IMPACT OF PARTICIPATORY EXTENSION ACTIVITIES ON SESAME PRODUCTION IN RINGIM AND TAURA LOCAL GOVERNMENT AREAS OF JIGAWA STATE

BY

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DECLARATION

I hereby declare that this thesis has been written by me personally and is the result of my own work. No previous work of this has been presented to this University or elsewhere for the award of any degree. Works by other authors, which served as sources of information, have been duly acknowledged by reference to them.

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CERTIFICATION

This thesis entitled "IMPACT OF PARTICIPATORY EXTENSION ACTIVITIES ON SESAME PRODUCTION IN RINGIM AND TAURA LOCAL GOVERNMENT AREAS OF JIGAWA STATE " by UMAR, USMAN SABO meets the regulations governing the award of the degree of M.Sc (Agricultural Extension and Rural Sociology) of Ahmadu Bello University, Zaria, and approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to:

the memory of my father (Late Alhaji Umaru Biro) for his support, care and concern during my early schooling days;

my mother (Late Hajiya Binta `Anti') who had trained and supported me to be what I am today;

my guardian (Late Hajiya Aishatu Abdullahi) who have taken a lot of burden and serious concern for my education;

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ABSTRACT

The study was designed to assess the impact of participatory extension activities on sesame production in Ringim and Taura Local Government Areas of Jigawa State. Forty participating farmers were purposively selected while forty non-participating farmers were randomly selected from the list of sesame farmers. The two categories of farmers established result demonstration plots of 0.25 ha each from which primary data were collected. Secondary data were collected from JARDA, IAR/ABU, Zaria, SG2000, Agricultural Departments of the two LGAs and the Internet. The participating farmers used an average seed rate of 6 kg/ha while the non-participating farmers used an average of 16 kg/ha and they applied their inorganic fertilizer by side placement. The average yield of the participating farmers was 942 kg/ha while the non-participating farmers had average yield of 567 kg/ha. The Z-test analysis revealed that calculated Z = 13.38 which was greater than table value of 1.96 at 5 percent level of probability suggesting that there was significant difference between the production of the two categories of farmers. The results also revealed that overwhelming majority of the respondents faced the problem of lack of inorganic fertilizers during production. Finally, the study concluded that farmers production could be improved through participatory extension activities. Recommendations proffered for increased and sustainable production were that participatory extension activities should be encouraged in Jigawa State while timely supply of inorganic fertilizers to farmers at affordable prices should be encouraged and that campaign should be launched through radios and JARDA Media Unit to create awareness of the improved production technologies of sesame to farmers in Jigawa State.

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CHAPTER ONE

1.0 INTRODUCTION

Nigeria is predominantly an agricultural country. Small scale farmers in the country, like their counterparts in other developing countries are in technology trap. Crude production implements, small fragmented land holdings, low-yielding crop varieties and animal breeds, unimproved cultural practices, poverty, undeveloped rural infrastructure and inefficient extension services, limited access to credits, all sum up to make their output and productivity low (Sokoya, 1998). Inspite of the eminent position of the petroleum sub-sector, especially in the area of income generation, the agricultural sector plays a major and significant role in the overall economic growth and development of the country (Jibowo. 1989).

In the 1970s and early 1980s, the then Kano State was engaged in the Training and Demonstration (T & D) extension system which laid emphasis on practical demonstration rather than visits. Jigawa Agricultural and Rural Development Authority (JARDA) from its inception in 1992 to date adopted the unified extension system of the Training and Visit (T & V) system of extension (JARDA, 1998). Although the T & V extension has effectively created farmers awareness on improved production techniques and new crop varieties, other advantages of the extension system included effective supervision, effective research-extension-farmer linkage and proper funding of extension activities (Atala *et al*., 1992). But, it has failed to address the immediate problems of the farmers in different agro-ecological zones of the country thereby suggesting a need for a much better different approach.

Participatory Extension Approach (PEA) is new in Nigerian agriculture. It has been widely used in many countries of the world in order to involve farmers, who are the stakeholders in planning and execution of programmes that address their immediate needs. Axinn (1988), Zinnah (1997) and Atala (2001) stated that throughout the world, there is growing evidence that when rural people are organize for their benefit, much can be achieved. The participatory approach takes advantage of this principle and emphasizes significant participation by those who are to be affected by the agricultural extension system.

Low yields of sesame in the study area have been associated with, among other things, the inability of the extension services to reach and address the immediate problems of farmers. Farmers' awareness of improved production techniques has been very low because extension has not been very effective in transmitting information on improved technologies of production to target farmers. This makes the farmers to continue to use varieties which have low yield potentials, low quality and matures late. The farmers' average yield on sesame is about 300 kg/ha whereas a yield of 1,000kg/ha (1 ton) can be attained from an improved variety (Ilu, 2002). In order to meet the need of the farmers and the rapidly growing population in the State, there is the need for improvement in the T & V system of extension. The extension service should be made to educate the farmers on improved production methods practically on their own farms for rapid adoption.

To achieve this, capacity building as a tool of PEA was used through extension activities, which involved advicing and supervising the farmers in transferring the improved technologies of sesame production to Jigawa State farmers through the conduct of result demonstration plots. This participatory approach method is responsive to intended beneficiaries' agricultural development problems and information needs because its extension objectives, strategies, methods, messages are specifically developed based on survey results of the farmers' Knowledge, Attitude and Practice (KAP) vis-à-vis the recommended agricultural technologies. The participatory extension approach in essence follows the well-known principles of rural reconstruction: "Start with what people already know and build on what they already have" (FAO, 1997).

1.1 History and Production Level of Sesame in Jigawa State

Sesame seed, (*Sesamum indicum* L.) is an oil seed plant with deep rooting system and it is well adapted to dry conditions. It grows on relatively poor soils, in climates often unsuitable for other crops and it is widely valued for its high nutritional and financial values. Sesame is a crop of great antiquity, it has been under cultivation as far back as 2350 B.C. in Babylon where it was first known. At present, the crop is grown in many tropical and sub-tropical countries such as India, China, Mexico, Venezuela and Sudan (Van Rheenen, 1973).

Sesame seed cultivation in Jigawa State started long ago during the period Nigerians went to Mecca by foot, through Sudan (JARDA, 1998). It was formerly grown in small portions of land by very few farmers. Sesame production started gaining prominence in 1973 as a result of drought and the subsequent incidence of groundnut Rosette Virus diseases which brought about the collapse of the famous Kano Groundnut Pyramids in the present day Kano and Jigawa States. Groundnut farmers had to resort to an alternative cash crop which is sesame. Sesame production is a common practice of farmers in the study area during the wet season i.e. June to October, especially for provision of food and income. Traditionally, the crop is grown sole as well as in mixture with cereals and legumes, particularly millet, sorghum, groundnut and cowpeas.

1.2 Uses of Sesame

Sarkar (2002) described sesame as the oldest oilseed crop known to mankind. Sesame seed is processed locally in the state and utilized in various forms. But two recipes are most popular: (1) "kantu" (which is a snack prepared from roasted sesame seed) and (2) vegetable oil for cooking. The oil is used in salad preparation, margarine as well as industrial preparation of perfumery, cosmetics (skin conditioning agents and moisturizers, hair preparations, bath oils, hand products and make-ups), pharmaceuticals (for drug delivery), insecticides and paints. The by-product of sesame after oil extraction, is used in local dishes which includes "Taushe and Fate-fate" while it also serves as a very good protein source in livestock feed.

1.3 Problem Statement

Sesame is grown in Jigawa State as a rainfed cash crop and as a major source of income. Despite all attempts to increase production of sesame in Nigeria, the average farmer still produces only at a subsistence level, using traditional system of farming and low-yielding varieties. Extension services have not been very effective because improved technologies of sesame production are available in Research Institutes, but have not successfully reached sesame farmers.

Jigawa State has tried a number of approaches which included the commodity specialised, the general agricultural extension, the project, the education institution and the T and V approach to improve agricultural production. The past approaches have in one way or the other developed agriculture and the rural populace but have not fully addressed the issue of involving the beneficiaries in problems identification, prioritization, solutions identification and priotization, decision making and action plans to remedy the problems.

The agricultural extension participatory approach takes the clientele as a key figure in decision making, planning, execution and evaluation of any project which is meant to benefit them. This would go a long way in sustaining the project because it is directed to address the farmers' real needs. Axinn and Thorat (1972) have found that in most cases the first-line extension agents who are in direct contact with farmers are frequently ill-equipped and poorly trained for successful execution of their extension assignments. Majority of the farmers in the State are not aware of the modern ways of production. FAO (1969) confirmed that nearly all the recorded increases in aggregate food production emanating from the small holdings have previously been largely accomplished through expansion in cultivated land area because farmers are engaged in traditional farming.

Sesame is grown mainly as a source of income. The problem identification and solution prioritization exercises revealed that farmers have shown serious concern on the need to improve the yields and marketing of the crop, so as to increase their profit margin. Hence, the use of participatory extension activities by which the researcher trained and involved the farmers in problem identification, problem prioritization, solution ranking, creation of awareness on improved production technology, training and action plans to remedy the problems. Eziakor (1990) stated that there is an increasing realisation that the successful adoption and implementation of improved production practices by the small scale farmers holds the key to the realisation of increased yields on their small holdings. Improved extension services, should lead to adoption of improved sesame production technology, higher yields, better marketing, increased farm income and finally improve farmers' standard of living.

The study focused on and attempted to provide answers to the following research questions.

1. What are the socio-economic characteristics of the sesame farmers who participated in the study?
2. What are the sesame cropping patterns and agronomic practices in the study area.
3 Are there any differences between input/output levels of production of participating and non-participating sesame farmers?
4 What are the participating sesame farmers perception on continuous use of the improved production technology?

1.4 Objectives of the Study

The main objective of the study is to assess the impact of participatory extension activities using result demonstration plots on sesame production in selected Local Government Areas (LGAs) of Jigawa State.

The specific objectives were to:

1. describe the socio-economic characteristics of sesame farmers in the study area.
2. identify sesame cropping patterns and agronomic practices in the study area,
3. compare the input/output levels for sesame production among participating and non-participating farmers,
4. examine the participating sesame farmers perception on continuous use of

the improved production technology.

1.5 Justification of the Study

There exists a knowledge gap in the application of participatory extension activities for sesame production in Nigeria. This gap needs to be bridged through this research. Sesame is an excellent source of oil used in cooking and other industrial uses, especially in the manufacturing of cosmetics, pharmaceuticals, insecticides and paints. Sesame seeds or flour can be added to recipes to give a better nutritional balance for health (CHEMONICS/ USAID, 2002).

This study would create awareness among farmers on the need for the adoption of improved sesame production technology as well as to link farmers in groups with better market outlets for better prices for their produce. Farmers yields on sesame have been as low as 300kg/ha. Ilu (2002) confirmed that an average yield of 1.0 ton/ha was recorded in Gombe, Kano, Katsina and Jigawa States under the Sasakawa Global 2000 (SG2000), Management Training Plots (MTPs).

The results of the study would add to academic knowledge, serve as an important document for researchers, in the field of sesame production and would serve as a guide to extensionists, farmers and policy makers in the LGAs, States and Nigeria in general. It is expected that this study would serve the rural development agencies, producers and marketing agencies with baseline empirical data and information for future reference in the area of participatory extension activities in relation to crop production. This can be a useful tool in planning, monitoring and evaluation of rural development strategies.

1.6 Hypothesis

The hypothesis put forward in this study is:

There is no significant difference in the production of the participating and the non-participating sesame farmers.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Farmers Characteristics

Agricultural extension delivery system being a techno-social science cannot be divorced from the socio-cultural and economic environments that the target audience (recipients or farmers) as well as the providers are operating. The success or failure of any extension delivery system depends on the ability of the system to be adapted and be operated in a target environment with limited external intervention (Cook and Kothari, 2001). Extension service is an important catalyst for enhancing the pace and range of adoption of innovative agricultural technologies. It tended to position the farmers mainly at the receiving end and refused to use them as source of information and guidance to the agricultural research and extension (Douthwaite, 2000).

For efficiency and improvement in the rural settings, Nigerian farmers should have a strong capacity to organize themselves such as to screen technology/policy options and to effect the implementation of appropriate decisions. These would improve the situation of the Nigerian farmers and would enable them face new challenges of the country's diversified economy under a growing population, their inputs and needs should shape both research and extension delivery (Arokoyo, 2002).

The central principle of participatory approach in extension is to empower farmers to be able to identify their problems and seek solutions to the problems. However, to empower the farming community, there would be direct contacts and linkages between participating and non-participating farmers through field visits and field days, the participants would regularly inform the community about their activities and present their achievements. This way, farmer to farmer extension is re-enforced thereby resulting in technology adoption and dissemination among farmers within and outside the community. For effective farmer-participation to be achieved, a change in attitude of extension workers is required. This can only be achieved through training, re-training and constant supervision from the extension workers (Stewart, 1998). Therefore, the purpose of the extension workers' training shall be to re-orient him/her from the traditional technology transfer approach to facilitation of farmers needs assessment, monitoring and evaluation. Other important areas of re-orientation shall include training on; organising and managing groups, different techniques of facilitation and organization of field visits and field days (Okatahi, 1998).

What people do by tradition is mainly determined by the organization of the society and its culture. Amoako (2003) stated that sub-Saharan Africa (Nigeria inclusive) is the only region in the world where overall, livelihoods and food security continue to deteriorate. Over the last 14 years, the number of Africans living below the poverty line has increased to 50%. The majority of the Africans still face widespread rural poverty, worsening food insecurity and degradation of the resources on which their farming systems depend. Seventy percent of the population (430 million people) live in rural areas and about ninety percent of these rural dwellers live on small-scale farms. Although economies of sub-Saharan Africa are essentially based on agriculture, for over three decades the region has faced a structural food deficit whereby it could not keep pace with population growth. For farmers, one's geographic and socio-economic location determines the particular configuration of hardships to be faced.

Traditional production systems of rural households were geared for subsistence and were generally sustainable under conditions of low population pressure and isolated markets. However, this equilibrium is increasingly stressed by population growth which in turn triggers either intensification of agriculture or expansion into marginal lands. Expansion into marginal areas brings increased risk of crop failure, environmental degradation and loss of biodiversity thereby reducing both the productivity and sustainability of agricultural systems over time (Amoako, 2003).

Ogungbile and Ega (1989) stated that the rate of adoption of improved technology by small-scale farmers has been very slow in Nigeria. The relevance of the technologies been developed at the research institutes is therefore in question. Improved technologies are usually released with recommendations pertaining to the physical and biological conditions required for the technologies to be successful. Since small-scale farmers would consider profit maximization option only when food security is guaranteed, on-farm testing needs also to take into consideration other socio-economic factors affecting technology adoption.

Olukosi (2002) lamented that the failure of many development projects in Nigeria has been attributed to lack of sufficient attention given to the target group in terms of suitable information dissemination strategy. The change agents may have only very cursory knowledge of the environment to which they have been assigned. Floquet (1993) confirmed that adapting the teaching programme to the traditional activities of the farmers, to their culture, their environment, their needs and their time table shall bring positive result in the adoption of innovations.

Progressive agriculture involves the farmer in making decisions for himself about which crops to grow, how to grow them, how best to use the land, labour and money. By persuading farmers to adopt progressive agricultural methods, extension workers encourage farmers to make decisions for themselves on farming matters which have in the past been strongly influenced by the tradition and habits of the society. For a successful and sustainable technology transfer to farmers, the extension worker must comply with the following suggestions:-

1. study the social organization and the culture of the people with whom he works.
2. identify himself with their aims and ways of life.
3. know their customs, traditions and economic activities.
4. understand the values of the society, that is things that people consider most important.

Other areas of concern to the extension worker are risks in agriculture such as uncertain consequences of climatic changes, growing strengths of urban markets in relation to labour and cash movements. Physical and social infrastructure development and general economic growth. Cadisch *et al*. (2002) concluded that poverty and low productivity in the rural areas leads to lack of investment in the natural resource base and overexploitation of ecosystem services which finally relates to the vicious circle of poverty as experienced by most rural areas in the country. Unless the vicious circle described above of unsuitable agricultural practices and unfavourable economic returns to agricultural production is broken, Nigeria would be unable to guarantee viable livelihoods for it's rural populations nor ensure broader economic development for its citizens of which majority are rural dwellers.

The role of socio-economic factors in improving farmers' efficiency is widely acknowledged. Farmer's age in correlation with farming experience according to Agada (1998) has significant influence on the decision-making process of farmers with respect to risk aversion, adoption of improved agricultural technologies and other production related decisions.

2.2 Farmers Cropping Patterns and Agronomic Practices In Crop Production

The term cropping system is used to describe the pattern in which crops are grown in a given area over a period of time and includes the technical and the managerial resources that are utilized. When we talk about the cropping pattern of a given area, we are not only interested in how those crops are distributed on the field at any given time and how this distribution changes as time goes on. In addition the level of management, the distribution of crops in space on the field i.e., whether intercropping or sole cropping is practiced needs to be taken into consideration (Onwueme and Sinha, 1991). Other areas of concern in cropping patterns are whether production is intensive or extensive, the type of crop grown e.g. grain crops, legumes, oil crops, vegetables, arable cropping, pasturing etc. Cropping pattern is determined by the type and intensity of the land cultivation found within an area and this included shifting cultivation, continuous cropping, crop rotation and monoculture, intercropping and sole cropping.

In tropical Africa, plantation and cash crops are invariably grown as sole crops such as oil palm in Cameroon, coffee in Kenya, cocoa in Ghana and rubber in Nigeria. In some instances, they may be intercropped with food crops when the plantation is young, such as plantains and cocoyams in cocoa plantations and cassava in rubber plantations. Even for arable cash crops such as tobacco and groundnuts in Nigeria, sole cropping is the rule but the sole crop may be subjected to shifting cultivation or to continuous cropping with rotation.

Agriculture in sub-Saharan Africa is characterised by small, fragmented, resource-poor farms on which multiple food crops are mainly grown for family consumption (Jean and Halons-Kim, 1998). In Nigeria, some of the major crops grown for food and cash are rice, maize, millet, sorghum, wheat, cowpea, groundnut, soyabeans, cassava, yams, potatoes, sesame, sugarcane, tobacco, cotton, bambaranut, kenaf, etc. Cereals and grain legumes are grown extensively with about 75% being consumed by the producing households.

Farming in the northern Guinea Savanna agroecological zone of Nigeria is based on arable crops. Norman (1974) described sorghum as the most important staple food crop. Sorghum/millet/cowpea systems dominated the northern part of the zone while the southern part is dominated by the sorghum/millet/maize. He further found out that mixed cropping is more prevalent on upland fields with 83.4% of the total cultivated area in Zaria area to be devoted to crop mixture. Other crop mixtures found in the area are cotton/cowpea, maize/cotton/cowpea, millet/cotton/cowpea, maize/cowpea, maize/rice, sorghum/groundnut/pepper/ maize/okra, etc. Norman (1974) and Abalu (1976) concluded that mixed cropping is known to be consistent with farmers' food security objectives and they noted 156 different crop mixtures in the agroecological zone.

Ridge cultivation system is widespread in the agro-ecological zone. Cultural and agronomic practices practiced by the small-scale farmers included land preparation, varietal selection, seed dressing and sowing, weed control, insect and disease control, fertilizer application and harvesting. Naturally, the traditional cropping systems have their strengths and weaknesses. It is well understood that the current cropping practices of peasant farmers have undergone considerable modifications and time honoured adaptation to environment which is why farmers consider them as more stable and reliable than newly introduced practices (Abalu and Yayock, 1980). Also, the crops grown in mixtures have advantages of mutualism and reduce the incidence and severity of pest and weed attack thereby reducing production risk and uncertainty. In fact, small farms have been observed to be distinctly better in matters of management, proportion of owned inputs, stability of income and the owners' ability to accommodate better a lower price level for their products (Basu, 1978).

However, there are important weaknesses of traditional cropping systems. Basically, low productivity which is attributed to use of low productive methods and instrument and the unwouldingness or inability to adopt improved techniques is the most disturbing characteristics of peasant farmers (Abalu and Atala, 1982). The importance of technology development and diffusion in bringing about improvement in small scale farmers productivity and income is well recognized by agricultural theoreticians, administrators and practitioners. This has led to a participatory approach to technology development whereby the stakeholders are central figures in development, planning and execution of plans to remedy farmers' real problems in crop production.

2.3 Input/Output Levels of Production

The theory of efficiency is derived from the production process, which involved the transformation of inputs into outputs. This process is normally undertaken by producing units, farm firms in agriculture whose ultimate objective may be profit maximization, sales maximization, satisfying food security or a combination of some or all of these objectives (Olayide and Heady, 1982). The concept of efficiency is concerned with the relative performance of the process used in transforming given inputs into outputs (Mijindadi, 1980 and Kohler, 1982).

Inputs which are also referred to as factors of production or resources are usually combined in a production process to produce output. Resource, basically refers to inputs used in the production process, e.g. seeds, fertilizers, agro-chemicals and labour as used in this project. It had been reported that Nigeria's inability to produce sufficient food to feed its population like most developing countries was due to inadequate input supply (FAO, 1985). IITA (1991) confirmed that almost all the food output emanating from small holdings comes from an expansion of about 2% per year in the land area of crops grown, not from increases in yield.

In agriculture, just like any other industry, inputs are used to produce output from which income is derived. The aim of any production is to attain optimum yield. Thus non-input availability leads to a vicious circle of poverty where low input leads to low output and low income. Ingawa (1999) stated that access to required inputs would affect the level of output both in quality and quantity. He also revealed that farmers with good access to markets, better farm equipments and who use credit are most likely to use fertilizers to boost their production. He further stated that fertilizer is second to labour in terms of the total cost of production.

For producing a crop, costs and return are important factors which dominate the decision making process of farmers. To improve small-scale farmers production, extension would have to train the farmers on improved production techniques and also link the farmers to inputs sources or organizations for a sustainable, improved production. Farmers produce on sesame should be improved upon through extension by teaching the farmers to thresh and winnow their sesame on a tarpaulin or polythene sheet to avoid the sesame seed been mixed up with soil and debris for better income.

2.4 Farmers' Perception of Agricultural Technologies in Crop Production

One of the major problems facing developing countries in the tropics is the production of sufficient food, fibre and shelter for their large populations. The greatest challenge which faces these developing countries (Nigeria inclusive) today is to eliminate hunger and to over come poverty. The challenge is greatest in rural areas where employment is only dependent on agricultural production. Food production therefore, is very important in the economies of tropical developing countries and agriculture provides the means to increase food and fibre production. Agriculture has always played a leading role in people's lives in tropical countries, where at least 75 percent of the total labour force is engaged in agriculture (Youdeowei *et al.*, 1990).

Successful extension work is feasible when there is reciprocal relationship between the extension worker and the beneficiary of extension work (farmers, rural families, etc). This way of looking at extension requires that the extension workers are committed to the welfare of the beneficiaries. In the relationship, the freedom of decision-making and the personal responsibility of the partner must be preserved in full because the farmer alone would ultimately bear responsibility for the consequences of his/her actions.

With respect to technology transfer, past studies (Abalu and Yayock, 1980; Daramola, 1988; Hagenimann, 1998) have shown that at least four steps are required to transfer an identified technology to users in food production and rural – based enterprises. These steps are (a) market and consumer evaluation of the product (b) technical evaluation of the piloting scale (c) adjustment of the technology to the users' need and (d) invitation of enterprises to use the developed technologies through technical and financial training. The technical training should relate to the crop e.g. sesame, while the financial training should relate to loans and bookkeeping.

Researchers and farmers perception to improved crop production technologies differ. While the researchers rate the innovations based on adjused importance and contribution to yield. Farmers looked at the innovations in relative terms that which innovations are more popular with the farmers. Daramola (1988) stated that the farmers perception in ranking of innovations during a study revealed that fertilizer application is the most popular innovation followed by improved seeds, machinery, herbicides, pesticides and agronomic practices in that order.

According to Ogunwale and Maurya (1991), farmers' perceptions have been affected by the benevolent patron-cleint relations that have been built up by the government in most irrigation schemes. This has resulted in over-dependence of farmers on government agencies for their farming operations. As Voh (2002) puts it, farmers would be mobilized to actively participate in activities that are centred on their own expressed felt or real needs. This, for improved and sustainable crop production, avenue must be created to change their perception towards innovations in agriculture. The farmers must be viewed as central figure in problem identification, technology development, planning, execution and evaluation of innovations that are directed to improve their production and standard of living.

2.5 Sesame Production in Nigeria

Dike and Oparaeke (1997) stated that sesame (beniseeds), *Sesamum indicum* L.) is a well established crop in parts of Nigerian savanna where it is grown mainly by small-scale farmers. Large-scale mechanized production of sesame in Nigeria is yet to be realised. Most of the sesame, both consumed locally and exported, is produced in small farm holdings owned by peasant farmers.

Sesame production is relatively easier when compared to other rainfed crops and therefore, more easily adopted by small-scale, resource poor peasant farmers as well as risk-sensitive farmers. This is because sesame grows well in a wide range of soil and rainfall conditions (Purseglove, 1968). In Nigeria therefore, it grows from Benue State in the Southern Guinea savanna (1500mm rainfall) with heavy clay soils to the State in the Sudan savanna (900mm rainfall) with light sandy soils (Mahmood, 2001).

Agronomic practices in sesame production are simple, serving on poor soils, requiring low levels of fertilizer, minimum cultivation and minimum crop protection measures. These positive characteristics make sesame an ideal cash crop for income generation for poor farmers and a tool for participatory extension in Jigawa State. Production trend of sesame in the last decade in Jigawa State and Nigeria has been on an annual increase, this is because more farmers go into the production of sesame because of its economic importance.

Sesame production in Jigawa State started growing from 1994 and every year more farmers went into the cultivation of the crop. Total annual production in 1994 was 7,000 tonnes and in 1997 rose to a total of 45,000 tonnes of sesame produced in Jigawa State. Every year, more farmers go into sesame production in the State because of the financial yield. The same thing applied to Nigeria because total production of sesame at 1990 was 44,000 tonnes whiles by 2001, the production rose to 69,000 tonnes of sesame produced in the country.

When sesame is compared with some other food and cash crops grown in the State, production of millet in 1994 was 240,000 tonnes while in 1997 dropped to 206,000 tonnes. Sorghum in 1994 was 210,000 tonnes while in 1997 reduced to 199,000 tonnes. Cowpea production in 1994 was 60,000 tonnes while it dropped to 35,000 tonnes in 1997. In the State, groundnut production reached 50,000 tonnes in 1994 while it dropped to 31,000 tonnes in 1997. Bambara nut in 1994 was 2,000 tonnes while in 1997 dropped to only 1,000 tonnes. The only crop that rose in production (like sesame) in the State was maize, its production in 1994 was 1,000 tonnes and was 2,000 tonnes in 1997 (JARDA, 1998).

2.6 Chemical Composition and Propagation of Sesame

Sesame seeds contain 45-55 percent oil, 19-25 percent protein and about 5 percent water. The oil is of high quality, odourless and not liable to become rancid. The principal unsaturated fatty acids are oleic and linoleic with about 40 percent of each and about 14 percent saturated acids. Linolenic acid is not present in sesame (Purseglove, 1968). Other amino acids found in sesame are isoleucine, leucine, lysine, methionmine, arginine, histidine, tryptophan, valine, threonine and phenylanine. arginine has the highest content of amino acid found in sesame with 11.9 percent while Tryptophan has the lowest with 1.7 percent (Misari, 1998). Rheenen Van (1973) established that sesame seed is a rich source of oil, protein, phosphorus and calcium. The crop is grown from seed and seedlings appear above the ground in about 3-10 days based on crop variety, soil tilt, planting depth and moisture availability in the soil. Sesame matures in about 90 days after sowing and is harvested immediately when the crop is physically matured before it dries.

2.7 The Role of Agricultural Extension in Agricultural Development in Nigeria

One of the most important issues that has featured currently in the agenda of policy makers, analysts and theorists in the past two decades in Nigeria is how to reverse the trend of agricultural decline and tackle the problem of food shortage permanently (NARP, 1999). USDA (1977) described extension as the most successful adult education and in some reports as the most successful out of school, informal youth education movement in the world. The effects of agricultural extension as stated by USDA (1977) have resulted in improving the standard of living of the rural people in:

a. assuring adequate supplies of food and fiber

b. increasing family/household strength, stability and economic security.

c. Improving human food and nutrition.

d. Providing economic opportunity and

e. Improving the environment and conserving natural resources.

Empirical studies have shown that agricultural extension have contributed in improving agriculture in Nigeria. The major outgrowth of extension work have been in the areas of increased production in crops and livestock through technology dissemination and adoption.

An extension service is knowledge management organization whose main stock is intellectual capital and whose purpose is to introduce change for the benefit of its clients. Because extension is already associated with the management of information, communication and knowledge, it is logical to borrow from modern concepts of knowledge management which refers to the ability of an organization to get the right information to the right person at the right time on a user-friendly manner (Reinjinties *et al.*, 1992). Ituma (1998) stated that agricultural extension practice in the world over is an educational procedure directed towards linking technology creation and technology utilization sub-system. He further stated that the essence of extension is to bring about desired changes within a social system. These changes are manifested in the enhancement of skill, knowledge and attitude of farmers towards food production practices. A good case can be made that agricultural extension services are also in the business of providing knowledge, intensive products and services (Warren, 1991). The main objective of Nigerian extension programmes as put forward by Tijjani (1977) centred around general need to transform the present traditional agriculture into a modern one. Such that agriculture should be capable of sustaining the nation's growing demand for food, agricultural raw materials and guarantee enough income for the betterment of the rural people.

By people's needs, this meant that extension should assist to identify the needs of the farmers and generally relate these needs as well as the aspiration to the value utilization of the new technology related to these needs. It is necessary to establish confidence between the farmer and extension worker, so that the farmer can be convinced that the extension worker is interested in his welfare. The roles of extension in agricultural development as put forward by Mijindadi (1985) includes:-

1. Inputs (fertilizer, seeds) distribution
2. Seed multiplication
3. Crop demonstrations (methods and results)
4. Conduction of field days and agricultural shows
5. Training of farmers and field extension staff.
6. Linkage with research institutes
7. Credit administration
8. Workbull utilisation and tractor hire services
9. Linkages with marketing outlets.
10. Organization of village level institutions (farmers' council, farmers' cooperatives and village agricultural committee)
11. Home economics extension.
12. Home and farm visits, and
13. Information Unit (Radio/TV programmes, public enlightenment campaign, distribution of publications).

Benor *et al*. (1984) described the aim of Training and Visit (T & V) system of agricultural extension as to build a professional extension service that is capable of assisting farmers to raise production, increase their incomes and to provide appropriate support for agricultural development. To be successful, the T and V must be adapted to fit local conditions. Some important features in this system are professionalism, a single line of command, concentration of effort, time-bound work, field and farmer orientation, regular and continuous training, and close linkage with research.

Arokoyo (2002) emphasized that the major challenges confronting agricultural extension services in sub-Saharan Africa (Nigeria inclusive) today are globalization, lack of coherent policy, downsizing of the public sector, poorly trained staff, lack of dialogue between stakeholders, researchers (extension staff and farmers), lack of effective farmers' organizations, lack of support services (other than extension) and difficulty in reaching female farmers. In Nigeria extension services is faced with many problems which make it rather difficult for serious impact to be made particularly with respect to food production in the country.

The problems as stated by Imrana (1982) included:-

1. Neglect of food production research in earlier years.
2. Development of technology which is at variance with traditional system of farming.
3. Inadequate credit facilities for farmers.
4. Lack of guaranteed price for food crops and poor marketing.
5. Poor storage and processing facilities.
6. Limited number of extension workers.
7. Poor means of transportation for the extension staff.
8. Poor condition of service.

9. Poor fertility of soil and lack of clearing equipments.
10. Inadequate logistical support to extension workers and poor funding to extension.
11. Unfavourable environmental conditions.
12. High cost of labour and poor image of farming.
13. Lack of feed for livestock.
14. Poor organization of farmers.
15. Disparity between rural and urban farmers.
16. Poor communication between research and extension, and
17. Weak communication link between extension and farmers.

Ineffective working relationships among agricultural researchers, extension staff and farmers are one of the most challenging problems of extension services in developing countries (Merril-Sands and Kaimowitz, 1989; Kaimowitz, 1990; FAO, 1995 and Zinnah, 1997). Farmers have little voice in deciding research and extension agendas. The poor working relationships between these supposed interrelated groups leads to duplication of roles and activities and faulty understanding of farmers' real needs, which waste the scarce human and financial resources available for research and extension. There is, therefore, need for attitudinal re-orientation so that the different actors in technology development and dissemination can begin to see each other as belonging to a system whose performance and efficiency depend on the synergy between them.

It is evidenced that agricultural extension in developing countries is faced by multifaceted challenges as a result of the rapidly changing dynamics of the agricultural and rural development globally and on the African continent and Nigeria in particular. These changes are making an already complex organization even more complex. Realistically, to overcome these challenges, deliberate changes in the extension service delivery rests with the agricultural training and research institutions. They need to develop flexible and responsive agricultural training and programmes based on farmers' needs.

Akinbode (1996) confirmed that agricultural and rural development in Nigeria have changed through many phases and programmes have been launched in the quest to develop the rural populace and their profession (farming). Adedoyin *et al.* (1998) listed the programmes that were used in mobilizing the resources in agricultural and rural sectors as: The National Accelerated Food Production Programme (NAFPP, 1972); Integrated Agricultural Development Projects (1st generation ADP, 1975); Operation Feed the Nation (OFN, 1976); River Basin Development Authorities (RBDAs, 1976); Rural Banking Scheme (RBS, 1978); Land Use Decree (1978); Green Revolution National Committee (GRNC, 1979); The World Bank Assisted Agricultural Development Projects (2nd generation ADPs, 1986); National Directorate of Employment (NDE, 1986); Peoples Bank of Nigeria (PBN, 1987); Better Life Programme (BLP, 1987); National Land Development Authority (NALDA, 1991) and Family Economic Advancement Programme (FEAP, 1997). Other programmes launched in the country for agricultural and rural transformation included the Special Rice Production Programme (SRPP, 1998); Poverty Alleviation Programme (PAP, 1999) and the most recent National Special Programme for Food Security (NSPFS, 2002) which encompasses the use of participatory extension approach in identification of farmers real problems for possible solutions.

2.8 Agricultural Extension Approach

There is no single accepted definition of extension. Extension is a service by extension workers, which is directed to farmers and their families. It involves training and influencing farmers on new ideas, equipment and methods that are to improve farm efficiency and to better the farmers' standard of living (Van den Ban and Hawkins, 1996). Zinnah (1997) and Atala (2001) stated that there are different types or approaches to agricultural extension worldwide and that each approach was conceived as appropriate in particular circumstances and has its own advantages and disadvantages. Generally, there are eight major types or approaches to agricultural extension in the world today (Axinn 1988):

1. The general agricultural extension approach
2. The commodity specialised approach
3. The training and visit (T & V) approach
4. The cost sharing approach
5. The education institution approach.
6. The project approach
7. The farming systems development approach and
8. The agricultural extension participatory approach.

Throughout the various new fashions that have shaped rural development programmes over the past few decades in Nigeria, increasing emphasis has now been laid on the involvement of local people. Some advocates stress participation as a means of making programmes more effective and ensuring that activities continue after the programmes have ended (Van Veldhuizen *et al.,* 1997). They found that the very core of the development process to be, the increased control that people gain over shaping their own lives. Highly participatory agricultural extension is generally concerned with a broad range of agricultural subjects, shifting its local focus from, time to time as village problems change or as new needs arise.

2.9 Identification of Participatory Extension Approach (PEA)

In the late 1980s, it was realized that most technologies developed by researchers alone were inappropriate for smallholder farmers (Hagenimann, 1998). They confirmed that farmer participatory research became the approach to adapt technologies to farmers' conditions and by the 1990s, to develop technologies together with farmers. Farmers were now seen as partners in research and extension and the key players in the innovation process. This led to an understanding that the main key to agricultural development is to enhance farmers' capacities to develop and diffuse new technologies and techniques themselves from farmer to farmer. Chambers and Jiggens (1986) confirmed that the pioneering work led to a focus on participatory approaches that redefined the role of scientists and farmers, this also pointed to flaws in the technology sourcing, transfer model of adoption used in the past.

2.10 Perception of Participatory Extension Approach

Participatory Extension Approach is a way of improving the effectiveness of rural extension efforts by government agencies, Non-Governmental Organizations (NGOs) and other organizations engaged in rural development. PEA when institutionalized in extension organizations can help to improve organizational performance at the interface between the service providers (the extensionists) and the clients (the farmers). Hagenimann *et al*. (1998) described participatory extension that it is like a school of trying, where you try out ideas and share your experiences with others. Some characteristics of PEA as described by Hagenimann *et al*. (1998) are as follows:-

- they integrate community mobilization for planning and action with rural development, agricultural extension and research;
- they are based on an equal partnership between farmers, researchers and extension agents who can all learn from each other and contribute their knowledge and skill;
- it aims to strengthen rural people's problem solving, planning and management abilities;
- it promotes farmers' capacity to adopt and develop new and appropriate technologies/innovations (usually these are agricultural technologies and practices but it can also be in social institutions, in health, water and sanitation, education and other rural development domains);
- it encourages smallholder farmers to learn through experimentation, building on their own knowledge and practices and blending them with new ideas. This takes place in a cycle of action and reflection which is called `action learning';
- it recognizes that communities are not homogenous but consist of various social groups with conflicts and differences in interests, power and capabilities. The goal is to achieve equitable and sustainable development through the negotiation of interests among these groups and by providing space for the poor and marginalized individuals in collective decision making.

2.11 The Effect of Participatory Extension Approach on Farmers

The concept of participation has been a subject of lengthy debates because of its complexity and dimensions. The purpose of participatory agricultural extension is to increase the production of farming people as with other approaches, but it is also to increase the consumption and enhance the quality of life of rural people. Zinnah (1997) stated that participation can be viewed in several ways specifically, it also aims to: -

- increase the relevance of extension message to farm peoples' needs.
- enhance learning by clientele through purposeful participation and group pressure.
- secure appropriate recommendations from agricultural researchers through participatory feed back from farmers to researchers.
- assist in adjusting inputs supplies, credit and marketing to farmers' needs.
- increase the efficiency and effectiveness (and thus the cost effectiveness) of agricultural extension delivery.
- serve as an exercise of empowering rural people.

To motivate people for learning and action, one has to identify and address their key concerns. Only farmers themselves can effectively identify, clarify and prioritize these issues and formulate their needs. The extension worker facilitates people's own analysis. This process harnesses farmers' natural energy and they become motivated to commit themselves to initiating action and for sustainability of the programme. To change the rural farmers for better based on their felt needs, the following steps have to be followed for a sustainable development.

1. Entering the community and building trust.
2. Identifying and supporting effective local organizations.
3. Feedback to the community (farmers).

4. Raising awareness among the farmers and the community.

5. Identifying community needs.

6. Prioritizing problems and needs

7. Searching for solutions.

8. Mandating local institutions.

9. Action planning

10. Learning through experimenting and trying out new ideas.

11. Mid-season evaluation of the experiments and new techniques.

12. Process review, self-evaluation and planning.

Participation is a goal in itself to give farmers more opportunities to influence their own future and gain more power in the society. It is desired for farmers to participate in decision making regarding the extension programme because participation makes it possible to achieve more profound changes in the ways people think. By establishing dialogue with the farmers and respecting their views, researchers and extension workers shall learn to do things in the farmers' way. Participation enhances research/extension to understand farmers' decision making in a sequence and this would lead to mutual trust and confidence between them (the extension workers, the farmers and researchers).

Sayers and Campbell (2001) emphasized that sustainable improvements to the livelihoods of poor tropical farmers require a different type of research aimed at enhancing the capacity of the rural people to adapt to changing conditions rather than at delivery "finished technologies". Focus should be directed more holistically on complex-content-social, ecological, economical and institutional which determines success or failure in achieving impact.

2.12 Participation in Development

Participation in development is a process of equitable and active involvement of all stakeholders in the formulation of development policies and strategies and in the analysis, planning, implementation, monitoring and evaluation of development activities. To allow for a more equitable development process, disadvantaged stakeholders need to be empowered to increase their level of knowledge, influence and control over their own livelihoods, including development initiatives affecting them (Voh, 2002). Development is an objective that every country, state or individual wants to achieve. It is in this regard that countries of the world are divided into developed and underdeveloped or developing countries. The desire of each country is to become developed. Rogers (1996) sees development as a type of social change in which new ideas are introduced into a social system in order to produce higher per capita incomes and level of living through more modern production methods and improved social organisation.

Today, there is growing realization that development is concerned with people rather than material things. Nigeria accordingly has to change its development strategy. Instead of economic growth, emphasis is now placed on poverty eradication. Development is thus beyond the economic criteria. Development must therefore be conceived of as, a multi-dimensional process involving changes in social structures, attitude and institutions, as well as the acceleration of economic growth, the reduction of inequality and the eradication of absolute poverty (Todaro, 1977). Ruthenburg (1974) sees agricultural development to depend to a high degree on technical innovations, that is, on the introduction of new products and new production techniques which give rise to a more favourable relationship between costs and return in farming.

Rogers (1996) in his opinion stated that development is concerned with change and one of its basic concepts is continuity. He emphasized that development must arise from within the community itself as peaceful yet radical change. Development does not mean everything new but building on natural links. Development goals vary in nature and its purpose is that the people should be better off in their own terms. Achieving what they want, being self-determining and self reliant must be part of the goals of development. Development then is the process of regions or communities or sectors to identify and maximize their own potential to contribute to society by participating more fully in all its activities.

Participation or involvement represents a departure from "Planning for" to "planning with" people (Zinnah, 1997). Participation has quite different connotations to different people and can take the form of : -

- Involving local people (individuals, groups, young and old, men and women, large and small farmers) to analyze their own problems
- Using local peoples' idea
- Letting people contribute to decisions, which affect them
- Respect and appreciation for local peoples' (e.g. farmers knowledge) and
- Empathy with the people one works with.

The processes that describe the approach consists of the following key elements or tools: Facilitation, Capacity building, Participation, Cost sharing, Institutional linkages and partnership, Information flow, Supervision, Monitoring and Evaluation, and Baseline (livelihood) analysis.

2.13 Analysis of Country Experiences Worldwide on Participatory Extension Approach

The World Conference on Agrarian Reform and Rural Development (WCARRD), organized by Food and Agricultural Organization (FAO) of the United Nations in Rome in 1979, suggested the clear advantage of the participatory approach. The analysis of country experiences in the implementation of the WCARRD programmes of action showed that increasing number of countries are showing interest and are trying the participatory approach in extension as a way of reaching large numbers of small scale farmers more effectively. Outstanding examples of such participation include the Small Farmers Development Projects in Nepal and Bangladesh, the Farmers Associations of Japan, Sri Lanka's Sarvodaya Shramada Movement, Ethiopia's Peasant Association, the Basic Village Education Project in Guatemala, the Turkana Indigenous Range Management Organization in Kenya, the Pueblo project in Mexico and the Local Brigades in the People's Republic of China (Axinn, 1988). The farmer to farmer sustainable agricultural movement in Latin America and its evolution and expansion in Nicaragua, Mexico and Honduras. Tananua foundations in Sumba Island of Indonesia which was assisted by World Neighbour Organisation.

Other experiences in Africa included successful development and spreading of soil and water conservation technologies in Masuingo, the modified "fana-juju" (a soil and water conservation technology) in Zaka district of Zimbabwe. Other technologies that spread fast among farmers in the same country (Zimbabwe) are cropped fields, mulching and intercropping which were tried in Gutu and Chivi Districts (Hagenimann *et al.*, 1998). In Senegal, the cooperation between Rural Community

Councils and the forest services in establishment, management and use of wood is a good example of participatory approach in forestry programmes.

In Nigeria, the participatory extension approach is currently in use by the Food and Agricultural Organisation (FAO) in some states in the National Special Programme for Food Security (NSPFS) which started in 2002 whereby farmers' needs in the crop and livestock sectors were identified using the participatory approach to plan for action and solve the needs. Chambers (1985) refers to this approach as "the farmer – first and last model". The basic assumption of the participatory approach is that farming people have much wisdom regarding production of food from their land, but their levels of living and productivity could be improved by learning more of what is known from outside.

It is assumed that effective extension cannot be achieved without the active participation of the farmers themselves, as well as of the research and related services. There is a reinforcing effect in group learning and group action and that extension efficiency is gained by focusing on important points based on expressed needs of farmers, by reaching more small farmers through their groups/organizations instead of through individuals. When research personnel do not participate with farmers and extension staff in setting priorities, there may be a lack of feed-back to the research agenda, and sometimes the generation of inappropriate technology (Axinn and Thorat, 1972).

2.14 Theoretical Framework.

The theoretical background for this study was based on the theories of social change and the concept of rural development. Strauss (1959) stated that the essence of human life is change, development and growth. However, the process of change involves interaction and so, individuals must be understood in terms of the groups in which they belong or participate. Social change refers to changes in social structure and social relationships and it involves a change in the structure or function of societal forms. Rogers and Shoemaker (1971) and Ake (1988) identified social change as the interaction of the different elements of social life especially the economic, social and political structure as well as the belief systems to produce changes within a nation or society. Social change is either planned or unplanned, a change is considered social when its widespread use affects societal pattern of daily life or the structure of its institution.

The theory of social change was used to examine the relationship between participating and non-participating farmers' production levels and to examine the cost and return analysis of participation in the project. The relevant aspect of the social change theory to this study is therefore the planned change - an interventionist perspective that seeks to introduce idea to achieve set goals. The planned change in this study is introduction of series of participatory extension activities, to create awareness and adoption of improved farm techniques with the specific objective to alter the undesirable situation which is the low-yields of sesame, associated with farmers' traditional production practice.

Gefu (1989) confirmed that all societies were at a particular development stage and were all "traditional" and that traditional societies would experience similar changes as it had happened to societies in developed nations and eventually became "modern". Some writers who emphasized transformation of culture believed that embebbed in the traditional society were cultural practices believed to be barriers to development. In order to develop, these cultural barriers have to be removed, particularly those cultural practices perceived not to be beneficial to the society.

Theoretically, therefore, one can hypothesize a relationship between increased production and certain factors that may determine it. In the context of this study, the participatory extension activities conducted with farmers which included problem identification, problem prioritization, solution identification, solution prioritization , participation in action plan and training on identified solution have effects on participating farmers' sesame production.

CHAPTER THREE

3.0 METHODOLOGY

3.1 The Study Area

The study was conducted in Ringim and Taura LGAs of Jigawa State. The State covers a land area of 22,210 square kilometers and is located between latitude 10^0 57′ and 13^o3′ North and longitude 8^0 08′ and 10^0 37′ East of the equator. It shares a common boundary to the north by Katsina State, Niger Republic and Yobe State. To the East and South the State is bordered by Bauchi State and to the west by Kano State. There are two well - marked seasons, the rainy and dry seasons. Rainfall is between June and September while the dry season lasts from October to May. The mean annual rainfall ranging from 260mm in the north to 1082mm in the south. The climate is tropical, the mean daily maximum temperature is 35^0C and 19^0C respectively. Throughout the State in December and January, the temperature can fall as low as 10^oC or lower at night. Most part of the State lies within the Sudan vegetation zone while some traces of Guinea savanna exists in the South (JARDA, 1998).

The State has a population of 2,829,929 of which majority are farmers (National Population Census, 1991) residing in the rural areas, comprising of a total of 373,000 farm families. The coverage of these farm families with agricultural extension activities has being facilitated by 376 Village Extension Agents (VEAs) at a VEA to farm families ratio of 1:1080 (JARDA, 1998). The major crops grown during wet season are millet, maize, sorghum, rice, groundnut, cowpea, vegetables, cotton and sesame. Wheat, maize, cowpea and vegetables are also grown during the dry season. Livestock production occupies a central stage as almost every household keeps one or more domestic animals such as sheep, goats, cattle, poultry and donkeys.

Farmers in the state are predominantly rural, small-scale, low-income dwellers whose production is largely dependent on unimproved technologies. Cultivable land appears to be plentiful, but farm sizes still remain small, ranging from 0.5 to 6.0 hectares (JARDA, 1998).

3.2 Sampling Procedure and Sample Size

Sesame is an economic crop produced in almost all LGAs of Jigawa State. However, the bulk of the production is within Zone II with the following LGAs leading in production Ringim, Taura, Gagarawa, Gumel and Maigatari. The sesame produced in other LGAs of the Zones although meager, constituted a significant proportion of the total production in the State.

After identifying the real farmers' problems, out of a total of one thousand, eight hundred and forty-six (1,846) sesame farmers in the study area, twenty (20) participating farmers were purposively selected based on their interest in the improved production technology. Similar members of non-participating farmers were randomly selected from the list supplied by SG2000/LGA to serve as control from each of the two selected LGAs. Eighty (80) sesame farmers served as respondents for this study. The selection of these two categories of farmers and the conduction of result demonstration plots (0.25 ha each) enabled the researcher to compare and evaluate production, yields, marketing opportunities, problems and prospects of sesame production within and outside the study area in Jigawa State.

3.3 Methods of Data Collection

In order to achieve the study objectives, both primary and secondary data were collected through individual and group interviews and a questionnaire instrument. Additional information was gathered through informal observations during transect walk and meetings and also from the conduct of result demonstration plots. The primary data were collected between June 2002 to April 2003 from forty participating farmers and forty non-participating farmers giving a total of eighty sesame farmers who served as respondents for the study.

The secondary data collected included rainfall records and the trend of sesame production and agricultural extension activities in the State which were supplied by JARDA. IAR/ABU, Zaria and SG 2000 supplied information on improved production technologies for sesame production. Information on the current trend of sesame production, and export, seed used in metric tons and hecterage cultivated in Nigeria were obtained from the Internet and the office of the National Sesame Seed Farmers Association of Nigeria (NSSFAN) in Abuja.

3.4 Analytical Tools

Various analytical tools exist for the analysis of farm production information. The tools of analysis employed in this study were descriptive statistics and Z-test.

3.4.1 Descriptive Statistics

The descriptive statistics used include measures of central tendency such as mean, percentages and frequency. These were used to satisfy objectives 1, 2 and 4. These tools were used to describe personal characteristics such as age, sex, farming experience, marital status, level of education, household size, annual income, planting pattern, cost of product, yields, among others to compare the participating and non-participating farmers.

3.4.2 Z-test

Z-test was used for objective 3. The analytical tool was used to test for significance in the production level of participating and non-participating farmers.

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{x^2_1}{n_1} + \frac{x^2_2}{n_2}}}$$

Where Z = is the calculated Z-value

x_1 = mean of production of participating farmers.

x_2 = mean of production of non-participating farmers.

x^2_1 = variance of production of participating farmers.

x^2_2 = variance of production of non-participating farmers.

n_1 = sample size of participating farmers

n_2 = sample size of non-participating farmers

Decision rule for the hypothesis was:-

Accept (Ho) if calculated Z-value is less than table value of 1.96 at 5% level of significance.

Reject (Ho) if calculated Z-value is greater than table value of 1.96 at 5% level of significant.

3.5 Definition and Measurement of Variables

1. **Age**: Refers to the chronological number of years that a selected respondent had lived since birth to the time of study. Most societies recognise age as a basis of stratification and it is an important factor that is expected to inhibit or facilitate the impact of a social interaction. Maigida (2000) stated that as workers get older, they are less likely to resign their jobs, they are stable and have fewer alternative of job opportunities.

Age of the respondent was measured as actual age in years as given by the respondent since birth to the time of the study.

2. Level of Education: Refers to acquisition of knowledge through formal or organised means or through schooling. The role of education is considered very important in the acceptance of new farm practices (Osuji, 1983). It involves the development of the mental powers that may enable the educated to view issues objectively rather than complying with traditional rigidity, that goes with the uneducated mind. Education makes it possible for people to share and use information for development. For rural people, education equips them with the ability to take advantage of developmental programmes such as the ones in agriculture. The relevance of education to agricultural development programmes could be seen in the opportunities that are opened to the educated farmer to read and understand extension bulletins, posters and instructional materials. Education is among the most important determinants of participation in development issues. It creates a favourable condition for communication and dissemination of improved technologies in agriculture.

Education was measured as the number of years the respondent have engaged in formal schooling. No formal school scored 0, one to seven years of schooling (primary school) scored 1, eight to twelve years of schooling (secondary school) scored 2 while thirteen years and above (post-secondary school) scored 3.

3. Farming Experience: This refers to the length of time in years that the respondent had been engaged in farming as an occupation. The practical experience of a farmer counts a lot in his ability to adopt or reject an improved production practices.

Farming experience was measured as the actual number of years since a respondent started farming generally as an occupation.

4. **Household Size**: Refers to the total number of people in the household which includes the wives, children and dependents who reside within the family and eat from the "same pot" (Hill, 1975). Atala (1980) stated that in most societies, the size of the family is usually related to the socio-economic status of the family head. A farmer's major task is to provide enough food for the family. A large family size would mean more food and therefore more effort to provide this food. Farmers rely mostly on family labour especially that their children perform some of the farm operations. The marital status of the farmers is important as it revealed any societal, socio-cultural, economic or family bound constraints that can affect farmers production level or participation in agricultural extension activities.

Size of household was measured as the total number of people living within the family at the time of this study.

5. **Income:** Refers to the total amount realized by a respondent in a year from the sale of crops produced during the year (wet-season and dry season crops) and other agricultural products. Income is used in maintaining the family, procurement of production inputs and other social and economic activities of the farm-family.

This was measured as the total amount realized by the respondent from the sale of crops produced and other agricultural products during the year 2002.

6. **Extension Visit**: Refers to contact by Extension Agents (EAs) with farmers in delivering extension messages to farmers or the farmers seeking for information from the EAs. This partly depends on the frequency of contact between the extension agents and farmers. Farmers who are visited more often tend to participate in agricultural activities than farmers who are not visited (Maigida, 2000). Farmers may not be visited by the extension agents because of poor roads, poor transportation system and some farms are inaccessible.

Extension visit was measured as the actual number of times in a season that the farmer had contact with the EA during wet season 2001.

7. Participatory Extension Activities: This refers to the participatory extension activities conducted with participating farmers before and during the production process. The activities were directed towards involving the farmers in identifying their real problem, create awareness on improved production techniques and action plans to remedy the problem.

This was measured as the total scores attained by a respondent for participating in the participatory activities in the project. The highest score for these activities was 6 while the non-participating farmers recorded zero (0) for not participating. The scoring for these activities is as follows:

a) **Meetings:** Refers to the coming together of farmers through arrangements in order to discuss common issues related to production problems facing the farming community. Agendas are followed during a meeting in order that issues and problems are attended to one after the other for the development of the community. In a meeting, each participant has the right to voice out his or her feelings before the officials and members during the deliberation.

Meetings was measured as actual number of time(s) a respondent attended meetings for deliberations. Once represented 1 score, twice was represented by 2 scores while 3 scores for three times.

b) **Problem Identification:** Refers to coming together of the farmers (in a sitting) to identify difficulties in production that needs attention and thought of the farmers and the extensionists in finding solutions to the problems sited. Problems are location and farm family specific because an immediate problem to one farm family may be of less importance to another family. Problems may never end because solutions to a problem sometimes leads to the emergence of another problem.

This was measured as 1 score for the respondent who attended the problem identification exercise, while 0 for otherwise.

c) **Solution Ranking:** Refers to the degree of importance attached to the suggested solutions found to a problem. This meant that some solutions would be ranked high while others are low. The high ranked solutions must have received consensus of the meeting members.

This was measured as 1 score for the respondent who attended the solution ranking exercise while 0 for otherwise.

d) **Training:** Refers to imparting skills to a target audience to effect positive changes in their know-how and prepare them for improvement in their profession (farming). Training involves given practical instructions on the job. The training venue should be a conducive place and must consist of a facilitator, audience group and training materials for better understanding.

This was measured as 1 score for a respondent who attended the training session organized on the improved production technology and the conduct of the result demonstration plot while 0 for otherwise.

Production: Production which is the dependent variable referred to all the processes followed in sesame production from site selection to tilling the soil and to harvesting and threshing. The participating farmers followed all improved agronomic practices for sesame production while the non-participating farmers were engaged in their usual traditional way of farming in the quest to attain crop yield. The area under production for this study was 0.25 ha for both categories of farmers while cost of production and yields were later compared between the two groups of sesame farmers to see the effect of participatory extension activities on sesame production.

Yield was collected based on number of bags of sesame (average of 75 kg/bag) harvested within the demonstration plot and the control. The yield attained from the production was later converted from bags into kg/ha for ease of computation and comparison.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Study Objective One: describe the socio-economic characteristics of sesame farmers studied

4.1.1. Age Distribution of the Respondents

Various studies have emphasized the importance of socio-economic factors as influencing the decision of farmers on farming activities. Information from the fieldwork conducted, indicated that all the respondents (80 farmers) were adult males. Majority (35%) of the participating farmers were between the ages of 25 to 35 years while majority (37.5%) of the non-participating farmers were between the ages of 46 to 55 years. The least (15%) age category of the participating farmers ranged between 46 to 55 years while the least (17.5%) category for the non-participating farmers ranged between 56 to 85 years of age (Table 1). Out of the eighty (80) farmers interviewed, the youngest of them all was twenty-five (25) years old while the oldest was eighty five (85) years of age. This meant that majority of the respondents in the participating farmers group were of middle age with mean age of 30 years while the non-participating farmers were older with mean age of 51 years.

Table 1: Age Distribution of Respondents.

Respondents Age (yrs)	Participating farmers		Non-participating farmers	
	Freq.	%	Freq.	%
25-35	14	35.0	7	17.5
36-45	13	32.5	11	27.5
46-55	6	15.0	15	37.5
56-85	7	17.5	7	17.5
Total	40	100.0	40	100.0

4.1.2 Length of Time In Farming of the Respondents

The study revealed that majority of the respondents were full-time, low income farmers with their main occupation as farming. Majority (37.5%) of the participating farmers had acquired farming experience in crop production between 6 to 10 years. The least (5%) among the participating farmers had acquired farming experience of between 1 to 5 years. Majority (57.5%) of the non-participating farmers had acquired farming experience of 21 years and above while the least (7.5%) among the non-participating farmers had acquired farming experience of between 1 to 5 years (Table 2). This revealed that the participating farmers were younger and had acquired less years of farming experience when compared with the non-participating farmers. The participating farmers can afford to take risks and uncertainties in agriculture because of their exposure to agricultural innovations through their education. The non-participating farmers were older and were perhaps more sensitive to risks in agriculture because of their past experiences in agriculture and thereby afraid of possible failures of using innovations in agriculture.

Table 2: Distribution of Farmers According to Length of Time in Farming.

Respondents farming experience (yrs)	Participating farmers		Non-participating farmers	
	Freq.	%	Freq.	%
1-5	2	5.0	3	7.5
6-10	15	37.5	5	12.5
11-15	5	12.5	5	12.5
16-20	11	27.5	4	10.0
21 and above	7	17.5	23	57.5
Total	40	100.0	40	100.0

4.1.3 Educational Background of the Farmers

The study revealed that majority (42.5%) of the participating farmers had acquired up to secondary school education while 10% had either acquired primary or post secondary school education (Table 3). Majority (75%) of the non-participating farmers had no formal education and this was likely to affect their exposure to innovations been introduced into the communities while only 10% of the non-participating farmers had acquired post-secondary school education. There is always the need to enhance the general educational background of the small scale farmers in order to improve their productivity and income. Sidhu (1976) emphasised the importance of education and literacy in the development process particularly in agricultural development. Atala (1980); Atala and Abdullahi, (1991); Agbamu (1993); Eziakor (1990); Voh (1978) also found in line with this study that the level of farmers' education is believed to influence the use of improved technology in agricultural production and hence, farm productivity.

Table 3: Distribution of Farmers According to Level of Education.

Level of Education	Participating farmers		Non-participating farmers	
	Freq.	%	Freq.	%
No formal education	15	37.5	30	75.0
Attended Primary school	4	10.0	1	2.5
Attended Secondary school	17	42.5	5	12.5
Attended Post-secondary school	4	10.0	4	10.0
Total	40	100.0	40	100.0

4.1.4 Marital Status and Number of Children of Respondents

The survey revealed that almost all (94 %) of the respondents were married while only 6 % were not married and were among the participating farmers. Majority (54%) of the respondents had two wives while 31 % had only one wife and only 8 % of the respondents had three wives, non of the respondents had four (4) wives.

The African family systems allow relatives to be accommodated as members of the family, eating from the same pot, contributing to family labour and making joint financial decision related to agricultural production. The survey revealed that the lowest number of children recorded among the married farmers was only one child while the highest number was eighteen children. Majority (42.5%) of the participating farmers had between one to four children, 32.5% had between five to eight children while only 5% had thirteen and above number of children. Majority (35%) of the non-participating farmers had between five to eight children, 22.5% had between one to four children, 20% had thirteen and above number of children while only 10% had between nine and twelve children.

Most of the children within the household constitute to family labour, which relates to the total area of land cultivated and the amount of produce harvested by the household. Table 4, showed the total number of children owned by the respondents and not all the children contribute to family labour. The reason for the low contribution was that each child/relative has his own personal farm or occupation independent of the guardian and the younger ones were engaged in schools in the mornings which reduced the time they could be available on the farm for farming activities. So, the household leaders had to use hired labour on the farms. Children/relatives gave helping hands only during peak periods on the farm such as during sowing, weeding, fertilizer application and harvesting.

Table 4: Children Distribution of Respondents

Number of children of respondents	Participating farmers		Non-participating farmers	
	Freq.	%	Freq.	%
0	5	12.5	5	12.5
1-4	17	42.5	9	22.5
5-8	13	32.5	14	35.0
9-12	3	7.5	4	10.0
13 and above	2	5.0	8	20.0
Total	40	100.0	40	100.0

4.1.5 Size of Farm Holdings

The study revealed that the smallest land acquired among the respondents was 0.8 ha. devoted to farming while the biggest land acquired by a respondent was 20.0 ha. of cultivable land. Majority (42.5%) among the participating farmers had up to 3.0 ha to 5.9 ha of land devoted to crop production (related crops produced in the area), 22.5% had up to 2.9 ha, 20% had between 6.0 to 8.9 ha, 10% had 12.0 ha and above while only 5% of the participating farmers had between 9.0 to 11.9 ha of land put to crop production. Majority (55%) of the non-participating farmers had 3.0 to 5.9 ha of land put to crop production, 32.5% had cultivable land up to 2.9 ha, 7.5% of the respondents in the non-participating farmers group had between 6.0 to 8.9 ha of land while only 2.5% (1 respondent) had 12.0 ha and above area of land put to crop production during the wet season (Table 5).

The results from this study revealed that the non-participating farmers had more land area put to crop production than the participating farmers, this was because the non-participating farmers were older and had more family responsibilities than the participating farmers. This meant that, the non-participating farmers needed to put more area of land into production in order to attain a given uniform yields because of the traditional method they used when compared to the participating farmers who used the improved techniques of production. Other studies by Wouldiams *et al.* (1984) and Agbamu, (1993) found in line with this study that the improved production techniques when used on the farm by farmers usually increase farmers yields within a given area of land.

Table 5: Distribution of Respondents According to Total Area of Land put to Crop Production

Land acquired by Respondents (ha)	Participating farmers		Non-participating farmers	
	Freq.	%	Freq.	%
0.1-2.9	9	2	13	32.5
3.0-5.9	17	42.5	22	55.0
6.0-8.9	8	20.0	3	7.5
9.0-11.9	2	5.0	1	2.5
12 and above	4	10.0	1	2.5
Total	40	100.0	40	100.0

Results from this study revealed that the poorer ones among the farmers (respondents) owned less land area (0.8ha) while the richer ones owned bigger land area of about 20.0ha devoted to crop production. The survey data also revealed that the larger the size of the farm families the bigger the farmlands owned and the better the labour available to the family for agricultural production.

4.1.6 Occupation of Respondents

The field work analysis indicated that, the major occupation of the respondents was farming and they were low income small scale farmers who rely solely on their cultivable land for agricultural production. Ninety percent (majority) of the respondents were full-time farmers who were engaged in crop production, 5 % of the respondents combined farming with livestock production while only 2.5 % of the respondents were engaged in fishing and motor-cycle hire. Other secondary occupations of the respondents included trading, driving, carpentry, brick laying, hand crafts, civil service and politics. The secondary occupations were done during the off-season periods of the year to enable the farmers, get some income for family use.

4.1.7 Total Income of Respondents in 2001

Total income of the respondents were calculated based on the amount of money realised from the sales of crops produced and income realised during the year (2001) from non-farm activities. The results of the field survey revealed that majority, 30% of the participating farmers realised between ₦50,001:00 to ₦100,000:00 or ₦100,001:00 to ₦200,000:00 during 2001 while only 10% realised between ₦7,500:00 to ₦25,000:00 during the year (Table 6). Majority (32.5%) of the non-participating farmers realised between ₦50,001:00 to ₦100,000:00 during the year while only 7.5% realised between ₦7,500:00 to ₦25,000:00 during the year 2001. The field study revealed that there was no much difference in the total income of both the participating and the non-participating farmers in the project in the year 2001 (before the project).

Table 6: Income of Respondents in the year 2001.

Amount (₦)	Participating Farmers		Non-Participating Farmers	
	Frequency	Percentage	Frequency	Percentage
7500-25000	4	10.0	3	7.5
25001-50000	5	12.5	8	20.0
50001-100000	12	30.0	13	32.5
100001-200000	12	30.0	9	22.5
200001 and above	7	17.5	7	17.5

The field study also revealed that the socio-economic characteristics of farmers in the study areas were similar to what have been found by numerous studies in the rural areas of Hausaland (Baba, 1975; Norman, 1976; Voh, 1980; and Atala and Abdullahi, 1991).

Tables 7 and 8 revealed the comparison of socio-economic variables between the participating and non-participating farmers. The mean age of the participating farmers was 44 years while the non-participating farmers recorded 47 years. The mean years of farming experience to the participating farmers was 15 years while the non-participating farmers recorded 22 years. This revealed that the non-participating farmers had acquired more years in crop production business than the participating farmers.

Table 7: Socio-economic Variables of Participating farmers (n = 40).

Variables	Statistics			
	Min	Max	Mean	SEM
Age of respondents (years)	25	85	44	2.3573
Farming experience (years)	4	35	15	1.2850
Education	0	18	6	0.8605
Household size	0	10	2	0.3580
Income (₦)	3000	680250	79797.75	18070.035
Extension visit	0	20	6	0.8438

Table 8: Socio-economic Variables of Non-participating farmers (n = 40).

Variables	Statistics			
	Min	Max	Mean	SEM
Age of respondents (years)	27	75	47	1.8011
Farming experience (years)	4	48	22	1.7658
Education	0	17	3	0.7850
Household size	0	9	3	0.3906
Income (₦)	2600	259200	57939.50	9666.591
Extension visit	0	20	4	0.4520

4.2 Study Objective Two: sesame cropping patterns and agronomic practices

4.2.1 Crop Production Practices

The study revealed that crop production, in the study area was practised under subsistence farming. Majority of the respondents confirmed that they were only engaged in rainfed agriculture while very few among the respondents moved to nearby fadama areas for dry season farming. The respondents were usually engaged in multiple cropping systems with sesame. The analysis revealed that 8% of the respondents grew sesame/millet, 10% grew sesame/cowpea, 9% grew sesame/sorghum, 74% (majority) of the respondents grew sesame as a sole crop. These findings showed that the commonly consumed food items in the study area, were the crops used in the multiple-cropping system with sesame. Other mixed cropping systems with sesame found within the areas were those with groundnuts and vegetables.

4.2.2 Ridging

The field survey analysis revealed that all the respondents (100%) constructed ridges on their farms before sowing sesame seeds. Ninety-seven percent (almost all) of the respondents constructed their ridges at an inter-row spacing of 75cm while only 2.5% (only one respondent) constructed his ridges at 1 metre apart. The uniformity of the spacing and the ridging habit by farmers were related to the use of oxen and Emcot plough which many of the respondents had.

4.2.3 Planting Methods

Among the planting methods available for sesame production, only two were practised by the respondents. An overwhelming majority (97.5%) of the respondents planted their sesame seed by dibbling, only 2.5% drilled his sesame seed while none of the respondents had ever broadcasted their sesame seed during sowing. This planting method was in-line with what is practised in most sesame growing areas of the State. The recommended practice for sowing sesame is by dibbling seeds in holes of 25 cm apart of which most non-participating farmers were not complying with. The participating farmers sowed their sesame seeds at 25 cm apart on rows of 75cm apart.

4.2.4 Variety and Seed Rate

Varietal selection is one of the most important aspects of crop production which when combined with proper farm management, leads to the attainment of optimum yields by farmers. The study revealed that 100% (all) of the participating farmers planted one of the two improved varieties of sesame (E-8 and Yandev-55) while majority (55%) of the non-participating farmers sowed local variety (Dan-Ausar) of sesame which has low yield potentials, lower oil contents and dark in colour, while 22.5% of the non-participating farmers sowed the two (2) improved varieties (E-8 and Yandev 55). This revealed that some of the non-participating farmers (45%) used the improved varieties of sesame, which has the ability to increase their yields even when using their traditional system of farming (Table 9). This revealed that the increase in yield recorded by some non-participating farmers was due to the improved varieties of sesame used in sowing. This also revealed that the non-participating farmers showed some level of interests in the improved production technology, this would go a long way in the dissemination and adoption of the improved technology among sesame farmers in the state.

The field work revealed that majority (60%) of the respondents in the non-participating farmers group used seed rate of 14 kg/hectare, 20% used 11kg of seed/hectare, 15% used 18kg of seed/hectare, while 5% used 22 kg of seed/hectare. The participating farmers used the recommended seed rates of between 5-8 kg per ha.

Table 9: Types of Sesame Varieties planted by the Respondents

Varieties	Participating farmers		Non-participating farmers	
	Freq.	%	Freq.	%
E-8	20	50.0	9	22.5
Yandev-55	20	50.0	9	22.5
Local	0	0	22	55.0
Total	40	100.0	40	100.0

4.2.5 Time of Planting and Spacing

The fieldwork survey revealed that 65% of the respondents planted their sesame in June, 34% planted in July while about only 1% planted their sesame seed in August, 2002. All the participating farmers planted their sesame at a spacing of 25 cm between plants. Majority (30%) of the respondents in the non-participating farmers group, spaced their plants at 50cm between plants, 25% spaced at 25cm, 15% spaced at 30cm, 2.5% spaced at 40cm, 20% spaced at 60cm, 5% spaced at 75cm, while only 2.5% (one respondent) spaced his plants at 1 metre and above between plants. The study also revealed that the non-participating farmers used wider crop spacing which had affected their yields negatively because of low plant population found on their plots which subjected their sesame plots to serious weed competition. The recommended spacing is 25 cm between plants and 2 plants per stands.

4.2.6 Weeding

The study revealed that all the respondents (100%) weeded their sesame plots. Majority (65%) of the participating farmers weeded their sesame plots twice, 32.5% weeded three (3) times while only 2.5% (one respondent) weeded his sesame plot once during the growing season. Majority (75%) of the non-participating farmers weeded their plots twice, 25 % weeded their plots thrice during the growing season while not even one non-participating farmer (respondent) reported to have weeded his sesame plot once (Table 10). The study also revealed that majority of the respondents, weeded their sesame plots twice during the growing sesame. The study revealed that the third weeding done by some respondents was uneconomical because it raised the cost of production thereby reducing farmers' income.

Table 10: Number of times respondents weed their sesame plots.

Weeding	Participating farmers		Non-participating farmers	
	Freq.	%	Freq.	%
Once	1	2.5	0	0
Twice	26	65.0	30	75.0
Thrice	13	32.5	10	25.0
Total	40	100.0	40	100.0

4.2.7 Thinning

All the respondents (100%) thinned their sesame plants. Majority (65%) of the respondents thinned to 3 plants per stand, 22.5% thinned to 2 plants per stand, 20% thinned to 4 plants per stand while only 2.5% of the respondents thinned to either 1 plant or 5 plants per stand. This revealed that thinning was an important aspect of production in the study area, the recommended thinning rate is 2 plants per stand. Thinning, if not done properly creates competition between sesame plants weeds, nutrients, moisture and sunlight and this has serious negative effect on the production resulting in reduced yields.

4.2.8 Types of Fertilizers, Time and Methods of Application

The result of the field survey revealed that 90% (majority) of the respondents applied fertilizers while 10% did not apply any fertilizer on their sesame. Majority (45%) of the farmers applied only inorganic fertilizers, 35% applied only organic fertilizer while only 10% of the respondents applied both inorganic and organic fertilizers.

With regards to the methods of fertilizer application, (100%) all the participating farmers applied their fertilizers by side placement (dig and bury method) between June and August, 2002. Majority (45%) of the non-participating farmers applied their fertilizers by placement (place and go method), 33% by broadcasting, while only 10% used side placement (dig and bury method) and 10% did not apply any fertilizer. The study revealed that, the best method of fertilizer application was the side placement (dig and bury). With this method, no fertilizer wastage, all the nutrients in the fertilizers are readily made available to the crop plant for growth and vigour. An inorganic fertilizer when applied wrongly leads to excessive use of fertilizers which would affect farmers' yield negatively and could cause soil salinity and adds to the cost of production.

Ten (10) percent of the respondents in non-participating farmers group applied their fertilizers in the month of May, this referred to mostly the farmers that used organic fertilizer and the application (broadcasting) of the fertilizer was done just before ridging commenced in the field. Twenty (20) percent of the respondents applied their fertilizers in June, 45% made their application in July, 10% applied in August while only 2.5% applied his fertilizer in September, 2002. The study revealed that majority of the respondents in the non-participating farmers' group applied their fertilizers any how they liked which could have less effect on their crop yields.

4.2.9 Harvesting and Drying

Findings of the field-work survey revealed that majority (57.5%) of the respondents harvested their sesame plots in October, 40% harvested in September while only 2.5% of the respondents harvested their sesame in the month of November, 2002. Drying is an important aspect which a farmer has to undergo before threshing and winnowing. The number of days, which farmers allowed their harvested sesame to dry, varies. One respondent (2.5%) allowed his harvested sesame to dry in 10 days, 5% of the respondents dried in 12 days, 17.5% of the respondents dried in 15 days, 3% dried in 18 days, 5% dried in 20 days, 20% dried in 21 days while majority (45%) of the farmers responded that they allowed their harvested sesame to dry in 14 days.

Irrespective of the number of days to dry, sesame should be properly dried before threshing and winnowing to avoid waste and contamination, 14 days is adequate for sesame plant to dry properly. To improve the quality of sesame seed, participating farmers threshed on a polythene sheet to avoid mixture with sand and other materials.

4.2.10 Other Farm Operations in sesame production

The field survey revealed that other farm operations carried out in sesame production included clearing and burning of shrubs, earthening up, rogueing, spot harvesting, winnowing, measuring of produce into bags using "mudus" and transporting. Majority (58%) of the farmers revealed that they earthened-up their ridges during production and this served as a dual purpose of weed control and second fertilizer application (Urea) by burying. One (1) respondent revealed that he was engaged in transplanting and spot harvesting. All the farmers interviewed responded that they threshed, winnowed, bagged and finally store in bags or transport to markets for income.

4.3 Study Objective Three: input/output levels for sesame production between participating and non-participating farmers.

The analysis revealed that ridges were spaced at 75cm apart by all the eighty (80) respondents and the sowing dates for the two groups of farmers were the same, June and July, 2002. The seed rate per hectare used by the participating farmers was between 5-8 kg/ha while the non-participating farmers used seed rate of 8-24 kg/ha with an average of 16 kg/ha. The study revealed that the participating farmers had closer intra-row plant spacing than the non-participating farmers.

The average yield of the participating farmers during the project was 942 kg/ha while the non participating farmers, recorded an average yield of 567 kg/ha, an average difference of 375 kg/ha. The average yields of the participating and non-participating farmers during wet season of 2001 before the introduction of the participatory activities were 632 kg/ha and 496 kg/ha respectively giving a difference of 136 kg/ha (Table 12). The increase in yields of sesame recorded by the participating farmers during 2002 could have been due to increased farmers' awareness of improved production technologies (Appendix I) for sesame as a result of the participatory extension activities introduced.

There was a little difference in the cost of production per hectare of sesame. The average cost of production during the research for the participating farmers was ₦21,002.00 while those of the non-participating farmers was ₦21,276.00, a difference of ₦274.00/ha. The income of participating farmers at harvest, taking an average cost of one bag (75kg) of sesame to be ₦3,570.00 (₦48.00/kg) was

₦45,216.00/ha while the income for the non-participating farmers was ₦27,216.00/ha giving a difference of ₦18,000.00 as profit per hectare for the participating farmers over the non-participating farmers' income.

Sesame seed is such a produce that in most cases the longer it is stored during the year (if demand is high) the higher the price you get per given quantity. With the average cost of a bag as stated by the respondents after 3 months from harvest (March, 2003) as ₦3,993.00 (₦53.00/kg), the income of each participating farmers rose to ₦49,926.00/ha while the non-participating farmers got ₦30,051.00/ha (Table 11), giving a difference of ₦19,875.00/ ha for the participating farmers as compared to the non-participating farmers' income during the research.

Almost all the participating farmers in the project revealed that they intended to adopt the improved production technologies because they had seen reality and had increased their sesame yields, from the use of the improved technologies. This is in agreement with the findings of Atala *et al*. (1992) and Igbokwe (1985) whereby the high positive relationships between income and adoption could be attributed to profitability of the improved varieties of sesame adopted by farmers as demonstrated by the findings of this study. The cost and returns of sesame production per hectare to the participating and non-participating farmers during this study is shown in Table 11.

The cost and return analysis showed that the participating farmers at harvest received a profit of ₦1.15 on every ₦1.00 invested during production while after 3 months, this increased to a profit of ₦1.38 on every ₦1.00 invested. The study also revealed that

Table 11: Cost and Return Analysis of sesame production

Item	Cost per hectare	
	Part. Farmers (₦)	Non-part. Farmers (₦)
Seeds (₦100.00/kg)	650.00	1,600.00
Land preparation (including ridging)	2,385.00	2,233.00
Sowing	1,278.00	1,472.00
Weedings	4,795.00	3,922.00
Organic Fertilizer and application	2,140.00	1,590.00
Inorganic Fertilizer and Application	6,412.00	6,840.00
Insecticide and application	30.00	70.00
Harvesting	1,793.00	1,895.00
Threshing/Winnowing	1,519.00	1,654.00
Total cost of production	21,002.00	21,276.00
Average yield	942kg	567kg
Average price/kg at harvest	48.00	48.00
Gross income at harvest	45,216.00	27,216.00
Net income at harvest	24,214.00	5,940.00
Gain on every N1.00 invested in production at harvest		
Average price/kg after 3 months of harvest	1.15	0.28
Gross income after 3 months of harvest	53.00	53.00
Net income after 3 months of harvest	49,926.00	30,051.00
Gain on every ₦1.00 invested in production after 3	28,924.00	8,775.00
months of harvest	1.38	0.41

the non-participating farmers during harvest, got a profit of 32 kobo (₦0.32) on every ₦1.00 invested during production while after storing for 3 months the profit increased to 41 kobo (₦0.41) on every ₦1.00 invested during production. This revealed that the total amount of money the participating farmers put into production of sesame, they got in returns 100% or over, this is in line with CIMMYT recommendations. CIMMYT (1980) emphasized that a minimum rate of return as low as 50 percent may be acceptable if the technology introduced to farmers simply represents an adjustment in the current farmers' practice. If the technology is new to the farmers and requires that they learn some skills, a 100 percent or above minimum rate of return is a reasonable estimate i.e. equivalent of "2 to 1" return, as this study has practically demonstrated from the average net-income of the participating farmers in the project.

The level of production among sesame producers was found to be lower than the potential yield obtainable in the study area (Ilu, 2002). To improve the level of sesame production among farmers, participatory extension activities were planned and executed among selected farmers (participating farmers) to create awareness in farmers of the improved technologies of production with the aim of improving the farmers yields. The results in Table 12 which were obtained from comparing the production levels of the participating and the non-participating farmers before and after the project revealed the impact of the participatory extension activities on the participating farmers' production.

Table 12. Variability in Production Levels (yield in kg/ha) between participating and non- participating farmers before (2001) and after execution of participatory extension activities (2002)

Category	Before execution of participatory Extension Activities (2001)					After execution of participatory Extension Activities (2002)				
	Mean yield (kg/ha)	Min.	Max.	SE Mean	Standard Dev.	Mean yield (kg/ha)	Min.	Max.	SE Mean	Standard Dev.
Participating farmers (N=40)	632	360	1050	28.28	178.88	942	750	1350	26.16	165.44
Non- participating farmers (N=40)	496	360	660	11.21	70.88	567	450	700	10.06	63.64

The analysis on Table 12 revealed that average yields of both participating and non participating farmers was estimated at 632 kg/ha and 496 kg/ha in 2001 respectively. This was before the execution of the participatory extension activities in 2002. However, after the execution of the participatory extension activities with farmers (participating farmers), yield was measured again to see if there were changes in production level. Results obtained and shown in Table 12 shows that there was remarkable difference in yield between the participating and non-participating farmers during the research in 2002.

The yield for participating farmers ranged from a minimum of 750 kg/ha to a maximum of 1,350 kg/ha with a mean yield of 942 kg/ha. The non-participating farmers though had better yields in 2001 was by far, lower than what was obtained among the participating farmers. The non-participating farmers yield ranged from a minimum of 450 kg/ha to a maximum of 750 kg/ha with a mean of 567 kg/ha. When the differences in yields during the years 2001 and 2002 between participating and non-participating farmers were compared for the respective years; it was found that though participating farmers mean yield was higher by 136 kg in 2001, the difference rose to 375 kg in 2002. This showed 275% increase in yield of participating farmers in 2002 when compared to 2001.

The variability among all farmers studied was found to be low. The standard error of mean estimation for participating farmers was found to be 28.28 and 26.16 in 2001 and 2002, respectively. This mean that yield among the farmers was more stable in 2002 than in 2001. This was also found to be true among the non-participating farmers because the standard error of mean estimation being 11.21 and 10.06 in 2001 and 2002 respectively. Despite these remarkable difference in production level between participating and non-participating farmers, statistical significance of these differences in production level was tested. The Z-test analysis at 5% (0.05) level of probability revealed that calculated Z = 13.38 which is greater than table value of 1.96. Hence, H_1 was accepted that there was significant difference between the production level of the participating and the non-participating farmers during the study.

From the foregoing, it is clear that the production level of participating farmers has been remarkably improved after execution of the participatory extension activities with the participating farmers in the study area. The slight improvement in yield of non- participating farmers in the year 2002 could be as a result of their interaction with some of the extension workers and the participating farmers whereby awareness was created that production can be improved through the improved production technologies. Talhart effect (environmental factor) that could have acted on the production of the non-participating farmers is assumed to have acted also same on the participating farmers since all the farmers were in the same study location. This study substantially improved the yields of the participating farmers as has been the case in other past studies (Bunch, 1991; UNDP, 1992; Shah, 1994; and Pretty, 1995).

4.4 Study Objective Four: Perception of Participating Farmers on Continuous Use of the Improved Production Technology

Ninety (90) percent of all the respondents in the participating farmers' group indicated their wouldingness to continue with the project after this year, while 10%

stated that they did not want to continue with the project. When asked for reasons why farmers wanted to continue with the project, 67.5% (majority) of the respondents stated that they wanted to continue because of the increased in yields they got. Fifteen percent (15%) of the respondents stated that their reason for continuation was because of the increase in their income, 25% because of acquisition of improved varieties of sesame and 5% was to acquire knowledge and skills for proper management of their farms.

Table 13: Reasons for continuous use of improved production technology of sesame.

Reasons	Frequency of Respondents	Percentage of Respondents
Increased yields	27	67.5
Increased income	6	15.0
To acquire knowledge and skills for proper farm management	2	5.0
To acquire improved varieties of sesame	1	2.5

Out of 10% of the respondents who wished to discontinue with the project, 2% stated that their main reason was high cost of production inputs while 2% was because of unstable price (market fluctuation) which may lead to low price of sesame at harvest. Two (2)percent responded that they wanted to discontinue because of improper contacts with extension workers while 2% complained of insufficient cash with which to procure inputs for the production technology.

Table 14: Reasons for discontinuous use of improved production technology of sesame.

Reasons	Frequency of Respondents	Percentage of Respondents

High cost of production inputs	1	2.5
Unsuitable price of sesame at harvest	1	2.5
Improper contact with extension workers	1	2.5
Insufficient cash to procure inputs	1	2.5

The results of this study revealed that the majority of the participating farmers were woulding to continue with the project. This is evident from the yields they got and the plans they had to expand their sesame production in 2003 wet season. Majority of the non-participating farmers also stated that they wanted to join the project by fully using the improved production technologies of sesame production in 2003. This also revealed that there would be increase in the rate of dissemination of the improved production techniques among sesame farmers in the study area.

Ninety five percent (95%) of all the respondents (both participating and non-participating farmers) revealed that they faced one problem or the other in sesame production while only 5% did not respond. Forty-two percent (42%) of the respondents revealed that their most serious constraint to sesame production was lack of inorganic fertilizers at the right time during the growing season. Ten (10) percent of the respondents indicated that their major problem was low price attached to sesame at harvest, 11% revealed that their most pressing problem was shattering of the crop after harvest, 10% stated that improved seeds of sesame were not readily available to farmers during the planting period. Ten (10%) percent complained of high cost of inputs, 7% complained of unstable weather conditions during the growing season. Two (2%) percent complained of problems associated with harvesting and drying due to theft and only 2% complained of insect pests and disease attack on their sesame crop.

Table 15:Problems encountered by farmers in sesame production.

Reasons	Frequency of Respondents	Percentage of Respondents
Lack of inorganic fertilizers at the right time	34	42.5
Low price attached to sesame at harvest	8	10.0
Shattering of sesame seed after harvest	11	13.75
Improved sesame seeds were not available at	8	10.0
planting	8	10.0
High cost of inputs	6	7.5
Unstable weather conditions	2	2.5
Problems related to harvesting and drying	2	2.5
Insect pests and disease attack		

Evidence from related studies which support these findings are found in the studies by Herschback (1983); Popola (1981) and Sethuraman (1976) who found that the major constraints faced by operators of small establishments in the informal sector were lack of capital, dependence on what might be limited supply of goods and services and inaccessible credit. The implication showed that the above problems when addressed by extension service through participatory extension approach would serve as a key to agricultural and rural development in Jigawa State and Nigeria in general. This could be a starting point for agricultural development through increased production per unit area. This would mean more income to the farmers, if marketing problems are simultaneously addressed.

4.4.1 Farmers Response on Solution to Sesame Production Problems

The farmers (respondents), when asked to suggest possible solutions to problems encountered in sesame production, majority (55%) suggested that the government should change the system of fertilizer distribution from the hands of politicians to the Farmers' Organisations through the State Agricultural Development Project (ADP). Fifteen percent (15%) suggested that extension workers in the State should disseminate the improved production technologies of sesame production to farmers. Seven percent (7%) suggested that Research Institutes in the country with mandates on sesame research should do more research to benefit farmers. It was also suggested by 15 % of the respondents that extension workers should assist farmers in organising the State and LGA chapters of Sesame Seed Growers Association (SSGA) for better coordination. Three percent (3%) of the respondents suggested that State Government should assist in establishing Sesame Commodity Board (SCB) in the State and only 2% of the respondents suggested the following:-

a. sesame should not be planted during heavy rainfalls.

b. purchase of sesame produce should be based on weight per kg/bag and not per bag as currently done by the local buying agents in the markets.

c. Federal, State and Local Governments should put subsidy on fertilizers.

d. sesame should be harvested at the right time, to avoid seed shattering.

Other suggestions made during planning sessions and meetings with the respondents, included land preparation equipments such as cultivator and Emcort ploughs should be made available to farmers at the right time, credit institutions should make agricultural loans available to farmers at the right time and the Federal and State government should assist in stabilizing the price of sesame for farmers to get better prices for their produce.

Table 16: Solutions to problems encountered in sesame production.

Solutions	Frequency of Respondents	Percentage of Respondents
State Government to modify fertilizer distribution	44	55.0
State Government to establish Sesame Commodity Board	3	3.75
State Government to put subsidy on fertilizers	2	2.5
Extension to disseminate production technology to farmers	12	15.0
Extension should assist farmers to form Sesame Seed Growers Association	7	8.75
Research Institutes to conduct research to benefit farmers	6	7.5
Avoid planting sesame during heavy rainfalls.	2	2.5
Procure sesame seed on weight (kg) and not per bag	2	2.5
Harvest sesame on time	2	2.5

4.4.2 Storage and Marketing of Sesame

Majority (85%) of the farmers responded that they sold part or all of the sesame they produced. Eight percent (8%) of the respondents did not sell their sesame while 7% failed to respond. When asked the duration of time they stored their sesame after harvest before selling, 15% sell immediately after harvest, majority (20%) of the farmers responded that they stored for only two months while 16% sell after 4 months while 15% sell after 6 months and only (1%) stored for a year. When asked to comment on the varieties of sesame the farmers preferred for selling, 40% preferred Yandev-55, while 24% preferred E-8, 28% preferred local varieties and only 8% did not respond.

When the farmers were asked whether they faced marketing problems or not, in disposing of their sesame harvest, majority (84%) of the respondents revealed that they faced marketing problems while 16% stated that they did not face any marketing problem. When asked, what were the marketing problems they faced, majority (69%) of the farmers stated that they faced the problem of middle-men who reduced sesame prices for their own personal interests. Sixteen percent (16%) of the farmers stated that their main problem was that there was no Commodity Marketing Board that has been established for sesame in the state while 3% revealed that their main problem was that local purchase of sesame produce done at the village level was in bags/"mudus" and not on weight of the produce i.e. kg/bag. Other marketing problems faced by farmers as revealed during the field survey included:-

a. lack of functional Sesame Seed Growers Association in the State;
b. lack of good transportation system to create a good network between farmers and buyers in the State and outside;
c. only few people consume sesame locally in the State;
d. unnecessary delay in payment of produce after purchase is deliberately done by some buying agents to bring down the unit price of sesame, and
e. lack of good storage facilities and problems of pests that attack produce during storage.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION, RECOMMENDATIONS

5.1 SUMMARY

Due to the significance of sesame as a major income generating crop, its remarkable industrial uses and as food for both man and livestock in Nigeria, in this created the interest in the research. The persistent decline in yields of sesame generated the research need in the use of improved production technology of sesame to address this problem of yield decline through participatory extension activities. Sesame cultivation should be improved upon in both quantity and quality so as to increase farmers income and the foreign exchange earnings of the country.

However, past studies have been directed at studying adoption rates, factors related to diffusion of agricultural innovations, marketing of food crops, inputs and their effects on crop yield, economics of crop production and production problems in Nigerian agriculture. In contrast, very few studies have been conducted in the country on the use of participatory extension approach to increase farmers' production or to address their immediate problems. Participatory extension approach is new in Nigerian context. Its perceived advantages and examples of where it is used in the world are found in the literature reviewed.

This study therefore, attempted through participatory extension activities, to improve sesame production in Jigawa State. The study was conducted in Ringim and Taura LGAs of Jigawa state. The two (2) LGAs fall within Zone II, of Jigawa State Agricultural and Rural Development Authority (JARDA), and the LGAs were among prominent sesame growing areas of the State.

Forty (40) participating farmers were purposively selected based on their interest in the project while forty (40) non-participating farmers were randomly selected from the list of sesame farmers based on their interest to serve as control for the study. This was to enable the production of the two categories of farmers to be compared, to see the effect of participatory extension activities on production. Farmers and extension workers were trained on the conduct of result demonstration plots using the improved production techniques of sesame production and data collection.

Primary and secondary data were collected and used in the final write-up. The first set of data were collected by the zonal extension team and the researcher during meetings, formal and informal discussions, problem identification, solution ranking exercise and transect walk (reconnaissance survey). The second sets of data, were collected during the conduct of the result demonstration plots (0.25 ha) exercise (from June 2002 to November 2002) by the Extension Agents (EAs) in the project while the third sets of primary data were collected through interview schedule which was also administered by the EAs in the project, this started in October, 2002 and ended in April 2003.

Specifically, descriptive statistics and Z-Test analyses were carried out to examine the effects of participatory extension activities on production. A descriptive analysis of the eighty (80) respondents in the study area was carried out to understand the socio-economic characteristics of these sesame farmers, their cropping patterns and agronomic practices followed, their production capacity and their perceptions in the continuous use of the improved production technologies.

Results of the study showed that the least age of the respondents was 25 years, 35% of the participating farmers fell within the age bracket of 25-35 years while majority (37.5%) of the non-participating farmers were within the age bracket of 46 – 55 years. Majority (42.5%) of the participating farmers had acquired up to secondary school education while majority (75%) of the non-participating farmers had no formal education and this was likely to have affected their exposure to agricultural innovations. On length of time in farming (crop production), majority of the participating farmers had acquired less farming experience (4-12 years) than the majority of the non-participating farmers (13-25 years).

The survey showed that majority, 94% of the respondents were married with minimum of one (1) child and maximum of eighteen (18) children. Major occupation of the respondents was farming, 91% were full-time farmers engaged in crop production. The size of farm holdings of the farmers interviewed ranged between 0.8 to 20.0 ha. The farmers were engaged in both sole crop sesame and in multiple cropping patterns with millet, sorghum and cowpea.

All the respondents constructed ridges on their farms before planting as in the recommended practices of production. The uniform 75cm spacing between ridges found in the study area was due to the use of oxen and Emcort ploughs in the construction of ridges. The dibbling, planting method was engaged by almost all the farmers in the project while plant spacing of between 25cm to 1m were engaged by the respondents. The varieties used in the project included E-8 and Yandev-55, which were improved while Dan-Ausar was the local variety sowed by some of the non-participating farmers. Fertilizer used by the respondents included compound fertilizers (NPK), Urea fertilizer and Farm Yard Manure (FYM). Majority (59%) of the farmers interviewed harvested their sesame in late September and early October, 2002 and majority (48%) of the farmers dried the harvested sesame in 14 days before they threshed and winnowed for storage or market.

When inputs and output levels of production for the participating and the non-participating farmers were compared, the participating farmers used seed rates of 5 - 8 kg/ha while the non-participating farmers used between 8-24 kg/ha. The average yield of the participating farmers during the research was 942 kg/ha while the non-participating farmers harvested an average of 567 kg/ha, a difference of 375 kg/ha. The average net income of the participating farmers at harvest was ₦24,214.00/ha while the non-participating farmers got ₦5,940.00. For those farmers who stored their sesame for up to 3 months after harvest, the net income of the participating farmers rose to ₦28,924.00/ha while the non-participating farmers attained ₦8,775.00/ha within the same period. This proved that there was 100% or above revenue return from the use of the improved production technologies.

Majority (81%) of the participating farmers stated that they would want to continue with the use of the improved production technologies and gave their reasons for the continuation while the remaining 19% wanted to discontinue with the technologies and their reasons for discontinuation was also given.

The Z-test analysis revealed that there were significance differences between the participating and the non-participating farmers' production levels which revealed the advantage of using the improved production technology and the impact of participatory extension activities on sesame production.

5.2 CONCLUSION

The result of the study revealed that farmers' production levels could be improved upon through the use of participatory extension activities to address farmers' immediate production problems. It could be concluded from this study that the project had proved another view of why agricultural innovations are not getting to the majority of the small-scale farmers because of inability of the technologies/extension to address farmers immediate needs. This research found out that the participating farmers would want to continue with the use of improved technologies of production in future. The result of this study revealed that the non-participating farmers were copying the production related activities carried out on the research demonstration plots of the participating farmers. It showed that there were clear evidence of much better sesame plots with the participating farmers when compared to the non-participating farmers in the project (Table 15).

Jigawa State has vast potentials for sesame production. The realization of this potential would, however, depend on strengthening the extension system and the provision of enabling environment that would make production inputs readily available to farmers at the right time in a sustainable manner. As shown by this study, it is no exaggeration to conclude that the technological opportunities when offered to farmers in a participatory manner (approach) could be a starting point for agricultural development in Nigeria whereby our production can be sustainable, meet up much better with the demands of the World Market, increase farmers income and eventually raise farmers standard of living.

5.3 RECOMMENDATIONS

This study, like any other one of its kinds, was expected to proffer some valuable policy guidelines that can be advanced to improve farmers conditions. Based on the findings of this study, the following recommendations should be taken into consideration, in order to promote and increase the production of sesame in

Jigawa state in particular and Nigeria in general.

1. Participatory extension activities should be introduced to farmers in Jigawa State in order to address farmers immediate problems for sustainability. This is necessary because farmers problems are many but participatory approach would lead to the identification of the real problems of farmers whereby plans and action could be made to remedy the situation.
2. Government should encourage the participation of private investors in the area of farm inputs supplies to farmers and should also create enabling environment and framework that would make the private sector function effectively in making agricultural inputs readily available to farmers in affordable prices and in a sustainable manner.
3. The study observed that farmers in the study area had problem of getting inputs such as improved seeds and fertilizers. It is therefore recommended that Jigawa State Government, through the ADP, should revive the JASCO commercial stores that were in existence in the 1980s. These stores can be used to store seeds, fertilizers and agro-chemicals and thus prevent adulteration.
4. There is the need for the State Government to embark on enlightenment campaign through Radio/TV programmes, distribution of pamphlets and extension visits to villages to inform farmers in general of the need to embark on improved production technologies of sesame production.
5. The JARDA's extension network in the State should be re-examined to make it more efficient at the Block and Cells levels in order to ease production and marketing. Extension services and farmers organizations should work

together to involve all farmers in all crop production and related issues for sustainable production.

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APPENDIX

APPENDIX I

IMPROVED PRODUCTION TECHNOLOGIES FOR SESAME PRODUCTION

To attain optimum yields, farmers have to follow package of improved management practices of sesame production. These included the following:-

i. Site selection: Select well drained sandy loam foils. Heavy soils or water logged areas should be avoided as this leads to stunted growth in sesame. Soils should be free drain. Sites with too much shade should be avoided.

ii. Land preparation: The land for sesame production can either be prepared manually or mechanically well ahead of rains. The land should be free from debris and rubbish. Farm sanitation is very vital. Ridges can be constructed either by oxens or tractors at a spacing of 75cm apart as soon as the rains starts. Keeping the soil loose has been found to encourage good germination and satisfactory establishment.

iii. Seed rate: The optimum seed rates have been found to be between 5kg to 8kg of sesame seed per ha. Source of seed is very important.

iv. Seed dressing: Dress sesame seeds meant for planting by Apron star 42 WS at the rate of 1 sachet of seed dressing chemical to 3kg of seed.

v. Planting dates: plant sesame when the rains are fully established i.e. late June or early July.

vi. Plant spacing/population: Seeds should be planted at the depth of between 2cm to 4 cm and the soil should lightly cover the seeds in the planting holes. Small finger pinch of seeds should be dropped per hole at a spacing of 25 cm between holes. At 2 weeks, the plants should be thinned to 2 plants per stand i.e. over 60,000 plants/ha.

vii. Fertilizer application: Sesame responds to nitrogen and phosphate fertilizers. Apply 4 bags (50kg) of NPK 15-15-15 at thinning and 1 bag of Urea per ha at 6 weeks after sowing. Generally, the application of appropriate fertilizers in the right proportion would increase yields. The recommended rates are as follows: Nitrogen 20-60 kg/ha, phosphorus 30-50 kg/ha, while potassium should be 30 kg/ha. Methods of fertilizer application should be the dig and bury method.

viii. Weed control: Hand weed, 2-3 times depending on the severity of weeds on the farm. Avoid serious weed competition with sesame in the field.

ix. Insect pests and disease control: As of now, no severe recorded pest problems on sesame in the state. Cercospora leaf spot (fungal disease) is a major disease of sesame and can be controlled by planting resistant varieties, dress seeds, or by spraying. Benlate or Difolatan. For insect pests, look out for grasshoppers, caterpillar, these can be controlled by spraying with Karate 2.5 EC, Decis 2.5 EC and Perfekthion 50 EC.

x. Harvesting: The crop matures in about 90 days and requires a dry spell for harvesting. The crop should be harvested when 90% of the capsules turn from green to yellow. Delayed harvesting would subject the plant to shattering, which would result in a big loss to the farmer and attracts black ants to damage the sesame seed.

xi. Drying and threshing: The harvested plants should be tied upright on a mat or tarpaulin spread underneath to dry for about 14 days. When the plants are completely dried they should be turn upside down over mats or tarpaulin and beaten to shake out the seeds. The seeds should be winnowed properly to remove thrash and rubbish and then store in dry-clean bags for subsequent needs.

xii. Yields: Yields of about 1,200 kg/ha have been recorded in the state.

APPENDIX II

AHMADU BELLO UNIVERSITY, ZARIA

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY
M.Sc AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY - 2001/2002

TOPIC: Impact of Participatory Extension Tools on Sesame Production in Two Local Government Areas of Jigawa State

CHECKLISTS FOR FARMERS' INTERVIEW.

A. FARMERS' SOCIO-ECONOMIC CHARACTERISTICS/BACKGROUND DATA

Farmer's Name:..

Age: ....

3. Village/Town: ....

4. Local Government Area: ....

5. Farming experience in years ....

6. Marital status (tick) Married [ ] Single [ ]

7. How many years of Formal education have you?

Primary .... Years Secondary .... years

Post-secondary .... Years

Others (specify) .... Years

b. If informal, how many years of education have you?

Quranic school .... Years Adult education .... years

Others (specify) .... Years

B. SIZE OF HOUSEHOLD

8. Total number of children: ....

9. Number of children staying with you at present? Males.... Females ....

10. Number of wives at present ....

11. How many of the household members contribute to the family labour? .... member(s)

C. OCCUPATION

12. What are your occupations? Mention the major one first

……………………………………………………………………………………..

……………………………………………………………………………………..

D FARMER'S ANNUAL INCOME LEVEL

13. Give an estimate of amount of money you earned from the sale of each crop in the last growing seasons. (January to December 2001)

Crop	Farm size (ha)	Amount invested ()	Amount realised ()

14. Give an estimate of amount of money you earned from each non-farm activity last year (January to December, 2001).

Non-farm Activities	Income ()

E. CROPPING SYSTEM

14. What is the total land area owned by you for farming? ………….. (Ha.)

15. List the sesame cropping systems you follow on your farms

Cropping system .... Ha. cultivated

……………………………….................. .... (Ha.)

...............……………………………….... .... (Ha.)

………………………………................... .... (Ha.)

16. Do you ridge your sesame field/plot? Yes [ ] No [ ]

17. If yes, what is the spacing between ridges .... (cm.)

18. What method of planting do you employ on your sesame field/plot(s)? pls tick.

Dibbling [ ]

Drilling [[ ]

Broadcasting [ ]

19. What varieties do you plant?

....

....

How many "mudus" (1.8kg) of sesame seed do you plant per 0.25 ha

.... (mudus)

20. What spacing do you employ between plants? .... (cm.)

21. In which month of the year do you plant your sesame? .... (month)

21. Do you weed your sesame field/plot(s)? Yes [ ] No [ ]

22. How many times do you weed? .... (time(s))

23. Do you thin your sesame? Yes [ ] No [ ]

24. If yes, how many plants do you leave per stand? .... plants/stand

25. Do you apply fertilizer? Yes [ ] No [ ]

26. If yes, which type do you apply? Please tick

    i. Inorganic fertilizer [ ]

    ii. Organic fertilizers [ ]

27. If yes, what method(s) of fertilizer application do you employ?

    .... (Application method)

    ....

28. When do you apply the fertilizer? .... (month)

29. When do you harvest your sesame? .... (months)

30. How many days do you allow your sesame to dry? .... days

31. What other farm operations do you perform on your sesame field/plot?

    ....

    ....

    ....

F. FARMER'S INPUT/OUTPUT LEVELS OF PRODUCTION

32 What was the cost of land preparation (0.25 ha.) on your sesame field/plot

....

33 What was the cost of sesame seed used in planting your plot (0.25 ha.)

....

34. What was the cost of planting your sesame plot (0.25 ha) ....

35. What was the total cost of weeding your sesame plot (0.25 ha) ....

36. What was the cost of organic fertilizer (if applied) per plot (0.25ha)………..

37. How many bags of inorganic fertilizers did you applied per plot (0.25 ha.)

Type of fertilizer	No. of 50kg Bag(s)	Cost of 50kg Bag(s)
Superphosphate	……………………….	………………
Compound	……………………….	………………
Urea	……………………….	………………
Others specify………..	………………………..	………………

38 What was the total cost of pesticides and application? (0.25 Ha.)

………………………………………….

39. What was the cost of harvesting your sesame plot? (0.25 ha.) ……………….

40 What was the cost of threshing/winnowing your harvested sesame seed?

…………………………………….

41. What was the yield of your sesame plot (0.25 ha.) this year (2002) ……………………………. bags/0.25 Ha.

42. What is the cost of one bag of sesame seed at harvest? …………………….

43. What is the cost of one bag of sesame seed after 4 months and above after harvest? …………………………………………….

44. What was your sesame yield in the year 2001 per 0.25ha plot…………. bags/0.25 ha.

G. EXTENSION VISITS

45. Do you have contact with extension workers? Yes [ ] No [ ]

46. If yes, how many times is the contact per wet season? ……….. (number only)

47. Have you ever visited extension worker/extension office? Yes [ ] No [ ]

48. If yes, how many time per wet season? …………….. (times)

49. What were the reasons for the visit(s)?

………………………………………………………………………………..

………………………………………………………………………………..

……………………………………………………………………………….

50. Have you ever conducted result demonstration plot? Yes [ ] No [ ]

If yes, on what crops and how many times?

Crops	Times
....	....
....	....
....	....

J. SUSTAINABILITY OF THE PROJECT

52. Do you want to continue with the project after this year (2002)?

    Yes [ ] No [ ]

53. If yes, why do you want to continue?

    ....

    ....

    ....

54. If no, why do you want to discontinue?

    ....

    ....

H. FACTORS MILITATING AGAINST SESAME PRODUCTION

55. What problems do you encounter in sesame production and what solutions were taken?

Problem	Solution
………………………………… ………………………………… ………………………………… ………………………………… …………………………………	………………………………… ………………………………… ………………………………… ………………………………… …………………………………

56. What suggestions would you give for a successful sesame production?

……………………………………………………………………………..

……………………………………………………………………………..

……………………………………………………………………………..

I. MARKETING OF SESAME SEED

57. Do you sell part or the whole of sesame you produced? Yes [ ] No [ ]

58. If yes, for how long do you keep your sesame for sell after harvest? ……………………………….Months and how much do you sell a bag at the time of sale? ……………………………./bag

59. When do you usually sell your sesame? ………………. (month only)

60 What type of sesame seed do you prefer for sale? ………………………. (type of sesame only)

61. Do you encouter any problem in marketing your sesame? Yes [ ] No [ ]

62. If yes, what are the marketing problems you faced?

……………………………………………………………………………..

……………………………………………………………………………..

……………………………………………………………………………..

AHMADU BELLO UNIVERSITY, ZARIA
DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY
M.Sc AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY - 2001/2002

TOPIC: Impact of Participatory Extension Tool on Sesame Production in Two Local Government Areas of Jigawa State

CHECKLISTS (B) FOR PARTICIPATING FARMERS' INTERVIEW.

A. FARMERS' SOCIO-ECONOMIC CHARACTERISTICS/BACKGROUND DATA

1. Farmer's Name:...
2. Village/Town: ....
3. Local Government Area: ....
4. How many meeting(s) did you attend before the conduct of the sesame demonstration plot ..………………… time(s)
5. Were you present at the problem identification session organized with farmers in the village. Yes [ ] No [ ]
6. Were you present at the solution identification and ranking exercise organized with farmers in the village. Yes [ ] No [ ]
7. Were you present at the transect-walk exercise taken around the village with farmers . Yes [ ] No [ ]
8. Were you present during the training session organized at Agro-service centre Ringim. Yes [ ] No [ ]
9. Demonstration plot
   - (a) Did you sowed improved sesame seed . Yes [ ] No [ ]
   - (b) If yes, which variety did you sow ……………………………………………….
   - (c) Did you sowed your sesame seed at the correct spacing of 40 cm between plants. Yes [ ] No [ ]
   - (d) Did you apply fertilizers. Yes [ ] No [ ]
   - (e) If yes, which type of fertilizer (s) did you apply, (i) Organic fertilizer (ii) inorganic fertilizers.
   - (f) Which method of application did you used ……………………. (method

only).

(g) Which month of the year did you applied the fertilizer(s) …………..
(month only).

(h) How many time(s) did you weed your sesame plot during the growing sesame ……………. (time (s) only).

(i) Which month of the year did you harvested your sesame plot …….. (month only).

(J) Did you use any agro-chemical/pesticide on your sesame during the growing season. Yes [ ] No [ ]

(k) Were you present at the farmers field day organised in the village
Yes [ ] No [ ]

(l) Have you ever discussed any production issue with other sesame farmers Yes [ ] No [ ]

APPENDIX III

RESPONDENTS AND EXTENSION WORKERS IN THE RESEARCH

Ringim LGA participating farmers.

1. Alhaji Hamidan Yandutse - Farmer leader
2. Yau Dashiro Innawa
3. Halliru Yau Kwartawa
4. Isa Garba Kwartawa
5. Halilu Bako Kwartawa
6. Umaru Ahmadu Kwartawa
7. Hamisu Dabi
8. Wada Umaru Dabi
9. Ibrahim Na'awna
10. Magaji Sankara
11. Auwalu Dakwaso
12. Mohammadu Inuwa Gabarin
13. Mall. Sabo Yakasawa
14. Mohammed Isah Gasakole
15. Maiunguwa Kulluru Hamza
16. Umaru Ahmed
17. Alhaji Wada Ringim
18. Alhaji Usaini Yanbiyu
19. Mall. Auwalu Gyangyan
20. Mall. Hamisu Zango-Kanya

Ringim LGA Non-Participating Farmers

1. Habibu Musa Kwartawa
2. Suleiman Mudi
3. Isyaku Abdu Kwartawa
4. Mallam Iliya Yakasawa
5. Mallam Ali Zaki
6. Haruna Usman Dabi
7. Musa Iliya Dabi
8. Muazu Abdu Dabi
9. Alh. Jubrin Adamu Dabi
10. Alh. Muazu Kwartawa
11. Tanimu Mohammed Sintilmawa
12. Mall. Ibrahim Yandutse
13. Datti Umaru Tsakani
14. Adananu Ladan Yandutse
15. Rabilu Danladi Kyacame
16. Hamidan Galadi
17. Alh. Kabiru Gabarin
18. Dan-Halima Ladan Kyarama
19. Mohammadu Mustapha Z/Kanya
20. Mallam Lawan Zangon-Kanya

Taura LGA Participating Farmers

1. Alaramma Mallam Aminu Maje - Farmer Leader
2. Rashidi Hamisu Kiri
3. Ibrahim Mai-Mei Majia
4. Habu Dan Larai Majia
5. Jafaru Majia
6. Alh. Dalha Gambo Majia
7. Alhassan Arewa Abakura
8. Ado Habu Abakura
9. Saidu Danladi Majia
10. Abdu Ibrahim Maje
11. Badamasi Datti Majia
12. Mallam Dare Maje
13. Abubakar Moh. Sani Maje
14. Mallam Isiyaku Maje
15. Mustapha Ubale Maje
16. Abdu Ibrahim Maje
17. Alh. Yakubu Maje
18. Iliya Jahadi Maje
19. Mohammadu Sani Maje
20. Sule Karfe Maje

Taura LGA Non-Participating Farmers

1. Abdu Illa D/Dinya
2. Yau Mati Majia
3. Rabiu Sagaho Majia
4. Mallam Aminu Maje
5. Ahmadu Rufai Maje
6. Alh. Tsoho Yandutse
7. Alh. Nafiu Sabo Kanti
8. Alhaji Mutari
9. Alhaji Basiru
10. Manitu Ilu
11. Ibrahim Abdullahi
12. Mallam Alhassan
13. Mall. Garba Abubakar
14. Mall. Isa Haruna
15. Alhaji Nasiru Taura
16. Mallam Aminu S/Yaya
17. Mallam Musa Maiturare
18. Ibrahim Garba Kwana
19. Mallam Suleiman Aminu
20. Mallam Iliyasu Baffa

Extension Workers in the Research

1. Ismaila Isa Gabarin - SZEO II
2. Kamilu Yunusa - EA Yandutse
3. Magaji Muazu - EA Yakasaw
4. Ismaila Usaini - EA Gabarin
5. Usaini Iliyasu - EA Ringim
6. Aminu Mustapha- EA Majia
7. Murtala Zakari - EA Z/Maje