EFFICIENCY ANALYSIS OF COTTON PRODUCTION IN GASSOL AND LAU LOCAL GOVERNMENT AREAS OF TARABA STATE, NIGERIA

BY

MUHAMMAD, BALA

(M.Sc/AE/08/0106)

JULY, 2012

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A THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION, SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY, MODIBBO ADAMA UNIVERSITY OF TECHNOLOGY, YOLA, NIGERIA, IN PARTIAL FULFILLMENT OF THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (M.Sc) IN AGRICULTURAL ECONOMICS.

JULY, 2012

DECLARATION

I hereby declare that the work in this thesis entitled "Efficiency Analysis of Cotton Production in Gassol and Lau Local Government Areas of Taraba State" has been performed by me in the Department of Agricultural, Economics and Extension, under the supervision of Dr. A.A.U. Jongur. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree at any university.

…….. ……

Muhammad Bala **Date**

DEDICATION

This thesis is dedicated to the entire family of Majidadi, to my wife, Haj. Hauwa Umaru and to my Children for their patience and constant supplication towards my educational struggles.

APPROVAL PAGE

We certify that thesis entitled "Efficiency Analysis of Cotton Production in Gassol and Lau Local Government Areas of Taraba State" was carried out by Muhammad Bala (M.Sc/AE/08/0106) and meets the regulations governing the award of Masters of Science in Agricultural Economics of the Modibbo Adama University of Technology, Yola and approved for its contribution to knowledge and literary presentations.

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ABSTRACT

This Study analyzed the efficiency of cotton Production in Gassol and Lau Local Government Areas of Taraba State. The specific objectives of the study were to: describe the socio-economic characteristics of cotton farmers, determined the profitability of investment in cotton production, determined the technical efficiency in cotton production, identified the sources of inefficiency in cotton production and examined the constraints affecting cotton production. Data were collected with the aid of structured questionnaires administered to 81 randomly selected farmers in the study areas. The data were analyzed using descriptive statistics, budgeting technique and stochastic frontier production function analysis. Result revealed that majority of farmers (67.9%) were young, mostly males (86.42%) and educated (86.41%). The result of the budgeting technique showed that the total revenue (TR), gross margin (GM), net Farm income (NFI) and Return on Investment (ROI) per hectare were ₦55,108.70, ₦21,128.70, ₦20, 008.70 and ₦0.62 respectively. The result of the stochastic frontier production analysis revealed that the variance of parameter gamma (γ) and sigma Squared (σ^2) of the production function were significant at 1% level of probability. The variance indicates positive and significant relationship at 5% level of

probability for agro-chemicals and family labour and 1% level of probability for fertilizer, labour and farm size. Mean technical efficiency index was 0.77 while the minimum and maximum technical efficiency were 0.37 and 0.97 respectively. The study also identified challenges faced by cotton producers which include low price of cotton seed and high cost of inputs among others. The study recommended that loans should be disbursed timely and adequately to cotton producers and inputs (Fertilizer) should be channeled through the community leaders in the study areas.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Cotton *(Gossipium SPP)* is a plant grown in warm countries that has a soft white hair around its seed used in textile industries, and of great importance to international trade (korcher, 1981, David and Adamu, 1991, Horton *et.al*, 2003). It remains the most important natural fibre of the 20th Century that contributed to the development of the Nigeria economy. Cotton is commonly grown under favorable condition e.g. Soil type and fertilizer requirements. Nigeria has experienced its peak period in cotton production in 2003/2004 with about 536,400 metric ton output. Since then production has been in decline due to price fluctuation, low farm income, pest infestation and primitive techniques of production (Muhammad, 2007).

The Nigeria's output of cotton in 2006/2007 was 631,500 bales (CBN, 2007). This shows that compare to that of 2003/2004 a decline in cotton production is being experienced in the country. To overcome future occurrence, the Federal Ministry of Science and Technology set up council known as the Raw Materials Research and Development Council (RMRDC, 2002) to work out ways of implementing the production of some specific crops; and cotton is one of them. In the council report, it recommended that a collaboration effort has to be made with Afcott Nigeria Plc Yola, Adamawa State, to improve on the seed variety so that high yielding and pest resistant variety would be available to the farmers.

Prior to council recommendation, cotton production in Afcott Nigeria Plc, which was established in 1986, has been on the increase. As Mshelia (1991) opined, there has been increase in the average output of farmers as follows: 1.230 tonnes/ha in 1988, 1.391 tonnes/ha in 1989 and 1.530 tones/ha in 1990, which in each case compared favourably with the National average of 250kg/ha.

Further decline in the output of cotton in the recent past made the then Nigerian's president Obasanjo's administration to come up with a new policy on revitalization of textile industries in Nigeria with a capital production taken 20 billion Naira through Cotton Development Committee with Hon. Minister of Agriculture and Rural Development as Chairman of the (CDC, 2005).

Table 1.1 Seed cotton output (000 tonns) and Annual Growth Rate in Nigeria (1991-2010).

Year	Output (metric ton)	Annual Growth rate (%)
1991 – 1994	1067	6.7
1995 – 1998	1241	61.7
1999 – 2002	1585	15.3
2003 – 2006	1551	4.24
2007 – 2010	1405	3.98

Source: Federal Ministry of Agriculture, (2007).

Observation has shown that there was a decline in cotton production in Nigeria after every four years. This endangered the future prospect of the Nigeria textile industries, which resulted into falling of the country's foreign exchange. The decline may be attributed to the oil boom in seventies, where it becomes prominent and took over from the agricultural sector in terms of relative importance in almost all aspect of Nigeria economic life. Subsequently, the agricultural sector becomes dormant and neglected (Argbokan, 2001, Aminu, 2004).

Prior to the oil boom, cotton was one of the main sources of foreign exchange and the second largest employer of labour after the Government sector (Gbadegesin and Uyoubisere, 1994). Cotton output, in 1973, was almost equivalent to the requirement of the textile industry (Andre and Beckman, 1978). However, twenty years later, cotton production in the country could only account 38 percent of the requirement of the Nigeria textile industry, while the remaining 62 percent was imported (Chukwendu, 1993).

Despite the fact that, Nigeria is a bonafide member country for international cotton adversary committee (ICAC, 2002), the quantity of cotton lint required by our spinning industries is always increasing in contrast to the supply (Mshelia, 1991). For Nigeria to maintain a stable domestic need as well as surplus for exportation, effort has to be made towards increasing output and efficiency in cotton production.

1.2 Problem statement

Agriculture is the dominant occupation in Nigeria; generally and in Gassol and Lau Local Areas of Taraba State in particular, whose ultimate goal is the attainment of self sufficiency in all of its sub-sector as well as the realization of the structural development of the rural areas and its overall socio-economic transportation. In order to achieve these goals, various efforts have been made to promote cotton production by individuals as well as private organization in the country (Idem, 1999). Such measures include the abolition of cotton marketing board in 1989 by the Federal Government of Nigeria.

This had favoured the producers of cotton as the degree of competition in the marketing system has increased, leading to the higher producer prices. For instance, the higher price fixed by the defunct cotton board for seed cotton was ₦850.00/tone for the 1985/86 season, while after the abolition in 1989 the average price of a tone of seed cotton has increased to ₦3000 (Olukosi and Isitor 2005). The abolition of commodity board paved way for the establishment of cotton merchants such as Afcott Nigeria (Plc) in Adamawa State in 1986, Wacot in Gombe, and other independent markets with Olam in Gombe State, Sinlag textile in Niger State, Adhila Plc in Kano State, e.t.c aimed at reviving cotton production in Nigeria.

Other efforts were the establishment of Institute for Agricultural Research (IAR) in Zaria with cotton as its mandate crop, and the National Accelerated Industrials Crop Production Programme (NAICPP) which was established in 1994. Despite all these taking measures, now a day cotton production in the country has still taken a down-ward trend as the gap between demand and supply is becoming wider and wider every year, hence supply does not equate demand (Mshelia, 1991).

The decline in the annual growth rate from 61.7% in 1995 – 1998 was 15.3% in 1999 – 2002 to 4.24% in 2003 – 2006 and to 3.98% in 2007 – 2010 (Table 1.1). This is a matter of the utmost concern, which, if the situation persist, the demand for our local textile industries can hardly be met. Therefore, there is a need to further investigation in to an efficiency analysis in cotton production by small-scale farmers as 80 percent of the cotton production in the country is done by small-scale farmers (Ibrahim, 2002).

1.3 Research Questions

This study focused on answering the following questions:

i. What are the socio-economic characteristics of the cotton farmers in the study areas?

ii. What are the costs and returns associated with cotton production in the study areas?

iii. Are the cotton farmers utilizing their productive inputs efficiently?

iv. Do the socio-economic characteristics of the cotton farmers affect their technical efficiency?

v. What are the constraints faced by cotton farmers in the study areas?

1.4 Objectives of the Study

The main objective of this study is to determine the efficiency of cotton production in Gassol and Lau Local Government Areas of Taraba State.

The specific objectives were to:

i. Describe the socio-economic characteristics of cotton farmers in the study areas;

ii. Determine the profitability of cotton production;

iii. Examine the technical efficiency of factors employed in the production;

iv. Analyze the influence of some socio-economics characteristics of farmers on their technical efficiency, and

v. Describe the constraints affecting cotton production in the study areas.

1.5 Research hypotheses

This study examined the following Hypotheses as:

$H_{01}: \beta_1 =$ The parameters estimates of explanatory variables are not significantly different from zero

$H_{02}: \beta_2 =$ There is no technical inefficiency effect in cotton production.

$H_{03}: \beta_3 =$ There is no significant effect of the socio-economic characteristics of cotton farmers on their technical efficiency.

1.6 Justification of the study

Farming can only function effectively within a framework of efficient production and other supportive services like research and communication (Adams, 1992). Therefore, the efficient utilization of cotton will lead to more output that would cater the high demand of cotton as a raw material to local textile industries in Nigeria, hence, its foreign consumption, which provides foreign exchange earnings for the country and generate employment opportunity; consequently, uplifting the socio-economic of the farmers.

The result of this study will be useful to policy makers for the formulation of policies especially towards the realization of textile industries in Nigeria. In addition, it will be useful in increasing the per capita income of the farmers, subsequently their living standard and improve seed production. The study will be useful to investigators, researchers and to students for further studies on cotton efficiency. It will also serve as a guide to enhance cotton production in Nigeria.

CHAPTER TWO

LITERATURE REVIEW

2.1 Origin and history of cotton *(Gossypium Spp)*.

Cotton is a plant grown in warms countries with soft white hair around its seed that is being use to make fabric and thread. The historical origin of its commercial exploitation, particularly with regard to textile uses is not known. However, its cultivation, which is commonly grown in Africa, originated from Asia and Central America (Gibbon and Pain, 1983).

The commercial cotton production in Nigeria was introduced during the colonial era, to provide raw material for the textile industries in Europe and to run the colonies of which Nigeria was one (Dittoh, 1980; Mshelia, 1991). The commercial cotton production was reconstituted under Royal Charter, to encourage the growing of cotton in the British Empire. In the same vein, the British Cotton Growing Association, in 1909, in conjunction with the department of Agriculture of Ghana, attempted to develop export industries of cotton in Northern Ghana (Dittoh, 1980). During the period of reconstitution of the British cotton growing association in 1904, cotton propagation was effectively encourage in Nigeria; whereby about 10.16 metric tonnes of different varieties of American cotton seeds were brought into the country. In 1909 Moor plantation which was the association's of cotton production was given to the Nigeria Government for experimentation work (Mshelia, 1991).

The domestic cotton that is being produced in the cotton producing area of North-West, which comprises Kaduna, Katsina, Kebbi and Sokoto States, is 60-65 percent of the total production. On the other hand, 30-35 percent is being produced in the North-East, which comprises Adamawa, Bauchi, Taraba and Yobe States. The North-Central, which comprises the Riverine areas of Benue, Niger, kwara and Plateau States have less than 5 percent of the total production (Mshelia, 1991).

2.2 Role of cotton production to economic development

ICAC (2003) report shows that cotton remains the most important natural fibre of the 20th century. This is because it represents 38 percent of the fibre market. In

terms of development, cotton is crucially important for future generation in the aspect of employment and in the international market, cotton is one of the most traded agricultural raw materials. It plays a critical role in West and Central Africa economies, which share total domestic products of 1.3 percent in Cameroun and 8.8 percent in Benin (Mshelia, 1991). The report further stressed that cotton plays significant role in export and contribute substantially to the employment of two million people in Burkina Fasso and 16 percent of the Malian population. Further, the report concludes that West and Central Africa produce 5 percent of the World cotton and the remaining 95 percent is exported within the region. That is why the region has been vulnerable to world cotton price fluctuations. Gbadegesin and Uyoubisere (1994) ascertain that, prior to the oil boom in Nigeria; cotton was one of the main sources of the Nigerian foreign ex-change and the second largest employer of labour after the public sector.

2.3 Demand and supply of cotton in Nigeria

Andrae and Beckman (1987) said that cotton output, in 1973, was roughly equivalent to the requirement of the textile industries. Twenty years later, cotton production in Nigeria could only account for 38 percent of the requirement of the textile industry and the remaining 62 percent was imported (Chukwendu, 1993).

Mshelia (1991) pointed out that cotton production in the country has taken a down-ward trend as the gap between demand and supply is becoming wider every year. This is because; the supply does not meet the demand, meaning that demand for raw materials cannot be met by our local textile industries. Since the deregulation of the market by the government, through abolishing the cotton marketing board, trading price of cotton is determined in an open market between buyers and sellers.

RMRDC (2004) reported that over forty textile mills and similar number of ginneries have received better price. In addition, consumption of cotton lint by textile industry in Nigeria is about 100,000 tonnes or 85,000 tonnes. This is an indication that textile mills in the county are forced to import 15,000 tonnes of cotton to cover the short fall in local supply, and for certain specific requirement for finer yearns that is not grown locally, for a simple reason that the local supply is not enough to meet the demand.

In addition, the report stressed that against a total demand of about 80,000 metric tonnes of lint per annum (that is 240,000 metric tonnes seed cotton) by textile mills the total production of lint has been less, thus resulting in a gap between demand and supply. It is expected that this gap will widen further as the steps taken by the government to revive the textile industry may lead to decrease in capacity utilization that have low demand of cotton production. Consequently, the initiative has led to an unprecedented process in price for the two consecutive seasons.

2.4 Profitability of cotton production

As a measure of farms net return from farm enterprises, Olukosi and Erhabor (1988) defined gross margin (GM) as the difference between the gross farm income (GFI) and the total variable cost (TVC) i.e, GM=GFI-TVC. This formula is used as a measure of profitability under the assumption that fixed cost is negligible as what obtains under the traditional farming system, and that the analysis is for a short term.

Mshelia (1991) carried out a study on the economic analysis of cotton in Nigeria, using Afcott out-growers scheme in Adamawa State as a case study. The study shows that cotton production is a profit venture given the assurance of prompt supply of labour and good market for the product. Aminu (2004) carrying out a study on the economic analysis of cotton production in Numan Local Government area of Adamawa State, revealed that cotton production is profitable, hence it should be embarked upon by farmers in the study area. Dittoh (1980), in a study on relative profitability of cotton indicated cotton as being the most rewarding crop to produce.

2.5 Theoretical frame work

The neoclassical theory of production is based on the notion of efficiency. The idea which gives the maximum possible output of a given quantity of inputs was emphasized in the textbook definition of a production function (Kumbhakar, 1994). As stated by Alimi (2000) that resources must be available and efficiently used in order to achieve optimum production level. The mission of increasing agricultural productivity to sustain food requirement, therefore, could be facilitated through efficient management of productive resources and this study is based on this theory.

As defined by shepherd (1985) that 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 of inputs. Helfand (2003) reiterated that the analysis of efficiency is generally associated with the possibility of the farms, producing a certain optimal level of output farm given bundle of resources or certain level of output at less cost. This indicated that production efficiency is the attainment of production goal without waste because economic built up variety of theories of efficiency with the basic idea of no waste.

However, the fundamental idea underlying all efficiency measures is that of quantifying 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 given bundle of input. Olayide and Heady (1982) maintained that resource use efficiency is definable in terms of individual resources, inputs or in terms of a combination of them. Ogunjobi (1999) outlined the importance of efficiency measurement to include: success indicator and performance measure by which production units are evaluated. The exploring of hypothesis concerning the sources of efficiency differential can only be possible by measuring efficiency and separating its effects from the effects of production environment and identification of sources of inefficiency is important to the institution of public and private policies designed to improve performance.

The crucial role of efficiency in increasing agricultural output by researchers and policy makers has remained an area of important research, both in developed and developing countries. This is particularly, so in developing economies where resources are meager and opportunity for developing and adopting better technology is dwindling (Ali and Chaudhary, 1990).

Shapiro (1983) stated that the reason behind the measure of efficiency is that if farmers are not making efficient use of existing technologies, the efforts designed to improve efficiency would be more cost effective than introducing a new technology as a means of increasing output. Bravo-Ureta and Reiger (1991) examined that efficiency measurement is important because it leads to a sustainable resource savings; which have important implications for both policy formulations and farm management. Tadesse and Krishnamurthy (1997) pointed out that productive

efficiency benefits economy by determining the extent to which it is possible to raise productivity by improving the neglected resource. Hall and Leveen (1978) reported that gains in efficiency are particularly important in periods to generate higher incomes, and thus stand a better chance of surviving and prospering.

2.6 The concept of production and production function.

Production is the conversion of input(s) into output(s). Olayemi (2004) defined production as the process of transforming production factor into output. Further, he stated that production represent a particular process, techniques or technology adopted in the transformation of production inputs into outputs. Olayide and Heady (1989), on the other hand, defined the production process as one whereby some good and services called input are transformed into goods and services called output. Olayemi (2004) summarized the four key production issues which shall be the focus of the entrepreneur to be: what and how much to produce, what and how much input to use, how to combined inputs to maximize profit and how to combine entrepreneurs to maximize profit.

The production function, on the other hand, stipulates the technical relationship between inputs and outputs used in production process. This function that is assured to be continues and differentiable in mathematical term, shows the mathematical relationship that describes the ways in which the quantities of an output produce depends on the quantity of inputs use. Economists use it to determined rates of return to the various factors of production. It expresses outputs as a function of variable inputs given the quantities of fixed inputs, which remain unchanged during a production period, that is;

$$Q = f\left(x_{1,} x_{2,} x_{3} .... x_{n} + 1, x_{n} + 2 \right) .... (2.1)$$

Where: Q = output

$x_1, x_2 .... x_n$ = Variable inputs

$x_n + 1, x_n + 2$ = fixed inputs for the production period.

2.7 Cost and returns in agricultural production

Olukosi and Erhabor (1988) said that cost refers to the value of inputs used in production or the expenses incurred in producing a particular amount of product, while return refers to the gains from production. In another development, Adegeye and Dittoh (1985) defined cost as the value of the inputs used in production and profit, as they said, is obtained by subtracting the cost from revenue. This implies that the more one produces the more will be the cost. As observed by Olayide and Heady (1982) production is aimed at maximizing output, maximizing profit, maximizing satisfaction, minimizing cost or a combination of some or all of them.

Cost in crop production are of two major categories: variable cost which refers to the cost of variable inputs or factors of production such as labour, seeds, fertilizer and so on (Ogungbile and Olukosi, 1989); and fixed cost which refers to the cost of physical assets such as buildings, tractors, rent interest or capital and breeding stocks. Spurlock and Gills (1997) stated that variable cost are those that are controlled by manager in the short-run and that will increased as total planned production is increased. Rahman and Lawal (2003) recommended that labour saving technologies should be introduced to farmers to cut down the cost of labour.

2.8 Efficiency studies

The concept of efficiency is concerned with the relative performance of the processes used in transferring given inputs into outputs. The study of productive efficiency started with the pioneering works of Farrell (1957) as cited by Ojo and Imodu (2000). Three types of efficiency were identified: technical, allocative and economic efficiencies. Technical efficiency is defined as the ability to achieve a high level of output given a similar level of production inputs. Allocative efficiency is 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 technical and allocative efficiency and occurs when a firm chooses resources and enterprises in such a way as to attain economic optimum. Adesina and Djato, (1997), Abdourahmane, *et.al;* (2001) defined economic efficiency as the ability to produce a given level of output using a cost minimizing inputs ratio.

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

proportion that do not lead to profit minimization. The authors further reported two measures of technical efficiency: Timer measure of technical efficiency which is the ration of actual output to potential output given the level of input use and Kopp measure of technical efficiency compares the actual level of input use to the level which could be used if a farm is located on the frontier given the actual output usage. Both measures yield substantially similar results (Russell and Young, 1983).

The analysis of efficiency is generally associated with the possibility of farmers producing a certain level of output at less cost. The analysis has fallen into two categories: parametric and non-parametric. The former is an approach that relies on the specification of the production function while the later is an approach which has advantage of imposing non-appropriate parametric restriction to the underlying technology (Adewuyi and Okunwadewa, 2001).

Bravo-Ureta and Rieger (1991) and Ogunjobi (1999) enumerated the importance of efficiency as follows: firstly, it is a success indicator and performance measure by which production units are evaluated. Secondly, the exploring of hypothesis concerning the sources of efficiency differential can only be possible by measuring efficiency and separating its effects from the effects of the production environment. Thirdly, identification of sources of inefficiency is important to the institution of public and private policies designed to improve performance.

2.9 Stochastic frontier production function

There are two types of frontier models: deterministic and stochastic model. The former is used to describe that group of method that assumed a parametric form of production frontier along with a strict one sided error term (Coelli, 1995), and example of such work are works of Aigner and Chu (1968); Afriat (1972) and Schimidt (1979). The deterministic frontier takes no account of the possible influence of measurement errors and other noise upon the shape and position of the estimated frontier, since all observed deviations from the frontier are assumed to be the result of technical inefficiency (Coelli, 1995). Aigner and Chu (1968) and Meeusen and Vanden Brock (1977) considered estimation of a parametric frontier production in input/output space and specified a Cobb-Douglas production in Logarithm for sample of N firms as $\ln(Y_i) = F(X_i,\beta)-U_i$ where $_i = 1,2 - - - N$

Aigner *et.al.*(1997) and Vanden Brock (1977) independently proposed the stochastic frontier production function where noise is accounted for by adding a symmetric error term V_i to the non negative error of the deterministic model (Tran *et.al;* 1993; Coelli, 1995). The parameters of this model are estimated by the maximum likelihood estimator (MLE) and corrected ordinarily least squares (COLS). The development and availability of automated maximum likelihood makes the ML estimator more preferred to the COLS estimator (Tran, *et. al*; 1993; Coelli, 1992).

The stochastic model specification not only addressed the noise problem associated with earlier deterministic frontiers, but also permits the estimation of standard error and test of hypothesis which were not possible with the early deterministic models because of the violation of maximum likelihood conditions. The main criticism of stochastic frontier is that there is no appropriate justification for selection of any particular distributional form for V_i.

The stochastic frontier model is widely used as tool of analysis in agricultural studies, in both developed and the developing countries of the world. Tadesse and Krishnamurthy (1997) estimated TE in paddy farms in Tamil Nadu using stochastic frontier model. The study shows that 90 percent of the variation in output among paddy farmers is due to difference in TE. Land animal, power and fertilizer have significant influence on the technical efficiency levels of the farmers. Ojo and Imoudo (2000) conducted a comparative study on production and technical efficiency of oil palm in Ondo State of Nigeria and found out that training of farm settlers increase their technical efficiency than those not trained and concluded that technical efficiency is positively correlated with training.

Another study is that conducted by Amaza *et.al*, (2001) on the factors that influence technical efficiency of cotton farmers in Nigeria. They conclude that the status of cotton farmers, credit and education are positively correlated with technical efficiency. Maurice *et.al;* (2004) examined the resource use productivity in cereal crop production among Fadama farmers in Adamawa state. The result indicates that the TE among the sample farmers ranged from 0.29 to 0.97 with mean TE of 0.8. Umoh (2006) conducted a study on resource-use efficiency in urban farming in Uyo, Akwa Ibom State, using stochastic frontier production function. The study found out that urban farmers were 70 percent technology efficiency with maximum technical

efficiency of 0.91 while minimum TE in urban farming was 0.43. 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 training experience and level of education increased the technical efficiency of farmers.

2.10 Socio-economic characteristic of cotton farmers

Socio-economic characteristics of farmers influence decision-making, availability and level of use of conventional inputs and technology of the farmers, which may contributes to or affect their productivity level include: age, level of education, marital status, land ownership, access to credit etc (Adebayo and Onu, 1999). The level of farmers' education is believed to influence the use of improved technology in agricultural production and hence farm productivity (Awolola, 1995). According to Renato and Euan (2004), education was found to be of significant factor associated with the technical efficiency of farmers, implying that human capital is an important factor in carrying out production and management tasks on cotton farms.

Adewuyi and Okunwadewa (2001) reported that the economic efficiency level of farmers was significantly affected by farming experience, farm distance, education and extension services. Abdullahi (1981) also noted that although the country is endowed with agricultural land, the system and ethnic boundaries makes it difficult for farmers to easily acquire land for agricultural purpose outside their cultural location. Therefore, the socio-economic factors of farmers may contribute to or affect their productivity.

2.11 Constraints to cotton production

Mentor and Elberhar (1991) attributed the challenges being faced by cotton farmers; which include: inadequate supply of improved seeds, pesticides, pest and diseases infestation, high labour cost, droughts and rosette epidemic and inadequate tractor hiring services among others. Yieldmaz and Ozkan (2004) revealed that labour is the most critical factor in cotton production as its insufficient supply in critical period could result in total failure in farming business. According to them, those with

large family size are put at the advantage side as compare to those who depends solely on hired labour.

Dittoh (1980) worked on output and hectarage response to price of wheat and cotton, using time series data, observed that statistical estimates of supply response have been too low because of incorrect formulation of price factor to which the farmers react. He pointed out that farmers react not only to the last year's price, but the price they expected and that does not wholly or even greatly depend on the last year's price.

Ibrahim (2008) identified the constraints associated to cotton production as: low price of seed cotton, highly cost inputs, shortage of labour, inadequate funds and insufficient extension agents. Olukosi *et.al*; (2007) noted that abolition of the crop commodity board has been a remarkable improvement in cotton production and its supply, indicating that the price of the produce is responsible for its supply. Onu *et.al;* (2000) have drawn attention in their study of cotton production in Nigeria, applying the stochastic production frontier model; that labour and material inputs are the major factors that are associated with changes in the output of cotton. They concluded that at 5 percent level of significance a 1 percent increase in labour would lead to a 0.39 percent increase in farm revenue and vice versa.

Olayide (1982) using lest square regression derived supply function from Nigeria main commodity export, cotton inclusive. Taking the exponential function as the lead equation for each of the three models, he concluded that the price elasticity of supply showed that if commodity marketing board pricing policies could be modified to allow world market price to influence production, higher responses will be obtained from commodity producers. Gwandi *et.al;* (2010) in their study work, which analyzed the efficiency of resource use in cotton production in Gassol Local Government Area of Taraba State, Nigeria, using the double log function, which gave best fit with R^2 of 82 percent indicated that quantity of fertilizer, seed quantity, agrochemicals and farm size are significantly the influence of cotton output.

From the review, it is evident that the major constrains affecting cotton production in the study areas are low price of seeds of cotton lint, high cost of input and inadequate credit facilities, among others.

CHAPTER THREE

METHODOLOGY

3.1 The study Area

The study was conducted in Gassol and Lau Local Government Areas of Taraba State. The state is located in north-eastern part of Nigeria. It is roughly between latitudes $6^0$30' and $9^0$36'N of the equator and longitudes 9^0 11' and 11 50'E of the Greenwich Meridian (Taraba State Government diary, 2010). The state has land area of about 60,291km^2 with a population figure of 2,300,736 people; comprising 1,199,849 males and 1,100,887 females respectively (NPC, 2006).

The State share boundaries with Bauchi State in the North and Gombe State in Nort-East, Adamawa State in the East and Plateau State in North-West. The State is further bounded to West by both Nasarawa and Benue States, while it shares an International Boundaries with the republic of Cameroun to the South and South East (Taraba State Government Diary, 2010). The State has a tropical climates marked by dry and rainy seasons, which start in April and ends in October. The wettest weathers are August and September, the dry season starts in November and ends in April. The mean annual rain fall rages from 800mm in the north to over 2000mm in the south. The minimum temperature daily recorded is 14.8^{0}C and the mean maximum temperature recorded is 34.4^{0}C (TADP, 2006).

The dominant soil group in the state are ferruginous (Gleric, Lurisol, Eutrict, Legosol and Ferric Lurison) found in the north and entisols along the southern part. The central part of the state is covered with vertisol and ultisols group (TADP, 2006). The vegetation cover of the state is guinea savannah. The topography is essentially marked with mountainous land traversed by the big river valleys such as Benue, Taraba, Donga Bibinu. The valleys of Mambilla and Fali mountains form part of the undulating landscape of the state. The state is predominantly agrarian in nature, with about 80 percent of its inhabitants depending on its subsistence farming practices mainly in food crops (TADP, 2006).

The climate, soil and hydrology of the study areas provided a conducive atmosphere for the cultivation of cash crops, grazing of animals, fresh water fishing and forestry. The rich alleviation tract of soil found in most part of the state makes Taraba State conducive for growing various foods and cash crops. The cropping system in the area is either mono cropping or mix cropping. The State is blessed with natural resources and geographical features (Agboola, 1979). Being referred to as nature's gift to the nation, the state has sixteen local government areas: Ardo-Kola, Bali, Donga, Gashaka, Gassol, Ibbi, Jalingo, Karim Lamido, Lau, Sardauna, Takum, Ussa, Wukari, Yorro, Zing. With Jalingo the state capital (Figure i).

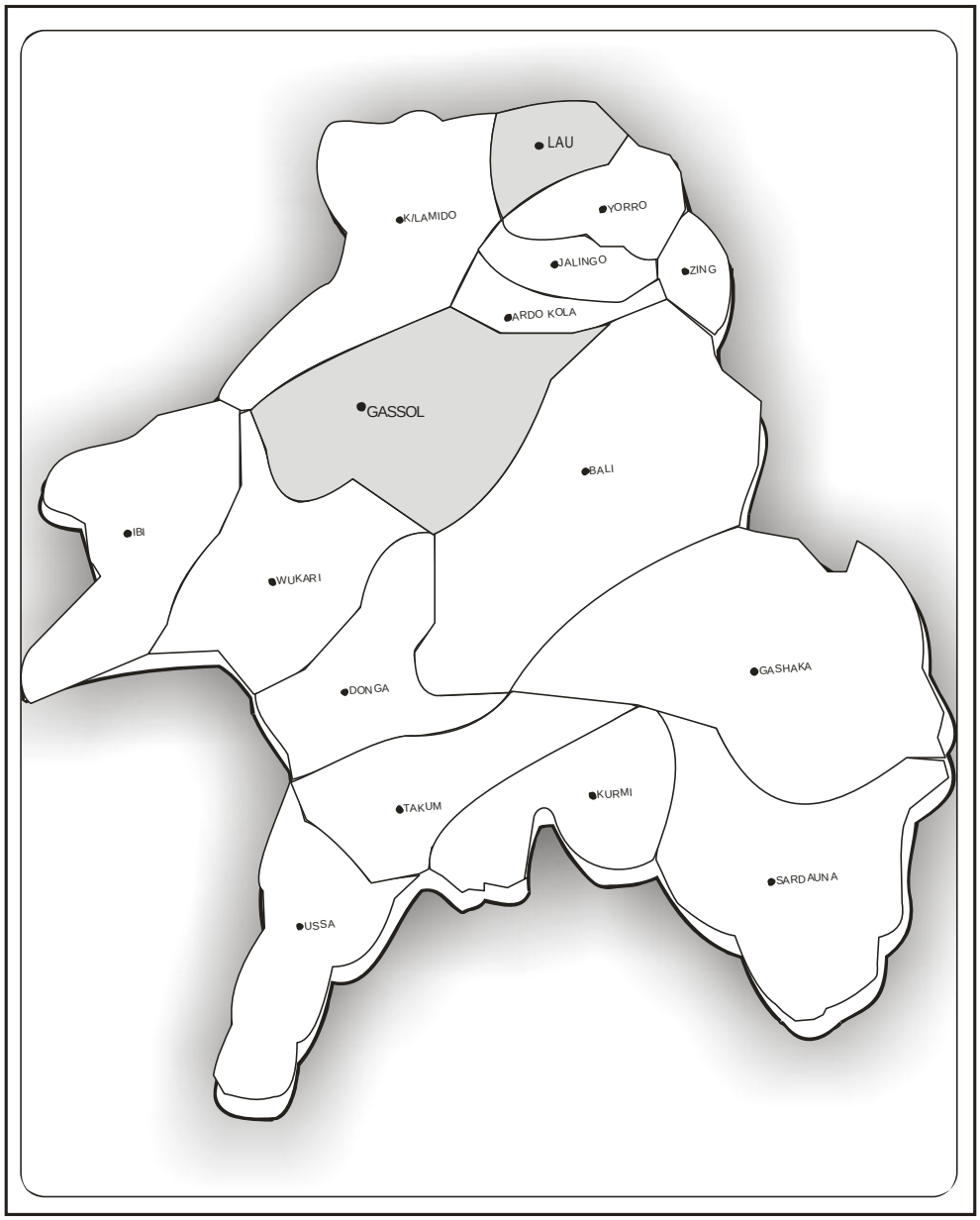

Fig. 1: Map of Taraba State.
Source: Taraba State Diary, 2010.

3.2 Source of data and sampling technique

Data for this study was obtained mainly from primary source; primary data was collected, using structured questionnaire administration. The data was collected from 81 cotton producers, using multi-stage sampling techniques, which involved the selection of Gassol and Lau Local Government Areas. The first stage involved the purposive selection of cotton growing district: Lau, Kunini, Abbare, Gassol, Kurmo, Lallami, (Figure ii).

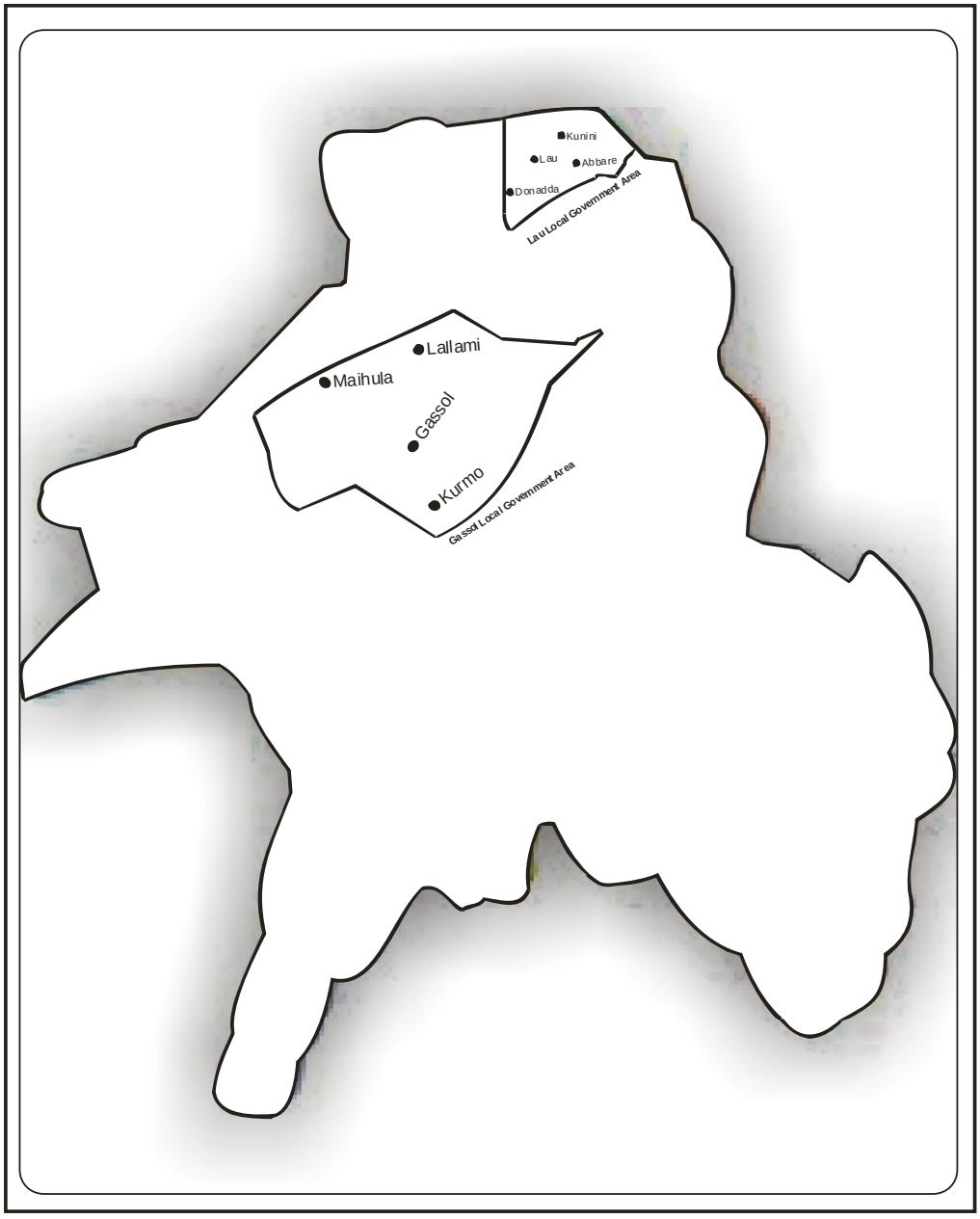

Fig. II: Map of Taraba State showing the Study Areas.
Source: Taraba State Diary, 2010.

The questionnaires were distributed in eight villages as the second stage of the sampling in proportion to the size of the district as the first sampling frame, (Table 3.2).

Table: 3.2 Selected Villages from Five Districts in the study areas.

Districts	**Number of Villages**	**Number of Villages selected**
Abbare	5	2
Mutum-biyu	5	1
Gassol	6	2
Lau	5	2
Kunini	4	1
Total	25	8

Source: Statistical records of the district headquarters of the two local government areas for the study (2010).

Using Afcott out-growers scheme as shown in table 3.3 below, the third stage was the random selection of a total of 81 cotton farmers by adopting a proportion; as adopted by Adebayo and Olayemi (2005).

Table: 3.3 Distributed questionnaires in eight villages

Districts	Population of Cotton Growers	Questionnaires
Abbare	255	15
Lallami	230	14
Lau	192	12
Kunini	185	11
Maihula	195	13
Donadda	150	9
Kurmo	83	4
Gassol	60	3
Total	1350	81

Source: Statistical records of Affcott out growers scheme, Taraba State (2001).

$S = P/p \times Q/1$ …….…… (3.1)

Where:

S = Total Number of respondents sampled.

P = Number of cotton farmers at each location.

p = Total population of cotton farmers in the study area.

Q = Total number the questionnaires to be administered.

3.3 Method of data analysis

The data collected was subjected to descriptive and inferential statistics. The descriptive statistic was used to achieve objective one and five of the study. Also, the descriptive statistics, like frequency and percentage, was used to describe variables and their occurrences among respondents. Mean was used as measure of central tendency. Gross Margin analysis was used in determining the profitability of cotton production among farmers. The inferential statistics involved the use of stochastic frontier production function, to determine the technical efficiency of cotton farmers in the study areas.

3.4 Gross margin analysis

This was used in determining the generated income from cotton production in the study areas. The gross margin gives the differences between the gross income and total cost of production (Adegeye and Dittoh, 1985). The value of production (i.e gross income) was obtained from seed cotton in Kg, whereas the variable cost was the cost of input, like fertilizer, labour, insecticide, transportation, herbicide and ploughing. The gross margin was explicitly stated thus;

$$GM = GFI - TVC \quad \ldots\ldots (3.2).$$

Where: GM = Gross Margin (₦/Ha).

GFI = Gross Farm Income (₦).

TVC = Total Variable Cost (₦/Ha).

Net return per output = $TR - TC\ (TFC + TVC)\ Q \quad \ldots\ldots (3.3).$

$$NFI = GM - TFC \quad \ldots\ldots (3\text{-}4).$$

Where:

NFI = Net Farm Income (₦/Ha).

TFC = Total Fixed Cost (₦/Ha).

Q = Total Quantity of Cotton (Kg).

3.5 The stochastic frontier production function.

The use of the stochastic frontier production function has some conceptual advantage in that, it allows for the decomposition of the error term into random error and inefficiency effect rather than attributing all errors to random effects (Xu and Jerry, 1998, Ojo, 2008).

It is specified as:

$Y_i = f(X_i{:}\beta) + (V_i - U_i)$ $i = 1, 2 \ldots\ldots N$ (Battese, *et.al*, 1992)………………………….3.5

Where: Y_i = an output of the i^{th} farm.

X_i = Vector of input quantities of the i^{th} farm.

β = Vector of unknown parameter to be estimated.

V_i = Assumed to account for random factors such as weather, risk and measurement error.

3.6 The empirical stochastic production model

The stochastic frontier production model used was specified as follows:-

$Log\ Y_i = \beta o + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + \beta_8 \log X_8 + Vi - Ui$ ……………………………………………………………….(3.6).

Where:

$Log\ Y_i$ = output (Kg of seed cotton of i^{th} farmer).

X_1 = Total land area under cultivation (Ha).

X_2 = family labour used in production (in Main day).

X_3 = hired labour used in production (in Main day).

X_4 = Quantity of Agro-chemicals (in litres) per Ha.

X_5 = Quantity of fertilizer (in Kg) per Ha

X_6 = Expenses on ploughing (Animal traction) in naira per Ha

X_7 = Quantity of cotton seeds (in Kg) per Ha

X_8 = depreciation on fixed cost items (n Naira)

V_i = Random noise (white noise) which are the $N(0, \sigma^2_v)$

Ui = are inefficiency effects which are non-negative, half normal distribution $N(\sigma^2_u)$

Note: The variable X_8 (depreciation on fixed cost items) was included because straight line method was used in computing fixed farm assets.

The corresponding cost frontier as used by Ogundari *et.al*; (2006) can be derived analytically and written in general form as:

$C = f(\rho, Y_i, \gamma_i) + (V_i - U_i)$ ……………………………………………………………….(3.7).

Where: C = Minimum Cost Used in the production of Y_i.

ρ= Vector variable of input prices.

f = suitable function form.

Y_i = Value of output in Kg.

$\propto_i$ = parameter to be estimated.

Using Sheppard's Lemma (Bravo-Ureta and Rieger, 1991); the minimum cost input demand equation is obtained as:

$$\frac{\delta c}{\delta p_i} = X_i(P, Y_i Q) \text{.............................} (3.8)$$

By substituting equation (3.6) and (3.7) into (3.8) yield the economic efficient of input vector X_e. The technically efficient input vector (X_t) and economically efficient input vector can be used to compute the cost of technically efficient (X_t, P) and economically efficient (X_e, P) input combinations with the firms observed output. The cost of farm's actual operating inputs combination is given as (X_a, P). These three cost measures are the basis for computing the following: technical, economic and allocative efficiency indices as explained by Bravo-Ureta and Rieger, (1991).

$$TE = X_t . \frac{p}{X_e} . P \quad \ldots\ldots\ldots\ldots (3.9)$$

$$EE = X_e \frac{P}{X_a} P \quad \ldots\ldots\ldots\ldots (3.10)$$

$$AE = \frac{EE}{TE} = X_e \frac{P}{X_e} . P \quad \ldots\ldots\ldots\ldots (3.11)$$

Where: TE, EE and AE are technical efficiency, economic efficiency and allocative efficiency, respectively.

3.7 The inefficiency model

It is assumed that the technical inefficiency effects are independently distributed and U_i arises by truncation (at zero) of the normal distribution with mean, U_{ij} and variance S^2, where U_{ij} is defined by:

$$uij = \delta_0 + \delta_1 z_1 ij + \delta_2 z_2 ij + \delta_3 z_3 ij + \delta_4 z_4 ij + \delta_5 z_5 ij$$

Where: U_{ij} = the technical inefficiency of the farmer.

Z_1 = Years of the farming experience.

Z_2 = Years of formal education.

Z_3 = Extension contact (number of meeting).

Z_4 = House hold size.

Z_5 = other occupation (where one indicate farming and zero otherwise).

(δ_0-δ_5 = Unknown parameters to be estimated).

The maximum likelihood estimates (MLE) of β and γ coefficients was estimated simultaneously using computer program frontier 4.1, where the variance parameters are expressed in terms of $\sigma_s^2 = \sigma_u^2 + \sigma_v^2$ and $\gamma = \sigma_u^2/\sigma_s^2$ (Coelli, 1994, Ajibefun, 1998).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter deals with the presentations, analysis and discussions of data obtained from Gassol and Lau Local government areas. These include socio economic characteristics of respondents, gross margin analysis, efficiency of farmers and the problems associated with cotton production in the study areas.

4.1 Socio-economic characteristics of the respondents.

4.1.1 Age distribution of respondents

The distribution of respondents according to their age groups, showed that most of the farmers are young i.e. 67.9 percent of cotton farmers are below the age of 41years. The mean age of the cotton farmers was 32 years. The preponderance of farmers in the cotton farming profession means that their productivity is expected to be high since they are expected to be active and energetic. This result is in conformity with Ibrahim (2002) who noted in his findings on resource use efficiency in small cotton production in Adamawa State that farmers in their active years are productive and can also easily adopt agricultural techniques (Table 4.1)

Table 4.1 Age distribution of respondents.

Age interval (years)	No of respondents	Percentage (%)
Less than 30 years	20	24.69
31-40	35	43.21
41-50	11	13.58
50 and above	15	18.52
Mean 32		
Total	**81**	**100**

Source: Field Survey, 2010

4.1.2 Distribution of respondents' sex

The sex distribution of respondents shown in table 4.2 revealed that most of farmers are males (86.42%) as against (13.58%) females. This indicates that men participate more in cotton production than their female counterparts (Table 4.2). The low percentage of women in cotton production may be explained by socio-cultural factors affecting women and not as a result of technical and managerial inefficiency. For instance, housekeeping and taking care of their children were among other socio-cultural factors affecting most women in the study areas (Table 4.2).

Table 4.2 Distribution of respondents' sex

Sex	No of respondents	Percentage (%)
Male	70	86.42
Female	11	13.58
Total	**81**	**100**

Source: Field Survey, 2010

4.1.3 Marital status of the respondents

Table 4.3 shows that 71.60% of the respondents were married whereas 18.52% were single. The result shows that married people are more in the cotton farming as compared to those who are single. This may be attributed to more family responsibilities such as catering for food, education of their children while single farmers face lesser responsibilities (Table 4.3).

Table 4.3 Marital status of the respondents

Marital status	No of respondents	Percentage (%)
Married	58	71.60
Single	15	18.52
Widowed/widower	5	6.17
Divorced/divorce	3	3.71
Total	**81**	**100**

Source: Field Survey, 2010

4.1.4 Distribution of respondents' family size.

Table 4.4 reveals that (86.42%) of farmers have family sizes of 1-10 people in their household while a few (13.58%) have more than ten (10) people. The mean of the family size was 6 people. The respondents' large family size is above the recommended average of four per family in Nigeria. The large family size is relevant to cotton production because family labour constitutes the highest form of labour supply in cotton production in Nigeria. (Ibrahim, 2002).

Table 4.4 Distribution of respondents' family size

Family size	No of respondents	Percentage (%)
1-5	49	60.49
6-10	21	25.93
11 and above	11	13.58
Mean		
Total	**81**	**100**

Source: Field Survey, 2010

4.1.5 Distribution of respondents' farm size.

Table 4.5 shows that most farmers (88.41%) had farm size ranging from 0.5-5ha while the remaining (11.11%) had farm size ranging from 6-10ha. This revealed that majority of the farmers are small scale farmers. This may be as a result of poverty situation where farmers are poor and can only afford to cultivate small parcel of land and obtain small output that could neither satisfy his consumption nor provide surplus for sale and investment and expansion of his farm. (Ibrahim, 2002).

Table 4.5 Distribution of respondents' farm size

Farm size	No of respondents	Percentage (%)
0.5-5	72	88.89
6-10	9	11.11
Total	**81**	**100**

Source: Field Survey, 2010

4.1.6 Literacy of the respondents

As shown in table 4.6, majority of farmers (86.41%) have been to school while only 13.59% have not been to school at all. Education has been found to be a vital component in technology adoption in agriculture (Alabi and Aruna, 2006). The study shows that most farmers know how to read and write. The mean age of schooling is 9 years meaning that most of the farmers have attained education above primary school level. It can be inferred that adoption of farming techniques may be easier as most of them would find it easy to read the specification labeled on the innovations. Consequently, this will help them to access relevant information that will enable in their production. (Alabi and Aruna, 2006).

Table 4.6 Literacy level of the respondents

Literacy level	No of respondents	Percentage (%)
Non-formal education	11	13.58
Primary school	20	24.69
Secondary school	25	30.86
Tertiary	25	30.86
Mean age of schooling		
Total	**81**	**100**

Source: Field Survey, 2010

4.1.7 Distribution of respondents' according to land acquisition methods

Table 4.7 shows that 43.21% of the land in the study areas was acquired by family inheritance, 25.93% by leasing, 18.19% by hiring and 12.67% through borrowing. The result reveals that majority (43.21%) of land which was acquired through family inheritance is a prevalent culture in Gassol and Lau local government case study, where land is owned by family list not individual. This would have a negative impact on the overall economy of Nigeria as persons who are willing to use the land they would find it difficult to do so because of land tenure system practiced in Nigeria.

Table 4.7 Distribution of respondents' according to land acquisition methods

Land acquisition	No of respondents	Percentage (%)
Family inheritance	35	43.21
Leasing	21	25.93
Hired	15	18.19
Borrowed	10	12.67
Total	**81**	**100**

Source: Field Survey, 2010

4.1.8 Distribution of respondents' farming experience

Table 4.8 shows the distribution of respondents' farming experience. The table indicates that majority of farmers (50.62%) have 11 years and above farming experience. The mean farming experience of 9 years, was indication that farmers had cotton farming experience and so can make use of the experience for improvement in their production (Table 4.8).

Table 4.8 Distribution of respondents' farming experience

Experience (years)	No of respondents	Percentage (%)
1-5	21	25.92
6-10	19	23.45
11 and above	41	50.62
Mean		
Total	**81**	**100**

Source: Field Survey, 2010

4.1.9 Distribution of respondents on visit by extension agent.

Table 4.9 shows that 81.49% of the respondents have been visited by extension agents while 18.51% have not been visited by any extension agent at all. This result revealed that the farmers are receiving the attention of the extension agents in the study area. The implication of this is that innovation adoption among farmers would be also high in Nigeria generally because of frequent contact with extension agent. That is why any producer that has contact with technological information that can improve their production and make use of the innovation will be more efficient than those who have no access to such technological information (Table 4.9).

Table 4.9 Distribution of respondents' visit by extension agent

No. of visit in weeks	No of respondents	Percentage (%)
No. visit	15	18.51
Once	21	25.92
Twice	19	23.47
Thrice	26	32.10
Total	**81**	**100**

Source: Field Survey, 2010

4.2 Gross Margin Analysis

The results of gross margin analysis, for the respondents are shown in table 4.10 and 4.11 respectively. The average variable cost/ha was ₦32,860.00 which represent 96.70% of the total farming cost while average fixed cost ₦1,120 represent (3.3%) of the total cost of farming. Thus the total cost of farming operation/ha was ₦35.76. The total revenue (TR), gross margin (GM) and Net Farm Income (NFI) per hectare of cotton were, ₦55,108.70, ₦21,128.7 and ₦20,008.70 respectively.

From these results, it can be deduced that cotton farming is a profit venture. This finding is in conformity with the finding of Mshelia (1991), Ibrahim (2002) and Ibrahim (2008). The return on naira invested by farmers in the study areas was ₦0.62 (Table 4.10).

Table 4.10 Estimated cost of inputs used by the respondents

Input	Quantity used by Respondents (a)	Unit price (₦) (b)	Total cost (₦) (a x b)
Variable Cost			
Clearing and ploughing	1 ha	4,250	4,250.0
Seeds	20kg/bag	32.5	650.0
Family labour	40 Man days	375	15,000.0
Hired labour	10 Man days	350	3,500.0
Fertilizer (NPK/urea one bag used	2500	1 bag of 50Kg	50.00Kg
Insecticide	2 liters	1250	2,500
Harvesting	950.1 Kg/ha	3.262/Kg	4,050
Transportation	20 bags of 50Kg	35.3/Kg	710
Sewing rope	1 bundle	150.00	150
Bagging/Sewing	20 bags	27.5/bag	550
Total Variable Cost			**32,860.00**
Fixed Cost			
Hoe	3	550	1650 (35)
Axe	1	1000.00	1000 (150)
Cutlass	1	500.00	400 (150)
Sprayer	1	4000.00	4000 (520)
Total Depreciation			(1120)

Source: Field Survey, 2010

Note: Depreciation values in parenthesis (…)

The Depreciation of fixed farm assets were computed using straight line method as shown below:-

$$D = \frac{P - S}{N}$$

Where:

D = Depreciation value in N

P = Cost of implement in N

S= Salvage value of implements or tools in Naira (20% of its original value).

N= Expected life span of implements/tools (5years was considered for life span of implements/tools).

Table 4.11 Average cost and returns to cotton farmers

Variables	**Value (₦)**
A. Variable cost	32,860.00
B. Fixed cost	1,120.00
Total cost of production	33,980.00
C. Returns	
Total average output	950.15kg
Average price/ha	58.00
Total revenue	55,108.70
Gross margin (TR-TVC)	21,128.70
NFI (GM-TFC)	20,008.70
Return on naira invested (R.O.I.)	0.62

Source: Field Survey, 2010

4.2.1 Results of factors employed in production

The maximum likelihood parameters results discussed are: results of the stochastic frontier production function, results of inefficiency model and variance of parameters.

4.2.2 Results of the stochastic frontier production functions analysis.

Table 4.12 shows the maximum likelihood estimates of the respondents. The results show positive relationship between the inputs such as agro-chemicals, fertilizer, family labour and farm size. The relationship is also statistical significant at 5 percent level of significance for agrochemicals and family labour and one percent for fertilizer and farm size respectively. Fertilizer coefficient has the highest value of 0.47, followed by family labour and farm size with 0.32 each.

The positive and significant relationship between agrochemicals, fertilizer, family labour and farm size indicated that if more agrochemicals, fertilizer, family labour and farm size are used in cotton farming, there will be more than proportionate increase in the output of cotton. Since fertilizer has the highest coefficient, it means that it increase can be more experienced in output of cotton farmers by increasing the kg of fertilizer applied to cotton farm than by increase in any other factor that influence cotton output as specified in this model (Table 4.12).

4.2.3 Result of inefficiency model

The result of the inefficiency model in Table 4.12 shows that the coefficient of the entire variable had negative sign. Farming experience and visitation by extension agent were statistically significant at 5%, while literacy level was statistically significant at 1% level significance. The negative and significant relationship of the variable in the inefficiency model suggests that inefficiency in production was less among cotton farmers. The signs and coefficients in the inefficiency model are interpreted in the opposite way such that a negative sign increase inefficiency and positive sign increase efficiency. This shows that some socio-economic characteristics have influence on the efficiency of farmers' output. Inefficiency parameters establish the fact that inefficiency of cotton production decrease with increases in farming experience.

4.2.4 Variance parameters

Table 4.12 shows that the estimate of variance parameter Sigma Squared (σ^2) is 0.82 and was statistically significant at one percent level of probability. Thus it is also significantly different from zero. This shows a good fit and correctness of the distributional form assumed for the composite error term.

Gamma (γ) is 0.56 which is statistically significant at one percent. This shows the amount of variation resulting from the technical inefficiency of the farmers. This means that more than 56% percent of the variation in farmers output is due to difference in technical efficiency. This implies that the ordinary least squares (OLS)) estimate will not be adequate in explaining the inefficiencies on cotton farming. The predicted technical efficiency varies across the respondents, ranging between 0.70 and 0.90 on the scale of maximum one with mean technical efficiency of 0.97. This implies that cotton producers are 97% efficient in the use of their input.

The returns to scale (summation of coefficients of land, family labour, agro-chemicals and fertilizer) were 1.15. Since the return to scale is greater than one, it suggests that the producers of cotton are operating at stage I in the production curve. At this stage, marginal physical product of cotton is greater than the average physical product (MPP>APP), meaning that the rate of input used into product is increasing and it reaches its maximum at the end of stage I.

Although this is a rational zone of production yet the point of diminishing returns or efficiency has not been attained. The farmers can only attain that point when Marginal Physical Product (MPP) is equal to Average Physical Product (APP) (MPP=APP) with elasticity equal to one, i.e. a one percentage change in input will produce a one percentage change in output. This is the point where farmers use minimum amount of variable inputs.

Table 4.12 Maximum likelihood of parameters of stochastic productions function for cotton farmers

Variables	Parameters	Coefficient	t-value
Constant	β_0	0.43*	0.365
Land (x_1)	β_1	0.32*	0.298
Labour (x_2)	β_2	0.32*	0.206
Agrochemical (lit)/h (x_4)	β_4	0.04**	0.213
Fertilizer (kg)/h (x_5)	β_7	0.47*	0.396
Inefficiency model			
Constant	δ_0	0.27*	-0.298
Farming experience	δ_1	-0.26**	-0.242
Literacy	δ_2	-0.61*	-0.393
Extension agent contact	δ_3	-0.47**	-0.264
Variance parameters			
Sigma squared	σ^2	0.82*	0.24
Gamma	γ	0.56*	0.37
Minimum TE	0.37		
Maximum TE	0.97		
Mean TE	0.77		
Returns to scale	1.15		
* Significant at 1 percent			
**Significant at 5 percent			

Source: Survey Data, 2010.

4.2.5 Frequency distribution of technical efficiency of cotton farmers

Table 4.13 shows the frequency distribution of technical efficiency of cotton farmers. The result shows that 80.25% of the cotton farmers fall to the range of 0.60 and above while 19.75% of them fall below the range of 0.60. The best farmer has a technical efficiency of 0.97 while the worst farmer has a technical efficiency of 0.37. The mean technical efficiency is 0.77, meaning that farmers (on average) were able to obtain 77% optimal output from a given quantity of production inputs. This implies that farmers were not efficient as their observed output was 23% less than the maximum output. This can be increased by 23% through improved resource allocation with no additional cost. The magnitude of a mean technical efficiency of the farmers

is a reflection of the fact that most of them carry out cotton production under technical condition involving the use of local inputs. The mode of the technical efficiency was 0.97 meaning that majority of the farmers had technical efficiency of 0.97 (Table 4.13).

Table 4.13 Frequency distribution of technical efficiency of cotton farmers

Range of technical efficiency		No of respondents	Percentage (%)
0.30-0.39		4	4.94
0.40-0.49		5	6.17
0.50-0.59		7	8.64
0.60-0.69		25	30.86
0.70-0.79		17	20.99
0.80-0.89		17	20.99
0.90-0.99		6	7.41
Minimum	0.37		
Maximum	0.97		
Mean	0.77		
Mode	0.97		
TOTAL		**81**	**100.00**

Source: Survey Data, 2010

4.2.6 Constraints associated with cotton production.

From Table 4.14 we can see that low price of seed of cotton ranked first as one of the major constraints faced by cotton farmers in the study areas. This represented 21.88%, pest and disease infestation ranked second with 21.09%, while high cost of inputs, inadequate funds, shortage of labour and insufficient extension agents occupied the third, fourth and fifth positions with 19.53%, 15.63%, 11.72% and 10.16% in that order.

This finding, is in conformity with the work of Dittoh (1980) who worked on output and hectarage response to price of cotton and wheat in North-eastern Ghana using time series data and observed that statistical estimate of supply response have been too low because of incorrect formulation of price to which the farmers react. In

the same vein, the finding is in line with that of Mshelia (1991), Aminu (2004) and Ibrahim (2002) who, also revealed that cotton farmers respond positively to price of seed of cotton in Adamawa State by cultivating more hectare of land the following year.

The high cost of inputs in the study areas may be attributed to low supply of inputs used, especially fertilizer and insecticide which directly affected yield negatively as compared to yield of 1500kg-2000kg/ha by intensified inputs used by its out growers scheme in Adamawa State (Mshelia, 1991)

The research also agreed with the findings of (Yilmaz and Ozkan, 2004) who discovered that labour is the most critical factor in cotton production as its insufficient supply in critical period could result in total failure in farming business. The inadequate funds may probably be the reason why farmers could not purchase more of fertilizer and insecticides because of vicious cycle of poverty experienced by most of the peasant farmers in Nigeria.

The insufficient extension agent is prevalent in most community of Nigeria today as one hardly see extension agent in villages. Even their demonstration plot or SPAT cannot longer be seen these days instead they are concentrated in towns and cities, where they can enjoy social amenities. This is a threat to agricultural growth and development as most farmers cannot supply correctly some agricultural innovations on their farms that require the attention of the extension agents.

Table 4.14 Constraints associated with cotton production.

Constraints	**No. of Respondents**	**Percentage**	**Rank****
Low price of seed of cotton/Lint	28	21.88	1
Pest and Diseases infestation	27	21.09	2
High cost of input	25	19.53	3
Inadequate credit facilities	20	15.63	4
Shortage of labour	15	11.72	5
Insufficient extension agent	13	10.16	6
Total	**128 ***	**100**	

Source: Field Survey, 2010.

* Multiple responses used.
**Ranks in descending order of magnitude.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF MAJOR FINDINGS

The study has analyzed the efficiency of cotton production in Gassol and Lau Local Government areas of Taraba State, Nigeria. Primary data were collected from 81 cotton growers using multi-stage, purposive as well as simple random sampling techniques in the selection of respondents. Data collected were analyzed using descriptive statistics, budgeting techniques and stochastic production function analysis. The findings revealed the following results:

The socio-economic characteristic of the respondents showed that most farmers (80.24%) are young with mean age of 32 years. Also, the study revealed that males are more than females in cotton farming. Majority of the farmers in the study areas are literates and mean family size was 6 people. The findings indicated that farmers' mean experience was 9 years. Most farmers operated within a farm size ranging from 0.5-5 hectares and had contact with extension agent and produced mean output of 950.15kg per hectare. The budgeting analysis revealed a gross margin and net farm increase of ₦21, 128.70 and ₦20, 008.70 per hectare while return on naira invested was ₦0.62.

The result of the stochastic frontier coefficients for land and fertilizer had the positive signs and only agro-chemical was statistically significant at five percent, the rest are significant at one percent. The positive signs indicated that an increase in any of them would lead to increase in cotton output. The parameters of inefficiency model revealed negative signs, indicating an increase in technical efficiency. The sigma squared (σ^2) was 0.82 represent good fit and correctness of the distributional form assumed for the composite error term. Gamma (γ) was 0.56 which shows the amount of variation resulting from technical inefficiencies of the farmers. This also means that 56 percent of the variation in farmers is due to their difference in technical efficiency.

The mean technical efficiency of the entire farmers was 0.77 which is less than one indicated that farmers were not operating on the efficiency range. These suggest that farmers' output can be increase by 23% by improving resource allocation. The

minimum TE index is 0.37 while the maximum is 0.99. The elasticity of production is 0.29 which is less than one, suggesting that cotton producers are operating at stage II in the production curve. This is the stage where marginal physical product (MPP) of cotton is less than the average physical product (APP). Although this is a rational zone, yet efficiency has not been attained. The problems that were found to be associated with cotton farming in the study areas includes: low price of seed cotton/lint, high cost of inputs, inadequate funds, shortage of labour, insufficient extension and pest and disease infestation.

5.2 CONCLUSION

Based on the results of the study, the following conclusions were drawn: male are more engaged in cotton farming and the farmers in the study areas were in their active age and educated. Cotton farming in the study areas was profitable. There is opportunity for cotton farmers to increase their efficiency by twenty-three percent, socio-economic characteristic have influence on the technical efficiency. The parameters of explanatory variables are significantly different from zero.

5.3 RECOMMENDATIONS

Based on the analysis of the findings, the following recommendations were made:-

1. Farmers should apply more fertilizers as it coefficient was the highest towards increase in output of seed cotton.
2. The distribution of the fertilizers should be done through community leaders to avoid diversion which gingers higher prices of the commodity.
3. A reliable marketing system should be put in place to curtail farmers' exploitation by independent/foreign marketers.
4. Agricultural Development Programmes of each state should stimulate and motivate extension staff to give the rural farmers the needed assistance on agricultural innovations frequently.
5. Financial institution should disburse loans timely and adequately to cotton producers in the areas since the return on naira invested can pay both principal and interest on current interest rate of 18%-19% by most commercial banks (Nigeria Agricultural Banks, WEMA Banks).

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APPENDIX I: RESEARCH QUESTIONNAIRE

INSTRUCTIONS:

Please kindly tick in the appropriate place ( ) or write where applicable.

Section A: Socio-economic characteristics of cotton farmers

1. Village/District:…….

2. Local Government Area:……

3. Sex: (a) Male [ ] (b) Male [ ]

4. Age:……. (Years)

5. Marital status: (a) Married [ ] (b) Single [ ] (c) Divorced [ ]

(d) Widow/er [ ]

6. If married how many wife(ves)?.....

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

8. Number of people in the household

   (a) Male children (less than 15 years)……..

   (b) Female children Less than 15 years).

9. Highest level of education attained:

   (a) Non formal education [ ] (b) Primary school education [ ]

   (c) Secondary education [ ]

   (d) Tertiary education [ ].

   (e) Others (Specify if any) ……

10. Occupation:

   (a) What is your main occupation?.....

   (b) Other minor occupations (in order of preference)
      (i) ……
      (ii) ……..
      (iii) ……
      (iv) ……...

11. How long have you been in the cotton farming business?:…… years.

SECTION B: COTTON PRODUCTION ACTIVTIES

12. How many hectares do you cultivate in a year?.....ha.

13. How many plots of farm land do you have?..... ha.

14. How do you acquire the land

    (a) Renting [ ]
    (b) Inheritance [ ]
    (c) Purchase [ ]
    (d) Others (Please specify):……

15. If the source of the land acquired is through renting how much did you pay/ha per year? ₦:…….

SECTION C: LABOUR DATA

16. Which type of labour did you use?

    (a) family labour [ ]
    (b) Hired labour [ ]
    (c) Both [ ]

17. If family labour. Kindly provide answers to the following questions in table below.

(17a) Information on family labour on cotton production.

Farm operation	**Adult male**			**Adult female**		**Children**
	No of days worked	No of hours worked/day	No of days worked/day	No of hours worked/day	No of days worked	No of hours worked/day
Land clearing						
Tillage						
Sowing						
Wedding						
Fertilizer app						
Chemical App						
Picking/Bagging						
Transportation						
Others						

(17b) if hired labour, provide answer to the table below:

Table 17b: Information on hired Labour on cotton production.

	Adult male			**Adult female**			**Children**		
Farm operation	No of days worked	No of hours worked/ day	Wages rate/day food money value ₦	No of days worked	No of hours worked/ day	Wage/rate day food money value ₦	No of days/ worked	No of hours worked/ day	Wage rate/day food money value ₦
Land clearing									
Tillage									
Sowing									
Wedding									
Fertilizer app									
Chemical App									
Picking/Bagging									
Transportation									
Others									

SECTION D: COST OF COTTON PRODUCTION

18 (a) Please fill in the following information on input used for 2010/2011 Cropping season.

Input	Amount/quantity per/hectare	Cost input used (₦)	Transportation cost (₦)	Total Cost (₦)
(i) Seed				
(ii) fertilizer (inorganic)				
(iii) Agrochemicals				
(iv) Tractor Hiring				
(v)Animal traction (Ox-drawn plough)				

b) **Fixed Capital Asset**

Item	Year of purchase	No owned	Cost per unit (₦)	Life span (years)	Total cost
i) Hoe					
ii) Axe					
iii) Cutlass					
iv) Rake					
v) Sprayer					
vi) Bullock					
vii) Others					
a)					
b)					
c)					

SECTION E: INFORMATION ON HOW COTTON YIELD AND SALES'

19. Please kindly provide answers to the questions in the table below:-

S/No	Items
I	Farm yield per hectare (kg)_____
ii	Price per kilogramme (₦)_____
iii	Total revenue (₦)_____
iv	Transportation cost_____
v	Time of sales (month)_____
vi	Other cost (please specify)_____

20. Do you have ready market for seed cotton (a) Yes [ ] b) No [ ]

21. If yes, which cotton processing industry patronizes your product in the 2009/2010 season.
   (a) Afcott [ ]
   (b) OLAM [ ]
   (c) WACOT [ ]
   (d) All of the above
   (e) Others (please specify:_____

22. Were you satisfied with the prize offered to you in 2009/2010 growing season? (a) Yes [ ] (b) No [ ]

23. If No why?_____

24. Were you a cotton grower before the establishment of the above cotton processing industries? (a) Yes [ ] (b) No [ ]

25. If no, why do you grow it now?_____
_____

SECTION F: INFORMATION ON SOURCE OF FINANCING COTTON FARMING

26. What is your source(s) of money for cotton farming?

   (a) Personal savings [ ] (b) Borrowing from friend and relatives [ ]

(c) Loan from banks [ ] (d) From money lenders [ ]
(e) Other Please specify: ……..

27. What is the Amount required/ha by lending agencies ……
28. Duration/gestation period for the loan ……
29. What is the interest rate charge by?
    (a) NACB……..
    (b) Commercial Bank …….
    (c) Lending Agencies ……..

SECTION G: CONSTRAINTS ASSOCIATED WITH COTTON PRODUCTION

30. Are you visited by extension agents? (a) Yes [ ] (b) No [ ]

31. If yes how often are you visited? (a) Once a week [ ] (b) Twice a week [ ] (c) More than twice a week [ ]

32. Which body renders you extension Services? (a) TADP [ ] (b) Ministry of Agriculture [ ] (c) Afcott (d) Others (please specify):……

33. What are your major problems in production and marketing of seed cotton in your locality?
    a) Low price of seed cotton [ ]
    b) High cost of input [ ]
    c) Labour shortage [ ]
    d) Inadequate funds [ ]
    e) Insufficient extension agents [ ]
    f) Land tenure [ ]
    g) Pest and diseases infection [ ]
    h) Manipulation by Local buying agents (LBAS) [ ]
    i) Others (please specify)……

34. Do you crop cotton with other crop?
    (a) Yes [ ]
    (b) No [ ]
35. If yes what are its problems on mixed or multiple cropping?
36. In what ways do you think the problems identified can be solved?
    ……
    ……
    ……

37. Generally what are the solutions you envisage on cotton production
    ……
    ……
    ……
    ……
    ……