ECONOMIC ANALYSIS OF RAIN-FED CABBAGE (*Brassica oleracea Var. Capitata*) PRODUCTION IN SELECTED LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA

By

Bashiru Dahiru MAGAJI
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DECLARATION

I declare that the work in this thesis titled Economic Analysis of Rain-fed Cabbage Production in Selected Local Government Areas of Kaduna State, Nigeria has been carried out by me in the Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture, Ahmadu Bello University, Zaria. The information derived from the literature has been acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this university or any other institution.

Bashiru Dahiru MAGAJI Student	Date

CERTIFICATION

This thesis titled ECONOMIC ANALYSIS OF RAIN-FED CABBAGE PRODUCTION IN SELECTED LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA, by Bashiru Dahiru MAGAJI meets the regulations governing the award of the Degree of Master of Science, Ahmadu Bello University, Zaria, and is approved for its contribution to scientific knowledge and literary presentation.

______________________________ ________________

Prof. Z. Abdulsalam — Date
Chairman, Supervisory Committee

______________________________ ________________

Prof. S. A. Rahman — Date
Member, Supervisory Committee

______________________________ ________________

Prof. Z. Abdulsalam — Date
Head of Department

______________________________ ________________

Prof. A. Z. Hassan — Date
Dean School of Postgraduate Studies

DEDICATION

This thesis is dedicated to Almighty Allah (SWT) the most beneficent, the most merciful, the sovereign, the compassionate, the compeller, the greatest, the creator of all creatures, the fashioner, the giver of all and the sustainer who created the heavens and the earth, and sends down water from the heaven with which he brings forth for our provision.

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TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

The study ascertained the cost and returns and analyzed technical efficiency of rain-fed cabbage production in Kudan, Sabon-Gari and Zaria LGAs of Kaduna State, Nigeria. Primary data were collected from 130 cabbage farmers selected using multi stage sampling techniques. The data of 2013 cropping season were collected with the aid of structured questionnaire. Data collected were analyzed using descriptive statistics and stochastic frontier production function. The results of the socioeconomic characteristics of the respondents revealed that over 90% of the respondents were within the active ages of 20-52 years; about 61% had western formal education with average farm size of 0.19 hectares. The average output of cabbage in the study area was 11, 766.57 kg/ha. Cabbage Production is profitable with an average return of ₦1.30 for every ₦1 invested in the study area. The maximum likelihood estimates (MLEs) of the stochastic frontier production function model revealed that farm size was significant to cabbage output. The technical efficiency scores revealed that the most efficient farmer operated at 98% efficiency, the least efficient farmer was found to operate at 1% efficiency level, while the mean was indicating that cabbage farmers still have room to increase the efficiency in their farming activities from the optimum (100%) is yet to be attained by a typical farmer in the study area. However, the mean economic efficiency of the cabbage farmers was 0.80, implying that output fell by 20% from the maximum possible attainable level due to economic inefficiency of the farmers. The inefficiency model revealed that age squared, family size, extension contact and educational level, increased TE, while credit access and farming experience were the determinant of allocative efficiency of the farmers. The results indicated that all the variables were significant ($P<0.01$).The major challenges faced by the cabbage farmers include insect and disease attack (55%), inadequate capital (14%) and activities of middlemen (14%). The study therefore, recommends investing in research and extension activities by the government and NGOs as well as encouraging more involvement in cabbage production especially by the unemployed youth as a step towards unemployment and poverty reduction.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

There has been a rise in the production of vegetables in general, stimulated by high public demand, driven in large part by enhanced consumer awareness of the dietary and health benefits of fresh vegetable consumption (Iheke, 2009).Vegetables are good sources of protein, mineral salts, sugars, vitamins, and essential oils that increase man's resistance to disease (Akpan, Essien, Akpan and Bassey, 2011). It is asserted by Mlozi (2003) that increase in vegetable production improved food security and offered employment opportunities to many rural women in Nigeria. According to Kebede and Gan (1999), the main sources of farm income for small and limited resource farmers are basically arable crop production consisting of vegetable and non-vegetable crops. Asian Vegetable Research Development Centre for Africa (AVRDC) (2004) documented that vegetables are the most affordable and accessible sources of micronutrients and its production is increasingly recognized as a catalyst for rural development and as a means of generating foreign exchange in developing countries.

Agricultural production in Nigeria is dominated by small-scale farmers who produce more than 90 percent of the food consumed in the country. One of the major crops produced are vegetables which represent an essential part of agricultural products. Their production remains entrenched in Nigerian agriculture and forms an important condiment in the national diet (Ibekwe and Adesope, 2010). Amongst the different foods, production and consumption of vegetables are very important because of their contribution to good health by providing inexpensive sources of minerals and vitamins needed to supplement people's diet which are mainly carbohydrates (Adedoyin, Torimiro and Ogunbanyo, 1996).Vegetables are the most important and extensively cultivated food and income generating crops in many parts of Africa (Adebisi-Adelani, Olajide-Taiyo and Adeboye, 2011). According to Mohammed (2002), they can give high yield per unit area of land and hence generate high incomes for the farmers.

The major issues limiting agricultural productivity in Nigeria include low yields, due to the use of low technology inputs, poor yielding seeds and livestock, poor adoption of improved production technologies, poor infrastructure, poor access to finance and poor marketing structures (Central Bank of Nigeria (CBN), 2010). Thus, to raise productivity and stimulate the sector, these problems need to be mitigated through adequate research and provision of technologies which would lead to competitive production (CBN, 2010). Increased output and productivity are directly related to production efficiency which arises from efficient input usage given the state of technology (Maurice, 2004).

Cabbage (*Brassica oleracea Var.Capitata L.*) is the most important vegetable commercially of the Cole crops, which include Cabbage, *Cauliflower, Brussels sprouts, Kale, Kohlrabi, Collard, Broccoli,* and many others. It also ranks as one of the most important of all vegetable crops and is universally cultivated as a garden, truck and general farm crop. The market for cabbage, like that for potatoes, is continuous throughout the year, and this tends to make it one of the staple vegetables (Small Farmer's Journal (SFJ), 2014). Fresh cabbages are sold through fresh produce market, processors, restaurants and retailers.

Cabbages are among the most important vegetables in Africa in general and particularly in Nigeria, especially for lower income groups. It serves as an income source among groups most affected by poverty, including small farmers, youths, and most especially women who play an important role in agricultural production (International Institute for Tropical Agriculture (IITA), 2009).

1.2 Problem Statement

Nigeria's agricultural productivity is declining as food production dropped by 20 percent at the end of 2007 cropping season. This is reflected in rising food prices, under capacity utilization of some agro-based industries and the importation of some food items to complement domestic production (2007) (CBN, 2010). The low productivity will likely discourage farmers especially new entrants because, profitability of the various enterprises is compromised.

In developing countries including Nigeria, the consumption of vegetables is generally lower than the Food and Agricultural Organizations of the United Nations (FAO) recommendation of 75kg per year (206g per capita per day) (Badmus and Yekinni, 2011).One of the major reasons for low productivity in agriculture all over the world has been ascribed to the inability of farmers to fully exploit the available technologies resulting in lower efficiencies of production (Murthy, Sudha, Hegde and Dakshinamoorthy, 2009). To reduce the problem of the current food challenge, government at different levels have embarked on various programmes aimed at stimulating food production particularly among the resource poor farmers (Nsikak-Abasi and Sunday, 2013). Ibeawuchi, Obiefuna, Nwosu, Nwocha, Ofor and Ezeibekwe (2010) stated that in Nigeria, about 70-75% of the population are farmers. Generally, the people were poor and most of them were small scale farmers who produced majority of the food. They were said to be resource poor and practiced small scale farming (0.1-2 ha) thus raising questions about the production efficiency of the farmers.

Despite the efforts and involvement of farming families in cabbage production in the study area over the years, the generality of their income and productivity has remained low. There is however scanty research works on efficiency and profitability analysis of cabbage production in the study area. Against the backdrop that cabbage production is not capital intensive and can be and can be undertaken all year-round even by resources poor farmers, the following research questions were raised:

i. What are the socio-economic characteristics of cabbage farmers in the study area?
ii. What are the costs and returns associated with cabbage production in the study area?
iii. What are the input-output levels in cabbage production in the study area?
iv. What are the technical, allocative and economic efficiencies of the small scale cabbage farmers in the study area?
v. What are the factors affecting the technical efficiency of the small scale cabbage production?
vi. What are the challenges faced by the cabbage farmers in the study area?

1.3 Objectives of the Study

The broad objective of this study was to determine the profitability and technical efficiency of rainfed cabbage production in Kudan, Sabon- Gari and Zaria Local Government Areas of Kaduna State. The specific objectives were to:

i. describe the socio-economic characteristics of cabbage farmers in the study area;
ii. ascertain the costs and returns and the profitability or otherwise of cabbage production in the study area;

iii. describe the inputs and output levels in cabbage production in the study area;

iv. estimate the technical, allocative and economic efficiencies of cabbage production in the study area;

v. identify the factors affecting the technical efficiency in cabbage production in the study area and

vi. describe the constraint faced by the cabbage farmers in the study area.

1.4 Justification of the Study

In an economy where resources are scarce and opportunities for new technology are lacking, efficiency studies can show the possibility of raising productivity by improving efficiency without expanding the resources base (Adewunmi and Adebayo, 2008).This study therefore helped to provide information that will serve as a guide to agricultural key players on cabbage investment decisions in Nigeria. The study will also be helpful for those who are involved in decision making process at the farm, state and national levels. The study aimed at examining the economics of cabbage production, with a view to provide information to farmers towards improving the existing allocation pattern of their resources.

1.5 Hypotheses

The hypotheses tested in this study were:

i. Cabbage production in the study area was not profitable

ii. The explanatory variables included in the model did not significantly explain the output of cabbage.

CHAPTER TWO

LITERATURE REVIEW

2.1 Economic Importance of Cabbage

A crucial role of vegetable production especially, cabbage, tomatoes, okra and *amaranthus* play in the economies of developing countries including Nigeria can be looked at in terms of rural employment, sources of raw materials for the industries and source of food for people (Tindal, 1983). Vegetables are major component of Nigerian diet as in other part of the world. Hence, vegetables production is a vital area of agriculture. It plays a vital role in nutrition and most vegetables are valuable source of vitamins, mineral and dietary fibre and are low in fat and calories (Adeniji, 2008). They are cheap and available. Apart from this, farmer's socio-economic status has been positively affected through its production, in that it has helped in reduction of poverty in farm households (Adeniji, 2008).

Cabbages, supply essential micro-nutrient in human nutrition that act as preventive agents to several ailments. Increased cabbage production may improve food security and offer employment opportunities to the populace (Mlozi, 2003).Cabbage is one of the priority vegetable crops cultivated in smallholder crop-livestock systems in Northern Nigeria in an attempt to diversify income generating sources as well as to enhance nutrition of smallholder farmers (SFJ,2014).

Cabbage production has been playing a vital role in both human and animal nutrition, poverty reduction and in changing farmer's socio-economic status (Omokore, Akinlola and Atiyong, 2009). Cabbage is fairly low in calorie, a good source for many minerals particularly potassium, relatively high in vitamin C and A, relatively low in protein content, it makes food portable and supplies good enrichment to the body

(IITA, 2010). Uncooked cabbage is high in glutamine, an amino acid essential for intestinal health. Cabbage contains vitamin K (essential for blood clothing protein), potassium (which help regulates blood pressure) and quartering antioxidant that is a natural antihistamine that can be benefit allergy sufferers (Earth Clinic, 2008).

2.2 Concept of Efficiency

According to Simonyan, Olukosi, Omelehin and Atala (2012), a production process may be technically inefficient if it fails to produce maximum output from a given bundle of inputs and is therefore operating beneath its stochastic production frontier. However, the analysis of allocative efficiency usually assumes that the farm firm seeks to optimize a profit maximization objective function subject to resource constraints. Resources are said to be efficiently allocated when the value of marginal product of each resource equals its price.

Allocative efficiency refers to the adjustment of inputs and outputs to reflect relative prices (price efficiency) under a given technology (Ellis, 1988). Unlike technical efficiency concept that only consider the process of production, allocative efficiency concepts pertain to the idea that society is concerned with not only how an output is produced, but also with what outputs and balance of output are produced (Hensher, 2001).

The term efficiency of a firm can be defined as its ability to produce the largest possible amount of output from a given set of inputs. The modern theory of efficiency dates back to the pioneering work of Farrell (1957) who proposed that the technical efficiency of a firm consist of technical and allocative components and the combination of these two components provide a measure of total economic or overall efficiency. He defined technical efficiency as the ability of a firm to produce a given level output with a minimum quantity of inputs under certain technology and allocative efficiency as ability of a firm to choose optimal input levels for a given factor prices. In Farrell's framework, economic efficiency (EE) is an overall performance measure and is equal to the product of TE and AE (that is EE = TE*AE). Technical efficiency which is the main focus of this study is the ability to produce a given level of output with a minimum quantity of inputs and can be measured either as input conserving oriented technical efficiency or output-expanding oriented technical efficiency. Output-expanding oriented technical efficiency is the ratio of observed to maximum feasible output, conditional on technical and observed input usage (Ali, 1996).

Efficiency measurement is useful in determining the magnitude of the gains that could be achieved by adopting improved production technology. Efficiency in resource allocation has a far-reaching impact on the observed farm output level. The presence of shortfall in efficiency means that output can be increased without using additional conventional inputs and new technology. (Zhu, 2000; Tauer, 2001; Rahman, Ajayi and Gabriel, 2002). Farmers possess the potential to achieve both technical and allocative efficiency in farm enterprises but inefficiency may arise due to a variety of factors some of which are beyond the control of the farmers (Rahman, Ajayi and Gabriel, 2002).

2.3 Factors Affecting Technical Efficiency

Several factors including socio-economic and demographic factors, plot level characteristics, environmental factors and non-physical factors are likely to affect the efficiency of smallholder farmers. Ajibefun and Daramola (1999) have shown that the significant determinants of technical efficiency of block-makers and saw-millers in

Nigeria are age of operator, level of education, business experience, and the number of employees and level of investment.

Ojo, Mohammed, Adeniji and Ojo (2009) had identified education, farming experience, extension contacts, farming experience, age and household size as the major factors influencing technical efficiency of irrigated onion farmers in Sokoto State, Nigeria. Ali, Shah, Jan, Fayaz, Ullah and Khan (2013) identified tractor hours, seed rate, labor days, irrigation numbers, chemical fertilizer, farm yard manure (FYM) and herbicide as the variables for finding technical efficiency while age, experience and education of sugarcane growers were taken as the technical inefficiency factors in Dera Ismail Khan,Pakistan.

According to Musemwa, Mushenje, Aghdasi and Zhou (2013), Factors which affected economic efficiency of the resettled farmers in Zimbabwe were secondary education, household size, farm size, cultivated area and arable land owned. They reported that none of the included socio-economic variables had significant effects on the allocative and economic efficiency of the resettled farmers.

2.4 Stochastic Frontier Production Function

The modeling, estimation and application of stochastic frontier production functions to economic analysis assumed prominence in econometrics and applied economic analysis during the last two decades. Early applications of stochastic frontier production functions to economic analysis include those of Aigner, Amemiya and Polirier (1977) who applied the stochastic frontier production functions in the analysis of the United States agricultural data. Battese and Corra (1977) applied the techniques to the pastoral zone of Eastern Australia. And more recently, empirical applications of the technique in efficiency analysis have been reported (Ojo, 2003; Maurice, 2004; Idiong, 2007; Usman, 2009; Adejoh, 2009; Amodu, 2010).

The stochastic frontier production function was independently proposed by Aigner, *et al.*, (1977) and Meeusen and Van den Broeck (1977). The stochastic production function is defined by

$Y_i = f(x_i; \beta) + e_i$ ……………………………………………………..…….. (1)

$e_i = v_i - u_i$ ……………………………………………………...…………(2)

Where:

Y_i = observed output of the ith sample farm. $f(x_i; \beta)$ is a suitable functional form such as Cobb- Douglas, x_i vector of the inputs used by the i-th farm, β vector of unknown parameters to be estimated, e_i is the error term made up of two components: v_i is a random error having zero mean which is associated with random factors outside the farmers control such as topography, weather, measurement errors, disruptions of supplies and is assumed to be an independently and identically distributed $N(0,\delta^2 v)$ random variable and independent of u_i. On the other hand, u_i is a non-negative truncated half normal random variable associated with farm-specific factors, which leads to the i-th farm not attaining maximum efficiency of production. u_i is associated with technical inefficiency of the firm and ranges between zero and one. U_i follows an identical and independent half-normal distribution, $N(0, \delta^2 u)$. N represents the number of firms involved in the cross-sectional survey. The stochastic frontier production function model is estimated using the maximum likelihood estimation procedure (MLE) (Bakhsh, 2007).

2.5 Profitability in Crop Production

As with any economic analysis, the profitability of an investment is based on a comparison of the returns and cost of the investment. Another way to add value on the production side would be to reduce processing costs by increasing the efficiency (and thus the profitability) of production (Masters, Lovett and Yidana, 2005). Hence, the profitability of crop production depends on reducing the farming cost as much as possible, and at the same time maximizing the income from the sale of crop.

Profitability in some farm business exists because they are managed more efficiently than others. The reward for doing the job better is usually profit. The prospect of earning and maintaining profitability serves as the incentives for creativity and efficiently among farmers. Profitability stimulates risky ventures and drives farmers to develop ways of cutting cost and improving technology always in an effort to satisfy consumer interest (Troke, 1981). Profitable agriculture is dependent on productive soil and cabbage production is not an exception.

2.6 Theoretical Framework

Three types of efficiency are identified in the literature. These are technical efficiency, allocative efficiency and overall or economic efficiency (Farrell, 1957; Olayide and Heady, 1982). Technical efficiency is the ability of a firm to produce a given level of output with minimum quality of inputs under a given technology. Allocative efficiency is a measure of the degree of sources in achieving the best combination of different inputs in producing a specific level of output considering the relative prices of these inputs. Economic efficiency is a product of technical and allocative efficiency (Olayide and Heady, 1982). In one sense, the efficiency of a farm is its success in producing as large an amount of output as possible from given sets of inputs. Maximum efficiency of a farm is attained when it becomes possible to reshuffle a given resource combination without decreasing the total output.

Since the seminal work of Farrell in (1957), several empirical studies have been conducted on farm efficiency. These papers have employed several measures of efficiency. These measures are classified broadly into three namely: deterministic parametric estimation, non-parametric mathematical programming and the stochastic parametric estimation. There are two non-parametric measures of efficiency. The first, based on the work of Chava and Aliber (1983) and Chava and Cox (1988) evaluates efficiency based on the neoclassical theories of consistency, restriction of production form, recoverability and extrapolation without maintaining any hypothesis of functional form. The second, first used by Farrell (1957) decomposed efficiency into technical and allocative. Fare and Grabowski, (1985) extended Farrell's method by relating the restrictive assumption of constant return to scale and of strong disposability of inputs (Liewelyn and Williams, 1996).

Several approaches, which fall under the two broad groups of parametric and non-parametric methods, have been used in empirical studies of farm efficiency. These include the production functions, programming techniques and recently, the efficiency frontier. The frontier is concerned with the concept of maximality in which the function sets a limit to the range of possible observations (Forsund, Lovell and Schmidt, 1980). Thus, it is possible to observe points below the production frontier for firms producing less than the maximum possible output but no point can lie above the production frontier, given the technology available. The frontier represents an efficient technology, and deviation from the frontier is regarded as inefficient. The literature emphasizes two broad approaches to production frontier estimation and technical efficiency measurement: (a) The non-parametric programming approach, and (b) the statistical approach. The programming approach requires the construction of a free disposal convex hull in the input-output space from a given sample of observations of inputs and outputs (Farrell, 1957). The convex hull (generated from a subset of the given sample) serves as an estimate of the production frontier, depicting the maximum possible output. Production efficiency of an economic unit is thus measured as the ratio of the actual output to the maximum output possible on the convex hull corresponding to the given set of inputs.

The statistical approach of production frontier estimation can be sub-divided into two, namely, the neutral-shift frontier and the non-neutral shift frontiers. The former approach measures the maximum possible output and then production efficiencies by specifying a composed error formulation to the conventional production function (Aigner, Amemiya, and Poirier, 1976; Meeusen and van den Broeck, 1977). The non-neutral approach uses a varying coefficients production function formulation (Kalirajan and Obwona, 1994). The main feature of the stochastic production frontier is that the disturbance term is composed of two parts: a symmetric component and a one sided component. The symmetric (normal) component, *vi*, captures the random effects due to the measurement error, statistical noise and other non-symmetrical influences outside the control of the firm. It is assumed to have a normal distribution. The one-sided (non-positive) component, u_i with $u_i \geq 0$, captures technical inefficiency relative to the stochastic frontier. This is the randomness under the control of the firm. It is assumed to be half normal or exponential. The random errors, *vi* are assumed to be independently and identically distributed as N $(0, \sigma^2_v)$ random variables, independent of u_i*'s*. The u_i*'s* are also assumed to be independently and identically distributed as, for example, exponential (Meeusen and van den Broeck, 1977), half normal (Aigner *et al*., 1976), truncated normal and gamma (Greene, 1990). The stochastic frontier function is typically specified as:

$Y_i = f(X_{ij}, \beta) + v_i - u_i \; (i = 1,2,3, \ldots, n)$………………………………………..……. (1)

where Y_i is the wheat output of the i-th farm; X_{ij} represents a $(1 \times K)$ vector that values are functions of the jth inputs by the i-th farm; β_i are $(K \times 1)$ vector of production coefficient to be estimated, v_i = Random variability in the production that cannot be influenced by the farm; and u_i = Deviation from maximum potential output attributable to the technical efficiency. The model is such that the possible production Y_i, is bounded above by the stochastic quality, $f(X_i, \beta)\exp(v_i)$ (that is, when $u_i = 0$) hence, the term stochastic frontier.

Given suitable distributional assumptions for the error terms, direct estimates of the parameters can be obtained by either the Maximum Likelihood Method (MLM) or the Corrected Ordinary Least Squares Methods (COLS). However, the MLM estimator has been found to be asymmetrically more efficient than the COLS (Coelli, 1995). Thus, the MLM has been preferred in empirical analysis.

In the context of the stochastic frontier production function, the technical efficiency of an individual farm is defined as the ratio of the observed output to the corresponding frontier output, conditional on the levels of inputs used by the farm. Thus, the technical efficiency of farm i is:

$TEI = exp(-u_i)$…………………………………………………………….………… (2)

That is:

$TEI = Y_i/Y_i^* = f(X_i, \beta)\, exp(v_i - ui) \,/\, f(X_i, \beta)\, exp(v_i)\, exp(-u_i)$…………………..…. (3)

TEI = Technical efficiency of farmer i; Y_i = observed output; and Y_i^*= frontier output. The technical efficiency of a farm ranges from 0 to 1. Maximum efficiency in production has a value of 1.0. Lower values represent less than maximum efficiency in production.

2.7 Empirical Studies

2.7.1 Socio economic characteristics of arable crop farmers

Ibekwe, Orebiyi, Henri-Ukoha, Okorji, Nwagbo, and Chidiebere-Mark, (2012) reported that cassava farming is dominated by young people who are active and within the productive age, the farmers are well experienced in cassava production with mean age of 13 years, the mean farm size was 2.6 hectares with average household size of 6 persons in the South East Nigeria.

Ogunbameru and Okeowo (2013), described the age of cassava farmers, range from 30 – 50 which is about 91.3%. They revealed that most respondents were male (73.8%). About 96% of the respondents are married. Educational attainment of the farmers does not only raise agricultural productivity but also enhances farmers' ability to understand and evaluate information on new techniques and processes.

According to Omolola (1988), the size of the household largely depends on the status of farmers and particularly on the number of wives the farmer has. One of the most important factors affecting production level and productivity among farmers is the composition and size of farming family, they reported that most of the respondents had household size between 1 – 10, with a mean family size of seven (7). About 46% has experiences between 6 – 10 years.

Orefi, Mimidoo, and Peter. (2011) reported that the mean age of tomato farmers in Benue State was 37 years with the standard deviation of 11. The mean size of the family of the respondent farmers was recorded as 9 people per family with the standard deviation of 4. The educational level of the farmers denotes the mean value of years of schooling of the respondent farmer which was 8 years with the standard deviation of 5 years.

2.7.2 Cost and return analysis

Net farm income is the difference between gross income (revenue) and total cost of production. (Olukosi and Erhabor, 2005). It is used to show the levels of costs, returns and net profit that accrue to farmers involved in production. The technique emphasizes the costs (fixed and variable cost) and returns of any production enterprise. Olukosi and Ogungbile (1989) have examined two major categories of costs involved in crop production. These are fixed and variable cost. Fixed costs (FC) refer to those costs that do not vary with the level of production or output while variable cost (VC) refers to those costs that vary with output. The total cost (TC) is the sum of total fixed cost (TFC) and total variable cost (TVC).

Some studies carried out to estimate profitability in vegetable production using net farm income include the following: Badmus and Yekinni (2011) who determine the profit of exotic vegetable among urban fadama women farmers in Akinyele Local Government Area of Oyo State found that the total revenue generated from the sales of the produce for a typical farmer was ₦829, 489.00 while the total fixed and variable inputs cost amounted to ₦163, 998.85k with the Net Farm Income of ₦665, 490.15. Edet and Etim (2010) found that the average revenue from okra production in Ivo local government area of Ebonyi State is ₦61,507.89 per hectare while the total cost is ₦25, 726.18 per hectare, which give rise to ₦35,781.71 profit or net profit per hectare.

Weinberger and Lumpkin, (2005) reported that farmers who are engaged in the production of vegetables often earn higher incomes than those engaged in the production of cereal crops alone. Also, Ateng (1998) observed that vegetables like egg plant, radish, cabbage, cauliflower, and pumpkin gave returns at least three times higher than rice. (Ajewole and Folayan, 2008) indicated that exotic vegetables including cabbage production generate higher profit, provided more employment and income to the farmers than those of indigenous vegetables

2.7.3 Vegetable production

Nurah (1999) reported that commercial vegetable production is quite labour demanding and that many farmers will rely on family labour if the farm size is small and production will usually compete with the food and tree crops for family labour. Most farmers therefore hire labour to supplement their own family labour supply.

Richter (1994) reported that some practitioners of peri-urban vegetable production still complain about shortage of labour and it is often found that available family and hired labour has been diverted to higher paid factory employment.

Abdulai (2006) reported that over 80% of vegetable producers covered by the study do not own land permanently to undertake any meaningful production. The implication is that, investments made in developing the land is minimal or non-existent, permanent farm structures cannot be erected and the future of the vegetable industry is uncertain though it proof profitable to most farmers. The allocative efficiency indices for land and labour obtained from the study are 0.4556 and 0.4651 respectively.

2.7.4 Technical, allocative and economic efficiencies

By using the trans logarithmic stochastic frontier production function in which inefficiency effects are a function of socioeconomic variables, Ajibefun *et al*. (1996) obtained technical indicators whose average was 82%. They found positive correlations between the degree of technical inefficiency and the farmer's age, farm size and proportion of hired labour used, and a negative correlation between the degree of technical inefficiency and the producer's experience. Lyubov and Jensen (1998) used the same approach as Ajibefun *et al*. (1996) to analyse the technical efficiency of grain production in the Ukraine from 1989 to 1991. Out of the 80 farms considered, they found that variables such as the number of farm workers per hectare, the proportion of active household members engaged in non-agricultural activities, and the distance between the farm and the nearest city, have a negative impact on technical inefficiency.

Nwauwa and Omonona (2010) reported that fluted pumpkin farmers in Kwara State operated at a high level of both average technical and allocative efficiency of 0.90% and above for all the age categories. Though, their analysis revealed that farmers operated at a high economic efficiency level, but age group 40-49 operated at 0.87% which is far below average compared to the other groups. They also revealed that there are significant differences in the technical, allocative and economic efficiencies of the farmers in the study area. They founded Quantity of fertilizer used and number of labour (both family and hired) to be significant factors that were associated with technical efficiency, while cost of plot and labour were also significant under allocative efficiency. However, their inefficiency sources model showed that years of experience and farm size contributed significantly to the explanation of the farmer's efficiency.

Bifarin, Alimi, Baruwa and Ajewole (2010) reported that farmer education and access to credit contributed significantly and positively to technical inefficiency, while extension visit had a significant impact, but had an inverse relationship with technical inefficiency. In terms of allocative efficiency only access to credit was significant.

This contributed positively to allocative inefficiency. The coefficient of age was negative for technical and economic inefficiencies, which implies that the older the farmer is, the more efficient he becomes.

Tsoho, Omotesho, Salau and Adewumi (2012) reported that four variables (extension visits, source of irrigation water, crop diversification and location of the farm), two variables (extension visits and location of the farm) and three variables (extension contact, source of irrigation water and crop diversification) were significant at different levels of significance for technical, allocative and economic efficiency of vegetable farmers in Sokoto State respectively. Gbigbi (2011) reported that the mean economic efficiency of sweet potato farmers in Delta State was 0.61 with a range of 0.13 to 0.99. Education, access to extension, access to credit and membership of farmers' cooperative positively and significantly influence economic efficiency.

Amodu (2010) reported that over 72% of part-time farmers in Idah North Central Nigeria were above average in resource use efficiency; maximum efficiency is 0.98, while minimum efficiency is 0.36 with mean efficiency of 0.65. They also revealed that rising age and household size contribute to resource use inefficiency in part time food crop farming, while level of education and years of farming experience increased resource use efficiency among the sample farmers. On their analysis of technical efficiency in cowpea production in Osun State, Nigeria, Omonona, Egbetokun and Akanbi. (2010) reported that farmers' average technical efficiency is 87%, farm size, seed, hired labour, family labour, fertilizer and pesticides are significant at 1% and found some socio-economic variables using tobit regression model to be significantly different from zero at 1% for cooperative membership and farming experience.

Audu, Otitolaiye and Ibitoye (2013) reported that all the cost elements included in the cost function were positively influenced the total cost of cassava producers in Kogi State and the influence of each was statistically significant at the 1 percent level of probability. Age of the farmers, educational attainment of the farmers, household size, farming experience, extension visit, access to credit and membership of farmers association were significant determinants of cost efficiency at different levels of probability.

On their study of cost efficiency in small scale maize production of Ondo State farmers, Ogundari *et al*. (2006) indicated that about 83% of the farmers included in the sample operate close to the frontier level, achieving scores of about 16% or lower in terms of cost difference in the relation for the best-practiced technology. However, the level of the observed cost efficiency has been shown to be significantly influenced by age and farming experiences. Olurefi *et al.* (2011) employed the stochastic frontier analysis with a Cobb-Douglas functional form to examine the ability of tomato farmers to flourish in Benue state, Nigeria from technical efficiency standpoint. They identified high level of inefficiency among tomato producers in the state with mean technical efficiency of 0.58.

2.7.5 Production constraints faced by smallholder cabbage farmers

On their study on the Influence of Different Applications on Insect Populations and Damage to Cabbage in Ghana, Mochia *et al.* (2011), reported that cabbage production is confronted with numerous constraints. These include high cost of inputs such as pesticides and fertilizers and attack by insect pests and diseases. Caterpillars of the Diamond back moth (*Plutella xylostella*), the cabbage web worm (*Hellula undalis*) and cabbage aphids (*Brevicoryne brassicae*) are the most serious pests of cabbage in Ghana causing percentage leaf damage between 18 and 31%. Pest infestation normally leads to reduction in market value and in some cases total crop failure. Plant parasitic nematodes have also been implicated to constraint cabbage production (Waceke, 2007).

Ravishankar (1995) conducted a study in Chickamagalore district of Karnataka and reported that, the constraints faced by the vegetable growers were lack of technical guidance, more pests and diseases, high cost of fertilizers, high cost of plant protection chemicals, no availability of seed materials and fertilizers in time. Kumar (2004) in his study on tomato growers in Belgaum district of Karnataka reported that, majority of the farmers (75.83%) faced the problem of technical knowledge and guidance about improved cultivation practices as well as post-harvest technology. Whereas, 65 per cent of the respondents faced the problem of high fluctuation in market price, followed by high transportation cost (62.53%), labour shortage, high wages (55.83%) and lack of irrigation facilities and power shortage (46.66%).

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

Kaduna State lies in the North western part of the country's geopolitical zones, about 200km away from Abuja the Federal Capital. The State lies between Latitudes 9°N and 12°N of the equator and between Longitudes 6°E and 9°E of the prime meridian. It shares boundaries with Katsina and Kano States to the North, Plateau State to the north east, Nasarawa and Abuja to the South, and Niger and Zamfara States to the West (Kaduna State Government, 2012).The population of the State according to the 2006 census stood at 6,113,503, using 3.18% growth rate, the projected population of the state stands at 7,474,369 (2013 projection) (Kaduna State Official Website, 2014).

The state occupies an area of approximately 68,000 square kilometers or 7% of Nigeria's land mass. The state has 23 Local Government Areas (NPC, 2006). The mean annual rainfall shows a marked decrease from South to North (1,524mm to 635mm). Two distinct seasons, rainy and dry witnessed in the state. The relative humidity is constantly below 40 degrees except in few wet months when it goes up to an average of 60 degrees. The duration of dry season is 5-7 months which normally starts from October.

Both irrigation and rain-fed farming are practiced in the State. Farming is the main occupation of the people with emphasis on the cultivation of cereals like wheat, maize, sorghum, millet, rice, and legumes like peas, cowpea, soya bean and groundnut which are either irrigated or rain-fed. On the irrigated land, vegetable crops like tomatoes, pepper, and cabbage are grown. The cropping systems are dominated by sole and mixed cropping. Some of the farmers are involved in livestock keeping but

Fulani herdsmen dominate the rearing of livestock in the area. Cabbage is one of the most important vegetable crops grown in the Northern part of the State.

3.2 Sampling Procedure

Multistage sampling technique was used for this study. Three LGAs in the State namely; Kudan, Sabon-Gari and Zaria were purposively selected. These LGAs were selected because of their high involvement in cabbage production. The second stage involved purposive selection of two villages from each of the selected LGAs based on their intensity of cabbage production and accessibility. These villages were Hunkuyi, Gidan mekadarko in Kudan, K/Manu, Jushi in Sabon-Gari and Kekeyi, Dagaci in Zaria LGAs respectively. Reconnaissance survey was conducted with the village extension agents of Kaduna State Agricultural Development Project (KADP) to find out the population of cabbage farmers in the mentioned villages. Ten percent of the sample frames in each of these areas was randomly selected; giving a total of 130 respondents (Table 1). Only farmers involved in cabbage production (solely or mixed) were selected for the study.

Table 3.1: Study Population and Sample Size of Cabbage Farmers

L.G.A.'s	Villages	Sample Frame	Sample Size (10%)
Kudan	Hunkuyi	500	50
	Gidanmekadarko	200	20
Sabon-Gari	K/manu	200	20
	Jushi	150	15
Zaria	Kakeyi	150	15
	Dagaci	100	10
Total		**1300**	**130**

Source: *KADP, 2012*

3.3 Data Collection

Primary data were used for this study. These were collected with the aid of structured questionnaire. Information was collected on: (a) farmers' socio-economic characteristics such as age of household head, gender of household head, marital status, educational level of household head, farm size, land quality, technology adoption, per capita aggregate income, access to market, membership of cooperative, household size. (b) constraints faced by the farmers.(c) farmer's food consumption and expenditure; and (d) The output data include the total value of cabbage produced by adding cash receipts from selling farm products plus those consumed at home and given out as gifts while the input data include land size (ha), seed (kg) , agro-chemicals (litre), labor (man-days), quantity of fertilizers (kg),and cost of other simple farm tools such as cutlass, hoes and other simple farm implements. The data were based on 2013 cropping season.

3.4. Analytical Techniques

3.4.1 Descriptive statistics

Descriptive statistics such as percentages, frequency distributions and means were used to achieve objectives i, iii and vi of the study.

3.4.2 Net farm income

This was used to satisfy objective i of the study. It is expressed as:

$$NFI = \sum_{i=1}^{n} P_i Y_i - \sum_{j=1}^{m} P_{xj} X_j - \sum_{k=1}^{k} F_k$$

Where;

NFI = Net Farm Income,

Y_i = Cabbage output (measured in kg),

P_i = Unit price of the cabbage (measured in average weight in Naira/ kg),

X_j = Quantity of variable inputs (where j = 1, 2, 3, m),

Px_j = Price/Unit of variable input (₦),

F_k = Cost of fixed inputs (where k = 1, 2, 3…k fixed input) and

∑ = Summation (addition) sign

The Net Farm Income (NF1) is Gross Receipt less Total Cost (GR-TC).

Return per naira invested (RNI) was obtained by dividing the gross income (GI) over the total cost (TC) minus one

Therefore, RNI= (GI/TC)-1

3.4.3 Stochastic frontier production function

A stochastic frontier production function was employed to achieve objectives iii and iv of the study. The approach specified the relationship between output and input levels using two error terms. One error term represents the technical inefficiency which was estimated via Maximum Likelihood Estimation Method (MLE) following Rahji, (2005).The MLE has the property of generating a consistent and asymptotic efficient estimator. The frontier production model with a multiplicative disturbance term was specified implicitly as:

$Y= f(Xa, \beta) e^{E}$ ……………………………………………………………..…. (1)

Where;

Y=output of cabbage (kg);

Xa = vector of input quantities;

β = a vector of parameter and

E= Stochastic disturbance term consisting of two independent elements U and V, Where;

E = V-U

The symmetric component , V is for random variation in output due to the factors outside the farmers' control such as weather and diseases . It is assumed to be normally, independently and identically distributed N~ (0, δ^2v). A one – sided component ≤ 0 reflects technical inefficiency relative to the stochastic frontier. Thus, U= 0 for a farm output which is lies on the frontier and U < 0 for output which is below the frontier, hence the distribution of U is half normal as specified for cabbage production in the study area.

The explicit form of the model Cobb-Douglas stochastic frontier production function was specified as:

$InY = b_o + b_1InX_1 + b_2InX_2 + b_3InX_3 + b_4InX_4 + b_4InX_5 + V_1 - U_i$ ………… (2)

Where:

Y = Output of cabbage (kg);

X_1 = Land (hectares);

X_2 = Fertilizer (kg);

X_3 = Seed (kg);

X_4 = Labour (man-day);

X_5 = Agro-chemicals (litre);

b_o = constant term; and

b_1, b_2, b_3, b_4 and b_5 = coefficients of the inputs with respect to output level. The output was measured in kilogram (kg). The unit price was also measured in kg.

The *a priori* expectation was that the coefficients of the whole inputs X_1 to X_5 which are $b_{1,}$ $b_{2,}$ $b_{3,}$ b_4 and b_5 should be positive, respectively (i.e. greater than zero).

Therefore, each variable was expected to have positive effect on the dependent variable (cabbage output).

V_1 = random error term and

$-U_i$ = inefficiency component of error term

The inefficiency model was of the form:

$-U_i = d_o + d_1Z_i + d_2Z_2 + d_3Z_3 + d_4Z_4 + d_5Z_5 + d_6Z_6$ ………………………………… (3)

Where;

$-U_i$ = technical inefficiency,

d_o= intercept,

d_1-d_4 = respective coefficients of the independent variables,

Z_1 = age of the farmers (years),

Z_2 = family size,

Z_3 = extension contact (number of contacts),

Z_4 = levels of education,

Z_5 = Credit, and

Z_6 = Experience in cabbage production

The specification of the model for the inefficiency effects in equation (3) implies that, if the independent variables of the inefficiency model have a negative sign for an estimated parameter, then the associated variable has a positive effect on efficiency while a positive sign indicates that the reverse is true.

Thus, the *a priori* expectation was that the coefficients of the independent variables of the inefficiency model (i.e. $d_{1,}$ $d_{2,}$ $d_{3,}$ $d_{4,}$ d_5 and d_6) should be negative, respectively (i.e. less than zero).Therefore, each variable was expected to have positive effect on technical efficiency.

Allocative efficiency was computed as

$$AE_i = \frac{1}{CE_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Where

AE_i = Allocative efficiency level of the ith farmer

CE_i = Cost efficiency level of the ith farmer

Economic efficiency was computed as

$$EE_{ij} = TE_i * AE_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Where

TE_i = Technical efficiency level of the ith farmer

AE_i = Allocative efficiency level of the ith farmer

3.4.4 Measurement of dependent and independent variables

Five explanatory variables measured as continuous and discrete variables were hypothesized for determinants of cabbage production.

(i) Quantity of seeds: This was measured in kilograms (kg). It was included in the model to examine the actual weight of the cabbage seed. The estimated coefficient of seed was expected to have positive effect on cabbage output.

(ii) Quantity of fertilizer: This was measured in kilograms (kg). It was included in the model to examine how the actual quantity of the fertilizer used affected output. The estimated coefficient of fertilizer was expected to have positive effect on cabbage output.

(iii) Labour: This consist of family and hired labour, it will be included in the model to examine how variability in labour use affected output. The estimated coefficient of labour inputs was expected to have positive effect on the output of cabbage farmers.

(iv) Agro-chemical: This was measured in litres. It was included in the model to examine how the actual litres of agro-chemicals used affected cabbage output. The estimated coefficient of agro-chemicals was expected to have positive effect on cabbage output.

(v) Age: This refers to the number of years an individual attained from birth. It is a continuous variable and was measured in years. The estimated coefficient of age was expected to have negative sign on the dependent variable (inefficiency model)

(vi) Household size: This means the total number of people in the house which includes the wives, children and dependents that reside within the same house. This was measured in numbers. The estimated coefficient of family size was expected to have negative effect on technical inefficiency.

(vii) Educational status: This refers to the acquisition of knowledge through formal schooling. This was measured by the number of years spent in school. The sign of the estimated coefficient of educational level of the farmers was expected to have positive effect on technical efficiency.

(viii) Numbers of extension contacts: This refers to the access to government extension services by the respondents in the production cycle. It was measured in numbers. The estimated coefficient of the cabbage farmer's extension contact was expected to have positive effect on technical efficiency.

(ix) Credit: This refers to the access to credit loan from private and public organizations by the respondents in the production cycle. This was measured in Naira. The estimated coefficient of credit access of the farmers was expected to have positive effect on technical efficiency.

(x) Farming Experience: This refers to the number of years the respondents spend in cabbage farming. This was measured in years. The estimated coefficient of the farming experience was expected to have positive effect on technical efficiency.

3.4.5 Hypothesis testing

T-ratio statistic

The t-statistic was used to test hypothesis i of the study. The t-statistic is expressed as follows:

$$t = \frac{\overline{NFI}}{\sigma_{NFI}}$$

Where;

t = Estimated t-value,

$\overline{NFI}$ = Average Net Farm Income and

σ_{NFI} = Standard error of NFI

T-ratio statistic

The t-statistic was used to test hypothesis ii of the study. The t-statistic is expressed as follows:

$$t = \frac{\beta_i}{\sigma_{\beta_i}}$$

Where;

t = Estimated t-ratio,

β_i = Slope coefficient of the i^{th} explanatory variable and

σ_{β_i}= Standard error of β_i

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of the Cabbage Farmers

The results of the analysis of the socioeconomic characteristics of cabbage producers are presented in Table 2. The result revealed that more than 90% of the farmers were found to be within the age bracket of 20-52 years. The least number of the respondents (9%) were found to be between the ages of 53 years and above. The mean age of the farmers was 39 years with a minimum of 20 years and maximum of 62 years. This implies that most of the farmers are within their active age. This is in line with the finding of Ibekwe *et al*. (2012) who reported that cassava farming is dominated by young people who are active and within the productive age.

The result in Table 2 further shows that 39% of the farmers did not have any formal western education, 15% of the respondent had only primary education, and 24% had secondary education while, 22% had tertiary education. This indicates that majority of the farmer's possessed formal western education at various levels. Ogunbameru and Okeowo (2013) reported that educational attainment of the farmers does not only raise agricultural productivity but also enhances farmers' ability to understand and evaluate information on new techniques and processes.

The study revealed that majority of the farmers (45%) had between 1-5 persons in household, 15% of the farmers had 6-10 persons in the household. The maximum household size was 34 persons with minimum of 1 person and average of 9 persons, implying that there is appreciable number of persons per household who could serve as a ready source of cheap family labour supply to accomplish various farm operations. According to the report of (Oluwatayo *et al.*, 2008), there is a positive and significant relationship between household size and farmers' efficiency in production.

However, the absolute number of people in a certain family cannot be used to justify the potential for productive farm work.

The study shows that more than 56% of the cabbage farmers had between 1-10 years production experience, while 43% had more than 10 years experience in cabbage farming. The average years of the farmer's production experience was more than 13 years, implying that most of the farmers have production experience in cabbage farming .Ajibefun *et al*. (1996) found a negative correlation between the degree of technical inefficiency and the producer's experience.

Extension contact in a year was between 1-3 for majority of the farmers (68%),while about 12% of the farmers had extension contact between 8-10 times. The average extension visit to the farmers was 2 times in a year. Audu *et al.* (2013) reported that extension visits was significant determinants of cost efficiency at different levels of probability.

The result revealed that majority of the farmers used less than 0.25 (81%) hectare of land, while less than 1% of the farmers used between 0.76-1 hectares of land on cabbage production in the study area. The mean farm size was 0.19 hectares, this shows that cabbage farming is dominated by small scale farmers in the area. Abdulai (2006) reported that over 80% of vegetable producers do not own land permanently to undertake any meaningful production.

Table 4.1: Distribution of Cabbage Farmers based on socioeconomic characteristics

Characteristics	Frequency (n=130)	Percentage
Age (Years)		
20-30	39	30.00
31-41	37	28.46
42-52	42	32.31
≥53	12	9.23
Mean	39	
Level of Education		
No Formal Education	51	39.23
Primary Education	20	15.38
Secondary Education	31	23.85
Tertiary Education	28	21.54
Family size		
0-5	58	44.62
6-10	20	15.38
>10	52	40.00
Mean	9	
Production Experience (Years)		
0-5	37	28.46
6-10	37	28.46
>10	56	43.08
Mean	13	
Extension contact		
0-3	88	67.69
4-7	27	20.77
8-10	15	11.54
Mean	2	
Farm Size (ha)		
<0.25	105	80.77
0.25 - 0.5	17	13.08
0.56 - 0.75	7	5.38
0.76 – 1	1	0.77
Mean	0.19	

Source: *Survey data (2013)*

4.2 Profitability Analysis of Cabbage Production

The net farm income per hectare is the difference between the total revenue and total cost of production. The structure of the average net farm income of cabbage farmers in the study area was examined and shown in Table 4.3. The total variable cost of the farmers was estimated to be ₦132, 370 per hectare and the total fixed cost was estimated to be ₦2, 152.31 per hectare. The average total revenue per hectare was estimated to be ₦309, 173.40 per hectare.

The results show that the net farm income of the cabbage farmers in the study area was ₦174, 651.09 per hectare. The average rate of returns on investment (return per naira invested) was ₦1.30k, indicating that for every ₦1 a farmer invested on cabbage production in the study area, ₦1.30k was realized as profit. This implies that cabbage production in the study area was profitable. Based on the findings of Badmos and Akinyele (2011) who found the average revenue of cabbage to be ₦211, 160.0 more than that of cucumber, lettuce, watermelon and carrot with average revenue of ₦127,726.92, ₦135,316.67, ₦169,939.26 and ₦185,345.28 respectively on the net farm income analysis of exotic vegetables production in Oyo State. Similarly, Edet and Etim (2010) found the net farm income of okra farmers in Ebonyi was ₦35, 781.71 per hectare. This implies that cabbage generated higher profit than some other crops in Nigeria. Atang (1998) observed that vegetable crops like cabbage, cornflower and pumpkin gave more returns than rice. This agreed with the finding of Ajewole and Folayan (2008) who stated that exotic vegetables generate higher profit than those of indigenous vegetables.

Table 4.2: Average Net Farm Income from Cabbage Production in Kaduna State

Variables	Average Quantity/ha	Unit Price(₦)	Value (₦)
A- Variable Costs			
a- Seed (Kg)	0.98	6000	5,880.00
b- Fertilizer (Kg)	347.6	100	34,760.00
c- Labour (Man-day)	87.36	500	43,680.00
d- Agrochemicals (L)	48.05	1000	48,050.00
Total Variable Costs (a+b+c+d)			132,370.00
B- Fixed Costs			
e- Cost of renting Land			1,300.00
f- Depreciation of tools (Hoes and Cutlass)			852.31
Total Fixed Costs (e+f)			2,152.31
C-Total Costs (TVC+TFC)			**134,522.31**
D- Total Revenue			**309,173.40**
E- Net Farm Income (NFI)= TR-TC			**174,651.09**
F- Return to Investment= (TR/TC)-1	**1.30**		

Source: *Survey data (2013)*

Hypothesis 1: Cabbage production in the study area is not profitable

The result of the test is presented in Table 4.3.1. The result was significant at 1% level of probability and hypothesis 1 was therefore rejected. Cabbage production in the study area is profitable.

Table 4.2.1: Test of hypothesis for the profitability of cabbage production in the study area

Hypothesis	Test-statistics	Test-statistics value	Decision
H_0	T-test	13.55***	Rejected

Source: *Survey data (2013)*
Note: **** =Significant at 1% level of probability*

4.3 Inputs and Output in Cabbage Production in the Study Areas

The summary statistics of the variables obtained from the cabbage farmers in the study area are presented in Table 4.4. The average output of cabbage in the study area was 11766.57kg/ha (11.77 tonnes), while the potential yield of cabbage is 20-25 tonnes per hectare, implying that farmers are not achieving the yield potential of cabbage in the study area. The farmers utilized 0.98 kg/ha of seed, 347.60kg/ha of fertilizer, 87 man-days/ha labour and 48.05 litres/ha of agrochemicals to obtain the output. This however, contradicts the recommended rates of seed (0.6) and fertilizer (200kg). (Agricultural Development in Nigeria (ADENI) / National Agricultural Extension Research and Liaison Service (NAERLS), 2007).

Table 4.3: Input and Output Levels in Cabbage Production

Variables	Min	Max	Mean	Std.
Output (Kg/ha)	1932.25	12500	11766.6	2256.27
Seed (Kg/ha)	0.26	20.83	0.98	2.14
Fertilizer (Kg/ha)	36	1250	347.6	293.81
Labour (Man-day/ha)	12.96	250	87.36	57.07
Agrochemicals (L/ha)	1.85	184.21	48.05	31.22

Source: Survey data (2013)

4.4 Technical Efficiency of Cabbage Farmers using Cobb Douglas Stochastic Frontier Model

The Maximum Likelihood Estimates (MLE) of the parameters of the Cobb-Douglas stochastic frontier production function and inefficiency model was estimated using FRONTIER 4.1 software developed by Coelli (1996).The MLEs of the Cobb-Douglass stochastic frontier model with the half-normal distribution assumption made on the efficiency error term are presented in Table 4.5.The result contain estimate of the parameters of the frontier production function and the variance parameters of the model.

The variance parameters for sigma square (δ^2) and gamma (γ) are 0.23 and 0.99, respectively. They are significant at 1% level. The sigma square indicates the goodness of fit and correctness of the distributional form assumed for the composite error term. The gamma (γ) estimate indicates the systematic variance that is unexplained by the production function and is the dominant source of random errors. The estimate of γ= 0.99 or 99% means that the inefficiency effects had significant contribution to the technical inefficiency of cabbage farmers in the study area.

The mean average technical efficiency for the farmers was 0.87 implying that, on the average the farmers are able to obtain 87% of potential output from a given mix of production inputs. Thus, in a short run, there is minimal scope (13%) of increasing the efficiency, by adopting technology and techniques used by the efficient cabbage farmer.

The results show that only the coefficient of land size was positive and statistically significant at 1% level. Labour input also found to be positive. This implies that an increase in the use of this production inputs would bring about increase in cabbage output.

The estimated coefficient for farm size was 0.97 which was positive in line with the *a priori* expectation and statistically significant at 1% level. The magnitude of the coefficient indicates that the output of cabbage crop was inelastic to the changes in the level of cultivated land area. Therefore, this implies that a 1% increase in cultivated land area, *ceteris paribus*, would lead to 0.97 increases in cabbage output, and *vice versa*. This further suggests that land is a significant factor associated with changes in agricultural production. This result is in accord with Udoh (2006) who identified land as a critical factor in agricultural production. This result is similar to the finding of Kabwe (2012) which showed a positive relationship between land size or farm size and farm level efficiency of smallholder farmer. This also, agrees with the findings of Maurice *et al.*, (2005), who found that land was a significant factor and positively related to the output of rice farmers in Adamawa state.

Table 4.4: Maximum Likelihood Estimates of the Production Factors for Cabbage and the Inefficiency Factors Affecting Technical Efficiency in Kaduna State, Nigeria

Models	**Coefficient**	**Standard-Error**	**T-ratio**
Production model			
Constant	10.82	0.06	180.40***
Land	0.97	0.002	446.10***
Seed	-0.07	0.08	-0.96
Fertilizer	-0.002	0.01	-0.17
Labour	0.008	0.006	1.43
Pesticide	-0.004	0.005	-0.79
Inefficiency model			
Constant	-2.502	0.936	-2.67***
Age	0.122	0.046	2.66***
Age squared	-0.01	0.001	-4.55***
Marital Status	0.903	0.181	4.99***
Family size	-0.034	0.011	-2.94***
Contact with Extension Agents	-0.39	0.088	-4.43***
Primary Education	-1.752	0.207	-8.45***
Secondary Education	-1.967	0.191	-10.28***
Tertiary Education	-1.5	0.193	-7.78***
Sigma-squared	0.233	0.019	12.56***
Gamma	0.99	0.102	9.71***
Mean Technical Efficiency	0.87		
Number of Observation	130		

***Source:** Computed from survey data (2013)*
***Note:** ***=Significant at 1%*

Hypothesis 2: The explanatory variables included in the model did not significantly explain the output of cabbage in the study area.

The result of the test is presented in Table 4.5.1. Land was the only significant explanatory variable. It was found to be significant at 1% level of probability and hypothesis 1 was therefore rejected.

Table 4.4.1: Test of hypothesis for the effect of explanatory variables on cabbage production

Hypothesis	**Test-statistics**	**Test-statistics value**	**Decision**
H0	T-ratio	446.10***	Rejected

***Source:** Survey data (2013)*
***Note:** *** =Significant at 1% level of probability*

4.4.1 Estimated stochastic frontier cost functions

The MLEs parameter of the stochastic frontier cost function for cabbage farmers is presented in Table 4.6. The results show that the estimated sigma squared (δ^2) was (0.146) and significant at 1% level of probability. This indicates the goodness of fit and correctness of the specified assumption of the composite error term distribution (Idiong, 2007). The value of gamma (γ) was (0.607) and significant at 1% level, suggesting that 61% of the variation from the frontier output of cabbage farmers was due to the cost inefficiency of the farmers.

The estimated coefficients of the parameters of the cost function were found to be positive. The result revealed that the estimated coefficient of fertilizer was positive and significant at 1% probability level. This implies that an increase in the cost of fertilizer increased the total cost of cabbage production. This agrees with the finding of Asogwa *et al.* (2011) and Ugwumba (2010) who reported a positive and significant influence of fertilizer cost on total cost of farm production in Benue and Imo States respectively.

The estimated coefficient of credit was positive and significant at 1% probability level. This implies that increase in credit access increased cost inefficiency of cabbage growers in the study area. The result agreed with the finding of Bifarin *et al.* (2010) who reported that access to credit had positive and significant effect on the cost efficiency of plantain farmers in Ondo State.

The estimated coefficient of farming experience was negative and significantly affected the cost efficiency of cabbage farmers in the study area at 10% probability level. This implies that increase in farming experience increased cost efficiency of cabbage farmers in the study area. Audu *et al.* (2013) who found farming experience as significant determinant of the cost efficiency of cassava farmers in Kogi State, Nigeria.

Table 4.5: Maximum Likelihood Estimates Results of Stochastic Frontier Cost Function of Cabbage Production in Kaduna State.

Characteristics	Coefficients	Standard Error	T-value
Cost Model			
Constant	1.133	0.989	1.146
Output	0.055	0.259	0.214
Cost of Seed	0.136	0.102	1.334
Cost of Fertilizer	0.748	0.15	4.976***
Cost of Labour	0.113	0.34	0.334
Cost of Land	0.05	0.282	0.178
Inefficiency Model			
Constant	-0.032	0.997	-0.032
Age	-0.009	0.118	-0.075
Marital Status	0.15	0.833	0.181
Family Size	-0.002	0.051	-0.048
Extension	0.003	0.963	0.003
Education	0.081	0.931	0.087
Credit	2.5	0.43	5.81***
Experience	-1.3	0.55	2.36**
Sigma-squared	0.146	0.045	3.244***
Gamma	0.607	0.16	3.794***
Likelihood Ratio Test	0.385		

***Source:** Survey data (2013)*

***Note:** *** and ** =Significant at 1 and 5% Level of probability*

4.4.2 Frequency distribution of technical efficiency (TE) estimates of cabbage farmers

The frequency distribution of the technical efficiency levels for cabbage farmers in the study area as obtained from the stochastic frontier model is presented in Table 4.7. It was observed from the study that 7% of the farmers operated at a efficiency level of less than 0.26, 3% of the farmers operated at technical efficiency that ranged from 0.26-0.5, while majority, that is 90% of the farmers operated at more than 0.75 efficiency level. The mean technical efficiency for the cabbage farmers in the study area was 0.87. The farmer with the best practice had a technical efficiency of 0.98 while the least efficient farmer operated at 0.01 level.. This implies that cabbage farmers on average are not fully technically efficient. However, only 10% of the farmers operated at a technical efficiency level of less than 0.75, while the remaining farmers operated technical efficiency greater than 0.75. This agreed with the finding of Rahman *et al*., (2000) on their study of land management and resources use efficiency in North region of Bangladesh.

4.4.3 Frequency distribution of allocative efficiency (AE) estimates of cabbage farmers

The frequency distribution of the allocative efficiency estimates of the cabbage farmers as obtained from the stochastic frontier cost function is presented in Table 4.7. The allocative efficiency estimates ranged from 0.66 to 0.99, with an average of 0.92. The results revealed that the model class (>75%) had a higher allocative efficiency than the lowest class (<26%). However, none of the farmers had a 100% efficiency index. This implies that allocative efficiency among the cabbage farmers could be increased by 8% in the study area through better utilization of their farm resources with current state of technology.

4.4.4 Frequency distribution of economic efficiency estimates of cabbage farmers

The frequency distribution of the economic efficiency estimates for cabbage farmers in the study area as obtained from the stochastic frontier cost function model is presented in Table 4.7. It was observed from the study that 85% of the farmers had economic efficiency (EE) of 0.75 and above while 15% of the farmers operated at less than 0.75 efficiency level. The mean economic efficiency for the sampled farmers in the study area was 0.80. The farmer with the best practice had an economic efficiency of 0.96 while 0.01 was for the least efficient farmers. This implies that on the average, output fell by 20% from the maximum possible attainable level due to inefficiency.

Table 4.6: Frequency Distribution of Technical, Allocative and Economic Estimates from the Stochastic Frontier Models

Efficiency Level	Technical Efficiency		Allocative Efficiency		Economic Efficiency	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
<0.26	9	6.92	0	0.00	10	7.69
0.26-0.5	4	3.08	0	0.00	3	2.31
0.51-0.75	0	0.00	3	2.31	7	5.38
>0.75	117	90.00	127	97.69	110	84.62
Total	130	100.00	130	100.00	130	100.00
Minimum	0.01		0.66		0.01	
Maximum	0.98		0.99		0.96	
Mean	0.87		0.92		0.8	

Source: *Survey Data (2013)*

4.5 Technical Inefficiency Estimates of Cabbage Farmers in the Study Area

The results of the determinants of the technical inefficiency of cabbage farmers are further presented in Table 4.5. A negative coefficient means an increase in efficiency or a positive effect on technical efficiency, while a positive coefficient means an increase in inefficiency or a negative effect on productivity. The estimates of the inefficiency model revealed that all the variables are statistically significant at 1% level. The result shows that age squared, family size, extension contact and educational levels had a negative signs, and therefore reduced technical inefficiency (increase technical efficiency).

The age variable could have either positive or negative effect on technical efficiency. Older farmers are more experienced and would be more technically efficient than younger farmers. However, with respect to new ideas and techniques of farming, older farmers are less likely to adopt innovations and thus would be less technically efficient than younger farmers (Nsikak-Abasi and Sunday, 2013). In this study, farmer’s age and age squared had positive and negative sign relationships respectively and both had significant effect on technical efficiency at 1% level. Thus, farmers with more years of experience in farming will have more technical skills in management and thus higher efficiency than younger farmers as the study revealed. Increased experience in cultivation may also enhance critical evaluation of the relevance of better production decisions, including efficient utilization of productive resources. This result is in conformity with the findings of Khai *et al*. (2008), Aye and Mungatana, (2010) who found that older farmers had significant effect on technical efficiency of soya beans farmers in Mekong River Delta of Vietnam.

The negative sign on the estimated coefficient for family size (-0.034) indicated that an increase in household size of cabbage farmers reduced technical inefficiency (increase technical efficiency). The effect of household size on farm level technical efficiency of cabbage farming in the study area is traceable to its contribution to the supply of family labour for work on the farm. This finding is in line with Ahmadu and Erhabor (2012) who reported that family size was negative and significantly related to technical inefficiency of rice farmers.

The estimated coefficient of extension contact (-0.390) was negative and statistically significant at 1% level, implying that regular contact with experienced cabbage farmers increased technical efficiency.

Education had a negative relationship with technical inefficiency. This implies that an increase in the level of education would decrease technical inefficiency or increase technical efficiency. However, efficiency of the farmers differed at different level of education. This could probably be explained by the fact that high levels of education exposes and it can raise the technical competence of an entrepreneur. Therefore, the farmers probably employed their educational advantage as opportunity to develop their farming experience and capability to adopt innovations and technologies for improved productivity. This agreed with the finding of Girei and Dire (2013) that identified education as a significant and positive factor on efficiency of vegetable crop farmers.

4.6 Challenges in Cabbage Production in the Study Area

Cabbage farming in the study area within the period of this survey was associated with several constraints. The major constraints identified during the study were ranked and presented in Table 4.9. Insect and disease attack (55%) ranked as the first major constraint as asserted by the respondents. The farmers complained bitterly about the devastating effects of insect pest and diseases of cabbage. Farmers identified cabbage looper (*Trichoplusian*), Diamond back moth (DBM) (*Plutella xylostella*), imported cabbage worm (*Pieris rapea*), cabbage maggot (*Delia radicum*) and flea beetles (*Phyllotreta spp*) as the major insect pests affecting cabbage production which resulted to the wilting of plants, curling of leaves and leaf spots. This agreed with the finding of Omokore *et al*., (2009) and Osei *et al*., (2013) who identified the above named constraints facing cabbage growers in Northern Nigeria and Ghana respectively.

Financial constraint/ inadequate capital (14%) and the activities of the middlemen (14%) were ranked as the second constraints. Shortage of water (8%), transportation problem (5%) and high cost of inputs (3%) were ranked as the fourth, fifth and sixth constraints of cabbage production in the study area respectively.

Table 4.7: Problems Associated with Cabbage Production in Kaduna State

Problems	**Frequency*(n=260)**	**Percentage**	**Rank**
Insect and Disease Attack	144	55.38	1
Financial Constraints	36	13.85	2
Activities of the Middlemen	36	13.85	2
Water shortage	22	8.46	4
Transportation Problem	14	5.38	5
High cost of Inputs	8	3.08	6
Total	**260**	**100**	

Source: *Survey data (2013)*
*Multiple Responses allowed**

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The broad objective of this study was to examine the profitability and technical efficiency of cabbage production in the study area. The specific objectives were to describe the socio economic characteristics of the respondents, ascertain the costs and return associated with cabbage production, describe input and output levels of cabbage farmers, analyze the technical, allocative and economic efficiencies of cabbage farmers, identify the factors affecting technical efficiency of cabbage farmers and describe the challenges faced by cabbage farmers in the study area.

Primary data were used and were elicited using structured questionnaire administered to the respondents. Multistage sampling technique was used for this study. The first stage involved a purposive selection of three major Cabbage producing Local Government Areas and from which two major cabbage producing villages were also purposively selected. Ten percent (10%) of the sampling frame in each of these areas was randomly selected. A total of 130 farmers formed the sample size for the study. The analytical techniques used to analyze the data include descriptive statistics, net farm income and stochastic frontier production function.

The results revealed that over 90% of the respondents were within the active ages of 20-52 years and about 61% had western formal education. The average farm size was found to be 0.19 hectares in the study area.

The average output of cabbage was 47,067.51kg per hectare, while the net farm income analysis result indicated that cabbage production had total revenue of ₦309,173.40k per hectare with ₦134,522.31k as total cost of production and the net farm income was ₦174,651.09k per hectare. The average rate of return on investment was ₦1.30k. The result of the hypothesis tested revealed that cabbage production is profitable in the study area.

The stochastic frontier production function was estimated. It was observed from the study that 90% of the farmers had 98% technical efficiency (TE), 85% allocative efficiency (AE) and economic efficiency of more than 0.75, while the remaining farmers operated within 0.75 and below. The mean technical, allocative and economic efficiencies for the farmers in the study area were 0.87, 0.92 and 0.80 respectively. Coefficient of farm size was found to be the only significant variable of the production models. The results of allocative efficiency revealed that cost of fertilizer influenced the total cost of cabbage production, while credit access and farming experience were the inefficiency variables determine allocative efficiency of the farmers. All the inefficiency variables except age and marital status were found to be significant and increase technical efficiency or decrease inefficiency (negative coefficient). Age was significant and reduces technical efficiency or increase inefficiency (positive coefficient). The result of the hypothesis tested revealed that the explanatory variables included in the model had significantly explained the output of cabbage in the study area.

The major constraints identified by the cabbage farmers in the study area were insects and diseases attack (55%), inadequate capital (14%), activities of middlemen (14%), shortage of water (8%), high cost of transportation (5%) and (3%).

5.2 Conclusion

Based on the findings of this study, it could be concluded that cabbage production in the study area was profitable with returns of ₦1.30 for every ₦1.00 spent. Given the economic potential of cabbage in the study area, any attempt to increase its productivity would be a right step towards curbing unemployment and poverty reduction in the study area.

The farm specific technical efficiency distribution reveals that none of the farmers achieved the maximum efficiency level. Thus, within the context of efficient agricultural production, output can still be increased by 13 percent using available inputs and technology by reallocating the resources more optimally.

5.3 Recommendations

Based on the findings of this study, the following recommendations are hereby put forward for improving cabbage production in Kaduna State.

i. Despite the relatively high production efficiency of the farmers, there exist opportunity for enhancing their present level of efficiency which would require more efficient resource utilization by the cabbage farmers. This could be achieved through technical and micro credit support from Local Government Authorities and non governmental agencies in the study areas.

ii. Extension service should be intensified by the non-governmental organizations and the Local Government Authorities to educate and encourage farmers to adopt modern cultural practices of cabbage production in order to reduce the incidence of insects and disease and promote efficient utilization of existing knowledge and skills to increase their yield.

iii. More research on cabbage should be encouraged by the government and non-governmental organizations especially in the areas of disease and pest control. This will solve the problem of infestation during the growing period.

iv. In view of the relatively high profitability level in cabbage production, government and non-governmental organizations should encourage unemployed youth to partake in cabbage production enterprises in order to reduce unemployment and poverty level. Policies that would encourage relatively younger and educated persons and provide them easy access to improved seeds, credit, fertilizers and mechanization will go a long way in addressing unemployment problem and poverty reduction in the study areas.

5.4 Contribution of the study to knowledge

i. The study revealed that cabbage production in the study area is profitable with the net farm income of ₦174,651.09 per hectare despite the problems identified. The average rate of return on investment (return per naira invested) was ₦1.30k, indicating that for every ₦1 invested in cabbage production in the study area, a profit of ₦1.30k was made.

ii. The study revealed that a typical cabbage farmer in the study area achieved technical efficiency of 87 percent.

iii. The study discovered that pest and diseases attack, inadequate capital and activities of middlemen were the major constraints affecting cabbage production in the study area.

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APPENDIX

M.Sc. Research Questionnaire for Cabbage Production

ECONOMIC ANALYSIS OF RAINFED CABBAGE PRODUCTIO IN SELECTED LGAS OF KADUNA STATE, NIGERIA.

Dear Respondent,

This questionnaire is from 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.

Bashiru Dahiru MAGAJI

Village/Community…………………………………………………….L.G.A ……………………………………………………….

A. SOCIO –ECONOMICS CHARATERISTICS OF CABBAGE FARMER

1. Name of farmer………………………………

2. Sex: 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)…………….

7. How long have you been in cabbage 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 cabbage farming?

A .Personal savings ( ) b. credit (borrow) ( )

c. Friends and family ( )

d. Money Lenders (Borrow) (   )

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

a. commercial bank(   ) b. Nigeria Agricultural Cooperative And Rural Development banks(   )

c. Cooperative Society (   ) d. Money Lenders (   )   e. Friends and Family (   )

f. Others (specify)…………………………………………………………

13. How much did you borrow to finance last production? (Fill for the source you indicated in Q .12)

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

14. Have you been visited by an extension agent/ experienced cabbage farmer? Yes (   ) No (   )

15. If yes, to 14 above, how many times in last one year?

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

17. Of what benefit were the techniques learnt to you to the success of your farm? ……………………………………………………………………………………………………..........

B. INFORMATION ON CABBAGE INPUTS

(I) Farm size (Ha)

18. How many cabbage farm plots do you have? .... Indicate and the size in the table below.

Plot NO	Plot Size (Ha)
1	
2	
3	

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

Plot	**Mode of Acquisition**				
	(a) Inheritance	(b) Lease	(c) Borrowed	(d) Gift	(e) Purchased
1					
2					
3					

20. If the land was rented, how much did you pay per season/ha ? ………… Naira

21. If the land was purchased, what was the amount paid/ha ?……………. Naira

22. What was the mode of land preparation on the cabbage field?

(a). Animal traction ( ). (b).Tractor hiring ( ). (c). Manual implements ( ). (d). Others………………………..

23. If you employ any in 22 above, how much do you pay per hectare?……………. Naira

24. What is the cost of maintenance for your farm implements and other related cost in your last production? ………………………… Naira

(II) Variable inputs (Last production Cycle)

25. Seed (Kg)

Plot No	Quantity of Seed(Kg)	Cost (₦)
1		
2		
3		

26. Fertilizer.

Plot No	Fertilizer type	Quantity(Kg)	Cost(₦)
1			
2			
3			

27. Agro Chemical

Plot No	Agro Chemical type	Quantity(litre)	Cost(₦)
1			
2			
3			

28. Labour input

(a). Land preparation

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(b). Planting / Transplanting

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(c). Fertilizer Application

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(d). First Weeding

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost(₦)
1						
2						
3						

(e). Second Weeding

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost(₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(f). Replacement

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(g). Harvesting

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

C. INFORMATION ON CABBAGE OUTPUT (Last production cycle)

Plot No	No of qty produced	kg
1		
2		
3		

D. INFORMATION ON THE SALES OF CABBAGE

Plot No	No of qty produced	Price per unit sold (₦)	Total sales (₦)
1			
2			
3			

29. What is your total profit made from cabbage in the last one year? ……………………………….

20. What quantity of cabbage was consumed at home (a). Farm no.1………………… (b). Farm no 2 …………...   (c).   Farm no. 3 ………………

31. What quantity was given out as gifts? (a) Farm no.1…………………..

(b). Farm no 2 …………………..   (c). Farm no. 3……………………..

32. Constraints of cabbage production

S/n	CONSTRAINTS
1	
2	
3	
4	
5	
6	
7	

33. Suggest possible solution to the constraints in cabbage production.

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
………………………………………………………………………..

E. MARKETING INFORMATION

34. Where do you sell your cabbage? (a). On the farm ( )

(b). Village market ( ) (c). Urban market ( ) (d). Others (specify)……………………………..

35. When do you sell your cabbage? (a) . Immediately after harvest ( ) (b). 1 week after harvest ( ) (c). Others (specify)………………………….

36. Why do you sell your output in the specified period in question (35) above? …………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………….

37. What type of problems do you encounter in selling your cabbage? …………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
……..

38. What type of cost do you incur in selling your cabbage in the various farms?

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
……………………………………………………………………………

Thanks for your Attention