gender: Male ( ) Female ( )

3. Age (years)……

4. Marital status: Married ( ) Single ( )

5. Highest level of Education:

(a) No Formal Education ( ) (b) Primary school Education ( ) (c) Secondary School Education ( ) (d) Tertiary Education ( )

6. Family Size (All the number of the people depending on you for living)…….

(a) No of Adult Male ( ) (b) No of Adult female ( ) (c) Children >15yrs ( ) (d) Children <15yrs ( )

7. How long have you been in maize farming? (Years of experience)……

8. Do you belong to any co-operative/Association? Yes ( ) No ( )

9. If yes, (Years of participation) ----------

10. What benefit did you derive as a member?.....

11. What is your major source of capital for maize farming?

12. If you borrow, what were the sources of the credit and the amount borrowed?

SOURCE OF LOAN	AMOUNT(₦)	INTERST RATE (%)
Commercial Bank		
Nigeria agricultural Cooperative And Rural Development Bank		
Cooperative Societies		
Money Lenders		
Friends And Family		
Others (Specify)		

13. Have you been visited by an extension agent in the last one year? Yes ( ) No ( )

14. If Yes, How many times in last one year?.....

15. Did you visit an extension agent last year? Yes ( ) No ( )

16. If Yes, How many times in last one year?.....

17. What activities did the agent teach you? .....

Activities/Technology	Benefit
Fertilizer application	a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( ) d. very beneficial ( )
Intercropping	a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( ) d. very beneficial ( )
Plant Spacing	a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( ) d. very beneficial ( )
Pest Control	a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( )

	d. very beneficial ( )

18. Have you been trained on maize farming? Yes ( ) No ( )

19. If Yes, what activities, which organization conducted the training and what benefit did you derived from the training?.....

Activities/Technology	Organization	Benefit
Fertilizer application		a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( ) d. very beneficial ( )
Intercropping		a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( ) d. very beneficial ( )
Plant Spacing		a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( ) d. very beneficial ( )
Pest Control		a. Not beneficial ( ) b. somehow beneficial ( ) c. beneficial ( ) d. very beneficial ( )

20. Of what benefit were the techniques learnt to you to the success of your farm apart from the one listed on the table above? .....

(1) Farm size (Ha)

Plots	Size	Crops
1		
2		
3		

(ii). How did you acquire your land? *(Tick below)*

Plot	**Plot size (ha)**	**Mode of Acquisition**				
		(a) Inheritance	(b) Lease	(c) Borrowed	(d)Gift	(e) Purchased
1						

2						
3						

(iii). How much does it cost to rent one Hectare of land per season in your village? ....……..... Naira

(iv). Do you plant maize only or mixed with other crops?

(v). If mixed, with what crops do you plant with maize?.....

Variable inputs (Last production Cycle)

(ii)Seed (Kg) maize

Plot No	Quantity of Seed(Kg)	Cost (₦)	Quantity of seed (kg) for other crops if mixed	Cost (₦)
1				
2				
3				

(iii).Fertilizer.

Plot No	Fertilizerty pe	Quantity(Kg) maize	Cost(₦)	Quantity(Kg) for other crop if mixed	Cost(₦)
1					
2					
3					

(iv).Agrochemical.

Plot No	Agrochemical ype	Quantity(litres) for maize	Cost(₦)	Quantity(litres) for other crop if mixed	Cost(₦)
1					
2					
3					

Labour input

(i) Land preparation

Plot No	Labour for maize			Labour for other crops (mixure)		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(ii) Planting

Plot No	Labour for maize			Labour for other crops		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(iii) Fertilizer Application

Plot No	Labour for maize			Labour for other crops		
	No of people	No of Hours	Cost(₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(iv) First Weeding

Plot No	Labour for maize			Labour for other crops		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost(₦)
1						
2						
3						

(v) Second Weeding

Plot No	Labour for maize			Labour for other crops		
	No of people	No of Hours	Cost(₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(v) Harvesting

Plot No	Labour for maize			Labour for other crops		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

Information on maize output and other crops

Plot No	No. of output of maize produced(Kg)	Total Qty sold	Price/Unit	Plot No	No. of output of other crops produced(Kg)	Total Qty sold	Price/Unit
1				1			
2				2			
3				3			

25. Number of months that harvest lasted in 2013 season.

Crop	Name of Crop	How long did the harvest last?(no. of months out of 12)	How long do you think your harvest will last this time(no.of months)
Most important cereal crop			
Most important legume crop			

Most important root/tuber crop			

26. In the past 12 months, were there months in which you did not have enough food to meet your family's needs? Yes ( ) NO ( )

27. If yes, which were the months in the last 12 months that you did not have enough food to meet your family's needs?

Months	Did you have enough food to meet your family's needs 1=Yes,0=No
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

28. In which months does your household rely on food purchase for feeding?.....

29. Give the months when food prices are highest……

30. How much do you spend on food purchase for last season?.....

31. How many times do you eat in a day?.....

32. What type of food do you eat for your breakfast?.....

33. What type of food do you eat for your lunch?.....

34. What type of food do you eat for your dinner?.....

35. What is the quantity of food mention above? (a) half plate ( ), (b) full plate

36. Household expenses (LAST YEAR CROPPING SEASON)

Items	Amount(₦)/week	Amount(₦)/month
1. Food		
2. Rent		
3. Clothing		
4. Housing maintenance.		
5. Light/electric power		
6. Fuel		

7. Pharmaceutical products		
8. Hospital care		
9. Schooling		
10. Community levy/contribution		
11. Financial assistance/ monetary gifts (present)		
12. Travels		
13. Contributions to associations and groups		
14. Others (pls. specify)		

37. On-farm and off-farm income (*Provide estimation*)

Source	crop	Amount (₦)
1. Maize income	Value of maize sold	
2. Income derived from other produce	1= Maize	
	2= Cowpea	
	3= Rice	
	4= Vegetable	
	5= Millet	
	6= Others (Specify)	
3. Off-farm income		

38. Wealth and Assets: LIVESTOCK

Kindly indicate how many livestock you own and also provide other related information.

	Number of livestock presently owned	How many did you have last year 2012?	How many have you sold this year 2012?	Amount realize (₦)	How many have you consumed this year2013?	Amount of animal products consumed last week (Qty/unit	Amount of animal product sold last week (Qty/unit
Cattle							
Cattle meat							
Sheep							
Sheep meat							
Goat							
Goat meat							
Chickens							
Ducks							
Others							

39. State the constraints affecting your production

i) ……
(ii) ……
(iii) ……
(iv)……
(v) …….

40. What are the coping strategies employed to reduce the problems?

i) ……
(ii) ……
(iii) ……
(iv)……
(v) ……

41. What suggestions will you give to help in solving the above constraints?

(i) ……
(ii) ……
(iii) ……
(iv) ……
(v) ……

Thanks for your Attention

.