# Factors Affecting the Adoption of Improved Sorghum practices by small holder Farmers in Soba and Zaria Local Government Areas of Kaduna State, Nigeria.

By

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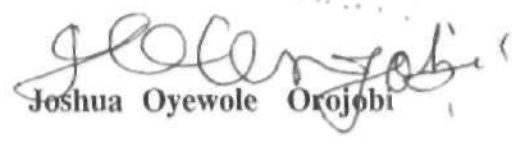
A Thesis Submitted to the Postgraduate School, Ahmadu Bello University, Zaria, in partial Fulfilment of the requirements for the Degree of Doctor of Philosophy (Ph.D.): Agricultural Extension and Rural Sociology.

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Economics and Rural Sociology,
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1999

## *DECLARATION*

I here-by declare that this thesis has been written by me and that it is a report of my own research work. It has not been presented before in any previous application for a higher degree. All quotations were distinguished by quotation marks and the sources of information were specifically acknowledged by means of references.



**Joshua Oyewole Orojobi**

Date: 9th November, 1999

## CERTIFICATION

This thesis entitled "Factors Affecting the adoption of improved sorghum practices by small holder farmers in Soba and Zaria Local Government Areas of Kaduna State, Nigeria" by Joshua Oyewole Orojobi meets the requirements governing the award of the degree of Doctor of Philosophy (Ph.D.) of Ahmadu Bello University, Zaria, and is approved for its contribution to scientific knowledge and literary presentation.

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## DEDICATION

This thesis is dedicated to the memory of my late parents Chief Olaniyan Orojobi and his wife Segilola Olawumi for their industry and devotion.

## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| 1. | A.B.U.: | Ahmadu Bello University |
| 2. | A.D.P.: | Agricultural Development Projects |
| 3. | A.E.R.L.S.: | Agricultural Extension and Research Liaison Services. |
| 4. | A.K.I.S.: | Agricultural Knowledge and Information System. |
| 5. | D.A.C.: | Division of Agricultural Colleges. |
| 6. | D.F.R.R.I.: | Directorate for Food. Road and Rural Infrastructure. |
| 7. | F.A.O.: | Food and Agriculural Organisation. |
| 8. | F.A.S.COM.: | Farmers' Agricultural Supply Company. |
| 9. | F.S.C.: | Farmers Service Centres. |
| 10. | G.R.: | Green Revolution. |
| 11. | H.N.D. | Higher National Diploma. |
| 12. | I.A.D.P.: | Integrated Agricultural Development Project. |
| 13. | I.A.R.: | Institute for Agricultural Research. |
| 14. | I.I.T.A.: | International Institute of Tropical Agriculture. |
| 15. | K.A.D.P.: | Kaduna State Agricultural Development Programme. |
| 16. | M.A.N.R.: | Ministry of Agriculture and National Resources. |
| 17. | M.T.R.M.: | Monthly Technology Review Meeting. |
| 18. | N.A.I.C.: | Nigerian Agricultural Insurance Company. |
| 19. | N.A.C.B. | Nigerian Agricultural and Co-operative Bank. |
| 20. | N.A.E.R.L.S.: | National Agricultural Extension and Research Liason Services. |
| 21. | N.A.F.P.P.: | National Accelerated Food Production Project. |
| 22. | N.R.S.A.: | Nigerian Rural Sociological Association. |
| 23 | N.T.C.: | Nigerian Tobacco Company. |
| 24. | O.F.N.: | Operation Feed the Nation. |
| 25. | R.B.R.D.A.: | River Basin and Rural Development Authority. |
| 26. | S.A.P.: | Structural Adjustment Programme. |
| 27. | T & V: | Training and Visit. |
| 28. | U.A.C.: | United African Company. |

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Finally, I would like to say that any errors of facts, faults of style, conceptual inadequacies, errors of judgement, facts reported and views expressed and any other inadequacies that still remain in this work are entirely my direct responsibility rather than that of the able scholars mentioned in this roll call of acknowledgements.

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## ABSTRACT

The Federal and State Governments of Nigeria have invested huge sums of money into the agricultural sector and food production in the last three decades. Despite these efforts, the development of agriculture is not yet satisfactory and our dream of self-sufficiency in food production in the country is yet to be realised. This is because majority of the farmers still depend on low yielding crop varieties and they still follow the indigenous cultural practices on their farms while modern farm inputs were not extensively used despite the efforts of Research Institutes.

This study examined the level of awareness and adoption of improved sorghum varieties and related recommended farm practices. It also explored the relationships between selected independent variabiles and adoption of agricultural innovations.

The study was conducted in Soba and Zaria Local Government Areas of Kaduna State. The primary data was from a sample of 313 respondents in 18 villages. Both the villages and the respondents in each village were randomly selected. The data collected were subjected to statistical analysis. Frequency distribution of the key variables were obtained to provide counts, percentages distribution in tabular form. Pearson Product-Moment correlation tests were used to determine the relationships between adoption of agricultural innovations and selected independent varibales while step-wise multiple regression analysis technique was used to determine the best combination of variables predictive of adoption behaviour of farmers.

This study found that the level of awareness of improved seeds, seed dressing chemicals, correct spacing, fertilizer application rate and the use of storage chemicals was high, while the

level of awareness of seed rate and use of herbicides was low. The study also found that the level of adoption of improved sorghum varieties was above average (53%) while the level of adoption of seed dressing chemicals, fertilizer application rate and the use of storage chemicals was high. The level of adoption of correct spacing, seed rate, thinning and the use of herbicides was low.

This study found that the major factors constraining adoption of agricultural innovations in the area included inadequate access to farm inputs, inadequate technical advice and information from extension, lack of money and farm credit to employ labour and to buy farm inputs, high cost of farm inputs and high cost of labour. The study also found that formal education, level of literacy, farm income, family size, farm labour force, number of farm plots, membership of social organisations, farm credit, extension services exposure, mass media exposure and awareness of agricultural innovations were positively and significantly related to adoption of agricultural innovations while age and years of farming experience were not significantly related to adoption of agricultural innovations at .05 level of significance. This study found that awareness of agricultural innovations, extension services exposure, farm size, formal education and family size were predictive of adoprion behaviour of farmers.

This study recommended that extension workers have to provide effective and efficient services to the farmers. In addition, agricultural education programmes on radio and television should be increased to create awareness needed to enhance adoption. Agricultural Research Institutes should increase research work into farms and farmers problems and development of high yielding, disease resistant new varieties of seed for farmers to adopt. Research should be

intensified into mixed cropping system spacing of such crops, fertilizer requirements for mixed cropping bearing in mind the environmental conditions, so especially climate and soils of the area. Farm inputs including credit should be provided at favorable conditions that farmers can easily get them.

Adoption of agricultural innovations research needs to be multi-disciplinary because many variables are involved. Future studies should not only cover socio-economic variables, but should include environmental and spatial variables at different ecological zones to discover the missing variables influencing adoption behaviour of farmers.

# CHAPTER ONE

## INTRODUCTION

Despite the growing importance of industrial sector and the influence of petroleum production in the country, agriculture remains and will continue to remain a key sector in the Nigerian economy. Before the oil boom in the 1970s, agriculture contributed a lot and was by far the most important sector of the Nigerian economy. For example, in 1964, agriculture contributed about 61% to the Gross Domestic Product (GDP) and 71% of the total export. But by 1970, the contribution of agriculture to G.D.P. was 48% while its contribution to the total export was only 32.38%. By 1980, the contribution of agriculture to Gross Domestic Product was only 18% while its contribution to total export was less than 5% (Abba, et al 1985, p.18). However, the contribution of agriculture to G.D.P. started improving gradually from 1985. The share of agriculture to the Gross Domestic Product in 1985 was 23.53% and it gradually rose to 31.17% in 1996 (Table 1.1).

Agriculture contributed to the general development of the country through export taxes levied on primary produce and the trading surpluses of the previous Marketing Boards. Foreign exchange earnings from export crops like cocoa, cotton, oil palm, groundnuts were used for the provision of infrastructural facilities such as water supply, roads construction, building of schools and colleges, hospitals, electricity supply and housing estates in urban centres.

Notwithstanding the sharp relative decline, agriculture has been estimated to be the largest employer of labour, accounting for about 47.2% of the active labour force (Olayide et al, 1980, p.7). Apart from being the greatest employer of labour force in the country,

agriculture provides food for not only the rural population but also the rapidly growing urban population

**Table 1.1: Share of Agriculture in Gross Domestic Product (GDP) of Nigeria 1985 - 1996.**

| Year | All sectors ( Billion) | Agricultural sector ( Billion) | % Share of Agriculture in total |
|---|---|---|---|
| 1985 | 74.47 | 17.52 | 23.53 |
| 1986 | 72.90 | 18.00 | 24.69 |
| 1987 | 73.77 | 17.92 | 24.29 |
| 1988 | 77.76 | 24.83 | 31.93 |
| 1989 | 83.46 | 26.07 | 31.24 |
| 1990 | 90.36 | 27.21 | 30. 1 |
| 1991 | 94.53 | 28.43 | 29.9O |
| 1992 | 97.42 | 29.43 | 30.08 |
| 1993 | 100.03 | 30.13 | 30.12 |
| 1994 | 101.04 | 31.04 | 30.72 |
| 1995 | 103.51 | 32.09 | 31.00 |
| 1996 | 106.87 | 33.31 | 31.17 |

Source: Central Bank of Nigeria- Annual Reports and Statement of Accounts 1985 - 1996.

However, from early 1970s, the supply of food produced in the country declined and it still cannot meet the demand for it. As a result of poor management of national resources (especially from petroleum), Nigeria started large scale importation of food to feed the

growing population from the early 1970s. Most of the locally produced and consumed food items in Nigeria are produced by small scale farmers. Infact, Olayide et al (1980) claimed that over 95% of agricultural produce in Nigeria are produced by small scale farmers whose individual holdings are less than five (5) hectares.

The growing industrial sector has been making increasing demands on the agricultural sector. Most local industries depend on the agricultural sector for the supply of raw materials. In addition, agricultural sector provides markets for the industrial products. The greater part of the consumer goods and a large part of the capital goods produced in urban centres are consumed by the agricultural population (Stephen, 1980).

Although agricultural sector is an important sector in the economy of Nigeria, the method of production is largely traditional. It is typically small scale, non-mechanised and with production essentially aimed at meeting domestic consumption needs. However, Helleiner correctly noted that "many Nigerian peasants are engaged at one and the same time in production for export, production for internal trade and production for subsistence" (Helleiner, 1966, 46). The bulk of food and export crops production takes place under the traditional setting. Holdings are small and scattered or fragmented. The main tools consist of hoes, cutlasses, axes and knives. An average small scale farmer is illiterate or has little western education with relatively small capital to work with. Yield is still very low and productivity per capital, land and labour is still low in the country.

In an attempt to remove some of the constraints limiting agricultural development in the country, various goals were set, many policies, strategies and tasks were set up or

suggested over the years. For examples, an F.A.O. report to the Government of Nigeria listed six principal tasks facing Nigerian agriculture (F.A.O, 1966). They are to (a) provide an adequate and well balanced food supply for the growing population at increasing quantity and quality; (b) provide raw materials for domestic industries, (c) provide agricultural export earnings (d) provide employment to Nigerians
(e) contribute a major part of capital needed to finance economic development and
(f) make a good beginning in modernizing the methods of production and use of natural and human resources and thereby increasing the productivity of labour in agriculure, as well as the output per hectare and per anunal. In the 1970s and 1980s, a lot of efforts were made to achieve some of the goals with varying degrees of successes and failures. Some of the efforts made include the establishment of National Accelerated Food Production Programme (N.A.F.P.P), River Basin and Rural Development Authorities (R.B.R.D.A), Operation Feed the Nation (O.F.N), Agricultural Development Projects (A.D.P), Green Revolution (G.R), large scale capital intensive irrigation projects, Directorate of Food, Roads, and Rural Infrastructure (D.F.R.R.I). More Agricultural Research Institutes, Schools and Colleges of Agriculture and agricultural extension agencies were set up. Yet output from major crops is still relatively low (Table 1.2) while the level of productivity per labour, capital and land is still low.

Some of the goals of agricultural development in Nigeria in the 4th National Development Plan 1981-85 (pp 78 - 79) include (a) increased production of food and other raw materials to meet the needs of a growing population and rising industrial production;(b)

the attainment of self-sufficiency in food within the plan period;(c) increased production and processing of export crops with a view to expanding and diversifying the country's foreign exchange earnings;(d) the expansion of employment opportunities to absorb the increasing labour force of the nation and (e) the evolution of appropriate institutional and administrative apparatus to facilitate the rapid development of the country's agricultural potentials. A careful examination of the goals listed above will show that one of the ways to achieve them is the introduction of improved farm practices, relevant technologies and appropriate farm inputs like fertilizers, improved seeds, tools, agro-chemicals to the farmers. This means agricultural innovations have to be developed and tested by researchers, they have to be accepted and adopted by farmers before we can get higher agricultural productivity and self-sufficiency in food production in the country. Moreover, policy makers, researchers, extension workers and even the farmers must know and understand the farming system and other socio-economic factors that are influencing agricultural development in Nigeria. In support of this point, Helleiner (1966, 69) correctly noted that "there exists a considerable gap between available knowledge and its application in the peasant sector. If the already accumulated stock of knowledge is to be employed, those who have it, usually the government officials, must understand the factors influencing peasant's receptivity to it".

Importance and potential contribution of sorghum as food crop and raw material to local industries is another issue underlying this research problem. Sorghum is the most important cereal crop produced in Nigeria in terms of hectare, output, consumption and the contribution to the nutritional value. Sorghum is planted between May and June and it is

harvested in December/January. About 2/3 of the sorghum planted in the Northern States of Nigeria is intercropped, often with millet as the early crop. This is because the growth cycles of the two crops are ideally suited to mixtures. The most important mixtures are said to be sorghum/millet; sorghum/millet/cowpeas and sorghum/millet/cowpeas/groundnuts (Norman et al 1976; Agboola, 1979).

Sorghum was cultivated on an average of about 5.7 million hectares of land between 1970 and 1974 in the country (Abalu 1980, 37). Also an average of about 4 million tonnes was produced in the Northern States of Nigria. Agboola (1979) reported that about two million small scale farmers were engaged in the production of sorghum. In recent years, sorghum production in the country has gradually increased from 4.6 million tonnes in 1984 to over 7.5 million tonnes in 1996 (Table 1.2).

Sorghum is the most important staple food crop consumed by the majority of the population in the Northern States of Nigeria and Kaduna State in particular. Sorghum is grown primarily for human consumption in the form of flour to produce various forms of local food. It is also used in brewing of beer and local drinks. Many local food items (fura, feti, koko, akamu, kunu, tseki) are produced from the flour. But the most common one in Nigeria is `tuwo', made by stirring the flour in hot water and allowing the thick paste to cool for food (Agboola 1979, 73). Sorghum grains are also used to feed horses, cattle and other livestock. The long stalks are used for a variety of building purposes including the thatching of houses, the fencing of compounds while some stems are used to form trellis to provide support for climbing yam vines.

The main contribution of sorghum to the food economy in Nigeria consists in its richness in protein. The protein content of grain crops varies from 15.03% for sorghum, 12.51% for rice to 10.65% for maize (Agboola 1979, quoting Oyenuga 1968). Simmons

(1976), in her study of the small scale rural food processing industry in Northern Nigeria, showed that in the Northern States, 73% of total calories from cereals and 52.3% of the per capita protein intake are contributed by sorghum alone.

Despite the fact that sorghum is the most important cereal crop in Nigeria and that research institutes have developed improved varieties of the crop, the level of its adoption by small scale farmers is still very low. Majority of the farmers still use the local varieties with low yield and traditional cultural practices are still followed . The impact of the progress made by research has been limited on the farming system by the fact that the improved varieties have been mainly suitable for sole cropping rather than mixed cropping which is the usual farming practice (Norman, 1972). In addition, the improved varieties have not been very resistant to disease and pests such as stem borers, striga, head mold, shoot fly and midge (Abalu and D'Silva, 1985).

It is clear from Table 1.2 that the output of major crops (Sorghum, millet, rice and maize) have changed very little over the years. The gap between the yields that farmers are obtaining from their fields and those that are potentially possible under improved conditions as well as under experimental situations have been found to be very wide (Atala and Abdullahi 1991, 32). This unsatisfactory condition justifies the need to further investigate and identify the factors constraining adoption of improved sorghum varieties and related innovations.

**Table 1.2: Estimated Annual Production of Sorghum Maize, Millet and Rice in Nigeria, 1984 - 1996 ('000 Tonnes).**

| Year | Sorghum | Millet | Maize | Rice |
|---|---|---|---|---|
| 1984 | 4608 | 3349 | 1058 | 157 |
| 1985 | 4991 | 3684 | 1190 | 196 |
| 1986 | 5455 | 4111 | 1336 | 283 |
| 1987 | 5182 | 3905 | 1202 | 297 |
| 1988 | 5182 | 5136 | 5268 | 2081 |
| 1989 | 7265 | 4770 | 5008 | 3303 |
| 1990 | 4185 | 5136 | 5768 | 2500 |
| 1991 | 5367 | 4109 | 5810 | 3185 |
| 1992 | 5909 | 4501 | 5840 | 3260 |
| 1993 | 6051 | 4602 | 6290 | 3065 |
| 1994 | 6197 | 4757 | 6902 | 2427 |
| 1995 | 6997 | 5563 | 6931 | 3203 |
| 1996 | 7514 | 5803 | 6217 | 3122 |

Source: Annual Report and Statement of Accounts from 1985-1996 Central Bank of Nigeria

## Statement of the Problem

The level of agricultural development in Nigeria is still low despite huge amount of investment in the agricultural sector by both the Federal and State Governments in the last three decades. The problem of feeding the growing population still persists while the contribution of agriculture to agro-based industries in terms of supplying raw materials is not yet satisfactory.

Output is low because farmers still use mostly indigenous low yielding crop varieties. Most farmers do not follow the recommended practices on their farms. Long-seasoned varieties that have been grown by their ancestors for years are still commonly used, while the modern farm inputs like fertilizers, agro-chemicals, labour saving tools are not extensively used. To solve these problems, national and international Agricultural Research Institutes have developed improved seeds of various crops and relevant cultural practices such as the use of fertilizers, seed dressing and herbicides for various ecological zones in the country. However, the level of adoption of such agricultural innovations by the small scale farmers remains low and unsatisfactory.

To identify the problems connected with adoption and non-adoption of agricultural innovations in Nigeria, several adoption studies have been carried out (such as those of Clark and Akinbode 1968; Kidd, 1968; Alao. 1971; Voh, 1978; Atala, 1980; Arokoyo, 1981). However, in most of these studies the emphasis was on the personal, psychological and socio-psychological attributes or characteristics of individual farmers (for example Akiwowo and Basu 1968, Ogionwo, 1978). Most of the studies cited above dealt with the effects of

particular personal factors upon adoption behaviours of farmers.

One of the weaknesses of this approach is that it pays little attention to the systemic or institutional factors that may hamper agricultural development programmes. Some research efforts indicated communication as the most important facilitator of modernity or development (Rogers with Svenning, 1969). But Contreras (1980) warned that communication can have little effect in modernizing peasants unless structural changes first make modernization possible. He added that there are systemic factors like farm credit system, extension system, inputs delivery system, land tenure system and marketing system that individual peasant farmer cannot control but can be changed only by government policies and group action. Although inadequate or lack of access to these system variables are known to impede adoption of improved agricultural innovations, they have not been systematically studied. This study therefore examined the idea that apart from the individual characteristics of the farmers, access to or no access to the factors of the social system of which the farmer is a part can enhance or impede his adoption behaviour. This study examined the extent to which access to farm credit and other farm inputs, extension services, farm land and agricultural mass media may influence adoption of improved sorghum varieties and related agricultural innovations in Soba and Zaria Local Government Areas of Kaduna State. The study also attempted to predict adoption behaviour of farmers with a set of system and individual factors such as income, formal education, farming experience and membership of social organisations.

## Objectives of the Study

The broad objective of this study is to gain an understanding of the processes and factors which explain the adoption of agricultural innovations and adoption behaviour of farmers. The study paid particular attention to system factors influencing adoption of recommended practices in agriculture.

The specific objectives of the study therefore are:

1. To identify and describe the basic characteristics of the respondents in the study area.
2. To determine the level of awareness and adoption of improved sorghum varieties and related recommended farm practices among farmers in Soba and Zaria Local Government Areas of Kaduna State.
3. To identify the factors that influence farmers adoption (usage) of improved sorghum varieties and related recommended practices.
4. To determine the relationships of institutional factors (farm credit, extension service, farm land, mass media) and personal attributes (like age, formal education, family size, farming experience, farm income, membership of social organisations, awareness of agricultural innovations, to adoption of improved sorghum varieties and related farm practices by small scale farmers in Soba and Zaria Local Government Areas of Kaduna State.
5. To determine the relative significance of each of the variables and a combination of them in explaining adoption behaviour of small scale farmers in the area of this study.

## Justification of this Study

Every effort must be geared towards increasing food production to feed the growing population in the country. To achieve this, serious efforts have been made over the years by the Research Institutes and the Universities to develop improved recommended practices for farmers to adopt and use. However, the goal of self-sufficiency in food production in the country is still a mirage despite the huge financial and human resources that are going into agricultural sector every year. This justifies the need for further research to find out which factors can induce or stimulate the adoption of agricultural innovations so as to increase food production in the area of this study.

This study may provide an additional micro data about the farmer, his farm, his socio-economic and institutional factors that may influence farmers decision - making process about his farm. Understanding of the farmers' decision making process can be an asset to the policy makers, researchers and extension workers in the development and testing of appropriate technologies and getting such technologies adopted by the farmers. This study may help the extension services to know the communication channels for effective dissemination of agricultural information to farmers.

Theoretically, in addition to establishing the possible relationships between selected independent variables and adoption of agricultural innovations, this study would provide us with the relative importance of composite factors for predicting adoption behaviour of small holder farmers in the study area.

# CHAPTER TWO

# LITERATURE REVIEW AND THEORETICAL FRAMEWORK

## Introduction

It is beyond the scope of this thesis to do a general review of literature on adoption of innovations studies. This study was concerned with the relationships between selected institutional or system variables and adoption of agricultural innovations, using sorghum varieties and related recommended farm practices as the focus of attention. The aim of the literature review is to give a brief review of selected relevant studies that have been done in the area, to provide basis for the theoretical frame-work; to provide insights into methods and procedures that will assist the operationalisation and measurement of the variables; and to provide a basis for interpreting the findings.

Many inter-related factors have been identified to influence adoption of agricultural innovations. People's perception may influence their adoption behaviour far more than the technical characteristics of innovations. For instance, Rogers (1983) identified five perceived characteristics of innovations which may influence their rate of adoption as including relative advantage, complexity, compatibility, trialability and observability. When certain institutional factors like farm credit, and other inputs, extension services and mass media are well developed in a social system, they enhance the adoption of agricultural innovations. Rogers and Shoemaker (1971) reported that multi-channels of communication such as radio, television, newspapers and magazines are used to create awareness, adoption of innovations increases. Socio-economic characteristics of individuals have also been identified as important variables that influence adoption behaviour of farmers (Voh 1979;

Atala, 1980).

**Factors Affecting Adoption of Agricultural Innovations**

This section focused on a brief review of the findings and conclusions of studies about the factors affecting adoption of agricultural innovations.

The behaviour of the peasant farmer and his attitude to change have for long been the subject of intensive study by social scientists all over the world. Studies have been undertaken with a view to finding what factors are responsible for influencing the peasant farmers to readily accept and adopt certain innovations and to reject others even when such innovations appear to be superior to the farmer's age - long practice (Zaria; 1984). The peasant farmer all over the world, and especially in developing countries of Asia, Latin America and Africa has often been described in such negative terms as "ultra conservative, illiterate" `resistant to change' and such other stereotyped attributes . For example, Rogers and Svenning (1969:40) in their attempt to describe the attributes or characteristics of the subculture of peasantry used negative concepts like mutual distrust in interpersonal relations, perceived limited goods, lack of innovativeness, limited aspiration, lack of deferred gratification, limited view of the world, low empathy, farmilistic, fatalistic in their study of Colombian peasants. The Nigerian farmer has often been depicted by observers in the same negative light as his Colombian counterpart. Onazi (1973:4) for example pointed out that "the farmer has often been accused of being too conservative, illiterate, culturally oriented and unwilling to accept change." Similarly, Prawl (1969) observed that "the Nigerian

farmer has been portrayed as a highly conservative person, resistant to change and lacking in innovation".

But there were other social scientists who saw Nigerian farmer in a more positive light. Edache (1980, 113-114) asserted that "small scale farmers are not by nature resistant to change per se" and that "they appeared unresponsive to agricultural programmes or improved technologies designed to improve production and raise their standard of living because the social, economic and the physical environment in which they operated dictated it". In support of Edache's view above about Nigerian farmer, Atala (1984:6) wrote that "if the farmers did not adopt agricultural innovations, it was not simply because they were fatalistic, lacking risk - orientation, uncreative, with a tendency toward poor future orientation, or poor entrepreneurship. They suffered from very low achievement motivation, they were superstitious and catholic, they had not learnt the development mystique of the Protestants ethic and the spirit of capitalism, or the values of saving and investment. One major reason was because their socio-economic characteristics did not facilitate adoption of agricultural innovations" (Beltran 1970, quoted by Atala 1984:6).

In his analysis of the Green Revolution of 1960s, Wharton (1969) reported that adequate supply of water, fertilizer, improved seeds of wheat, rice and corn, pesticides, modern equipment were the main factors that encouraged the increased output of crops and the new varieties rapidly spread within countries and across the national boundaries in Asia and Latin America. It was reported that the earlier adopters of the new technologies were

the wealthier, more modern farmers, that have better soils, access to roads, markets, credit, literate in the region that were already more advanced. In another country, Feliciano (1964) outlined several reasons for accepting new farming innovations among Philippino farmers. They included the seen and proved effectiveness of the practice, novelty of the practice, ease of doing the practice, availability of needed resources, influence of neighbours and friends and the compatibility of the practices with the farmers needs and goals.

In the case of a study in the Old Western Nigeria, Clark and Akinbode (1968) reported that farmers adopted cocoa because they received the necessary detailed information from a person in whom they had confidence, they saw a neighbour and/or a friend followed the practice successfully, they were encouraged by a salesman or dealer, they thought they could make more money. They added that economic gain was a major reason for adoption and continuing to follow the cocoa spraying programme. Basu (1969) also revealed that farmers adopted the innovations in the Old Western Nigeria because of group influence (members accepted change introduced by the associations like fertilizers, improved seeds as group norms). Other factors that helped tobacco farmers to adopt innovations included input availability like tractor hiring service, storing of tobacco scientifically and marketing facilities provided by N.T.C.

Norman (1976), in his study of farmers and farms in three villages in the Old Zaria Province argued that the way crops were grown was influenced by tradition, level of technology, resources availability, the farming system and the physical environment. In his study in Kaduna State, Banta (1981) reported that the reasons for adoption of improved

sorghum package included high yield improved seed, and that the seed dressing chemicals, credit and intensive extension services were provided. In the case of socio-economic analysis of the transfer and adoption of agricultural technology, Harold (1981) reported that the quality, acceptability and appropriateness of infrastructures like farm credit, extension services, marketing facilities, communication system enhanced the adoption of agricultural innovations.

Ajaegbu (1969), in his study of the problems of accepting innovations and effecting rural economic changes in the coastal creeks and Lagoons of South Western Nigeria reported that those who actually started these new practices included mainly Chiefs, councillors, former politicians, traders, present and retired school masters, lawyers and clergymen. These people were generally quite enlightened, had lived outside the areas, particularly in Lagos and Ibadan at one time or another and had the necessary working capital, although many others were obliged to get loans from the government or through co-operative societies. He found that large number of his respondents adopted as a result of influence of examples of others and contact with extension agents.

Nweke and Akorhe (1983) in their study of adoption of rice production technologies in Plateau State revealed that the rate of adoption of new technologies was determined not by demonstration per se but by availability of material components of the technologies like tractors, that reduce cost of labour, fertilizer made available at subsidised rate. Osuji (1983) also reported that income, extension visits, distance of the sources of information - actual spatial distance and distance due to bad and inaccessible roads were factors that influenced adoption of agricultural innovations.

In his study of innovative behaviour and personal attributes of Nigerian farmers, Ogionwo (1978) concluded that adoption behaviour was dependent upon a number of forces characterised not only by the economic and social factors of the individual's environment but also by his personality characteristics as shown by self-perception in the existing socio-cultural environment. Voh (1984), in his study of Farm Technology Adoption among Farmers in Gusau Agricultural Development Project found that farmers adopted innovations for many reasons. The reasons they gave included: to increase crop yield and income, availability of technical guidance, the desire to gain recognition in the community and the proven effectiveness of the practices. They also had profit motive in their minds.

In summary, the review in this section revealed that adoption of agricultural innovation is a function of a variety of factors. These factors may include the characteristics of the innovations, the socio-economic, physical and institutional environment where the farmer operates, and his personal attributes.

**Relationship between Institutional Variables and Adoption of Agricultural Innovation**

A farmer is operating in, and he or she is part of a social system. Earlier adoption of agricultural innovation studies assumed that the social system is homogeneous and that the innovations are equally relevant or adoptable by all members of the social system. Accordingly, individual attributes were seen as the major explanations for differences in adoption behaviour. But in reality, the social system is heterogeneous in terms of access to factors that can enhance or facilitate adoption of agricultural innovations. Apart from his or her individual characteristics, a farmer's decision - making process about farming is

inflenced by a myriad of systemic factors. The literature review therefore first focused on access to extension service, farm credit, farmland and access to sources of agricultural information, especially mass media.

**Extension Exposure**

Extension exposure can be in form of farm and home visits by extension agents, demonstrations, farmers various meetings with extension agents, field days/trips. Before extension agents can stimulate adoption of agricultural innovation they must have effective contact with the farmers. Rogers and Svenning (1969) reported that there was positive and significant relationship between change agents' contact with farmers and adoption of agricultural innovations in their studies in Colombia, India and Kenya.

In a study conducted by Edache (1980) in Kano State, he found that a highly significant relationship was observed between the frequency of extension agent - farmer visits and the adoption of recommended farm practices. This confirmed Roger's (1983) findings that change agent - farmer contact is one of the best consistent predictors of agricultural innovativeness.

Earlier studies in the Old Western Nigeria by Clark and Akinbode (1968); Kidd.. 1968; Basu (1969), all found that frequency of farmer contact with extension agent is positively and significantly associated with adoption of innovations among the farmers they studied. In the South Eastern Nigeria, studies by Ogionwo (1978) reported that in terms of effectiveness of the use of sources of information, oral extension topped the list. In the

Northern States of Nigeria, studies by Voh (1979); Arokoyo (1981); and Atala (1988) found a highly significant and positive relationship between the frequency of extension agents contact with farmers and adoption of recommended agricultural innovations.

## Farm Credit

Farm credit is "a process of obtaining control over the use of money, goods and services in the present, in exchange for a promise to repay at some specific time" (Adegeye et al 1982, 42). Literature is not lacking on the importance and problems of farm credit in agricultural development in Nigeria (Oluwasanmi and Alao, 1965); Ogunfowora, 1972; Ajakaiye, 1984; Adeniyi, 1987; Agbo and Philip, 1991). But very few of these really focused on the relationship between farm credit and adoption of agricultural innovations.

According to Ajakaiye (1984:236); the Nigerian farmers need credit especially for their farm production because the vicious circle of poverty, low productivity, and low farm income leaves them with virtually no savings to invest in the capital required in the transformation of their production technology. The need for increased supply of farm credit according to Ogunfowora (1972) stemed from the following:

(a) Most of the innovations which the peasant farmers are being called upon to adopt inevitably increase the capital requirements of those farmers. Studies have shown that number of profitable changes proposed on farming systems by small scale farmers were not effected due largely to shortage of capital.

(b) Most peasant farmers produce at the subsistence level, hence there is usually small surplus out of which savings could be made.

The seasonal nature of agriculture calls for both short and medium term credit to finance farm production activities.

(d) Adequate supply of loans could strengthen farmer's position and bargaining strength in the disposal of his products. In many cases, farmers have been forced by urgent demands for cash, to dispose of their products at very poor market prices.

(e) Farmers need credit for production expansion particularly for introducing supplementary enterprises in order to enhance income flows (Adeniyi, 1987:346).

Farm credit institutions in Kaduna State include formal institutional sources like Nigerian Agricultural and Co-operative Bank (N.A.C.B), Agricultural Credit Guarantee Scheme through the Commercial and Merchant Banks, Farmers Supply Company (FASCOM), Co-operatives, Nigerian Tobacco Company (N.T.C.). Non-formal institutional sources of farm credit are relatives, friend, family, local money lenders, middle men, traders and commission agents. But according to recent studies (Adeniyi, 1987; Agbo and Philip, 1991) Non-formal credit institutions or sources still dominate the credit environment. This is partly so because family and friends usually lend money to farmers more as a social obligation than for profit. Perhaps, more fundamentally, the small scale farmers rarely benefit from the loan schemes of formal institutions because they do not have adequate collateral security which most financial institutions require to cover the loan. Complicated

land tenure system prevents some farmers from using their farmland as collateral security.

In some cases when the farm credit was approved, it went to the well to do progressive farmers at the expense of small scale farmers (D'Silva and Raza, 1980). Williams, (1978) also identified lack of credit facilities as one of the factors that kept many farmers from adopting improved practices. In the study of Guided Change Projects (GCP) in Zaria area, Banta (1981) reported that farmers that had access to farm credit and other inputs in addition to extension service adopted the recommended agricultural innovations more than farmers who had none. Also in his study of NAFPP farmers in Kano State, Edache (1980) reported that farmers who got farm credit tended to adopt improved agricultural practices more than those who had none. Studies by Abalu and Yayok, (1980), Famoriyo, (1980) and Okuneye (1984) also identified lack of farm credit as one of the constraints to adoption of agricultural innovations.

Farm credit is expected to be able to remove financial constraints on farming and accelerate the adoption of agricultural innovations. But the reviewed literature indicated that many small scale farmers do not have access to farm credit and lack of farm credit limited the adoption of agricultural innovations. However, the relationship between farm credit and adoption of agricultural innovations, has not been an area of serious study in this area.

**Farmland**

Land is an important factor in agricultural production. Without access to farmland, farming cannot take place. Even if the small scale farmers are convinced by extension agents of the usefulness of the new technologies and other farm inputs are available,

adoption can still be hampered by the nature of land tenure system, size of holdings and the number of fields available to a farmer. According to some studies (e.g. Famoriyo, (1979); Ega, 1984; Ekong, 1988), land is acquired in most parts of Nigeria through inheritance, allocation and gifts, sales, pledge, lease and loan. Population presure on land can lead to individual land holdings and fragmentation of farmland.

Farmers with access to adequate farmland will find it easy to adopt new ideas in farming so as to increase their production and income. It is therefore expected that there is positive relationship between the size of farmholdings and adoption of agricultural innovations. Lionberger (1972) indicated that "size of farm is always positively related to the adoption of new practices by farmers in U.S.A". Rogers and Svenning (1969: 258) found in Colombia that one particular indicator of excellence in farming is farm size, whether measured in land units or labour inputs. They reported positive correlation between farm size in land units and adoption of agricultural innovations.

In Nigeria, Akiwowo and Basu (1969) found that there is no relationship between farm size and adoption of recommended farm practices. But Clark and Akinbode (1968) reported that among maize, cocoa and poultry farmers, high adoption was significantly correlated to farm size. Also most of the recent studies (Edache (1978); Atala (1980); Ekong, (1988) found the size of farmland to be positively and significantly related to the adoption of agricultural innovations.

**Mass Media Exposure**

Mass media play an important role in the adoption process. Rogers and Svenning

(1969) reported that mass media exposure was positively related to innovativeness. Lionberger (1960) also said that the number of sources used or contacts with information sources was positively related to adoption rate.

Some studies in Nigeria showed the importance of radio in disseminating agricultural information to farmers. Kidd (1971) reported in Western Nigeria that radio was the most important source of agricultural information. In the Eastern States, (Obibuaku (1978) reported that radio proved to be the most effective medium for creating awareness among farming communities.

Bogunjoko (1981) reported that younger farmers in Northern Nigeria tended to use more sources of information, especially mass media channels. Atala (1980) reported a very strong positive relationship between sources of information and adoption of agricultural innovations. Ekong (1988) noted that even though family members, friends, neighbours and local formal organisations play very important part in the Nigerian farmers awareness of innovations, it was identified that there was positive relationship between mass media (radio, T.V., newspapers, films) and adoption of agricultural innvations. Most of other studies Alao (1971), Oginowo (1978), Arokoyo (1981) Matanmi (1991) found positive and significant relationship between mass media (especially radio) and level of adoption of agricultural innovations.

**Relationship between Personal Characteristics and Adoption of Agricultural Innovations**

Literature on diffusion and adoption of innovation studies provided us with a whole

range of personal characteristics of farmers that may influence their decision-making process about adoption or non-adoption of agricultural innovations. However, the present study focused on personal attributes like age, formal education, level of literacy, farm income, farming experience, family size and social participation and how they were associated with the adoption of agricultural innovations.

**Age:**

Age has been found to be one of the important independent variables in adoption - diffusion studies. Lionberger (1960) claimed that elderly farmers seemed to be some what less inclined to adopt new farm practices than young ones. Gross (1979) carried out studies that supported the argument that elderly farmers would hesitate to adopt any new farm practices or changes that could jeoperdise their security and prestige. Their study indicated that adoption was highest among the middle aged farmers.

In Nigeria, Clark and Akinbode (1968), Basu (1968), Basu and Akiwowo (1969), Edache 1980 and Voh (1982) found no relationship between age of the farmers and adoption of agricultural innovations while Ogionwo (1978), Atala (1980) and Zaria (1984) found negative relationship between age and adoption of agricultural innovations. However, Francis (1974), in his study in Togo, West Africa, showed that adoption of agricultural practices is positively correlated with age. Francis advanced that in developing societies there are constraints including high bride prices, educational expenses and various consumption items of more social status values than new farm practices. It was also possible that elderly people interested in farming may have access to more land, more income and

credit facilities than young men.

**Formal Education**

*Education is one of the key factors for the modernization of traditional societies* including agriculture. It is an important factor in bringing about social change and in exposure to information about modern farming methods. Education enhances people's receptivity to the mass media. There is a general assumption that formal education facilitates learning and as such those farmers who have attended schools would under normal circumstances have a more favourable attitude towards the adoption of improved farming practices. Rogers and Shoemaker (1971) generalised that earlier adopters had more years of education than do later adopters. They also found significant relationship between functional literacy and print media exposure in their study of Colombia villages.

Some studies in India reported the correlation of schooling with adoption of agricultural innovations. For example, Shungi et al (1971) concluded that literacy training played a prominent role in the process of agricultural development in India. They reported that average level of adoption were higher for literates than non-literates and it was indicated that education was related to farmers contacts with extension agents, use of mass media, participation in formal organisations and urban contacts. Sharman (1966) and Sawhney (1967) found in India that with increasing level of education, there was an increasing use of mass media sources of information and that education affects the use of modern means of communication among the Indian farmers.

Research findings in Nigeria and other West African countries showed some element

of inconsistency in their findings. For example, Williams (1969), Basu (1969), and Basu and Akiwowo (1968) found no significant relationship between formal education and rate of adoption of agricultural innovations. On the other hand, Clark and Akinbode (1968), Voh (1982) Atala (1980), and Awolola (1984) reported that there is positive and significant relationship between formal education and adoption of agricultural innovations. Kidd (1968) reported that farmers who attended extension programmes and other related sources of information were either primary school leavers or had higher education or people who attended adult education classes.

Francis (1974), however, found in Togo, a West African country that formal education was actually negatively associated with adoption of agricultural innovations. To Francis, it was not unusual because he noted that formal education was considered to be a first step away from farming. He explained that more education resulted in developing negative attitudes towards agriculture. Also other sources of income reduce dependence upon farm production and made it possible to be less concerned about potentially profitable innovative ideas. In support of Francis, one of the factors for the failure of the farm settlement schemes in Nigeria in the late 1950s and early 1960s was the negative attitudes the young school leavers had towards agriculture in the South Westtern part of Nigeria.

*Literacy Level*

Edache (1980), Voh (1979), Atala (1980) found in the Northern part of Nigeria that literacy was strongly and positively associated with adoption of agricultural innovations. But Ogionwo (1978) reported that level of literacy was not highly correlated with information seeking behaviour or actual adoption of farm practices. He added that there were many

other variables that influence exposure to sources of information and adoption like income. social status.

**Farm Income**

In the process of agricultural production, capital is essential to acquire the basic factors of production. Therefore, farmers with higher income are expected to have more capital and be able to invest in agricultural innovations than farmers with low incomes. Lionberger (1960) reported that high farm income was associated with high level of adoption of agricultural innovations in America.

In Nigeria, Ogionwo (1978) reported that gross farm income had a positively high correlation with innovativeness. The study confirmed his hypothesis that innovativeness was positively correlated with income both as a cause and effect, that rich people can afford to innovate and those who innovated got richer. Ekong (1988) also reported that when other things were held constant, there was positive relationship between level of income and adoption of innovations. Nweke (1981) also reported that capital base and opportunity to gain cash income were significant determinants of agricultural progressiveness among small holder farmers in Southern Nigeria.

**Length of Farming Experience:**

A farmer with more years of farming experience is assumed to be more innovative and more knowledgeable about recommended farm practices in agriculture and readily sees the need to use ideas that will increase his farming productivity. Accordingly, it is expected that adoption of agricultural innovation would be related to the years of farming experience.

However, findings from previous studies were not consistent on this hypothesis. Some rejected it while others accepted the hypothesis. For example, Clark and Akinbode (1968) found that there was no relationship between length of farming experience and adoption of innovations among maize and cocoa farmers, but they reported that there was significant relationship between length of farming and adoption of innovations among poultry farmers. Basu (1969) also reported that there was no significant relationship between years of farming experience and adoption of recommended farm practices. However, Opare (1977) in Ghana, reported that the number of years respondents had been growing cocoa was positively associated with the adoption of recommended farm practices. Also in a more recent study in Nigeria, Awolola (1984) found a positive and significant relationship between years of farming experience and adoption of agricultural innovations.

**Family Size**

Most small scale farmers depend on family labour as the cost of farm labour continues to increase. But the findings of previous studies in Nigeria were not consistent. For example, Kidd (1968) found that the number of dependants did not relate to adoption of Ministry of Agriculture and Natural Resources Programmes. Even though Clark and Akinbode (1968) reported that there was significant relationship between size of family and adoption of innovations by cocoa and poultry farmers, they found no significant relationship between family size and adoption of innovations among the maize farmers.

In the South Western Nigeria, Alao (1971), Patel and Anthonio (1971) found that there was positive relationship between family size and adoption of innovations, but Voh

(1979) reported that innovative farmers tended to have some what smaller families. Awolola (1984) found a negative but significant relationship between number of helpers on farm and level of adoption of innovations while Atala (1980) reported that there was a negligible positive relationship between household size and adoption of agricultural innovations.

**Social Participation**

Social or community participation may be defined as an individual's social contact. The general assumption is that "the innovativeness of an individual is directly related to his level of social participation. Persons who are active in formal organisations or voluntary associations are more innovative than persons who are not" Rothman, (1974:435). Rogers and Shoemaker (1971:383) also generalised that satisfaction with collective innovation decision is positively related to the degree of participation of members of the social system. Farmers who have broader range of social contacts (with a wider, variety of people and institutions are more likely to be responsive to agricultural innovations. In Nigeria, both the earlier studies (like Clark and Akinbode 1968), Kidd (1968) and recent findings (like Zaria 1984, Atala 1988) agreed with the findings in U.S.A. that there is positive and significant relationship between social participation and adoption of recommended farm practices.

Ogionwo (1978:60) quoted L. Festinger and his associates (1948:486) that people who were interested in community activities were likely to mix more with other people in the community and thus have a greater possibility of being told of a new thing because they had a greater number of contacts. Social participation makes an individual more innovative Ogionwo concluded that social participation was significantly and positively related to

innovativeness. Basu (1968) also reported clear significant relationship between participation in formal organisations and adoption of recommended farm practices in four villages he studied in the Old Western State of Nigeria. He found that as a result of group influence, members accepted changes like use of fertilizers and the improved seeds as part of group norms.

**Summary of Literature Review**

The literature review showed that many inter-related factors influence the adoption of agricultural innovations. Rogers (1983), for example identified five perceived characteristics of innovations which may influence their adoption rate as including relative advantage, complexity, compatibility, trialability and observability. The literature review also indicated that the attributes of potential adopters could also influence the level of adoption of agricultural innovations. Such attributes may include age, formal education, level of literacy, length of farming experiences, income, family size and social participation in the community activities.

It was also shown that institutional factors such as extension system, farm credit system, inputs procurement and delivery system, farmland and communication system especially mass media, influence the level of adoption of agricultural innovations. It was also found that whenever the material components of agricultural innovations like tractor hiring services, fertilizers, working capital or loan from government or co-operatives, water supply, agro-chemicals, improved seeds are available, farmers tend to adopt more innovations. However, where the material components are lacking or inadequate, adoption

of agricultural innovation appears to be impeded.

In terms of the relationship between institutional factors and adoption of agricultural innovations, the review of literature indicated that there was positive and significant relationship between contact with extension service, access to farm credit, farmland, mass media (especially radio) and adoption of agricultural innovations.

## Theoretical Framework

This study is based on the classical diffusion and adoption theory. Diffusion and adoption of innovation is a multi-disciplinary theory of planned social change which is brought about by the spread of new ideas, practices or technologies through a social system. The classical diffusion and adoption theory is made up of four elements, namely (i) the innovation (ii) communication channels (iii) time and (iv) a social system.

Innovation: According to Rogers (1983:11) innovation is define as an idea, practice or object that is perceived as new by an individual or other unit of adoption. Rogers (1983) also identified full main characteristics of innovation which affect their rate of adoption as follows:

1. Relative advantage: This is innovation is perceived as better than the idea or object, it is intended to replace. Relative advantage is usually expressed in terms of economic gains, although subsistence farmer may consider the avoidance of risk as more important. The economic advantage of an extension package involving, say improved seeds, fertilizers and credit may produce an increase in yield.
2. Compatibility: This is the degree to which an innovation is perceived by the

innovation is consistent with his values, his management objectives, hispast experience, the level of technology and the stage of farm development.

3. Complexity: This is the degree to which an innovation is perceived as difficult to understand.

4. Trialability: This is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on installment plan will generally be adopted more quickly than innovations that are not divisible. If a farmer can try out an innovation without committing too much money, he may adopt it more quickly. For example, new seeds, fertilizers and herbicides can be bought in small quantities and tried out on a limited scale.

5. Observability: This is the degree to which results of an innovation are visible to others.

**Communication Channels:** Communication is the process by which participants create and share information with one another in order to reach a mutual understanding. When an innovation is developed, it has to be communicated through period of time among members of a social system. Thus the process involves the transmission of information about our innovation from an originating source to the ultimate or potential users. The communication channels used by farmers are commonly classified as follows:

(a) Mass media channels such as radio, television, publications and commercial; sources.

(b) Interpersonal channels like personal contacts with extension agents, traders, friends and other farmers.

Time: Adoption is not a sudden event, but a process. Farmer do not accept innovations immediately, they need time to think things over before making a decision. Hence, time is an important element in the adoption and diffusion process. Time dimension involved in adoption and diffusion process are:-

(i) In the innovation decision process by which individual passes from first knowledge of an innovation through its adoption or rejection.

(ii) In the innovativeness of an individual or other unit of adoption i.e the relative earliness or lateness with which an innovation is adopted compared with other members of a social system and

(iii) In an innovation is rate of adoption in a system, usually measured as the numbeeer of members of the system that adopt the innovation in a given time period (Rogers 1983).

The innovation decision process: A farmer's decision about whether or not to adopt recommended innovations has been recognised to occur over a period of time in stages rather than instantaneous.

The process was developed essentially by North American Rural Sociologists as consisting of popular stages (Lionberger, 1960).

1. Awareness: whereby an individual becomes aware of the existence of an innovation.
2. Interest stage: the individual develops an interest in the innovation and actively seek more information about it.

3. Evaluation stage: the individual makes a mental evaluation of the innovation relevant to his own personal situation and then decides whether or not to try the innovation.

4. Trial stage: based on the individual's judgement of the worth of the innovation. He actually tries it on a small scale to determine the relevance and usefulness of the innovation for himself a practical evaluation.

5. Adoption stage: based on the individual's mental or practical evaluation, he makes a final decision as to whether to adopt or reject. Adoption is therefore defined as a decision to make full use of a new idea as the best course of action available.

Innovativeness and adopter categories: Innovativeness is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system. Adopter categories are the classification of members of a social on system on the basis of innovativeness. Rogers and shoemaker (1971) identified five adopter categories innovator, early adopter, early majority, late majority and laggards. The rate of adoption is the relative speed with which an innovation is adopted by members of a social system. A farmer may decide to discontinue a practice which he had previously adopted on acquiring more information about the practice.

One of the most important determinant of outcome of the innovation decision process is the adopter's perception of the characteristics of the innovation. Perception here is defined as the way an individual responds to any sense or impression which he detects.

Perception not only varies with individuals, it may also differ widely from what is consistent to be real. Thus a recommended practice thought to be an excellent innovation by the researcher who developed it may not be viewed similarly by the local farmer. Perception then is a function of situation.

Social system: According to Rogers (1983) a social system is defined as a set of inter related units that are engaged in joint problem solving to accomplish a common goal. The members or units of a social system may be individuals, informal groups, complex organisations or subsystems. A social system constitutes a set of boundaries within which innovations diffuse.

In a social system, there are structures and arrangements of units. There could be social effects that cam influence the structure of the system. Norms and values can be barriers to social change in the system. Certain individuals like opinion leaders and extension agents can influence adoption of innovations. The structure of the social system can influence the innovations consequences i.e. changes that occur to individuals or social groups as a result of the adoption of an innovation.

The adoption of agricultural innovations is influenced by a gamut of variables like environmental factors (Okigbo, 1981); socio-economic variables (Rogers, 1983); and socio-psychological variables (Ogionwo, 1978). These variables are inter-related or inter-dependent. The reviewed literature revealed that there are some relationships between the characteristics of adopters like age, formal education, family size, farm size, farm income, level of living and adoption of agricultural innovations (Rogers and Shoemaker 1971; Voh,

1979; Atala, 1980). However, there are still some inconsistencies in some of the findings about the relationships between the adopter characteristics and rate of adoption of agricultural innovations. For example, Basu and Akiwowo (1969); Edache, 1980; Voh, 1982 did not find any relationship between age and adoption of agriultural innovations, but Ogionwo, 1978; Zaria, 1984; Atala, 1980; reported negative relationship between age and level of adoption of agricultural innovation. Awolola (1984) found in Nigeria that there was a positive and significant relationship between education and adoption of agricultural innovations. However, Francis (1974), in his Togo study revealed that formal education was negatively associated with adoption of agricultural innovations.

Previous studies (Rogers, 1983) revealed that the perceived characteristics of an innovation by potential adopters is also very important in determining adoption and non-adoption of such innovations. While some of the characteristics of an innovation may enhance its adoption (e.g. observability - that can be demonstrated) or innovations with greater relative advantage (with more profit) can be easily adopted, other characteristics like complexity (too technical) or in-compatibility (against norms or values) may impede adoption of agricultural innovations.

Access to institutional variables like extension services, farm credit, farmland and mass media enhances the adoption of agricultural innovations. For example, Osuntogun and Oludimu, 1982; Edache, 1980; Banta, 1981; and Williams, 1978; revealed that when farm credit was provided with other farm inputs, adoption was enhanced. D'Silva and Raza (1981) reported also that it was farm credit and other farm inputs with intensive individual

extension services that gave the progressive and large scale farmers advantages over the small scale farmers in the adoption of farm technologies introduced by Funtua Agricultural Development Projects. Other studies like Alao, 1971; Voh, 1979; Obibuaku, 1978; further showed that mass media, especially radio, enhances the adoption of agricultural innovations.

Theoretically, therefore, we may expect that the variables reviewed in this study would affect the adoption behaviour of farmers either positively or negatively. Therefore, the theoretical framework upon which this study was based was that the farmers in the study area are capable of and willing to adopt improved sorghum varieties and related recommended farm practices provided such innovations are profitable, available at the right time and at the price they can pay, necessary information and education is made available (extension service) farm credit and other farm inputs are made available, the innovation is compatible with the existing farming practices and do conform to their norms and values. As Edache (1980:114) revealed, "small scale farmers are not by nature resistant to change per se. If they appear un-responsive to agricultural programmes or improved technologies designed to improve production and raise the standard of living, it is because of the social, economic and physical environment in which they operate." Williams (1978:7) also advanced that Nigerian subsistence farmers "are rational and economic men, who can react to economic stimuli almost as quickly as any highly commercial farmer in the world. Given a favourable setting, they can be responsive to the idea of higher income; they will respond to the introduction of profitable new crops and the adoption of profitable new practices."

Contreras (1980) in his study in Brazil and Guatemala identified a myriad of institutional factors that may affect adoption of agricultural innovations as earlier revealed in the section of the statement of research problem for this study. In Nigeria, Alao (1971) included community structural factors (such as community solidarity, level of institutional development) among the large number of factors he considered affecting adoption of agricultural innovation. Havens (1975) also contended in his study of Colombian peasant coffee farmers that "the reason for the failure of technology to bring about widespread changes in peasant societies is that the important obstacle to rural social change is the social structure - the structure of land tenure, of political participation, of economic segregation (both class differentiation and lack of integration into the national economy), the inequitable distribution of wealth, of services, of legal privileges and rights, and on and on. But these factors have been all frequently overlooked" (Havens, 1975, p.107).

From the work of the three Rural Sociologists briefly mentioned (Contreras, 1980; Alao, 1971; and Havens, 1975); it is clear that many and varied individual and institutional factors may affect the adoption of agricultural innovation and level of agricultural development of an area. Therefore, the model presented for this study focuses on three institutional factors and selected individual attributes that are very important in bringing adoption of agricultural innovation and consequently increased agricultural production in an area. The contention here is that these factors - extension services exposure, farm credit and mass media exposure facilitate the adoption of agricultural innovations and therefore increase agricultural development of an area.

**Agricultural Development:** Rogers and Svenning (1969:8) defined development as "a type of social change in which new ideas are introduced into a social system in order to produce higher per capital income and levels of living through more modern production methods and improved social organisations". In the present study, therefore, 'agricultural development' refers to the deliberate and planned introduction of high yielding improved sorghum varieties and related recommended farm practices into a social system (study area) so as to increase food and general agricultural production in the State.

**Model of Factors Affecting Adoption of Agricultural Innovations**

The literature reviewed has shown that many individual characteristics and institutional factors affect the level of adoption of agricultural innovations and consequently the level of agricultural development of an area. From the review of the literature, it can also be hypothesized that agricultural development is a function of (a) differences in access to institutional factors by farmers and (b) a function of differences in the individual's socio-economic attributes.

The components of the model of factors to explain adoption of agricultural innovations and agricultural development in the area are presented in Figure I. Looking at the components of the model as a whole, the institutional factors and individual attributes represent the antecedent or independent variables, adoption of agricultural innovations represents the intervening variable, while agricultural development is the consequence of the relationships between the variables. Therefore, it is very important for extension workers, researchers and the policy makers to understand the roles of the various

components of this model to boost agricultural development of an area.

An effective and efficient extension system that will use multi-channels to reach the farmers through demonstrations, farm and home visits, field/open days, continuous farmer training and agricultural shows are expected. It is believed by authorities (like Akinbode 1982 Williams 1978) that an effective and efficient extension system will increase adoption of agricultural innovations and lead to increased food production and agricultural development. Adequate farm credit from government, banks and co-operatives is essential. When farm credit is available in form of cash and or kind, farmers will be able to buy farm inputs like fertilizers, agro-chemicals, farmland, tractors and other labour saving devices and also pay for hired labour. This is expected to increase the adoption of agricultural innovation and raise the level of agricultural production in the area. An effective agricultural mass media would include regular agricultural programmes on radio and television; agricultural publications (like leaflets, guides, bulletins, newspapers) and agricultural educational films. Effective use of multi-channels of mass media would lead to increased adoption of agricultural innovation and consequently increased agricultural growth and development in the area.

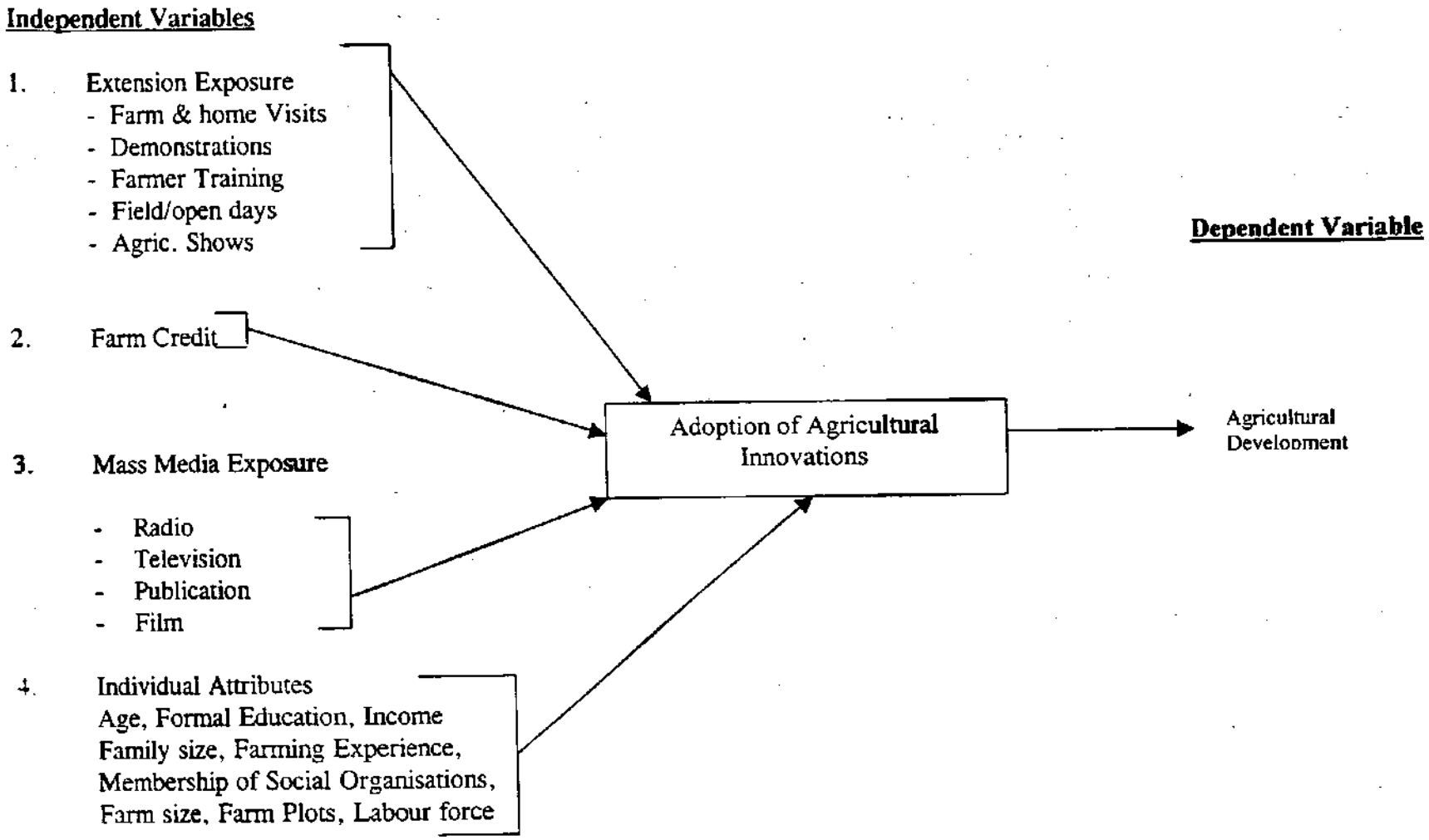
Some of the characteristics of the farmers also affect the level of adoption of new ideas and consequently raise the level of agricultural development. Formal education, for example, enhances adoption of innovations. As more educated farmers adopt new ideas, it will increase agricultural production and development. Increase in farm income stimulates the use of new farming practices. Farmers will have money to buy farm inputs and employ

more labour and this will lead to the development of agriculture. When there is an increase in the size of the family and family labour force on the farm, the family will be able and willing to adopt more of agricultural practices to feed and maintain large family. This will lead to increased food production and raise the level of agricultural development.

An increase in the farm size and/or increase in the number of fields owned by a farmer enhances adoption of new agricultural practices because this is an increase in one of the factors of production. This will therefore promote agricultural development. Farmers that take part in social or community activities have greater opportunities to learn from peer groups about farming. They could get relevant information about agriculture from social and economic organisations like farmers' co-operatives. Such information can stimulate them to adopt new ideas and practices and this will increase agricultural production and development in the area.

Putting together the foregoing discussion, a model is developed for the purpose of this study and presented in Figure I.

**Figure I: Model of Factors Affecting Adoption of Agricultural Innovations**



## Operational Indices

This section deals with the way the variables investigated have been defined and measured.

### Independent Variables

#### Extension Services Exposure

Extension services exposure is the extent to which the respondents were exposed to extension services. It was measured as the frequency of contact of the respondents with extension agents and /or the usage of various extension services. Questions were used to elicit information from respondents. Positive response for each question scored one (1) point while negative response scored zero. The sum of the scores represented a respondent's extension services exposure score. The maximum possible extension services exposure score by a respondent was 13. The items used in the extension services exposure are indicate in Appendix A.

### Farm Credit

Series of questions were asked in the questionnaire schedule to determine the accessibility to farm credit by farmers. Positive response to a question scored one (1) point while negative response scored zero. The sum of all the scores made up a respondent's access to farm credit score. The total maximum possible score for a respondent was seven. The items used in the access to farm credit are indicated in the questionnaire schedule (see Appendix A).

### Mass Media Exposure

A general measure of agricultural mass media exposure was used rather than separate measure of exposure for each of the four media included in this study which were radio, television, printed materials and agricultural films. Series of questions were asked in the interview schedule to elicit information on the exposure to each media. Positive or `yes' response answer scored one (1) point while negative or `no' response answer scored zero. The sum of all the scores made up a respondent's agricultural mass media exposure score. The total maximum possible score for a respondent in the agricultural mass media exposure was 17. The items used in the agricultural mass media exposure are indicated in the questionnaire schedule (see Appendix A).

### Age

Age is an important factor for determining seniority in the traditional setting. Elderly people hold special position of leadership, prestige, respect and reverence in their communities. Therefore, age may play an important role in the decision making process in the adoption of agricultural innovations. Age was measured as the age given by the respondents at the time of this study. The number of years given represented a respondent's score.

### Formal Education

Formal education refers to the education acquired through regular or formal attendance at schools and colleges. This variable was measured as the number of years the respondent spent in schools and colleges. The total number of years in school represented a respondent's score.

**Level of Literacy**

Level of literacy refers to the ability of the respondent to read Hausa, `Ajami' (Arabic Script) and or English Language. It is expected that literate respondents are more exposed to printed sources of agricultural information and as such they are likely to be aware and more responsive to agricultural innovations. This variable was therefore measured by the individual's ability to read any or all the three languages presented. There was a score of one(1) point for each language the respondent reported ability to read.

**Farm Income**

Farm income refers to the money realised from the sale of crops produced and livestock sold within a year. It was assumed that farmers with higher farm income will have money to invest in farming and hence, more responsive to improved farm practices. They would also be able to face more risks. But many of the respondents do not keep farm records. Some were also not willing to give information about their income. The figures were therefore based on their own estimate. This was a serious limitation in measuring this variable. However, this variable was measured as the total value in Naira of the crops and livestock sold in the last season as given by the respondents at the time of this study.

**Length of Farming Experience**

This concept was defined as the number of years the respondent had been working as a full-time farmer and was measured by the actual number of years the respondent reported to have had full responsibility for the management of a farm.

*Family Size*

This variable was defined as the number of wives, children, brothers, other relations and dependants that the respondent feeds and who lived under the same roof or in the same compound with him at the time of this study. The total number of people in the respondent's household was his score.

**Membership of Social Organisations**

This variable was defined as an individual's social contacts. This variable was measured as the number of social organisations a respondent claimed to be a member. A respondent's score was the sum of social organisations he or she was a member. Membership of one social organisation scored one (1) point while non membership scored zero (o). The social organisations mentioned included cultural groups, farmers co-operatives, *political parties, religious organisations, thrift and loan societies and group farming.*

**Farm Labour Force:** This concept was defined as the number of people helping with farm work Including people in the family unit and paid labourers) and this variable was measured by the actual number of people working for the respondent on his or her farm in the year of this study.

**Farm Size:** The size of farm was defined as the size of land holding in hectares and was measured by the actual size in the hectares the respondent cultivated in the year of this study. This was measured as the size of the farm (in hectares) the respondent claimed to have actually farmed during the year.

**Number of Farm plots:** This variable was defined as the number of non-contiguous fields (farm plots) the respondent cultivated during the year of this study. The variable was

measured as the total number of fields the respondent farmed at the time of this study.

**Awareness of Agricultural Innovations**

Awareness implies that the respondent learns or hears of the existence of a new idea or practice in agriculture but may lack detailed knowledge and information about it. Awareness in the present study was measured as the reported knowledge of the existence of any of the eight (8) recommended improved farm practices related to sorghum production that were included in this study. Awareness of one practice scored one point while non awareness was scored zero. Awareness score for each respondent was the sum of the number of farm practices he or she reported being aware of. The maximum awareness score possible was eight (8) for a respondent.

**Dependent Variable**

**Adoption of Agricultural Innovations**

Adoption was defined as the stage a person decides that the new idea, product or practice is good enough for full scale and continued use. The individual farmer accepts the innovation as a normal part of his or her methods of operation on his or her farm. Adoption of agricultural innovations for this study was measured as the sum of farm practices he or she reported using out of the eight (8) farm practices under study. Adoption of one practice scored one (1) point while not adopting it scored zero (o). The adoption score for each respondent was the sum of the practices he reported using at the time of this study. There was a maximum score of eight (8) points for each respondent.

**Hypotheses**

**Study Objectives 1,2 and 3**

There are no hypotheses offered for this descriptive part of the study.

Study Objectives 4 and 5

Based on the review of the literature on the variables selected and the theoretical frame-work for this study, the following general and empirical hypotheses have been selected for examination and for statistical testing.

General Hypothesis One:

That adoption of agricultural innovations is a function of access to institutional factors. In order words, the adoption of improved recommended farm practices is facilitated when small scale farmers have access to institutional factors like extension services, farm credit, farmland and agricultural mass media.

Empirical Hypothesis:

1. There is positive and significant relationship between farmers access to extension services and level of adoption of agricultural innovations.
2. There is positive and significant relationship between access to farm credit and level of adoption of agricultural innovations.
3. There is positive and significant relationship between access to mass media and level of adoption of agricultural innovations.

General Hypothesis Two

That adoption of improved recommended agricultural practices is a function of a variety of personal attributes of small scale farmers like age, formal education, level of literacy, farm income, family size, farming experience, size of labour force, farm size, membership of social organisations and awareness of agricultural innovation.

Empirical Hypotheses

4. There is positive and significant relationship between the number of fields (farm plots)

owned and the level of adoption of agricultural innovations.

5. There is positive and significant relationship between the size of farm holdings and t he level of adoption of agricultural innovations.
6. There is positive and significant relationship between age and level of adoption of agricultural innovations.
7. There is positive and significant relationship between the level of formal education and adoption of agricultural innovations.
8. There is positive and significant relationship between the level of literacy and adoption of agricultural innovations.
9. There is positive and significant relationship between years of farming experience and the level of adoption of agricultural innovations.
10. There is positive and significant relationship between family size and level of adoption of agricultural innovations.
11. There is positive and significant relationship between the size of farm labour force and the level of adoption of agricultural innovations.
12. There is positive and significant relationship between farm income and level of adoption of agricultural innovations.
13. There is positive and significant relationship between the level of membership of social organisations and level of adoption of agricultural innovations.
14. There is positive and significant relationship between awareness and level of adoption of agricultural innovations.

# CHAPTER THREE

## METHODS AND PROCEDURES

### The Setting

This study was carried out in Soba and Zaria Local Government areas of kaduna State, Nigeria, between 7th August, and 31st October, 1990. Kaduna State is located between Latitude $9^0$N and $12^0$N of the equator and Longitude $6^0$E and $9^0$E of the Prime Meridian. It has an area about 35, 213 square kilometres with a population of over 4 millions (Nigerian Year Book, 1994).

The two local government areas of this study consist mostly of upland laterite soils (Gona Daji) with few swamp or lowland soils (Fadama) in some areas. The area has about 5 to 6 months of rainy seasons from May to October.

The two local government areas were purposely selected for this study because:

1. Kaduna State Agricultural Development Project (ADP) Maigana zone is located within the area. Maigana zone is responsible for agricultural development and extension services in (1) Soba (2) Zaria (3) Ikara (4) Igabi (5) Kaduna (6) Giwa (7) Sabongari and (8) Birni Gwari Local Government areas of the State. In terms of physical environment, crops and livestock production, Soba and Zaria Local Government areas are representatives of the Maigana zone.
2. The Institute for Agricultural Research (I.A.R), of Ahmadu Bello University, Zaria, is located in this zone. The I.A.R. has the Federal Government mandate to cover

North Western Nigeria (comprising Kaduna, Kano, Bauchi, Katsina, Sokoto, Kebbi and Jigawa States) in terms of research and extension services to the farmers. More importantly, the I.A.R. and other Research Institutes have developed new improved varieties of sorghum and other crops like maize, cotton, millet, rice and cowpea. Over the years, attempts have been made to encourage farmers in these areas to adopt improved agricultural innovations through the ADP extension services. It is assumed and expected that the impact of the existence of I.A.R. and A.D.P. would be felt in these areas.

**Selection of the Villages and Respondents.**

There was no comprehensive list of all the villages in each local government area. A list of the villages in each local government area was therefore compiled by the investigator through the use of survey maps of the area. The method of drawing sample in a lottery was used to select the villages: The name of each village was written out on a piece of paper and folded. All were put in a container. The container was shaken thoroughly each time before the name of the village was picked up. This process was done for each local government area for the study and a total of eighteen (18) villages were selected in the two local government areas.

**Selection of Respondents**

Within each of the villages selected, lists of the farmers compiled by extension agents were used. Where there were no such lists in the villages, the investigator compiled the lists of farmers. A simple random sample like the one described for the selection of the villages was used for the selection of 20 farmers (respondents) from each of the 18 villages. This

was planned to make a total of 360 respondents for the study. During the actual interview, the number of respondents interviewed varied from 11 at Maigana to 20 each in nine (9) of the other villages. After repeated visits to some of the villages, a total of 320 respondents were finally interviewed. Seven (7) of these were rejected because of incomplete vital information. Hence, 313 respondents were used for the empirical analysis of this study. The respondents were farmers who farm on their own with farming as their main occupation. Their ages ranged between 18 and 75 years.

**Methods of Data Collection**

Personal contacts were made with the Kaduna State Agricultural Development Project (KADP), Local Government Officials, District and Village heads to obtain permission to conduct this research, to maintain rapport with the authorities and to get relevant information for this study. The primary data used for this study were collected through the use of interview schedule consisting of structured questions (Appendix A).

**Administration of Interview Schedule**

The investigator assisted by three enumerators with qualifications of National Diploma in Agricultural Technology (ND) administered the interview schedule. The enumerators have good knowledge of oral and written Hausa and English Language to be able to translate the interview schedule effectively into Hausa Language. The enumerators were trained for the job. Visits were made to the villages before the actual administration of the questionnaire and all aspects of the interview schedule were discussed during the training sessions.

The interviews were conducted at dates and times mutually agreed upon by the respondents and enumerators in each village. Some interviews were conducted in the

evening because the respondents were very busy on their farms in the mornings and afternoons. The enumerators worked together in each of the villages daily. The investigator supervised the conduct of the interviews in all the 18 villages.

### Statistical Techniques

The data collected from the fieldwork was subjected to statistical analysis. Percentages in tabular form were used as appropriate. To establish the assumed relationship between the independent variables and adoption of agricultural innovations, the Pearson Correlation Co-efficient statistical analysis was used to provide a means of determining the existence, direction and strength of the relationships between selected independent variables and adoption of agricultural innovations. The multiple regression analysis was used to determine the best combination of variables predictive of adoption behaviour of farmers.

## CHAPTER FOUR

## FINDINGS AND DISCUSSIONS

**Study Objective One:** Basic Characteristics of the Respondents.

The basic characteristics of the respondents that were examined in this study included age, formal education, level of literacy, farm income, farming experience, family size, farm labour force, and membership of social organisations (Table 4.1).

**Age:** The age distribution varied from 20 years to 75 years while the mean age was 38 years. The details of the grouping of the ages, the frequencies and the percentages in each group were presented in Table 4.1A. The table indicated that 85% of the respondents were between twenty and 50 years (young and middle aged farmers). These were farmers that were still in their active and productive age groups. They may therefore be expected to be active farmers with interest, ability and willingness to try new ideas in farming. About 15% of the respondents were old farmers that were 51 years old and above.

**Formal Education:** Table 4.1B presented the pattern of formal education showing that 70% of the respondents did not have formal education, 17% of the respondents spent between 1 and 6 years in school while 13% of the respondents had some years in secondary school (between 7 and 13 years in school). The Table also showed that 15% of the respondents could read in English Language, 49% claimed that they could read in Hausa language while 74% of the respondents claimed that they could read Arabic script "Ajami".

This result showed that the level of literacy was low in English language and moderate in Hausa language. However, many of the respondents were able to read Arabic scripts.

Farm Income: Table 4.1D showed that 22% of the respondents had farm income below 6,000.00 a year while only 14% (45 respondents) had farm income greater than 10,000.00 a year. Most of the respondents did not keep adequate farm records and the figures used were based on their own estimates. Most of the respondents (86%) were in the low income group (less than ₦10,000 a year).

**Length of Farming Experience**

This study (Table 4.1E) showed that 13% of the respondents had less than 5 years of farming experience while 87% of the respondents had 5 years and above. This study showed that the majority of the respondents had considerable years of farming experience and would have had opportunity to be aware of and adopt agricultural innovations. The study indicated that the years of farming experience varied between 1 and 61 years with a mean of 18 years.

Family Size: The family size ranged from one person to 30 people, while the mean family size was 14 people. Table 4.1F showed that 57% of the respondents had between 6 and 15 members in their family while 26% had 16 members and above in the family. Table 4.1F showed that 75% of the respondents did the farm work with the members of their families while 25% of the respondents combined hired labour with family labour in their farming operations. The Table also indicated that only 16% of the respondents used tractors in their farm operations while only 7% of the respondents used ox-plough in their farm operations.

## TABLE 4.1: Distribution of Respondents According to Their Basic Characteristics

| | | |
|---|---|---|
| **A Age Group** | Frequency (N313) | Percentage |
| 20 - 30 years | 99 | 31 |
| 31 - 50 years | 178 | 54 |
| 51 years and above | 45 | 15 |
| **B Formal Education** | **Frequency N=313** | **Percentage** |
| *No formal Education* | 219 | 70 |
| 1 - 6 years in school | 53 | 17 |
| 7 years and above in school | 41 | 13 |
| **C. Level of Literacy** | **Frequency (N=313)** | **Percentage** |
| Can read Hausa | 153 | 49 |
| Can read Ajami | 231 | 74 |
| Can read English Language. | 46 | 15 |
| **D. Farm Income** | **Frequency (N=313)** | **Percentage** |
| < 5,000.00 | 12 | 4 |
| 5,000.00- 6,000.00 | 55 | 18 |
| 6,001.00- 7,000.00 | 20 | 6 |
| 7,001.00- 8,000.00 | 106 | 3334 |
| 8,001.00- 9,000.00 | 50 | 16 |
| 9,001.00-10,000.00 | 25 | 8.00 |
| 10,000.00 | 25 | 14.00 |
| | 45 | |
| **E. Years of Farming Experience** | **Frequency (N=313)** | **Percentage** |
| Less than 5 years | 42 | 13 |
| 5 - 10 years | 73 | 23 |
| 11 - 25 years | 129 | 41 |
| 26 years and above | 69 | 23 |
| **F. Family Size** | **Frequency(N=313)** | **Percentage** |
| 1 B 5 | 52 | 17 |
| 16 B 15 | 181 | 57 |
| 16 and above | 80 | 26 |
| **G. Sources of Farm Labour** | **Frequency(N =313)** | **Percentage** |
| Self and Family labour | 227 | 75 |
| Hired & Family labour | 75 | 25 |
| **H. Types of Technologies Used For Farming** | **Frequency(N =313)** | **Percentage** |
| i. Tractor For Farming | 4 | 1.00 |
| Tractor used and owned | 45 | 15.00 |
| *Tractor used and hired* | 264 | 84 |
| Don't use Tractor | | 3 |
| ii. Ox-Plough For Farming | 8 | 4 |
| Ox-plough used & owned | 13 | 93 |
| *Ox-plough used & hired* | 292 | |
| Don't use Ox-plough | | |

TABLE 4.1 Continued.

| I. Membership of Social Organisation | Frequency(N =313) | Percentage |
|---|---|---|
| Cultural Group: Member | 26 | 8 |
| Non-Member | 287 | 92 |
| Co-operative: Member | 57 | 18 |
| Non-Member | 256 | 82 |
| Political Organisation: | | |
| Member | 97 | 31 |
| Non-Member | 216 | 69 |
| Religious Organisation: | | |
| Member | 211 | 67 |
| Non-Member | 102 | 33 |
| Thrift and Loan Member | 59 | 19 |
| Non-Member | 254 | 81 |
| Group Farming: Member | 41 | 13 |
| Non-Member | 272 | 87 |

| **J. Farmland** | **Frequency(N=313)** | **Percentage** |
|---|---|---|
| (i) Land Acquisition Methods | | |
| Inheritance | 286 | 86 |
| Purchase | 159 | 51 |
| Gift | 24 | 8 |
| Pledge | 38 | 12 |
| Lease | 36 | 11 |
| Others (e.g. Loan) | 74 | 24 |
| (ii) No. of Fields | **Frequency (N=313)** | |
| 1-5 fields | 201 | 64 |
| 6-10 fields | 99 | 32 |
| 11 and above | 13 | 4 |
| (iii) Size of Farmland | 5 | 2 |
| Less than 1 hectare | 129 | 41 |
| 1 - 5 hectares | 85 | 27 |
| 6 - 10 hectares | 24 | 10 |
| 11 - 15 hectares | 27 | 9 |
| 16 - 20 hectares | 33 | 11 |
| 21 hectares and above | | |

## Membership of Social Organisations

A summary of social organisations mentioned was presented in Table 4.1.I The study indicated that the level of membership in social organisation was low. The number of

respondents that belonged to social organisations where farmers could have economic benefits were few. For example, only 18% of the respondents belonged to farmers co-operatives, 13% of the respondents belonged to group farming while 19% of the respondents belonged to thrift and loan social organisations. However, some of the respondents belonged to two or more social organisations.

Farm Land

Access to farmland is an important factor that may influence adoption of agricultural innovations. In the present study, attempt was made to identify the methods of land acquisition, number of farm plots and the size of farm holdings actually cultivated at the time of this study. This study revealed that the most common methods of land acquisition were through inheritance, direct purchase, gift, pledge and lease (Table 4.1J). Table 4.1J showed that 86% of the respondents got their farmland through inheritance, about 51% purchased their land, about 8% of the respondents got land through gift, about 12% of the respondents got land through pledge, 11% got land through lease while 24% of the respondents got land through loans. Some of the respondents mentioned two or more methods of land acquisition.

Table 4.1J showed that about 64% of the respondents had between one and five farm plots, 32% of the respondents had between 6 and 10 non - contiguous fields and the rest (4%) had 11 and above fields. Average number of plots owned was 5.0. This result indicated that the farmers would be spending a lot of time, money and effort to move from one field to the other. When fields (farm plots) are small, fragmented and non-contiguous, the use of modern technologies like tractors may not be easy.

The size of the farmland available to a farmer is very important in his or her farm related decision making process. But in the study area, most of the respondents did not keep records of the size of their fragmented farm holdings. Consequently, they gave the estimates of their farmland in hectares. Table 4.11 showed that about 70% of the respondents had between under one hectare and ten hectares of farmland, while the average size of holdings was 8.8 hectares. The respondents were asked to indicate whether they had enough land for farming or not. About 66% of the respondents claimed that they had enough land for farming while the rest (34%) respondents said that they did not have sufficient land for farming and they hoped to buy more land in future.

**Study Objective Two:** The level of awareness and adoption (usage) of improved sorghum varieties and related recommended farm practices.

Eight agricultural innovations related to successful production of sorghum examined in this study included :

(1) Improved sorghum varieties, (4) Correct spacing

(2) Seed dressing chemicals (5) Thinning

(3) Seed rate (6) Fertilizer application rate

(7) Use of herbicides (8) Use of storage chemicals.

The respondents were asked to indicate which of the innovations they were aware of and/or were using on their farms at the time of this study. Each agricultural innovation will be discussed separately. The distribution of respondents according to their level of awareness knowledge, adoption and non-adoption of agricultural innovations selected for this

study is presented in Table 4.2.

**1. Awareness and Adoption of Improved Sorghum Varieties**

The Institute for Agricultural Research (I.A.R.)of A.B.U., Zaria and other Research Institutes in Nigeria have developed, tested and released improved sorghum varieties to farmers in its seven mandate States through the Agricultural Development Projects (A.D.Ps) and similar organisations. The innovations were selected for study because of their high yield potentials and resistant to striga and major leaf diseases. Moreover, the innovations have been released into the area over a decade ago and recommended farm agronomic practices for their successful production have also been taught to farmers by extension agents in the area. The practices include:

(a) Samsorg - 13: The seed colour of this variety of sorghum is white and it is classified as medium maturing. It matures between 140 and 150 days. The potential yield is between 1800 and 3000 kg per hectare. The plant height varies between 140cm and 150cm and it is the shortest semi-dwarf of medium season varieties. It is resistant to major leaf diseases like Downy mildew and streak. It was released in 1982.

(b) Samsorg -14: The seed colour of this variety is also white and it is classified as medium maturing because it matures between 140 and 150 days. The potential yield is between 1500 and 3000kg per hectare. The plant height is between 150 and 160cm. It is tall and resistant to striga and major leaf diseases. This variety is regarded as having good seed quality, good palatability and the highest yielder at the time of release in 1982.

Samsorg - 17: This variety has medium sized yellow seed and it is classified as late

maturing because it matures between 160 and 180 days. It had potential of producing yield of between 1800 and 3000kg per hectare. It is semi-dwarf with height between 140 and 150cm. It is tolerant to striga and resistant to major leaf diseases like streak. The outstanding characteristics are high yielding and good for brewing. It was released in 1982.

(d) Samsorg - 20: This variety has large yellow seeds and it is classified as late maturing. It matures between 160 and 180 days. This variety has potential yield of 1800 to 3000kg per hectare. The plant height is between 140 and 150cm and it is regarded as semi-dwarf. It is tolerant to striga and resistant to major leaf diseases like Guinea corn smut. Its outstanding characteristics are high yield potential and tolerant to striga.

(e) Samsorg - 21: This variety has large white seed and is late maturing. It matures between 160 and 180 days. It is semi - dwarf with the height of about 140 and 150cm. The potential yield is between 1800 and 3000kg per hectare. Its outstanding characteristics include high yield potential and tolerant to striga. It was released in 1978, Institute for Agricultural Research, Samaru, (1989), pp. 13 - 17.

All the varieties described above were specifically adapted to the Northern Guinea Savanna ecological Zone. The farmers' own local sorghum varieties e.g. Farafara are generally noted for low yield and not resistant to striga and major leaf diseases like streak and downy mildew. Moreover, the farmers' own sorghum varieties take longer period to mature. Some mature after 5 to 6 months. Consequently local sorghum varieties are not ideal in ecological zones with short rainy season like the situation being experienced in recent years in Kaduna State.

Table 4.2, showed that the level of awareness of the innovations was 94% while the

level of adoption was 53%. The study indicated that 47% of the respondents were non - users of the practice in the area of this study.

2. **Awareness and Adoption of Seed Dressing Chemicals**

In order to ensure good germination, seeds of sorghum, especially seeds of improved varieties are expected to be dressed with Apron plus or Fernasan D or Aldrex T before planting. The recommendation is a sachet of any of the three seed dressing chemicals to about 31/2 kg sorghum seed or two sachets to one hectare of land. The respondents were asked to indicate if they were aware of the practice. If yes, did they dress their sorghum seeds before planting? The respondents were also asked to give reasons why they dressed or did not dress their seeds of sorghum before planting. This study showed in Table 4.2 that 94% of the respondents were aware of the innovations while about 75% of the respondents dressed their sorghum seeds before planting.

3. **Awareness and Adoption of Seed Rate:**

The recommended seed rate for improved sorghum varieties is 5 - 7kg seeds per hectare of land or 3 - 5 seeds per 2.5cm deep hole. The improved sorghum seedlings should be thinned to two plants per stand about two weeks after germination.

This study indicated that 41% of the respondents were aware of the recommended practices for the innovations while 24% of the respondents adopted the recommendations. (Table 4.2).

Table 4.2

**Distribution of Respondents According to their Awareness**

**Knowledge, Adoption and Non - adoption of Agricultural Innovations.**

| | Awareness | N = 313 | Adoption | N = 313 | Non-Adoption | N=313 |
|---|---|---|---|---|---|---|
| Agricultural Innovations | No. of Resp. | % | No of Resp. | % | No of Resp. | % |
| 1. Improved Seeds of Sorghum | 295 | 94.50 | 165 | 52.72 | 148 | 47.00 |
| 2. Seed Dressing | 293 | 93.61 | 234 | 74.76 | 79 | 25.00 |
| 3. Correct Spacing | 276 | 88.18 | 98 | 31.00 | 215 | 69.00 |
| 4.Seed Rate | 128 | 40.49 | 74 | 23.64 | 239 | 76.00 |
| 5. Thinning | 190 | 60.70 | 144 | 46.01 | 169 | 54.00 |
| 6. Fetilizer Application | 310 | 99.04 | 301 | 96.17 | 12 | 5.00 |
| 7. Use of Herbicides | 60 | 19.17 | 16 | 5.11 | 297 | 95 |
| 8. Use of Storage Chemicals | 288 | 92.01 | 224 | 71.50 | 89 | 28 |

4. **Awareness and Adoption of Recommended Spacing.**

The recommended spacing for improved sorghum varieties was 25 to 30cm apart on ridges that were one metre apart. This recommendation is for sole cropping. But the farmers traditional practice is mostly mixed cropping in the area. Consequently, farmers' own spacing is a function of the number and type of other crops he or she may like to plant on a particular farm land and the cultural requirements of such crops. As the number of other crops on the same farmland increased, the spacing of sorghum changed to give room

for the other crops to grow. As indicated in Table 4.2, this study showed that about 88% of the respondents were aware of the recommendation while only 31% of the respondents adopted the recommendation. This indicated that 69% of the respondents did not adopt recommended spacing. Further investigation revealed that most of the adopters planted sorghum as sole cropping on part of their farms.

Where the practice was adopted for sorghum, some farmers still planted one or two other crops, especially millet with sorghum. There was no generally accepted spacing recommendations from research when crops are planted in mixtures. This is still a problem because many crops with different characteristics were involved. Accordingly, farmers in the area used their practical knowledge and experience of the environment especially soils, climate and crops to determine the combination of crops on their farms.

5. **Awareness and Adoption of Thinning**

The recommendation is that as early as possible, about two weeks after germination, the seedlings of sorghum should be thinned to two plants per stand. The best yield as indicated by earlier studies on sorghum population ranging between 22,000 to 47,000 plants per hectare Extension Bulletin, No.1, 1985:11). The present study indicated that 61% of the respondents were aware of the recommended practice while about 46% of the respondents claimed to have adopted the practice of thinning. This study showed that 54% of the respondents were still following the old traditional system of planting more than five seed per stand without making effort to thin the seedlings to two plants per stand.

Generally, in this part of the country, there is scarcity of farm labour during the

planting season. Many of the farmers could not pay for the high cost of labour at the planting season, especially June to September when demand for labour and cost of labour were very high. This study indicated that the level of adoption of thinning practice was relatively low in the area (46%) as shown in Table 4.2.

## 6. Awareness and Adoption of Fertilizer Application Rate.

In the past strategy for maintaining soil fertility was bush fallowing in which farmlands were rotated rather than crops. It usually involved short period of land occupancy and long period of fallow for the restoration of soil fertility. In this way soil fertility is maintained in a natural way. However, fallow system faced problems as the population density increased. Fallow system was only possible when there was an abundant supply of land relative to population. When there is an increase in food requirements for the growing population, the period of fallow is greatly reduced, there-by reducing soil fertility and less food for the growing population. Moreover, in this part of Nigeria, most of the farm lands are essentially made up of upland soils that are lateritic in composition. As a result of this, arable crops like sorghum cannot do very well without the use of fertilizers.

The recommended rate of fertilizer is (a) superphsphate (SUPA) at 150kg per hectare or (b) Calcium Amonium Nitrate (CAN) at 250kg per hectare of land.

The application method may be ring application or broadcasting method. The broadcasting method may cost less in terms of labour requirement but may waste fertilizer and it also encouraged the growth of unwanted weeds. The ring application method is more

effective and economical than broadcasting method. The first dose of fertilizer should be applied by broadcasting it into old furrows before making new ridges or applied by placement in hole about 7cm away from the seedlings two weeks after germination preferably immediately after good rain. The second dose of fertilizer should be applied in the same way about 6 weeks after the first dose. The application should be by placing small amount that can be held by two fingers and a thumb into 2.5cm deep hole about 7cm away from the plant.

This study showed in Table 4.2 that about 99% of the respondents claimed that they were aware of the recommended rate of fertilizer application while 96% of the respondents said that they used the recommended rate of fertilizer at the time of this study. About 4% of the respondents did not use fertilizer or did not use the recommended rate. Some of this group of respondents used manure on their farms.

7. <u>Awareness and Adoption of Herbicides</u>

Most farmers in the study area control weeds on their farms using the traditional weeding techniques like the use of hand hoes and cutlasses using family labour.

The problem of weed control has been identified as a major factor limiting the size of holdings and consequently the total agricultural output in Nigeria. Norman (1973) reported that farm size depended on the farmer's ability to control weeds. Lagoke et al (1981) also reported that 75% of potential maize and 64% of sorghum were lost to weeds in the Northern Guinea Savanna Zone of Nigeria (Ogungbile 1984:40). There is also the problem of scarcity and high cost of hired labour especially when there is need to expand production

beyond the subsistence level. Hand weeding became more expensive and the hired labour insufficient during the planting season, especially May to October. This problem is discussed here so as to highlight the importance of the use of labour saving devices like the use of chemicals to reduce demand for farm labour in agricultural production.

Chemical weed control is the use of chemicals to kill the weeds. Such chemicals called herbicides are poisonous to weeds but harmless to the crops if properly applied. They tend to be specific, each destroys a particular type of weeds. This is why they do not destroy the plants when used according to recommendations. Herbicide is labour saving. Herbicide is ideal on small holdings with rough surfaces that cannot be worked by heavy tractors and equipment without major stumping and resurfacing. Herbicide is job specific and meets the specific needs of weed control. It is therefore not likely to create the problem of unemployment as other labour saving, capital intensive techniques (Ogungbile 1984).

In the present study, the recommendation is that the farmers should use any of the following herbicides to control weeds on their sorghum farms: Gardosprum A, Sorgaprum or Gesdosprum at the rate of four litres per hectare of land. This study showed (Table 4.2) that 19% of the respondents claimed to be aware of the use of herbicides while 5% of the respondents adopted herbicides on their farms. The few adopters were found to be literate and elite farmers in the area. This indicated that 95% of the respondents are not using the innovation. The study showed that the level of awareness and adoption of the practices were very low in the area. This was so because the innovation requires special technical knowledge to use. They are complex innovations to use at the peasant farmer level.

Moreover, they are very expensive. For instance a gallon of four litres costs about 3,000.00. Many variables need to be considered before using it successfully: land must be well prepared, the right chemicals and the right quantity must be used as recommended.

8. **Awareness and Adoption of Storage Chemicals**

Farmers in the area hardly stored their sorghum grains for a long period. But when they did, they stored their sorghum grains in traditional storage structures like ports, grass mat (Zana); bushiya storage and `Rumbu'. Generally most grains cannot be stored for a long period under the hot and humid tropical conditions using any of the four traditional methods of storage mentioned above. They are not effective. Therefore, modern storage methods have been designed and tested by researchers and introduced to farmers in the area by extension workers.

The recommendation is that phostoxine tablets should be used to store sorghum grains to be kept for six months or longer period. One phostoxine tablet was to be used to store about one bag of sorghum grains of 50kg. The most common facilities that were recommended at the small scale farmers level were steel drums with metal lids for storage. The drums must be full and air tight. Bags may be used. In this case, grains must be in the polyethene bag and preferably put the polyethene bag inside a bigger sack. It must be air tight also. Silos as storage facilities were also recommended for large scale farmers, government and non-government organisations that can bear the cost of silos.

This study (Table 4.2) indicated that 92% of the respondents were aware of the use of the innovation while 72% of the respondents claimed that they used the recommended practices. This study showed that the level of awareness and adoption of the innovation was

high in the area. Many of the respondents claimed to know the importance of proper storage with chemicals using appropriate storage facilities. However, there is still room for improvement because some of the respondents still lacked the knowledge of storing grains with chemicals.

This section examined the level of awareness and adoption of improved sorghum varieties and related recommended farm practices. The study found that the level of awareness of some innovations such as improved seeds of sorghum, seed dressing chemicals, correct spacing, fertilizer application rate, thinning and the use of storage chemicals was high, but the level of awareness of herbicides was low in the area. The level of adoption of improved sorghum varieties was moderate (53%) while the level of adoption of fertilizer application rate (96%), seed dressing chemicals (75%) and the use of storage chemicals (72%) was high. However, the study showed that the level of adoption of seed rate (24%), correct spacing (31%), thinning (46%) and the use of herbicides, (5%) was low in the study area.

**Sources of Agricultural Information mostly used by the Respondents in the Area.**

To understand the major sources of agricultural information used by the respondents and to understand the importance of the various sources to the farmers in the area, the respondents were presented with a list of 14 different possible sources of agricultural information. The respondents were asked to rate the various sources with the rating scale ranging from zero to three. A summary of the findings is presented in Table 4.3. The study showed that radio came first with 75% of the respondents rating it as very important, extension agent rated second with 68% while friends and other farmers rated third with 62%

rating them as very important. Newspapers, leaflets and magazines came 4th with 61%, result demonstration came 5th with 47% of the respondents rating it as very important while agricultural shows came 6th with 46% of the respondents rating it as very important.

**Study Objective Three:** Factors that affect farmers adoption (usage), of improved sorghum varieties and related recommended farm practices.

**Improved Sorghum Varieties:**

Table 4.4 presents the major reasons given by the respondents for using a particular practice. The adopters were asked to give the reasons that motivated them to use the practices. Various reasons were advanced by the respondents for using the innovation. Some of the respondents gave more than one reason. For instance, 76% of the adopters used the practice to obtain increased crop yield, 38% of the adopters said that the innovation gave better quality grains. Also 88% of the adopters used innovation to obtain increased income, 32% of the adopters said that they used the practices because technical advice was available from the extension agents, 80% of adopters said that they adopted because the seeds of were made available in the area. In the same way 46% of the adopters said that the practices were not risky but simple to adopt, while 52% of the adopters claimed that the innovations were compatible with their existing farming practices.

Table 4.3

**Distribution of Respondents According to their Rating of Various Sources of Agricultural Information.**

| Sources | Rating | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 3 Very Important | | 2 Important | | 1 Not Important | | 0 No Opinion | |
| | No.of Resp. | % | No of Resp. | % | No. of Resp. | % | No.of Resp. | % |
| 1.Friends and other farmers | 194 | 62 | 103 | 32.9 | 14 | 4.5 | 2 | 0.6 |
| 2.Radio | 234 | 74.8 | 70 | 22.4 | 3 | 1.0 | 6 | 1.9 |
| 3.Extension Agent | 214 | 68.4 | 65 | 22.8 | 16 | 5.1 | 18 | 5.8 |
| 4.Commercial Sellers | 59 | 18.8 | 172 | 55 | 64 | 20.4 | 18 | 5.8 |
| 5. Agric. Samaru | 135 | 43.1 | 137 | 43.8 | 19 | 6.1 | 22 | 7.0 |
| 6. Agric. Publication | 47 | 15.0 | 121 | 38.7 | 45 | 14.4 | 100 | 31.9 |
| 7. Television | 52 | 16.6 | 110 | 35.1 | 72 | 23.0 | 79 | 25.2 |
| 8 Agricultural Shows | 146 | 46.6 | 128 | 40.9 | 25 | 8.0 | 14 | 4.5 |
| 9.Result Demonstration | 146 | 46.6 | 128 | 40.9 | 27 | 8.6 | 12 | 3.8 |
| 10.Co-operative Societies | 81 | 25.9 | 144 | 46.0 | 57 | 18.2 | 31 | 9.9 |
| 11. Farm Service Centres | 77 | 24.6 | 117 | 37.4 | 69 | 22.0 | 50 | 16.0 |
| 12. Farmers' Supply Company | 54 | 17.3 | 107 | 34.2 | 108 | 34.5 | 44 | 14.1 |
| 13. Village Head | 69 | 22.0 | 119 | 38.0 | 49 | 15.7 | 76 | 24.3 |
| 14. News papers and Magazine | 188 | 60.1 | 79 | 25.2 | 31 | 9.9 | 15 | 4.8 |

Table 4.5 presents the major reasons given by the respondents for not using a particular practice. Table 4.2 earlier indicated that 47% of the respondents were not using the practices. Various reasons were given by the respondents (non-adopters) for not using this innovation . Some of the non-adopters gave multiple reasons for not using the practice. In this study (Table 4.5), 85% of non-adopters of the practice said that they had no access to improved sorghum varieties, 59% of non-adopters claimed that they lacked technical advice from extension agents while 39% of non-adopters said that they did not have money to buy the improved sorghum varieties. About 35% of the non-adopters of the innovation preferred local sorghum varieties. Also 24% of the non-adopters lacked interest or no conviction. The non-adopters preferred local sorghum varieties which they claimed gave them longer stalks which they used for fencing, roofing and as fuel wood while 7% of non-adopters said that they did not like yellow colour varieties which they claimed do not store well.

This study implied that 47% of the respondents were still using low yielding local varieties of sorghum in the area. This study also showed that though, I.A.R., has developed, released and recommended different improved varieties of sorghum, some of the respondents still claimed that the innovations were not readily available to small scale farmers in the area. This study identified that there are white and yellow improved sorghum grains Samsorg - 14, Samsorg - 21 and Samsorg 17 and Samsorg - 20 respectively. Therefore, the consumers have choice with respect to the colour of the sorghum grains they wanted to use for food.

Also storage of yellow sorghum grains could not be a problem if a proper modern storage technique is used as discussed under "storage with chemicals."

**Seed Dressing Chemicals**

Table 4.4 showed that the respondents gave different reasons for using seed dressing chemicals. This study showed that 94% adopted it to reduce seed destruction and wastage, while 57% of adopters dressed their seed before planting to get better germination. Also 25% of adopters dressed their seeds before planting because the innovation was compatible with their farming practices while 55% claimed that the practice was easy to use. All the adopters claimed that they used the recommended dosage and achieved good results in the form of good germination and increased sorghum production.

Table 4.5 of this study further indicated that 25% of all the respondents were not using the practice. Various reasons were advanced by them for not dressing their seeds before planting. Table 4.5 showed that some of the non-adopters provided multiple reasons for not dressing their sorghum seeds before planting. About 89% of non-adopters said that they did not have the knowledge and no technical advice from extension agents while 66% of non-adopters lacked conviction i.e. they were not convinced about the effectiveness of the practice. Also 38% of non-adopters claimed that they did not have money to buy the innovations while 28% of non-adopters said that the innovations were not available in their area.

**Table 4.4: Major Reasons Given for Using Practices Related to Improved Sorghum Varieties**

| | Practices | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Major Reasons Given for Using Particular Practice | Seed Variety N* = 165 | Seed Dressing Chemical N* = 234 | Correct Spacing N* =98 | Seed Rate N* =74 | Thinning N*=144 | Fertilizers Application Rate N*=301 | Use of herbicide N*=16 | Use of Storage Chemicals N*=224 |
| | | % of Users reporting a given reason | % of Users reporting a given reason | % of Users reporting a given reason | % of Users reporting a given reason | % of Users reporting a given reason | % of Users reporting a given reason | % of Users reporting a given reason | % of Users reporting a given reason |
| 1. | To give hiher yield and better growth | 76% | xxx | 90% | 47% | 75% | 100% | 38% | xxx |
| 2. | To obtain Increase in Income | 88% | xxx | 33% | xxx | 25% | 95% | xxx | xxx |
| 3. | Technical Advice/Extension Service available | 32% | xxx | 26% | xxx | 19% | 25% | xxx | xxx |
| 4. | Compatible with the existing practices | 52% | 25% | xxx | xxx | xxx | 13% | xxx | xxx |
| 5. | To reduce Seed destruction and wastage | xxx | 94% | xxx | xxx | xxx | xxx | xxx | xxx |
| 6. | Easy to use and to give better germination | xxx | 57% | xxx | xxx | xxx | xxx | xxx | xxx |
| 7. | It saves seeds | xxx | xxx | xxx | 97% | xxx | xxx | xxx | xxx |
| 8. | To reduce manual labour on farm | xxx | xxx | xxx | xxx | xxx | xxx | 100% | xxx |
| 9. | *To reduce post-harvest loss of stored grain* | xxx | xxx | xxx | xxx | xxx | xxx | xxx | 92% |
| 10. | Better than traditional practice | xxx | xxx | xxx | xxx | xxx | xxx | xxx | xxx |
| 11. | Seeds and other inputs available | xxx | xxx | xxx | xxx | xxx | xxx | xxx | xxx |
| 12. | Easy to adopt/Not risky | 80% | 55% | xxx | xxx | xxx | xxx | xxx | xxx |
| 13. | Labour available | 46% | xxx | xxx | xxx | xxx | xxx | xxx | xxxx |
| 14. | To control weeds | xxx | xxx | xxx | xxx | 14% | xxx | 75% | xxx |
| 15. | To prevent disease in the store | xxx | xxx | xxx | xxx | xxx | xxx | xxx | 89% |
| 16. | To enhance the quality of stored grains | xxx | xxx | xxx | xxx | xxx | xxx | xxx | 25% |
| 17. | To give better quality grains | 38% | xxx | xxx | xxx | xxx | xxx | xxx | xxx |

N* = Number of the respondents who reported using practice xxx = Not applicable

Non-adoption reduced the rate of seed germination and consequently yield. Seed dressing chemicals was one of the innovations that was popular in the study area. Even when farmers planted local varieties of sorghum, they adopted the practice. The present study is in accord with that of Arokoyo (1981) and Voh (1984) who also reported that many small scale farmers were using the practice before planting.

Seed Rate:

The seed rate adopters were asked to give reasons for adopting the practice. Two major reasons were advanced for using the recommendations. Table 4.4 showed that 97% of the adopters said that they adopted the recommendation to save seeds while 47% claimed that recommendation ensured better growth of plants.

Table 4.2 showed that 76% of the respondents did not adopt the recommendation. Non-adopters were asked to give reasons for not adopting recommended practice. Various reasons were given for not adopting the seed rate recommendation (Table 4.5). Some of the respondents gave multiple reasons for not adopting the recommendation. Table 4.5 showed that 97%of the non-adopters said that they lacked technical knowledge and advice from extension agents while 88% of non-adopters found it difficult to count seeds during planting. Also 75% of non-adopters of recommendation said that planting more than 5 seeds per hole

was inherited while 65% of non-adopters of recommendation claimed that planting more than 5 seeds per hole ensured higher chance of germination. This group of non-adopters did not undertake thinning of plants after germination.

This study indicated that adoption of recommendation was rejected by the majority of the respondents who followed the traditional farming system. The traditional farming system mostly involved mixed cropping. In this farming system, the type of other crops to mix with sorghum determines the seed rate, time of planting the other crops and the spacing pattern of the mixed crops. Moreover, relevant information and technical knowledge about seed rate were lacking in the area, especially where crops were mixed on the same farm. This study indicated that many of the respondents in the area had wrong idea that more seeds per hole would produce higher yield. The result of non-adoption of seed rate recommendation led to over-population of plants per stand. Plant over-population reduced soil nutrients and retarded crop growth.

Recommended Spacing

Table 4.4 showed the major reasons given by the adopters. The table indicated that 90% of the adopters used the practice to ensure higher yield while 26% of the adopters accepted the recommendation because extension advice was provided. However, 33% of adopters claimed that they adopted the recommendation to obtain increase in income.

Table 4.5 showed the various reasons given by the non-adopters for not using the practice. The table showed that 98% of the non-adopters said that it would not allow mixed cropping which is the dominant farming practice in the area. About 81% of non-adopters claimed that the practice would require more fertilizer, while 95% of non adopters said that it was not easy to measure distance between plants. Further more, 49% of no-adopters claimed that they lacked technical advice and information from extension agents, 26% of the non-adopters said that it was labourious in terms of time and labour requirements while 27% of the non-adopters said that the innovation was incompatible with the traditional local practice.

This study showed that the recommendation was not popular and not adopted by the majority of the respondents because it was incompatible and in conflict with the farming system of the area. The study also showed that many of the respondents lacked the technical advice about the recommended spacing of the innovations.

The finding of this study with respect to the practice is in accord with some of the previous studies in Nigeria. For instance, Davis (1980:74) reported that in the 1950s and 1960s, researchers in the I.A.R., Samaru largely based their trials and recommendations on sole cropping, contrary to the farmers traditional system of multiple cropping. This, according to him, resulted in the extension workers encountering resistance when attempting to recommend sole cropping agronomic practices. In the Guided Change Project in Zaria,

Banta (1981) revealed that recommended plant spacing was rejected because mixed cropping would be impossible. Also Voh (1984) reported that at Gusau ADP, the method of spacing recommended was incompatible to their (farmers) own traditional farming system which was mostly mixed cropping.

**Thinning:**

Table 4.4 presented the reasons given by the respondents for thinning their sorghum seedlings. The table showed that 75% of the adopters said that they adopted the practice to obtain higher yield while 50% claimed that they thinned their sorghum seedlings to ensure better growth of the crops. This study also showed that 25% of the adopters thinned the seedlings to obtain increase in income while 19% said that they thinned because extension advice was available in their area and they also had labour to do the practice.

The non-adopters were asked to give reasons for not thinning their seedlings as recommended. Multiple reasons were advanced by the non-adopters of the practice. Table 4.5 showed that 94% of the non-adopters said that they lacked knowledge and technical advice from extension workers, while 25% claimed that they lacked conviction. Also 50% of non-adopters said that planting more than 5 seeds per stand without thinning was inherited, while 52% of non-adopters claimed that labour was not available and that it was costly to employ labour for thinning practice.

**Fertilizer Application Rate:**

Table 4.4 showed the major reasons given by the adopters of fertilizer application rate. All the adopters (100%) claimed that they used fertilizer so as to give higher yield and

better growth of their crops. Also 95% of the adopters used the recommended rate to obtain increase in income while 25% of adopters said that advice and information were made available by the extension agents. Also 13% of the adopters said that fertilizer application was compatible with their existing farming practice.

Table 4.5 showed the major reasons given by some of the respondents for not using fertilizer. The table showed that 83% of non-adopters said that they lacked money to buy fertilizer and that fertilizer was costly, while 50% of non-adopters of fertilizer claimed that fertilizer was not easily available in their area.

This study also found that 17% of non-adopters of fertilizer preferred manure because, according to them, it is cheaper than fertilizer.

This study indicated that most of the respondents in the area were aware of the importance of the innovation and they were using it. Fertilizer was found by the respondents to be compatible with their farming system. Accordingly, even when farmers planted the local sorghum varieties, they adopted the practice on their farms. However, few of the respondents did not use fertilizer because of the high cost of the commodity and low income of the farmers.

**Herbicides**

Table 4.2 showed that 5% of the respondents (16 farmers) adopted herbicides on their farms. In table 4.4, all the adopters said that they used the practice to reduce manual labour on the farms, 75% of the adopters said that they used the innovations to control weeds while 38% of the adopters wanted to ensure higher yield. All the adopters claimed that they

got good results when the innovations were correctly used. This study showed in Table 4.2 that 95% of the respondents did not adopt it on their farms. Table 4.5 showed that 98% of the non-adopters said that the innovations were costly and no money to buy the chemicals, while 84% of non-adopters said that there was no technical knowledge and information from the extension agents. This study therefore showed that high cost of the innovation, lack of money and inadequate knowledge about the practice were the major constraints to its adoption. For instance in his study of problems of the use of herbicides on small farm holdings in some parts of Northern Nigeria, Ogungbile (1984:40) reported that the factors responsible for poor use and performance of the practice on small farm holdings included high cost of the practice, wrong method of its application and weeding practices of the farmers.

Storage with Chemicals

Table 4.4 showed the major reasons given by the respondents for using the practice. The table indicated that 89% of the adopters said that they used it to prevent diseases in the store and 92% of the adopters of this innovation claimed that they used the innovation to reduce post harvest loss of stored grains, while 25% of the adopters used the practice to enhance the quality of the stored sorghum grains.

In Table 4.5, it was shown that 51% of non-adopters said that they did not have money to buy the storage chemicals, 84% of non-adopters claimed that there was no technical advice and information from extension agents while 29% of non-adopters said that they had no conviction i.e. the respondents were not convinced about the effectiveness of

innovations. Inadequate use of the practice or ineffective storage methods and techniques reduced the quantity and quality of stored grains. For instance, Agboola (1985) reported that as a result of the use of ineffective storage methods and techniques, losses in quantity and quality was estimated at about 20% of the total grains produced annually in Nigeria.

In summary, the major reasons for not using some of the recommended farm practices included high cost of the innovations (e.g. herbicides, fertilizers), lack of technical knowledge and information from extension workers (e.g. seed rate, thinning), lack of money or capital to invest in agriculture generally and incompatibility of some of the recommendations with the farming system of the area (e.g. recommended spacing, thinning), and lack of access to improved sorghum varieties. However, respondents in the area adopted some of the innovations studied when some of the motivating factors were present.

**Study Objective Four: Institutional and Personal Variables and their Relationships with Adoption of Agricultural Innovations.**

Each variable was examined separately and the result of the empirical testing of the hypothesis of the relationship of the variable with the adoption of agricultural innovations discussed. The Pearson Product-Moment correlation analysis was used for hypothesis testing. The Pearson Product-Moment correlation statistical technique is a measure of the degree of relationship between two variables, say x and y. It gives in numerical terms the extent to which sample observations on x correlated with sample observations on y. It can also be used to determine the existence, direction and strength of a relationship between the dependent and independent variables. The Pearson Product-Moment Correlation co-efficient

dependent and independent variables. The Pearson Product-Moment Correlation co-efficient was denoted by r and the value of r lies between -1 and +1. The relationships between adoption of agricultural innovations and the selected independent variables were summarised in Table 4.9.

**Part I: Institutional Variables**

The institutional variables examined in this study were extension services exposure, farm credit and mass media exposure.

**Extension Services Exposure**

The respondents were asked series of questions to assess the extension services exposure. Table 4.6 presents the frequency distribution of the respondents according to their exposure to extension services. The Table showed that 83% of the respondents were aware of the presence of an extension agent in their areas while 79% claimed that they knew the extension agents in their area. The extension agents were expected to visit the farmers forthnightly. This study indicated that about 48% of the respondents claimed that the extension agents visited them forthnightly while 28% said that they were not visited at all by extension agents (Table 4.6). This study also found that 40% of the respondents had in the past one year made at least one visit to the extension agent to get technical advice or information on agriculture while about 60% did not visit the extension agents. About 53% of the respondents said that the extension agents organised field days in their areas while about 45% of the respondents attended the field days as reported in Table 4.6.

**Table 4.5: Major Reasons Given for Not Using Practices Related to Improved Sorghum Varieties**

| | | Practices | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Major Reasons Given for Not Using Practices Related to Improved Sorghum Varieties | | Seed Variety N* = 148 | Seed Dressing Chemical N* = 79 | Correct Spacing N* =215 | Seed Rate N* =239 | Thinning N*=169 | Fertilizers Applications Rate N*=12 | Use of herbicide N*=297 | Use of Storage Chemicals N*=89 |
| | | % of Users reporting a given practice | % of Users reporting a given practice | % of Users reporting a given practice | % of Users reporting a given practice | % of Users reporting a given practice | % of Users reporting a given practice | % of Users reporting a given practice | % of Users reporting a given practice |
| 1. | No access to improved seed of Sorghum | 85 | xxx | xxx | xxx | xxx | xxx | xxx | xxx |
| 2. | No knowledge and no advice from extension workers | 59 | 89 | 49 | 97 | 94 | xxx | 84 | 84 |
| 3. | Prefer local varieties with long stalks for fencing and roofing | 35 | xxx | xxx | xxx | xxx | xxx | xxx | xxx |
| 4. | No money, it is costly | 39 | 38 | xxx | xxx | xxx | 83 | 98 | 51 |
| 5. | Not convinced of its effectiveness | 24 | 66 | xxx | xxx | 25 | xxx | xxx | 29 |
| 6. | Yellow colour variestires do not store well | 7 | xxx | xxx | xxx | xxx | xxx | xxx | xxx |
| 7. | Not easily available | xxx | 28 | xxx | xxx | xxx | 50 | xxx | xxx |
| 8. | Incompatible with local practice | xxx | xxx | 27 | 75 | 84 | xxx | xxx | xxx |
| 9. | Labourious, difficult to count seeds | xxx | xxx | xxx | 88 | xxx | xxx | xxx | xxx |
| 10. | Planting more than 5 seeds per hole ensures higher chance of germination | xxx | xxx | xxx | 65 | xxx | xxx | xxx | xxx |
| 11. | It is not easy to measure distance between plants | xxx | xxx | 95 | xxx | xxx | xxx | xxx | xxx |
| 12. | It will not allow mixed cropping | xxx | xxx | 98 | xxx | xxx | xxx | xxx | xxx |
| 13. | It will require more fertilizers | xxx | xxx | 81 | xxx | xxx | xxx | xxx | xxx |
| 14. | Practice inherited | xxx | xxx | xxx | xxx | 50 | xxx | xxx | xxx |
| 15. | Labour not available and costly interms of time and labour requirements | xxx | xxx | 26 | xxx | 52 | xxx | xxx | xxx |
| 16. | Prefer manure because it could be cheaper | xxx | xxx | xxx | xxx | xxx | 17 | xxx | xxx |

N* = Non-user of the practice xxx = Not applicable

This study also indicated that about 68% of the respondents said that extension agents had demonstration plots in their area while about 67% of the respondents claimed that they visited the demonstration plots at least once in the last three years to learn about agricultural innovations. This study also indicated that 72% of the respondents claimed that agricultural shows were organised in their area while 63% of the respondents attended such shows. Agricultural show is one of the extension teaching methods by which agents could reach the farmers. It could be used as a method for creating awareness about agricultural innovations. When extension services exposure was correlated with adoption of agricultural innovations, the correlation coefficient (r) was .2370 (Table 4.9). This is a positive and significant relationship. This revealed that as exposure to extension services increases, the level of adoption of agricultural innovation increases.

The reason for the positive and significant relationship between exposure to extension services and adoption of agricultural innovation can be explained in many ways. Extension bridges the gap between research and the farmer. The roles of educating, informing farmers and creating awareness about agricultural technologies and practices are performed by extension workers. Therefore, adoption of agricultural innovation is a function of the effectiveness of extension service.

**TABLE 4.6: Distribution of Respondents According to Extension Services EXPOSURE.**

| | Questions | Frequency (N313) | Percentage |
|---|---|---|---|
| (a) | Are you aware of extension agent in your area?<br>Yes<br>No | <br>261<br>52 | <br>83<br>17 |
| (b) | Do you know him?<br>Yes<br>No | <br>246<br>67 | <br>79<br>21 |
| (c) | No of times agent visited? No visit<br>6 times a year<br>once a month forthnightly | 88<br>23<br>53<br>149 | 28<br>7<br>17<br>48 |
| (d) | Ever gone to an extension agent?<br>Yes<br>No | <br>126<br>187 | <br>40<br>60 |
| (e) | How often do you go?<br>No visit<br>Once<br>Twice<br>3 or more times | 182<br>25<br>41<br>65 | 58<br>8<br>13<br>21 |
| (f) | Has the extension agent organised a field day?<br>Yes<br>No | <br>166<br>144 | <br>53<br>47 |
| (g) | Do you attend the field day?<br>Yes<br>No | <br>141<br>172 | <br>45<br>55 |
| (h) | Did the extension agent establish demonstration plot?<br>Yes<br>No | <br>214<br>99 | <br>68<br>32 |
| (i) | How often did you attend the demonstration Plot?<br>No visit<br>Once<br>Twice<br>3 or more time | <br>106<br>37<br>65<br>105 | <br>34<br>12<br>21<br>34 |
| (j) | Did agent organise agric. show?<br>Yes<br>No | <br>226<br>87 | <br>72<br>28 |
| K | Did you attend the agric. show?<br>Yes<br>No | <br>197<br>116 | <br>63<br>37 |

Extension service is controlled and influenced by policy makers at the Federal, State, Local Government and related organisations. When innovations are developed and tested at the research institutes, it is the responsibility of extension workers to make the innovations and other related recommendations available to farmers. It is therefore clear that adequate and continuous provision of relevant and appropriate innovations to farmers would facilitate and stimulate adoption of agricultural innovations. In other words, it is the effectiveness of extension service that determines the rate of adoption of agricultural innovations.

The finding about this variable agreed with the findings in America and India (Rogers, 1983) and some of the studies in Nigeria (Alao, 1971) Atala 1980, Ogionwo, 1978 Voh 1982) that also reported positive and significant relationship between extension contact and adoption of agricultural innovations.

Farm Credit

This study attempted to determine the extent of access to farm credit in the study area. Series of questions were asked to achieve this objective. For instance, the respondents were asked to indicate if they were aware of government farm credit programmes, whether they got farm credit or not, the sources of farm credit and why farmers did not use farm credit.

Table 4.7 presents a summary of the findings. About 96% of the respondents were aware of farm credit programmes from banks and co-operatives while only 27% said that

they got farm credit for farming in the last three years. This result showed that 73% of the respondents did not have access to any form of farm credit. About 22% of the respondents got the farm credit in cash, about 4% of the respondents got it in form of inputs like seeds, fertilizer, implements and tractor services. Table 4.7 also shows that only a small number of the respondents (6%) got farm credit from banks and farmers co-operatives. Other sources that are not important are money lenders, local traders, relatives and friends. Table 4.7 also indicated the major reasons the respondents gave for not using farm credit like unfavourable repayment conditions, and lack of knowledge.

It was clear from the findings of this study that farmers in the area lacked access to institutional sources of farm credit like banks and co-operative societies. Most of the respondents did not have acceptable collateral or security that the financial houses were demanding. Some of the respondents relied on non-institutional sources of loan such as friends and relatives (14%), traditional money lenders (2%) and traders (4%) for their credit needs. However, the non-institutional sources were characterised by the smallness in size of loans and sometimes high interest rate. More importantly, they were grossly inadequate and unsatisfactory to the credit needs of the farmers in the area.

As access to farm credit was correlated with adoption of agricultural innovations, it gave a correlation co-efficient (r) of .0714 (Table 4.9). This indicated a positive but insignificant relationship between farm credit and level of adoption of agricultural innovations.

**TABLE 4.7 Distribution of Respondents According to Access to Farm Credit**

| A | Farm Credit | Frequency(N=313) | Percentage |
|---|---|---|---|
| | Are you aware of Govt. farm credit programme? | | |
| | Yes | 300 | 96 |
| | No | 13 | 4 |
| | Did you get farm credit? | | |
| | Yes | 83 | 27 |
| | No | 230 | 73 |
| B | Sources Of Farm Credit | | |
| | Commercial Banks Farmers | 14 | |
| | Co-operatives Money lenders | 6 | 4 |
| | Friends and Relatives Local | 7 | 2 |
| | Traders | 45 | 2 |
| | No farm credit | 11 | 14 |
| | | 230 | 4 |
| | | | 73 |
| C | Reasons For Not Using Farm Credit | | |
| | Unfavourable conditions | 75 | 24 |
| | Not profitable | 6 | 2 |
| | Repayment period not good | 8 | 3 |
| | No need | 11 | 4 |
| | Lack of knowledge | 27 | 7 |
| | Applied but did not get | 18 | 6 |
| | Other personal reasons | 97 | 31 |
| | No response | 76 | 24 |

As farmers have access to farm credit, they will be able to expand the level of operations, buy farm inputs like fertilizers, improved seeds, herbicides and other chemicals.

They will also be able to employ and pay for hired labour or would be able to hire or buy labour saving devices like tractors, water pumps or ox-ploughs. They would be able to properly harvest and store their crops and transport them to the market at the right time. All these would enhance and stimulate adoption of agricultural innovations.

Institutional farm credit can be influenced by governmental financial institutions in a social system. We found in this study that farmers lacked capital and farm credit for investment in agriculture. Credit from informal sources like friends and relatives or money lenders were found to be grossly inadequate. The present study conformed and it is in accord with some of the earlier findings (e.g. Havens, 1975; Edache, 1980; Banta;1981) that farmers who had access to farm credit in kind, cash or both adopted agricultural innovations more and produced more crops than other farmers who lacked access to farm credit.

Mass Media Exposure

The four areas of mass media included in this study were the radio,television. printed materials and agricultural films. Series of questions were asked to determine the extent to which the respondents were exposed to agricultural programmes on radio, television and usage of agricultural publications and agricultural education films. Table 4.8 presents the distribution of respondents according to their mass media exposure. This study shows that 87% of respondents claimed that they had radio or had a place to listen to agricultural programmes. This study also showed that more than 96% of the respondents listened to agricultural programmes on radio at least once a week. The most important

agricultural programmes the respondents mentioned include `Noma Kankara', and Kungiyar Manoma'. These are agricultural programmes in Hausa language to inform and educate farmers about farming practices in the area. Radio appeared to be very popular as a source of information and education in the area. Those who did not have radio of their own had places to listen to one. As may be expected, only 14% of the respondents owned television. But 39% of the respondents said that they watched agricultural programmes on television. The study showed (Table 4.8) that 39% of the respondents claimed to be able to read leaflets, magazines and newspapers while about 40% of the respondents claimed to be reading the printed materials.

The study showed that 42% of the respondents claimed that agricultural films were brought to their villages in the last two years, about 28% of the respondents watched all the films while 17% of the respondents watched some of the shows.

Mass media exposure was correlated with adoption of agricultural innovations and it gave a correlation co-efficient (r) of .2018 (Table 4.9). This indicated a positive and significant relationship between mass media exposure and level of adoption of agricultural innovations. This revealed that as access to mass media increased, the level of adoption of agricultural innovations increased.

Mass media exposure increase the farmers' knowledge and information processing. Mass media broaden the minds of the farmers about their socio-economic and physical environment and agriculture. Therefore, mass media increase the level of awareness of people about agricultural innovations and practices. Consequently, farmers who are exposed to agricultural mass media are likely to adopt agricultural innovation and practices more than other farmers.

The present study is in accord with some of the previous studies (e.g. Alao, 1971; Monu and Omole, 1982; Matanmi 1991) that also reported that there is positive and significant relationship between mass media (e.g Radio) and level of adoption of agricultural innovations.

**Part II: Personal Attributes**

The personal attributes that were examined in this study included age, formal education, level of literacy, farm income, farming experience, family size, farm labour, farm size, membership of social organisations and awareness of agricultural innovations.

**Age**: When age was correlated with the level of adoption of agricultural innovations, the value of the correlation co-efficient (r) was - .0207 (Table 4.9). This shows a negative correlation of age with adoption of agricultural innovation, but the relationship was not statistically significant.

Most rural elders tend to have limited contact with people and cultures outside their environment. Moreover, ability, interest and motivation to go into the unknown, to try new ideas generally tend to diminish with increasing age. Accordingly, younger people are likely to be more innovative than the elderly people. The finding in this study with respect to age conformed with the findings of Ogionwo (1978), Zaria (1984) and Atala (1980) who reported negative relationship between age and level of adoption of agricultial innovations. However, some of the studies reviewed earlier (Edache, 1980; Voh, 1982) did not find any significant relationship between age and level of adoption of agricultural innovations.

## TABLE 4.8. Distribution of Respondents According to Mass Media Exposure.

| | Questions | Frequency (N=313) | Percentage |
|---|---|---|---|
| A | Radio<br>Do you have radioathome?<br>Yes<br>*No* | <br><br>271<br>42 | <br><br>87<br>13 |
| | Do you listen to agric. Programmes on radio?<br>Yes<br>No | <br>308<br>5 | <br>98<br>2 |
| | How often do you listen to agric. programme on radio week?<br>Less than once<br>Once<br>Twice<br>3 or more times | <br><br>14<br>29<br>137<br>135 | <br><br>4<br>9<br>44<br>43 |
| B | Television<br>Do you own a T.V. set or have a place to watch T.V<br>Yes<br>No | <br><br><br>45<br>268 | <br><br><br>14<br>86 |
| | Do you watch agric. programmes on Television?<br>Yes<br>No | <br>121<br>192 | <br>39<br>61 |
| | If yes, how often?<br>No response<br>Once a Month<br>Once a Week<br>Twice a Week<br>Regularly | <br>184<br>35<br>52<br>33<br>9 | <br>59<br>11<br>17<br>10<br>3 |
| C | Printed Media<br>Do you read magazines<br>leaflets and newspapers?<br>Yes<br>No | <br><br><br>123<br>190 | <br><br><br>39<br>61 |
| | If yes, do you read agric. information?<br>Yes<br>No | <br>115<br>198 | <br>37<br>63 |
| | *How often do you read agric. information?*<br>Regularly<br>Occasionally<br>No Response | <br><br>102<br>26<br>190 | <br><br>33<br>7<br>60 |
| D | Agricultural Films<br>Was agric. Films brought to your village in the last 2 years?<br>Yes<br>No | <br><br><br>131<br>182 | <br><br><br>42<br>58 |
| | If yes, did you watch the agric. films?<br>*Did not watch*<br>Watch some of the films<br>Watch all the films<br>No Response | <br><br>90<br>52<br>87<br>84 | <br><br>29<br>16<br>28<br>27 |

*Formal Education*

Formal education was correlated with adoption of agricultural innovations and it gave a correlation co-efficient (r) of .1155 (Table 4.9). This indicated positive and significant relationship between formal education and adoption of agricultural innovations. This showed that as the level of formal education increased, the level of adoption of agricultural innovations increased.

The explanation for this result is found in the fact that formal education is a facilitating factor of modernization and development. Formal education widens the information field and extends the horizon for ideas of an individual and groups of people. This is so because an educated person has extra access to information through printed materials like books, journals, leaflets, and films. Educated people visit urban centres and other cultures where they can come in contact with new ideas and innovations that they could take to their communities for adoption. Also an educated farmer could have greater direct and personal contacts with Research Institutes, Agricultural Development Projects, National Seeds Services officers than non-literate farmers where they could get information about agricultural innovations. Formal education enhances curiosity and inquisitiveness for knowledge and new ideas. All these increase the level of awareness and hence facilitate or stimulate adoption of agricultural innovations.

The present study agreed with the findings reported in India by Shungi et al (1971) and in Nigeria by Voh (1982) who reported that formal education was positively and

significantly related to adoption of agricultural innovations. However, the present study is at variance with some previous studies like Basu (1969), Akiwowo (1969) Clark and Akinbode (1968) who reported that there was no relationship between formal education and level of adoption of agricultural innovations.

**Level of Literacy**

Level of literacy was correlated with the adoption of agricultural innovation and it gave a correlation co-efficient (r) of .1057 (Table 4.9). This is a positive and significant relationship between level of literacy and adoption of agricultural innovations. Literacy is expected to be a stimulating and enhancing factor of innovation adoption. A literate farmer in English, Hausa or Arabic has extra advantage of getting information about agriculture from printed materials like books, leaflets, magazines and the newspapers. This will probably lead to greater level of awareness and adoption of innovations in agriculture.

The present study is however at is variance with the previous studies by Rogers (1983) in Colombia; Sharman, (1966) in India and Edache (1980); Voh, 1982 in Nigeria. They all found positive and significant relationship between level of literacy and adoption of agricultural innovations.

**Farm Income**

Farm income was correlated with adoption of agricultural innovation and it gave a correlation co-efficient (r) of .0554 (Table 4.9). This indicates a positive but insignificant relationship between farm income and level of adoption of agricultural innovations.

Income determines ability to invest in agricultural production. Capital is essential to acquire the main factors of production like land, labour, farm inputs such as fertilizers, improved seeds and tractors. When modern farm inputs are available at affordable prices at the right time to farmers, adoption of agricultural innovations is enhanced. But when farm income is low and farm inputs are costly, lacking or inadequate, farmers tend to adopt less of agricultural innovations. This finding is at variance with some of the previous studies (Rogers 1983; Nweke, 1981; Ekong; 1988) who reported positive and significant relationship between farm income and level of adoption of agricultural innovations.

**Years of Farming Experience**

Years of farming experience was correlated with level of adoption of agricultural innovations and it gave a correlation co-efficient (r) of .0425 (Table 4.9). This indicates a statistically insignificant relationship between the length of farming experience and level of adoption of agricultural innovations. The length of farming experience generally tends to increase with age. Therefore, older farmers may adopt less innovation than younger farmers. Elderly people are generally regarded as late adopters. Moreover, elderly people in rural area with more years of farming may lack formal education that would have exposed them to new ideas and practices. Hence, they may adopt less of agricultural innovations.

This study is in accord with the findings of studies by Clark and Akinbode (1968) and Basu (1968) who also found no relationship between length of farming and level of adoption of agricultural innovations. However, the present study is at variance with the findings of Opare (1977) in Ghana and Awolola (1984) in Nigeria who reported positive and significant relationship between length of farming experience and level of adoption of agricultural innovations.

**Family Size**

Family size was correlated with adoption of agricultural innovations and it provided a correlation co-efficient (r) of .1560 (Table 4.9). This indicates that the family size was positively and significantly related to adoption of agricultural innovations. This means that as the family size increased, the level of adoption of agricultural innovations also increased. This indicated that the larger the size of the family, the larger the potential labour force for the family. However there would be more mouths to feed, more members to clothe, house and cared for during marriages, festivals, in providing education and health needs. Therefore, to meet the social and economic needs of the large size family, the members may have to increase productivity from land and labour by adopting modern technologies in agriculture.

This finding agreed with the findings of Alao, (1971) Patel and Anthonio (1972) Awolola (1984) that reported that there was positive and significant relationship between family size and level of adoption of agricultural innovations.

**Farm Labour Force**

Farm labour force was correlated with adoption of agricultural innovations and it gave a correlation co-efficient (r) of .0744 (Table 4.9). This indicates a positive but insignificant relationship between farm labour force and adoption of agricultural innovations.

A farmer who has large labour force on farm either from his family or he or she has money to hire labour is in a position to raise his productivity through adopting more agricultural innovations. Also farmers with large family size who depend on family labour

may like to expand production to maintain the large family by adopting modern farm technologies like fertilizer, improved seeds. All these would enhance adoption of agricultural innovations and increase productivity from the land.

The study is at variance with that of Awolola (1984) who reported positive and significant relationship between number of helpers on farm and level of adoption of agricultural innovations. However, this study is in accord with the findings of Atala (1980) who reported that there was negligible relationship between household size and adoption of agricultural innovations.

**Membership of Social Organisation**

Membership of social organisation was correlated with adoption of agricultural innovations and it gave a correlation co-efficient (r) of .06672 (Table 4.9). This indicates that membership of social organisation was positively but insignificantly related to adoption of agricultural innovations.

People tend to learn from peer groups and associates either consciously or unconsciously. Also formal and non-formal education could be imparted by extension agents through co-operatives, farming groups or religious organisations. Through associations, members could become aware of new ideas and they could be stimulated to adopt such ideas and practices. Membership of social organisations enhances people's interest to adopt innovations since they have similar interest and goals. For instance, members of tobacco growers associations, rice growers associations were encouraged to follow recommended farm practices for such crops. The associations promoted special interests of members and

scientific ideas were passed to members from such associations.

However, finding is at variance with the findings in both U.S.A. (Rogers, 1983; Rothman, 1974) and Nigeria (Zaria, 1984; Ogionwo, 1978). They reported that there was positive and significant relationship between the membership of social organisations and level of adoption of agricultural innovations.

**Awareness of Agricultural Innovations**

Awareness of agricultural innovation was correlated with adoption of agricultural innovations and it provided a correlation co-efficient (r) of .4370 (Table 4.9). This indicated a positive and significant relationship between the level of awareness and adoption of agricultural innovations. In other words, as the level of awareness increased, the level of adoption of agricultural innovations also increased.

Awareness is the first stage in the adoption process. When a farmer is aware of a practice or innovation, he or she is able to make correct decisions about it. Awareness therefore enhances the capacity to compare and contrast possible alternatives in farming decisions and in operations. Awareness and adoption are functions of effectiveness of extension service through farm visits, demonstrations, agricultural shows and the use of mass media. Farmers that are aware of agricultural innovations would adopt them more than farmers who are not aware. The finding of this study on awareness was in accord with the reports of some previous studies (Alao, 1973; Arokoyo, 1981; Voh, 1982) that reported that there was positive and significant relationship between the level of awareness and adoption of agricultural innovations.

**Table 4.9: Matrix of Zero-Order Relationships Obtained Using Pearson Correlation**

| Variable | | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X1 | Age | 1.000 | | | | | | | | | | | | | | |
| X2 | Formal education | -.3021 | 1.000 | | | | | | | | | | | | | |
| X3 | Level of literacy | -.2518 | .5167 | 1.000 | | | | | | | | | | | | |
| X4 | Farm income | .1881 | .0714 | -.0312 | 1.000 | | | | | | | | | | | |
| X5 | Farming experience | .6925 | -2879 | -.1809 | .0453 | 1.000 | | | | | | | | | | |
| X6 | Family size | .3589 | -.0404 | .0291 | .2806 | .4283 | 1.000 | | | | | | | | | |
| X7 | Size of farm labour | .1385 | .2675 | .0326 | .4407 | .1357 | .4049 | 1.000 | | | | | | | | |
| X8 | Farm plots | .1217 | -.1249 | .0662 | .0657 | .0897 | .1254 | -.0026 | 1.000 | | | | | | | |
| X9 | Farm size | .0200 | -.0487 | -.1064 | .0868 | .0435 | .0233 | -.0222 | 3002 | 1.000 | | | | | | |
| X10 | Membership Soc. Org. | -.0409 | -.0939 | .0083 | -.0068 | -.0838 | -.0443 | -.0355 | .1126 | .2974 | 1.000 | | | | | |
| X11 | Access to farm credit | -.0553 | -.0234 | .0258 | .0959 | -.0133 | .0776 | .0508 | .0867 | .0458 | .1939 | 1.000 | | | | |
| X12 | Extension exposure | .0318 | -.0197 | -.0113 | .1461 | .1013 | .1772 | .1133 | .1369 | .0094 | .1985 | .1943 | 1.000 | | | |
| X13 | Mass media exposure | -.2907 | .2767 | .3217 | .0414 | -.1283 | -.0031 | .0043 | .0176 | .0309 | .0642 | .1105 | .2866 | 1.000 | | |
| X14 | Awareness of innovations | -.0185 | 0021 | -.0114 | .1011 | -.0182 | .0898 | .0827 | .1326 | .0393 | .2301 | .0738 | .1928 | .1726 | 1.000 | |
| X15 | Adoption | -.0207 | * .1155 | .1057 | .0554 | .0425 | * .1560 | .0744 | .1208 | .0957 | .0672 | .0714 | ** .2390 | ** .2018 | ** .4370 | 1.000 |

* = Significant relationships at the .05 level of significance ** = Significant relationships at the .01 level of significance

**Study Objective Five: to Determine the Relative Significance of each Factor and a Combination of them in Explaining Adoption Behaviour of the Farmers.**

This study so far has established that adoption of agricultural innovation occurs as a function of several institutional factors and personal attributes of the respondents. Most of the findings revealed varying levels of relationships of independent variables with adoption of agricultural innovations. There is therefore the need to determine the relative significance of each of the independent variables in this study and a combination of them in explaining adoption behaviour of the farmers.

To test the contribution of each variable and allow for a more predictive analysis, the data for this study were further subjected to step wise multiple regression analysis. The stepwise multiple regression analysis is a statistical technique for studying relationship of a combination of independent variables with a single dependent variable. It has the ability to select the best independent variables in predicting the variation in the dependent variable. In other words, the method makes it possible to obtain the individual contribution of an independent variable to predicting the dependent variable.

Twelve variables (Table 4.10) were selected and entered into the equation for stepwise multiple regression analysis with adoption of agricultural innovations as the dependent variable.

**TABLE 4.10 Variables Correlated with Adoption of Agricultural Innovations.**

| | Variable | Coefficient (r) | Remark |
|---|---|---|---|
| 1 | Awareness of Agric. Innovations | ** .4370 | S |
| 2 | Mass Media Exposure | ** .2018 | S |
| 3 | Extension Exposure | ** .2390 | S |
| 4 | Farm Credit | .07114 | NS |
| 5 | Formal Education | * .1155 | S |
| 6 | Level of Literacy | .1057 | NS |
| 7 | Farm Income | .0554 | NS |
| 8 | Family Size | * .1560 | S |
| 9 | Farm Labour force | .0744 | NS |
| 10 | Farm plot | .1208 | NS |
| 11 | Size of farmland | .0957 | NS |
| 12 | Membership of Organisation | .0672 | NS |

* S = Significant at .05 level

** S = Significant at .01 level

NS = Not significant.

At each step, the independent variable with the highest contribution to predicting adoption behaviour of the farmers was picked and entered and its contribution examined.

The process of computing the regression was repeated until no other variable would make a significant contribution to the prediction equation. A summary of the findings is presented in Table 4.11 showing:

(a) The independent variables in the order they were selected and entered into the model of multiple regression equation.

(b) The cumulative multiple R.

(c) A multiple R square which is the amount of variation in the dependent variable explained by the independent variable.

(d) R square change - This is the variance explained by each of the independent variables.

Table 4.11 presented a summary of the five variables that were predictive of adoption among the 12 independent variables entered into the step-wise multiple regression analysis. The Table indicates the measures of the influence of each independent variable upon adoption behaviour of the small holder farmers in the area.

The most important predictor of adoption behaviour of farmers was found to be awareness of agricultural innovations, which explained about 19% of the adoption variance. Exposure to extension services, farm size, formal education and family size acounted for about 6% of the adoption variance. The five predictors therefore jointly accounted for about 25% of the variance in adoption, leaving about 75% of the variance attributed to other factors. This indicates that some variables that were very important in predicting adoption behaviour of farmers had been left out or the measurement of some of the variables included in the present study needs further examination in future studies. However, this study is in accord with Alao (1973:305) who also found that awareness of agricultural programmes is

the most important predictor of adoption behaviour of farmers, while this study is at variance with Voh (1982:25) who reported leadership role in farm matters as the most important predictor of adoption behaviour of farmers in his own study.

**TABLE 4.11 Stepwise Multiple Regression Analysis for Best Explanatory Variables to Determine Adoption Behaviour of Farmers.**

| Variable in the Model | Multiple R | R Square | R Square change |
|---|---|---|---|
| Awareness | .43698 | .19095 | .19095 |
| Access To Extension | .46455 | .21581 | .2486 |
| Farm Size | .47816 | .22864 | .01283 |
| Formal Education | .48980 | .23990 | .01126 |
| Family Size | .49984 | .24984 | .00994 |

# CHAPTER FIVE

## SUMMARY, IMPLICATIONS AND CONCLUSION

### Research Problem and Objectives

The condition of the present day agricultural sector and food production is not satisfactory despite the huge investment in that sector by both the States and the Federal Governments in the last three decades. The problem of feeding the growing population is still with us while raw materials are not adequate for agro-based industries. One of the major reasons for this situation is that peasant farmers still use mostly low yielding crop varieties while the recommended farm practices from the Research Institutes are not adequately followed by many farmers. The Research Institutes in Nigeria have discovered and developed improved seeds and seedlings for various crops and relevant cultural and agronomic practices have been recommended for their adoption. However, the level of adoption of agricultural innovations by farmers is still low and unsatisfactory.

Literature reviewed showed that some studies have been carried out to investigate the problems connected with adoption of agricultural innovations (Alao, 1971; Voh, 1979; Atala, 1980; Arokoyo 1981). But most of these studies dealt with the effects of particular personal variables upon adoption behaviour of farmers. The studies also included crops with different agronomic and cultural practices for their production. The present study focused on one arable crop, sorghum varieties and the related cultural and agronomic practices that effect its production in the area.

Apart from the individual attributes, the institutional factors in a community may also influence decision making process in agriculture. The present study therefore explored the idea that exposure to selected institutional variables like extension service, mass media and access to farm credit may enhance the level of adoption of improved sorghum varieties and related agricultural innovations in the area.

The specific objectives of the study include the following:

1. To identify and describe the basic characteristics of the respondents in the study area.
2. To determine the level of awareness and adoption of improved sorghum varieties and related recommended farm practices among farmers in the area of study.
3. Tp identify the factors that influence farmers adoption (usage) of improved sorghum varieties and related recommended farm practices.
4. To determine the relationships between the selected independent variables like extension exposure, farm credit, mass media exposure, farm size, farm income, awareness of innovation and level of adoption of agricultural innovations.
5. To determine the relative significance of each of the independent variables and a combination of them in explaining adoption behaviour of farmers.

**Methodology**

This study was carried out in Soba and Zaria Local Government Areas of Kaduna State. The data used for the study were obtained from both the secondary and primary sources. The primary data were from the 18 villages that were randomly sampled for this study. The respondents in each village were also randomly selected. A total of 313 respondents who completed the interview schedule were used for the analysis. The interview schedule consisted of both structured questions.

Data collected were subjected to statistical analysis which included frequency distribution of the key variables presented in percentages and in tabular form. Pearson product moment correlation tests were used to provide a means of determining the existence, direction and strength of relationships between adoption of agricultural innovation and the selected independent variables. The stepwise multiple regression analysis technique was used to determine the best combination of variables predictive of adoption behaviour of farmers.

**Summary of Findings and Implications**

About 86% of the respondents were between 20 and 50 years old. So most of the respondents were still in their active working years. The study showed that over 70% of the respondents had no formal education (Table. 4.1). Also more than 77% of the respondents had over 5 years of farming experiences and they depended mostly on family labour on their farms. The respondents were mostly small scale farmers with fragmented farm holdings that were acquired through inheritance, purchase, gift, pledge or lease (Table 4.1). More than 90% did not have access to institutional farm credit while credit from non-institutional sources, like relatives, friends, money lenders were found to be grossly inadequate. Majority of the respondents (80%) had less than 10 hectares of farm land (Table 4.1).

Table 4.2 presented a summary of the level of awareness and adoption of agricultural innovations for this study. The study showed high level of awareness for the following innovations.

(i) Improved seeds of sorghum (95% aware)

(ii) Seed dressing chemicals (94% aware)

(iii) Use of storage chemicals (92% aware)

(iv) Fertilizer application rate (99% aware)

But the level of awareness of the following innovations was low:

(i) Seed rate (41% aware)

(ii) Use of herbicides (19 aware)

The level of adoption of improved sorghum seed was just a little above average, (53%), but the following innovations had high level of adoption.

(i) Seed dressing chemicals (75% adopted)

(ii) Fertilizer application rate (96% adopted)

(iii) Use of storage chemicals (72% adopted).

However, the study indicated that there was low level of adoption of the following innovations.

(i) Recommended spacing (31% adopted)

(ii) Thinning (46% adopted)

(iii) Use of herbicides (5% adopted)

(iv) Seed rate (24% adopted)

The implication of the findings for extension service and agricultural development of the area is therefore that agricultural extension agents should play more effective and

efficient role to improve the situation. Extension agents have to provide needed information and education to the farmers. This should be done by increasing educational visits to the farmers and demonstration.

Most of the respondents had inadequate practical knowledge of how to use some of teh agricultural innovations, especially herbicides and storage chemicals. Demonstration and agricultural shows are good extension teaching methods for creating awareness of agricultural innovations. However, the present study (Table 4:3) showed that less than 47% of the respondents regarded the demonstrations and agricultural shows as very important sources of information. The extension agents should therefore carry out more effective demonstrations on the farmers farms on how to use agricultural innovations. There is also need for extension agents to disseminate knowledge and information about improved sorghum varieties and related agricultural innovation. Other farmers should be fully made aware of the demonstration farms in their area and be encouraged to learn from the demonstration farms.

Agricultural shows should be organised annually at the local government areas and the farmers should be encouraged and educated by the extension agents to participate fully and actively. Regular home and farm educational visits by extension agents should be intensified while the essential farm inputs (fertilizers, improved seeds, agro-chemicals), should be made easily available to the farmers in the area. All these would increase the level of awareness and enhance the adoption of agricultural innovation.

The major reasons given by the respondents for using and reasons for not using a

particular practice have been discussed in chapter four and also summarised in Table 4.4 and 4.5. The major constraints that emerged for not using the practices may be outlined as below with implications for extension work:

1. Inadequate access to improved sorghum varieties and related farm practices like agro-chemicals, fertilizers and the high cost of such farm inputs. The implication of this is that the Research Institutes and other relevant organisations like the National Seeds Services, should make the improved sorghum varieties readily available to farmers. There is need to increase seeds multiplication programmes. The Research Institutes should make high-yielding, disease resistant and improved varieties of sorghum available to farmers to adopt. The high-yielding varieties of sorghum should be properly demonstrated by extension agents on the farmers' fields in the area. The farmers may not adopt fertilizers, high yielding varieties of seeds, plant protection chemicals if they are costly. There is therefore need for the re-examination of the government policy on procument, sale and distribution of fertilizer and other farm inputs if the self-sufficiency in food production goal in the country is to be a reality.

2. Inadequate advice and information from extension agents: There is need for extension agents to be more effective in educating and informing the farmers in all aspects of agriculture. There is therefore need for more well trained extension agents to cover all the villages in a local government area. The extension agents should carry out demonstration plots about innovations in agriculture that we want farmers to adopt on their farms.

3. There is inadequate application knowledge in the use of some innovations like herbicides and storage chemicals. Very few of the respondents (5%) in the study area used herbicides (Table 4.2) because of their limited application knowledge and the high cost of such innovations. Therefore, Research Institutes should intensify research into herbicides use and the extension agents should educate the farmers on how to use herbicides. Less costly weed control methods should be developed to reduce the high cost of controlling weeds through the use of human labour and costly herbicides.

4. Inadequate capital for farming: This study indicated that inadequate money was one of the factors that limited the adoption of some innovations and the employment of farm labour. The farmers had low income and there was lack of farm credit (Table 4.1 and 4.5). Only a small percentage (6% of the respondents had access to credit from banks and co-operatives. For farmers to adopt improved farm practices there is need to provide them with farm credit in cash and or in kind at the right time and in sufficient quantity and under terms favourable for profitable use by farmers to encourage widespread adoption of agricultural innovations.

5. Others issues like lack of conviction and incompatibility of innovations: These require that extension agents and research institutes should know more about what the farmers are doing and why. New agricultural technologies we are extending are expected to be relevant to the needs of the farmers. Extension agents should carry

out demonstration plots on the farmers farms. This should be done through the full and active participation of the farmers at all the stages of demonstration farms. Research workers should also test new ideas and innovations on the farmers farms. There is also need to organise farmers to visit the research farms and successful other farmers to see and learn. All these will lead to greater awareness and conviction that will stimulate adoption of profitable agricultural innovations.

Tables 4.11 presents the summary of the five variables that were predictive of adoption behaviour among the independent variables that were positively and significantly related to adoption of agricultural innovations. This study showed that awareness of agricultural innovations was the key factor in predicting adoption behaviour of farmers as it explained about 19% of adoption variance. The other four variables, i.e extension services exposure, farm size, formal education and family size accounted for about 6% of adoption variance. The five variables jointly accounted for about 25% of the variance in adoption.

***Implications of Empirical Findings for Agricultural Extension***

i. Extension Services: This study indicated that awareness was positively and significantly related to adoption of agricultural innovations and it was the key variable in predicting adoption behaviour of farmers. Awareness is the first stage in the adoption process and it is the role of extension agent to initiate the process of awareness and usage of agricultural innovations. Extension Services exposure was also found to be significantly and positively related to adoption of agricultural innovations. The implications of this is that agricultural extension service should be

more effective and efficient to be able to reach the small scale farmers. Extension agents should be using multi-channels of communication to reach farmers through education, information and regular contacts to create awareness and facilitate the adoption of agricultural innovations.

ii. Education: Formal education was found to be positively and significantly related to adoption of agricultural innovations. Formal education was also found to be one of the five variables that contributed much to predicting adoption behaviour of farmers. The implications of this is that formal education should be encouraged among the youths in the rural areas. Adult functional literacy programmes should be organised for the adults in the rural areas. Moreover, practical agricultural education should be part of such educational programmes. All these would increase the level of awareness and facilitate adoption of agricultural innovations.

iii. Mass Media: Exposure to mass media was found to be positively and significantly related to adoption of agricultural innovations. This study also found that radio was a very important source of agricultural information. The implication of this is that there is need for more effective use of mass media (especially radio) by extension agencies for creating awareness of agricultural innovations. There is need to increase agricultural education programmes on radio and television to create awareness and educate farmers about agricultural innovations. More agricultural publications should be in Hausa language and Arabic `Ajami' that many of the respondents claimed that they could read. All these would increase awareness and facilitate

adoption of agricultural innovations and more food production in the area.

iv. Membership of Social Organisations: The study found that there were some existing social organisation in the area (Table 4.1). There is need for extension agents to educate and encourage more farmers to participate in social and economic organisations so as to benefit from the advantages of such organisations. Extension agents could reach (educate and inform) more farmers through such groups like farmers co-operatives. Farm credit and tractor hiring services, which this study showed that many of the respondents could not get may be obtained through efforts of farmers' co-operatives if the co-operatives could be effectively and efficiently managed. This would enhance agricultural development and food production in the area.

v. Farm credit: This study showed that farmers had inadequate access to farm credit and other farm inputs while the level of farm income was low. As advocated earlier in this study there is need to make farm credit and other farm inputs available to the farmers for them to increase agricultural production in the area. Farm credit can be given to farmers through co-operatives. Farmers land can be used as collateral security if the loan has to be from banks. There should be favourable conditions for the repayment of farm credit like low interest rates. The loan can be given out to farmers in form of inputs like fertilizers, agro-chemical or services like tractor hiring while the repayment should be after the sale of crops.

## Implications for Further Research

Fertilizers became a very scarce and or costly commodity at the time of this study. Therefore, Research Institutes should develop less costly alternative methods of improving the fertility of the soil in the area.

The finding indicated tha mixed cropping is still the most predominant and popular farming system. There is need for Research Institutes to intensify research into possible crop combinations, spacing of such crops and the fertilizer requirements for mixed cropping, bearing in mind the environmental conditions, especially climate and soil types of the area.

It is the farmers' adoption of the recommended agricultural innovations that could increase food production and transform the agricultural sector of the area to a modern one. Therefore, there is need for further studies to find out the missing variables that would fully explain the farmers adoption behaviour. The measurement of the variables needs to be more refined.

One explanation for the differences in the results of the different studies is the differences in methodological approaches, procedures and the selection and measurement of the variables. In order to be able to compare and generalise results meaningfully, there is need to further carry out adoption studies at different ecological zones of the country. More importantly, adoption of agricultural innovations research needs to be multi- disciplinary so as to be able to determine the adoption behaviour of farmers. Further studies in this area should not only cover areas of socio-economic variables, but also environmental, spatial and temporal variables.

## Conclusion

This study examined factors influencing adoption of agricultural innovations. The study found that adoption of agricultural innovations is influenced by inter-related institutional factors like extension services exposure, mass media exposure, farm credit as well as personal attributes like formal education, farm income, labour force, membership of social organisations and awareness of agricultural innovations.

However, empirical findings indicated that awareness was the major variable predictive of adoption behaviour of farmers. Other variables found contributing to predicting adoption behaviour of farmers included formal education, extension services, farm size and size of the family. The implication of the findings included more effective and efficient extension services. But extension service can only be effective when combined with effective research into farmers problems and needs, provision of relevant technologies, farm credit and other farm inputs.

The study identified that the farmers needed more than information and education. Farmers lacked basic farm inputs that could facilitate the adoption of agricultural innovation. For some of the respondents it was scarcity and/or high cost of the recommendations rather than lack of its knowledge that was the constraint to its adoption, e.g fertilizers. Therefore, organising effective extension services and educational programmes as advocated in this study means not only provision of technical advice, education and information to the farmers but also provision of farm inputs and farm credit facilities to facilitate the adoption of agricultural innovations.

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**APPENDIX A**

**FARMERS' INTERVIEW SCHEDULE**

Name or interviewer:----------

Date of interview:----------

Time of started----------/PM----------

Time ended:----------/PM----------

State:----------Kaduna State----------

Local Government Area (L.G.A.):----------

Name of Village:----------

Respondent's number:----------

Respondent's name:----------

**Introductory Statement**

Good morning/Good afternoon/Good evening my dear friend/ brother/ elder. I am from College of 'Agric, Samaru.' My name is..... I am interested in talking to you about your farming practices. This study is being done to find better ways in which 'Agric. Samaru', the Ministry of Agriculture and the 'A.D.P. ' can help you and your fellow farmers. I shall be very grateful therefore, if you can give me few minutes of your time. Please feel free and answer the questions accurately and honestly.

Confidentiality is guaranteed for any information supplied. Your name will not be associated with your answers in any publication, be it public or private. This research has nothing to do with tax assessment.

Thank you.

J.O. Orojobi

(Investigator)

**Personal Socio-Economic Attributes.**

1. **Age**: *What is your age?* *years*

2. <u>Formal Education</u>
   a. Did you ever attend any schools?
      Yes
      No
   b. if yes, how many years did you spend in school?
      -------years.
   c. What formal education did you have?
      Adult education classes
      Primary school incomplete
      Primary school complete
      Post primary school incomplete
      Post primary school complete
      Post secondary institutions

**Literacy.**

3. Which of the following languages can you read?
   Hausa
   'Ajmi'-(Arabic script)
   English language
   Cannot read any of them

4. If you can read any of the above languages, what newspapers, magazines or other publication do you read?

<u>Occupation</u>
(Only respondents with farming as their main occupation should be include in the sample).

5a. What is your major occupation?
---

5b Do you have other sources of income besides farming?
**Yes**
No

5c. If yes, give detail of the other sources of income:

6a. What are the major crop you grow on your farm?
.....

b. What is the most important crop that you grow for your home consumption?----------

c. What are the most important crops you grow for sale (cash crops):----------

d. Do you grow sufficient food crops to feed yourself and your family (for a whole year?
Yes
No

7. What tools do you use for farming?

a. Tractor ☐ own ☐ hire ☐

b. Ox-plough own hire

d. Traditional implements (hoes, axes, matchet)

e. Others, please specify----------

8a. Do you keep any livestock?
Yes
No

8b. <u>Farm Income</u>

What is the total value of crop and livestock you sold last season? ----------

9. How do you sell your produce?
At local market

To money lender

At co-operatives

No sale

10. <u>Farming Experience</u>
How long have you being farming on your own?
----------years

11 **Family Size**

How many people do you feed?----------

How many of these help with farm work?----------

Wives----------

Children----------

Others----------

**Social Participation in the Community.**

12. Which of the following social organisation do you belong now?
Please indicate your activities in them.

| Organization | A *Member* | B *Attendance at* meetings regularly Yes or No | C *Committee* membership | D *Held* Office | E *Contribute to org* R O |
|---|---|---|---|---|---|
| 1. Village council<br>2. Cultural group<br>3. Farmers co-operative<br>4. Political Party<br>5. Religious org.<br>6. Group farming<br>7. Thrift &loan Soc.<br>8. Others | | | | | |

13. **Socio-Economic Status**

Please indicate which of the following items do you have now and many of each where applicable:

| Properties | Number | Properties | Number |
|---|---|---|---|
| Zinc roof house<br>Bicycle<br>Motor cycle<br>Radio<br>Television<br>Refrigerator<br>Ox-plough<br>Tractor<br>Car | | Electricity<br>Spraying<br>Machine<br>Cattle<br>Sheep<br>Goats<br>Horses<br>Donkeys<br>Poultry/fowls<br>Others | |

**Institutional Factors.**

A. **Access to Farmland.**

14. How many farm plot do you have?

----------farm plots

15. Do you have access to sufficient land for farming?

Yes No

16. If no, how do you hope to increase your farm land next year or in future?

17. What is the total hectares of all your plot planted last year?----------
---------- hectares

18. How did you acquire your farm land?

Inheritance (Gado)

Purchase (saye)

Given (kyauta)

Pledge (Jingina)

Lease (Haya)

Others (Please specify) ----------

## B. Access To Agricultural Credit

19. Are you aware that the government has agricultural loan schemes for small holder farmers.
Yes 1 No 0

20. Did you get credit for farming 1 the last 5 years?
Yes No (Goto question 28)

21. If yes, from what sources did you obtain it?
s Commercial bank 2

Farmers' Co-operative societies 2

Farmers' Supply Company 2

Traditional money lender 1

Friends and relatives 1

A local trader

Others (please specify) ----------

22. In what form did you receive teh credit?

In form of cash

In form of inputs (seed, fertilizers and insecticides, etc)

In form of implements

23. If cash, what was the total amount?
#----------

24. For what purpose was the cash credit used?
Farming 2
Non-farming 1

25. Is there any interest involved in the loan?

Yes 1 No 0

26. If yes, what is the nature of the interest terms?

---

27. Have you paid back the agricultural credit?

Yes 1 No 0

28. If No, why not?

29. If your answer to question 20 is No, what are your reasons for not using or discontinuing the use of credit for farming?

a. Denial of credit by established credit
Institutions because of collateral or infavourable conditions

b. Not profitable-Interest too high

c. Repayment period unfavourable

d. I do not need credit for farming

d. Others ----------

C. **Exposure to Extension Services.**

30a. Do you know if there is an extension agent in your village area?

Yes 1 No 0

30b. Yes 1 No 0

c. If yes to question (30 a), how often did the extension agent visit you during the last farming season?

| | |
|---|---|
| Forthnightly (two times a month) | 3 |
| Once a month | 2 |
| About 6 times in a year | 1 |

31. Did you ever go to see an extension agent?

No visit

Yes 1 No 0

32. If yes, how often during the last one year?

3 or more times 3

2 times 2

once 1

33. Has the extension agent ever arranged for a filed day in your village area?

Yes 1 No 0

34. If yes, did you attend the field day?

Yes 1 No 0

35. Did the extension agent establish agricultural demonstration plot?

Yes 1 No 0

36. If yes, how often during the last farming season did you visit the demonstration plot?

3 or more time3

2 times 2
Once 1
No visit 0

37. Did agricultural extension agencies organise agricultural show in the last one year in your village area?

Yes 1 No 0

38. If yes, did you attend the agricultural show?

Yes 1 No 0

39. What are the agencies responsible for making the improved technologies and inputs available to farmers n your area?

Yes 1 No 0

40. Are the improved farm technologies and inputs available to farmers in your area?

Yes 1 No 0

41. If yes, name the most important improved farm technologies and inputs they make available.

42 If no to question 40, why not?

## Exposure to Agricultural Mass Media-Agric Radio Usage

43. Do you have a radio in your home?
    Yes 1 No 0
44. If no, do you have a place you can listen to one?
    Yes 1 No 0
45. Do you sometimes listen to news broadcast?
    Religious Programmes
    Agricultural Programmes
    Request Programme
    Others.
46. If agricultural programme is mentioned on question 45 ask: How often in a week do you listen to Agricultural programmes on radio?
    More than 3 times in a week 3
    About 2 to 3 time in a week 2
    Once in a week 1
    Less than one time in a week 0
47. Name some of the radio agricultural programmes:
48. Are the present time of broadcast suitable for you?
    Yes No
49. What are the most suitable time for you to listen to agricultural programmes on radio?
    a. Between -------- and ---------- AM\p (1st choice)
    b. Between -------- and ---------- P\M (2nd choice)

### Television Agricultural Programme

50a. Do you have T.V receiving set?
    Yes 1 No 0
b. If no, do you have a place you can watch one?
    Yes 1 No 0
51. Do you sometimes watch agricultural programme on Television?
    Yes 1 No 0
52. If yes, how often do you watch T.V agricultural programme?
    Regularly/twice a week 3
    Once a week 2
    Once a month 1
53. Name one of the programmes you have watched on Television.

### Agricultural Printed Materials (For Literates only)

54. Do you read any newspaper, leaflets, or magazine, bulletins, etc?
    Yes 1 No 0

55. If yes, do you read agricultural information from any of the printed materials mentioned?

Yes 1 No 0

56. How often do you read agricultural information from the printed materials

Regularly 2

Occasionally 1

57. If no to questions 54 and 55, what are your reasons for not reading agricultural information from the printed materials?

**Agricultural Film**

58. Was an agricultural film brought to this village or the nearby village during the last one year?

Yes 1 No 0

59. If yes, did you watch:

All the shows 2

Did not watch any of the shows 0

60a. **Awareness (Unaided) Knowledge**

As a farmer growing sorghum, please tell me all the recommended (improved) practices for growing sorghum you have heard about, and when you first heard about them?

| Practice | Year first heard about |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |
| 8. | |
| 9. | |
| 10 | |
| 11. | |
| 12 | |

**Awareness (Aided) Knowledge**

60b. Please indicate ( ) which of the following recommendations (improved) practices about sorghum are have heard of and when you first heard about them.

| S/N | Practices | Heard about | Year heard about |
|---|---|---|---|
| 1. | Improved recommended guinea corn varieties; Short Kaura (yellow) Fara-fara (white), Mori (Pearl-white), others | | |
| 2 | Dress seed with chemicals one packet to three mudu of seed before planting. | | |
| 3 | Prepare contour ridges one metre apart. | | |
| 4 | Make the space between stand to be 30cm. | | |
| 5 | Plant after rains are well established. Mid-May to early June. | | |
| 6 | Plant 3-5 seeds per 2.5cm deep hole. | | |
| 7 | Thin the seedlings to 2 plants per stand about 2 weeks after germination. | | |
| 8 | Fertilizer application: 150kg (3bags) of Superphosphate (SUPA) fertilizer and 250kg (5bags) of Calcium Amonium Nitrate (CAN) fertilizer to one hectre of sorghum plants. | | |
| 9 | Use insecticides to control diseases on your farm. | | |
| 10 | Weed regularly to control weeds or use herbicides to control weeds. | | |
| 11 | Burn or sub-dry stalks after harvest to control guinea corn diseases. | | |
| 12 | Control storage insect pests with use of chemicals. | | |

## Adoption of Improved Recommended Sorghum practices

61. Please indicate which of the following recommended practices about sorghum you are currently using and when you started: (see A, 60a & b).

| S/N | Practices | Adoption currently using | Year adopted |
|---|---|---|---|
| 1. | Improved recommended guinea corn varieties; Short Kaura (yellow) Fara-fara (white), Mori (Pearl-white), others | | |
| 2 | Dress seed with chemicals one packet to three mudu of seed before planting. | | |
| 3 | Prepare contour ridges one metre apart. | | |
| 4 | Make the space between stand to be 30cm. | | |
| 5 | Plant after rains are well established. Mid-May to early June. | | |
| 6 | Plant 3-5 seeds per 2.5cm deep hole. | | |
| 7 | Thin the seedlings to 2 plants per stand about 2 weeks after germination. | | |
| 8 | Fertilizer application: 150kg (3bags) of Superphosphate (SUPA) fertilizer and 250kg (5bags) of Calcium Amonium Nitraaate (CAN) fertilizer to one hectre of sorghum plants. | | |
| 9 | Use insecticides to control diseases on your farm. | | |
| 10 | Weed regularly to control weeds or use herbicides to control weeds. | | |
| 11 | Burn or sub-dry stalks after harvest to control guinea corn diseases. | | |
| 12 | Control storage insect pests with use of chemicals. | | |

### *Sources of information on recommended practices*

**62.** Please indicate from which of these sources of information did you first hear about the following recommended practices. (Please check only one source for each practice.) (See A, 60a & b).

| S\N | Sources of information | Use of recommended seeds 1 | Use of seed dressing chemicals 2 | Use of fertilizer 3 | Contour ridges 4 | Planting date 5 |
|---|---|---|---|---|---|---|
| 1. | Friends 7 other farmers | | | | | |
| 2. | Radio | | | | | |
| 3. | Extension Agents | | | | | |
| 4 | Commercial sellers | | | | | |
| 5 | Agric. Samaru | | | | | |
| 6 | Agric. Publications | | | | | |
| 7 | Television | | | | | |
| 8 | Agric. Shows | | | | | |
| 9 | Result demonstration | | | | | |
| 10 | Co-operative societies | | | | | |
| 11 | Farm service centres | | | | | |
| 12 | Farmers supply company | | | | | |
| 13 | Village head | | | | | |
| 14 | Newspapers and Magazines | | | | | |

## Importance of Sources of Information

63. Please rate the following sources according to their importance as sources of information on improved recommended farm practices. Circle the number which best describe your feelings.

Key: 3 = Very important
2 = Important
1 = Not important
0 = Don't know/uncertain

| S\N | Sources | Rating scale | | | |
|---|---|---|---|---|---|
| 1. | Friends and other farmers | 3 | 2 | 1 | 0 |
| 2. | Radio | 3 | 2 | 1 | 0 |
| 3. | Extension agent | 3 | 2 | 1 | 0 |
| 4. | Commercial seller | 3 | 2 | 1 | 0 |
| 5. | Agric. Samaru | 3 | 2 | 1 | 0 |
| 6. | Agric. Publications | 3 | 2 | 1 | 0 |
| 7. | Television | 3 | 2 | 1 | 0 |
| 8. | Demonstration | 3 | 2 | 1 | 0 |
| 9. | Agric. Shows | 3 | 2 | 1 | 0 |
| 10 | Co-operative societies | 3 | 2 | 1 | 0 |
| 11. | Farm service centres | 3 | 2 | 1 | 0 |
| 12 | Farmers supply company | 3 | 2 | 1 | 0 |
| 13. | Newspapers and Magazines | 3 | 2 | 1 | 0 |
| 14. | Village head | 3 | 2 | 1 | 0 |
| | | 3 | 2 | 1 | 0 |

64. What are your major constraints for not using (adopting) or discontinuing the use of improved recommended farm practices you have heard about? (Note: Only the practices the respondent heard about but not adopting should be read out. (see question 60a & b).

| S\N | Recommended Practices | Constraining Factors |
|---|---|---|
| 1. | Improved seeds of sorghum | |
| 2. | Seed dressing chemicals | |
| 3. | Contour ridging-one metre apart | |
| 4. | Planting date: Mid-May Early June. When rains are well established. | |
| 5. | Inter-stand spacing - 30cm | |
| 6. | Seed rate-plant 3 to 5 seeds per 2.5cm deep hole. | |
| 7. | Thin to 2 plants per stand | |
| 8.<br>(a)<br>(b) | Fertilizer application<br>Superphosphate/150kg/ha (3 bags).<br>(CAN Calcium Amonium Nitrate 250kg/ha (5 bags) | |
| 9. | Weed Regularly or use Herbicides | |
| 10. | Use of insecticides to control diseases on the farm. | |
| 11 | Burn or sun-dry stalks after harvest to control guinea corn diseases. | |
| 12 | Control storage insect pests with the use of chemicals | |

65. What are the major factors motivating you to use (adopt) the improved recommended practices you have heard about (Note: Only the practices adopted in question 61 should be read out in the list below).

| S\N | Recommended Ppractices | Motivating Factors |
|---|---|---|
| 1. | Improved seeds of sorghum | |
| 2. | Seed dressing chemicals | |
| 3. | Contour ridging-one metre apart | |
| 4. | Planting date: Mid-May Early June. When rains are well established. | |
| 5. | Inter-stand spacing - 30cm | |
| 6. | Seed rate-plant 3 to 5 seeds per 2.5cm deep hole. | |
| 7. | Thin to 2 plants per stand | |
| 8.<br>(a)<br>(b) | Fertilizer application<br>Superphosphate/150kg/ha (3 bags).<br>(CAN Calcium Amonium Nitrate 250kg/ha (5 bags) | |
| 9. | Weed Regulary or use Herbicides | |
| 10. | Use of insecticides to control diseases on the farm. | |
| 11 | Burn or sun-dry stalks after harvest to control guinea corn diseases. | |
| 12 | Control storage insect pests with the use of chemicals | |

## APPENDIX B

### Villages where the study was conducted
### Zaria Local Government Area

| S/N | Village | Distance from Zaria | Respondents |
|---|---|---|---|
| 1 | Sayen Tunkara | 9km | 18 |
| 2 | Dorayi | 25km | 13 |
| 3 | Sayen Sura | 22km | 20 |
| 4 | Pamadina | 45km | 20 |
| 5 | Fangarnu | 10km | 20 |
| 6 | Majeru | 15km | 16 |
| 7 | Kafin Madarn | 28km | 20 |
| 8 | Tundun Kusa | 25km | 20 |
| 9 | Anguwan Kanawa | 23km | 18 |

### Soba Local Governement Area

| S/N | Village | Distance from Zaria | Respondents |
|---|---|---|---|
| 10 | Kwari Soba | 370km | 16 |
| 11 | Soba | 45km | 20 |
| 12 | Awai | 25km | 20 |
| 13 | Wanka | 24km | 15 |
| 14 | Gamagira | 56km | 20 |
| 15 | Maigana | 25km | 11 |
| 16 | Tashan Ice Mai | 27km | 11 |
| 17 | Yakasai | 18km | 20 |
| 18 | Gimba | 30km | 15 |
| | | | 313 |




SOURCE:- Federal Lands and Survey, Kaduna.

APP. C:-MAP OF KADUNA STATE SHOWING THE STUDY AREAS.