ECONOMIC ANALYSIS OF SORGHUM PRODUCTION

IN HONG LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

BY

KADAFA, YAYIRUS MARKUS

(M.Sc/AE/08/0285)

MARCH, 2013

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A PROJECT THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION, MODIBBO ADAMA UNIVERSITY OF TECHNOLOGY, YOLA IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTERS OF SCIENCE (M. Sc) IN AGRICULTURAL ECONOMICS, SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY.

MARCH, 2013

DECLARATION

I hereby declare that the thesis **"Economic Analysis of Sorghum Production in Hong Local Government Area of Adamawa State, Nigeria"** was writing by me and is a record of my own research work. It has not been presented before in any previous application for a higher degree. All references cited have been duly acknowledged.

_____ _____

Yayirus Markus Kadafa Date

DEDICATION

This work is dedicated to my beloved wife Mrs Susuti Yayirus.

APPROVAL PAGE

This project thesis is entitled **"Economic Analysis of Sorghum Production in Hong Local Government area of Adamawa State"** meets the regulations governing the award of masters of science of the Modibbo Adama University of Technology, Yola and is approved for its contribution in to knowledge and literacy presentation

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ABSTRACT

This study was carried out economic analysis of sorghum production in Hong Local Government Area of Adamawa State. The objectives of the study include to; describe the socio-economic characteristics of the sorghum famers in the study area, determine the profitability of sorghum production; determine the efficiency of resource use in sorghum production and identify the constraints facing sorghum famers in the study area. Multi-stage sampling method was used to select a sample of 180 sorghum famers who were served with structured questionnaires for their responses. Descriptive statistics, budgeting techniques, production function and t-test were the analytical tools used. The result shows that 36% of the respondents were within the age of 31-40 years. 46% had tertiary education and 35.3% had farming experience between 11-15 years. Majority of the farmers (57.3%) hold less than 2 hectares of land, indicating that they are basically small-scale farmers. A gross margin and net income of ₦32,958.72 and ₦28,304.53/ha respectively revealed that sorghum production is profitable. The result of production function analysis revealed that the exponential function was the best fit function of all the five explanatory variables were found to be significant and contributed positively to sorghum yield. These are farm size, fertilizer, hired labour, family labour and seed. This shows that an increase in the use of these input will increase output significantly. The coefficient of multiple determinations R^2, indicates that 89.3% of the variation in sorghum yield is explained by the variables included in the model. The overall model is also significant at 1% as shown by the F statistic. The return to scale, which is the summation of elasticity is 1.014, which indicates increasing return to scale. The ratio of marginal value product to marginal factor cost was computed for farm size, fertilizer, hired labour and seed. The result shows that seed were underutilized, while, farm size, fertilizer and hired labour were over utilized. Therefore, increasing seed would increase output of sorghum while decreasing farm size, fertilizer and hired labour will increase revenue, and bring the production to optimal level. Major constraints identified were high cost of fertilizer, inadequate improved seed, high cost of input, inadequate credit facilities, pests and diseases, inadequate extension services, poor access road, poor market outlet and poor timely distribution of such input. Recommendations were directed towards research development of low input cost technologies, provision of extension services, financial support to farmers, and timely supply of farm input at subsidized rate.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Nigeria is still essentially an agricultural country in spite of the importance of petroleum in the economy. In 2006 for instance; agriculture's contribution was 32.1 percent of the Gross Domestic Product (GDP). About 70 percent of the people are involved in food and agricultural production and agro - businesses. Agriculture used to be the prime mover of the Nigerian economy, especially up to the 1970s before petroleum become important. However even, at that time, the food sub -sector was stagnating subsequently, stagnation and decline covered the whole agricultural sector (Government of Nigeria, 2006).

Agricultural development is the foundation for economic development, and the agricultural sector is undoubtedly the prime area of consideration for economic progress. Despite the importance of this sector and in spite of the fact that 72 percent of Nigerian

households engaged in agriculture most of the farmers are wallowing in abject poverty (Baiyegunhi and Fraser, 2009).

Sorghum is one of the major cereal crops widely grown in Nigeria, and a very important staple food but now is being substituted by other crops such as rice, wheat, barley and maize for the populace particularly in northern part of the country. According to Tashkalma *et al.* (2010), this crop is still one of the principal source of energy and is the, fifth major crop grown for human consumption in the world being surpassed only by rice, wheat, barley and corn. Sorghum has a wide utilization as source of energy in the nutrition of both humans and livestock. It is the first most important cereal crop in Nigeria and is mainly used for food, animal feeds and making drinks, (Ojo, 2000)

Adamawa Agricultural Development Programme (ADADP 1996) reported that sorghum has the largest hectares of all crops grown in Adamawa state and it is grown on an area of 70,000 hectares with 41,000 hectares under sole and 29,000 hectares in mixtures with other crops. The total production of sorghum in the state in 1993 was 105,000 tons with an estimated average yield of 1.5 tons/ha as cited by Tashikalma *et al.* (2010). Sorghum as one of the most important staple food crops in Nigeria. It's production surpasses all other crops. Baiyegunhi and Fraser, (2009) in the Nigeria Savannah zone, sorghum is grown on an estimated area of 4.5 million hectares with annual production one put of about 6 million tones. National Agricultural Extension and Rural Liaison Service (NAERLS), (1997). The leaves and grains are also used for livestock feed and the stalks for thatching houses and making fences. Sorghum is a very valuable industrial crop for brewing alcoholic and non-alcoholic drinks as well as in the baking and confectionary industry in Nigeria. According to National Research Council (NRC), (1996) sorghum has greater untapped potentials than any other crop. It even postulated that if the twentieth century was the century of wheat, rice and maize, then the twenty-first century could become the century of sorghum.

Sorghum in Africa is processed into a very wide variety of attractive and nutrition traditional foods, such as semi-leavened bread, couscous, dumplings and fermented and non-fermented porridge. It is the grain of 21 century Africa. New products such as instant soft porridge and malt extract are great successes. In the competitive environment of multination enterprises, sorghum has been proven to be the best alternative to barley for larger brewing. The potential for sorghum to be the driver of economic development in Africa is enormous.

Continuing focused fundamental and applied research is essential to unleash sorghum's capacity to be the cornerstone of food security in Africa. (Tailor and Robbins, 1993).

Sorghum (*Sorghum bicolor* L Moench) is one of the most important staple food crops in the country (Aba *et al.*, 2004). The crop is environmentally friendly as it is water — efficient, requires little or no fertilizers or pesticides and is biodegradable Food and Agricultural Organization (FAO), (1995). In the savanna and the semi - arid regions of Nigeria, million of people consume sorghum in their daily diets as staple foods (Obilana, 1981). These foods are high in energy and nutrition and are therefore recommended for the infants, pregnant and lactating mothers, the elderly and the convalescents (Obilana, 2005).

Sorghum production surpasses all other crops in terms of food contribution, sorghum is the major cereal consumed by the majority of the population, about 73% of the total calories from cereals and 52% of the per capital protein intake are contributed by sorghum alone (NAERLS, 1997). The leaves and grains are also used for livestock feeds and the stalks for thatching houses and making fences. The shortfall in cereal production, particularly sorghum production, has been reported in Nigeria Savannah zone, where sorghum is grown on an estimated area of 4.5 million ha with annual production output of about 6 million tones NAER1s, (1997), sorghum is also used as a raw material for lager beer brewing (Aisien and Mats, 1987).

This figure has risen to about 7.0 million tonnes annually in Nigeria (Obilana, 2005). Consequently, Nigeria becomes the highest sorghum producer in the West African sub-region, Accounting for 71% of the regional total sorghum output. Globally also the country leads in sorghum production for human consumption and has risen from its fifth position in 1995 (FAO, 1995). To be third largest producer of sorghum in the world after the USA and India. Where more than 90% of their sorghum harvest is used for animal feed (Obilana, 2005).

Sorghum is adopted to a wide range environmental conditions, particularly, drought. Hence, it is widely grown in different ecological zones of Nigeria (Showemimo *et al.*, 2000). It has a number of morphological and physiological characteristics that contribute to its adaptation to dry conditions. These include an extensive root system, waxy bloom on the leaves that reduces water lose, ability to stop growth in periods of drought and resume when condition are favourable as well as tolerance to water logging (FAO, 1995). The crop equally

grows on a wide range of soils. Sand, loam, sandy loam, saline and alkaline soil with a pH range of 4.0-8.5 (Aba *et al.*, 2004).

Sorghum is also a very valuable industrial crop for brewing alcoholic and non — alcoholic drinks as well as in the baking confectionery industry (Debrah, 1993). This is true in Nigeria. According to NRC (1996), sorghum has greater untapped potentials than any other crop. They even postulated that if the twentieth century was the century of wheat, rice and maize, then the twenty - first century could become the century of sorghum.

1.2 Statement of Problem

Agriculture is faced with very great challenges as it has to adequately feed the teeming population and provide raw materials for the growing industries. Despite the fact that the ban on cereal importation has long since been rescinded local sorghum has become the grain of choice in Nigeria for both beer brewing and malt beverage manufacture (NRC, 1996). These developments have benefited local farmers and led to industrial development, as well as saving the cost of unnecessary imports. Nigeria is still essentially an agrarian country in spite of the importance of petroleum in the economy. Before independence, Nigeria's economy was largely sustained through agricultural exports. In 2010 for instance, agriculture's contribution was about 40.84 percent of the Gross- Domestic Product (GDP) Maurice (2012). About 70 percent of the people are involved in food and agricultural production and agro-businesses and was the largest source of employment Central Bank of Nigeria (CBN) (2007).

Agriculture used to be the prime mover of the Nigerian economy, especially up to the 1970s before petroleum became important. Agricultural export drove the economy forward. However, even at that time, the food sub- sector was stagnating. Subsequently, stagnation and decline covered the whole agricultural sectors thus, for much of the period from about 1970, agriculture has been unable to spear head the development of the Nigerian economy.

While one cannot blame agricultural neglect alone for the nation's dwindling export trade in agricultural commodities, other factors such as increase in industrial activities in the country, government policies on local value added commodity processing, finance pricing etc. have all contributed to the weakening of the nation's capacity to participate effectively in the commodity export trade (Government of Nigeria, 2004). Moreover, factors on the side of demand and supply indicate the nature of the problems of the Nigerian agriculture. These include low incomes which create the vicious circle of low food demand leading to low

production and output which again results in low incomes. There are also related factors such as poor or traditional technologies including the use of the hoe and cutlass for production which poses on increase to output and income. For instance, the average farm size hardly exceeds 1.5 hectares in Nigerian agriculture, (Maxwell, 2004). Historically, rates of poverty reduction have been very closely related to agricultural performance - particularly to the rate of growth of agricultural productivity. In simple terms, this indicates that the countries that have increased their agricultural productivity they most have also achieved the greatest reduction in poverty.

However, despite decades of investment in new agricultural technology and rural development, hunger and poverty continue to plague large areas of the developing world including Nigeria. According to Farrington and Deshingkar (2004) the problem is particularly acute where people depend on rain fed agriculture, in particular Sub-Saharan Africa, where the impact of new technologies has generally stagnated and even fallen in some areas.

Achieving the Millennium Development Goal (MDG) of halving the proportion of people living in absolute poverty by 2015 will depend largely on increasing agricultural productivity, which remains, perhaps the single most important determinant of economic growth and poverty reduction. (Farrington and Deshingkar, 2004). This fact is not lost on developing countries or their development agency partners, who are seeking ways to stimulate agricultural development. But serious doubts are emerging as to whether agricultural productivity can be increased where it is needed most, and what part, if any, small - scale farming will Play in the feature over the years, there have been different agricultural policies targeted at improving the performance of the agricultural sector and reviving export trade in semi - processed agricultural commodities. These policies focused mainly on attaining self - sufficiency in food and raw materials for industrial improvement of the socio-economic welfare of the sources of foreign exchange earning through increased agricultural exports arising from adoption of appropriate technologies in food production and distribution while the policies are sound the will and strategies to implement them had largely been absent (Farrington and Deshingkar,2004).

Although Opinions differ on the magnitude of Nigeria’s food problem its nature has never been in doubt. At the national level, the main food problems are food supply deficits, poverty and uneven distribution of income in term of ability to buy food (Ohajianya, 2004) on

the economic front, inadequate food has resulted in reduced export earnings, large food imports, low revenue for government, shortage of raw materials for industries and increase inflationary pressure (CBN, 2000).

In essence, agriculture's contribution to the national economy has been dwindling. This is so given that Nigeria has varies and complex constraints militating against the realization of increased agricultural output among which we low crop yields, use for unimproved crop varieties, inconsistent Macro - economic policies and poor input and produce marketing systems, catastrophes, diseases and pests out break have also contributed to this situation Shaib *et al.,* (1997). Sorghum, which is one of the staple foods, contributes the main food crop for over 750 million people who live in the semi arid tropics of Africa, Asia and Latin America Bennett *et al.,* (1990). The largest group of producers are the small-scale subsistence farmers with minimal access to production inputs such as fertilizers, pesticides, improved seeds (hybrids or varieties), good soil and water improved credit facilities for their purchases Doggette (1988).

Sorghum is cultivated across the world in the warmer climatic areas, it is quantitatively the world's fifth largest most important cereal grain, after wheat, maize rice and barley. In Africa, sorghum is still largely a subsistence food crop. In Nigeria, majority of sorghum producers are the peasants depending greatly on sorghum as their source of income, have little no knowledge of maximizing their production with minimum resources to obtain optimum productivity and maximum profit. This has brought to light the concept of "Economic analysis" which can be defined as a statistical procedure conducted to find out the relationship between inputs and output (Mekeham, 1979).

Despite all these measures, sorghum production in the country has still taken a downward trend as the gap between demand and supply is becoming wider and wider every year, hence supply does not equate demand (FAO, 1987) This is a matter of concern, hence if the situation persists; it means that the demand for our local brewing and malt beverage manufacture industries can hardly be met. Therefore, there is a need for further investigation in to an economic analysis of sorghum production by small - scale farmers as about 70% of the sorghum production in the country is done by small scale farmers (NAERLS, 1997).

Although much work has been done in finding the agronomic and crop improvement, little attention has been paid to the economic analysis of sorghum production in the study area.

It is in view of the prospect which this crop holds for the agro-allied industries in Nigeria that there is a clear need for the conduct of the studies on the economic analysis of sorghum production. The study answered the following questions:

i. What are the socio - economic characteristics of sorghum farmers in the study area?

ii. Is sorghum production a profitable venture?

iii. How efficient are the sorghum producers in the use of resources?

iv. What are the constraints facing the sorghum farmers in the study area?

1.3 Objectives of the Study

The broad objective of the study is to carry out the economic analysis of sorghum production, in Hong Local Government Area.

The specific objectives are to:-

i. describe the socio-economic characteristics of the sorghum farmers in the study area:

ii. determine the profitability of sorghum production in the study area.

iii. determine the efficiency of resource use in sorghum production.

iv. identify the constraints facing sorghum farmers in the study area.

1.4 Research Hypothesis

The test of hypothesis stated in the null forms is as follow:

Ho_{1}. Sorghum production is not profitable in the study area.

1.5 Justification of the Study

The demand for sorghum in this region is increasing because of population growth, mainly from the urban area, and also because of high level of poverty and the need to substitute carbohydrate demand with low - cost food (FAO, 2001). Food security has been defined by FAO (2001) not only in term of access to availability of food but also in terms of resource distribution to produce food and purchasing power to buy food where it is not produced. Sorghum is an important crop in Nigeria, unlike other crops it is virtually grown in all the northern states, and some parts of the southern states of the country. This is due to its unique ability to tolerate and survive under adverse condition of continuous or intermittent drought, it also withstands temporary water logging Pureglove, (1988) another physiological characteristics of the crop, is the silica deposition on the endodermis of its roots, which

prevents collapse during drought stress. Sorghum grain is used as livestock feed in the developed countries but provide human food in India, and food and beer in Africa. Its cultivations, processing and marketing provide employment opportunities for several farming and non - fanning households. Sorghum serves as raw materials for several industries and it's by - products are use for livestock production. Sorghum bases and stems are used for making fences and food cooking, also the straw is fed to animals the leaves may be used as mulching materials. Some sorghum have sweet Juicy stems which may be used to produced syrup. (Ibrahim 1995 and El-Faedil, 1990).

Over the past 25 years sorghum production has increased steadily in Africa, from 11.6 million tonnes in 1976 to 20.9 million tones is 2001. However, as can be seen the increase in production has been as a result of increasing the land area under cultivation and there has been no overall improvement in yield.

Average yields remain below 1 tonne/ha. This is because cultivation in Africa is still mainly characterized by traditional farming practices, with low inputs (No inorganic fertilizers or pesticides) and traditional varieties International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (1997). Such low yields mean that there is often no surplus sorghum, without which processing industries can not be created.

It is expected that the findings from this study have provide useful information and technical advice to local farmers involved in sorghum production in the study area. This study has also assist in establishing the profitability of sorghum production in the study area. Moreover, the study would be useful to researchers, who in future would like to engaged in a similar research in the study area and government in formulating policy that will affect self - sufficiency in sorghum production in Hong local government area.

1.6 Limitation of the Study

Out of one hundred and eighty questionnaires administered, only one hundred and fifty were correctly filled and thereby used for the analysis of the study. This make the researcher unable to make use of the one hundred and eighty questionnaires as stressed earlier.
Moreover, some of the responses obtained from some farmers were based on their memory recall. There is also the limitation faced by time and finances of the researcher, hence the scope of the research is limited to the study area only.

CHAPTER TWO

LITERATURE REVIEW

2.1 Origin and Distribution of Sorghum

Sorghum (*Sorghum bicolor* Moench) is believed to have originated from Africa, but in India the cultivations of this crop goes beyond recorded history (Dorrel and Donald, 1980) The cultivation of sorghum played a crucial role in the spread of the Bantu (Black) group of people across sub-Saharan Africa. To day, Sorghum is cultivated across the world in the warmer climatic areas. It is quantitatively the world's fifth largest most important cereal grain, after wheat maize, rice and barley (Diamond, 1998). However, there are no established facts from which to derive the history of the crop, but the date of origin can only be guessed at around 300 - 400 BC (Snowden, 1995) there is still much room for difference of opinion (Dowet and Huckabay, 1967).

Sorghum was probably demonstrated in Ethiopia between 5,000 to 7,000 years ago. From there it was distributed along trade and shipping routes around the African continent, and through the middle East to India at least 3,000 years ago. Sorghum was first taken to America through slave trade from west Africa. It was a re-introduced in the late 19" Century for Commercial cultivation and subsequently spread to south Africa and Australia (Daggette, 1988). Sorghum can be grown under condition which are unfavourable for most of the cereal crops. It has extensive root system and the ability to temporarily grown in period of drought which makes it to withstand very arid condition.

2.2 Sorghum Production Trend in the World

The total production of sorghum in the world expanded from 40 million metric tonnes at the beginning of 1960's to 66 million metric tonnes in 1978 - 81. Moreover by 1990 - 2000, it had fallen to 58 million metric tonnes out of which 7 million metric tonnes was from Nigeria. Though the area under sorghum cultivation decline only slightly from 45.6 to 44.4 million hectares during the same period (FAO, 1991, 2001). The five (5) largest producers of sorghum in the world for the period 1990 are united state 25%, India 25%, Mexico 7%, China 9% and Nigeria 7% together these five countries account for 73% of the world production (FAO, 1991). United State Department of Agriculture (USDA 2004) reported that, the world sorghum production dropped from 58 million metric tonnes in 1990 to 53 million metric

tonnes by the year 2000. However this figure has substantially increased to 56.7 million metric tonnes by the end of 2004. the united states is still the current major producer and exporter of sorghum in the world market.

As a continent, Africa is the largest producer of sorghum with Approximately 18.5 million metric tonnes produced annually. Nigeria is the largest producer of Sorghum in Africa, and currently the world second major producer with 8,050 metric tonnes). While, on the consumption trend, Mexico is currently the major consumer of sorghum (103,000 metric tonnes). The world consumption figure has increased from 54, 642 thousand metric tonnes in 2000 to 56,316 metric tonnes by the end of year 2004 (FAO 1991).

Nigeria consumes over 90% of its total production domestically, while exporting less than 10 percent to the world market annually (USDA, 2004). FAO (2003) reported that world annual sorghum production is over 60 millions tones, of which Africa produces about 20 million tones. This makes sorghum, quantitatively the second most important Cereal grain in Africa after maize. The major sorghum producing countries of Africa. It can be seen that sorghum production takes place across the continent with the northern African countries of Nigeria, Sudan, Ethiopia and Burkina Faso accounting for nearly 70% of Africa's production (USDA, 2004).

However, these figures do not do justice to the importance of sorghum in Africa. It is the only viable food grain crop for many of the world's most food insecure people who live in sub-Saharan Africa. In the mid 1990s, it was estimated that in 20 of the 29 countries in the region per capital daily food in take averaged less than 2,000 calories; according to the FAO a daily intake of less than 2,400 calories is indicative of widespread hunger. The problem of food shortages in sub - Sahara Africa is to a large extent due to the fact that much of the region is characterized by small scale farmers. (FAO, 2003).

2.3 **Sorghum Utilization**

The uses of sorghum in Nigeria can be grouped into two: traditional and industrial. The traditional uses include a variety of traditional foods, beverages and drinks while its non-food traditional uses include: thatching of roofs and fencing of compounds. Sorghum consumption for food is mainly in the form of flour or paste processed into two main dishes: "OGI" or "AKAMU", a thin porridge and "Tuwo", a thick porridge. Other dishes that are sometimes made from sorghum include a number of deep fried snacks, steamed dumpling, etc (Obilana,

1981). Of all the cereal crops, sorghum contribute about 50% of the calories in Nigeria generally and about 73% in the savanna regions of the country in particular (Simons, 1976).

Sorghum foods are also high in minerals, vitamins and some essential amino acids which are further enhanced through biofortification thus, making them superior to other cereal foods. They contribute more energy and digestible protein in the diets of the majority of the people in the sub-Saharan regions than those obtained from root and tuber crops (Aba *et al.*, 2004). In addition, its polyphenol (mostly tannin) contents are used as antioxidants just as the slow digestibility of sorghum starch and protein makes its foods useful in diabetic treatments.

Table 2.1: Sorghum Production in Nigeria (1000 MT) from 2000-2010

Market Year	Production	Change
2000	7800	4.00 %
2001	7800	0.00%
2002	7850	0.64%
2003	9000	14.65%
2004	10000	11.11%
2005	10500	5.00%
2006	10500	0.00%
2007	10000	-4.76%
2008	11000	10.00%
2009	11500	4.55%
2010	11700	1.74%

Source: United State Department of Agriculture, (2010)

However production of sorghum in Adamawa state has been on the decline since 2000 when 174,000 metric tonnes was recorded compared with 157.8 metric tonnes in 2005 (ADADP 2003). Also there is variation in the number of hectares propagated throughout the state. The total production of sorghum in the state in 2001 was 72,000 tones with an estimated yield of 1.18 tonnes per hectares (National Bareau of statistics (NBS), 2002).

2.4 Relative Importance of Sorghum in African Countries

Annual rainfall is in the range 500 - 700 mm per years hence, most of the countries in Africa where sorghum is a significant arable crop are arid and area at risk of desertification. It also be seen that sorghum is also an important crop in east Africa where overall there is a good rainfall. This is related to the fact that the rain is sub - tropical Africa is intermitted and characterized by brief period of very high rainfall. In fact sorghum is not only drought resistant, it can also withstand periods of water - logging (Doggett, 1988). In Kenya, trials during the short rainy season showed that an improved sorghum variety KAT 369 yielded 4.1 tones/ha in comparison to the 3.2 tonnes/ha for maize (TCRISAT, 1994). The precise reasons for sorghum's environmental tolerance are not fully understood, and are undoubtedly multifactorial. Sorghum often has deep penetrating and extensive roots (NRC, 1996). Apparently it conserves moisture by reducing transpiration when stressed by leaf rolling and closing stomata, higher than normal leves of particular wax appear to be importance in this respect (Jordan and Sullivan, 1982). Sorghum also appears to have a high capacity for osmotic adjustment to stress to maintain turgor pressure in cells (Nguyen *et al.,* 1997). Certain sorghum varieties also posses 'stay green genes that enable them to continue to photosynthesis, post — flowering during drought. Further research into the mechanism of sorghum's environment tolerance will clearly be highly beneficial

2.5 Theoretical Framework

The neoclassical theory of production is based on the notion of efficiency.This idea was emphasized in the text book definition of a production function, which gives the maximum possible output of a given quantity of Inputs (Kumbhakar, 1994). Alimi, (2000) stated that resources must be available and efficiently used in order to achieve optimum production level. Hence the mission of increasing agricultural productivity to sustain food requirement could be facilated through efficient management of productive resources and therefore this study is based on this premise. Efficiency of resource-use is the ratio of useful

output to the total input that gives a maximum value of output from any given total inputs (Shepherd, 1985). Helfand (2003) reiterated that the analysis of efficiency is generally associated with the possibility of farms producing a certain optimal level of output from a given bandle of resources, or certain level of output at least cost. Productive efficiency can be seen to be the attainment of production goal without waste. Economists have built up a variety of theories of efficiency.

However, the fundamental idea underlying all efficiency measures is that of the quantity of goods and services per unit of input (Ajibefun and Daramola, 1999). Consequently a firm is said to be technically inefficient if too little output is being produced from a given bandle of inputs. Olayide and Heady (1982) maintained that resource use efficiency or resource productivity is definable in terms of individual resource in puts or in terms of combination of them.

Ali and Chaadhary (1990) reported that the reason behind measure of efficiency is that if farmers are not making efficient use of existing technologies, then efforts designed to improved efficiency would be more cost effective than introducing a new technology as a means of increasing out put (Shapiro, 1983). Gains inefficiency are particularly important in periods likely to generate higher income and thus stand a better chance of surviving and propering (Hall and Leveen, 1979).

Ogunjobi (1999) stated that efficiency measurement is important because it is a success indicator and performance measure by which production units and evaluated.

2.6 The Concept of Production

Production is the conversion of input (s) into output(s). Production is the process of transforming production factor into output (Olayide and Heady 1982). He further states, it present a particular process, techniques or technology adopted in the transformation of production inputs into outputs. Olayide and Heady, (1982) defined products as a process whereby inputs are transformed into output. He further summarized the four key production issues which shall be the focus of the entrepreneur to be:

In other to achieve optimum production level, resource must be available and whatever quantities of available resources must be used efficiently.

Production theory therefore provides a basis for analyzing the factors that explain changes, in output level. A production function on the other hand is a mathematical

relationship which describes the ways in which the quantity of an output produce depends on the quantity of inputs use. It expresses output as a function of variable inputs given the quantities of fixed inputs, which remain unchanged during production period that is:

$Q = f (X_1, X_2, X_3, \ldots\ldots\ldots\ldots Xn, Z_1, Z_2, Z_3, \ldots\ldots\ldots\ldots Zn) \ldots\ldots\ldots 2.1$

Where Q = quantity of output

$X_1, X_2, X_3, \ldots\ldots\ldots\ldots X_n$, = variable inputs

$Z_1, Z_2, Z_3, \ldots\ldots\ldots\ldots Z_n$ = fixed input for the production period.

2.7 Socio - Economic Characteristic of Sorghum Farmers

Musa *et al.,* (2007) mentioned the fact that the socio - economic characteristics of farmers may have great influence on the production of food crops in the country. Socio - economic characteristics of farmers influence decision making availability and level of use of conventional inputs and technology (Moses, 2007). Some of the socio-economic features of the farmers which may contributed to a affect their productivity level includes: age, level of education, marital status, land ownership, farm sizes access to credit and so on (Adebayo and Onu, 1999).

2.8 Cost and Returns in Agricultural Production

Cost refers to the value of the inputs used in production while profit is obtained by subtracting the cost from revenue (Adegeye and Dittoh, 1985)

There are two major categories of cost involved in crop production. These are variable and fixed costs. Variable cost (VC) refers to those cost that vary with the level of production (output). Examples are cost of seeds, cost of fertilizers, expenses on hired labour etc (Olukosi and Ogungbile, 1989). Spurlock and Gills (1997) stated that variable cost can be controlled in the short - run, and that it will increase as the total planned production is increased. Fixed cost (FC) on the other hand refers to those cost that do not vary with level of production or output. Examples are rent on land, interest on capital, depreciation cost, cost of machinery, building etc. the summation of variable cost (VC) and fixed cost (FC) give rise to total cost (TC). Depreciation will be determined using Annual Revaluation Method. Gaytengioglu and Sureta (2000) reported that labour and rent accounted for the greatest share of production cost. Rahman and Lawal, (2003) recommended that labour - saving technologies and should be introduced to farmers to cut down the cost of labour.

Sankhayan (1988) asserted that agricultural production function is the principles for allocation of scarce resources such as land, labour, capital and management which have alternative uses so as to achieve pre – defined objectives such as profit maximization, satisfaction or combination at micro and macro levels. Similarly Mshelia *et al.,* (2005) employed gross and market margin analysis to measure profit obtained from paddy rice processing in Adamawa State. The result of the analysis revealed that the whole sellers who purchased paddy rice processed and marketed it made a gross margin of ₦19.52kg, with a marketing margin of 43.40% and processing cost of ₦7.21/ha of processed rice. Also gross margin for retailers of processed paddy rice was ₦7.41/kg of processed rice. Furthermore, the analysis revealed that for every naira invested by the wholesalers on paddy rice processing yielded 40 kobo as gross margin which was higher than retailer who had 13 kobo as returns on naira invested. Investment returns are therefore higher than wholesalers of processed paddy than with the retailers.

A study of profitability of yam production was carried out in the northern part of Taraba State by Abubakar *et al.,* (2005) from result of costs and returns determination using budgetary techniques to obtain the farmers profit reported that the average cost per hectare for yam production was ₦111,191.95 indicating that farmers made ₦52,959.00 gross margin per hectare. Furthermore, they stressed that 60% of the cost of production was yam seed followed by cost of labour which was 34.99% of the total cost, land rent and fertilizer had 1.23% and 4.31% of the total cost respectively. In the same vein Ugwu (2006) worked out an enterprise budget to ascertain the viability of small holder pig farmers in the state. The results showed that the farmers made a profit of ₦102,819.54 per annum per average farmers, he concluded that pig production in Enugu State is a profitable livestock enterprise. In a related study Okeke (2007) found out that cattle marketers in Jos metropolis of Plateau State had ₦46,000.00 as profit margin per month.

In a similar study, Ibrahim (2008) conducted a research study on the economics of sole cotton production in Lau Local Government Area of Taraba State and concluded that cotton farming is profitable in the study area. He came up with average total variable cost/ha of ₦22,395.50 which represent 94.7% of the total farming cost. While depreciation of fixed cost was ₦1,250.00 which represent 5.3% of the total cost of farming. Thus, the total cost of farming operation was ₦23,644.00. The total revenue (TR) was ₦41,495.85, gross margin

(GM) was ₦19,101.85 and net farm income (NFI)/ha was ₦17,851.85 respectively. He further stressed that the return on naira invested (R.O.I) by farmers in the study area was revealed that for everyone naira invested, ₦0.76 was gained. This also shows that production is highly profitable.

2.9 Efficiency in Agricultural Production

The study of productive efficiency started with the pioneering works of Farrel, 1957 as cited by Ojo and Imoudu (2000). Three types of efficiency were identified.

Technical, allocative and economic efficiencies. Technical efficiency is the achievement of the maximum potential output from a given quantity of inputs under a given technology. It is the attainment of production goal without wastage (Jondrow *et al.*, 1982, Amaza and Olayemi, 1999). Abdourahmane *et al* (2001) defined economic efficiency as the ability to produce a given level of output using a cost minimizing input ratios. Technical efficiency is defined as the ability to achieve a high level of output given similar level of production inputs. While allocative efficiency has to do with the extent to which farmers make efficient decision by using inputs up to the level at which their marginal contribution value is equal to the factor cost. Economic efficiency combines both technical and allocative and occurs when a firm chooses resources and enterprises in such a way as to attain economic optimum (Adesina and Djato, 1997). Technical inefficiency arises when less than maximum output is obtained from a given bundle of factors and allocative inefficiency arises when factors are used in proportions that do no lead to profit maximization.

Maurice (2004) examined the resource use productivity in cereal crop production among Fadama farmers in Adamawa state. The result indicate that the technical efficiency among the sampled farmers ranged from 0.29 to 0.97 with mean technical efficiency of 0.80 Maurice *et al.*, (2005) analyzed the technical inefficiency in rice based cropping patterns among dry season Fadama farmers in Adamawa state. The result of the inefficiency model indicated that farming experience and level of education increased the technical efficiency of farmers.

Moses and Adebayo (2007). In a study on efficiency of factors determining rainfed rice production in Ganye local Government area of Adamawa state using production function analysis. The studied revealed that farm size and seeds are critical factors in rice production. The farmers were not efficient in the use of their resources (Seeds, land and herbicides).

Further, efficacy can be defined as the ration of marginal values product to the Marginal Factor Cost (MFC). The marginal value product is the increasing to the revenue as a result of a unit addition of the output, while the Marginal Factors Cost (MFC) is the addition of cost as a result of using additional unit of input (Alimi, 2000). Kay (1981) stated that, a firm maximizes its profit to an input, if the ratio of its Marginal Value Product (MVP) to the marginal cost (MFC) is a unity. He further stated that a ratio less than unity shows over utilization of farm input and decreasing the rate of use that input will increase the level of profit of the firm while a ratio greater than unity indicates under utilization of the input and increasing its level of use will enhance profit.

2.10 Constraints in Sorghum Production

Tashikalma *et al*., (2001) have drawn attention to the constraints being faced by the sorghum farmers; which include; shortage/high cost of inputs (45.88%), inadequate farms credit (21.18%), striga infestation (17.65%) while flood, high cost of labour were not left out. Jongur et al., (2007) also reported that constraint to masakwa sorghum production can be arranged in the order of grazers e.g cattle rearers grazing on farms (27.78%), low flooding as a result of low rainfall in to the river Benue (20.28%) to insufficient credit with (3.33%). Other constraints he reported facing the sorghum farmers especially in the area is resource use and allocation. These farmers allocated their resources and choose enterprises based on their experience without scientific approach (Baiyegunhi et al., 2010). Also, Akunola (1987), respond that family demands may compete with the farm enterprises for scare financial resources of farmers. Department in households may create financial constraints that make it difficult for farm operators to have the finance to embrace new innovation or production practice. Ani *et al*, (2008) stressed that certain factors could influence the adopting process. These could vary depending on the socio-cultural characteristics of the farmer as the nature and type of technology.

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

The study was conducted in Hong Local Government Area of Adamawa State. Hong is located in the northern part of Adamawa state. The study area lies between latitude 10^0 13^l N and longitude 12^0 55^l E of the Greenwich meridian. Hong Local Government has a land area of about 117, 240 square kilometers with a population of about 169, 183 (National Population Commission, 2006). By 2012, the local government is expected to have 204,994 inhabitants. The climate is generally of hot humid tropical type with minimum mean temperature of about 26.1°C. Also rainfall is experienced between April to October and this varies directly proportional to relative humidity and inversely with sunshine (Adebayo, 1997). The annual rainfall ranges from 900mm - 1100mm. the natural vegetation is of the Savannah, a luvisol soil type (alluvium, shales. and basement complex) supporting a flora comprising shrubs, deciduous trees and grasses.

The major occupation of the people is farming and few traders, blacksmiths, craftsmen and civil servants, the major crops grown in the area are groundnut, sorghum, maize, rice millet, bambara nuts, cowpea and tiger nut. Apart from crops cultivation. They also engage in animal rearing such as goats, sheep, cattle, poultry etc. The local government has seven (7) administrative districts which include Hong, Dugwaba, Pella, Kulunyi, Gaya, Hildi and Uba districts.

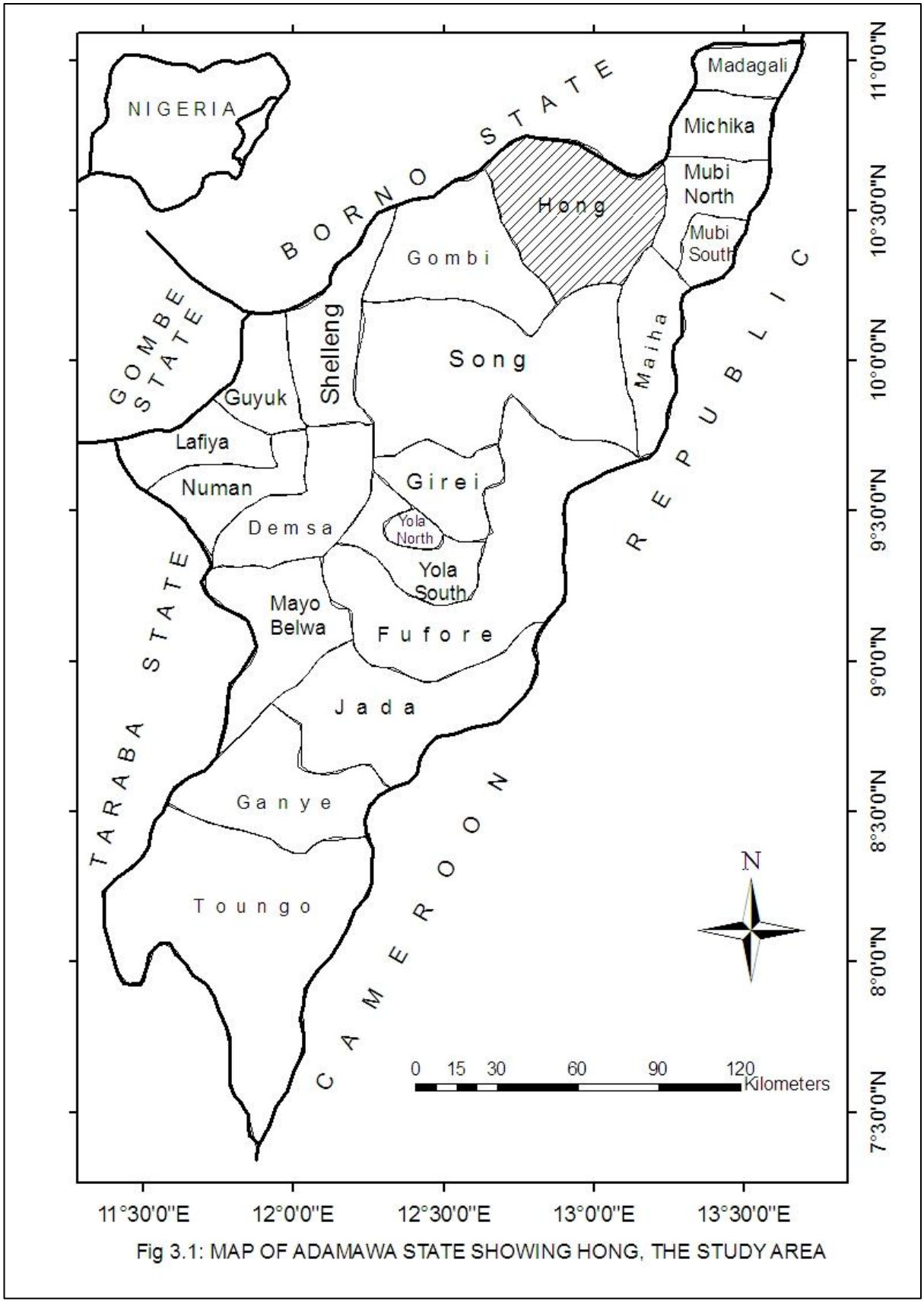

Fig 3.1: MAP OF ADAMAWA STATE SHOWING HONG, THE STUDY AREA

3.2 Sources of Data and Data Collection.

The data for this study were from primary source. This were obtained through the use of structured questionnaire, which were administered to 180 respondents (Sorghum famers) proportionate to the size of the districts that were be served with questionnaire. Data were collected from farmers which were covered 2010 farming period.

3.3 Sampling Techniques and Sample Size.

The study employed multi-stage random sampling technique in the selection of respondents. In the first stage, five out of the seven districts in Hong Local Government Area of Adamawa State were randomly selected. Within each district the manes of all the district were written on papers and wrapped from where five were picked at random. In the second stage two to six villages were randomly sampled in each of the selected districts area, giving a total of 20 sampled villages. This was done through listing out all the villages in each of the sampled district areas from where two to six villages were also randomly picked. Third stage sampling involved the random selection of 150 sorghum farmers in the 20 sampled villages proportionate to the size of the respondents in each of the villages and were administered questionnaire as shown in table 3.1.

Table 3.1 Sampling Technique in the Twenty Villages

Districts	Villages	No. of Sorghum farmers in the village	Sampled farmers	Total sample
Hong	Hong	145	10	10
	Dilmava	139	9	9
	Dazal	98	6	6
	Thabu	127	8	8
	Kwabaktina	130	8	8
	Dilbuni	80	4	4
	Sub-total	**719**	**Sub-total**	**45**
Kullinyi	Kala'a	150	11	11
	Makera	125	9	9
	Bangshika	105	7	7
	Kwambolla	98	6	6
	Dilwacira	94	5	5
	Sub-total	**572**	**Sub-total**	**38**
Gaya	Gaya	138	9	9
	Chika Gaya	122	7	7
	Mijli	133	8	8
	Kwatau	102	6	6
	Sub-total	**495**	**Sub-total**	**30**
Hildi	Hildi	139	10	10
	Gashala Kufum	97	7	7
	Gashala Migizil	85	5	5
	Sub-total	**321**	**Sub-total**	**22**
Uba	Uba	146	10	10
	Sabon gari	92	5	5
	Sub-total	**238**	**Sub-total**	**15**
Total	**20**	**2345**	**150**	**150**

Source: field survey 2011

3.4 Method of Data Analysis

Descriptive statistics, Gross Margin, production function analysis and z-test are the analytical tools that were used for this study.

3.4.1 Descriptive Statistics

Descriptive statistic involves the use of tables, percentages, means averages and standard deviation to analyze the socio-economic characteristics of the respondents which

include their age, gender, level of education, marital status, acquisition of land, farm size, farming experience source of labour, seed varieties, rate of fertilizer application and marketing channels.

3.4.2 Gross Margin (GM) Analysis.

The gross margin was used to estimate the cost and returns to sorghum production in the study area, following Adebayo (2005) the gross margin per hectare, which is the difference between total revenue per hectare and total variable cost per hectare, the gross margin analysis is used to study the performance of an enterprise. It is a very useful planning tool in situation where fixed capital is neglisible portion of the farming enterprise as is the case in subsistence agriculture (Olukosi and Erhabor, 1988). This value of production (i.e Gross Income) were obtained from sorghum seed in/kg where as the variable cost were the cost of inputs like labour, insecticide, fertilizer, transportation, herbicides and ploughing.

The formula for the gross margin is given as:

Gross Margin (GM) = Gross Income (GI) - Total Variable Cost (TVC)…3.1

Where:

GM = Gross Margin ₦/ha

GI = Gross Income ₦/ha

TVC = Total Variable Cost ₦ /ha

Also, Net Farm Income (NFI) was calculated which is given as:

NFI = GM – TFC ……3.2

Where:

NFI = Net Farm Income

TFC = Total Fixed Cost

(Olukosi and Erahbor, 1998 and Mshelia, *et al.,* 2005).

3.4.3 Production Function Analysis

Production function analysis was used to examine the influence of various variables on the out put of Sorghum produced in the area as well as the marginal analysis of the efficiency of input used by farmers.

Four functional forms were used these include, linear, exponential, double log and Semi - Log functions to determine which will fit best. The explicit formula for the model is stated below.

1. Linear function

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots\ldots\ldots\ldots + b_5 X_5 + ui \quad \ldots\ldots\ldots\ldots 3.3$$

2. Exponential function

$$Lny = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots\ldots\ldots\ldots + b_5 X_5 + ui \quad \ldots\ldots\ldots 3.4$$

3. Double log (cobb douglas) function

$$Log\ Y = b_0 + b_1 \log X_1 + b_2 Log\ X_2 + b_3 Log\ X_3 + \ldots\ldots + b_5 Log\ X_5 + ui \quad \ldots 3.5$$

4. Semi – logarithm function

$$Y = Ln\ b_0 + b_1 Ln\ X_1 + b_2 Ln\ X_2 + b_3 Ln\ X_3 + \ldots\ldots + b_5 Ln\ X_5 + ui \quad \ldots\ldots\ldots 3.6$$

Where:

Y = output of sorghum in kg /ha

X_1 = farm size in hectares i.e a hectare is 100m by 100m

X_2 = quantity of fertilizer in kg/ha

X_3 = cost of hired labour in manday/ha i.e. 8 hrs/mandays

X_4 = family labour used in manday/ha i.e. 8 hrs/mandays

X_5 = quantity of seed planted in kg/ha

b_0= Constants terms i.e unchangeable

b_1- b_5 = coefficient of the independent variable.

Ui = Error term.

3.4.4 Marginal Analysis of Resource Utilization.

Marginal analysis of resource utilization. This tool were used to determine resource use efficiency of some of the inputs used by the farmer following Iheanacho et al; (2000). This were calculated using the formula.

$$r = \frac{MVP}{MFC} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.7$$

where:

r= is the ratio of the resource use efficiency

MVP = is the marginal value product.

MFC = is the marginal factor cost of input (unit price of inputs).

From estimated regression result of best production functions equation, the values of MPP and MVP for the resources were obtained for use and were estimated as follows.

$$MPPxi = \frac{dy}{dx} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.8$$

$$MVPxi = MPPxi \times Py \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.9$$

where:

MPPxi = marginal physical products of input xi

MVPxi = marginal value of input xi

Py = unit price of the output

Conclusion were arrived at using the following,

When:

$\frac{MVP}{MFC} = 1$ Shows that the resource is efficiently utilized in the production. This is the best point to maximize profit.

$\frac{MVP}{MFC} < 1$ shows over utilization of the resources and profit will be increased by decreasing quantity used of the input.

$\frac{MVP}{MFC} > 1$ Indicates under utilization of the resource and increasing the rate of use of the input will increase the level of profit.

3.4.5 Hypothesis Testing

Ho : Sorghum production is not profitable in the study are.

The Z – statistics is given by;

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{N_1}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.10$$

Where;

$\bar{x}_1$ = Mean of the output of sorghum

$\bar{x}_2$ = Mean value of the variable *i*

S_1^2 = Variance of the sorghum farmers

N_1 = Sample size

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio-Economic Characteristics of the Sorghum Farmers

The socio-economic characteristics of farmers that have the potential to facilitate production, the relevant ones considered include; age of respondent, marital status, educational background, years of experience, Household size, land acquisition method, farm size, type of cropping system, source of seed for planting, type of seed planted, source of labour, type of market used, source of capital, membership of cooperative societies and contact with extension agents.

4.1.1 Age Distribution of the Respondents

As revealed by the table 4.1 (36%) of the respondents were between the age of 31 and 40 years, while 26% fall between the age of 41 and 50. 24.7% are between the age 20 and 30. While 8% are between the age 51 and 60, and 61 and 70 years constituted about 3.3%. Those who were below 20 years constitute 2%. The table revealed that majority of the sorghum producers in the study area are the youths. This confirmed that youths are now increasingly involved in agriculture. Because they are still strong enough to work on the farm and hence increased productivity. However, older age farmers still play vital role in the business. This result conforms with the works of Adebayo and Onu (1999), who noted that age is one of the several socio economic features that affects the level of farmers productivity.

Table 4.1: Distribution of the Respondents According to Age

Age (years)	Frequency	Percentage (%)
Below 20	3	2
20-30	37	24.7
31-40	54	36
41-50	39	26
51-60	12	8
61-70	5	3.3
Mean age 38.93		
Total	150	100

Source: Field Survey, 2011

4.1.2 Marital Status of Respondents

Majority of sorghum farmers are married as shown in table 4.2. The table revealed that 58% of the farmers are married while about 27.3% are unmarried. Only 10.7% and 4% were widowed and divorced respectively. This indicates that married people participate more in sorghum production than unmarried people. It could be due to the facts that they have more family responsibilities such as provision of food, education/training of children. The contribution of marital status on agricultural production can be explained in terms of the supply of agricultural family labour. Family labour would be more where the household heads are married. The result also agreed with the findings of Maurice (2012), who stated that marital status on agricultural production can be explained in terms of the supply of agricultural family labour. The supply of family labour would be more where the household heads are married.

Table 4.2: Distribution of Respondent Based on Marital Status

Marital status	Frequency	Percentage (%)
Single	41	27.3
Married	87	58
Divorced	6	4
Widowed	16	10.7
Total	150	100

Source: Field Survey, 2011

4.1.3 Educational Background of the Respondents

Table 4.3 shows that there is high level of education among the sorghum producers, which clearly shows that the level of adoption of innovation by the farmers can be very high. 46% of the farmers had tertiary education, 21.3% and 17.3% had secondary education and no formal education respectively, while 15.3% had primary education. This is an indication majority of the farmers are literate and could be receptive to agricultural innovation. Baiyegunli and Froser (2009) states that an educated farmers will be able to handle instruction manuals on input and machinery uses. The implication is that the prospects for the acceptance of innovation are reasonably high.

Table 4.3: Educational Background of the Respondents

Educational background	Frequency	Percentage (%)
No formal education	26	17.3
Primary education	23	15.3
Secondary education	32	21.3
Tertiary education	69	46
Total	150	100

Source: Field Survey, 2011

4.1.4 Farming Experience of Respondents

Table 4.4. About 35.3% of the respondents have been farming sorghum for between 11 and 15 years. 14.7% had between 5 and 10 years of experience, while 12% between 26 and 30 years, which therefore shows that majority of the respondents (35.3%) have farming experience of 11-15 years. This implies that the farmers had experience to improve their production techniques, to increase their productivity. The result also agrees with the findings of Ogundele and Okoruwa (2006), who stated that the longer a person stays on a Job, the more likely the person, is to become an expert. People with experience in farming tend to adopt. Innovation since they must have tried various farming practices on the other hand, older people particularly in the rural area tend to be skeptical about new innovation and most often would prefer to stick to their age-long, Traditional practice rather than taking a stick getting involved in new practices.

Table 4.4: Distribution of Respondent Based on Farming Experience

Farming experience (years)	Frequency	Percentage (%)
Below 5	6	4
5-10	22	14.7
11-15	53	35.3
16-20	24	16
21-25	7	4.7
26-30	18	12
31-35	11	7.3
36-40	3	2
41-45	2	1.3
46 and above	4	2.7
Mean farming experience 19.09		
Total	150	100

Source: Field Survey, 2011

4.1.5 Household Size of the Respondents

The household is the major source of term labor in small agriculture, though most farm operations.

Table 4.5 shows that 57.3% of the respondents have household size between 5 and 10 people. About 17% have between 11 and 15 people in their households while 16% have below 5 people. 6.7% between 16 and 20 people, 2% of the respondents have between 21 and 25 people. Only o.7% have between 26 and 30 people and 31 and 35 people also formed 0.7%. The household is the major source of farm labour in small scale agricultural, though most farm operations in the study area are gender specific the contribution of women cannot be overemphasized especially during harvesting extended family system still exist in the study area. The reason for keeping larger family is to provide more farms works.

The result also agrees with the finding of Maurice (2012) who stated that the number of person in household is very important in determining the labour available for farm works

Table 4.5: Distribution of Respondent Based on Household Size

Household size	Frequency	Percentage (%)
Below 5	24	14
5-10	86	57.3
11-15	25	16.7
16-20	10	6.7
21-25	3	2
26-30	1	0.7
31-35	1	0.7
Mean family size 8.94		
Total	150	100

Source: Field Survey, 2011

4.1.6 Land Acquisition Method in Sorghum Production

Land is the most important aspect of the production of both crops and animals. As observation by Adebayo and Onu (1999) that land ownership in one of the socio-economic characteristics of farmers which affects their productivity. However, ownership of land often interferes with its used as an agriculture asset. As shown in table 4.6, 77.3% respondents obtained the farmland through inheritance with land use of degree of 1978, one will have thought that land acquisition was through government efforts. However, the study findings shows that land does not necessarily belong to government as 77.3% of the farmers acquire their land through inheritance while 14.7% obtained their farmlands through gift, 6.7% through lease while only 1.3% obtained their own land through purchase. The implication of majority using inherited land is that it would lead to fragmentation of farm land as a result of sharing among siblings hence reducing the size of farm land for agricultural practices.

Table 4.6: Distribution of the Respondent Based on Land Acquisition

Land acquisition	Frequency	Percentage (%)
Inheritance	116	77.3
Gift	2	14.7
Lease	10	6.7
Purchase	22	1.3
Total	150	100

Source: Field Survey, 2011

4.1.7 Farm Size of Respondent

Majority (57.3%) of the farmers hold less than 2 hectares these may be attributed to high level of poverty where poor farmers can only afford small parcel of land for subsistence farming couple with inadequate credit facilities necessary to expand their farm lands. Indicating that they are basically small-scale holders, about 41% fall between 3 and 5 hectares of the farm while 2% hold between 6 and 8 hectares. The longer the family size is relevant as it determines the labour output.

The finding also coincide with the work of Awoke and Okorji (2004), small scale farmers are farmers who cultivate between 0.1 and 4.99 hectares and produce on subsistence.

Table 4.7: Distribution of Respondents Based on their Farm Size

Farm size (ha)	Frequency	Percentage (%)
Below 2	86	57.3
3-5	61	40.7
6-8	3	2
Total	150	100

Source: Field Survey, 2011

4.1.8 Type of Cropping System of the Respondents

As revealed by table 4.8 below, 65.3% of the respondents are into mixed cropping, while 34.7% practice sole cropping. This also reveals that majority of the respondents 65.3% are engaged in mixed cropping.

Farmers consider risk minimization and income generation are the main factors responsible for the practice of mixed cropping. Maurice also reported that farmers cultivate different crops based on their adaptability to a particular season, domestic needs, and it is also a characteristic feature of traditional farming system in Nigeria. The scarcity of good farm land and lack of adequate capital to expand production might be the predisposing factors to the practice of mixed cropping.

Table 4.8: Distribution of the Respondents Based on Cropping System

Type of cropping	Frequency	Percentage (%)
Mixed	98	65.3
Sole	52	34.7
Total	150	100

Source: Field Survey, 2011

4.1.9 Source of Seed for Planting by the Respondents

Table 4.9 shows that about 77.3% of the respondents used part of their previous harvest for seed while 16% obtained from market and 4% obtained seed from gift and only about 2.7% obtained seed from ADP. This indicate that majority of the farmers obtained their seed from previous harvest while improved seed varieties were not even available at affordable price to the farmers. The implication of this may be attributed to low sorghum output and it could discourage them from the production of sorghum.

Table 4.9: Distribution of Respondent Based on Source of Seed for Planting

Source of seed for planting	Frequency	Percentage (%)
ADP	4	2.7
Market	24	16
Previous harvest	116	77.3
Gift	6	4
Total	150	100

Source: Field Survey, 2011

4.1.10 Type of Seed Planted by the Respondent

Majority (83.3%) of the farmers used local variety while 9.3% used improved variety and only 7.3% used both local and improved variety for their planting. This indicates that majority of the farmers used local variety for planting while improved variety are not even available at affordable price to the farmers. This implies that most sorghum seeds obtained from previous harvest are not treated which in term lead to low yield.

Table 4.10: Distribution of the Respondent based on type of seed Planted

Type of seed planted	Frequency	Percentage (%)
Local variety	125	83.3
Improved variety	14	9.3
Both local and improved	11	7.3
Total	150	100

Source: Field Survey, 2011

4.1.11 Source of Labour of the Respondents

Table 4.11 shows that family labour formed the highest type of labour by the respondents (72%). I6% used hired labour while 12% used both family and hired labour. This can be due to the facts that most of the people involves in the business operate on a very small scale. So family is very important to them. The larger the family size is relevant as it determines the labour output labour on the small farm was employing excessive labour. This can be attributed to the surplus family labour available to the farmers.

Table 4.11: Distribution of the Respondent Based on Source of Labour

Source of labour	Frequency	Percentage (%)
Family	108	72
Hired	24	16
Both family and hired	18	12
Total	150	100

Source: Field Survey, 2011

4.1.12 Type of Market used by the Respondents

As revealed by table 4.12 many of the respondents (40.7%) sale their produce in both rural and urban market while 36% sell their produce in rural market, only 23.3% used urban market. The implication of price received by farmers in the study area is low hence, this may be attributed to low sorghum output and it could also discourage them from the farming.

The result therefore shows that most of the farmers are low income earners. The reason for the low income maybe attributed to the fact that majority of the farmers may not enjoy remunerative prices for their products which in turn enhance their production: prices of Agricultural produce is one of the incentives for promoting commercial production of Agricultural commodities

Table 4.12: Distribution of Respondent Based on Type of Market used

Type of market	Frequency	Percentage (%)
Rural	54	36
Urban	35	23.3
Both rural and urban	61	40.7
Total	150	100

Source: Field Survey, 2011

4.1.13 Source of Capital of the Respondents

Majority of the respondents (89.3%) used personal saving as a source of capital available to them as indicated in table 4.13 below and thrift (adashe) formed 8.7% while loan from Bank constitute only 2%. One can deduce from this that not many farmers were able to secure loan, possibly dues to their low level of cultivation and lack of collaterals. The result also agree with the work of Awoke (2003) who identified lack of collaterals and high interest rate as some of the major problems of agricultural production.

Table 4.13: Distribution of Respondent Based on Source of Capital

Source of capital	Frequency	Percentage (%)
Personal saving	134	89.3
Borrowed/loan	3	2
Thrift (Adashe)	13	8.7
Total	150	100

Source: Field Survey, 2011

4.1.14 Membership of Cooperative Societies

Table 4.14 shows that majority (82.7%) of the respondents do not belong to cooperative society, only 17.3% of the respondents belong to cooperative society. This indicates that majority of the farmers are ignorance of the benefit derived from cooperative society in the study area. This may not be so, as they could be aware but if they perceived benefits are not there, they will not be members.

Table 4.14: Distribution of the Respondent According Membership of Cooperatives Societies

Cooperative society	Frequency	Percentage (%)
Yes	26	17.3
No	124	82.7
Total	150	100

Source: Field Survey, 2011

4.1.15 Access to Extension Services of the Respondents

Extension as one of the major tools through which new innovation are transferred to farmers which usually have significant effect on the economic efficiency level of farmers. Majority (91.3%) of the farmers do not have access to extension services. This indicates that majority of the farmers do not have contact with extension agents which will invariably affect their level of adoption of innovation. The study show that extension visits in the study area was very poor, as only 8.7%. This implies that the level of efficiency of sorghum production in the study area might be static, since the extension workers were not visiting the farmers. That is why there is low use of improved sorghum varieties by farmers. The result also agrees with the findings of Orojobi, (1996) who stated that adoption of improved technologies for sorghum production in Kaduna State, Nigeria. It was found that the level of awareness of improved sorghum varieties was 53% and 42% of the respondents were non – users of improved sorghum varieties in the area.

Table 4.15: Distribution of Respondent Based on Contact Extension Agents

Access to extension services	Frequency	Percentage (%)
Yes	13	8.7
No	137	91.3
Total	150	100

Source: Field Survey, 2011

4.2 Cost and Return Associated with Sorghum Production

The distribution of cost and returns associated with sorghum production is presented on Table 4.16. The table shows that the average total cost of production per hectare was ₦32,134.98 out of which ₦27,480.79 was variable cost which accounts for 85.52% of total cost for sorghum production. This was largely attributed to high cost of labour and having converted family labour by cost at prevailing market price rate. The fixed cost was ₦4,654.19 which accounted for 14.48% of the total cost for sorghum production. The gross revenue generated per hectare was ₦60,439.51. The table reveals that the gross margin per hectare for sorghum production is estimated as ₦32,958.72 while the net farm income per hectare is estimated as ₦28,304.53. This therefore shows that sorghum production guarantees higher gross margin/ha. On the return on naira invested (R.O.I) sorghum production guarantees higher profit on naira invested for every one naira invested in sorghum production ₦1.19 and ₦0.88 were gained.

Fertilizer: This referred to the quantity of fertilizer used, while some farmers had little or no fertilizer to apply to their crop others can apply more than the recommended level per hectare. As revealed in table 4.16 the average money farmers spend on fertilizer per hectare was ₦2,563.50.

Labour: This is the amount of physical efforts used in the production process. It is made up of both family and hired labour. The average amount farmers spend on labour was ₦17,958.95 as shown in table 4.16. it was included to determine the level of labour utilization so as to ascertain if labour is being over utilized or underutilized. This is important in the light of common assumption in economic literature that labour in developing countries has low or near zero margin product. Labour input was measured in man-hours.

Herbicides: These include quantities in litres of herbicide used by the farmer during farm operation and it measured in liters per hectare it was ₦4,245.70.

Farm tools: As is common in traditional agriculture, majority of the farmers have less than 2 hectares of land may be attributed to high level of poverty where poor farmers can only afford small parcel of land for subsistence farming couple with inadequate credit facilities necessary to expand their farm lands. Indicating that they are basically small scale holders. Farmers utilized traditional implements such as hoes and cutlasses. As revealed in table 4.16 farmers in the study area have average depreciation of farm tools of ₦3,136.80 per hectares. This implies that the substitution of capital for labour is low, that is the production process is more labour intensive. The use of tractor is not common in the study area, mainly because of non availability, and where they are available the high cost of renting/hiring.

Gross revenue: Revenue for the sorghum is obtained by multiplying the total average of output with the unit price of the output it was ₦60,439.51 per hectare and the gross margin was ₦32,958.72 per hectare and the net farm income was ₦28,304.53 per hectare implying that sorghum production in the study area is profitable. This revealed that for every one naira invested in sorghum production a farmer make a profit of 19 kobo gain.

Profitability Analysis of Sorghum Production

Table 4.16: Average Cost and Returns per Hectare of Sorghum Production

Production input	Value in N/ha
A. Variable Cost	
Fertilizer	2,563.50
Labour	17,958.95
Herbicide	4,245.70
Seed	341.64
Transport	1,381.00
Ploughing	990.00
Total variable cost	27,480.79
B. Fixed Cost	
Rent on land	1,517.39
Farm tools	3,136.80
Total fixed cost	4,654.19
Total cost of production (A+B)	32,134.98
C. Returns	
Gross Revenue (GR)	60,439.51
Gross Margin (GM)	32,958.72
Net Farm Income (NFI)	28,304.53
Gross margin on naira invested	1.19

Income on naira invested	0.88

Source: Field Survey, 2011

4.3 Result of Production Function Analysis

The explanatory variables used were farm size, fertilizer, hired labour, family labour and seed. Four functional forms were fitted into the model. These are linear, exponential, semi-log and double-log functions as shown in Table 4.17. The result of the production function analysis revealed the exponential function as the best fit function based on economic, econometric and statistical criteria in sorghum production, hence linear function is not used as lead equation in production studies because return scale cannot be estimated APP and MPP there are the same, hence exponential function was chosen as the lead equation.

The model for the sorghum production is presented thus:

$$\begin{aligned} \text{Ln } y = {} & 2.622^{***} + 0.0306X_1^{*} + 0.1125X_2^{***} - 0.0139X_3^{**} \\ & (173.72) \quad (1.816) \quad (5.464) \quad (-2.572) \\ & + 0.000X_4^{*} + 0.314X_5^{***} \\ & (-1.795) \quad (11.797) \end{aligned}$$

*** Significant at 1%

** Significant at 5%

* Significant at 10%

Figures in parenthesis are t – values

The result shows that all the five explanatory variables were found to be significant and contributed positively to sorghum yield except hired labour. These are farm size (X_1), fertilizer (X_2), hired labour (X_3), family labour (X_4) and seed (X_5). This shows that an increase in the use of these inputs will increase output significantly. The coefficient of multiple determinations (R^2), indicates that 89.3% of the variation in sorghum yield is explained by the variables included in the model.

Thus, the variables have fitted well into the model. The overall model is also significant at 1% as shown by the F-statistic.

Farm size as revealed by the analysis is statistical significant at 10% level. Thus, a 10% increase in the area of land put into sorghum production would bring about increase in sorghum output by 0.31%. This implies that the more the farm size the higher the output.

Fertilizer is statistically significant at 1% level, this implies that increase in fertilizer application in sorghum, sorghum grew better and had higher yield and relative increase in income. Thus, a 10% increase in fertilizer will bring about increase in the yield of sorghum by 1.13%. This implies that the more the fertilizer the more the output.

Sorghum production is labour intensive, hence necessitating hiring labour statistically significant at 10% level. However, a 10% increase in mandays of hired labour put into sorghum production would bring about increase in sorghum yield by 0.139% used hired labour in their production activities, since agricultural production is undertaking by most farmers on part-time basis.

Family labour is positive and statistically significant at 10% level. However, a 10% increase in mandays of family labour put into sorghum production would bring about increase in yield by 0.00%. This implies that family labour on the small scale farming was employed above the economic optimum level. Seed input was employed in order to increase the quantity of output this revealed that farmers would increase profit by using more seeds, quantity of seed used was statistically significant at 1% level, a 10% increase in the quantity of seed used would bring about increase in sorghum yield by 3.14%. Therefore, the more the quantity of seed used in sorghum production the more the output. The returns to scale, which is the summation of elasticity is 1.014, which indicate increasing return to scale. This is a situation where by additional use of inputs will bring about more than proportionate increase in output.

Table 4.17 Result of the Regression Analysis for Sorghum Production Functional Forms

Variables	Linear	+Exponential	Semi-log	Double log
Constant	50.649	2.622	-800.940	2.219
	(1.609)	(173.721)***	(-6.166)***	(42.037)***
Farm size	136.114	0.020	877.002	0.260
	(6.065)***	(1.816)*	(9.379)***	(6.830)***
Fertilizer	1.469	0.001	5.477	0.015
	(5.187)***	(5.464)***	(0.300)	(1.972)*
Hired labour	-1.030	-0.001	6.587	0.001
	(-1.954)	(-2.572)**	(0.956)	(0.484)
Family labour	-0.550	0.000	6.568	0.002
	(-1.148)	(-1.795)*	(0.876)	(0.589)
Seed	57.394	0.025	1642.343	0.684
	(13.160)***	(11.797)***	(12.767)***	(13.085)***
R^2	93.4%	89.3%	91.5%	90.1%
F-ratio	406.854	239.575	310.165	261.938
S∈	94.72	0.045	107.383	0.043

Source: Field Survey, 2011

*** Significant at 1%

** Significant at 5%

* Significant at 10%

+ Lead equation

S∈ standard error

Figures in parenthesis are t – values

4.4 Marginal Productivity and Efficiency of Resource Use

The Marginal Physical Product (MPP) for input utilization was derived from the estimated regression coefficients using the arithmetic mean value of output and input as shown in Table 4.17.

The marginal physical product for each of the resources based on the exponential production function was obtained as follows:

Farm size (hectares) gave the highest value of MPP (14.624). This implies that increase in farm size by one hectare would result in extra 14.624kg of sorghum.

The estimated resource use efficiency is presented in Table 4.18.

Table 4.18: Estimated Resource use Efficiency

Variable	$\frac{\beta_1 \bar{y}}{\bar{x}}$	MPP	P_y	MVP	MFC	MVP/MFC
Farm size	$\frac{0.020 \times 1117.533}{1.5283}$	14.624	54.313	794.273	6043.951	0.131
Fertilizer	$\frac{0.001 \times 1117.533}{112.5035}$	0.0099	54.313	0.538	2852.663	0.0019
Hired labour	$\frac{-0.001 \times 1117.533}{13.9571}$	-0.08006	54.313	-4.348	350	-0.0124
Seed	$\frac{0.025 \times 1117.533}{12.5667}$	2.223	54.313	120.738	45.45	2.656

Source: Field Survey, 2011

The ratio of marginal value product to marginal factor cost was computed for farm size, fertilizer, hired labour and seed. The result shows that seed were under utilized, while farm size, fertilizer and hired labour were over utilized. Therefore, increasing quantity of seed would increase output of sorghum while decreasing farm size, fertilizer and hired labour will increase revenue, and bring the production to optimal level.

4.5 Result of Hypothesis Testing

The result of hypothesis testing using Z-Test statistics revealed that sorghum production is profitable in the study area. The computed Z-Test value of (1,351.33) is greater than the tabulated T-value of (1.645) at 1% level of significance. This implies that the null hypothesis is rejected for the alternative hypothesis. Meaning that at 1% level of significance that sorghum production is profitable in the study area.

Table 4.19 Result of Hypothesis Testing

Parameters	Sorghum
Mean profit	32,958.72
Standard deviation	131,163.49
No. of respondents	150
Computed Z	1,351.33
Tabulated Z	1.645

*** Significant at 1% level

4.6 Identified Constraints Associated with Sorghum Production

The constraint faced by sorghum farmers in the study area are reflected in table 4.19 accordingly. The study reveals the major problem facing the farmer cultivating sorghum is high cost fertilizer (11.97%), inadequate improved seed (11.71%), high cost of inputs (11.62%), inadequate credit facilities (11.45%), pests and disease (10.77%), inadequate extension services (10.68), access road (10.43), poor market outlet (10.09%), transportation cost (8.72%) and inadequate labour (2.56%).

The reason given for low fertilizer usage and inputs in general because of unavailability and high cost of these inputs.

Most of the small scale farmers grow local varieties. The major reason for rejecting the improved seeds were that it gave less food value than the local varieties, unavailability and high cost, they also said it needed more fertilizer which will increase the cost of production, it would not store well and it is more susceptible to the striga weed. It observed that most small scale farmers used seeds from the previous season harvest, which are often not treated before planting. These planted seeds are prone to pest and diseases attack resulting in low germination percentage. To overcome this problem, farmers plant more seeds in anticipation of getting germination percentage, more often farmers seem not to pay attention to the quantity of seeds planted, just because seedlings would be thinned, most times thinning are delayed beyond three weeks after germination which adversely affects yield. Poor timely

distribution of such inputs to farmers and diversion of such input by government officials and politicians are problems farmers face. Poor management aspects by the farmers (respondents) are also problems facing the farmers, poor extension services and delivery, as well as land ownership system also creates problems among farmers.

4.20 Constraints Associated with Sorghum Production

S/No	Problem	Frequency *	Percentage %
1	Inadequate credit facilities	134	11.45
2	High cost of inputs	136	11.62
3	Pests and diseases	126	10.77
4	Poor market outlet	118	10.09
5	Transportation cost	102	8.72
6	Poor access road	122	10.43
7	Inadequate improved seeds	137	11.71
8	Inadequate labour	30	2.56
9	High cost of fertilizer	140	11.97
10	Inadequate extension services	125	10.68
Total		**1170**	**100**

Source: field data, 2010

*Multiple responses

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Major Finding

The study was carried out in Hong Local Government Area of Adamawa State was centered on the economics of sorghum production in the area. A total of one hundred and eighty farmers from Hildi, Gashala Kufum, Gashala Migizil, Uba, Sabon gari, Kala'a, Makera, Bangshika, Kwambolla, Dilwacira Gaya, Chika-Gaya, Mijili, Kwatau, Hong, Dazal and Dilmava, Thabu, Kwabaktina, Dilbuni were surveyed.

The study indicated that majority of the producers were youths within the age of 31-40 years. Majority of the farmers participate in the production were married (58%) as against 27.3% unmarried. Moreover, 46% of the respondents had tertiary education 21.3% and 17.3% had secondary education and no formal education respectively, while 15.3% had primary education. The study also revealed that many (77.3%) of the farmers obtained their land through inheritance while 14.7% obtained their farm lands through gift, 6.7% through lease while only 1.3% obtained their own land through purchase. Majority of the farmers (72%) used family labour as their main source of labour for the production 16% used hired labour while 12% used both family and hired labor. The study also revealed that majority of farmers (89.3%) used personal savings as their main source capital for investment. While 8.7% used thrift (adashe) and 2% from bank. This indicates that most of the farmers used their personal savings for investment. Majority (91.3%) of the farmers does not have access to extension services and only 8.7% have access to extension services. This indicated that the majority of the farmers do not have contact with extension agents which will invariably affect their level of adoption of innovation.

The gross margin analysis shows that by investing about ₦27,480.79 of the total variable cost in sorghum production per hectare and average profit of about ₦32, 958.72 would be obtained so the venture can be said to be profitable. The result of the production function analysis revealed that exponential function gave the best fit which shows that the whole equation is in good fit. All the five independent variables were found to be significant.

These are X_1 (farm size), X_2 (fertilizer), X_3 (hired labour), X_4 (family labour) and X_5 (quantity of seed planted).

The return to scale, which is the summation of elasticities is 1.014, which indicate increasing return to scale. This is a situation whereby additional use of inputs will bring about more than proportionate increase in output. The ratio of marginal value product to marginal factor cost were computed for farm size, fertilizer, hired labour and seed. The result shows that quantity of seed, were underutilized, while farm size, fertilizer and hired labour were over utilized, therefore, increasing quantity of seed would increase output while decreasing farm size, fertilizer and hired labour will increase revenue, and bring the production to optimal level.

Some of the constraints that were identified in the study area which tends to affect the sorghum production include pest and disease infestation, inadequate and high cost of inputs, poor timely distribution of such inputs to farmers and diversion of such inputs by government officials and politicians, poor management aspect by the farmers, poor extension services and delivery as well as land ownership system also creates problems among farmers.

5.2 Conclusion

From the findings of this study, it can be concluded that the farmers in the study area are making profits from sorghum production. This income is very low, and thus leads to low levels of saving and investment. Farm resources were not efficiently utilized for sorghum production in the study area. Improvement in the level of farm production and farm size holding requires proper understanding of the technical and socio-economic constraints facing the farmers, especially in the area of resource use and allocation. These farmers allocated their resources and chose enterprises based on their experiences without scientific approach.

To increase aggregate sorghum production in the study area and to meet national domestic supply, there is need for resource use adjustments and the need to give farmers opportunity to make rational decisions.

5.3 Recommendations

This study proffers the following recommendation:

i. Most farmers used local seed varieties. Improved technologies on sorghum in terms of seed varieties, seed rates, spacing, date of planting and fertilizer rate should be extended to farmers for adoption.

ii. Labour was the most predominant cost item on the farm, there is therefore need for research to develop low cost technology in terms of harvesting, threshing/winnowing that will reduce the level of labour input for various farm operations.

iii. Farmers (especially the small scale farmers) should be enlightened through extension services to make use of production factors. This will increase aggregate productivity.

iv. Most of the resources such as quantity of seed planted were under-utilized. This was attributed to limited capital, high cost and inadequate input supply. There is need therefore to provide financial support through small credit schemes to help farmers to expand their production.

v. Farmers should form co-operative societies so that they can obtain credit facilities from government or other agencies that perform such services.

vi. Finally, farmers should adhere to efficient recommended agronomic practices in order to maximize profit and minimize losses.

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QUESTIONNAIRE FOR SORGHUM FARMERS

SECTION A: PERSONAL INFORMATION (to be completed by sorghum producers).

(1). Date of interview…….

(2) District Area……...

(3) Village……

(4) Age of respondent:…..... In years

(5) Marital Status: (a) Single [ ] (b) Married [ ] (c) Divorced [ ] (d) Widowed [ ]

(6) Educational level:

(a) No formal education [ ]

(b) Primary School education [ ]

(c) Secondary School education [ ]

(d) Tertiary education [ ]

(7) How many children do you have?.....

(8) How long have you been farming?.....

(9) Are you the head of the family?.....

(10) How many people do you have in your household including yourself?

……..

SECTION B: SORGHUM PRODUCTION ACTIVITIES

(11) What is your primary occupation?.....

(12) What other occupation do you have?.....

(13) How do you acquire land?

(a) Through inheritance [ ] (b) By Purchase [ ]

(c) By lease [ ] (d) By gift [ ] (e) Others (specify)……

(14) What is the total size of your sorghum farm…….in hectares.

(15) If purchased, what is the cost of farm land? ……in ₦/ha

(16) If rented, how much did you pay annual? …… in ₦/ha

(17) What type of cropping system do you practice?

(a) Mixed cropping [ ]

(b) Sole Cropping [ ]

(c) Others (Specify) ……..

(18) How did you get your sorghum seed?

(a) AD.ADP [ ] (b) Market [ ] (c) Previous harvest [ ]

(d) Gift [ ] (e) Others (specify) …….

(19) What type of seeds did you use?

(a) Local variety [ ] (b) Improved variety [ ] (c) Both local and improved variety [ ]

(20) Please state the crops you grow last season with the hectares, amount of seed.

S/No	Crop	Area in hectares	Quantity of seed in kg/ha	Fertilizer used. in kg/ha	yield in kg/ha	Price/100kg
1	Sorghum					
2	Groundnut					
3	Maize					
4	Rice					
5	Millet					
6	Vegetable					
7	Others					

Please state the ones that are intercropped:…….

(21) Do you grow sorghum solely?.....

(22) What did you do with the produce?

(a) All consumed at home (100%) [ ] (b) Sold out all [ ]

(c) More than 50% was consumed at Home and more than 50% sold [ ]

(d) Less than 50% was consumed at home and more than 50% sold [ ]

(e) Other (Specify)…….

Information on hired labour used on sorghum farm.

(20) Do you use family labour on your sorghum farm?

(a) Yes [ ] (b) No [ ]

(21) IF yes, kindly fill in the table below.

Data on labour used on sorghum farm for 2010 cropping season

Operation	Adult male				Adult female				Children			
Farm operation	No. engaged in the operation	No. of days worked	No. of hrs work/ days	Cost of hired labour(₦)	No. engaged in the operation	No. of days worked	No. of hrs work/ days	Cost of hired labour(₦)	No. engaged in the operation	No. of days worked	No. of hrs work/ days	Cost of hired labour(₦)
Land clearing												
Land preparation												
Planting												
Weeding												
Herbicide application												
Fertilizer application												
Harvesting												
Other operations (specify)												

(25) Do you use hired labour on your sorghum farm?

(a) Yes [ ] (b) No [ ]

(26) If yes, please fill the table below.

Operation	Adult male				Adult female				Children			
Farm operation	No. engaged in the operation	No. of days worked	No. of hrs work/ days	Cost of hired labour(₦)	No. engaged in the operation	No. of days worked	No. of hrs work/ days	Cost of hired labour(₦)	No. engaged in the operation	No. of days worked	No. of hrs work/ days	Cost of hired labour(₦)
Land clearing												
Land preparation												
Planting												
Weeding												
Herbicide application												
Fertilizer application												
Harvesting												
Other operations (specify)												

(27) Please, fill the total amount of other input used in the table below

Input	Source of input	Quantity purchased in kg/Lt	Total amount (₦)
Tractor traction			
Animal traction			
Seed			
Herbicide			
Fertilizer			
Insecticide			
Bags			
Others (Specified)			

(28) Fixed Capital Assets

Input	Year of purchase	Life span of the item	Source of input	Quantity purchased	Cost per unit of item at the time of purchase(₦)
Hoe					
Cutlass					
Axe					
Rake					
Sprayer					
Bullock					
Others (specify)					

(29) Information on sorghum yield for 2009/2010 cropping season.

Variables	
Farm output (Kg)	
Quantity consumed (Kg)	
Quantity given out as a gift (Kg)	
Quantity sold (Kg)	
Price/100kg bags (₦)	
Transportation cost (a) Farm to house (₦) (b) House to market (₦)	
Time of selling produce (month)	
Other cost incurred (Specify)	

(30) In what type of market do you sell your sorghum?

(a) Rural market [ ] (b) Urban market [ ]

(c) Both [ ]

(d) Others (Specify) ……..

(31) Do you store your sorghum before selling?

(a) Yes [ ] (b) No [ ]

(32) IF yes, how do you store your sorghum?

(a) Local storage facility [ ] (b) Silos [ ]

(c) Bag [ ]

(d) Others Specify……..

(33) What is the total cost of storage ……..…… (₦)/ha

(34) What are your sources of farming income?

(a) Personal saving [ ] (b) Borrowed [ ]

(c) "Adashe' [ ]

(d) Others (Specify)……..

(35) If borrowed give the following information

Sources	Amount (N)	Interest rate (%)
Friend/relatives		
Commercial banks		
Agricultural banks		
Co-operative society		
Others (specify)…….....		

(36) Do you belong to cooperative society?

(a) Yes [ ] (b) No [ ]

If No why? .....

If Yes what privilege did you get from the society?.....

……

(37) How would you rate the interest charged on the loan?

(a) Low [ ] (b) Moderate [ ] (c) High [ ]

(38) Are there any other costs incurred during the production season that is not mentioned.

(a) Yes [ ] (b) No. [ ]

(39) If yes, please indicate and show the amount ……

(40) Do you have access to extension service?

(a) Yes [ ] (b) No. [ ]

(41) If yes, how often do they visit you?

(a) Weekly [ ] (b) Fortnightly [ ] (c) Monthly [ ]

(d) Not at all [ ] (e) Others (specify) ……..

(42) What was the price of sorghum per 100kg bag last year? ……. (₦).

(43) What was the total number of bags sold? ……100kg/bag.

(44) Do you think of expanding your farm?

(a) Yes [ ] (b) No [ ]

(45) If No, why?.....

SECTION C: PRODUCTION PROBLEMS

(46) What are the major problems you have?

(Please tick the problems encountered by you)

S/No	FARM PROBLEMS	TICK
1.	Inadequate credit facilities	
2.	High cost of inputs	
3.	Pests and diseases	
4.	Poor market outlet	
5.	Transportation cost	
6.	Access road	
7.	Inadequate improved seeds	
8.	Inadequate labor	
9.	High cost of fertilizer	
10.	Others (Specify)…….	

(47) What do you think are the causes of these problems?

.....

.....

(48) Suggest ways through which these problems can be solved.

……

……

……