ANALYSIS OF THE ADOPTION OF RECOMMENDED SOYBEAN PRODUCTION PRACTICES IN ZARIA LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

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DECLARATION

I hereby declare that this dissertation titled **"Analysis of the Adoption of Recommended Soybean Production Practices in Zaria Local Government Area of Kaduna State,"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma at any institution. All borrowed information has been duly acknowledged in the text and a list of references provided.

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CERTIFICATION

This dissertation titled **"Analysis of the Adoption of Recommended Soybean Production Practices in Zaria Local Government Area Of Kaduna State"** by Ibrahim UMARU meets the regulations governing the award of Degree of Master of Science of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated to my parents Malam Umaru Ahmad Gwadabawa and Malama Aisha Adamu Tudun Doki.

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ABSTRACT

This study focused on analysis of the adoption of recommended soybean production practices in Zaria Local Government Area of Kaduna State, Nigeria. Primary data were collected from 165 respondents using structured questionnaire. The statistical tools used to analyze the data were descriptive statistics and regression analysis. The result of the analysis shows that 44% of the respondents with were within the age range of 31-50 years, with a mean age of 40 years, 67% of the respondents had household size ranging from 1-10 people, with an average of 10 persons. Majority (99%) of the farmers were literate. About 86% of the farmers do not have access to credit and therefore financing their production through personal savings. Also, 72% of the farmers do not belong to any cooperative association while majority (79%) of the farmers had no access to extension visit. The result of this study also shows that cumulative contributions of independent variables to the adoption of recommended soybean production practices had coefficient of determination (R^2 Adjusted) value of 0.68. This implies that all the variables together, explained 68 percent of the total variability in adoption of recommended soybean production practices in the study area. Meaning that farmers has 32% shortfall from total adoption of soybean production practices due to some factors outside their control (intervening variable) such as rainfall, temperature, humidity etc. The relationship between selected socioeconomic and institutional factors influencing adoption of recommended soybean production practices show that out of eight variables included in the model, six had significant influence on adoption of technologies. These were age, sex, education, farming experience, membership of cooperatives and extension contact. The effect of adoption of recommended soybean production practices on yield showed that planting date, spacing, fertilizer application, use of resistant variety and storage had significant influence at 10%, 10%, 10%, 5% and 1% respectively. While planting date, number of seed per hole, use of resistant variety and fertilizer application had significant influence at 5%, 1%, 1% and 1% respectively on farmers' income. The most important constraints faced by farmers to the adoption of recommended soybean production practices identified in the study area were high cost of the technology (59.4%), Insufficient credit facilities (30.9%), Inadequate awareness (13.9%) and complexity of the technology (12.7%). Based on the finding of this study, it could be concluded that adoption level of soybean production practices is on average having six out of thirteen technological practices being highly adopted by soybean farmers in the study area. It is recommended that the local government and non-governmental organizations dealing with extension agents should therefore embark more on the facilitation techniques of extension delivery. This will enable the farmers to identify their problems, determine their needs, and discover their potential themselves rather than always being fed with information.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Soybean (*Glycine max L. Merril)* has been variously described as a miracle bean because it is a cheap and protein-rich grain. Soybean originates from East Asia (Onasanya, 2002). It contains 40% high quality protein, 20% edible vegetable oil, a good balance of amino acids (Singh *et al.*, 1987; Weingartner, 1987) and has therefore, tremendous potentials to improve the nutritional status and welfare of the families of resource-poor farmers. Soybean also contribute to the enhanced sustainability of intensified cropping systems by improving soil fertility through nitrogen fixation, permitting a longer duration of ground cover in the cropping sequence, and providing useful crop residues for animal feed (Rahmianna and Nikkuni, 2002).

The world annually produced 28.6 million metric tons of soybeans in 1961-65, and reached 217.6 million metric tons in 2005-07. The quantity increased 7.6 times during the half century (AMREC, 2007). The USA produced more than 50 percent of the world soybean production until the 1980s but that share has declined to 37.0% in 2005-07. Brazil and Argentina though have significantly increased their shares steadily over the same period. Brazil is the second largest producer with 53.9 million tons, or 24.8% of world production. Argentina ranks third producing 41.4 million tons and 19.0% of world output. The top five countries; United States, Brazil, Argentina, China, and India, produce more 92% of the world's soybeans (AMREC, (2007).

Soybean is gaining prominence in Nigeria as over 200,000 ha of land were devoted to its cultivation as far back as 1992. This according to CTA was then the largest area of

land devoted to soybean cultivation in the whole of Africa (CTA, 1992). Soybean is farmed extensively, mainly by small scale farmers, which may account for its low yields. Despite this, Nigeria's experiment in the use of Soybean as a food crop offers a lot of promise. This is why its production has received considerable attention and direct government support in the last two decades. The interest in promoting soybean production and utilization is not unconnected with the immense economic and nutritional value of the crop.

It has been shown that Benue, Kaduna, Plateau and Niger are the major Soybean producing states in Nigeria, in descending order. Other Soya producing areas include Nasarawa, Kebbi, Kwara, Oyo, Jigawa, Borno, Bauchi, Sokoto, Taraba and the Federal Capital Territory. Benue State produced about 44 per cent of the national output while Kaduna State produced 26.7 per cent. The producing States for soybean accounted for 96 per cent of soybean produced in Nigeria. The high production levels in Benue state is both as a result of the large individual farm holdings and the number of producers. However, it was observed that, in Benue State, soybean is produced as a major crop in every Local Government Area, accounting for over half of the farm size of individual farmers. While in Kaduna state the production of soybean is localized in only fewLocal Government Areas(LGAs), soybean is produced in all the LGAs in Benue State. The LGAs producing higher quantities of soybean in Ondo and Oyo States are Akure North and Saki West indicating that these two LGAs have large markets for soybean in Southwest Nigeria (AMREC, (2007).

A glaring aspect of the Nigerian agricultural production system is the predominance of small- scale farmers using simple technology. They depend essentially on farming for their domestic consumption, income and the overall welfare of their family members.

These are farmers who cultivated their crops mainly for their consumption, and the excess of the produce is sold so that income generated from the sale is used to meet other family needs. However, soybean is a relatively new crop in Africa. It was seen as being appropriated only for large-scale farming where the crop can be used for industrial processing (Shannon *et al.,* 1995). World production statistics on soybean show that Nigeria is second to Zimbabwe, the leading producer of soybean in tropical Africa. Soybean is now grown in all ecological zones of Nigeria. Soybean is a very important legume in the Nigerian market in terms of its marketability, consumption level and raw material source. This crop being like most leguminous crop is planted between May and June and harvested between October and November.

Locally, soybean can be processed into various forms of food for human consumption, these forms include soymilk, soya vegetable, soya pap, soya bread etc (Ajia, 1992). All these forms of foods processed from soybean are very rich in protein, cheap to obtain and easy to prepare.

1.2 ProblemStatement

A commonly held view is that soybean is of little or no importance in sub-Saharan Africa, as the crop will not bring benefit to small-scale farmers who form the bulk of the farming community in Nigeria (Singh *et al.,* 1987). However, Soybean has good qualities which necessitated the Federal Government to develop policies on agriculture in favor of the production of soybean in Nigeria by encouraging research work on recommended soybean production practices such as proper land preparation, the use of improved seed varieties, proper seed treatment, sowing date, seed rate, spacing, fertilizer application, weed and pest control, harvesting and storage.

It is noted that soybean with various forms of food use, high nutritional values and relatively less expensive has very low level of adoption compared with other cereals and leguminous crops (Ajia, 1992).Soybean is farmed extensively, mainly by small scale farmers in the study area, which may account for its low yields. This could be attributed to poor production technologies, inadequate supply of inputs such as improved seed varieties, fertilizers and machineries, as well as pesticides and herbicides for pest and weed control respectively (Oyekan, 1987). Eziakor (1990) stated that there is a growing realization that the successful adoption and implementation of improved practices by the small-scale farmers holds the key to increased yields on their smallholdings. This study therefore, examinesthe adoption of recommended soybean production practices in Zaria Local Government Area of Kaduna State. Thus, the following research questions were raised:

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

ii. What are the factors influencing the adoption of recommended soybean production practices in Zaria Local Government Area?

iii. What is the rate of adoption of recommended soybean production practices in the study area?

iv. What are the effects of adoption of recommended soybean production practices on farmers' yields and income?

v. What are the constraints to adoption of soybean production recommended practices in the study area?

1.3 Objectives of the Study

The broad objective of this study is to examine the adoption of recommended soybean production practices in Zaria Local Government Area of Kaduna State. The specific objectives were to:

i. describe the socio-economic characteristics of soybean farmers in the study area;

ii. determine the factors that influence adoption of recommended soybean production practices in Zaria Local Government Area;

iii. describe rate of adoption of the recommended soybean production practicesby farmers in the study area;

iv. examine the effects of adoption of recommended soybean production practices on farmers' yields and income; and

v. identify the constraints to soybean production recommended practices in the study area.

1.4 Justification of the Study

Successive governments in Nigeria seem to have recognized the importance of agricultural extension services to the survival of the small-scale farmers in particular and agricultural development in general. Thus various agricultural development programmeshave evolved with the aim of modernizing and improving the farmer's technical knowledge and skills for greater output and higher standards of living (Akanya and Atala,1991).

One major concern is the provision of food for the rapidly increasing population in order to deal with the impending threat of food insecurity.The Food and Agricultural

Organization (1995) reported that about 800 million people representing 20 percent of the world's population are food in secured and this situation might accelerate especially in sub-Saharan Africa which is identified as the "hot spot" of food insecurity, if proper measures are not taken.

This study is therefore aimed at examining the adoption of recommended soybean production practices. The findings of this study will provide information on farmers' socio-economic characteristics that influence soybean farmers' decisions on the adoption of recommended soybean production practices. It will also help as a guide to policy makers on the short and long terms agricultural development plans relevant to farmer's local needs. It will also be useful to researchers and extension agents in fashioning out the best means for farmers to adopt relevant innovations. Furthermore, this study will seek to show the relationship between adoption and various independent variables considered in getting desired change in farmers for increased productivity. Finally, the research will aid extensionists and policy makers as an analytical frame of reference that can be used in planning, executing and evaluating present and future agricultural development concerning farmers' adoption of new agricultural technologies.

1.5 Hypotheses of the Study

The hypotheses tested in this study were:

i. Socio-economic characteristics have no significant effects on the adoption of recommended soybean production practices.

ii. Adoption of recommended soybean production practices has no significant effects on farmers' yields.

iii. Adoption of recommended soybean production practices has no significant effects on farmers' income.

CHAPTER TWO

LITERATURE REVIEW

2.1 Development of Improved Soybean Varieties and Utilization Technologies

Soybean may have been introduced to Nigeria as early as 1908, but its cultivation as a crop can be attributed to the introduction of the Malayan variety in 1937 by British colonial officers in Benue State (Singh *et al.*, 1987). Until recently, the Malayan variety was virtually the sole variety grown by farmers. This variety is low yielding, susceptible to bacterial diseases and is late maturing (Smith *et al*., 1995). The latter characteristic exposes soybean to pod shattering due to the desiccating action of the seasonal harmattan wind. The expansion of the crop was limited by the lack of suitable varieties. Moreover, most soybean varieties could not nodulate in association with the native rhizobia indigenous to African soils and the seed quickly lost viability which made it difficult for farmers to store it until the next cropping season (Dashiell *et al.*, 1987).

Over the last two decades, IITA has made substantial efforts to improve the productivity of the crop by developing high yielding, early maturing varieties capable of nodulating in association with local rhizobia, and possessing other good agronomic traits (IITA, 1994). Improved soybean varieties released in Nigeria include TGx 849-313D, TGx 1019-2EN, TGx 1019-2EB, TGx g1447-2E, TGx 536- 02D, TGx 306-036C, TGx 1485-1ED, and TGx 1440-1E (IITA, 1994). The identification of seed collected from farmers revealed that farmers were planting the following varieties: M351, Samsoy 1 and 2, TGx 536-02D, TGx 923-1E, TGx 1440- 1E, TGx 1448-2E, TGx 306-036C, and TGx 1485-1ED.

These varieties were introduced to farmers over a range of time following different channels. Early attempts to diffuse improved varieties started in the late 1970s with the introduction of the variety Genyi by the Department of Agriculture. It was not until the late 1980s that other improved varieties became available. In the early 1980s, the varieties Samsoy 1 and Samsoy 2 were released and introduced to farmers. In the late 1980s, the Benue State Agricultural and Rural Development Authority (BNARDA)-the State extension services-introduced the variety TGx 536-O2D developed by IITA for mass adoption. Recently the variety TGx 923- 1E was also introduced. Other improved varieties were also introduced through the formal diffusion channels, and could therefore be considered as an innovation.

Following the development and introduction of improved varieties, many food recipes using soybean were found to be highly acceptable to Nigerians, including their incorporation into traditional local dishes (Osho and Dashiell, 1998). Substantial efforts were made to promote soybean utilization technologies among rural and urban households. National research and extension personnel in many African countries have been trained in soybean production, processing, and utilization techniques. In Nigeria, more than 47, 000 persons, including about 30, 000 women, have been trained in the production and potential utilization of soybean in their families' diet (Osho and Dashiell, 1998).

2.2 Recommended Cultural Practices of Soybean Farming

The recommended cultural practices for soybean farming as developed by IITA, Ibadan in 1994 are as follows**:**

Planning

Start with a small area and gradually build up your skill in growing the crop. You will discover whether your plot of land has any problem and how you can overcome them. When you have successfully grown the crop on this small area, you may think of planting in a larger area.

Site selection

Choose land that is flat or with just a small slope, land that has deep soils and good drainage, with no problems of water logging.

Site preparation

Clear the land of grasses and weeds and prepare it the same way as you do for maize. There should be no weeds growing at planting time. Most soils in Nigeria do not require fertilizer in order to produce a good soybean crop.

Planting

Plant rows 60 to 75 centimeters wide and 5 to 6 centimeters between plants in each row, at a depth of 1 to 2 centimeters. About 50 kilograms of seed can be planted in 1 hectare. Soybeans grow best if planted alone, and not overshadowed by other crops. If grown in rotation with other crops, soybeans will produce better yields.

Fertilizer Application

Generally you do not need to use fertilizer. Good soil will provide good yields. Poor soil

may need to be improved before planting with fertilizer. Use 50 kilograms of 15-15-15 NPK and 200 kilograms of single super-phosphate per hectare.

Time to plant

In Nigeria, planting times vary according to the different ecological zones.

Humid forest	Lagos, Ogun, Bendel, Anambra, Imo, Cross River, Oyo, Ondo	10 to 20 July
Forest savanna	Southern Kwara,Benue.	10 to 30 June
Moist savanna	Northern Kwara, Niger, Kaduna, Bauchi, Gongola, southernSokoto	15 to 25 June
Dry Savanna	Plateau	5 to 15 June

Seeds

Recommended varieties:

- Samsoy 2
- TG x 849-313D.

  Seeds can be obtained from:

- National Seed service, Ibadan
- Director, National Cereals Research Institute, Badeggi, Bida.
- Agricultural development Project or Ministry of Agriculture in your state.

Plant Protection

Weed Control

Hand weed after planting, which is 1 to 2 weeks after planting, then second weeding followed 5 to 6 weeks. Hand weeding should be done 1,2, or 3 times, depending on how fast the weeds grow on your farm.

Pests Control

When the seed-lings are emerging, it is necessary to scare birds in early hours of morning and late afternoon. Birds can damage soybean only during the first 2 weeks after planting.

Rats and rabbits will eat leaves and tops of plants as soon as the first leaves begin to appear. As a means of discouraging them, keep dense vegetation back from the growing area.

In most areas, there is no problem of Insects. However if a few pod-sucking bugs appear, they will do little damage and usually you should do nothing about them. They are easier to detect in the morning before it becomes very hot.If there is a large population of pod-sucking bugs, you may spray with any of the following insecticides:

- Thiodan®
- Sherpa Plus®
- Cymbush® + Rogor®
- Cymbush Super®
- Decis® + Thiodan®

  Read labels and instructions carefully before use.

Harvesting. When the pods turn brown, tan or grey, depending on the variety, and the pods rattle when shaken, the whole plant should be harvested. That will normally happen 3 to 4 months after planting. If harvesting is delayed, the pods will shatter and the seeds may be scattered. The mature plants may be uprooted or cut at ground level and loosely stacked for later threshing. They should be harvested in dry conditions.

Threshing. Plants must be kept dry. They may be spread on a platform and sun-dried. Hand threshing is suitable for small quantities. They should be threshed as soon as possible.

Storage. Grains for eating should be stored in a dry condition, at less than 10% moisture. If it is possible to dent the bean with your teeth, the seed is not sufficiently dry. After proper drying the grains should be stored in woven sacks, in a well-ventilated barn. Seeds for planting should be stored in a plastic bag so that the seed remains at 10% moisture level. Keep until planting time in a cool part of the house (IITA, 1994).

2.3 Previous Studies on Socio-Economic Characteristics of Farmers

Many studies carried out in Nigeria have shown that there exists a close association between farmers socio-economic characteristics and awareness of adoption of recommended farm practices (Voh,1979 and Atala,1980). The review of the literature also finds that the status of the farmer in terms of his assets, population of the family, farm size, income, extension contact, and exposure are among the indices that determine the acceptance and the adoption of improved farming practices. Example of such studies are by Ozowa (1997), who studied the impact of mass media on adoption of agricultural innovation and found that socio-economic factors such as age, household size, formal

education, farm size, income, cosmopolitanisms and community status were related to adoption. Similarly, Atala*et al.* (1992), in their study on the impact of training and visit (T&V) system of extension on adoption of farm innovation and farm output in Kaduna State, found that the most important variables which influenced adoption were extension contact, farm size and hired labour while those for gross farm output were farm size, hired labour and non-farm income.

2.4 Nigeria's Experience in Empirical Adoption-Diffusion Studies

Several studies carried out in Nigeria have shown that there exist a close association between farmers' socio-economic characteristics and their awareness and adoption of a recommended practice.Voh (1979) and Atala (1980) found that socio-economic factors like age, household size, formal education, income, Cosmo politeness and community status were related to adoption. Awogbade (1981) found that because of the family or village structural arrangement in which the household head acts as both the legal and political spoke person on all matters, his decision often influence others to either adopt an agricultural innovation or not.

Osuji (1983) revealed that the ability of farmers to adopt new farm practices depended on their financial position, nearness to extension personnel as well as the farmers. In a study conducted by Mijindadi (1993), he reported that the extent to which innovations are adopted depend mainly on extension contact, membership of association and farmers' awareness.

Onyenwaku (1991) discovered that profitability was the major reason for adoption, while lack of awareness of the technology was the most limiting factor to adoption. The

study also showed that labour availability, frequency of attendance at farmers' meetings and extension contact were positively and significantly related with the intensity of adoption. Atala, *et al., (*1992) found that the most important variables which influenced adoption were extension contact, farm size and hired labour.

Igodan and Jabar (1993) found that the more knowledgeable the individual is, the more favorable attitude he/she had towards recommended technologies. Agbamu (1993) found that farmers' knowledge of innovations made predominant contribution towards adoption with a negative regression coefficient. Furthermore, Laogun (1993) discovered that income level, family size, social participation, extension contact, number of information sources used to introduce improved practices and extent of awareness were significantly related to adoption of recommended farm practices.

Onyibe*et al.*(2003) revealed that high yield potential of the extra-early maize varieties, their early maturing characteristic and compatibility with traditional cropping practice were the major factors responsible for its acceptance. Agbamu (1993) stated that the economic status, age, scale of production, educational level, cosmopoliteness and socio-cultural situation of farmers are possible factors that could affect adoption of innovations. Agbamu and Orhorhoro (2007) also found that educational level, income level, contact with extension agents, and types of fish pond affect adoption of innovations. While Idris*et al.* (2007) revealed that age of the farmers, level of education, farming experience and farm size were related to adoption.

2.5 Adoption and Diffusion of Innovations

Diffusion according to Daniel (1997) is the process by which an innovation is adopted or gain acceptance by members of a community. David and David (2000), said diffusion could be interpreted as aggregate adoption. Similarly, Adekoya and Tologbonse (2005), stated that the process of diffusion is a precursor to adoption, although this does not necessarily always end in the latter. Adoption is regarded as decision to make full use of an innovation or technology as the best course of action available. David and David (2000) further summed it up that adoption and diffusion is the processes governing the utilization of innovation.

The relevance of these perspectives to the study is that, linkage could be made between socio-economic characteristics of farmers with the adoption and its effects. That is, when there is a positive change in farmers' socio-economic characteristics, there is a possibility of a corresponding positive change in the adoption of recommended soybean production practices and consequently there is resultant effect.

The speed at which adoption can spread from one place to another depends on the following general attributes as indicated by Ogunbameru (2001):

1. **Relative advantage:** The degree to which an idea or technological innovation is perceived as being better than the one it seeks to replace.

2. **Compatibility:** The extent to which an idea or message is in line with prevailing or past socio-cultural values and beliefs.

3. **Complexity:** The degree to which an idea or message is perceived as relatively difficult to use and understand.

4. **Trialability/divisibility:** The extent to which an innovation can be experimented with limited scale.

5. **Observability:** The degree to which the results of an innovation or message content are visible to others.

6. **Risk level:** The extent to which an idea or message is perceived to expose the receiver to vulnerability due to failure.Also, new practices that are higher in cost generally tend to be adopted more slowly. The subjective risk that a farmer associates with a new practice may also be related to its adoption. It is usually only people we personally know and trust - and who we know have successfully adopted the innovation themselves - who can give us credible reassurances that our attempts to change won't result in embarrassment, humiliation, financial loss or wasted time (Ogunbameru, 2001).

7. **Group Action:** Some new ideas require group consensus and acceptance before they will be adopted. Others may be adopted on an entirely individual basis, provided they do not conflict with the community norms.

8. **The Educational Level of Farmers:** This could affect the type of media to be used in passing across innovations. For instance, the written materials have limited use in largely illiterate communities.

9. **Conflicting Information**: Whenever a new technology is introduced to a new community, its suitability, applicability and efficacy could be subjected to debates. Farmers are prone to receiving information concerning the technology from several sources which may contradict one another which makes it difficult to adopt the technology in question.

10. **Loss of flexibility**: Many innovations reduce farmers' flexibility. Flexibility entails farmers' ability to change commodities in response to price and climatic conditions. Zero tillage systems with chemical control of weeds restricts the range of crops that can be grown and the rotation of those crops.

2.5.1 Stages of the Adoption process

Rogers (1983) reported the following five stages of adoption process:

1. **Awareness:** At this stage an individual first hears about the innovation. This means that an individual is exposed to an idea but lacking detailed information about it. This is somewhat like seeing something without attaching meaning to it.

2. **Interest:** At this stage an individual is motivated to find out more information about the new idea. An individual wants to know what it is, how it works and what its potential may be.

3. **Evaluation:** At this stage mental trial of new idea takes place. An individual considers the relative advantage of the new idea over other practices/alternatives.

4. **Trial:** At this stage an individual tests the innovation on a small scale for himself. An individual seeks information about technique and method of applying the new idea.

5. **Adoption:** If satisfied with trial an individual will decide to use the innovation on large scale in preference to old methods.

Duration and length of time between any two stages varies with each practice and individuals. The rate at which different individuals go through the different stages varies with the personal characteristics of the individual and the nature of the group influence on him (Rogers, 1983).

2.5.2 Categories of adopters

Diffusion researchers believe that a population can be broken down into five different segments, based on their propensity to adopt a specific innovation: innovators, early adopters, early majorities, late majorities and laggards. Each group has its own "personality", at least as far as its attitude to a particular innovation is concerned.

It is not an easy job to shift people from one segment to another. It doesn't work that way. It is best to think of the membership of each segment as *static*. Innovations spread when they evolve to meet the needs of successive segments.

Innovators: The adoption process begins with a tiny number of visionary, imaginative innovators. They are also known as venturesome. They often lavish great time, energy and creativity on developing new ideas and have high net-worth plus considerable risk capital. Unfortunately their one-eyed fixation on a new behavior or idea can make them

seem dangerously idealistic to the pragmatic majority. Yet no change program can thrive without their energy and commitment.

Early adopters: Known as respectable, once the benefits start to become apparent, early adopters leap in. They are on the lookout for a strategic leap forward in their lives, farming businesses and are quick to make connections between clever innovations and their personal needs. Early adopters are vital for another reason. They become an independent test bed, ironing out the chinks and reinventing the innovation to suit mainstream needs. Fortunately early adopters are an easy audience. They don't need much persuading because they are on the lookout for anything that could give them a social or economic edge. When you call a public meeting to discuss new farming methods, they're the ones who come along.

Early majority: Early majorities are pragmatists, comfortable with moderately progressive ideas, but would not act without solid proof of benefits. They are the "deliberate". They are followers who are influenced by mainstream fashions and wary of fads. Majorities are cost sensitive and risk averters. They are looking for simple, proven, better ways of doing what they already do. They hate complexity. They have not got time to think about the product or project.

Late majority: They are conservative pragmatists who hate risk and are uncomfortable with would be new idea. Practically their only driver is the fear of not fitting in, hence they will follow mainstream fashions and established standards. They are often influenced by the fears and opinions of laggards.

Laggards: Meanwhile laggards hold out to the bitter end. They are the traditionists. They are people who see a high risk in adopting a particular product or behaviour.

Rogers (1983) went as far as assigning precise notional percentages for each segment which indicated that Innovators are 2.5%, Early Adopters are 13.5%, Early majority are 34%, Late majority are 34%, while Laggards constitute 16%, of the segment based on their propensity to adopt a specific innovation.

Rogers (1983) proposed the following five stages of Innovation-Decision Process.

1. **Knowledge:** At this stage an individual (or other decision-making unit) is exposed to the existence of the innovations and gains some understanding of how it functions.

2. **Persuasion:** At this stage an individual (or other decision-making unit) forms a favorable or unfavorable attitude towards the innovation.

3. **Decision:** At this stage an individual engages himself in activities that lead to a choice to adopt or reject the innovation.

4. **Implementation:** At this stage an individual puts an innovation into use.

5. **Confirmation:** At this stage an individual seeks reinforcement for an innovation-decision already made, but he or she may reverse this decision if exposed to conflicting messages about the innovation.

These classes of farmers are on the lookout for advantages and tend to see the risks as low because they are financially more secure, more personally confident, and better informed about the particular product or behaviour. As an innovation spreads from early adopters to majority audiences, face-to-face communication therefore becomes more

essential to the decision to adopt.

This principle is embodied in the Bass Forecasting Model which illustrates how face-to-face communication becomes more influential over time, and mass media less influential.

2.6 Concept of Effects

Effect is a change or changed state that occurs as a direct result of action by somebody or something else (www.answers.com/topic/effect accessed2011). Literature on effects of adoption of agricultural technologies has shown that not every technology brings about expected outcome (Williams, 1982). The concept will provide useful insights for understanding the effects of adoption of recommended soybean production practices on soybean yields and farmers' income. In order to motivate the farmers to adopt any farm technology, the extension functionaries should make sincere and concerted efforts for the transfer of technology to the farmers' fields. For popularizing and enhancing the rate of adoption of the new technology among the farmers, a conceptual model of extension system has been developed on the basis of field experience and empirical research. The model comprises of three main components variables viz 'input', 'process' and 'output'. (Sen, 1995). The technology generated through research (based on the considerations of national, community, individual priorities and feedback from the farmers) acts as 'Input' to activate the 'Process' consisting of policy options, organizational characteristics and extension education efforts so as to produce the desired 'Output', ie the satisfaction among the farmers.

2.7 Constraints to Adoption of Improved Technologies by Farmers

The process of increasing the efficiency of agricultural production through agricultural modernization depends mainly on the extent to which farmers can incorporate improved agriculturalpractices or technologies into their farming operations (Ani and Undiandeye, 2001). Ani (1998) has showed that acceptance of new farming practices takes place over time. Some characteristics may speed up rate of adoption while some serve as constraints to the adoption process.

According to Rogers (1995), several factors influence the adoption of agricultural technologies or innovations. These include, among others, the needs or wants of the farmers, their level of awareness and level of income. It is believed that all things being equal:

i. The higher the relative advantages of a new technology, the faster the rate of its adoption by the farmers;

ii. When a new technology is in agreement with the farmers' beliefs and values, the innovation or technology will be speedily accepted;

iii. The less complex the technology or innovation, the easier it is for farmers to understand and adopt;

iv. If the farmers are able to first apply or practice the technology on a small-scale, the more readily will it be accepted in full; and

v. If the result of an innovation is visible to the farmers, the more they will be convinced and encouraged to adopt it.

The reasons for non-adoption of improved technologies include inadequate knowledge of the technologies on cultural practices such as seed dressing chemicals, planting dates, seed rates, plant spacing, use of herbicides. The major reasons given by some farmers for non-adoption of improved seed and fertilizer application was that they were not readily available. Similar findings were obtained by Nweke and Chidebelu (1991).According to Onyenweaku (1991) farmers are beset with a lot of constraints that prevented them from adopting recommended practices, such as use of machineries, agrochemicals, fertilizers among others.

Marketing is another constraint identified by most of the farmers. Most of them suffer in the hands of unscrupulous middlemen who often exploit and rob them of benefits of their efforts. The problem is compounded because of lack of interference by government on matters affecting marketing and pricing of agricultural produce (Chikwendu 1997).

Other constraints farmers had was that of storage after harvest because most farmers did not have a store, hence they were compelled to sell their produce immediately after harvest and it is possible that prices at that time was not high enough to enable farmers to break even, let alone to make profit from the enterprise.

Chikezie (2009), reported that the major constraints to adoption of recommended cassava production practices in her study area were low capital outlay, followed by poor infrastructure. Other constraints include: poor access to credit facilities, labour intensive, land acquisition, lack of modern processing equipments, improved technologies, transportation, pests and disease. Cardwell *et al.* (1997), revealed that constraints to adoption of recommended hybrid maize production practices were losses due to pests and disease damages ranging from 20-25% and in the specific cases of the grey leaf spot disease, grain yield losses of 90% or more have been reported in several parts of the country. Other constraints were: post-harvestperishes ability, high labour requirement, inadequate and high cost of fertilizer, high cost of insecticides and pesticides and shortage of funds for farm land expansion.

The Technical Centre for Tropical Agricultural and Rural Cooperation (CTA) (1995), reported the constraints to adoption of recommended soybean production practices to include severe negative environmental impacts such as soil infertility, water pollution, pesticides related problems, several health problems related to heavy use of acutely toxic pesticides especially in countries where the regulatory system are weak. Other constraints identified included the fact that the farmers were not necessarily better off due to high production cost, and in some situations they were unable to select alternative crops or production systems.

2.8 Theoretical Framework

2.8.1 The theory of social change

Social change can be viewed as a state of dynamism which precludes stagnation and if well managed and directed, always implies progress, development and functioning of a

social system (Adekoya and Tologbonse, 2005).Ekong (2003), has further summed up his definition of social change as a modification in human attitudes and behavior pattern as a result of education (such as extension activities), and alteration in social conditions as a result of changes in the policies of a social organization, including consequences and manifestation of such changes. Social change can be planned or unplanned. Planned change is a conscious, deliberate and intended attempt to bring about the change by one or more agents (Rogers, 1995).

Social change emphasizes the process of spreading a new idea or innovation from its sources of invention or creation to, its ultimate users or adopters. Change agents have the duty of facilitating individual decision-making process with the goal of helping them to achieve their target more efficiently as the acquisition and processing of information followed by behavioral change (Rogers, 1983).

The adoption of recommended soybean production practices is a planned social change because the soybean farmer deliberately seeks to introduce improved varieties recommendation for the benefit of the area that falls under Northern Guinea Savannah where the crop is produced in commercial quantity due to suitability of soil and other climatic requirements favorable for the crop to thrive.

This perspective will be used to explain the socio-economic characteristics of soybean farmers which will also help to determine the factors affecting adoption of soybean recommended practices by the farmers. Furthermore, this perspective will also be used, to explain the introduction of improved soybean recommended production practices through different sources of information aimed at improving productivity.

2.9 Conceptual Model

A model is a figurative representation of a perceived object used to guide one in pursuit of knowledge. The model for this study posits that socio-economic characteristics of soybean farmers, institutional variables and attributes of the recommended practices would influence adoption of recommended soybean production practices. Similarly, this model posits that adoption of recommended soybean production practices may lead to increase or decrease in yield and income of soybean farmers.

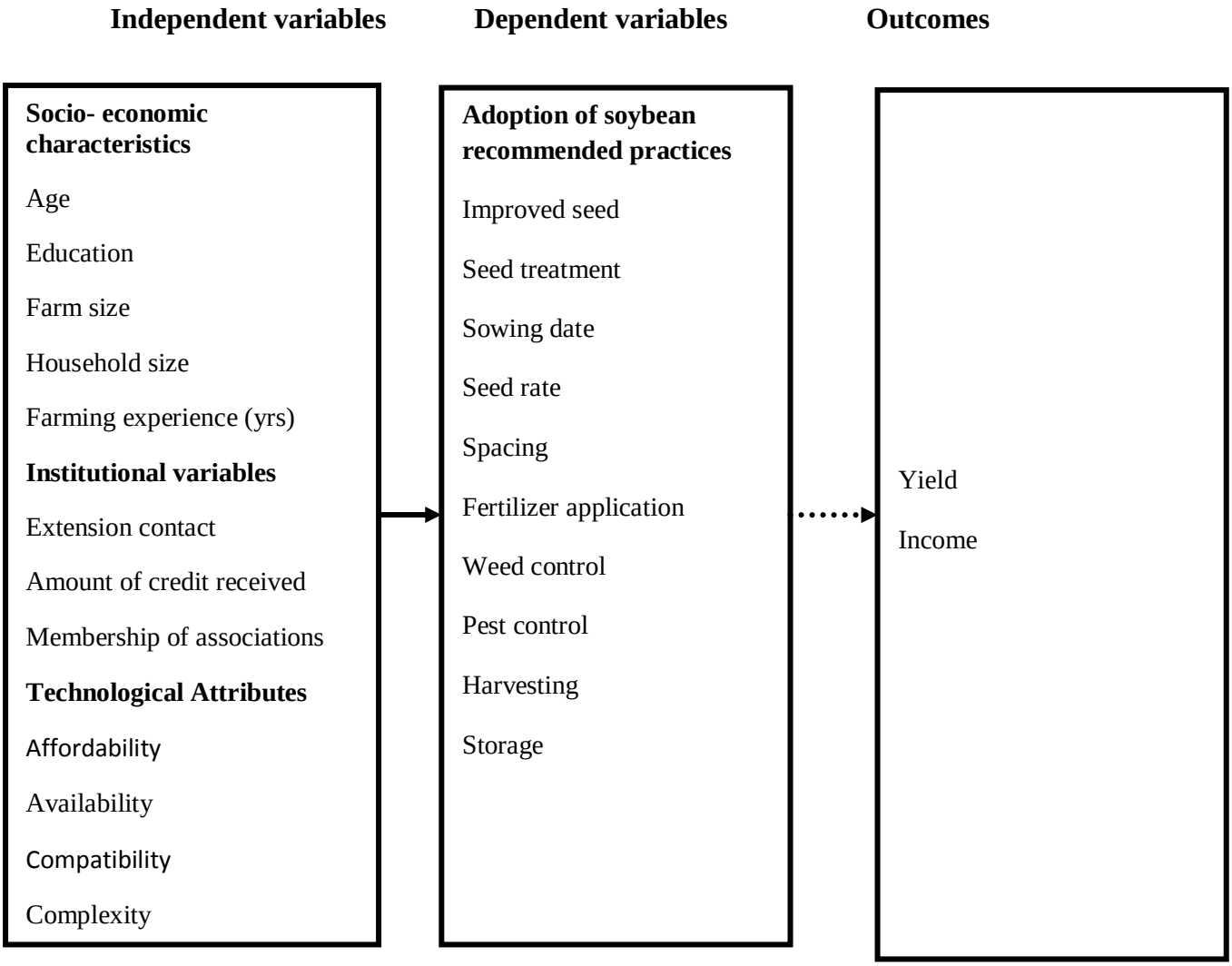


Figure 1: Model of factors influencing adoption of recommended soybean production practices by farmers and outcomes.

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

Zaria is a major city in Kaduna State in Northern Nigeria, as well as being a Local Government Area. Formerly known as "Zazzau", it was one of the original Seven Hausa city-states. Zaria itself is a very large, heterogeneous city whose Population of 1,490,000 comes from different parts of the world. It is second in size to the State capital, Kaduna. Zaria is easily accessible from different parts of the country by air via Kaduna, Kano, and Abuja and by rail and road. Zaria is located on the high plains of Northern Nigeria, 652.6 Meters above the sea level, and 950km away from the coast. Zaria region is characterized by gentle rolling plains dotted with groups of rocky residual hills developed on granite bedrockhttp://www.britannica.com/place/Zaria accessed 2013. It has a population of about 689,000 people (NPC, 2006) and a projected population of 974,246 in 2015 at 3.2% growth rate per annum.

Zaria possesses a tropical continental climate with a pronounced dry season, lasting up to seven months (October - May). During the dry season, a cool period is usually experienced between November and February. This emanates from the influence of the North-eastern (NE) winds (the Harmattan) which controls the tropical continental air mass coming from the Sahara. This weather prevails over most parts of the country. The NE winds are characterized by hazy to dusty conditions and low temperatures, as low as 15^0C at night. In the afternoons, up to 40^0C is sometimes recorded. The humidity also drops to less than 15% in December/Januaryhttp://www.britannica.com/place/Zaria accessed 2013.

Zaria experiences a brief period of hot but dry weather in March and April, followed by a progressive incursion of tropical maritime air mass from the Atlantic Ocean which displaces the NE (Harmattan) winds. During this short period, the mean daily maximum temperatures are fairly stable, and they range from 38^0C to 42^0C. After that, the South Westerly Monsoon winds laden with moisture bring the rain in thunderstorms and squalls with heavy fall of high intensities. The rainy season lasts from May to September/October with long-term annual rainfall of 1040mm in about 90 rain days.http://www.britannica.com/place/Zaria

The relatively deep tropical ferruginous soils and climate conditions of Zaria are suitable for and sustain a good cover of savanna woodland (Northern Guinea Savanna) with a variety of grasses, woody shrubs and short trees. However, increase in human population with its concomitant demands for grazing, subsistent cultivation, fuel-wood, and poor land management have had great impact on the natural vegetation. Consequently, new plant communities are developing around the townships and the densely nested villages of Zaria. The present vegetation may thus be described as parkland with annual grasses/shrubby cover interspersed with trees of special food and economic values such as *Parkiaclappertoniana, Tamarindaindiana*andsheabutter trees.

About 80% of the population is engaged in peasant farming producing both food and cash crops. The crops produced in the area include cotton, groundnuts, tobacco, maize, yam, beans, guinea corn, millet, ginger, rice, cassava, sugarcane, Shea nuts, cowpea, mango, kenaf, cocoyam, cassava, soybean, corn, onions, sorghum and potatoes. During the dry season, a considerable number of people in the area engage in irrigation farming along some major rivers and near dams. The crops cultivated are mainly vegetables.

Another important aspect of agriculture engaged by the people is the rearing of cattle, sheep and poultry farming**.**

Being in moist savanna zone, Zariahas high potentials for soybeanproduction. Thefavorable circumstances in the area include: relatively good soils, high solar radiation, adequate rainfall, and relatively low disease and insect pressures, these favors' soybean production.The farmers generally practice mixed farming in the area. The recommended soybean production technology was pushed to the area by IAR/IITA. These include: improved soybean varieties(Samsoy and TGX), seed treatment, germination test, land preparation, planting date, seed rate, number of seed per hole, spacing, fertilizer application, weed control, pest and disease control, harvesting and storage. The average yield of soybean is about 1.4MT/Ha in the area.

3.2 Sampling Procedure and Sample Size

A multi-stage sampling was used to select the respondents of this study. The first stage involves the purposive selection of Zaria Local Government area, because of its high potentials for soybean production. In the second stage,8 villages that are known for soybean production were also purposively selected. The third stage involved a random selection of 26% of soybean farmers' from each of the eight villages.

The sample frame of soybean farmers as obtained from Zaria office of Kaduna State Agricultural Development project was 635 soybean farmers. Twenty six percent (26%) of this sample frame was randomly selected for enumeration, giving a total sample size of one hundred and sixty five (165) respondents. This was due to limited resources and

time constrain. The breakdown of the selection of soybean farmer's is shown in table 3.1.

Table 3.1: population of soybean farmers

Village	Sample Frame	Sample Size (26%)
KasuwanDutse	123	32
KafinMadanni	83	22
Gabari	89	23
Dambo	63	16
Wuchichiri	79	21
Aba	71	18
Tankarau	53	14
Kako	74	19
TOTAL	635	165

3.3 Method of Data Collection

Both primary data and secondary source of information were used for the study. Primary data were collected from soybean farmers located in the study area through interviews using structured questionnaire in Zaria Local Government Area. The primary data collected include socio-economic characteristics of the respondents such as age of respondents, sex, household size, level of education, occupation, farm income level and membership of associations.

Data were also collected on soybean recommended production practices such as

improved agronomic practices, levels and use of the interpersonal, group and mass media sources of information by the soybean farmers. The secondary sources of information used include review of literature from official documents, journals, libraries, internet as well as reports kept by agricultural departments of the Local Governments and Kaduna Agricultural Development Project.

3.4 Analytical Techniques

The tools for analysis in the study were descriptive statistics such as mean, range and percentages to achieve objectives 1, 3, and 5. Multiple regression analysis was used to achieve objectives 2 and 4.

3.4.1 Descriptive statistics

Descriptive statistics such as mean, percentages, frequency distribution and range was used to achieve objectives 1, 3 and 5.

3.4.2 Multiple regression analysis

Multiple regression analysis was used to achieve objective 2 and 4 of the study. The general form of the regression equation is:

$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \ldots\ldots\ldots\ldots\ldots\ldots\ldots \beta_{11} X_{11} + e$ where;

Y = Recommended soybean practices accepted and used by the respondent.

X_1 = Age – (Years)

X_2 =Level of education – (Years of Formal education)

X_3 = farm size – (Size of Soybean Farm in Hectare)

X_4 = household size – Number of Household members that supply unpaid family labour in Soybean production

X_5 = farming experience – Years in Soybean farming

X_6 = extension contact - Number of extension contact in the last cropping season

X_7 = credit - amount of Credit accessed in last Cropping season(₦)

X_8 = membership of associations (Number of Co-operative organizations the farmer belongs to)

X_9 = Technology = (affordability, compatibility, complexity, availability)

a = Constant

U = error term

3.5 Definition and Measurement of Variables

3.5.1 Independent variables

Age: This is the number of years the respondent has lived. It was measured as the actual age given by the respondent.

Educational Level: This refers to respondent's level of formal education. This was measured by the number of years spent in school by the respondent.

Farm size: Refers to the physical extent of the land cultivated by a farmer. It was measured as the number of hectares the respondent puts under cultivation for soybean farming as reported by the respondent.

Household Size: This is defined as the total number of people living in a household. In this study, household size was measured as the total number of people living with the respondent. These people are the household head, his wife/wives, the children, and relatives/dependents that are actually living with the farmer as his household size.

Farming Experience: This was measured by the number of years the farmer has been into soybean farming.

Extension Contact: This is defined as the frequency of the respondent's contact with extension workers. It was measured by the number of visits respondent received from the extension officer in the year 2013.

Amount of Credit: This refers the amount of credit received for soybean farming from formal lending agencies (Banks, cooperative societies, and government agencies) and informal sources such as relatives, friends and money lenders. The farmers' score was the total amount of credit received in Naira for soybean farming.

Membership of Association: This refers to whether the respondent belongs to one co-operative group or another. For the purposes of carrying out their agricultural activities the farmers may constitute themselves into cooperatives/associations. The total number of cooperatives/associations the farmer belongs to, make up his/her score for the variable.

Affordability: This refers to the extent to which a recommended practice is affordable by the respondents. This was measured by the use of a 5-point likert scale: not

affordable = 1, fairly affordable = 2, affordable = 3, very affordable = 4 and highly affordable = 5.

Availability: Availability of technology is a variable that could affect the decision of a farmer to accept or reject an innovation. Respondents were asked if the technology reached them or not.

Compatibility: This is the level to which a recommended practice is perceived to meet the need and values of the respondent. This was measured by the use of 5-pointlikert scale: Not compatible =1, fairly compatible =2, compatible = 3, very compatible = 4 and highly compatible = 5.

Complexity: This is the level to which a recommended soybean practice is relatively difficult to understand or use. This was also measured by the use of 5-pointlikert scale: Not complex = 1, fairly complex = 2, complex = 3, very complex = 4 and highly complex = 5.

3.5.2 Dependent variable (Adoption)

This was measured as the number of recommended soybean practice accepted and used by the respondent. Each of the practice was given equal weight i.e. equal weight of the points were assigned to each practice, giving a maximum possible score of eleven points and a minimum of zero. The recommended soybean production practices include improved soybean varieties, seed treatment, planting date, seed rate, number of seed per hole, spacing, fertilizer application; weed control, pest and disease control, harvesting and storage.

3.5.3 Outcomes: This is the expected change in the yield and income level of soybean farmers as a result of the adoption of recommended soybean production practices.

Yield: this refers to be total quantity of soybean obtained by the respondent in 2013. It was measured in 100kg bags obtained by and individual farmer. This was further divided by the total land areas to obtain the yield per hectare.

Income: This is the money realized from the sale of soybean. Income was measured by the total estimated money (₦) as given by the respondents.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socioeconomic Characteristics of Soybean Farmers

4.1.1 Age distribution of soybean farmers

The result as presented in Table 4.1 revealed that about 44% of the soybean farmers were within the age range of 31-50 years with mean age of 40 years. The implication of this finding is that large proportion of the soybean farmers in the study area were adults and can adequately be regarded as active, agile and physically disposed to farming activities.Age is an important determinant of socio–economic status of a population since people wear in energy as they advance in age. Therefore, the generally aged farmers could have negative implications on the future of soybean cultivation in the study area. This is because these older people may not be willing to adopt innovations in agriculture; usually, they argued that their forefathers practiced farming successfully without modern innovations. However, it is important to note that the older a farmer becomes, the better his understanding of the social, climatic and economic factors that affect farming and thus more experience. This finding contradicted that ofAdegboye (2011), who observed that youth constitute the majority of the soybean farmers in the study area, as well as contradictedObeta and Nwagbo (1999), with similar findings on sorghum farmers. In both the findings they observed that younger farmers are more flexible to new ideas and risk; hence they are expected to adopt innovations more readily than older farmers. The reason for this variant might likely be associated with the farmers' experience.

Table 4.1: Age Distribution of Soybean Farmers

Age (years)	**Frequency**	**Percentage**
10-30	59	35.8
31-50	73	44.2
51-70	31	18.8
71-90	2	1.2
Total	165	100.0
Mean	**40**	

4.1.2 Household size of soybean farmers

Table 4.2 shows the distribution of soybean farmers by household size. Majority of the farmers about 67% had household size that ranged from 1-10 persons with an average of 10 persons. This implies that there is appreciable number of family labour supply to accomplish various farm operations. The significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household (Amaza, Joseph and Yakubu 2009). However, Ahmad (2011) argued that large household size is associated with increased household consumption expenditure which reduces the money that could be used for production purposes. According to the study by Lawal and Oluyole (2008), there is a positive and significant relationship between household size and farmers' efficiency in production.

Table 4.2: Households Distribution of Soybean Farmers

Household	Frequency	Percentage
1-10	110	66.6
11-20	34	20.6
21-30	17	10.3
31-40	4	2.4
Total	**165**	**100.0**
Mean	**10**	

4.1.3 Educational level of soybean farmers

Low level of literacy is one of the factors militating against agricultural development in Nigeria. The study revealed that 59.4% of the soybean farmers acquired primary, adult and arabic/islamic education. Similarly 27.9% had secondary education followed by 12.7% with tertiary education. Although the low literacy level is not enough to provide any white collar job, but their educational status however, is enough to provide them with the ability to read and write, handle and interpret messages relating to their farm operations in the instruction manuals on input and machinery uses, and also enable them to appreciate extension services. The level of formal education attained by an individual goes a long way in shaping his personality, attitude to life and adoption of new and improved practices (Ani, 1998). Adesoji and Adebayo (2008) observed that the more educated a farmer is, the more the chances that the farmer will adopt innovations than the uneducated ones. Mohammed *et al* (2009) noted that level of education is expected to influence farmers' adoption of agricultural innovations and decision on various aspects of farming. However in the study a large proportion about 43% of the farmers had Islamic education. Yet in this study education of the farmers was found to be

significant at 10%, which suggest that their Islamic education influences their adoption significantly.

Table 4.3: Educational level of soybean farmers

Educational level	**Frequency**	**Percentage**
Adult education	8	4.9
Arabic/Islamic education	71	43.0
Primary education	19	11.5
Secondary education	46	27.9
Tertiary education	21	12.7
Total	**165**	**100**

4.1.4 Sources of credit for soybean farmers

The result presented in Table 4.4 shows that about 85.5% of soybean farmers did not collect any form of loan to finance their soybean production, while those who had access to credit collected it from banks, friends, relatives and government loan. The low access to credit could be attributed to the fact that farmers do not have enough collateral to access bank loans. Ekong (2003) asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. It also agrees with findings of Nasiru (2010) who noted that access to micro-credit could have prospects in improving the productivity of farmers and contribute to uplifting the livelihoods of disadvantaged rural farming communities.

Table 4.4: Sources of credit for soybean farmers

Sources of Credit (N=165)	**Frequency**	**Percentage**
No access to credit	141	85.5
Access to credit	24	14.5
Sources of credit (n=24)		
Bank loan	6	25.0
Friends/Relatives	16	66.7
Government Agric. Loan	2	08.3

4.1.5 Number of extension contacts by soybean farmer

The results in Table 4.5 revealed that about 4% of the soybean farmers in the study area had no contact with extension agent while about 96.4% had one form of extension contact or the other. The average extension contacts observed was 10 times per year in soybean productions. This implies that extension services enhance soybean farmers' ability to efficiently utilize resources through the adoption of new and improved methods used in soybean production in the study area. According to Obwona (2000), extension service is very essential to the improvement of farm productivity and efficiency among farmers. Umar *et al.*(2009) argued that higher extension contacts would increase adoption of improved farm production technologies. They further argued that the frequency of extension contact is very essential as it guides the farmers from awareness to the adoption stage.

Table 4.5: Extension contacts of soybeans farmers

Extension Contacts (N=165)	Frequency	Percentage
Access to extension visit	159	96.4
No access to extension visit	6	3.6
Access to extension (n=159)		
Once a week	16	10.1
Once in two weeks	98	61.6
Once a month	40	25.2
Once in three months	5	3.1
Mean	**10**	

4.1.6 Membership of cooperative society

The result presented in Table 4.6 reveals the number of years spent as members of cooperative association. About (72%) of soybean farmers are not members of any cooperative association while 28% participated in the activities of cooperative societies with average participation of 5years. The finding of this result showed that most of the soybean farmers in the study area may not enjoy the assumed benefits accrued to co-operative societies through pooling of resources together for a better expansion, efficiency and effective management of resources and for profit maximization. Ekong (2003) and Ajayi (2002) observed that membership of cooperative societies has advantages of accessibility to micro-credit, input subsidy and also as avenue in cross breeding ideas and information.

Table 4.6: Distribution of soybean farmers on membership of cooperative society

Years in Cooperative (N=165)	Frequency	Percentage
Non membership	119	72.1
Membership	46	27.9
Membership (n=46)		
1-4	30	65.2
5-8	12	26.1
9-12	1	2.2
13-16	3	6.5
Mean	**5**	

Hypothesis I: Socioeconomic factors have no significant effect on the adoption of recommended soybean production practices.

The hypothesis that says socioeconomic factors has no significant effect on the adoption of recommended soybean production practices was tested using regression analysis. From the result it shows the degree of freedom of 164 with an alfa level of $p<0.01$ for all the parameters respectively, the calculated R^2 0.69. This implies that 69% of the variation in adoption level is associated with farmer's socio-economic characteristics, which was found to be significant at 1% probability level. This implies that significant relationship exist between the socioeconomic characteristics of the farmers and adoption of recommended soybean production. Meaning that farmers has 31% shortfall from total adoption of soybean production practices due to some factors outside their control (intervening variables) such as rainfall, temperature, humidity etc. The null hypothesis is therefore rejected and accepts the alternative.

Table 4.6.2: Hypothesis testing for socioeconomic and adoption of recommended soybean production

Hypothesis	Test-statistics	Value	Null hypothesis (H_o)	Alternate hypothesis (H_1)
Hypothesis	F-test	11.217***	Rejected	Accepted

Note: ***= Significant at 1% Level. **H_o**=Null Hypothesis. **H_1**= Alternative Hypothesis.

4.2 Factors that influence adoption of recommended soybean production practices

Multiple regression analysis was conducted in order to determine the specific contribution of each independent variable and the total variance explained by all the variables on adoption of improved soybean production technologies. Table 4.7 result shows that the adjusted R^2 had a value of 0.681. This implies that the independent variables were able to explain the dependent variables by about 68% which mean that 68% of the variation observed were attributed to the combine influence of the independent variables included in the model. Meaning that farmers has 32% shortfall from total adoption of soybean production practices due to some factors outside their control (intervening variable) such as rainfall, temperature, humidity etc. The F value of 5.720 was significant at 5% level, indicating that the model fits the data well.

The study showed that marital status, educational level, farming experience, cooperative membership and extension contact had significant and positive influence on adoption of improved soybean production technologies by respondents, while age, household size and credit had negative sign and significant influence on adoption of improved soybean production technologies by respondents. The result indicated that household and credit had no significant influence at 1%, 5% or 10% level of significance. The implication of

the negative sign could be that an increase in each of these level would lead to a decrease in the adoption level of respondents on soybean production technologies. Large household size means more mouth to be fed. Thus, farmers with large number of family members may decide to grow staple crops that could be used for feeding his family rather than producing soybean which is considered as cash crop in the study area, this may decrease the adoption of soybean recommended production practices. Likewise high interest rates on credit may decrease the adoption level of soybean recommended production practices. This is because high interest rate means a decrease in farmer's income.

The estimated coefficient of age (-0.003) was negatively signed and significant with adoption of recommended soybean production practices at 5% level of probability. The negative influence of age could be expected as a result of the fact that as a farmer grows old, there is tendency to reduce level of adoption as their ability to cope with various farm operations diminishes.

Gender showed significant relationship with adoption of improved technologies in soybean production. Due to many socio-cultural values and norms, males have freedom of mobility and participation in different extension programmes and consequently have greater access to agricultural information. However, Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana showed insignificant effects of gender on adoption.

Exposure to education will increase a farmer's ability to obtain, process, and use information relevant to the adoption of improved soybean technology. It will also help

farmers to search for appropriate technologies to alleviate their soybean production and consumption constraints (Boz*etal*., 2011; Idrisa *et al*., 2012). Thus, education could therefore increase the probability that a farmer will adopt an improved soybean technology. Obasi and Obasi (2004) found in their study that, among other factors, educational level influenced adoption decisions of farmers in Gboko localities of Benue State. The present study also agrees with that of Tiamiyu *et al*. (2001) who found positive and significant relationship between literacy level and adoption of soybean production technologies in Niger State, Nigeria.

The study revealed a significant relationship between adoption and farming experience among the respondents. With increased farming experience, farmers are generally better able to assess the relevance of new technologies. This often comes from their interactions with their neighboring farmers and the outside world. It can also be argued that the experience of farmers can generate or erode confidence. In other words, with more experience, a farmer can become more or less risk-averse to new technology and thus this variable can have a positive or negative effect on a farmer's decision to adopt improved technology. Farming experience was found to be positive and significant at 1%. Which implies that farming experience increases the adoption of soybean production in the area, however the result of the study disagreed with the report of Sanginga (1999) that the adoption of improved soybean varieties in Benue State was insignificantly related to farmers' farming experience in soybean cultivation.

Membership of social organization also had a positive and significant coefficient of 6.726. This means that farmers who are members of social organizations adopted recommended soybean practices more than non-members. This is because membership

of social organizations provides farmers with access to information on potential benefits of improved agricultural technologies. This is in agreement with Deji (2005) who observed that membership of cooperative societies positively and significantly influenced the adoption of agricultural innovation among farmers.

The regression results revealed that extension contact had positive and significant coefficient (1.845), indicating that adoption increased with increase in number of extension contacts offered to the famers. This is also in support of Saddiq (2012) and Agbamu (2006) who independently reported significant relationship between extension contact and adoption of recommended cotton production practices by farmers in ZamfaraState.

The estimated coefficient of affordability (0.781) of soybean recommended practices was positive and statistically significant at 5% level of probability. This implies that soybean farmers who could afford the technology will tend to maximize returns on investment in soybean farming. This can trigger adoption of improved soybean recommended practices among other production technologies. This finding is line with Idrisa *et al*. (2012) whose work on Logit and Tobit analyses of the determinants of likelihood and extent of adoption of improved soybean seed in Borno State, Nigeria, found out that affordability of technology influences farmers adoption of soybean technology.

Table 4.7: Factors that influence adoption of recommended soybean production practices

Adoption	Coefficient	Standard error	t-value
Constant	57.120	4.470	12.78***
Age	-0.003	0.001	-2.07**
Sex	9.675	2.249	4.30***
Household size	-0.226	0.159	-1.41
Education	2.621	1.526	1.72*
Farming experience	0.533	0.163	3.26***
Cooperative	6.726	2.379	2.83***
Extension	1.845	0.857	2.15**
Credit	-0.071	0.089	-0.80
Affordability	0.781	0 .368	2.12**
Compatibility	-0.011	0.009	-1.19
Complexity	-0.039	0.029	-1.33

R^2= 0.82, R^2Adjusted = 0.68, ***= significant at 1%, **= significant at 5% and *= significant at 10%

4.3 Rate of Adoption of Recommended Soybean Production Practices

The rate of farmer's adoption of recommended soybean production practices is presented in Table 4.8. Adoption and diffusion of recommended soybean production practices and information is likely to increase when high income expectations are projected. The adoption in this study was based on the thirteen recommended soybean production practices introduced to the farmers. The overall mean of adoption of recommended soybean production practices was 61.4; therefore any mean value below the average (61.4) is classified as low adoption and above the mean value is classified as high adoption of soybean recommended practice.

Improved varieties:

The choice of proper variety is the most important factor in crop production. Selecting a variety suited for agro-ecological environment is based on its suitability to the prevalent climatic conditions and cropping system. The choice of a variety is based on its maturity period, yield potential, drought tolerance, responsiveness to day length and pests and diseases resistance. The result presented in Table 4.8revealed that improved seed (60%) had a low adoption rate. This may be due to the fact that famers make use of seeds from their previous harvest which is not reliable and can jeopardize improved and sustainable productivity. This finding is in line with Zulu (2004) and Abdulrahman *et al.,* (2015) opined that most farmers have little or no access to improved seeds and continue to recycle seeds that have become exhausted after generations of cultivation.

Seed treatment:

Seed treatment with chemical prior to planting or using treated seeds is an essential aspect that led to better growth and productivity. This would enhance good germination and protect the seedlings from mortality due to pest attack, root rot and fungal infection soon after emergence. The result reveals that the adoption of soybean recommended seed treatment with chemicals before planting was low (55%).This may be due to the lack credit which could enable the farmers to purchase chemicals to carry out seed treatment or combat disease problems, although the economic advantage of spraying could lead to increase in yield.

Germination test:

Conducting seed germination test before planting is an important aspect in soybean production. Germination test will provide a good information on the germination rate of

seeds on the whole farm. When the percentage germination is 80% or less the seed rate has to be increased accordingly to achieve 100% germination. The result in Table 4.8 reveals that 80% of the respondents conducted germination test in the study area which was very high.

Land preparation:

Well-prepared land ensures good germination and reduces weed infestation. The result reveals that 48.5% of the respondents used appropriate implements such as hoe, animal drawn implements and tractor for land preparation.

Planting date:

Soybean produces well over a wide variety of planting dates, if moisture is available. Soybean should be planted as soon as the rains are well established. Table 4.8 reveals that 61.2% of the respondents planted their seeds between early June to early July which is the recommended date for soybean planting in the study area. Farmer's adherence to this planting date is low as revealed by the study.

Seed rate/ Seed per hole:

Adhering to recommended seed rate per hectare and planting appropriate number of seeds per hole is a pre-requisite for optimum soybean productivity. The result revealed that 61.8% of the respondents adopted the recommended rate of about 50-70kg (20-28 standard *Mudus*) per hectare. The result in Table 4.8 revealed high adoption of seed rate per hectare and

Planting appropriate number of seeds per hole for (61.8%) and (63.8%) respectively. This implies that, a good percentage of the farmers adhere to recommended seed rate per hectare and planting appropriate number of seeds per hole in the study area. This

could possibly due to the rural setting of the study site; having relatively large expanse of farmland.

Spacing:

Appropriate spacing between plants and rows enhances growth and development of soybean thus reduces the competition by companion crops, and built up of pests and diseases. The result reveals that 55.8% of the respondents have applied plant spacing of 75cm between rows and 10cm between stands. The rate of adoption of spacing between plants and rows is low.

Fertilizer application:

- In order to have a good yield of the crop and maintain the soil fertility under intensive, and continuous cropping, it is important to apply proper fertilizer rates for soybean at different ecological zones. Fertilizer usage enhances better development of soybean. The result reveals that high percentage (64.8%) of the respondents applied fertilizer at the recommended rate of NPK 15:15:15 20kg / ha; SUPA 40kg/ha; K_2O 20kg/ha.

Weed control technique:

The type of weed control technique adopted should be based on the nature of the problem and the resources available to the farmers. A timely weed control program can minimize the effects of weeds. Weed control in soybean could be manual or chemical or both. The result reveals that most of the respondents (68.5%) adopted the recommended weed control measures of hoe weeding at 2 weeks after planting (WAP) and 5-6 WAP or with herbicides for example paraquat plus and pendimethalin 50EC (250Ml of each/20L sprayer per hectare) to be applied within 2 days of planting for grasses

example Rottboellia or 3 to 4 weeks after sowing for most grasses and broad leaves weeds..

Several different insects occur in soybean fields but few are normally of any economic importance, and the species that cause damage are usually not abundant enough to warrant control measures. However, the study reveals that 57% of the respondents have low adoption in the use of chemicals to control pests and diseases on their fields.

Harvesting:

- Soybean requires timely harvesting to check excessive yield losses. Losses in yield may also occur from other sources if harvesting is delayed. The findings of the study reveal that most of the farmers (64.8%) harvested their crops 3-4 months after planting when the pod is straw colored or when 85% of the pods have turned brown for non-shattering varieties and 80% for shattering varieties.

Storage:

- Good storage management can greatly influence the storage ability of soybean and subsequent germination when planted in the field. Soybean should be stored at a moisture content of 10% or less and should not be exposed to high temperatures as this will increase deterioration and reduce seed viability. The study reveals that only 53.3% of the respondents stored their soybean when the moisture contents is 10% or less or when the seeds cannot be dented with teeth or fingernails. This implies low adoption rate in terms of good storage management practices.

4.8: Distribution of respondents according to rate of adoption

Adoption of Technologies	*Frequency	%	Level
Weed control	113	68.5	High
Germination test	109	66.1	High
Fertilizer application	107	64.8	High
Harvesting	107	64.8	High
Seed per hole	105	63.6	High
Seed rate	102	61.8	High
Planting date	101	61.2	Low
Improve variety	99	60.0	Low
Pests and diseases	94	57.0	Low
Spacing	92	55.8	Low
Seed treatment	91	55.2	Low
Storage	88	53.3	Low
Implement	80	48.5	Low
Mean		61.4	

*Multiple responses

4.3.1 Effect of adoption of recommended soybean production practices on farmers' yields

Multiple regression analysis was conducted in order to determine the specific contribution of each independent variable on adoption of improved soybean production technologies and the total variance explained by yield of the respondents (Table 4.9.1). The result shows that the adjusted R^2 had a value of 0.681. This implies that the

independent variables were able to explain the dependent variables by about 68% which mean that 68% of the variation observed were attributed to the combine influence of the independent variables included in the model. The F value of 5.720 was significant at 5% level, indicating that the model fits the data well. The study showed that planting date, spacing and use of resistant variety had significant and positively influenced the yield of improved soybean production, while fertilizer application and storage had negative sign and significant influence on the yield of improved soybean production. The result indicated that seed treatment, germination test, number of seed per hole and storage had no significant influence at 1%, 5% or 10% level of significance. The implication of the negative sign could be that an increase in each of this level would lead to a decrease in the yield of the farmers in the study area.

The estimated coefficient of planting date (40.039) is positive and significantly related to the yield of soybean at 10% level of probability. This implies that adopting timely planting date as a technology on improved soybean production technologies will increase the farmer's yield by magnitude of 40%.

The estimated coefficient of correct spacing (50.038) is positive and significantly related to the yield of soybean at 10% level of probability. This implies that adopting correct spacing as a technology on improved soybean production technologies will increase the farmer's yield by magnitude of 50%. It makes rational use of the land, assures steady high yields and permits greater diversification. This is because appropriate spacing between plants and rows enhances growth and development soybean, which invariably result to increase on farmer's yield.

Fertilizer application was negatively related to yield and statistically significant at 10% level of probability. This implies that a unit increase fertilizer application will result to decrease in farmers' yield. This inverse relationship between yield and fertilizer application may be because Soybean is a modulated crop which micro-organism used the nodule to manufacture the required food which in turn become the fertilizer but when fertilizer is used the activity of the micro-organism is inhibited as such the crop might not get enough to observed hence cause the reduction in yield.

The estimated coefficient of resistant variety (204.879) is positive and significantly related to the yield at 10% level of probability. This implies that a unit increase in resistant crop variety will help in seed protection from pest and disease damage, accelerated growth rate and better yield. This implies that adopting resistant seed variety as an improved soybean production technology will increase the farmer's yield by magnitude of 204.879.

The estimated coefficient of storage (-353.046) was negative and statistically significant at 1% level of probability. This implies that a unit increase in storage facilities will decrease the yield of the farmers by magnitude of -353.046. This inverse relationship between yield and storage may be as result of incidences of disease and pest infestation that usually occur during storage.

The estimated coefficient of affordability (0.681) of soybean recommended practices was positive and statistically significant at 1% level of probability. This implies that soybean farmers who could afford the technology will tend to increase yield in soybean

farming. This can trigger adoption of improved soybean recommended practices among other production technologies. This finding is line with Idrisa *et al*. (2012).

Table 4.9.1: Effect of adoption of recommended soybean production practices on farmers' yield

Yield	**Coefficient**	**Standard error**	**t-value**
Constant	1224.389	224.154	5.46***
Seed treatment	21.331	31.792	0.67
Germination test	-48.407	32.560	-1.49
Planting date	40.039	21.642	1.85*
Seed per hole	-76.436	56.508	-1.35
Spacing	50.038	29.755	1.70*
Fertilizer application	-153.307	92.558	-1.65*
Resistant variety	204.879	85.757	2.39**
Harvesting	-128.046	143.73	-0.89
Storage	-353.046	85.737	-4.12***
Affordability	0.681	0 .268	2.64***
Compatibility	-0.011	0.009	-1.19
Complexity	-0.039	0.029	-1.33

R^2= 0.84, R^2Adjusted = 0.681: ***= significant at 1%, **= significant at 5% and *= significant at 10%

Hypothesis II: Adoption of recommended soybean production practices has no significant effects on farmers yield.

The null hypothesis (H_o) which stated that adoption of recommended soybean production practices has no significant effects on farmers yield in the study area was tested using regression statistics presented as shown in Table 4.9.2. The estimated F-value was 10.01 with R^2-value of 0.49. In other words, the test is significant at 1% probability level. This suggests that the variables in multiple regression model are not zero, hence has significant relationship. This implies that adoption of recommended

soybean production practices has significant effects on farmers yield. This suggests that increase in adoption of soybean production practices will increase the yield of soybean. The H_o hypothesis is therefore rejected while theH_1 is accepted.

Table 4.9.2: hypothesis testing on the effect of adoption on recommended soybean production practices on farmers' yield.

Null hypotheses	**R^2**	**SEM**	**F-value**	**Significant**	**Decision**
Production function model					
H_0: $\beta_{ij} = 0$ yield	0.49	87149.65	10.01	$p \leq 0.01$	Reject H_0

Note: $p \leq 0.01$= Significant at 1% Level. **H_o**=Null Hypothesis.

4.3.2. Effect of adoption of recommended soybean production practices on farmers' income

Multiple regression analysis was conducted in order to determine the specific contribution of each independent variable on adoption of improved soybean production technologies and the total variance explained by income of the respondents. The result in Table 4.10 shows that the adjusted R^2 had a value of 0.421. This implies that the independent variables were able to explain the dependent variables by about 42%. The F value was 3.470 was significant at 5% level, indicating that the model fits.

The result showed that planting date and use of resistant variety had significant and positive influence on the income of soybean farmers while fertilizer application and number of seed per hole had negative sign and significant influence on the income of improved soybean farmers. The result indicated that seed treatment, germination test, spacing, harvesting and storage had no significant influence at 1%, 5% or 10% level of

significance. The implication of the negative sign could be that an increase in each of this level would lead to a decrease in the income of the farmers in the study area.

Multiple regression analysis was used to analyze the effect of adoption of improved soybean production technologies on farmer's income in the study area. The results of the analysis were presented in Table 4.10. The estimated coefficient of planting date (54354.78) is positive and significantly related to the income at 5% level of probability. This implies that adoption of timely planting date as a recommended practice on soybean production will increase farmer's income by magnitude of ₦54354.78.

Fertilizer application was negatively related to income and statistically significant at 10% level of probability. This implies that a unit increase fertilizer application will result to decrease in farmers' income. This inverse relationship between income and fertilizer application may be as result of high cost of fertilizer which results in high cost of production.

The estimated coefficient of resistant variety (56815.33) is positive and significantly related to the income at 1% level of probability. This implies that a unit increase in the use of resistant crop variety will help in seed protection from pest and disease damage, accelerated growth rate and better yield. This implies that adopting resistant seed variety as an improved soybean production technology will increase the farmer's income by magnitude of ₦56815.33.

The estimated coefficient of seed per hole (-44828.01) was negative and statistically significant at 1% level of probability. This implies that a unit increase in seed per hole will decrease the income of the farmers by magnitude of -44828.01. This inverse relationship between income and number of seed per hole may be as a result of high cost of treated seed which results in high cost of production.

Table 4.10 Effect of adoption of recommended soybean production practices on farmers' income

Income	Coefficient	Standard error	t-value
Constant	133581.3	60641.11	-0.94^{NS}
Seed treatment	6522.165	22481.26	0.29 ^{NS}
Germination test	11868.57	23024.21	0.52 ^{NS}
Planting date	54354.78	25103	2.16**
Seed per hole	-44828.01	26251.77	-1.71*
Resistant variety	56815.33	20641.11	2.75***
Spacing	-23444.94	21040.94	-1.11 ^{NS}
Fertilizer application	-14706.03	2807.03	-5.23***
Harvesting	86843.74	101637.40	0.85 ^{NS}
Storage	2879.002	60627.02	0.05 ^{NS}
Affordability	0.211	0 .268	0.981
Compatibility	-0.451	0.441	-1.03
Complexity	-0.039	0.029	-1.33

R^2= 0.54, R^2Adjusted = 0.42: ***= significant at 1%, **= significant at 5% and *= significant at 10%

Hypothesis III: Adoption of recommended soybean production practices has no significant effects on farmers' income.

The null hypothesis (H_o) which stated that adoption of recommended soybean production practices has no significant effects on farmers 'income in the study area was tested using the result of a regression statistics presented in Table 10.2. The estimated F-value was 13.11 with R^2-value of 0.57. In other words, the test is significant at 1% probability level. This suggests that the variables in the multiple regression model is not zero, hence has significant relationship. This implies that adoption of recommended soybean production practices has significant effects on farmers' income. The H_o hypothesis is therefore rejected and the alternative accepted.

Table 4.10.2: hypothesis testing on the effect of adoption on recommended soybean production practices on farmers' income.

Null hypotheses	**R^2**	**SEM**	**F-value**	**Significant**	**Decision**
Production function model					
$H_0\beta_{ij} = 0$ Income	0.57	441547180	13.11	$p \leq 0.01$	Reject Ho

Note: $p \leq 0.01$= Significant at 1% Level. **H_o**=Null Hypothesis.

4.4 Constraints to Adoption of Soybean Production Recommended Practices

The result presented in Table 4.11 shows the problems encountered during the process of adoption by farmers, these are: high cost of technology (59.4%); insufficient credit (30.9%); inadequate awareness (13.9%)' complexity of new technique (12.7%); high cost of technology (6.1%); low capital outlay (1.8%). These problems suggest the myriad of difficulties which farmers in the area of study face in the course of producing soybean in the study area. This implies that the extension agents still require more effort

to educate a large percentage of small holder farmers in the study area who are yet to adopt these technologies. This result corroborates with Ajayi (2002) who reported that most farmers lack the expected knowledge to operate modern technology and as such may not adopt such technologies.

Insufficient credit facilities are also cited as severe constraints to soybean production (30.9%) in the study area. This may account for the reason that most of the respondents are small- scale farmers. Also, the stringent conditions and bureaucratic bottleneck of credit institutions shy farmers away from obtaining loans to finance their farm operations. It also implies that availability of credit contributed significantly to technology adoption because credit is necessary for the purchase and use of new technologies by low capital base farmers. This is expected because access to credit enhances farmer's ability to purchase necessary inputs for soybean production such as improved seeds, fertilizers etc and pay for hired labour. This finding agree with Akpoko (2004) who reported that amount of credit received by farmers positively and significantly influenced the adoption of recommended soil management practices in Kaduna state, Nigeria.

Table 4.11: Constraints to soybean production recommended practices

Constraint	*Frequency	Percentage	Rank
High cost of technology	98	59.4	1st
Insufficient credit facilities	51	30.9	2nd
Inadequate awareness	23	13.9	3rd
Complexity of the technology	21	12.7	4th
Non accessibility of the technology	10	6.1	5th
Lack of technical know how	9	5.4	6th
Low capital outlay	3	1.8	7th
Total	**215**	**100.0**	

*multiple responses

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study focused on analysis of the adoption of recommended soybean productionpractices in Zaria Local Government Area of Kaduna State, Nigeria. Primary data were collected from 165 respondents using structured questionnaire. The statistical tools used to analyze the data were descriptive statistics and regression analysis. The result of the analysis shows that 44% of the respondents fall within the age range of 31-50 years, with a mean age of 40 years, 67% of the respondents had household size ranging from 1-10 people, with a mean household size of 10 persons. Majority (99%) of the farmers were literate. About 86% of the farmers do not have access to credit and therefore finance their production through their personal savings. However, 72% of the farmers do not belong to any cooperative association while majority (79%) of the farmers had no contact with extension agents and so did not have access to extension services.

The result also shows that cumulative contributions of independent variables to the adoption of recommended soybean production practices had coefficient of determination (R^2 Adjusted) value of 0.68. This implies that all the variables together, explained about 68 percent of the total variability in adoption of recommended soybean production practices in the study area. The relationship between selected socioeconomic and institutional factors influencing adoption of recommended soybean productionpractices show that out of eight variables included in the model, six had significant influence on adoption of technologies. These were age, sex, education, farming experience, membership of cooperatives.

The effect of adoption of recommended soybean productionpractices on yield of the farmers show that planting date, spacing, fertilizer application, use of resistant variety and storage had significant influences at 10%, 10%, 10%, 5% and 1% respectively on the yield of the farmers while planting date, number of seed per hole, use of resistant variety and fertilizer application had significant influences at 5%, 1%, 1% and 1% respectively on farmers' income.

Finally, the most important constraints faced by farmers to the adoption of recommended soybean productionpractices identified in the study area were high cost of the technology (59.4%), Insufficient credit facilities (30.9%), Inadequate awareness (13.9%) and complexity of the technology (12.7%).

5.2 Conclusion

Based on the finding of this study, it could be concluded that adoption level of soybean production practices is on average having six out of thirteen technological practices being highly adopted by soybean farmers in the study area. Also, the socio-economic factors which positively affect the adoption of soybean production technology were educational level, farming experience and extension contact of the respondents. However, the major constraints against the adoption of the technologies include high cost of technology, insufficient credit facilities, inadequate awareness and complexity of the technology.

5.3 Contribution of the Study to Knowledge

1. The study shows that weed control method was the highest (68.5%) technology adopted by soybean farmers in the study area

2. The result shows that the most important constraints to the adoption of recommended soybean productionpracticeswere high cost of technology (59.4%) and insufficient credit facilities (30.9%).

3. The result of this study shows farmers were able to achieve 83% level of adoption of soybean production technology practices which has significant impact on yield.

5.4 Recommendations

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

i. Cooperative membership was found to be positive and significant; they had influence on adoption of recommended soybean production practices. Encouragement should be made to form soybean cooperative societies by respondents in order to take advantage of government policies and programmes.

ii. Level of education among the farmers was found to be positive and significant. It influenced the adoption of recommended soybean production practices. It is also recommended that government should focus on establishing more schools with needed teaching facilities so that farmers and their children can have easy access to formal and qualitative education.

iii. Extension was found to be positive and significant and it had influence on adoption of soybean production practices. It is recommended that government and non-governmental organizations dealing with agricultural extension should therefore embark more on the facilitation techniques of extension delivery. This will enable the farmers to identify their problems, determine their needs, and discover their potential themselves rather than always being fed with information.

iv. The study had identified some constraints such as high cost of technology, insufficient credit facilities, inadequate awareness and complexity of the technology that may affect adoption of recommended soybean production practices. It is recommended that non-governmental organization and other intervening agencies on agriculture should ensure that strong institutional linkages and facilitation are created among farmers, input suppliers, credit institutions and market for effective service delivery.

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APPENDIX I

QUESTIONNAIRE FOR SOYBEAN FARMERS

Department of Agricultural Economics and Rural Sociology

Faculty of Agriculture Ahmadu Bello University, Zaria

Dear Sir/Madam

I am a postgraduate student of Ahmadu Bello University, Zaria. Currently working on the topic- "**Analysis of the Adoption of Recommended Soybean Production Practices in Zaria Local Government Area of Kaduna State."**

I will be grateful for your kind cooperation in filling this research questionnaire design purely for academic purposes.

Please answer the questions to the best of your knowledge, all information supplied will be treated with confidentiality.

Thank you.

Ibrahim UMARU

SECTION A: BACKGROUND INFORMATION

Questionnaire No……..……..…….

Name of respondent..……

Name of Village ……

SECTION B: SOCIO-ECONOMIC CHARACTERISTICS OF SOYBEAN PRODUCTION FARMERS IN THE STUDY AREA.

1. Age ……years
2. Sex: Male ( )
3. Female ( )
4. Marital Status:(i) Single ( ) (ii) Married ( ) (iii) Divorced ( ) (iv)Separated ( ) (v) Widow ( )

   Indicate your household size:
5. How many wives do you have? …….
6. How many children do you have?.....
7. Beside your wife/wives and children, are there some people living with you?
   Yes ( ) No ( )
8. If yes, how many of them? ……
9. Highest Educational attainment of Household Head:
   a. No formal education ( )
   b. Adult education …….years
   c. Islamic education…….years
   d. Primary education ……years
   e. Secondary education ……years
   f. Tertiary education……years

10. How long have you been in Soybean farming?.....years
11. Is Soybean farming your only occupation? Yes ( ) No ( )
12. If no, which other activities do you engaged in? (i) Civil service ( ) (ii) Trading ( ) (iii)Artisan ( ) (iv) Farm produce marketing ( ) (v) Others (specify) ……
13. Do you belong to any farmers' organization? Yes ( ) No ( )
14. If yes, how many farmers' organization do you now belong to?.....
15. For how long have you been a member of these organizations –
    (i) organization 1 ……..years (ii) organization 2 ……. years
    (iii) organization 3 …….. years
16. Did you receive any visit by extension workers in 2013? Yes ( ), No ( )
17. If yes, how many times were you visited by the extension workers with information on Soybean production during the 2013 farming seasons? (i) Once a week ( ) (ii) Once a month ( ) (iii) Once in three month ( ) (iv) Once in more than three months ( )
18. Are you satisfied with the visit? Yes ( ) No ( )
19. If yes, give reasons.

    i. They taught us improved technology ( )

    ii. They help solve our production problems ( )

    iii. They link us up with production inputs ( )

    iv. Assist in formation of farmers cooperatives ( )

    iv. Others (Specify)……

20. If no give reasons.
    Irregular visits ( ) difficulty in understanding the message ( ) high cost of the technology ( ) It is time consuming ( ) others (specify)……
21. Do you have access to credit for Soybean production? Yes ( ), No ( )
22. If Yes, from which of the following source(s) did you received credit in 2013 for soybean production
    (i) Loan from the government ( )
    (ii) Bank loan ( )
    (iii) Through money lenders ( )
    (iv) Through friends and relatives ( )
    (v) Others (specify) ……
23. Are you satisfied with what you obtained from any of your credit source? Yes ( ) No ( )
24. If yes, state the total amount of credit received in 2013 soybean production N……
25. If no, what are the problem(s)
    (i) Bureaucracy involved in securing loan from bank and government
    (ii) Lack of collateral security
    (iii) Credits and loans from friends and money lenders is very meager
    (iv) Short term loan
    (iv). Others (specify)……
26. If you do not received credit how do you finance your soybean farming?
    a. Self finance
    b. Assistance from family and friends
    c. Others (specify)……

SECTION C: ADOPTION OF RECOMMENDED SOYBEAN PRODUCTION PRACTICES.

25. Are you aware of Recommended Soybean production Practices? Yes ( ) No ( )

26. If yes,

a. Where do you obtain your soybean seeds for planting? (i) Seeds from previous cropping ( ) (ii) Open Market ( ) (iii) Seed Companies/Seed Producers ( ) (iv) Fiends/co-farmers ( )

b. Do you plant improved soybean varieties Yes ( ) No ( )

c. Do you conduct Seed treatment (with fungicides e.g Apron plus, or Captan, 1 satchet/8g of seeds before planting? Conducted ( ) Not Conducted ( )

d. Do you conduct Soybean germination test before planting? Conducted ( ) Not Conducted ( )

e. Which of the following implements do you use for land preparation ? Hoe ( ) Animal drawn implement ( ) Tractor ( )

f .Do you plant Soybean between mid -June to early July Yes ( ) No ( )

g. The recommended Quantity of Seed per Hectare is 50 – 70 kg/ha (20 – 28 standard mudus),do you apply this on your farm? Yes ( ) No ( )

h. No. of Seeds per hole recommended is – 3 to 4 seeds/hole do you use this recommendation? - Yes ( ) No ( )

I .Do you apply Plant Spacing of 75cm between rows and 10cm between stands? - Yes ( ) No ( )

j .Do you use the following Fertilizer application rate?, NPK 15:15:15 20kg/ha; SUPA 40kg/ha; K2O 20kg/ha - Yes ( ) No ( )

k. Do you apply the following recommendation for Weed control? – manual(hoe weeding) at 2weeks after planting(WAP) and 5-6 WAP or with herbicides e.g.Paraquat plus and Pendimethalin 50EC (250ml of each/20L sprayer per hectare or Fusilade forte,1-1 L (150ml) i.e 1milk of tin/15L sprayer- Yes ( ) No ( )

l. Do you control Pest and Disease l by planting resistant varieties or treated seeds ? -

Yes ( ) No ( )

m. Do you harvest your Soybean 3 – 4 months after planting when the pod is straw colored or when 85% of the pods have turned brown for non- shattering varieties and 80% for shattering varieties? Yes ( ) No ( )

n. Do you store the harvested Soybean when the moisture content is 10% or less or when the seeds cannot be dented with teeth or finger nails? Yes ( ) No ( )

25. From which of the following sources do you receive information on recommended soybean production practices?

a. Radio ( )
b. Television **( )**
c. Contact with research agencies? ( )
d. Fellow farmers ( )

e. Telephone e.g. (GSM) ( )
f. Extension agents ( )
g. Newspapers ( )
h. Community leaders ( )
i. Others (specify)…….. ( )

25. State reasons for using the recommended Soybean production practices
(i). increase in yield/output of soybean
(ii). increase in income
(iii). improvement of soil fertility
(iv). Others (specify)……

26. State Reasons for not using the recommended soybean production practices.
(i). it is expensive
(ii). it is difficult to practice
(iii). it is not available
(iv). it is not compatible with the existing norms and values
(v). others (specify)……

27. Do you wish to continue using the listed recommended soybean production practices you have indicated above? Yes ( ), No ( )

28. If No, give reasons:
(i). it is expensive
(ii). it is difficult to practice
(iii). it is not available
(iv). it is not compatible with the existing norms and values
(v). others (specify)……

SECTION D: OUTPUT AND COST OF PRODUCTION OF SOYBEAN BY THE FARMERS

29. How many hectares did you use for farming purpose in 2013?.....ha
30. What size of your farms did you use for soybean production in 2013 growing season?.....ha
31. What was the estimated quantity of soybean you harvested in 2013 growing season?.....(in kg/ha)
32. Did you have available labour for soybean production in 2013? Yes ( ),No()
32. Did you use hired labour for soybean production in 2013? Yes ( ),No ( )
33. If yes ,what is the total amount spent on hired labour in 2013……
34. Did you use family labour for soybean production in 2013? Yes (), No ()
35. If yes, how many people from your family did you use for the soybean production in 2013?
36. What was the average price in naira per 100kg bag of soybean in 2013 growing season? N…..
37. From the income obtained due to adoption of some recommended soybean production practices are you able to solve some basic pressing life demands in a form of?
a. Child education ( )
b. Provision of enough food stuff for the use of the family ( )
c. Good healthcare delivery ( )
d. Provision of adequate clothing ( )
e. Renovation/building of the house ( )
f . Possession of durable goods e.g. bicycle, motorcycle, car, deep freezer ( )
g. State any other(s) household materials apart from the ones in No.37 above……

38. How did the increase soybean output affect your income?
Pleases tick ( ) as applicable to you.
a. Very high ( ) b. High ( ) c. Average ( ) d. Low ( ) e. Very low ( )

SECTION E: CONSTRAINTS TO THE ADOPTION OF RECOMMENDED SOYBEAN PRODUCTION PRACTICES

39. Which of the following problems do you encounter in using the technology? Tick, if any:

b. High cost of the technology ( )
c. Complexity of the technology ( )
d. Non accessibility of the technology ( )
e. Lack of credit facilities ( )
f. Lack of awareness ( )
g. Insufficient information ( )
h. Lack of technical know-how ( )
i. Others (specify)…….....

…….

…….

…….

TECHNOLOGY CHARACTERISTICS:

AFFORDABILITY

40. Which of the following technology is affordable to you? Tick the correct option in the table below as applied to each technology. NA (Not Affordable) = 1, FA (Fairly Affordable) = 2, A (Affordable) = 3, VA (Very Affordable) = 4 and HA (Highly Affordable) = 5

S/N	Recommended Soybean production Practices	NA	FA	A	VA	HA
i.	Planting of improved soybean varieties					
ii.	Planting date – mid- june to early july					
iii.	Quantity of Seed per Hectare 50 – 70 kg/ha (20 – 28 standard mudus)					
iv.	No. of Seeds per hole – 3 to 4 seeds/hole					
v.	Plant Spacing – 75cm between rows and 10cm between stands.					
vi.	Fertilizer application rate, NPK 15:15:15 20kg/ha; SUPA 40kg/ha; K_2O 20kg/ha.					
vii.	Weed control – manual(hoe weeding) at 2weeks after planting(WAP) and 5-6 WAP or with herbicides e.gParaquat plus and Pendimethalin 50EC (250ml of each/20L sprayer per hectare or Fusilade forte,1-1 ½ L (150ml) i.e 1milk of tin/15L sprayer.					
viii.	Pest and Disease control by planting resistant varieties or treated seeds.					
Ix	Harvesting – 3 – 4 months after planting when the pod is straw colored or when 85% of the pods have turned brown for non- shattering varieties and 80% for shattering varieties.					
x.	Storage – stored when the moisture content is 10% or less or when the seeds cannot be dented with teeth or finger nails.					

COMPATIBILITY

41. Which of the following technology meets your needs or compatible with your values?

Tick the correct option in the table below as applied to each technology; NC (Not Compatible)=1, FC (Fairly Compatible) = 2, C (Compatible)=3, VC (Very

S/N	Recommended Soybean production Practices	NC	FC	C	VC	HC
i.	Planting of improved soybean varieties					
ii.	Planting date – mid- june to early july					
iii.	Quantity of Seed per Hectare 50 – 70 kg/ha (20 – 28 standard mudus)					
iv.	No. of Seeds per hole – 3 to 4 seeds/hole					
v.	Plant Spacing – 75cm between rows and 10cm between stands.					
vi.	Fertilizer application rate, NPK 15:15:15 20kg/ha; SUPA 40kg/ha; K_2O 20kg/ha.					
vii.	Weed control – manual(hoe weeding) at 2weeks after planting(WAP) and 5-6 WAP or with herbicides e.g. Paraquat plus and Pendimethalin 50EC (250ml of each/20L sprayer per hectare or Fusilade forte,1-1 ½ L (150ml) i.e 1milk of tin/15L sprayer.					
viii.	Pest and Disease control by planting resistant varieties or treated seeds.					
Ix	Harvesting – 3 – 4 months after planting when the pod is straw colored or when 85% of the pods have turned brown for non- shattering varieties and 80% for shattering varieties.					
x.	Storage – stored when the moisture content is 10% or less or when the seeds cannot be dented with teeth or finger nails.					

COMPLEXITY

42. Which of the following technology are complex to use of has high level of risk?

Tick the correct option in the table below as applied to each machine NC (Not Complex)=1, FC (Fairly Complex) = 2, C (Complex)=3, VC (Very Complex)=4 and HC (Highly Complex)=5

S/N	Recommended Soybean production Practices	NC	FC	C	VC	HC
i.	Planting of improved soybean varieties					
ii.	Planting date – mid- june to early july					
iii.	Quantity of Seed per Hectare 50 – 70 kg/ha (20 – 28 standard mudus)					
iv.	No. of Seeds per hole – 3 to 4 seeds/hole					
v.	Plant Spacing – 75cm between rows and 10cm between stands.					
vi.	Fertilizer application rate, NPK 15:15:15 20kg/ha; SUPA 40kg/ha; K2O 20kg/ha.					
vii.	Weed control – manual(hoe weeding) at 2weeks after planting(WAP) and 5-6 WAP or with herbicides e.g. Paraquat plus and Pendimethalin 50EC (250ml of each/20L sprayer per hectare or Fusilade forte,1-1 ½ L (150ml) i.e 1milk of tin/15L sprayer.					
viii.	Pest and Disease control by planting resistant varieties or treated seeds.					
Ix	Harvesting – 3 – 4 months after planting when the pod is straw colored or when 85% of the pods have turned brown for non-shattering varieties and 80% for shattering varieties.					
x.	Storage – stored when the moisture content is 10% or less or when the seeds cannot be dented with teeth or finger nails.					

43. What suggestions would you give that will help to accelerate the process of using Recommended Soybean production Practices in this area?

……

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……

……

Thank you very much.