INFLUENCE OF AGRICULTURAL MECHANIZATION ON CROP PRODUCTION IN BAUCHI AND YOBE STATES, NIGERIA

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DECLARATION

I, MAMMAN, ISA hereby declare that this Thesis titled "Influence of Agricultural Mechanization on Crop Production in Bauchi and Yobe States" had been written by me. It is a result of my own research work and has not been presented in any previous work for higher degree. The information derived from the literatures has been duly acknowledged in the text and list of references provided.

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Mamman ISA Date

(M.Sc/EDUC/0282/2009-2010)

CERTIFICATION

This Thesis titled "Influence of Agricultural Mechanization on Crop Production in Bauchi and Yobe States" by Mamman ISA has been read and meets the regulation governing the award of Degree of Masters of Science degree in (Agricultural Education) of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This Thesis is dedicated to my late father, Alhaji Madugu Isa, my mother Hajiya Habiba, my wife Mallama Maryam, and to my children Sa”adatu, Abdullahi and Isa.

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ABSTRACT

The study was carried out to determine the Influence of Agricultural Mechanization on Crop Production in Bauchi and Yobe States. Five specific objectives and five research questions were stated and five null hypotheses were formulated based on the research questions. The population for the study comprised of contact farmers from the five Agricultural Development Programme Zones in Bauchi and Yobe States. Multi-stage sampling technique was used to select three hundred and sixty-eight contact farmers. Questionnaire was used as instrument to collect data from the respondents. A four rating scale questionnaire was used for the respondents to indicate their degree of agreement or disagreement. The formulated null hypotheses were tested at 0.05 levels of significance. Percentage was used to analyse the bio-data of the respondents, while mean was used to answer the research questions. The answers from the research questions indicated that agricultural mechanization has a significant influence on crop production. The null hypotheses were tested using Chi square statistics. The results showed that they were all rejected because their calculated significant (p) values of 0.00 were lower than the 0.05 level of significance. The findings revealed that there was increase in crop yields, size of farm, income of the farmers and improvement in their standard of living. All the five null hypotheses were rejected. It was concluded that influence of agricultural mechanization on crop production was significant. The study recommended that mechanized farm tools and equipment should be provided to the farmers by the government in form of subsidy and ensures that it is the right category of farmers benefits. The study also recommended that there should be better funding of extension services programmes so that the extension workers can discharge their duty effectively.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

It has been well realized all over the world that in order to meet the food requirement of the rapid growing population and rapid industrialization, the mechanization of Agriculture is inescapable. The packages of mechanization technology include the use of more efficient and economical farm implements and machineries and suitable form of farm power. Mechanization requires appropriate machinery for ensuring timely field operations and effective application of various crop production inputs, utilizing human, animals and mechanical power sources. Equipments for tillage, sowing, irrigation, plant protection, harvesting, threshing and post harvest operations have widely been accepted by farmers. The key to economic development in developing countries such as Nigeria lies in raising the agricultural production. This can be achieved by bringing more land under cultivation. In this period of the nation agricultural development, more land can only be brought under cultivation if the important farming operations, such as tillage, planting, fertilizing, weeding and harvesting are mechanized.

Traditionally, the hand-hoes are the most commonly used implements or tools under peasant farming in many developing countries. These implements are used for wide range of field operations (Mushood, 2005). The need to supplement and possibly replace human labour with both animal and mechanical sources of power to boost production in Nigerian agricultural system has long been realized. This was more evident in the 1980s when the key intervention of the government was to make tractor services available to

farmers (Mushood, 2005). At Federal level, tax relief incentives were granted on most classes of imported farm machineries while at the State level, tractor hiring units (THU) were established for the purpose of acquiring, maintaining and hiring out tractors to farmers at subsidized hourly rates (Philip and Ezeh, 1988).

Agriculture is the basis of man's existence and it supports human beings through provision of food, clothing and raw materials. In the 1960's Nigeria was not only self sufficient in the agricultural food production, but the agricultural sector accounted for about 64% of the country's foreign exchange earnings and employed over 70% of the country's population. In Nigeria, despite the abundant water supply, favourable climate and wide areas of arable land, agricultural production is restricted due to inefficient methods of cultivation but yet contributed 32% gross domestic product(GDP) in 2001(Rank, 2010). The 'oil boom' period in the 1970s caused a long term negative effects on the agricultural sector which led Nigeria into importation of food worth $1.2billion in 1980s and the Agricultural sector's contribution to the country's GDP had declined from 63.4% in 1960 to unimpressive 18% in 2010.

The continuous failure of government's attempt to revamp agriculture through injection of huge amount of money into Agricultural Projects and programs such as: National Accelerated Food Production Programme (NAFPP) in 1972, Agricultural Development Projects (ADP) in 1975, The Operation Feed the Nation (OFN) in 1976 and establishment of the River Basin Development Authorities (RBDA) in 1986 that it was no longer a question of neglect alone. Since the early 1970s, efforts have been geared mainly towards tractorization. It is evident that this has not yielded the expected results

for a number of reasons. The reasons according to Bodet (1987) included lack of skilled operators and maintenance personnel, lack of suitable implements and spare parts and increase in the cost of tractors and implements.

Agricultural mechanization is the use of various power sources and improved farm tools and equipment, with a view to reduce the drudgery of the human beings and draught animals, enhance the cropping intensity, precision and timelines of efficiency of utilization of various crop inputs and reduce the losses at different stages of crop production. According to Olaoye and Rotimi (2010), the level, appropriate choice and subsequent proper use of mechanized inputs into agriculture has a direct and significant effect on achievable levels of land productivity, labour productivity, the profitability of farming, the sustainability, the environment and, on the quality of life of people engaged in agriculture. Amapu (2008) stated that for mechanization to succeed in rural areas government will have to increase the number of micro-finance houses with reduced interest rate to farmers. Amapu added that youths should be trained on the fabrication of simple farm tools and implements. By this practice, the youths would be self- employed and simple farm implements made available to farmers at reasonable prices. In recent years, there have been significant improvements in the design of farm tools and several types of tractors and implements are now available to replace the use of some hand tools.

Daramola et al stated that adoption of mechanization in crop production speeds up many farm operations. The use of modern farm machines reduces farm drudgery and encourages youths to participate in agricultural activities. Adoption of agricultural mechanization in crop production increases food production and the advancement of

rural economies. The need for increased adoption of mechanization by farmers has drawn attention of Agricultural Researchers in many countries to devote utmost interest and resource to engineering research in operations to minimize the drudgery, reduce labour intensities and unsanitary and inherent unhygienic handling that are involved in the traditional manual operations.

Crop production is a science called agronomy which is the branch of agriculture that treat the principle and practices of crop production and field management. Therefore better crop production follows adoption of new improved machineries and breeding of new crop varieties and other inputs like fertilizer. Four key factors influenced increases in the rate of crop production: more efficient use of labor; the timeliness of operations; more efficient use of inputs; and more sustainable productions systems. These four drivers played out at different rates in different crop production systems, but always led to more efficient systems with lower input costs. Technological innovations generally increased mechanization by integrating functional processes in a machine or crop production system and by making it possible for a farmer to manage increasingly large areas of land.

Aniedu (2007) noted that most of the essential farm inputs are rather not readily available or their cost is beyond the reach of most farmers. He equally observed other problems to include; lack of access to credit facilities, funding of research and inadequate storage facilities. The premise is that the level of technology prevailing in a given society reflects its capacity to optimize the use of natural and human resource in production (Nwaru, Onuoha and Onwukwalu, 2008). This low state of technology has been the problem of agriculture and technical progress in the states.

1.2 Statement of the Problem

The rapid population growth in Nigeria without corresponding increase in food production has resulted to food supply deficit, hunger and poverty (Adinya, 2001). Ike (2003) reveal that there is wide gap between what research findings have shown to be possible and feasible on one hand, and what actually obtain on the other hand. Ike further states that irrespective of the potentials and promises of any agricultural research findings the full potentials cannot be realized until full adoption by the farmers. Despite that a number of Agricultural Development Projects (ADP) has been set up by successive governments in the country (Nigeria). Tractors were made available to farmers either on hire or loan by the government and by few individuals and to some extent farmers have adopted some levels of mechanization.

Despite the fact that majority of the country's population are involved in various aspects of agricultural production, with the available resources on ground and huge amount of money injected in agricultural sector especially in agricultural mechanization, Nigeria still has to import large quantity of food, (Rank, 2010). Despite all the efforts made by the Bauchi and Yobe state governments to increase agricultural production through the provision of modern farm inputs such as, improved seeds, fertilizers, crop protection chemicals and machineries, the researcher observed that crop production in the study area cannot complement the huge efforts in terms of labour and cost expended on the overall activities on the farm. It is not uncommon to find peasant farmers selling their personal properties to buy fertilizers and hire labour for their farm at the onset of rainfall. It is also common to see peasant farmers buying farm products which they have been producing

from the open market to feed themselves few months after the harvesting season because they have run out of stock

Agriculture is a major occupation providing employment for about 70 percent of the people (Idrissa et al, 2008). Despite this, Nigeria is unable to produce enough food and fiber to meet her demand. This could be attributed among others, to the fact that majority of Nigerian farmers are subsistence smallholder farmers who cultivate between 1-2 hectares, which is usually scattered over a wide area (Akande, 2006).The wide spread hunger and malnutrition along with low and stagnating productivity in agriculture tends to be at the top of the list of food and agricultural concerns in developing countries. Food crisis has been the major problem of the rural households (Mohammed, Achem, Omisore, and Abdulquadri, 2009).

It has been reported (Faborode, 2001) that less than 2% of the agricultural production in Nigeria is mechanized in the real sense, leaving 98% of the production in the hands of traditional producers. The effect of this dependence on hand tool technology is low output and the technology cannot transform agriculture (Akande, 2006). It is very clear that the production is not enough to meet the demand of the growing population in the states. This production pattern in which the farmers cannot feed themselves not to talk of surplus for market to meet up with other necessity of life, this means that there are problems with the present production. It is based on these problems that the researcher deemed it necessary to carry out a research to determine the influence of agricultural mechanization on crop production in Bauchi and Yobe States with a view to increase crop productivity

1.3 Objectives of the Study

The main objective of this study was to determine the influence of agricultural mechanization on crop production in Bauchi and Yobe states. While the specific objectives were to:

1. determine crop yield per hectare influence by agricultural mechanization on crop production in Bauchi and Yobe States.
2. determine the influence of agricultural mechanization on the income capability of the farmers in Bauchi and Yobe States.
3. determine the influence of agricultural mechanization on the farm size cultivated by the farmers in Bauchi and Yobe States.
4. ascertain farmers' perception of the influence of socio-economic characteristics on mechanized crop production in Bauchi and Yobe States.
5. determine the influence of agricultural mechanization on the farmers' standard of living in Bauchi and Yobe States.

1.4 Research Questions

The study provided answers to the following research questions;

1. What is the influence of agricultural mechanization on crop yield per hectare of farmers in Bauchi and Yobe States?
2. What is the influence of agricultural mechanization on the income capability of crop producing farmers in Bauchi and Yobe States?

3. What is the influence of agricultural mechanization on farm size cultivation for crop production in Bauchi and Yobe States?
4. What is the influence of socio-economic characteristics on mechanized crop production in Bauchi and Yobe states?
5. What is the influence of agricultural mechanization on the farmers' standard of living in Bauchi and Yobe States?

1.5 Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 levels of significances:-

1. There is no significant influence of agricultural mechanization on crop yield per hectare of farmers in Bauchi and Yobe States
2. There is no significant influence of agricultural mechanization on the income of crop producing farmers in Bauchi and Yobe states.
3. There is no significant influence of agricultural mechanization on farm size cultivated for crop production in Bauchi and Yobe states.
4. There is no significant influence of mechanized crop production and socio economic characteristics of farmers in Bauchi and Yobe states
5. There is no significant influence of agricultural mechanization on the farmers' standard of living in Bauchi and Yobe states.

1.6 Significance of the Study

It is hoped that the findings of this research would be of benefit to the farmers, Bauchi state government, Yobe state government and the Federal government of Nigeria. The finding of this study would also create awareness among the farmers on the need of adopting mechanized crop production techniques which would improve their standard of living.

The findings will also be useful to ministry of agriculture for planning and shaping its mechanization projects and service delivery to the farmers so as to optimize crop yield. It will also be of great benefits to graduates of agriculture to consider enrolling in agricultural related programmes that are meant to provide employment for the youth in Bauchi state, Yobe state and the country at large. Furthermore, the finding would be of benefit to research institutions by the provision of useful recommendation.

1:7 Basic Assumptions of the Study

The study was based on the following assumptions that:

(1) Agricultural mechanization has increased the farmers' crop yield per hectare.

(2) Farmers' standard of living is influence by the agricultural mechanization on crop production.

(3) There is an increase in the size of land cultivated as a result of mechanized crop production.

1:8 Delimitation of the Study

The study was delimited to Influence of agricultural mechanization on crop production in Bauchi and Yobe States. The study was also delimited to production of millet, cowpea, groundnut, and sorghum, because they were major and most commonly grown crops in the area under study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The review of the related Literature was presented under the following sub-headings:

2.1Theoretical Framework

2.2 Meaning of Agricultural Mechanization.

2.3 Brief History of Agricultural Mechanization in Nigeria.

2.4 Problems of Agricultural Mechanization in Nigeria

2.5 Roles of Agricultural Mechanization and effects of Tractorization on Farming

2.6 Standard of Living of Farmers

2.7 Yields of Crops

2.8 **Adoption of Technology**

2.8.1 Adoption of Improved Farming Practices.

2.8.2 The Adoption Process for Mechanization

2.9 Crop Production

2.10 Factors influencing mechanized Farming and Farm Size Ownership in Nigeria

2.11 Empirical Studies.

2.12 Summary of the Reviewed Literature

2.1 Theoretical Framework

The theoretical background for this study is based on theories of social changes which stipulated that society's exhibited two kinds of forces: those which seek to promote change and those that strive to maintain the status quo. These forces are locked in perpetual combat, the former trying to throw the later off balance to gain ascendancy, and the latter trying to prevent this from happening". Strauss (1959) in Muhammad (2011) added that the essence of human life is change, development and growth. The process of change involves interaction with forces which are elements of change. The process of integrating these ideas will provide a sort of road maps towards adoption of new ideas, which will provide solution to present challenges and prevent obstacle to the realization of objectives. Social changes is either planned or unplanned, changes is considered social when it is wide spread affecting societal pattern of daily life or structure of its institutions. Rogers (1971) was of the view that imminent /or internal social change occurs when members of social system with little or no external influence create and develop a new idea which then spreads within the system, while on the other hand contact changes occurs according to Rogers, when sources external to the social system introduce a new idea. It may be either selective or directed. Selective contact results when members of social system are exposed to external influence and accept or reject a new idea from that source on the basis of their needs. The directed social change, or planned change, is coursed by outsider who on their own or as representatives of change agencies, intellectually seek to introduce ideas in order to achieve goals they have defined.

The theory of social change was used to examine factors affecting adoption of technologies by the farmers; of which increase in production of food in both quantity and quality is the philosophy behind the policies. The significance of social change to this study is therefore the planned change an interventionist perspective that seeks to introduce ideas to achieve set goals. The planned change in this study is the infusion of ideas to change the existing practices which are "unproductive" to some level, and to create awareness for the adoption of improved technologies with the specific objectives of altering the undesirable practices which are not meeting the challenges of modern farming practices and sustainable development ,(Spore, 2011).

Muhammad (2011) observed that all societies were at a particular developmental stage "Traditional" and that traditional societies would experience similar changes at it has happened to those societies in developed nations which eventually become "Modern". He further added that some writers who emphasized transformation of cultures believed that ebbed in the traditional society where cultural practices believed to be barriers to development. In order to develop, these cultural barriers have to be removed, most especially those cultural practices that breed conservative ideology.

2:2 **Meaning of Agricultural Mechanization**

Agricultural mechanization may be interpreted in several ways. To some, it is synonymous with tractorization, while others take it to imply increase in production per worker and per hectare of land cultivated. Therefore, the term "Agricultural Mechanization" can be defined as "a system in which farm machines are used instead of human labour" (Uguru, 1981). Rijk (1989) said, "Agricultural mechanization embrace the use of tools, implements and machines for agricultural land development, crop production, harvesting, preparation for storage and on-farm processing". Agricultural mechanization can be defined as the use of machine instead of human effort for agricultural production, processing, handling, preservation and storage .Agricultural mechanization is not an end but a means of eliminating drudgery in farming and encouraging increasing food production.

According to Spore (2002), agricultural mechanization will bring about changes in production methods, logistics and equipments. There is the need to adopt processes and tools to the mechanics of elderly and youthful bodies alike. The ergonomics option involves technological development of production tools and equipment as well as improvement in the harvesting, handling and processing methods in order to reduce drudgery and make agricultural production processes more attractive. Odigboh (2000), further defined agricultural mechanization as the use of machine, any machine, to accomplish a task or an operation involved in agricultural production. Such tasks or operations according to Odigboh,(2000) included reduction of human drudgery, improvement of timeliness and efficiency of various agricultural operations , bringing

more land under cultivation, preserving the quality of agricultural products, providing better rural living conditions and markedly advancing the economic growth.

Also, Nigerian Educational Research and Development Council (NERDC, 1991) defined Agricultural mechanization as the art and scientific application of mechanical aids for increased production and preservation of agricultural produce with increased efficiency and less drudgery. Gifford (1992) viewed agricultural mechanization as the manufacture, distribution and operation of all types of tools, implements, machines and equipments for agricultural land development, farm production and crop harvesting and primary processing. Also Mijindadi (1994) defined agricultural mechanization as the application of better and more efficient hand tools draught animals drawn implements as well as motorized equipments to reduce human efforts(drudgery), improve timeliness and the quality of various farm operations thereby increasing yields and raising the quality of products and the general efficiency of farm holdings.

Daramola, Igbokwe, Mosuro and Abdullahi, (2000) defined agricultural mechanization as the use of labour saving machinery in agricultural production. Also Iwena, (2007) defined agricultural mechanization as the application of engineering principles and technology in agricultural production, storage and processing on the farm. Agricultural mechanization in the broadest sense refers to the application of engineering, scientific and technological principles in the development and application of labour saving and productivity increasing devices such as machinery, improved breeds of animals and varieties of crops, husbandry methods and production inputs in production, storage and processing on the farm. It is applicable to land preparation, planting, husbandry, fertilizer

application, weeding, crop health, irrigation and crop harvesting, storage and processing and rearing, care and feeding and animal health as well as storage and processing of the produce in order to add value (Are, Igbokwe, Asadu, and Bawa, 2010).

From these definitions, agricultural mechanization is one of the various ways of agricultural development. Therefore, any attempt to give a complete analysis of the economies of mechanization would have to include the use of hand tools, machines as well as the use of draught animals and the corresponding implements to reduce human labour and increase the efficiency of production.

2:3 Brief History of Agricultural Mechanization in Nigeria

The use of animal draft force was first demonstrated in Nigeria in Daura in 1922 (Alkali, 1969). Serious attempt to introduce mixed farming started in northern Nigeria in 1926 (Holmes, 1938). According to Musa (1978), there has been attempt to introduce donkeys into soil cultivation operations, but after training, it was found that the load-carrying capacity of the donkey could be increased by 5 times by the use of a cart .According to Kalkat and Kaul (1983), horses are also used in Nigeria as draft animal but only to small scale sugarcane crushing and processing. The first animal drawn implement introduced in Nigeria was a wooden plough. As from 1934, these were replaced by steel ridging ploughs because of their durability (Holmes, 1938). Alkali (1969) added that this ridger was used for almost all tillage operations from ridge splitting, ridging, remolding, weed control to groundnut lifting. It was thought that Nigerian mixed farming required a multi-

purpose tool bar which would offer as many attachments as possible for different tillage operations and could be drawn by the local work bulls.

Sporadic efforts were made towards its importation and local development in Daudawa and Samaru but the results were unsatisfactory. The Emcot ridger manufactured by the John Holt Agricultural Engineering Company in Zaria was introduced in the mid-1960s and the Ariana and unibar toolbars such as Arara, occidentale and Kazaure were later introduced to the Nigerian Farmers and were available for technical evaluation at the Institute for Agricultural Research (IAR) (Alkali, 1969). Musa (1978) stated that from the early 1970s when sales of petroleum expanded Nigeria's foreign reserves efforts tended to shift from animal sources to mechanical power sources .Tractor mechanization approach was introduced in 1970s, but this failed because the small scale farmers were neglected in the scheme and because the tractors, implements and spare parts had to be imported with scarce foreign exchange. According to Bodet (1987), this failure led to the adoption of Animal Traction (AT) technology by the small scale farmers. However, with the present high cost of tractors, the best alternative is animal power. He added that more efforts need to be made by government organization and research institutions towards the development of other appropriate animal drawn implements for farm operations such as harvesting, water lifting and threshing. This will help animal power to make yet more impact on Nigerian agriculture.

2.4 Problems of Agricultural Mechanization in Nigeria

Since the early 1970s, efforts have been geared mainly towards tractorization. It is evident that this has not yielded the expected results for a number of reasons including lack of skilled operators and maintenance personnel, lack of suitable implements and spare parts and increase in the cost of tractors and implements (Bodet, 1987).Youdeowei (1990), in contributing to the problem of agricultural mechanization pointed out that absence of incentives for indigenous design and manufacture of farm equipments by the government militate against the adoption of agricultural mechanization. He added that some of the major problem facing farm mechanization in developing tropical countries included poor credit facilities and lack of classified data and information on the suitability, adaptability and performance of commercially available agricultural equipments to the prevailing types and condition of soil.

In order to realize the full benefit of agricultural mechanization, overall technological development of the country is necessary. This means the availability of improved crop varieties, fertilizer and storage facilities as well as transportation system to distribute and market agricultural produce (NERDC, 1991).Smith (1994) stated that a farm mechanization innovation will only be accepted by farmers if it provides a solution that the farmer is actively seeking. This means that it must be compatible with the farming system and the needs of the farmer taking technical, social and economic factors into account. According to Ogeiva (1998), technical know-how and seasonality of farm operation were the problems confronting the adoption of agricultural mechanization by the farmers. A number of farmers are illiterate and cannot read the instructions attached

to the machines concerning their operations. The mode of operation of farm machines is too tedious to be learnt. Also agricultural practices are seasonal in Nigeria and machines only work in the rainy season, machines can rust and get damaged during the dry season. All these served as hindrance on the adoption of agricultural mechanization.

Daramola (2000) said, machinery remains idle after the cropping season and this makes their purchase uneconomical. Anyanwu (2008) added that the available machines were not enough to reach all those who would like to hire them. The problem that militates against the mechanization of agricultural mechanization in rural areas is that farmers were poor and lack the money to purchase the machines. Also, poor topography of the landscape leading to malfunctioning of the machines and the machine may breakdown hindered the adoption agricultural mechanization. Traditional farming system does not give way to complete mechanization. That is, mechanization can be employed only in land preparation in mixed cropping system. Amapu (2008) added that scarcity and high cost of purchasing and hiring machines, lack of access to loan scheme by the farmers, poor knowledge of extension agents in engineering and land tenure system. Amapu added that the individual farm-size of the farmers are too small for the deployment of motorized farm implements such as tractors and this is because ownership of land is predominantly through inheritance.

2.5 Roles of Agricultural Mechanization and impact of Tractorization on Farming.

Agricultural mechanization plays important roles in agricultural production such as increased working capacity and speed of execution are proof of the technical roles of mechanization (FAO, 1988). Rijk (1989) reports that, “mechanization contributes to

increase in food production, productivity and advancement of rural economies". The use of machines makes possible some jobs which the farmer could not otherwise undertake such as rapid clearing of forest, ploughing in dry weather in order to plant with the early rains and green manuring on a field scale According to Youdeowei (1990), the roles of agricultural mechanization are to increase the farm output per human hour and to reduce spoilage, waste and other losses of agricultural produce. They added that land abandoned because of inappropriate use or inadequate capability to use can be reclaimed through mechanization. According to Ugochukwu, Otegbade, Okeke, Suleiman, Idriss and Patrick (2007), agricultural mechanization has led to increase in production and efficiency of farm operations. They added further that agricultural mechanization made person to specialize in agricultural operations. This will in turn lead to mastery in agricultural skills with a positive effect on increase production. With mechanization, the farmer is able to accomplish his tasks with ease and in good time.

Therefore, Agricultural mechanization may reduce the economic pressure that resort to bad agricultural practice such as the complete burning of all vegetative covers on new land and yet make it possible for the farmer to cultivate many hectares of land during a single season. Also, Anyanwu et al; (2008) stated that agricultural mechanization increase the profit margin of the farmer and also it makes possible for the farmer to make use of optimum production period. In addition, mechanization improves the quality of farm products in terms of taste, yield, processing and storage (Daramola, 2000). Mechanization therefore eases and speeds up many farm operations. The use of modern farm machines reduces farm drudgery and prevents the youths from not involving in

agricultural work it is however very expensive in capital cost and as farms in west Africa are poorly cleared of stumps, rocks etc. wear and tears on farm machines is very rapid and operating costs are consequently high. Also, Are et.al (2010), outlined the following as advantages of agricultural mechanization:

(a) Increased area and number of livestock: It increases the hectare under cultivation and the stock reared per head.

(b) Timeliness of operation: Agriculture is a time bound operation especially in a rain fed system. Mechanization ensures that all farm operations are carried out and completed within a short period of time.

(c) Increased productivity: It improves production efficiency by reducing cost per unit of product.

(d) Labour saving: mechanization substitutes human labour to a large extent in many farm operations. The labour so saved can be deployed in other sectors of the national economy.

(e) Reduced drudgery: It reduces the drudgery associated with farming and therefore it is more likely to attract young people into agriculture.

(f) Reduces human hazards: mechanization reduces the chances of damage to the health of farm hands especially those posed by working long hours, pests and diseases and the use of manual tools.

(g) Discourages unsustainable cultural practices: It discourages some cultural practices that may lead to land degradation such as bush burning and uncontrolled grazing.

(h) Increases farm revenue: Increased area of production and increased productivity often translate into increased yield and hence increased revenue for the farmer.

(i) Improved quality of farm products: Mechanization improves the quality of the farm products in terms of taste, yield, processing and storage. For example through mechanical sorting of rice grains and stones, the quality of rice can be improved and made ready for cooking.

(j) Large -scale production: It encourages large-scale production of desired produce thereby increasing quantity of produce and economy of scale.

(K) Increased output: It makes it possible for farmers to have an increase in output or production.

(m) Specialization of labour: It provides for farm labour to specialize in certain operations and farmers to specialize in certain types of production with some advantages of scale and market.

(n) Cooperation through clustering: Mechanization tends to encourage farmers to cluster in one area and cooperate in sharing machinery, inputs and marketing services.

Traditional bullock ploughing has been replaced by mechanized plough with gradual inroads of tractors and power tiller in the agricultural sector since the sixties. Mechanization has been one of the instruments for modernization of agriculture and that is why the green revolution programmes during the mid sixties was truly coined as biochemical and mechanical revolution. Demand for tractorization has therefore increased manifold but not to the extent as it happened in the case of other inputs like high yielding varieties of seed, chemical fertilizer and irrigation of course, there is an established premises for greater demand for tractor and power tiller for ploughing (Banerjee et al, 2008).

2.6 Standard of Living of the Farmers

From the sociological point, whether a standard of living is high or low is measurable by the extent to which it gives the best condition for the highest development of human life. Smith (1977) defines standard of living as all the things contributing to the quality of human existence. Atala (1988) viewed it as the material and impersonal resources which individuals possess and use to meet their physical, psychological, social condition or needs. Anonymous (2011), explained standard of living as a level of wealth, comfort, material goods and necessities available to certain socio-economic class in a certain geographic area. Wikipedia further explained that the evaluation of standard of

living commonly includes factors such as income, quality and availability of employment, class disparity, poverty rate, quality and affordability of housing, affordable access to quality health care, quality and availability of education, and inflation rate.

Farm economists have studied farm income principally from two points of view, namely: the income of individual farms, which have been used as measures of farm efficiency, and the annual income of the farmers as a class, as an index of their share of national dividend. It is the assumption that if the farmers' income, either individually or as a class, be increased, his economic welfare or standard of living would advance proportionately. Therefore, the farm incomes and the standard of farm families are so intimately related that the certainly worthy of joint consideration.

2.7 Yield of the Farmers

An immediate goal of agricultural policy in Nigeria is to produce more food. By doing this is to encourage greater output per crop, and per unit area of and labor. Gross farm output is the final agricultural output measures the value of agricultural products which free of intra-branch consumption is produced during accounting period and before processing, is available for export and/or consumption. The ability of a farmer to improve on his output may be determined by his physical and mental well-being, managerial skill, and exposure to extension services and access to inputs.

2.8 Adoption of Technology

Technology is assumed to mean a new, scientifically derived, often complex input supplied to farmers by organizations with deep technical expertise. Neill and Lee (2001)

point out that the majority of existing literature on agricultural technology adoption is focused on Green Revolution (GR) technologies such as irrigation, fertilizer use, and the adoption patterns of high-yield variety (HYV) seeds. Due to the development process of HYV and the inputs required to make them productive, studies examining HYV adoption look at very advanced forms of technology; HYV seeds are often the product of intensive laboratory research, and when they are targeted to farmers they are bundled with other technology inputs such as chemical fertilizers, pesticides and extensive irrigation because these are necessary for the HYV seeds to perform as designed. Because so many studies of agricultural technology adoption and diffusion focus on HYV and other GR inputs, their findings are concentrated on a "high-tech" definition of agricultural technology.

However, the association between most agricultural *technology* adoption literature and "high technology" inputs is incidental; it just so happens that at this point in time, most agricultural technologies being measured are scientifically advanced. This coincidence should not obstruct the point that a technology is simply the application of scientific knowledge for a certain end. A project or a technique can still be considered a technology even if the science is many steps removed from the eventual implementer. For example, a project where extension workers encourage farmers to rotate legumes into their planting cycles is quite "low-tech," but the chemistry behind the process of nitrogen fixation is extensive and elaborate. There are many lessons and best practices that can be learned from existing studies if *technology* is looked at in broader terms. Gershon and Umali (1993) define technology as "… a factor that changes the production function and regarding which there exists some uncertainty, whether perceived or objective (or both). The

uncertainty diminishes over time through the acquisition of experience and information, and the production function itself may change as adopters become more efficient in the application of the technology (Gershon and Umali 1993).

2.8.1 Adoption of Improved Farming Practices

Increasing the efficiency of agricultural production through agricultural modernization depends mainly on the extent to which farmers can incorporate improved agricultural technologies into their farming operations (Neill and Lee 2001). The acceptance or adoption of new farming technologies takes place overtime (Ani, 1999). Adoption of an improved technology is defined as the degree of use of new technology or the total application of the technology package when the farmer has full information about the technology and its potentials (Aniedu, 2007). Generally a farmer may not adopt a technology unless he/she thinks they will benefit with the decision about whether or not to adopt a recommended agricultural practice. Farmers are always keen to experiment with technology that promise to create favorable outcomes, substantially, increasing production and at the same time maintaining or improving the environment.

Adoption of an innovation involves the process whereby a prospective farmer is exposed to consider and final finally practices a particular innovation (Mosher, 1978) Adoption process of innovation can be seen as a mental process that a person passes through starting form first hearing a new idea to the complete and overall acceptance of the thought into his behavioral system. Innovation adoption stage is arrived at when the farmer makes complete and maximum use of practice and incorporates it as something

worthwhile (Bene, et al, 1994).it involves continuous learning, the opportunities in learning depends on the degree and category of interaction among the different enterprises, organization and related sectors, as well as institutional behaviors, and determine the extent and rate at which information and knowledge are produced, transformed and utilized (Mytelka,2000). Adoption however, can be described as a decision to make full use of an innovation or technology as the best course of action available (Rogers, 1995).he stressed that the process requires a great mental effort by the farmers before they could decide on whether to use the innovation or not.

The farmer is though not certain about the profitability of the technology. Roger (1969). Observed that prior to the adoption of new technology by an individual farmer; he or she will follow an adoption process like awareness, interest, evaluation, trial and adoption. According to him, for an innovation to be acceptable to the farmers, it must be economically profitable socially acceptable and technologically visible.

Innovation therefore, is not only the product of organized research and development activities undertaken within the universities and agricultural research and development institute, but include the enabling environment that encourages continuous learning, creativity and knowledge flow which facilitate innovation for socio-economic development(World Bank,2004).Okwu (2005) said that there was a wide agricultural research system and proven innovations, which are capable of revamping the farmers' agricultural production and national economic development in Nigeria. Innovation is the process of seeking for development, adopt, imitate and adopt technologies which are relatively different from previous ones(Hall and Dijkman, 2006).

Madukwe (2008) viewed the concept of innovation in the context of agriculture to mean a process whereby farmers and farms receive and employ agricultural technologies and services which are relatively new to them if they are new to their competitors or not. Madukwe (2008) further identified the following as new crop innovations: use of chemical herbicides, improve varieties and species of crops, fertilizers (organic and inorganic) tractor and its associated implements, mulching of crops, scientific methods of identification and control/treatment of crop disease/pests, modern irrigation system, modern method of soil preparation /planting of crops modern method of harvesting/processing/storage of crop products among others.

The rapid decrease in the soil fertility as a result of incessant cultivation, soil erosion and environmental degradation coupled with ever increasing human population and its pressure on available land space, low yield of crop emanating from traditional methods of farming have provided the urgent needs for farmers to adopt new agricultural innovation. Farmers are apprehensive about adopting new farming practices or crops. This is largely based upon an adherence to traditional, sometimes dating back several generations. Farmers must be shown proof that new practices will result in a better standard of living before they risk their family wellbeing- which is often directly influenced by their crop yield. As such, the major challenge for the adoption of new practices is one of education and trust. An opportunity exists to employ local youth to help build this trust. Often youth are attracted to job opportunities in urban centre only to be disappointed by the dismal living conditions and decrease in living standards.

In order to prevent this “brain drain” and at the same time, reform farming practices, some youth can be encouraged to start a business that sells services to local farmers. (Torres, 2010) further suggested using a standard camera cell phone (already common among rural youth), a businessperson can take pictures of diseased crop and upload that information to a center for analysis. That analysis and information about solution to treating crop disease can be shared with local farmers, thereby building trust and dependence. This trust can be translated in to additional service opportunities, such as the promotion of new crops, soil testing facility, hybrid seed production, and the lending of farming equipment (new plough, safer pesticides, etc). Local youth can engage in “cooperation” type arrangement where best practice can be shared amongst them to increase the overall yield of farmers within a larger area.

2.8.2 The Adoption Process for Mechanization

When reviewing the process of applying labour-saving (or labour productivity enhancing) innovations in agriculture, it is a serious but frequently made mistake to assume that this can be achieved only through applying mechanical engineering technology. In this context, nine different stages in the process of enhancing labor productivity may be distinguished (Rijk 1989):

Stage I: **Application of improved Hand tool Technology.** This process started in prehistoric times when early civilizations developed stick and stone tools which were the only means to enhance labor productivity. In many parts of the world, hand tools are the only technology used in agriculture, and even in highly mechanized agricultural systems, improved hand tools are still important.

Stage II: **Draft animal power application.** At this stage animal muscle power is substituted for human power, a process which already started in ancient civilizations. A large variety of implements and machines have been developed which use animals as the principle power source.

Stage III: **Stationary Power Substitution.** Mechanical power is substituted for human and animal power, used in stationary operations. Stationary operations are mechanized first because motive power sources required to move across the field are technically more complex and therefore require higher investment. Typically, operations mechanized at this stage are paddy dehusking, grain milling, pumping water, and threshing.

Stage IV: **Motive Power Substitution.** At this stage, substitution of mechanical power for muscle power takes place for field operations. It focuses on power-intensive field operations (for example, plowing), and machinery is of relatively simple design, and easy to operate. Mechanization is still straightforward, and crop production practices are usually unchanged. At Stage III and IV, mechanization takes advantage of lower costs of new power sources as compared with traditional ones.

Stage V: **Human Control Substitution.** At this stage the emphasis is on substitution of the human control functions. Depending on the complexity of the control function and the degree of its mechanization, machinery becomes increasingly complicated and costly. A potato lifter is simple in design, but fruit and cotton harvesting machinery are complex and expensive.

Stage VI: **Adaptation of Cropping Practices.** This stage features the adaptation of the cropping system to the machine. For example, removing weeds in broadcast crops cannot

be done with machines but row seeding and seed drills may be introduced to facilitate mechanization of weeding. Other examples include the increase in row distance to accommodate heavier and larger machinery to speed up field operations.

Stage VII: **Farming System Adaptation.** The farming system and production environment is changed to facilitate further increase in labour productivity and to benefit from economies of scale, necessary to make the investment in expensive machinery financially feasible. An example of this is the rapid decline of mixed farming systems in Europe since the late 1960s when farmers specialized in either, dairy, poultry, hog, or crop production. Some crops which are difficult to mechanize may disappear if acceptable substitutes become available, or if these can be produced in countries with low labor costs. At this stage, investments in land development, land consolidation, and rural infrastructure are often needed to facilitate advanced degrees of mechanization.

Stage VIII: **Plant Adaptation.** This stage features the adaptation of the plant and animal to the mechanization system. Mechanization has advanced to a stage were engineering alone can no longer provide further gains in labor productivity. Breeders increasingly take into account the suitability of new varieties for mechanized production.

Stage IX: **Automation of Agricultural Production.** This stage is progressing in countries with high labor costs and sophisticated demands on production and quality. Examples are automated rationing of concentrate feeding for individual dairy cows based on their milk production, and sprinkler irrigation systems activated by soil moisture.

2.9 Crop Production

Crop production is a complex business, requiring many skills (such as biology, agronomy, mechanics, and marketing) and covering a variety of operations throughout the year. The term crop production refers to the growing of staple food crops, fruits, nuts as well as other food produce and commercial crop. Growing crops for food was one of the first priorities of the earliest settlers arriving in North America. With shipboard supplies depleted, and having little familiarity with the land and native vegetation, groups arriving from Europe were quickly forced to learn to produce crops to ensure their survival. The stories of Native Americans teaching the settlers to plant and fertilize a corn crop are part of this country's lore.

In the era of Thomas Jefferson (arguably the most illustrious farmer that this nation has produced), farmers made up about 90% of the work force. As late as 1900, almost 40% of the labor force was engaged in producing crops and livestock for food, feed, and fiber. Now, with less than one percent of our population claiming farming as a principal occupation, most U.S. citizens have little or no crop production experience (Amadi, 2002)

Corn: The United States is, by far, the largest producer of corn in the world. Corn is grown on over 400,000 U.S. farms. In 2000, the U.S. produced almost ten billion bushel of the world's total 23 billion bushel crop. Corns grown for grains accounted for almost one quarter of the harvested crop acres in this country. Corn grown for silage accounts for about two percent of the total harvested cropland or about 6 million acres. The amount of land dedicated to corn silage production varies based on growing conditions. In years that

produce weather unfavorable to high corn grain yields, corn can be "salvaged" by harvesting the entire plant as silage

According to the National Corn Growers Association, about eighty percent of all corn grown in the U.S. is consumed by domestic and overseas livestock, poultry, and fish production. The crop is fed as ground grain, silage, high-moisture, and high-oil corn. About 12% of the U.S. corn crop ends up in foods that are either consumed directly (e.g. corn chips) or indirectly (e.g. high fructose corn syrup).

Soybeans: Approximately 2.8 billion bushels of soybeans were harvested from almost 73 million acres of cropland in the U.S. in 2000. This acreage is roughly equivalent to that of corn grown for grain. Over 350,000 farms in the United States produce soybeans, accounting for over 50% of the world's soybean production and $6.66 billion in soybean and product exports in 2000. Soybeans represented 56 percent of world oilseed production in 2000.Soybeans are used to create a variety of products, the most basic of which are soybean oil, meal, and hulls. According to the United Soybean Board, soybean oil, used in both food manufacturing and frying and sautéing, represents approximately 79 percent of all edible oil consumed in the United States. Soybean oil also makes its way into products ranging from anti-corrosion agents to Soy Diesel fuel to waterproof cement. Over 30 million tons of soybean meals are consumed as livestock feed in a year. Even the hulls are used as a component of cattle feed rations.

Hay: Hay production in the United States exceeds 150 million tons per year. Alfalfa is the primary hay crop grown in this country. U.S. hay is produced mainly for domestic

consumption although there is a growing export market. According to the National Hay Association, the most common exports are timothy, some alfalfa, Sudan grass, and Bermuda grass hay. Hay can be packaged in bales or made into cubes or pellets. Hay crops also produce seeds that can be used for planting or as specialized grains.

Wheat: Over 240,000 farms in the United States produce wheat. The U.S. produces about 13% of the world's wheat and supplies about 25% of the world's wheat export market. About two-thirds of total U.S. wheat production comes from the Great Plains (from Texas to Montana).

Cotton: Fewer than 32,000 farms in the United States produce cotton. Cotton is grown from coast-to-coast, but in only 17 southern states. Farms in those states produce over 20% of the world's cotton with annual exports of more than $3 billion. The nation's cotton farmers harvest about 17 million bales or 7.2 billion pounds of cotton each year.

Grain sorghum: In the United States, grain sorghum is used primarily as an animal feed, but is also used in food products and as an industrial feedstock. Industrial products that utilize sorghum include wallboard and biodegradable packaging materials. Worldwide, over half of the sorghum grown is for human consumption. Some farmers grow sorghum as a hedge against drought

Rice: Just over 9,000 farms produce rice in the United States. Those farms are concentrated in six states: Arkansas, California, Louisiana, Mississippi, Missouri, and

Texas. U.S. rice production accounts for just over 1% of the world's total, but this country is the second leading rice exporter with 18% of the world market (Amadi, 2002).

2.10 Factors Influencing Mechanized Farming and Farm Size Ownership in Nigeria

Increase in population demands increase in food production on sustained yield basis. The importance of improved farm technology in the agricultural sector cannot therefore be emphasized. However, it has been reported that rural farmers are sluggish in adopting improved technology as sold by various extension agents. This may be due to the sophisticated technologies which some rural development institutions promote. Hence the projects have no chance of benefiting the generality of the rural poor. (Beckman, 1982, Nzimiro, 1985, Oculi 1987, Kolawole 1986 and Ariyo 1991). It is hoped that gradual adoption of improved technology will one day make possible mechanized agriculture in Nigeria. Using data on methods of farmland preparation and farm size ownership collected from all the agricultural zones of Adamawa state of Nigeria, we contend that the rate of mechanized farm technology is still low and this is an impediment to increased food production in Nigeria. This calls for a fast approach to turn the country away from subsistence farming practices.

Adamawa state, having a 70% of her population as farmers is a good ground for testing the adoption of mechanized farm technology and increased farm size ownership as a means of improved food production. The major vegetation formation in the state is the southern guinea savannah, the northern guinea savanna and the Sudan savanna (Akosim*et al* 1999). The onset of the rainy season is normally accompanied by strong devastating

wind storms (Amadi 2002). The major food crops grown in the state include cereals, legumes and root crops; while the cash crops are mainly cotton, groundnut and sugarcane. (Sajo and Kadams, 1999). The implication is that since the land and climate favors crop production, with the adoption of mechanized agriculture, improved production will be sustained in all these Agricultural Crops, hence, Nigeria can feed the entire Africa.

2.11 Empirical Studies

Amadi (2002).conducted a study titled factors influencing mechanized farming and farm size ownership in Adamawa State, Nigeria. The major food crops grown in the state include cereals, legumes and root crops; while the cash crops are mainly cotton, groundnut and sugarcane. The implication is that since the land and climate favors crop production, with the adoption of mechanized agriculture, improved production will be sustained in all these Agricultural Crops, hence, Nigeria can feed the entire Africa. Data on method of farmland preparations, farm size and the infrastructure as put on ground by the Adamawa State Agricultural Development Programme (ADP) were collected from rural farmers and ADP management using questionnaires and focus group discussion between 2006 and 2009. The scope of the oral discussion included availability of tractors, cost of tractors hiring and the need to increase farm size.

The data collected were subjected tot-test and regression analysis. In order to test whether there is significant difference in farm size ownership and use of mechanized farm technology between the periods under review. Regression analysis was used to identify the conditions that favor mechanized agricultural practices. Descriptive statistics such as

tabular presentation and percentages were also used. The t-test result showed that there was significant difference in total farm size ownership among farmers between 2006 and 2009. The t-calculated value was -2.39948 while the table value was 0.074398. Even though the number of plots increased substantially per farmer, yet there was no doubling of farm size in any of the agricultural zones of the state during the 3years. This growth in plot size was low. However, when viewed in line with the present competition for land by other users, the rate is encouraging. One of the criteria for measuring the status of rural farmers is their farm size and from the study, the total farm size owned by the 435 farmers in 2006 was 2,135 hectares and this increased to 3,606 hectares in 2009, giving a percentage increase of 69.

The average farm size of rural farmers in 2006 was 4.9 hectares, and this also increased to about 8.3 hectares in 2009. The regression analysis for farm size shows that farm size is negatively related to road construction and maintenance, wash bores and extension agents, and positive related to culvert, tube wells, water pumps and loan. The implication is that increase in irrigation facilities and loan, lead to increases in farm size of rural farmers, which in turn motivates farmers to adopt mechanized farm technology. The t-test on improved technology use shows that there is a significant difference in the use of tractors for land preparation among farmers between 2006 and 2009. The t-calculated value is -2.49953, while the table value is0.0668.Regressionanalysis for farm technology showed that tube wells, loan and extension were positively related to farm technology use. In 2006, 22.3 percent of the farmers used tractors for land preparation, this increased to 42 percent in 2009.

The present study is similar with the past as both used regression analysis as a statistical tool, descriptive statistic involving frequency distribution as used in the past research was also used in the present study. However the two differed in location of the study, the former was carried out in Adamawa State, while the later was carried out in Bauchi and Yobe states. Equally sample of three hundred and sixty-eight contact farmers were used in the present study, while the former study used four hundred and thirty five farmers as samples for the study. T-test was used on improved technology use which showed that there was significant difference in the use of tractor for land preparation among farmers between 2006 and 2009 in the past research, while the present did not use t-test.

Ganapathy and Karunanithi, (2005) conducted a study on mechanization in LalgudiTaluk in southern India, to assess the level of mechanization. 540 farmers were interviewed using structured questionnaire on the energy usage in various agricultural operations. Three specific objectives were outlined as; present level of farm mechanization in LalgudiTaluk, to determine the scope of functions of mechanization of agriculture in the area and to identify the problems of agricultural mechanization in the area. For this study 20 sample villages were selected randomly from a total of 117 villages located in 5 developmental blocks. At least 25 farmers were randomly selected samples farmers in each of the villages under study. The findings showed that most of the farms in the study were small and fragmented and there were no big commercial farms. 67% of the farmers owned land, 11% was tenants and 22% were mixed operators who owned land and land on lease. Also farmers in the area adopted high level of mechanization.

The use of mechanical power was highest for paddy rice and least for cotton among the crops grown. The present study differs from the past in that the present study was carried out in Bauchi and Yobe States Nigeria, while the past study was carried out in Lalgudiin India. The present study used percentages, frequencies, and correlation in analyzing the data, while the past study used percentage to analyze the data. The past research used five hundred and forty farmers, while the present study used three hundred and sixty-eight as sample for the study. Equally the present study used Chi square to test the stated null hypotheses.

Oluyole (2009) carried out a study on the influence of technological change on labour availability: a case study of cocoa farming households in Ogun State; Nigeria. The following were specific objectives: to investigate the pattern of adoption of improved technologies in the study area; to determine the magnitude of labour requirements by different improved technologies; to determine whether there is significant change in labour use among the different technological combinations; and to determine the factors that affect the availability of labour in the study area. Three null hypotheses were stated for the study. Four cocoa producing local government areas (LGAs) were chosen for the study. The LGAs are Abeokuta North, Abeokuta South, Odeda and Owode. Twenty respondents were purposively selected from each LGA making a total of eighty respondents in all for the study. This, however, represents 15% of the entire population of cocoa farmers in the study area.

Respondents were classified into three technological groups depending on the number of technologies adopted by the respondent. The technological groups were low technology

(LT), medium technology (MT) and high technology (HT). Low technology was the adoption of a maximum of two technologies; Medium Technology was the adoption of between two and five technologies, while High Technology was the adoption of more than five technologies. Information were collected from the respondents with the aid of structured questionnaire and the data collected were analyzed using descriptive statistics, analysis of variance (ANOVA) and multivariate regression analysis. Descriptive statistics were used to analyse the pattern of adoption of technologies as well as the magnitude of labour requirements by different technologies. ANOVA was used to assess whether there is significant difference in the amount of labour used among the three technological groups. The finding showed that there was significant difference in the means of labour used among the three technological groups. Multi-variant Regression analysis was used to evaluate the effects of the income of farmer's extent of mechanization, adoption of herbicides application, adoption of insecticides application, adoption of improved seedlings as well as adoption of improved planting spacing on the availability of labour in the study area.

The present research is similar to the past in that both studies were on crop production and has to do with technology adoption on crop production. Both researches studies took place in Nigeria, structured questionnaire was used as instrument for data collection in both studies; descriptive statistics was used in both as a statistical tool. The present research differs from the past in that the former used a total of eighty respondents as sample for the study while the present study used three hundred and sixty-eight contact farmers as sample for the study. Equally, the present research used five null hypotheses

and used chi square to test the null hypotheses. Also multi-stage sampling was used in the present study. Also the past research used ANOVA but the present study used percentage, mean and standard deviation. The past research was carried out in Ogun State, while the present study was conducted in Bauchi and Yobe states. The past research was delimited to cocoa, while the present study was delimited to millet, cowpea, groundnut and sorghum.

Musa,Idrissa, Yahaya and Abdulsalam(2012).carried out a study to determine the factors affecting the adoption of mechanized equipments among farmers in Jere local government area of Borno State, Nigeria. The study examined the socio-economic characteristics of the farmers and their source of information about modern agricultural equipment to discover their production characteristics. Multi-stage sampling techniques were used to select a total of 60 respondents from whom data were collected using a structured questionnaire. The data generated were analyzed using descriptive (frequency distribution and percentages) and inferential (chi- square) statistics. The results showed that majority (71.7%) of the respondents were in their youthful age and more than half (66.7%) of them were males. The results further indicated that more than half of the respondents did not go beyond primary school level and 61.7% of them had fragmented farm lands. The distribution of respondents based on their exposure to information source reveal that more than half (58.71%) of them acquired information from extension agents, community meeting and their neighboring farmers. It was also observed that 50% of the respondents were between 1-5 kms away from their sources of information on machinery. Chi-square analysis showed the existence of a significant ($p \leq 0.05$) relationship between

the farmer's socio-economic characteristics (except for age and educational status) and the factors affecting their adoption of mechanized equipments.

The present study was similar to the past research in that both were on mechanization. Survey research design was used in the past research and the present research also used survey research design in conducting the study. Instrument for the data was a structured questionnaire which the present study also used questionnaire as its instrument for data collection. Descriptive statistics involving Frequencies distribution and percentage was used in the past research to analyse data which the present study also used the same statistics in analyzing its data.

The two researches studies however differ in location, the former was in Jere local government in Borno State, while the present was in Bauchi and Yobe States. Population of 60 respondents was used in the past study, while the present study used 368 respondents. The two studies also differ in that there was no any null hypothesis stated in the past study, while the present study tested five (5) null hypotheses.

Owombo (2012) carried out a study titled Economic Impact of Agricultural Mechanization Adoption: Evidence from maize farmers in Ondo East and Ondo South Local government areas of Ondo State. Primary data were used for the study. A multistage sampling technique was used for data collection. The first stage involved the purposive selection of the two local government areas. In the second stage, the local government areas were clustered into villages. The third stage involved the random selection of five villages in each of the two local government areas. The fourth and final stage involved the random selection of 20 farmers in each village making a total of 200

respondents in all. The village extension agents in the state were contacted to reach the farmers on their fortnightly training meeting. The data were collected using structured questionnaires. Data collected included farmers' demographic and socioeconomic characteristics such as age, sex, farm size, duration of fallow, labour use, off farm income, method of land preparation, method of seed planting, method of weed control, and method of harvesting, method of processing, mode of land acquisition, among others. Secondary data were obtained from records of the local government areas (LGAs) and Ondo State Agricultural Development Project zonal office. Data collected were analyzed using descriptive statistics, farm budgetary and logistic regression model. The descriptive statistics employed mean and percentage.

The present study is similar to the past in that both are survey researches and used farmers as respondents; questionnaire were the instrument for data collection in both the researches; descriptive statistics were used in both the research as a statistical tool; multi-stage sampling techniques, random sample was used in both the research. However, the present research differs from the past in locations; the former was conducted in Ondo State, while the present study was carried out in Bauchi and Yobe States. The past research used a total of two hundred respondents; while the present study used three hundred and sixty-eight contact farmers as respondents. The past study did not mention the number of its null hypothesis used, while the present tested five null hypotheses in the study. The past used farm budgetary and logistic regression model to analyze its data, while the present study used chi square to test its stated null hypothesis at 0.05 level of significant.

Owolabi,*et al*, (2012).Conducted a study on the adoption of draught animal technology among small scale farmers in Kaduna State. In order to examine the effect of draught animal technology adoption on crop output of farmers in Kaduna State a reconnaissance survey was conducted in five local government areas (LGAs)where draught animal technology were predominantly practiced. These were Giwa, Kubau, Soba, Kudan,and Makarfi local government areas. Ten Villages were purposively selected from the study area based on high intensity of draught animal technology usage. The total population of draught animal technology farmers in the study area was one thousand; two hundred and thirty-five (1235).Fifteen percent (15%) of this population were selected from each of the villages using random sampling technique to constitute the sample size of one hundred and eighty (180).

The data collected were analyzed using descriptive statistics and multiple regression models. It was revealed that 46.33% of respondents had adopted the use of draught animal in land leveling and ploughing. However, herbicide application, fertilizer application and harvesting technologies were not adopted by the farmers. This showed that farmers lacked the awareness of these technologies.

The findings revealed that estimated coefficient for age was positive and significant at 10% level of probability. This implied that the likelihood of adopting DAT was higher for older farmers than for younger ones. The parameter estimated for education was found positive and significant at 10%.This indicated that increase in year spent in formal education, the probability of adopting draught animal traction increases. The results further showed that farm size exerted positive influence on the adoption of draught

animal technology. Household size was positive and significant at 5% level of probability. This implies as family size increases, the probability of adopting DAT also increases. Furthermore, only membership of cooperative was significantly and positively influential to the adoption of DAT in the study area.

The present study was similar to the past because both the two research deals with technology adoption. Farmers were the population for the study in both the researches studies. Purposive and random sampling procedures were used in both the researches studies. Survey method was employed in the past study which the present research also used the same. However the two studies differ in location. The former was carried out in Kaduna state, while the present study was conducted in Bauchi and Yobe states. Equally the past study had a population of 1235 farmers and a sample of 180, while the present used a population of 51,580 contact farmers and a sample of 368 contact farmers.

2.12 Summary of Literature Reviewed

The Theoretical background to this study is based on the theories of social changes which stipulated that society's exhibited 2 kinds of forces: Those which seek to promote change and those that strive to maintain the status quo. The essence of human life is change, development and growth. However, the process of change involves interaction with the forces which are elements of change. The process of integrating these ideas will provides a sort of road maps towards adoption of new ideas which will provide solution to present challenges and prevent obstacles to the realization of objectives.

Agricultural mechanization has been reviewed from different author's point of view simply to mean the use of machine to accomplish a task or an operation involved in

agricultural production. It also includes reduction of human drudgery and efficiency of various agricultural operations as well as bringing more land under cultivation and preserving the quality of agricultural products, thereby providing better rural living conditions and markedly advancing the economic growth. Several advantages are associated with the mechanization of agricultural farm operations, which includes; increased area under cultivation and number livestock reared per head, timeliness of operation, increased productivity, labour saving, reduced drudgery, reduced human hazards, discourages unsustainable cultural practices, increases farm revenue, improved quality of farm produces, large-scale production increased output, specialization of labour and cooperation through clustering.

History revealed that agricultural mechanization started in Nigeria as far back as 1922. From then various animal drawn implements were introduced into the Nigerian agriculture, followed by the use of mechanical power sources in the 1970s. Since then there was a rising demand for tractor/power tillers. The impacts of equipments and power on agriculture are positively correlated. Roles of agricultural mechanization were also reviewed, to increase the farm output per human hour and to reduce spoilage, waste and other losses of agricultural produces. He added that, land abandoned because of inappropriate use or inadequate capability to use can be reclaimed through mechanization.

With regards to the problems of agricultural mechanization, since 1970's efforts have been geared mainly towards tractorization. Farmer's age is correlated with farming experience has significant influence on the decision-making process of the farmers with

respect to risk aversion, adoption of improved agricultural technologies and other production related decision. Household size, level of education and farm size are also reviewed as aspect of socio-economic status of the farmer.

Literature on technology adoption was also reviewed, however, the association between most agricultural technology adoption literature and "high technology" inputs is incidental; it just happens that at this point in time, most agricultural technologies being measured are scientifically advanced. Increasing the efficiency of agricultural production through agricultural mechanization depends mainly on the extent to which farmers can incorporates improved agricultural technologies in to their farming operations (Neill and Lee, 2001). The acceptance or adoption of new farming technologies takes place over time (Ani, 1999).

Also reviewed are the factors influencing mechanized farming and farm size ownership in Nigeria, effects of farm mechanization on labor, as well as the type of labour affected by mechanization on crop production, which revealed that, the type of labour likely to be affected by mechanization depends on which agricultural operation is mechanized. Sowing and irrigation are done largely by family labour (100%). There is no use of hired labour for this purpose. Mechanized farms used more hired labour than traditional farms for ploughing and threshing, this may be for the facts that this operation requires skilled labour.

Empirical studies by others were also reviewed. Amadi (2002) conducted a study of factors influencing mechanized farming and farm size ownership in Nigeria. Regression analysis for farm size shows that farm size is negatively related to road construction and

maintenance, wash bore and extension agents, and positive related to culvert, tube well, water pumps and loan. The implication is that increase in irrigation facilities and loan, leads to increase in farm size of rural farmers, who in turn motivates farmers to adopt mechanized farm technology. Ganapathy and Karunanithi (2005), also conducted a study in LalgudiTaluk in sourthen India, the findings showed that most of the farms in the study area were small and fragmented and there were no big commercial farms. 67% of the farmers owned land, 11% was tenants and 22% were mixed operators who owned land and land on lease. Also farmers in the area adopted high level of mechanization. Nkani,and Ceder, (2008),carried out a study to investigate farm mechanization practices for cassava and yam production in Rivers state, Nigeria. Finds revealed that Rivers state had low level of farm mechanization. It was also observed that the poor performance were due to poverty, ignorance and level of incentives to the use of machinery in agricultural production.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

This chapter describes the methodology for conducting the study under the following sub-headings:-

3.1 Research Design

Descriptive survey research design was used for this study.

3.2 Population for the Study

The population for this study comprised of Contact Farmers in the five Agricultural Development Zones in Bauchi and Yobe states. These zones comprised of Bauchi West, Bauchi North, Bauchi Central, Yobe Zone I and Yobe Zone II. A population of 51,580 contact farmers comprising of 17,100from Bauchi West; 7,200 from Bauchi Central;

6,160 from Bauchi Northern; 10,240 from Yobe Zone I and 10,880 from Yobe Zone II were used as population for the study as shown in Table 3.1

Table 3.1 Population for the Study

Zones	Population
Bauchi Western	17,100
Bauchi Central	7,200
Bauchi Northern	6,160
Yobe Zone I	10,240
Yobe Zone II	10,880
Total	51,580

Source: Yobe State Agricultural Development Programme (YOSADP,) and Bauchi State Agricultural

Development Programme (BSADP,) (2014)

3.3 Sampling Size and Sampling Procedure

Multi-stages sampling technique was employed for this study. The first stage involved a purposive selection of two Agricultural Development Zones, one from each state. The second stage involved a purposive selection of 10 Extension Blocks from each of the selected ADP Zones making a total of 20 Extension Blocks. The third stage involved a proportionate random selection of 368 contact farmers from the 20 extension blocks with reference to Krejcie and Morgan (1970) sample size determination for a research study. These constituted the sample for the study. A "Hat drawn" technique was used in selecting the individual sample. The breakdown of the sample size for the study is shown in Table 3.2

Table 3.2 Sample Size for the Study

AGRICULTURAL DEVELOPMENT ZONE	EXTENSION BLOCK	POPULATION	SAMPLE SIZE
Bauchi Northern Zone	Azare	560	23
Bauchi Northern Zone	Madara	160	07
Bauchi Northern Zone	Udubo	400	16
Bauchi Northern Zone	Gololo	240	10
Bauchi Northern Zone	Giade	320	13
Bauchi Northern Zone	Yana	400	16
Bauchi Northern Zone	Misau	1360	54
Bauchi Northern Zone	Dambam	320	13
Bauchi Northern Zone	Hardawa	560	23
Bauchi Northern Zone	Gamawa	400	16
Yobe Zone II	Potiskum	1360	54
Yobe Zone II	Nangere	560	23
Yobe Zone II	Mamudo	400	16
Yobe Zone II	Gadaka	560	23
Yobe Zone II	Yarimaram	320	13
Yobe Zone II	Ngelgarma	320	13
Yobe Zone II	Babbangida	160	07
Yobe Zone II	Sassawa	240	10
Yobe Zone II	Kukuri	240	10
Yobe Zone II	Kukargadu	160	07
	TOTAL	9040	368

3:4 Instruments for Data Collection

For the data collection, a structured questionnaire was used. The questionnaire was divided into six sections-A, B, C, D, E and F. The questions in each section were designed to provide data that was used to answer research questions I, II, III, IV and V. The questions were based on the objectives, research questions and null hypotheses of the

study to solicit for responses. Section "A" consisted of Nine questions on farmers demographic data, section 'B' consisted of nine questions to provide data to answer research question one, section 'C' consist of seven questions to provide data to answer research question two, while section 'D' consisted of nine questions to provide data to answer research question three section "E" consist of six questions to provide data to answer research question four and section "F" consisted of five questions to provide data to answer research question five. In all the sections, the respondents were required to tick the best answer of his/her choice from the options that follow each question. For options: Strongly Agree (SA), Agree (A), and Disagree (D) Strongly Disagree (SD). Points will be allocated as:-

Option	**point**
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

3.4.1 Validating of the Instrument

In order to ascertain the validity of the instrument, the researcher gave the draft copy of the designed questionnaire to three experts in the Department of Vocational and Technical Education for vetting. Based on their expert advice, a final copy was produced. This is in conformity with the opinion of Afolabi (1998) that validation of the instrument by experts is an important and acceptable type of validation.

3.4.2 Pilot Study

In order to establish the reliability of the instruments, a Pilot study was carried out in Andaza village in Kiyawa Local Government Area in Jigawa State. This is because the respondents have similar characteristics with the respondents under study. Ten copies of the designed questionnaire were administered to the farmers by the researcher personally and were retrieved immediately.

3.4.3 Reliability of the Instruments

The data collected from the Pilot study were subjected to reliability testing to determine the reliability coefficient and the internal consistency. Cronbach Alpha statistics, which measures the internal consistency of an instrument, was used. The result gave a coefficient of the internal consistency of 0.781 alpha levels which was significant. This is in line with the view of Olayiwola (2007) who stated that a reliable test will have a high reliability coefficient close to positive one (+1). Therefore, the instrument with 0.781 internal consistency coefficients is considered reliable for gathering data.

3.5 Procedure for Data Collection

The researcher with the help of the zonal extension officer in each of the two ADP Zones, employed the services of 20 village extension agents (VEA); one to each of the 20 selected extension block to serve as trained research assistants in the administration of the 368 copies of the questionnaire to the 368 respondents that is, contact farmers during their farm and home visits. Random selection using “Hat drawn techniques was used “YES” and “NO” were written on a pieces of paper and those that picked “YES” were

given questionnaire. The research assistant explained the questions to the respondents and the respondents filled in the questionnaire, while the research assistant collected back the filled questionnaire immediately after completion. It took four weeks to be accomplished.

3.6 Procedure for Data Analysis

The researcher used frequency count and percentages to analyse the demographic data of the respondents in section A. The mean of the responses were used to answer the research questions. All items that had mean responses of 2.50 were considered as “Agree” and those that had mean rating of less than 2.50 were considered as “Disagree”. Chi Square was used to test the null hypothesis at 0.05 level of significance. Where significant (P) was less than 0.05, the relationship or influence is significant otherwise it is not significant. In other word, if the P value is equal or greater than 0.05, the null hypothesis was retained otherwise it was rejected.

CHAPTER FOUR

PRESENTATION AND DATA ANALYSIS

This chapter presented and analyses the data collected during the conduct of the study .Out of three 368 copies of the questionnaire administered to the respondents, 362 were duly filled and returned. Details of the results were shown under the following sub-headings;

4.1 Bio-data of the respondents

4.2 Answers to the Research Questions

4.3 Testing of Null Hypotheses

4.4 Discussion of Findings

4.5 Summary of Major Findings

4.1 **Bio-Data of the Respondents**

This section analysed the bio-data of the respondents with regards to age, sex, highest educational qualification, farmers' annual income, farm size in hectares, average yields of crop cultivated, numbers of years of farming experience and source of income as shown in Table 4.1.

Table 4.1 Bio-Data of the Respondents.

Variables	Frequencies	Percentage (%)
Age (in years)		
18-25 years	62	17.1
26-35 years	114	31.5
36-45 years	90	24.9
46 and above	96	26.5
Total	362	100.0
Sex		
Male	298	82.3
Female	64	17.7
Total	362	100.0
Educational Qualification		
No formal education	144	39.8
Primary education	92	25.4
Secondary education	76	21.0
Tertiary education	50	13.8
Total	362	100.0
Farmers annual income		
Less than N15,000	102	26.2
N15,000-N25,999	83	22.9
N26,000-N50,999	88	24.3
Above N51,000	89	24.6
Total	362	100.0
Farm size in hectares		
Less than 5	104	28.7
5-15	193	53.3
Above 15	65	18.0
Total	362	100.0
Average crop yield in Kg		
Less than 1,000	77	21.3
1,001-5,000	105	29.0
Above 5,000	180	49.7
Total	362	100.0
Years of farming experience		
Less than 5	82	22.7
5-15	126	34.8
16-25	109	30.1
Above 25	45	12.4
Total	362	100.0
Source of income		
Sales of crop	180	49.7
Salary	18	5.0
Sales of livestock	109	30.1
Others	55	15.2
Total	362	100.0

Table 4.1 showed bio-data of the respondents. From the Table, it was found that majority 266 (56.4%) of the farmers were of the youthful working age between 26-45 years of age, with regards to sex, 298 (82.3%) of the respondents were male, With regards educational qualification, 236(65.2%) of the respondents did not go beyond primary education. 273(75.4%) of the farmers were poor had less than N51, 000 as their annual income. Farm size of less than 15 hectare were cultivated by most of the farmers in the study area with an average yields of not exceeding 5,000kgs and majority 317(97.6%) were less than 25 years in farming.

4.2 Answering Research Questions

The objective of this study was to determine the influence of agricultural mechanization on crop production in Bauchi and Yobe states. In order to achieve this, five research questions were stated. Thirty-six questionnaire items were raised and administered to respondents in order to collect data for the study. The data collected were used to answer the research questions and tested the five null hypotheses as presented in the subsequent paragraphs.

4.2.1 Research Question 1: What is the influence of agricultural mechanization on crop yield per hectare of farmers in Bauchi and Yobe States?

In order to answer research question one, nine questionnaire items were collected and from it, the mean were calculated from the frequency distribution of the respondents. The result of the computation is shown in Table 4.2.1 while the summary of the raw data are in Appendix III.

Table4.2.1 Mean Responses on Perception of Influence of Agricultural Mechanization on Farmers' Crop Yield. N = 362

S/NO	ITEMS	MEAN	S.D	REMARK
1	Adoption of mechanized land clearance and production increases crop yield	2.81	1.14	Agreed
2	The use of modern irrigation system increases crop yield	3.25	.95	Agreed
3	Mechanized processing/milling increases crop yield	2.85	1.13	Agreed
4	Adoption of mechanized sowing and fertilizer application increases crop yield	2.80	1.15	Agreed
5	Use of mechanized crop protection chemicals lead to increase in crop yield	3.15	.95	Agreed
6	Use of combined harvesters increases crop yield	3.29	.88	Agreed
7	Use of mechanized weeding increases crop yield	3.37	.81	Agreed
8	Adoption of mechanized sprayers increases crop yield	3.35	.82	Agreed
9	Adoption and usage of improved (hybrid) seeds increases crop yields	2.96	1.12	Agreed
	Aggregate mean	**3.09**		

Decision mean=2.50

Table 4.2.1 revealed that agricultural mechanization had significant influence on the crop yield per hectare. Aggregate mean of 3.09 of the respondents' responses indicated significant. It was found out that mean response of 3.37 of the respondents "agreed" that use of mechanized weeding increases crop yield. Also mean of 3.35 revealed that adoption of mechanized sprayers increased crop yield. This was next followed by the use of combined harvesters with a mean value of 3.29.

4.2.2 Research Question 2: What is the influence of agricultural mechanization on the income capability of crop producing farmers in Bauchi and Yobe States?

In order to answer research question two, seven questionnaire items were collected and from it, the mean were calculated from the frequency distribution of the respondents. The result of the computation is shown in Table 4.2.2.

Table4.2.2: Mean Responses on Perception of Influence of agricultural mechanization on income capability of farmers.

N =362

S/NO	ITEMS	MEAN	S.D	REMARK
1	I was able to invest in other business as a result of mechanized crop production	3.18	.85	Agreed
2	I was able to settle some of my outstanding debts as a result of adopting mechanized crop production	3.33	.88	Agreed
3	I have money to spend now from mechanized crop production	2.95	1.13	Agreed
4	Adoption of mechanized crop production has increased my income and savings	3.07	1.07	Agreed
5	I was able to embark on capital projects like building a house, buying a car/motor cycle etc with mechanization of crop production	3.19	1.08	Agreed
6	Income capability of the farmers is higher from mechanized crop production	3.37	.81	Agreed
7	Income capability of the farmers is low from mechanized crop production	2.49	1.08	Agreed
	Aggregate mean	**3.08**		

Table 4.2.2 revealed that the overall mean of the seven items was 3.08 which are higher than the 2.50 decision. A mean of 3.37 from the Table indicated that agricultural mechanization influenced the income capability of the farmers, while a mean of 3.33 of

the respondents were in agreement that the farmers were able to settle some of their outstanding debts as a result of adopting mechanized crop production.

4.2.3 **Research Question 3: What is the influence of agricultural mechanization on farm size cultivated for crop production in Bauchi and Yobe States?**

In order to answer this research question three, the mean of the nine items from the questionnaire was calculated from the frequency distribution of the respondents. The result of the computation is shown in Table 4.2.3, while the summary of the raw data are in Appendix III.

Table 4.2.3: Mean Responses on Perception of Influence of Agricultural mechanization on farmer's size of farm land cultivated.

N= 362

S/NO	ITEMS	MEAN	S.D	REMARK
1	The use of hand tools does not increase the size of farm land cultivated for crop production	3.14	.95	Agreed
2	hand tools technologies do not increase the size of farm land cultivated by the farmers for crop production	3.25	.90	Agreed
3	Use of animal traction increases the size of farm land for crop production	3.11	.97	Agreed
4	Adoption of animal traction does not increase area of land cultivated	3.12	.96	Agreed
5	Adoption of mechanical techniques increases the size of land cultivated	3.35	.81	Agreed
6	The use of mechanical tools has encouraged farmers to generate more income	3.02	1.13	Agreed
7	Mechanical tools do not lead to increase in the size of farm land cultivated	2.88	1.12	Agreed
8	The size of farm land cultivated remain unchanged for all forms of mechanized crop production	3.06	.95	Agreed
9	Size of farm land cultivated increases for all forms of mechanized crop production	3.01	1.15	Agreed
	Aggregate mean	**3.10**		

Table 4.2.3 revealed that a mean of 3.35 from question three showed that mechanized crop production influence farmers' size of farm land cultivated. Also, mean of 3.25 indicates that hand tool technologies does not increase the size of farm cultivated by the farmers.

4.2.4 Research Question 4: What is the influence of socio-economic characteristics of farmers on mechanized crop production in Bauchi and Yobe states?

The data collected from the questionnaire items 26-31 were used to answer this research question. The means were calculated from the frequency distribution of the respondents. The result of the computation is shown in Table 4.2.4, while the summary of the raw data are in Appendix III

Table 4.2.4: Mean Responses on Perception of influence of socio – economic characteristics on mechanized crop production:

N = 362

S/NO	ITEMS	MEAN	S.D	REMARK
1	Family labour which is determined by the house hold size influence the adoption of mechanized crop production	3.05	.99	Agreed
2	Farmers norms and values affect the usage of modern agricultural equipment for crop production	3.30	.84	Agreed
3	Income level of farmers influence purchase of modern implements needed for crop production	2.91	1.15	Agreed
4	Group labour discourages mechanized crop production	3.09	.97	Agreed
5	farmers farm size influence the usage of mechanized agricultural tools for their crop production	3.32	.89	Agreed
6	farmers number of years of farming experience influence their mechanized crop production	2.79	1.16	Agreed
	Aggregate mean	**3.08**		

Table 4.2.4 revealed the respondents perception on the six items concerning the Influence of socio – economic characteristics on mechanized crop production. It was revealed from the Table4.2.4 that a mean of 3.32 indicated that the farmers farm size influence the

usage of mechanized agricultural tools for crop production. Also a mean of 3.30 from the Table reveals that farmer's norms and values affects the usage of modern agricultural equipment for crop production.

4.2.5 Research Question 5: What is the influence of agricultural mechanization of farmers' standard of living in Bauchi and Yobe States?

In order to answer this research question, data collected from item 32-36 of the questionnaire were used. The mean was calculated from the frequency distribution of the respondents. The result of the computation is shown in Table 4.2.5, while the summary of the raw data are in Appendix III

Table 4.2.5: Mean Responses on Perception of Influence of Agricultural Mechanization on Farmers Standard of Living.

N =362

S/NO	ITEMS	MEAN	S.D	REMARK
1	Agricultural mechanization have encouraged farmers to have better nutrition	3.24	.88	Agreed
2	Agricultural mechanization have enabled farmers to have better health facilities	3.32	.82	Agreed
3	Agricultural mechanization enable farmers to send their children to school	3.07	1.12	Agreed
4	Agricultural mechanization have enable better housing	3.11	.95	Agreed
5	Agric enable al farmers have luxury items e.g. television, motor cycle, motor car and so on	3.25	.93	Agreed
	Aggregate mean	**3.20**		

Table 4.2.5 revealed that a mean of 3.32 showed that agricultural mechanization had positive influence on standard of living of farmers. It was also revealed from the Table

that a mean of 3.25 of the respondents agreed that mechanized crop production enabled farmers to have luxury items for example, television, motor cycle, motor car and so on.

4.3 Testing of Null Hypotheses

The five null hypotheses were tested using Chi Square statistics. The decision rule is that, when calculated chi square value is greater than the tabulated or the chi square critical, it means that there is significant influence between the variables. Therefore, where significant (p) value is less than (0.05), it is significant otherwise it is not significant. In other words, if p value is equal or greater than alpha (0.05), the null hypothesis will be retained otherwise it will be rejected.

4.3.1 Null Hypothesis 1: There is no significant influence of agricultural mechanization on crop yield per hectare of farmers in Bauchi and Yobe States

Table 4.3.1: Chi Square statistics on the Influence of Mechanized Crop Production on the farmers crop yield in Bauchi and Yobe states

Variable	SA	A	D	SD	Total Row	$\chi^2_{cal.}$	Df	$\chi^2_{critical}$	P
Total column	1628	636	681	313	3258	252.635	24	36.415	0.000

Table 4.3.1 Chi Square test statistics showed that there was significant influence of mechanized crop production on farmer's crop yield per hectare in Bauchi and Yobe states. This is because the calculated chi square value of 252.635 is greater than the critical Chi Square value of 36 at df 24, while the calculated p value of 0.000 is lower

than the 0.05 alpha levels of significance. Consequently the null hypothesis, which stated that there is no significant influence of mechanized crop production on farmers crop yield in Bauchi and Yobe states is hereby rejected and the alternate hypothesis which stated that mechanized crop production significantly influences farmer's crop yield in Bauchi and Yobe states is hereby accepted and retained.

4.3.2 Null Hypothesis 2: There is no significant influence of agricultural mechanization on the income of crop producing farmers in Bauchi and Yobe states.

Table 4.3.2: Chi Square statistics on the Influence of Mechanized Crop Production on Income capability of farmer in Bauchi and Yobe states

Chi-Square Test

Variable	**SA**	**A**	**D**	**SD**	**Total Row**	$\chi^2_{cal.}$	**Df**	$\chi^2_{critical}$	**P**
Total column	1271	446	582	235	2534	240.324	18	28.869	0.000

Table 3.3.2 revealed that there agricultural mechanization has significant influence on the income capability of farmer in Bauchi and Yobe states. This is because the calculated Chi Square value of 240.324 is greater than the critical Chi Square value 28.869 at df 18, while the calculated p value of 0.000 is lower than the 0.05 alpha level of significance. Consequently the null hypothesis which states that there is no significant

influence of mechanized crop production on income capability of farmers in Bauchi and Yobe states is hereby rejected.

Null Hypothesis 3: There is no significant influence of agricultural mechanization on farm size cultivated for crop production in Bauchi and Yobe states.

Table 4.3.3: Chi Square statistics on the Influence of Mechanized Crop Production on farmers' size of farm land cultivated in Bauchi and Yobe states

Variable	**SA**	**A**	**D**	**SD**	**Total Row**	$\chi^2_{cal.}$	**Df**	$\chi^2_{critical}$	**P**
Total column	1614	639	753	242	3248	199.725	24	36.415	0.000

Chi Square test statistics on Table 4.3.3 showed that there was significant influence of mechanized crop production on farmers' size of farm land cultivated in Bauchi and Yobe states. This is because the calculated Chi Square value of 199.725 is greater than the 36.415 Chi Square critical values at df 24, while the calculated p value of 0.000 is lower than the 0.05 alpha level of significance. Consequently the null hypothesis which states that there is no significant influence of mechanized crop production on farmers' size of farm land cultivated in Bauchi and Yobe states is hereby rejected.

Null Hypothesis 4: **There is no significant influence of mechanized crop production on socio -economic characteristics of farmers in Bauchi and Yobe states**

Table 4.3.4: Chi Square statistics on the Influence of Socio – economic characteristics of Farmers Mechanized Crop Production in Bauchi and Yobe states

Variable	**SA**	**A**	**D**	**SD**	**Total Row**	χ^2_{cal}	**Df**	$\chi^2_{critical}$	**P**
Total column	1057	438	480	197	2172	146.045	15	24.996	0.000

Table 4.3.4 revealed that there was significant influence of socio – economic characteristics of farmers on mechanized crop production in Bauchi and Yobe states. This is because the calculated Chi square value of 146.045 is greater than the critical Chi square value of 24.996 at df 15, while the calculated p value of 0.000 is lower than the 0.05 alpha level of significance. Consequently the null hypothesis which states that the socio – economic characteristics of farmers has no significant influence on mechanized crop production in Bauchi and Yobe states is hereby rejected.

Null Hypothesis 5: There is no significant influence of agricultural mechanization on the farmers' standard of living in Bauchi and Yobe states

Table 4.3.5: Chi Square statistics on the Influence of Mechanized Crop Production on the Standard of living of farmers in Bauchi and Yobe states

Variable	SA	A	D	SD	Total Row	$\chi^2_{cal.}$	Df	$\chi^2_{critical}$	P
Total column	944	386	382	98	1810	93.166	12	21.026	0.000

Table 4.3.5 of Chi Square test statistics showed that there was significant influence of mechanized crop production on standard of living of farmers in Bauchi and Yobe states. This is because the calculated Chi Square value of 93.166 was greater than the critical Chi Square value of 21.026 at df 12, while the calculated p value of 0.000 is lower than the 0.05 alpha level of significance. Consequently the null hypothesis which states that there is no significant influence of mechanized crop production on the standard of living of farmers in Bauchi and Yobe states is hereby rejected.

4.4 Summary of Major Findings

The following were the findings of the study;

1. Agricultural mechanization increases crop yield as mechanized weeding and mechanized spraying, sowing and fertilizer application among others increases farmers' crop yield. The null hypothesis was rejected.

2. Income of the farmers was higher from mechanized crop production and made them to be able to settle some of their outstanding debts.

3. There was an increase in the size of farm land cultivated as a result of mechanized crop production, while use of hand tools does not lead to increase in the size of farm land cultivated by the farmers.

4. The socio-economic characteristics of the farmers influence their mechanized crop production. Farmers norms and values as well as their farm size influences their usage of modern agricultural equipment for crop production.

5. Mechanized crop production enabled farmers among others, to be able to purchase luxury items like television set; a motorcycle etc and also had improved health conditions of the farming families.

4.5 Discussion of Major Findings

The discussions on findings are presented in relation to the outcome of the study and the corresponding research questions.

From the study, it was agreed that the use of mechanized weeding increases crop yield. Also adoption of mechanized sprayer, use of mechanical sowing and fertilizer application, use of combined harvesters, crop protection chemical and use of improved (hybrid) seeds increase crop yields. The result of the tested null hypothesis using Chi Square revealed that agricultural mechanization has significant influence on crop production. This agreed with Are et al (2010) who said that agricultural mechanization increases output.

The findings of the study revealed that agricultural mechanization has positively influence the income capability of the farmers. It was also found out that farmers were able to settle their outstanding debts as a result of adopting mechanized crop production. To buttress this, it was revealed from the tested null hypothesis that there was a significant influence of agricultural mechanization on crop production which leads to the rejection of the null hypothesis. This agreed with Anyanwu, et al (2008), that agricultural mechanization increases the profit margin of the farmers and also made it possible for the farmers to make use of optimum production period.

Discussion from research question three revealed that there was a significant influence of agricultural mechanization on the size of farm land cultivated. Therefore null hypothesis three which stated that there is no significant influence of agricultural mechanization on farm size cultivated for crop production in Bauchi and Yobe States was thereby rejected. This findings agreed with Are et al (2010) that agricultural mechanization increased the amount of land to be cultivated which the traditional crude hand tools cannot solve. It encourages large scale production of desired produce thereby increasing quality of produce and economy of scale. Ugochukwu et al (2007) said agricultural mechanization has led to increase in production and efficiency of farm operations.

With regards to the respondents perception concerning the influence of socio-economic characteristics on mechanized crop production in objective four, research question four and null hypothesis four, it was revealed that farmers farm size influence the usage of mechanized agricultural tools for crop production. Also, farmers norms and values affects the usage of modern agricultural equipments for crop production. The tested null

hypothesis revealed that significant influence existed between agricultural mechanization and socio- economic characteristics of farmers in Bauchi and Yobe States; this lead to the rejection of stated null hypothesis.

The study revealed that agricultural mechanization had positive influence on standard of living of farmers. It was agreed from the study that mechanized crop production enabled farmers to have luxury items for examples television, motorcycle, motor cars and so on, and also an improved health conditions. This agreed with Atala (1980), that standard of living is the material and impersonal resources which individual possessed and use to meet their psychological, social conditions or needs. Anonymous (2011), explained standard of living as a level of wealth, comport, material goods and necessities available to certain socio-economic class in a certain geographical area.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presented the summary, conclusion and recommendations of this study under the following sub-headings:

5.1 Summary

5.2 Conclusion

5.3 Recommendation

5.4 Limitation of the Study

5.5 Suggestion for furthers Study

5.1 Summary

The study was conducted to determine the influence of agricultural mechanization on crop production in Bauchi and Yobe States. In order to achieve this, five specific objectives and five research questions were raised. Five null hypotheses were also formulated. Descriptive research survey design was used for the study; sample size were 368 from a population of 51,580 contact farmers. The instrument used for the study was structured questionnaire which was administered by the researcher with the help of research assistants. Means were used to answer the five research questions while Chi Square was used to test the null hypotheses. Major findings of the study showed that;

1. Agricultural mechanization increases crop yield as mechanized weeding, mechanized spraying, sowing and fertilizer application among others increase farmers crop yield. The null hypothesis was rejected.
2. Income of the farmers was higher from mechanized crop production and made them to be able to settle some of their outstanding debts.
3. There was an increase in the size of farm land cultivated as a result of mechanized crop production, while use of hand tool does not lead to increase in the size of farm land cultivated by the farmers.
4. The socio-economic characteristics of the farmers influence their mechanized crop production. Farmer's norms and values as well as their farm size influenced their usage of modern agricultural equipment for crop production.
5. Mechanized crop production enabled farmers among others to be able to purchase luxury items like television set, a motorcycle, and so on. And also had improved health conditions of the farming families.

5.2 Conclusion

Based on the findings of the study, the following conclusions were made;

Farmer's crop yields increased with full adoption of agricultural mechanization in the study area. Crop production increased through mechanization and resulted in increase in income of the farmers thereby given room for increased production capacity thereby enabling the farmers to settle some of their outstanding debts. Crop producing Farmer's standard of living improved as a result of mechanized crop production in Bauchi and Yobe states.

5.3 Recommendations

Based on the findings of the study and the conclusion drawn, the following recommendations were made:

1. Mechanized farm tools and equipment should be provided to farmers in form of subsidy and ensure that it is the right category of farmers benefit.

2. There should be better funding of extension service programmes so that the extension workers can discharge their duty effectively.

5.4 Limitation of the Study

The limitation of the study was that the researcher had no control over the respondents, so choices of responses had some degree of inconsistency this may be attributed to some reservation on the part of the respondents to reveal personal opinions. This affected the study in terms of the time taken to complete it.

5.5 Suggestion for Further Study

The study has the following suggestion to made:

1. A similar study of the influence of agricultural mechanization on crop production should be carried out in other North-east states of Borno, Taraba, Gombe and Adamawa.

2. A comparative study of the influence of mechanized crop production should be carried out in all the North-east States of Nigeria.

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APPENDIX I

DEPARTMENT OF VOCATIONAL & TECHNICAL EDUCATION

AHMADU BELLO UNIVERSITY, ZARIA NIGERIA

FACULTY OF EDUCATION

Telephone: 069-51755, 50692
Vice Chancellor: Professor. Abdullahi Mustapha B.Sc. (Hons) Pharm(ABU), Ph.D (London) FPSN
Head of Department : Professor A.A Udoh B.Ed. (Hons) Nsukka M.Ed. & Ph.D Bus Edu. (ABU)

Your Ref: _____ 12th March, 2014

Our Ref: M.SC/EDUC/0282/2009-2010 Date: _____

The Programme Manager
Bauchi State Agricultural Development Programme
Bauchi.

Letter Of Identification

ISA MAMMAN - M.SC/EDUC/0282/2009-2010

This is to certify that the above mentioned name is a Postgraduate student (M.Sc Agricultural Education) in the Department of Vocational and Technical Education, Ahmadu Bello University, Zaria, carrying out a research topic: ***Influence of Adoption of Agricultural Mechanization by the Farmers on Crop Production in Bauchi and Yobe States.***

Please, kindly give him every assistance he may require.

DEPT. OF VOC. & TECH. EDUCATION
HEAD OF DEPT.
DATE

Professor A.A. Udoh
HEAD OF DEPARTMENT

Appendix II

QUESTIONNAIRE

Questionnaire for the Farmers

Agricultural Education section,
Department of Voc. & Tech. Education,
Faculty of Education,
Ahmadu Bello University, Zaria
12TH March, 2014.

Dear Respondent,

Request to fill questionnaire

I am a student of the above named institution undergoing a research on the topic "INFLUENCE OF AGRICULTURAL MECHANIZATION ON CROP PRODUCTION IN BAUCHI AND YOBE STATES".

Kindly, respond to the attached questionnaire as objectively as possible. All information given will be treated as confidential and used only for the purpose of this research study.

Thank you.

Yours faithfully,

Isa, Mamman

FARMERS' QUESTIONNAIRE

SECTION A: DEMOGRAPHIC DATA

Respond to this section by ticking (✓) the appropriate option

(1) Age (in years)

(a) 18-25 ( )

(b) 26-35 ( )

(c) 36-45 ( )

(d) 46 and above ( )

(2) Sex:

(a) Male ( )

(b) Female ( )

(3) Highest Educational qualification

(a) No formal education ( )

(b) Primary education ( )

(c) Secondary education ( )

(d) Tertiary education ( )

(4) Sources of Income

(a) Sales of crop ( )

(b) Salary ( )

(c) Sales of livestock ( )

(d) Others ( )

(5) Farmer's annual income in Naira

(a) Less than 15,000 ( )

(b) 15,000-25,999 ( )

(c) 26,000-50,999 ( )

(d) Above 51,000 ( )

(6) Farm size in hectares

(a) Less than 5 ( )

(b) 5-15 ( )

(c) Above 15 ( )

(7) Average yields of crops cultivated (in kilograms kg)

(a) Less than 1,000 ( )

(b) 1,001-5,000 ( )

(c) Above 5,000 ( )

(8)Number of years of Farming experience

(a) Less than 5 ( )

(b) 5-15 ( )

(c) 16-25 ( )

(d) Above 25 ( )

INSTRUCTION: Please, carefully read the statements in the section **B-E** below and tick appropriately the columns on the right hand side that indicates the level of your agreement or disagreement. Key: SA=Strongly Agree, A= Agree, D= Disagree, SD= Strongly Disagree

SECTION B: THE INFLUENCE OF AGRICULTURAL MECHANIZATION ON

FARMERS CROP YIELD

S/NO	**ITEMS**	**S A**	**A**	**D**	**S D**
1	Adoption of mechanized land clearance and preparation increases crop yield				
2	The use of modern irrigation system increases crop yield				
3	Mechanized Processing/Milling of farm produce increases crop yield				
4	The use of mechanized Sowing and fertilizer application increases crop yield				
5	use of mechanized crop protection chemicals lead to increases in crop yield				
6	Use of combined harvesters increases crop yield				
7	Use of mechanized weeding increases crop yield				
8	Adoption of mechanized sprayers increases crop yield				
9	Adoption and use of improved (hybrid) seeds used increases crop yield				

SECTION C: INFLUENCE OF AGRICULTURAL MECHANIZATION ON

INCOME CAPABILITY OF THE FARMERS

S/NO	**ITEMS**	SA	A	D	SD
1	I was able to invest in other business as a result of adopting mechanization				
2	I was able to settle some of my outstanding debts as a result of adopting mechanized crop production				
3	I have money to spend now than before I adopt mechanized crop production				
4	Adoption of mechanized crop production has increases my income and savings.				
5	I was able to embark on capital projects like building a house, buying a car/motor cycle etc with the adoption of mechanized crop production				
6	Income capability of the farmers is high before the adoption of mechanized crop production				
7	Income capability of the farmers is high after the adoption of mechanized crop production				

SECTION D: INFLUENCE OF AGRICULTURAL MECHANIZATION ON SIZE OF FARM LAND CULTIVATED

S/NO	ITEMS	S A	A	D	S D
1	The use of hand tools does not increase the size of farm land cultivated for crop production				
2	Hand tools technologies do not increase the size of farm land cultivated by the farmers for crop production				
3	Use Animal traction increases thesize of farm land for crop production				
4	Adoption of animal traction does not increase area of land cultivated				
5	Adoption of mechanical techniques increases the size of land cultivated				
6	The use of mechanical tools has encouraged farmers to generate more income				
7	Mechanical tools do not lead to increase in the size of farm land cultivated				
8	The size of farm land cultivated remain unchanged for all forms of mechanized crop production				
9	Size of farm land cultivated increases for all forms of mechanized crop production				

SECTION E: INFLUENCE OF SOCIO-ECONOMIC CHARACTERISTICS ON MECHANIZED CROP PRODUCTION

S/NO	ITEMS	SA	A	D	SD
1	Family labour which is determined by the house hold size influence the adoption of mechanized crop production				
2	farmers" norms and values affect the usage of modern agricultural equipments for crop production				
3	Income level of farmers influence purchase of modern implements needed for mechanized crop production				
4	Group labour discourages mechanized crop production				
5	Farmers" farm size influence the usage of mechanized agricultural tools for crop production				
6	Farmers" number of years of farming experience influence their mechanized crop production				

SECTION F: INFLUENCE OF AGRICULTURAL MECHANIZATION ON THE FARMERS STANDARD OF LIVING

S/NO	**ITEMS**	SA	A	D	SD
1	Have encourages farmers to have better nutrition				
2	To have better health facilities.				
3	To send their children to school.				
4	To have better housing				
5	To have luxury items e.g. television, motor cycle, motor car and so on.				

APPENDIX III

DETAILS OF STATISTICAL ANALYSIS

Frequency Table

Age

	Age(years)	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	62	17.1	17.1	17.1
	26-35	114	31.5	31.5	48.6
	36-45	90	24.9	24.9	73.5
	46 yrs and above	96	26.5	26.5	100.0
	Total	362	100.0	100.0	

Sex

	Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	298	82.3	82.3	82.3
	female	64	17.7	17.7	100.0
	Total	362	100.0	100.0	

Farmers annual income in Naira

Highest Educational Qualification

Educational Qualification			Percent	Valid Percent	Cumulative Percent
Valid	No formal education	144	39.8	39.8	39.8
	Primary education	92	25.4	25.4	65.2
	secondary education	76	21.0	21.0	86.2
	Tertiary education	50	13.8	13.8	100.0
	Total	362	100.0	100.0	

Sources of Income

Source of Income		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	sales of farm produce	180	49.7	49.7	49.7
	Salary	18	5.0	5.0	54.7
	sales of livestock	109	30.1	30.1	84.8
	Others	55	15.2	15.2	100.0
	Total	362	100.0	100.0	

Annual Income		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than N15000	102	28.2	28.2	28.2
	N15000 - N25999	83	22.9	22.9	51.1
	N26000 - N50999	88	24.3	24.3	75.4
	Above 51000	89	24.6	24.6	100.0
	Total	362	100.0	100.0	

Farm size in hectares

Farm Size Hectares		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 hectare	104	28.7	28.7	28.7
	5 - 15 hectare	193	53.3	53.3	82.0
	Above 15 hectare	65	18.0	18.0	100.0
	Total	362	100.0	100.0	

Average yields of crops cultivated (in Kg)

Average yields cultivated (in Kg)		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1,000 kg	77	21.3	21.3	21.3
	1,001 - 5,000 kg	105	29.0	29.0	50.3
	5,1001 - 10,000	112	30.9	30.9	81.2
	Above 10,000	68	18.8	18.8	100.0
	Total	362	100.0	100.0	

Number of years of farming experience

No of Years of Farming Experience		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 yrs	82	22.7	22.7	22.7
	5-15 yrs	126	34.8	34.8	57.5
	16-25 yrs	109	30.1	30.1	87.6
	Above 25 yrs	45	12.4	12.4	100.0
	Total	362	100.0	100.0	

1. Influence of Agricultural Mechanization on Farmer's Crop Yield

N=362

Statistics

	Adoption of mechanized land clearance increases crop yield	The use of modern irrigation system increases crop yield	Mechanized processing/ milling increases crop yield	Adoption of mechanized sowing and fertilizer application increases crop yield	Use of mechanized crop protection chemicals lead to increase in crop yield	Use of combined harvesters increases crop yield	Use of mechanized weeding increases crop yield	Adoption of mechanized sprayers increases crop yield	Adoption and usage of improved (hybrid) seeds increases crop yields
N	362	362	362	362	362	362	362	362	362
Mean	2.812	3.260	3.376	2.804	3.158	3.293	2.856	3.359	2.970
Std. Deviation	1.164	.953	.814	1.154	.959	.885	1.166	.828	1.147

2 Influence of Agricultural Mechanization on Income Capability of the Farmers.

Frequencies

Statistics

	I was able to invest in other business as a result of mechanized crop production	I was able to settle some of my out standing debts as a result of adopting Mechanized crop production	I have money to spend now from Mechanized crop production	Adoption of Mechanized crop production has increased my income and savings	I was able to embark on capital projects like building a house, buying a car/motor cycle etc with mechanization of crop production	Income capability of the farmers is higher from Mechanized crop production	Income capability of the farmers is low from Mechanized crop production
N	362	362	362	362	362	362	362
Mean	3.185	3.337	2.953	3.075	3.188	3.373	2.495
Std. Deviation	.954	.882	1.134	1.072	1.080	.820	1.089

3. Influence of Agricultural Mechanization on Size of Farm land Cultivated

Statistics

	The use of hand tools has increased the size of farm land cultivated for crop production	hand tools technologies do not increase the size of farm land cultivated by the farmers for crop production	Use of animal traction increases the size of farm land for crop production	Adoption of animal traction does not increase area of land cultivate	Adoption of mechanical techniques increases the size of land cultivated	The use of mechanical tools has encouraged farmers to generate more income	Mechanical tools do not lead to increase in the size of farm land cultivated	The size of farm land cultivated remain unchanged for all forms of mechanized crop production	Size of farm land cultivated increases for all forms of mechanized crop production
N	362	362	362	362	362	362	362	362	362
Mean	3.149	3.257	3.113	3.124	3.350	3.028	2.887	3.066	3.011
Std. Deviation	.956	.901	.971	.970	.820	1.136	1.129	.960	1.151

4 Influence of Socio-Economic Characteristics on Mechanized Crop Production

Frequencies

Statistics

	Family labour which is determined by the house hold size influence the adoption of mechanized crop production	Farmers norms and values affect the usage of modern agricultural equipment for crop production	Income level of farmers influence purchase of modern implements needed for crop production	Group labour discourages mechanized crop production	farmers farm size influence the usage of mechanized agricultural tools for their crop production	farmers number of years of farming experience influence their mechanized crop production
N	362	362	362	362	362	362
Mean	3.055	3.304	2.920	3.099	3.329	2.798
Std. Deviation	.994	.846	1.166	.980	.893	1.165

5 Influence of Agricultural Mechanization on the Farmers Standard of Living

Frequencies

Statistics

	Agricultural Mechanization have encouraged farmers to have better nutrition	Agricultural Mechanization have enabled farmers to have better health facilities	Agricultural Mechanization enable farmers to send their children to school	Agricultural Mechanization have enable better housing	Agricultural Mechanization have enable farmers have luxury items e.g. television, motor cycle, motor car and so on
N	362	362	362	362	362
Mean	3.254	3.323	3.072	3.119	3.243
Std. Deviation	.937	.821	1.129	.950	.885

TABLE 1

Table for Determining Sample Size from a Given Population

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

BAUCHI STATE AGRICULTURAL DEVELOPMENT PROGRAMME

Western Zone Project

Ministry of Agriculture and Natural Resources

P.M.B. 0266, Bauchi Bauchi State Nigeria

LIST OF CONTACT FARMERS, EXTENSION CELLS/BLOCKS AND NOS, OF EA'S IN THE ZONE

Your Ref: Your Ref: SUB-ZONAL EXTENSION AREAS Date:

Item	Alkaleri	Toro	Dass	Bogo	T/Balewa	Bauchi	Total Zone
Nos. of Extension blocks in the Zone	4	3	2	2	3	4	18
Nos. of Contact farmers in the Zone	1600	3640	2,640	1200	3620	4400	17,100
Contact farmers in each block	400	1213	1,320	600	1207	1100	5840
Contact farmers in each Cell	80	80	80	80	80	80	80
Total EA's in the Zone	20	32	34	11	31	55	183
Total EA's in each block.	5	11	17	6	10	14	63
Extension Cells in each block.	5	11	17 Bday	6	10	~~55~~ 14	63

No of farming families = 685,510

B.S.A.D.P (NORTHERN ZONE) EXTENSION STAFF DATA

NO. OF EXTENSION BLOCK	TOTAL OF EXT. AGENT IN EACH BLOCK	EXTENSION CELL IN EACH BLOCK	CONTACT FARMER IN EACH CELL	CONTACT FARMER IN EACH BLOCK	NO. OF CONTACT FERMERS IN THE ZONE
15 Blocks	1. Azare - 7 (seven)	7 (seven)	80 Farmers	560 Farmers	6,160 Farmers
	2. Chinade – 3 (three)	3 (three)	80 Farmers	240 Farmers	
	3. Madara - 2 (two)	2 (two)	80 Farmers	160 Farmers	
	4. Jama'are – 5 (five)	5 (five)	80 Farmers	400 Farmers	
	5. Itas – 2 (two)	2 (two)	80 Farmers	160 Farmers	
	6. Udubo – 5 (five)	5 (five)	80 Farmers	400 Farmers	
	7. Gamawa – 5 (five)	5 (five)	80 Farmers	400 Farmers	
	8. Gololo – 3 (three)	3 (three)	80 Farmers	240 Farmers	
	9. Katagum – 2 (two)	2 (two)	80 Farmers	160 Farmers	
	10. Sakwa – 6 (six)	6 (six)	80 Farmers	480 Farmers	
	11. Giade – 4 (four)	4 (four)	80 Farmers	320 Farmers	
	12. Yana – 5 (five)	5 (five)	80 Farmers	400 Farmers	
	13. Misau – 17 (seventeen)	17 (seventeen)	80 Farmers	1360 Farmers	
	14. Hardawa – 7 (seven)	7 (seven)	80 Farmers	560 Farmers	
	15. Dambam – 4 (four)	4 (four)	80 Farmers	320 Farmers	

Basic stats revision content >> tables

The chi-square table

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This table gives the cut off points (critical values) of the chi-square distribution. The alpha is the area under the curve to the right of the critical value.

	α =0.995	**0.99**	**0.975**	**0.95**	**0.9**	**0.1**	**0.05**	**0.025**	**0.01**	**0.005**
df =1	---	---	0.001	0.004	0.016	2.706	**3.841**	5.024	6.635	7.879
2	0.01	0.02	0.051	0.103	0.211	4.605	**5.991**	7.378	9.21	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	**7.815**	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	**9.488**	11.143	13.277	14.86
5	0.412	0.554	0.831	1.145	1.61	9.236	**11.07**	12.833	15.086	16.75
6	0.676	0.872	1.237	1.635	2.204	10.645	**12.592**	14.449	16.812	18.548
7	0.989	1.239	1.69	2.167	2.833	12.017	**14.067**	16.013	18.475	20.278
8	1.344	1.646	2.18	2.733	3.49	13.362	**15.507**	17.535	20.09	21.955
9	1.735	2.088	2.7	3.325	4.168	14.684	**16.919**	19.023	21.666	23.589
10	2.156	2.558	3.247	3.94	4.865	15.987	**18.307**	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	**19.675**	21.92	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	**21.026**	23.337	26.217	28.3
13	3.565	4.107	5.009	5.892	7.042	19.812	**22.362**	24.736	27.688	29.819
14	4.075	4.66	5.629	6.571	7.79	21.064	**23.685**	26.119	29.141	31.319

15	4.601	5.229	6.262	7.261	8.547	22.307	**24.996**	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	**26.296**	28.845	32	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	**27.587**	30.191	33.409	35.718
18	6.265	7.015	8.231	9.39	10.865	25.989	**28.869**	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	**30.144**	32.852	36.191	38.582
20	7.434	8.26	9.591	10.851	12.443	28.412	**31.41**	34.17	37.566	39.997
21	8.034	8.897	10.283	11.591	13.24	29.615	**32.671**	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	**33.924**	36.781	40.289	42.796
23	9.26	10.196	11.689	13.091	14.848	32.007	**35.172**	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	**36.415**	39.364	42.98	45.559
25	10.52	11.524	13.12	14.611	16.473	34.382	**37.652**	40.646	44.314	46.928
26	11.16	12.198	13.844	15.379	17.292	35.563	**38.885**	41.923	45.642	48.29
27	11.808	12.879	14.573	16.151	18.114	36.741	**40.113**	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	**41.337**	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	**42.557**	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	**43.773**	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	**55.758**	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	**67.505**	71.42	76.154	79.49
60	35.534	37.485	40.482	43.188	46.459	74.397	**79.082**	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	**90.531**	95.023	100.425	104.215
80	51.172	53.54	57.153	60.391	64.278	96.578	**101.879**	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	**113.145**	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	**124.342**	129.561	135.807	140.169