EFFECTS OF GROUP-BASED EXTENSION METHODS ON KNOWLEDGE AND PRODUCTION OF VEGETABLES AMONG DRY SEASON FARMERS IN SOUTHWESTERN NIGERIA

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CERTIFICATION

I certify that this study was carried out by Isaac Olukunle OKE, (Matric. No 139741) under my supervision, in the Department of Adult Education, University of Ibadan, Ibadan.

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DEDICATION

This research is dedicated to the BLESSED TRINITY-God the Father, God the Son, and God the Holy Spirit

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ABSTRACT

There are lots of constraints facing dry season vegetable production in Nigeria which can be corrected using the group-based extension services platform. Previous studies have focused on individual extension approaches that can only attend to one farmer at a time, thus limiting information dissemination. This study, therefore, investigated the effects of Farmers-Field School (FFS) and Demonstration Extension Methods (DEM) on knowledge and production of vegetables among dry season farmers in Southwestern Nigeria.

The study adopted a pretest-posttest, control group, quasi-experimental design with 2x2x3 factoral matrix. The participants were 233 dry season farmers (197 males; 36 females) with primary (123), secondary school (92) and tertiary (18) educational background respectively drawn purposively from Oyo (Experimental 38; Control 40), Osun (Experimental 43; Control 35) and Ogun (Experimental 45; Control 32) states. The FFS and DEM extension methods were used to introduce new vegetable varieties, drilling method of planting and fertiliser application as well as use of organic manure to participants in experimental groups while control groups employed traditional methods of vegetable production. *Celosia species* and *Amaranthus species* were two leafy vegetables involved in the study. Treatment lasted for 16 weeks after which the knowledge, adoption of improved technologies, yield of vegetables, income and expenditure of dry season farmers in both the experimental and control groups were compared. Seven hypotheses were tested at 0.05 significance level. Data were analysed using (Analysis of co-Variance) ANCOVA and Scheffe post hoc tests .

There was a significant main effect of treatment on knowledge of improved technologies by participants in experimental groups ($F_{(6,226)}$=4.27, η^2= 0.86). Oyo recorded highest level of increase in knowledge of improved technologies, followed by Osun and Ogun respectively. There was a significant main effect of treatment on adoption of improved technologies ($F_{(6, 226,)}$ = 8.83; η^2= 0.163). Highest level of adoption of improved technologies was recorded in Osun followed by Ogun and Oyo respectively. There was a significant main effect of treatment on yields (kg) of vegetable production of participants in experimental groups ($F_{(6,\ 226)}$=2.88, η^2=0.06), Oyo had highest increase in yields followed by Osun and Ogun respectively. There was a significant main effect of treatment on income on vegetable production ($F_{(6,\ 226)}$ = 3.41, η^2= .070). Highest increase in income was recorded in Ogun, followed by Osun and Oyo respectively. There was a significant main effect of treatment on reduction of dry season farmers' expenditure ($F_{(6,\ 226)}$ = 4.40; η^2 = .089); Oyo had the highest expenditure reduction followed by Ogun and Osun respectively. The male participants adopted the new technologies more than the female. Likewise, the level of adoption of new technology was higher among the participants with high level of education than with medium and low levels of education respectfully.

Group-based extension methods enhanced knowledge, new technology adoption, crop yield, and income of dry season vegetable farmers in Southwestern Nigeria. Thus, agricultural extension workers should be encouraged to adopt the use of two or more group-based extension methods to disseminate agricultural information to such categories of farmers.

Keywords: Group-based extension, Vegetable production, Dry season farming.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Three out of four poor people in developing countries live in rural areas, with majority relying, either directly or indirectly on agriculture for livelihood (World Bank, 2007). Suffice it to state that agriculture remains the main source of income for around 2.5 billion people in the developing world (FAO, 2003). In essence, the impact of the agricultural sector is wide-ranging, extending to economic growth, food security, poverty reduction, sustenance of livelihood, among others (Green, 2005).

Observably, after 50 years of independence, Nigeria is still battling with an agricultural sector characterised by food shortages and inconsistent agricultural policies. This trend has been attributed to the country's excessive reliance on rain-fed agricultural outputs, without due attention given to dry season farming. Succinctly, self sufficiency in food production will be very difficult to achieve in Nigeria if the country depends only on rain-fed farming. For self-sufficiency in food production to be realised, there is need to extend farming season beyond the rainy season through irrigated agriculture (Anambra State Agricultural Development Programme, 2000). Heavy dependence on rain-fed agriculture during conditions of erratic rainfall and recurrent droughts affects agricultural output, with adverse effects on the general economy. The World Bank (2001) estimates that hydrological variability currently costs the economy over one-third of its growth potential and has led to a 25 per cent increase in poverty rate. Enhancing public and private investment in irrigation development has been identified as one of the core strategies to delink economic performance from rainfall and enable sustainable growth and development (World Bank, 2006).

Obviously, there are two distinct seasons in Nigeria, the rainy (April to October) and the dry (November to March). Farmers are usually less busy on the farm during the dry season; therefore, irrigation farming serves as an alternative employment and additional source of income during this period. Dry season farming through irrigation contributes to the national economy in several ways. At the micro level, irrigation leads to an increase in yield per hectare and subsequent increase in income, consumption and food security (Bhaffarai & Pandy, 1977; Vaidya, 1994; Hussain & Hanjra, 2004). Irrigation enables smallholders to diversify cropping patterns, and switch from low-value subsistence production to high-value market-oriented production (Hangos, 2005). Dry season farming can benefit the poor especially through increased production, more yields, reduced risks of crop failure and all year round farm and non-farm employment (Hussain & Hanjra, 2004).

Dry season or irrigation farming at the aggregate level acts as production frontier to a higher level and makes crop production possible which is otherwise, risky, if not impossible, because of shortage of moisture. This has a positive effect on economic growth. Studies have shown that agricultural growth serves as an "engine" of overall economic growth, (Franks, 1997; Van Koppen, 2005), and irrigation-led technological changes were identified as the key-divers behind productivity growth in the agricultural sector (Dhawan, 1988; Alagh, 2001; Hussain & Hanjra, 2004).

The distinct dry season starting in November and lasting till the middle of March each year plays important roles in Nigerian agriculture. During this period, little or no rainfall is experienced and irrigated dry season farming remains the only viable option left for food vegetable production. The benefit of irrigation or dry season farming (which is the artificial supply of water for agricultural crop growth) in Nigeria is not limited to food supply, it also serves as a source of employment and income to dry season farmers during the dry season.

Notably, there are lots of constrain to dry season vegetable production. They include: non-availability of land, low prices, non-availability of credit, inadequate supply and high price of fertilisers, non-availability and high cost of improved seeds and inadequate extension services (Baba & Etuk, 1998). Others are water shortage, problem of pests and diseases, transportation problem, lack of storage facilities and poor marketing system.

Regardless of all these constraints, dry season farming is important and essential to boost food supply and the economy generally. For dry season farming to fully attain its rightful place and role in the Nigerian agricultural sector there is the need for improved extension services for the benefit of farmers. Extension service is the essential tool that can assist dry season farmers to attain the highest productivity possible. The aim may be to increase production, increase income or the improvement of family living (made possible by the increased income) and education for self-reliance in seeking and effecting improvements in the future.

Agricultural extension is a service which assists farm people through educational procedures, in improving farming methods and techniques, increasing production efficiency and income, improving their standard of living and lifting the social as well as educational levels of rural life. Swanson (1984) and Nagel (1997) define agricultural extension as the organised exchange of information for the purposive transfer of skills. This implies the information exchanged between farmers and extension agents is purposely to transfer new knowledge and skills to the farmers on their farms. Extension is a series of embedded educational and communicative intervention processes meant, among others; to supposedly resolve (usually multi-sector) problematic situations (Leeuwis and Van den Bun, 2004). Hence, extension is viewed as interventions aimed at solving problems on the farm in order to increase farmers' productivity. This process offers educational advice and information through the non-formal system to help farmers solve their problems. Invariably, with this, the efficiency in agricultural production and improved standard of living of the farmers' families would be gurateed.

A range of approaches to extension delivery have been promoted over the years. Early models focused on transfer of technology using a top-down linear approach, criticised due to the passive role allocated to farmers, as well as the failure to factor in the diversity of the socio-economic and institutional environments facing farmers and ultimately in generating behaviour change (Birner, 2006). A number of models have been implemented since the 1970s, combining different approaches with outreach services and adult education, including the World Bank's Training and Visit (T&V) model (Anderson

2006), participatory approaches (Hagmann, 1999) and most recently, farmer field schools (FFSs) (Berg & Jiggins, 2007). Additional extension models include ICT -based delivery which provides advice to farmers on-line and other approaches such as the promotion of model farms (Birner, Davis, Pender, Nkonya, Anandajayasekeram, Ekboir & Cohen, 2006).

The major limitation of individual extension approaches is that the extension agents can only attend to one farmer at a time and because of the limited number of the extension agents, only few farmers can be reached for the dissemination of agricultural information. The failure of many of these extension approaches to meet their set goals, coupled with inadequate personnel and limited budgets for supporting public extension, has led to continuous modification and experimentation with existing approaches (Birner et al., 2006). The approaches came under attack in the 1980s, due to the relatively high financial outlay required, making the individual approach unsuitable. These traditional extension approaches were criticised for providing a 'one size fits all' approach (Birner et al., 2006) which failed to factor in the diverse socio-economic and institutional environments faced by farmers as well as failing to involve them in the development of technology and practices suitable for their context, or to empower them more generally as problem solving decision makers. Ultimately extension has failed to achieve its main objective of farm productivity improvements, particularly in Africa (Birkhaeuser, Everson & Feder, 1991 Anderson, 2007). In addition, more intensive approaches were considered necessary to disseminate complex messages, on sustainable pest management. Since the 1980s, the approach to extension service delivery has drawn increasingly on more participatory methods, of which farmer field schools have become prominent (Van den Berg & Jiggins, 2007). Participatory approaches to extension are based on the idea that they create spaces for farmer self-learning and sharing and it allows the agents and agricultural researchers to learn from the farmers (Birner et al., 2006).

Farmer Field Schools (FFSs) originated in Asia as a means of achieving several objectives, central to this was the need to deliver training on 'integrated pest management' as an alternative to intensive pesticide spraying, which was severely damaging farm production, the environment and farmers' health. Integrated pest management (IPM) was developed in the 1960s and 70s (Kelly, 2005) and aimed to minimise pesticide use through the adoption of more 'natural' techniques of pest management. Integrated pest management methods promoted in FFSs typically ran from mere simple practices, such as not applying pesticides in the first 30 days after planting ('no early spray'), to more complex ones that require in-depth agro-ecological and crop management knowledge, such as being able to differentiate between beneficial and harmful insects, and creating a conducive environment for pest predators (Ricker-Gilbert, 2005).

Organic agriculture is a holistic production management system which promotes and enhances agro ecosystem health, including biodiversity, biological cycles, and soil biological activity (Muller, 2009). It emphasises the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, cultural, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system. An organic production system is designed to: enhance biological diversity within the whole system; increase soil biological activity; maintain long-term soil fertility; recycle wastes of plant and animal origin in order to return nutrients to the land, thus minimising the use of non-renewable resources; rely on renewable resources in locally organised agricultural systems; and to promote the healthy use of soil, water, and air, as well as minimise all forms of pollution that may result from agricultural practices (Alimentarius, 1999).

While there is a large literature dealing with issues on agricultural extension in developing countries, majority laid emphases on the outcome of the use of a particular method of extension on farmers. There is a dearth of literature on the use of two or more extension methods to disseminate dry season agricultural information to farmers. This research therefore, aimed at using the FFS and demonstration extension methods on the knowledge and production of vegetables among dry season farmers in Oyo, Osun and Ogun states. Therefore, two group-based extension methods; Demonstration and Farmer Field School (FFS) were used to disseminate new technologies to farmers. For this study, the new technologies to be transferred to farmers are organic manure application, new varieties of crops and new method of planting. Demonstration is a group extension approach designed to introduce practical skills to farmers in their natural environment.

There are a lot of constraints facing dry season vegetable production in Nigeria which can be corrected using the group-based extension services platform. Previous studies have focused on individual extension approaches that can only attend to one farmer at a time, thus limiting information dissemination. This study, therefore, investigated the effects of farmers-field school (FFS) and demonstration extension methods (DEM) on knowledge and production of vegetables among dry season farmers in Southwestern Nigeria.

1.2 Statement of Problem

In Nigeria, there are two distinct seasons, rainy and dry. The rainy season is the normal cropping season which starts from April and stops in October, while the dry season starts from November and ends in March. During the rainy season, the production of vegetable is high, resulting in the saturation of the market, but during the dry season there is usually the scarcity of this important farm product, leading to a high price due to inadequate supply. This seasonality has resulted in food insecurity, a challenge to sustainable food production. It has also been established that most farmers do not want to go into large scale production because they are apprehensive of high risk.

This has made the farmer to plant vegetables as intercrop of low significance as a way of avoiding risk. Even at this, it is still surprising that after more than two decades of horticultural research and extension activities in Nigeria; the nation is yet to be self sufficient in vegetable production

Major factors militating against high productivity among dry season farmers in Nigeria include: non-availability of suitable land for dry season farming, low prices of dry season crops produce, non-availability of credit, inadequate supply and high price of fertilisers, non-availability and high cost of improved vegetable seeds, non-availability and inadequate extension services. Others are water shortage for irrigation, problems of pests

and diseases, transportation problem, lack of storage facilities, adherence to traditional methods of planting crops and poor marketing system for dry season crops produce. These have resulted in low productivity experienced by dry season farmers which in turn made some dry season farmers abandon their farms for menial jobs in towns and cities.
The solution to all these problems is effective extension services that will take research results to farmers and present farmers' problems to research institutes and the government.

Notably, literature have shown that earlier approaches of technological transfer based on individual approach where the extension agents dealt with farmers on individual basis had many shortcomings: the passiveness of the farmers, high cost of extension services and inability to reach all farmers because only one farmer can be attended to at a time. These have led to the clarion call for the adoption of group- based participatory extension approaches. The group-based approaches considered in this study are farmer field school and demonstraton. The research will provide answers to these questions:

- What will be the effect of new technologies on farmers' yield and income?
- How effective are the group-based extension methods in transferring research results to dry season farmers in South-Western Nigeria?

1.3 Objectives of the Study

The broad objective is to examine the effects of two group-based extension methods on knowledge and production of vegetables among dry season farmers in south west Nigeria with a view to determine the modalities of promoting increased harvest and benefits during dry season.
The specific objectives are to:

i. establish the level of knowledge of vegetable production as a result of the group-based extension methods among dry season farmers.
ii. ascertain the level of adoption of the use organic manure, drilling method lanting and manure application, new crop varieties and new method of harvesting group-based extension methods

(treatments) on adoptions of organic fertiliser application, improved varieties of crops and crop planting methods among dry season farmers.

iii. determine the effects of the two group-based extension methods on dry season farmers' yield (production) , income and expenditure of dry season farmers' knowledge of vegetable production.

iv. ascertain the effects of farmers' age, sex, educational status and social status on the effects of the two group-based extension methods on dry season farmers' knowledge of vegetable production.

v. ascertain the effects of farmers' age, sex, educational status, and social status on the effects of the two group-based extension methods on dry season farmers' adoptions of organic fertilizer application, improved varieties of crops and crop planting methods.

vi. determine the effects of farmers' age, sex, educational status, and social status on the effects of the two group-based extension methods on dry season farmers' yield (production) and income.

1. 4 Significance of the Study

The expected findings of this study should help to spell out various support services that can boost the effective performance of agricultural extension agents in the discharge of their duties which should lead to the realisation of the goals and objectives of extension education. The anticipated findings of the study would serve as eye opener to the agricultural extension coordinators and assist them to understand the relevance of group-based extension methods which ensures farmers' participation with a view of adopting any of these methods as a means of transmitting new technologies to farmers to boost agricultural production in Nigeria. The expected findings of the study should also help other stakeholders in the field of extension education provide better extension services and communication facilities that hopefully will improve the performances of agricultural extension agents.

The expected findings of the study should provide means by which agricultural extension practices can be upgraded in Nigeria to compete with other developed nations of the world. Further, the study has the capacity of developing packages which will serve as models for agricultural extension programmes. The expected findings of the study shouldl further help the agricultural extension providers embark on expansion programmme for agricultural extension to make extension accessible to farmers yearning for increased agricultural production beyond their present level. Finally, the expected findings of this study should further add to the body of literature for students and future researchers in the field of adult education and agricultural extension.

1.5 Scope of the Study

The study investigated the effects of two group-based extension methods on the knowledge and production of vegetables among dry season farmers in South West Nigeria. The study was delimitated to examining the effect of Method Demonstration and Farmers' Field School Extension methods among dry season farmers in Oyo, Osun and Ogun states. The choice of these three states was based on their being close to each other, for proper monitoring and coordination of the experimental and control groups. The study locations covered three out of the six states that constitute the South-Western region of Nigeria to make the generalisation of the research result possible.

The Demonstration extension method was chosen because it is appropriate to introduce new skills to farmers which is seldom used by extension agents. Farmer field school was chosen because the system has been introduced in Oyo State in 1994and there is a need to test the approach for effectiveness for updating farmers' knowledge about new developments in agriculture. The towns covered were Ijaye (Oyo), Ilugun (Ogun) and Osogbo (Osun) for experimental groups and Omi Adio (Oyo), Ikire (Osun) and Imasai/Igbogila (Ogun). These locations were carefully selected because of the concentration of dry season farmers there which will make it convenient for the researcher to carry out group method demonstration and farmer field school teaching.

All the participants in the experimental and control groups were dry season farmers who were either full time or part-time dry season farmers who have been practicing dry season farming for at least two years. This group of farmers was chosen because they are often neglected by the extension agents who always consider their crops as minor, not usually listed among major crops. Two leafy vegetables, namely; Amaranthus spp. (green) and Celosia spp. (soko) were chosen for this study. These two crops are the most popularly grown dry season leafy vegetable crops in South-West Nigeria. The short gestation period of these crops also favoured a study of this nature.

1.6 Operational Definition of Terms

In this section, the terms, terminologies and concepts used are defined and explained as they were used in this study.

Extension: Extension is an educational process for bringing about the maximum number of desirable changes among the people, which involves both learning, and teaching and needs some tools or methods commonly known as extension-teaching methods. Extension involves communication and learning activities organied for rural people by educators from different disciplines including agriculture, health and business studies.

Agricultural Extension: The applicaton of scientific research and new knowledge to agricultural practices through farmer education. Agricultural extension and extension are used as synonyms in this thesis.

Extension-teaching methods: The extension-teaching methods are the tools andtechniques used to create situations in which communication can take place between the rural people and the extension workers. They are the methods of extending new knowledge & skills to the rural people by drawing their attention towards them, arousing their interest & helping them to have a sucessful experience of the new practice.

Agricultural Development: This refers to the totality of improvement in agricultural production, in order to bring about good nutrition and better income leading to improved living standards of farmers.

Vegetables: Vegetable is an edible plant or part of a plant, but usually excludes seeds and most sweet fruits. This typically means the leaf, stem, or root of a plant. Amaranthus spp. (green) and Celosia spp. (soko) are the two leafy vegetables involved in the study.

Dry Season Farmers: These are farmers that engage in the planting of crop plants (especially vegetables) during the dry season either in the flood plain, river banks, low lands and/or irrigated land. Water is usually supplied to crops artificially by manual wetting or through irrigation pipes.

Group-Based Extension Methods/Approaches: Group-based learning approaches or methods in agriculture are means of building farmer competencies and networking through gathering farmers to engage in learning and in ongoing processes of experimentation and development. The group size ranges from 20-30 but all members should be dry season farmers for this study. The teachings take place on farmers' farms and should not last more than 12-16 weeks. Extension methods and approaches are used as synonyms in this thesis.

Demonstration Method: Basically this shows farmers how to do something. The method shows a group of dry season farmers or class how something is done step-by-step for the purpose of teaching new techniques and practices to extension clientele. The first step is introduction, followed by on the farm teaching, demonstration of the skills taught, application of the skills on their farms and evaluation of the result of the application on farmers' yield and income.

Farmer Field School (FFS): The Farmer Field School is a form of adult education, which evolved from the concept that farmers learn optimally from field observation and experimentation. FFS is a group extension method which consists of 25 to30 Farmers who meet at least one morning every week for an entire crop growing season. A FFS is facilitated by extension workers or skilled farmers. Employing non-formal education methods, the field is used as the primary resource for discovery-based learning.

Amaranthus species: This is a member of the *Amaranthacea* family. It is a leaf vegetable and grain that has been eaten for centuries all over the world. Amaranth leaves are an excellent source of carotene, iron, calcium, protein, vitamin 'C' and trace elements. it is called 'efo tete' in Yoruba land.

Celosia species**:** Celosia argentea var. *argente* or Lagos spinach (a.k.a. quail grass, ‘Soko’, Celosia, feather cockscomb) is a broadleaf annual leaf vegetable. It grows all over the world naturalised wildflower, and is cultivated as a nutritious leafy green vegetable. It is traditional fare in the countries of Central and West Africa, and is one of the leading leafy green vegetables in Nigeria, where it is known as ‘soko yokoto’, meaning "make husbands fat and happy".

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The chapter contains the literature review and the theoretical framework. The first part of the chapter covers the review of past literature on Agricultural Extension, Group-Based Extension Methods as well as other relevant subjects in agricultural extension. The second section of this chapter focuses on Diffusion of Innovation Theory, and Transformative Learning Theory which are relevant theories to the study. This is followed by a conceptual model on which this study is based.

2.1 Concept of Agricultural Extension

The term extension according to Slawu (2008) was derived from the practice of British universities of having one educational programme within the premises of the university and another away from the university buildings. The programme conducted outside the university was described as‘’ extension education’’. The expression connoted an extension of knowledge from the university to places and people far beyond. The term ‘’Extension Education’’ was first introduced in 1873 by Cambridge University in England to describe a particular system dedicated to the dissemination of knowledge to rural people where they lived and worked. Within a short time, the idea had spread to other parts of Britain, Europe and North America (Kelsey and Heame, 1966).

Some definitions of extension across the 20th and 21st centuries are:

1949: The central task of extension is to help rural families help themselves by applying science, whether physical or social, to the daily routines of farming, homemaking, and family and community living (Bruner & Hsin, 1949).

1965: Agricultural extension has been described as a system of out-of-school education for rural people (Saville, 1965).

1973: Extension is a service or system which assists farm people, through educational procedures, in improving farming methods and techniques, increasing production efficiency and income, bettering their standard of living and lifting social and educational standards (Dahama, n.d.)

1996: Extension work is an out of school system of education which adults and young people learn by doing. It is a partnership between the government, the land-grant institutions, and the people, which provides services and education designed to meet the needs of the people (Kelsey & Hearne, 1966).

2006: Extension is the process of enabling change in individuals, communities and industries involved in the primary industry sector and in natural resource management (State Extension Leaders Network (SELN), 2006).

The term ''Agricultural Extension'' was only adopted in 1914 when the United States Federal Smith-Lever Act of 1914 formalised a nationwide cooperative federal-state-county programme and gave operational responsibility for this to the land grant colleges and universities (Salawu, 2008). He further stated that in the beginning, agricultural extension was concerned primarily with the improvement of agriculture, using conventional teaching methods. As time went on, home economics, youth programmes and rural community resource development were included. Agricultural extension spread to tropical Africa, the Caribbean, Asia and Latin America following the involvement of the United States of America (USA) in bilateral AID programmes after the Second World War (Salawu, 2008).

According to Okwoche and Asogwa (2012), agricultural extension has three main facets: (i) as a discipline it deals with the behaviour of people: It is educational in content and purposive in approach. Whether the content consists of agriculture, medicine, education, engineering etc, extension is always dependent on a firm knowledge and expertise; (ii) as a process, agricultural extension seeks to influence the behaviour of rural through education and information exchange; (iii) as a service, agricultural extension makes the government ministry, the university or voluntary agency as useful as possible of the people who support it through taxes and donations.

Agricultural extension now has three main facets:

Agricultural Extension is defined by Ekpere (1990) as the discipline which seeks to develop professional competencies essential to the operation of a system of services which assist rural people through educational programmes of improved farming methods and techniques, increased production efficiency and income, level of living and achievement of a more fulfilling rural life. He further stated that as a service, agricultural extension makes the government ministry, the university or voluntary agency as useful as possible to the people who support it through taxes and donations. The concept that the broader function of extension work is help people to solve their problems through the application of scientific knowledge is now generally accepted.

Extension can be defined as an education that brings about improvement in a systematic way, through carefully planned and organised programmes (Fenley & Williams, 1964). As a kind of work to teach rural people how to raise their standard of living, with minimum assistance from government and by their own efforts, using their own resources (Saville, 1965). It is an out of school system of education in which adult and young people learn by doing (Kelsey & Hearne, 1966). An informal out-of-school system of education designed to help rural people satisfy their needs, interests and desires. It is a system of education which involves adult learners (Obibuaku, 1983). It is seen as a comprehensive programme of services deliberately put in place for expanding, strengthening and empowering the capacity of the present and prospective farmers, farm families and other rural economic operators (Adedoyin, 2004).

Extension is concerned with three basic tasks: disseminating useful information, applying it to the analysis of practical problems and help people to use it to help themselves. Extension today goes beyond informal, non-formal and formal forms of education as it fits in the three forms of education known throughout the world (William, 1979).
In agriculture, the scope of extension is very broad. It is not a mere matter of giving the farmer actual knowledge from new research and technology, to help him raise his efficiency. It is this, of course, but it is more. It hopes to change his view of life, to persuade him and his family that they may reach and enjoy a higher and richer existence (Williams, 1978).

Extension work is considered as an aspect of adult education which differs from formal or classroom education in that it prepares its clientele to tackle the problems of today and helps those lives here and now. Formal education on the other hand, prepares its students for life after school years. According to Salawu (2008) the essence of extension work is that as educational processes it involves the following:

- Working with rural people along the lines of their immediate and felt needs and interests which frequently involves making a living, enhancing their level of living and improving their physical surrounding.
- Conducting worthwhile and acceptable activities in the spirit of cooperation and mutual respect between the extension worker and the rural people.
- Utilising support activities to bring extension work and extension staff up-to-date through use of subject-matter specialists, resource persons, in- service training, conferences and the like.
- Utilising certain teaching and communication techniques in attaining the educational objectives of extension.

Agricultural extension education is therefore an educational activity directed to bring about changes in people's life. It is a transformative process which leads to changes in what people know, changes in their reactions to situations and changes in what they do with their hands. The extension worker must therefore do all in his power to build up mutual trust between himself and the farmer by:

- demonstrating competence in needed practices or skills;
- conducting successful result demonstrations;
- showing genuine interest in the farmer and his family;
- doing what he promises and only promising what he can do, and
- having a social philosophy of extension which establishes a healthy relationship between the extension worker and the people Salawu, (2008).

Concept of Extension Educational Process: Extension is a continuous educational process. Primarily, in an effective extension education programme, the following five stages are included (Leagans, 1971):

Study of situation and problem–At this stage Extension Personnel should collect all information about farmers, i.e., farmers education, interest, requirement, way of thinking, viewpoint and social status. Information related to physical condition, i.e., type of soil, types of land, market, cropping method, size of land, family status, community service, communication facilities etc. should be collected and study of local, social, national and international problems should also be undertaken. Extension Personnel should analyse these factors on the basis of "What they are" and "What they ought to be". Only after analysing all these problems the solution should be considered.

Objectives and solution–At this stage, objectives of Extension Education should be according to above-mentioned requirements. In drafting the objectives the Extension Personnel should keep in mind the following points:

(i) Objectives should be limited and extremely important.

(ii) Participation of rural people should be compulsorily included.

(iii) Objectives should be able to bring about the desired change.

Teaching plan of work–There are two main points in this third stage: (i) what should be? And (ii) how it should be? In this stage, extension methods should be selected and all the conditions necessary for learning process should be created so that the people can easily learn it to solve their problem and bring about change in their behaviour. How the Extension Personnel selects the extension methods will reflect his true capabilities and worth.

Evaluation–At this stage, all the work done until now is evaluated and it is seen that whether the objectives were properly chosen and how they are executed. From this we can figure out whether we are going in right direction or not. The success and failure of extension educational programme depends on this stage of evaluation. The facts should be analysed without any bias during evaluation.

Reconsideration–If our evaluation results indicate that our aim and objectives are not fulfilled and that we have to do the work again than we should repeat educational process from first step to the last step (Leagans, 1971).

Four Paradigms of Agricultural Extension

Any particular extension system can be described in terms of both how communication takes place and why it takes place. It is not the case that paternalistic systems are always persuasive, nor is it the case that participatory projects are necessarily educational. Instead there are four possible combinations, each of which represents a different extension paradigm, as follows (National Agricultural and Forestry Extension Service (NAFES), 2005):

Technology Transfer (persuasive + paternalistic). This paradigm was prevalent in colonial times and reappeared in the 1970s and 1980s when the "Training and Visit" system was established across Asia. Technology transfer involves a top-down approach that delivers specific recommendations to farmers about the practices they should adopt.

Advisory Work (persuasive + participatory). This paradigm can be seen today where government organizations or private consulting companies respond to farmers' inquiries with technical prescriptions. It also takes the form of projects managed by donor agencies and NGOs that use participatory approaches to promote predetermined packages of technology (NAFES, 2005).

Human Resources Development (educational + paternalistic). This paradigm dominated the earliest days of extension in Europe and North America, when universities gave training to rural people who were too poor to attend full-time courses. It continues today in the outreach activities of colleges around the world. Top-down teaching methods are employed, but students are expected to make their own decisions about how to use the knowledge they acquire (NAFES, 2005).

Facilitation for Empowerment (educational + participatory). This paradigm involves methods such as experiential learning and farmer-to-farmer exchanges. Knowledge is gained through interactive processes and the participants are encouraged to make their own decisions. The best known examples in Asia are projects that use Farmer Field Schools (FFS) or participatory technology development (PTD NAFESM, 2005).

2.1.4 History of Agricultural Extension in Nigeria

Agricultural Extension in Nigeria

The history of agricultural extension in Nigeria is interwoven with that of agricultural development in general. This is because agricultural extension is concerned with all areas of agriculture (Salawu 2008). Jibowo (2005) and Madukwe (1995) Jibowo (2005) and Madukwe (1995) divide the history of agricultural extension in Nigeria into pre-colonial, colonial and post colonial periods.

The Pre-Colonial and Colonial Periods

During the pre-colonial era by the British, conscious efforts were made in selection, introduction and teaching of the practices involved in producing good varieties of crops and breeds of animals Jibowo, (2005). Farmers selected the best seeds for multiplication, from which the seedlings are transplanted to their farms. Similarly farmers introduced to their farms improved seeds and animals from their neighbouring communities and from Trans Saharan traders from neighbouring countries. The farmers experimented upon and projected their production methodologies without the assistance of formally designated extension agents (Jibowo 2005).

Extension teaching was largely through apprenticeship. Families have taught succeeding generation crop production, animal husbandry and soil management through observation and participation by learners. Neighbours and friends shared new knowledge of improved farm practices (Jibowo, 2005).

During the colonial era by the British, some agricultural development initiatives were undertaken with the purpose of increasing production. The first step was to establish the Department of Botanical Research in 1893 with its headquarters at Olokomeji in the former western Nigeria (Williams, 1978). Its responsibilities included conducting research in agriculture and forestry. In 1905, the British Cotton Growers Association acquired 10.35 square kilometres of land at the site now called Moor Plantation, Ibadan for growing cotton to feed the British textile mills. In 1910, Moor Plantation, Ibadan became the headquarters of the Department of Agriculture in Southern Nigeria, while the Department of Agriculture was established in the North in 1912 (Jibowo, 2005).

In 1921, a unified Department of Agriculture was formed in Nigeria, after the amalgamation of the North and South. The major policy of the central Department of Agriculture was to increase production of export crops for the British market which was ready to absorb it for its industrial growth. Extension activities were therefore directed towards increasing efficiency in crop production and marketing. Regulations were made to set and enforce standards in export crop production. The colonial government also established some agricultural development schemes to upgrade the skills of farmers and to produce agricultural commodities (Jibowo, 2005). The Kware irrigation scheme was established in 1926. It is situated 16miles or 25.74 kilometres north of Sokoto town. Its purposes were to increase rice yields and provide experimental data on production under severe drought during dry season and flooding during the rains. The scheme started with 1000 acres or 405 hectares involving 800 farmers with farms situated along the river banks. The irrigation scheme employed the shadoof which is an ancient Egyptian technique, also used by the Sudanese. The scheme did not attain much of its objectives because (a) the irrigation scheme (shardoof) was inadequate on large farms; (b) it is a slow technique of irrigation; (c) it was difficult to collect cost of services from users; (d) in 1943, 1945 and1954, river Rima over-flooded and washed away most of the rice crop; and (e) use of manure was not popular among the farmers (Jibowo, 2005).

The colonial period also witnessed the establishment of the Niger Agricultural project in 1949 with the aims of producing groundnut as export and guinea-corn for local consumption. It was also to relieve world food shortage, demonstrate better farming techniques and increase productivity of Nigeria's agriculture. The project was sited near Mokwa an area which is suitable for mechanised food crop production (Williams, 1978).

The Post-Colonial Period

Post-colonial agricultural extension in Nigeria can be categorised into two groups: government-organised agricultural programme and extension programmes organised and sponsored by private agencies. From independence to date, federal and state governments have introduced a number of agricultural programmes with extension components. Jibowo (2005) stated that the food production programmes adopted so far by the Federal Government included the National Accelerated Food Production Project (NAFPP) which was introduced in 1972, Agricultural Development Projects, ADP (1975), the Accelerated Development Area Project, ADAP (1982), and Multi-State Agricultural Development Projects, MSADP (1986). Other programmes were the Operation Feed the Nation Programme, OFN (1976), the River Basin Development Authority, RBDA (1973), the Green Revolution Programme, GRP (1980), the Directorate of Food, Roads and Rural Infrastructure, DFRRI (1986), the National Directorate of Employment, NDE (1986), the

Nigeria Agricultural Insurance Scheme, NAIS (1987) and the National Fadama Development Project, NFDP (1992). In recent years, the Poverty Alleviation Programme, PAP (2000), and National Economic Empowerment and Development Strategy, NEEDS (2004) were introduced. Specifically the National Special Programme for Food Security, NSPFS was launched in March 2003.

Some private agencies have embarked on agricultural extension services largely towards a specific clientele system of their choice. Some of the agencies are: The Nigerian Tobacco Company, oil companies such as Shell Petroleum Development Company and religious organisations such as the Catholic and the Anglican churches. Some Non-governmental organisations, NGO's such as the Leventis Foundation also operate some extension services (Jibowo, 2005).

Many international organisations have been involved in agricultural extension, agricultural and rural developments in Nigeria for decades. Notable among these are the World Bank, International Fund for Agricultural Development, IFAD, and United States Agency for International Development, USAID, Technical Centre for Agricultural and Rural Cooperation ACPECCTA, and Food and Agriculture Organisation, (FAO) of the United Nations (Jibowo, 2005).

2.1.2 The Basic Philosophy of Agricultural Extension in Nigeria

A philosophy is a body of principles governing human activities (Salawu, 2008). A philosophy of agricultural extension is, essentially, an understanding of ideas which an individual agricultural extension worker holds about rural people and rural environment. An extension worker's philosophy consists of the ideas he/she holds as important and which influence his/her attitude towards rural people. When these ideas are consciously thought out, they can serve as guidelines to extension work. A sound and positive agricultural extension philosophy can be an aid to an agricultural extension worker in effectively moving in the direction his/her philosophy suggests. If he/she believes that rural people are intelligent and capable of making use of educational opportunities, he is likely to provide such opportunities and assist the people in benefiting from them. On the other hand, if he/she down-grades the capabilities of rural people, he/she is likely to assume the attitude of a snub and consequently will encounter negative reaction from the people (Salawu, 2008).

Agricultural extension is based on the philosophy that rural people are intelligent, capable and desirous of acquiring new information and making use of it for their family and community improvement. This assumes direct approach to the people is required, friendly relationship and mutual trust between the extension worker and the people is assured. It also means the extension worker must have a thorough knowledge of the peoples' problems. Extension education is democratic in its approach. It is based on the principle of helping people to help themselves. The extension approach to economic development is, first, develop the people, and they will develop their farmland, their livestock, their educational and recreational institutions, their public services and anything else they wish (Salawu, 2008).

Agricultural extension philosophy is based on the premise that if farm people fully understand their relationship to the natural resources and other factors they deal with, it is possible for them to attain personal satisfaction in their way of life. Agricultural extension work is based on the idea that each individual is unique and important. People differ as to values and goals they hold. Extension education fosters action to realise values and attain goals which will aid them in establishing new ones. Extension education supports activities to introduce change. Improvement requires change, but change is not necessarily improvement. The key consideration is the quality and type of change that is acceptable to the people and one that contributes to the achievement of their goals (Salawu, 2008).

Extension education is also based on the belief that the aims and objectives of extension are not static. These must be modified on the basis of individual and social needs. It is the duty of extension to determine people's need and help them acquire knowledge that spurs or inspires them to action. The acquisition of knowledge as a basis for action is essential since it is the basic philosophy of extension to teach people how to think and not what to think. Through the acquisition of ability to think and to take positive action on the basis of mature deliberation, the individual can accept new ideas and practices which will help to attain a fuller and more satisfying life (Salawu, 2008).

A sound agricultural extension philosophy always looks ahead. We live in changing times and our agricultural extension philosophy must accommodate such changes. This means agricultural extension must have a definite goal. In addition, each agricultural extension worker must have his/her personal philosophy consisting of what he/she believes about people and his work. If his/her philosophy is a sound one, it can weather whatever storm he/she may encounter wherever he/she finds himself/herself Salawu, (2008).

2.1.3 Objectives of Agricultural Extension

Having looked at the definitions of agricultural extension, it is imperative to equally look at the objectives. Every extension programme or activity should have clearly defined objectives.

An objective may be defined as an end towards which efforts are directed or a condition to be attained. Objectives can be conceived as statements of purpose for which an extension service is established, change in clientele's behaviour being the ultimate end.
Leagan (1963) defines an objective as a "direction of movement". This means the direction in which an extension worker wants to take his/her clientele or the distance he/she wants to cover. For example, where or in what direction do you want to go with respect to poultry enterprise? Is it increased number of eggs? Better quality eggs, more efficient marketing or feed efficiency? If there is to be improvement in farming or in the development of farmers, the objectives of extension must be clearly stated and regularly modified in response to changing conditions.

According to Bardsley (1982), the objectives of agricultural extension are as follows: "To give to individual members of the community advice and assistance with respect to knowledge and methods of technical agriculture, with due consideration of the economic and social circumstances of the individual and other people collectively". The individual-oriented and institution oriented views of extension have become supplanted by the resource model (Obinne, 1997) and it states: “The basic concept was a pool of agricultural knowledge which resides in and is stored by all those related to the industry: farmer, research institutes, Department of Agriculture, and other organisations each contribute to this pool of knowledge, the farmer as a practitioner, the department as the coordinator, and the research organisations. The function of extension is to transfer and nurture this pool of knowledge within the rural industry. Thus extension embraces all those who contribute knowledge or transfer it to farmers. All participate in expanding the pool in different ways and at different times. The extension process is further defined as the skills required to shift knowledge within the pool, and to help others integrate this knowledge into their own practices (Bardsley, 1982).

The four elements common to modern agricultural extension programmes according to Obinne (1997) include:

knowledge to be extended- research findings;

people to be served- farmers;

a central extension organization,- department of agriculture, and

extension agent.

Kinds of Extension Objectives

In considering objectives and goals in extension it is important that we think of them in relation to the people with whom extension is dealing. The following types of objectives may be identified.

Group Objectives

These refer to the purpose which a group wants to achieve. Such a group may include Farmers’ Cooperative Societies, Farmers Councils and the like. The objectives of the group may be to improve the quality of cocoa beans or to market their produce in such a way as to maximise their income. In pursuing such objectives, the group exerts an influence on the individual.

Individual or Family Objectives

These are personal goals pursued in the production of a crop or in the improvement of a home. In pursuing individual or family objectives, the individual acts on his/her own, independent of the group.

Long-term objectives are those set by an individual or group to be attained during a relatively long period of time.

Short-term or immediate objectives are ones set and achievable within relatively short time say within a year.

Broad Objectives: These are all inclusive objectives of a society. They are achieved with great difficulty mainly because progress is not as apparent as in the more specific objectives. Another difficulty in that measurement of progress is not feasible.

Levels of Extension Objectives

Educators think of objectives as falling into various levels. Burton (1944) in Adedoyin (1986) identified four levels of objectives as follows:

The Over-all Societal Objectives

The central aim of every society is the attainment of the ‘’good life’’ for all its citizens. This kind of objective is useful in defining national ends, but they are of little use to extension action programmes. The following objectives listed in the Nigerian 4-year Development Plans are examples of societal objectives:

a great and dynamic economy;

a just and egalitarian society;

a land of bright and full opportunities for all citizens, and

a free and democratic society(Adedoyin, 1989).

Programmes objectives

These are more specific social objectives and are the type of statements found in programme documents of the extension services and development agencies. The objective towards which the activities of the extension services are directed is improvement for the economic and social wellbeing of the entire community. This level of objectives is therefore directed to the group rather than the individual. Examples are

‘’to help rural people determine their problems and initiate action to help rural people attain better living condition(Adedoyin, 1989).

Extension Workers’ Objectives (teaching objectives): Objectives at this level are stated in terms of the changes which the extension worker intends to bring about in the people with whom he/she works (Adedoyin, 1989). They show the ability of the worker to translate objectives into action programmes.

People’s Objective: This level of objectives is related to what the people wish to accomplish. A farmer may desire to increase his income from eggs by N100.00 or a youth club member may want to increase the number of birds in his broiler project to 100. Such objectives may not be known to the extension worker unless he sets out to find out for himself. If he is alert, he will easily see through people’s needs and desires during the course of routine activities or through a fact finding community survey (Adedoyin, 1989).

Experience shows that the most successful programmes are those based on actual situations, such programmes include the wants, needs, and problems of the people. These constitute the worker-learner objectives without which effective extension cannot be a reality. Objectives of the extension worker and those of his clientele need not be similar, but they need to have a common base (Kelsey & Hearne, 1966). The objectives of the people are those they believe they can achieve through participation in projects they have been involved in their design.

2.1.5 The Basic Principles of Agricultural Extension

Certain basic principles underlie the conduct of agricultural extension work. These principles differ with respect to the kind of community in which extension education is carried on. The democratic nature of African communities needs to be systematically followed and agricultural extension workers are therefore enjoined to follow this democratic nature. The reason for this is that methods adopted by an extension worker are important for his ultimate success and the implications of his methods are of great significance (Obibuaku, 1983).

It is necessary to lay emphasis on this democratic nature because, extension directors and supervisors in Nigeria as in many ex-British colonial territories are known to have the tendency to adopt autocratic approach to extension work (Bauman, 1966). Since they are products of British education and administration in which the distinction between the supervisors and the subordinate is unduly emphasised, they favour autocratic methods, preferring the use of memos and directives to face to-face communication. The subordinates including those who work with farmers appear to imitate their superiors in their relationship with farmers (Obibuaku, 1983). To counter this tendency, (Johnson, 1969) recommends: encouragement of the extension staff to adopt an attitude of persuasion through an approach which directs farmers as typified by such staff comments as ‘’ we told farmers to ‘’and ‘’ we supervised farmers, directing them ‘’ in what was to be done. Extension work is directed to changing people’s ways of doing things in specific pre-determined ways believed to be desirable for individuals and the entire society. The objective is to initiate actions that might lead to improvement on the farms, in the homes and within community institutions. This is a complex understanding and involves a set of principles. Extension principles may be defined as guidelines for the conduct of extension work and these principles are the bedrock upon which extension service rests (Obibuaku, 1983). The principles according to Obibuaku, (1983) are:

Extension should start where the people are. Acording to Williams, Fenley, and Williams, (1984) extension should work at the level where the people are, that is, at their level of knowledge, understanding, interest and degree of readiness. In order to be able to assist people to move to higher levels of aspiration, it is important extension workers know what the conditions are. It means personal contact with the local condition, its environment, and understanding of the social structure, the habits, traditions, attitude and economic status of the people and society. Colonial agriculturists and early extension workers in Nigeria, impressed by the large farms in North America and Western Europe and despising the peasant farmers prevalent in Nigeria, proceeded to set up large government demonstration farms ostensibly to impress the Nigerian farmer or to persuade him to embark on large-size farms. Several decades elapsed and not many farmers were persuaded to adopt the new system (Adereti & Ajayi, 2005).

According to Obibuaku (1983) the correct approach would have been to start with the peasant system and endeavour to improve the system and if physical and economic conditions permit, to aspire towards large-size farms. This was the approach later adopted, particularly in the Northern States, in the production of the relatively successful ‘’ cash crops’’ such as groundnuts and cotton. The first principle therefore implies that to succeed with farmers, new ideas must be related to what the farmer already knows and that with which he is familiar.

Extension should be based on the needs and interests of the people which are closely related to improving their livelihood through increasing farm production and their physical environment (William et al, 1984). It is imperative therefore to conceptualise the basic needs of the people in the rural set up since the needs and interests of people vary from one set of people to the other due to difference in culture. Extension can only function if these two variables are put into consideration. It is also imperative to note that extension workers must gain the confidence of their audience. This is so because farmers are said to be fatalistic as well as conservative in their attitudes. They are wary to thread on unsure grounds and are unlikely to take action without conviction. This is why it is necessary that the extension worker gains their confidence (Obibuaku, 1983). Unless they are sure of the ability and skill of an extension worker, they will not be persuaded to accept his recommendations especially if the extension worker is young and has had little or no farm experience. In that case, he must start with one or two programmes that are likely to succeed and must work on them until eventual success.

Extension should assist farmers to determine their problems, help them find desirable solutions and encourage them to take action (National Open University of Nigeria (NOUN), 2008). This assistance does not imply that the extension worker’s problems are replica of the farmer’s problems and does not indicate that the farmers cannot think on their own. Embarking on this will enable the farmers to have the perception that the extension worker cares about their problems by assisting them in identifying their problems. In proffering solutions to these problems, the extension worker should not in any way solve their problems on their behalf as this will amount to imposing his own value judgment on them.

It is an established fact that human beings have unsatisfied wants, this assertion is also applicable to the farmers. An extension worker cannot go far with people unless they want to help themselves, therefore programmes must start with the felt needs of the people and proceed to others that are also needed by them (NOUN, 2008). The wants of the people must be kept in reasonable relationship with the effort they are capable and willing to make. All the people within a community do not want the same thing at same time, and in the same fashion (Obibuaku, 1983). To this end, their values differ and so do their goals and the ability to achieve them.

The principle of co-operative work must be pursued to logical conclusion. This is so because the best programmes are determined by the local people and extension staff working together. Planning of programmes with the people is an important part of extension teaching. People understand a programme better and are more likely to support it if they participate in its creation (NOUN, 2008). Planning is also a learning process. By participating in programme planning, people learn to work together. Decisions that are collectively made are stronger and are more acceptable than the decisions that are passed and imposed on them from outside. Rural people tend to resist change until they see the benefit of such a change and there is no better way of helping them than by involving them in planning for change (NOUN, 2008).

Extension workers should work with all members of the family. The family should be regarded as a working unit in the home and in the field (Williiams, et al.1984). Religion, race or political interests should be put aside in working with rural people; extension workers should treat them as rational adults who are capable of making their own decisions.

The principle of the use of variety of teaching methods is another basic principle. In this case, a teaching method can be conceived in teaching a segregated learning unit. This is equally based on the principle of variety is the spice of life and that no one method will help to bring out desirable changes in people (NOUN 2008). No method therefore is an island. The implication of this principle is that, the more the variety of ways a topic is presented and practised, the quicker people tend to grasp the subject matter.

In African rural communities, participation in extension programme is voluntary and therefore programmes must meet the varying needs of individuals. Participation in extension programmes differ significantly in age, sex, education, attitudes, interests, needs and economic and social values. According to Obibuaku (1983), programmes must be attractive and tailored to meet the needs and interests of the varying groups.

Extension workers should provide maximum opportunity for the people to work on programmes that have been determined by them and the extension agent.The joint determination of the programmes is one thing and full participation is another dimension which is crucial to the eventual success of such programmes. The farmers feel fully satisfied when they are given maximum opportunity to practice what they participated in building. The principle of involvement has a sound psychological basis in that people are never interested in programmes which they have not helped to develop (Adereti & Ajayi, 2005*)*.

Extension workers should take advantage of any existing local group to involve the people in extension programmes. The people in rural areas tend to listen more to the local leaders than the extension workers since they are power brokers and the inability of the extension agent to work with them makes it impossible for him to succeed in his programmes. This principle must be strictly adhered to if innovation is to be well adopted by the local people. The existence of these local leaders makes it possible for extension agents to spread their service over a wide area. There are numerous organisations and groups that are in existence in Nigeria such as farmers' co-operative societies, farmer's councils, village unions. All these groups should be used more intensively in involving the people in extension programmes (NOUN, 2008).

Subject matter covered in extension must have definite purpose and must be specific so that programme would be able to achieve the purpose for which it was established. The subject matter here refers to the content of the extension programme, which must be relevant to the lives of the rural people and must therefore be useful to them. The content of the programme must be presented when it is most needed by the people. This is so because retention falls off rapidly if opportunity for application of what is learnt is not present. The subject matter covered must therefore be attainable within the time available within physical and economic resources of clientele and within the social condition and learning ability of the participants (Adereti & Ajayi, 2005).

The principle of constant evaluation must be followed. It should periodically appraise its work in the light of existing and changing conditions so that it can be seen whether the objectives are being achieved or not. Extension workers have to make endless decisions and then act according to what they understand to be the mandates of their decisions. In a similar vein, the longer a practice has been followed, the harder it is to be objective about its limitations and the harder it is to get at making needed changes. Therefore, frequent appraisal will assist a long way in arriving at these benefits (Adereti & Ajayi, 2005).
The principle of professionalism should be followed. Extension workers should work with extension professionals who can sell their programmes to their clientele. Credibility is therefore essential here. It should provide continuous opportunity, additional training and professional improvement for its staff.

Learning is a gradual process; therefore, results must not be expected soon. Research evidence has shown that learners must be exposed to new ideas over a period of time and in variety of ways before they begin to respond to them, rural people must not be rushed as they do not learn at the same rate. This principle must be put in mind when basic things are expected from the rural people. The adoption rate is therefore to be considered as a gradual process (Adereti & Ajayi, 2005*).* Adult learning remains high throughout life. Adults have had years of varied experience, set beliefs and habits. Their beliefs and habits tend to change very slowly. However, many of these have to be changed if progress is to be made. The Extension workers must therefore use all available strategies in taking care of these beliefs and habits (NOUN, 2008).

A close principle to the one just highlighted is the principle that extension is educational in function through assisting people to make their decisions among various alternatives put before them. Extension workers should not be involved with supply activities. The farmers may be expecting the extension agents to supply them with needed planting materials, fertilisers and fungicides (Adereti & Ajayi, 2005*).* This is basically contrary to its educational function. Extension workers should promote the use and development of volunteer leaders. It is through this forum that extension agents can reach many people and educate them of the need for change (Adereti & Ajayi, 2005*).* This principle therefore sees the volunteer leaders as loud speaker for extension. Without the use of the volunteer leader, most of the planned programmes will not be achieved.

Extension should be based on facts and knowledge Adereti and Ajayi, (2005*).* This principle can be achieved through the process of working closely with the researchers and the farmer. Therefore, extension in this regard will be seen as an intermediary or a link between researcher and the farmer (Adereti Ajayi, 2005*).*

Approaches to Agricultural Extension in Nigeria:

There are many models and types of extension activities around the World. Over the years, Nigeria has experimented a number of extension approaches and agricultural programmes with strong extension example, components. Notable among these extension approaches are: the conventional ministry operated extension system, project based extension, sectoral/commodity extension, university-based extension, integrated rural development approach and farmers-focused extension (Ilevbaoje, 20040). An extension approach is the basic planning philosophy that is being adopted by an agricultural extension organization (Leeuwis, 2004). This helps extensionists to understand the fundamentals, concepts and functional methods of extension adopted to fulfill its aims, especially in the planning phase (Akinnagbe & Ajayi, 2010).

One of the innovations in Nigerian agricultural extension is the Training and Visit (T&V) system. It was introduced to Nigeria in 1986 by the World Bank and was subsequently adopted in a most religious and enthusiastic manner. The purpose of the introduction of this pattern of extension system (T&V) was to remedy the weakness inherent in the previous approaches (Akinnagbe & Ajayi, 2010). It was also to strengthen research extension linkages by making research more relevant to the needs of the small-scale farmers. However, T&V and public extension systems in general, came under attack due to the cost of financing coupled with criticisms of irrelevance, inefficiency, and ineffectiveness and lack of equity (Rivera, 2001)

Numerous critiques of Training & Visit and other agricultural technology transfer approaches have led to a chorus of calls for 'demand-driven extension'. Demand-driven extension involves a shift from public sector extension delivery to a negotiated system through which farmers and rural community members determine their needs and have some control over extension services which are delivered by public, private, NGO or farmer organisation providers. The new paradigm in extension is often referred to as 'demand driven' extension. 'Demand' is defined by Neuchael Group (1999) as what people ask for, need and value so much that they are willing to invest their resources, such as time and money in order to receive the services.

Farmer Field Schools (FSS)

FFS is a participatory method of learning, technology development, and dissemination based on adult-learning principles such as experiential learning. Farmer field schools (FFS) were introduced into sub- Saharan African in the mid-1990s. They are being used in at least 27 SSA countries (Braun, Jiggins, Roling, van den Berg & Snijders, 2005). FFS originated from Asia, where it was developed to promote integrated pest management (IPM) programs. However, in Ghana FFS are being used for a variety of activities, including food security, animal husbandry, and soil and water conservation (Madukwe, 2006).

The Commodity Approach

This approach is generally organized through parastatal organistions or private sector firms. The basic characteristic of this approach is that the production system is vertically integrated from input supply to the technology adoption and marketing of the produce.

Farmers (i.e. outgrowers) produce a certain quantity and quality of a crop, animal species or animal product, and sell it to the company which is partnering them. In return, the company (sometimes also called sponsor or purchaser) provides inputs, credit, as well as extension, quality management (standards) and marketing services (Madukwe, 2006).

2.1.6 Nexus Between Agricultural Extension and Adult Education

Adult education usually refers to any form of learning undertaken by or provided for mature men and women outside the formal schooling system (Odeyemi, 2003). The main targets are specifically defined as youth (girls and boys over 15 years of age, but sometime younger) as well as women and men, generally poor or socially disadvantaged. Adult education is understood as a transmission process of general, technical or vocational knowledge, as well skills, values and attitudes, which takes place out of the formal education system with a view to remedying early education inadequacies of mature people or equipping them with the knowledge and cultural elements required for their self-fulfillment and active participation in the social, economic and political life of their societies (Pierre, 2006).

Agricultural extension is unofficial education process for farmers. This process provides farmers information and advices which help them to solve problems or difficulties facing in their life. Agricultural extension supports to develop production activities, increase production efficiency an continuously improve the living quality of farmers and their family. According to Birner et al (2006), agricultural extension is defined as the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods and well-being. They are provided by a variety of agencies in the public, commercial and voluntary sectors (Adebayo, 2004).

Adult education and agricultural extension play complementary roles. This is why adult education is a prerequisite for agricultural extension (Odeyemi, 2003). Adult education has been used to emphasis the arious adult education programmes, which includes remedial, distant learning literacy, health, education, agricultural extension among others

(Odeyemi, 2003). Verner and Booth (1964) designated all those educational activities designed for adults as adult education. In the same vein, Verner (1964) defined adult education as a relationship between an educational agent and learner in which the agents selects, arranges and continuously directs a sequence of progressive tasks that provide systematic experience to achieve learning for those whose participation in such activities is subsidiary and supplemental to a primary role in society. Williams (1981) also saw adult education as an extension and dissemination of resources to help adults solve their problems as individuals through their various organizations and agencies. All these three definitions of adult education entail all what agricultural extension stands for.

Principles of Adult Learning

The Canadian Literacy and Learning Network outline the seven key principles of adult learning. In other words, these seven principles distinguish adult learners from children and youth.

1. Adults must want to learn. They will only learn when they are internally motivated to do so.

2. Adults will only learn what they feel they need to learn. In other words, they are practical.

3. Adults learn by doing. Active participation is especially important to adult learners in comparison to children.

4. Adult learning is problem-based and these problems must be realistic. Adult learners like finding solutions to problems.

5. Adult learning is affected by the experience each adult brings.

6. Adults learn best informally. Adults learn what they feel they need to know whereas children learn from a curriculum.

7. Adults want guidance. Adults want information that will help them improve their situation or that of their children (CanadianLiteracy and Learning Networks (C L&L N), 2013). Most of these principles of adult education above are the same or almost the same to the principles of adult education.

Adults must want to learn. They will only learn when they are internally motivated to do so.This agrees with one of the principles of extension education that states that extension work must be based on the needs and interests of the people. In actual fact agricultural extension is usually introduced to farmers by presenting the advantages of the new innovation which will arouse the interest of the farmers and cause them to want to learn the new innovation.

Another principle of adult education that tallies with the principles of agricultural extension is the one that states that adults learn by doing. Active participation is especially important to adult learners in comparison to children. The latest approach being adopted by agricultural extension now is the participatory approach which ensures the ivolvement of farmers in the planning, execution and evaluation of any extension activity Extension work is an out of school system of education in which adult and young people learn by doing. It is partnership between the Govt. and the people, which provides service and education designed to meet the people. Its fundamental objective is the development of the people (Kelsey & Harne, 1963).

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The fourth principles of adult education states that adult learning is problem-based and these problems must be realistic. Adult learners like finding solutions to problems. This is in line with another principle of extension education that states that extension encourages people to take action and work out their own solutions to their problems rather than receiving ready-made solutions (Sanoria 1986). Agricultural extension employs problem solving technique to assist farmers to find solutions to their production problems.

On the principle that adult learning is affected by the experience each adult brings. This is in line with aother principle of extension education that extension work should be based on the knowledge, skills, customs, traditions, beliefs and values of the people. Agicultural extension usually builds upon the formal experiences of farmers to introduce new innovation and technologies to them. Adults learn best informally. Adults learn what they feel they need to know. Extension education is an informal type of education that takes place outside the walls of classroom but rather on the farm. On the last principle of extension education that adults want guidance (Sanoria 1986).

Adults want information that will help them improve their situation or that of their children. This guidance is being provided by the extension agents who guide the farmers by supplying them with all the information needed by the farmers to adopt innovations that will improve their productivity as well as their standard of living. Agricultural extension is a professional method of non-formal education aimed at inducing behavioural changes in the farmers for increasing their income through increased production and productivity by establishing firm linkages with research for solving farmer's problems ensuring adequate and timely supply of inputs and using proven methods of communication for speeding of the process of diffusion and adoption of innovations" (Sanoria 1986).

2. 1.7 Agricultural Extension Teaching Methods

Agricultural Extension teaching methods may be defined as devices used to create situations in which new information can pass freely between the extension worker and the farming communities. It is the function of the extension worker to use the extension methods which provide opportunities for rural people to learn and which stimulate mental and physical activities among the people. For extension workers to be successful, they must be proficient in technical knowledge and educational process and must also have the right attitude towards rural people (NOUN, 2008).

Four conditions are necessary for effective use of teaching methods. These include the learning situation, the learning objectives, the learning experiences and the use of a variety of teaching methods. The learning situation comprises the extension worker who has clear objectives, knows the subject matter to be taught and is able to communicate freely with the farmers. The learning situation also includes people who are capable and interested in learning and the subject-matter which must be pertinent to farmers' needs and which is taught at people's intellectual level. In physical terms, the learning situation should be free from outside distraction, suitable to the subject matter presented; available when required and ought to be skillfully used (Laogun, 2005).

As a pre-condition, objectives for the use of extension methods must be clearly established. An objective has already been defined as an end towards which teaching is directed. Any purposeful teaching has specific objectives which must contain four basic elements-people to be taught, behaviour changes to be made, subject matter to be taught and life situation in which action is to take place.

Another condition is the employment of effective learning experiences. A learning experience is defined as the mental or physical reaction one makes in a learning situation through seeing, hearing or performing activities during a learning process. The final condition is that provision should be made for the opportunity to use a variety of extension methods.

Extension methods have been classified into three groups on the basis of the number of people they are designed to reach: these are: (1) individual methods (2) group-based methods and (3) mass methods (Williams, 1978).

Individual Methods of Extension Services

Individual methods are used in extension teaching in recognition of the fact that learning is an individual process and that the personal influence of the extension worker is an important factor in securing people's participation in extension activities (National Open University of Nigeria (NOUN), 2008). The various methods which come under the classification of individual methods include farm and home visits, office calls, telephone calls, personal letters, informal contacts and result demonstrations (Williams, 1978).

Farm and home visits are essential elements of extension education. They provide a means of personal communication between the farm family and the extension worker in an environment where they can discuss matters of common interest in privacy and without the distractions and interruptions commonly experienced in group extension activities. Farm and home visits serve the following useful purposes; to;

acquaint extension worker with the farmer and farm family;
answer specific requests for help;
gain firsthand knowledge of problems faced by the farmer or villager;
explain a recommended practice;
follow up and observe the results of recommended practices;
plan an activity such as demonstration, or a meeting;
invite the farmer or villager to participate in a planned activity;
discuss policies and programmes and
recruit, train or encourage a local volunteer leader (NOUN, 2008).

2.1.8 Concept of Group-based Methods of Extension Services

The failure of various agricultural extension delivery approaches in developing countries to effectively bring about significant and sustainable agricultural growth has become a major concern to all stakeholders, including the donor communities. The concerns according to Madukwe (2006) has been fueled lately by the wave of pluralism, market liberalisation and globalisation sweeping across the world and giving rise to initiatives that will enhance efficiency and effectiveness of not only the sub-components of extension delivery but the entire system of technology generation, dissemination and use. He further states that with a rapidly expanding population, environmental degradation, political instability, economic failure and the declining budget, re-thinking the way agricultural technology is delivered to farmers has become necessary. This becomes a very important issue as the ways by which agricultural technology is taken to farmers in developing countries need a total overhauling as agricultural technology is changing from time to time. One of the latest approaches or strategies is the group method of agricultural extension Madukwe (2006).

FFS are platforms and "schools without walls" for improving decision-making capacity of farming communities and stimulating local innovation for sustainable agriculture **(**Braun et al, 2000**).** FFS offers community-based, non formal education to groups of 20-25 farmers through self-discovery and participatory learning principles. Some authors advocate for group sizes of 25-50 **(**Matata & Okech, 1998**)**. The learning process is based on agro ecological principles covering a cropping cycle. The school brings together farmers who live in the same village/catchment and thus, are sharing the same ecological settings and socioeconomic and political situation.

Group-based learning approaches are effective means of building farmers' competencies by engaging people in processes of experimentation and development (Schad, 2011). The group provides space for mutual learning, improves analytical skills, supports networking and gains recognition of input suppliers, marketing outlets and knowledge providers. This approach is a new starting point for a new paradigm in extension that recognises the farmer as equal partner-and his farm as a source of innovation (Leewis, 2004; Hoffmann, 2007).

Group based extension approach plays valuable role in policy advocacy and in realizing economies of scale. One major benefit of this approach is that farmers support each other to learn and adopt new technologies. Bergevoet and Van Voerkum (2006), and Hoffmann (2009) highlight various advantages such as:

The opportunity to share knowledge gained from individual experience with others. Easier adoption of innovations due to the higher number of like-minded people and more thorough weighing of advantages/advantages in group discussions and frequent monitoring and valuation of the advisor's performance.

According to Conroy (2003), the group learning extension services are more client-driven and efficient, strengthening farmer's bargaining power with traders; reducing transaction costs for input supplies and output buyers; economies of scale (e.g. from bulking up in output marketing or storage) facilitating savings and access to credit and reducing public-sector extension costs. This strategy ensures the dissemination of agricultural information by extension providers to a wider spectrum of farmers, including women and youth, unlike the other formal extension methods. The salient feature of the new approach according to Akinnagbe and Ajayi (2010) is the reversal learning, where research and extension learn from farmers. The key elements in the paradigm are to put emphasis on people rather than things, decentralise, empower, value and work according to the needs of stakeholders learn from beneficiaries and beneficiaries learn from each other

(Asiabaka, 2003). It urges public extension to concentrate on more marginal areas, to take account of the diversity of rural livelihoods, to be innovative in its organisation and to develop the capacity for strengthening the demand side of extension (Farrington, Christoplos, Kidd, & Beckman, 2002.). Other benefits of group-based extension l earning methods include greater extension coverage, offer a more reflective learning environment in which farmers can listen, discuss and decide upon their involvement in the extension activity, and concerted action to tackle their problems.

Issues in Group Extension

To form structure and develop a group of farmers by extension purposes is a complex process; such groups do not appear overnight. It is not sufficient for the extension agent merely to bring the farmers together for a particular activity. He must give time and thought to the fact that the farmers will constitute a group, will function as a group and will display characteristics associated with groups. There are four sets of important issues the agent will have to bear in mind (Oakley. & Garforth . 1986).

Purpose: The agent should endeavour to develop the group to encourage its members to continue to meet and establish the group on a permanent basis. By this, the agent will be developing a base from which group members can continue their development efforts. The agent should also use the group to transmit ideas, information and knowledge that will assist farmers in their agricultural activitie (Oakle & Garforth, 1986).

Size: The most suitable size for groups in rural extension is between 20 and 40 members. If the group is too large, it becomes unwise and many farmers may feel lost and bewildered. Smaller groups allow closer contact, a better chance of involvement and more opportunity for strengthening bonds of friendship and support among members. One common determinant of group size is geographical location: its members will be restricted to those living within a particular area (Oakley & Garforth, 1986).

Membership: Since the extension agents' job is to help farmers identify and tackle problems, it is better to have groups of farmers with common problems. If the agent is working with a group made up of different types of farmers ranging for example from cocoa farmer to vegetable growers, it may be difficult for him to achieve a common purpose within the group. The agent, therefore, should pay careful attention to group membership and ensure members share a common interest and problems (Oakley& Garforth, 1986).

Agent's Relationship With Group: The agent should give considerable thought to his relationship with the group. Ideally, he will want to encourage the group's information and help to strengthen it. The agent should avoid being directly responsible for setting up the groups. In all his activities with the groups, the agent should beware of the group becoming totally dependent upon him and of creating a structure that needs him for survival, the agent should strive to encourage an element of independence in the group, by encouraging the group to take the initiative in extension activities and to decide for itself in what way can be of assistance (Oakley and Garforth, 1986). The extension agent should bear these four issues in mind as he discharge his duties with extension groups. His primary concern will be to carry out his work well to ensure that more farmers come into contact with new ideas and programmes through the group approach.

Group-Based Extension Method, Group Extension and Adoption of New Technologies

The overall results of manure application for different crops using group-based extension methods according to Valerie, Edson, Damien, and Aleston (2002) give the following results: The average fertiliser yield response for climbing beans across all 59 demonstrations was only 3.85 kilograms and the average v/c ratio for fertiliser was only 1.85. Despite the poor overall results, there is evidence that some farmers did well; 46 per cent farmers in Gitarama and 42 per cent farmers in Butaré had v/c ratios greater than two; in Butare, 60 per cent had v/c ratios greater than three. Thirty-one per cent of farmers in Gikongoro had ratios greater than two. Unfortunately, there were numerous cases of very poor performance where farmers would have lost money had they paid for the inputs (38 per cent of participants in Butaré and Gikongoro, and 13 per cent in Gitarama.

The overall results for soyabeans in the district of Taba in zone 4D was good with a yield response of 6.2 kilograms and a v/c ratio of 3.30. In Taba, 80% of the demonstrations attained a level of profitability adequate to stimulate farmer interest in the input package (v/c ratio greater than two). The next best district in Gitarama was Musambira with 44% attaining v/c ratios greater than two. This shows that using group-based extension methods could lead to adoption of new technologies Valerie et al, (2002).

Results obtained by Robert and Stephanie (2007) using demonstration method to introduce rhizobium-inoculated soyabean were consistent with results in Thailand and Vietnam. Without nitrogen fertiliser, inoculation increased soyabean yield by an average of 20%. Soyabeans also responded to fertiliser at 40 kg N/ha with a 30% yield increase. Inoculation increased the gross margin by $28US. With improved agronomy and higher yields, it is expected that responses to rhizobium could be even greater. Demonstration trials in the early wet season 2006 gave even better results for mungbean and peanut. The average yield increase for the rhizobium-inoculated treatment compared to farmer practice for Mungbean was 296 kg/ha (41%) and 379 kg/ha (27%) for peanut. This gave an increase in profit (gross margin) of $104 for mungbean and $115 for peanut.

In terms of food security, only 30% of farmers produced 5 bags or more before the receipt of the mini-pack. After receipt of the mini-pack, 80% of those farmers produced 5 bags or more of maize on their farms. Assuming families on the average need to produce 5 bags per season, it can be concluded that through FIPS-Africa's interventions, the number of food secure families increased from 30 to 80% of households.Interestingly, farmers reduced their acreage under maize from 0.81 to 0.69 acres. Benefits are therefore likely to be underestimated as farmers could have benefited from growing higher value crops on the land taken out of maize production (Anderson & Muthamia, 2007).

In Nyeri district, Demonstration method was used by Anderson and Muthamia (2007) to introduce new crop varieties to 73 farmers who had received a 150g mini-pack of a Western Seed Co. variety, the farmers 97% said they had used Western Seed Co.

varieties in the 2005 long rainy season. Before receiving instruction from FIPS-Africa, farmers said they had on average produced 3.9 bags/0.86 acres (5.7 bags / acre). After receipt of mini-pack and instruction on improved maize crop management, yields increased on average to 9.1 bags/0.77 acres (14.4 bags / acre). Extra yield produced/farmer was on average, 5.2 bags equivalent to KSh 6,224 (GBP 48). Interestingly, whilst maize yields increased by a factor of 2.33, mean land area under maize cultivation declined by 10% presumably as farmers realised they could produce enough for their needs from a smaller land area. Most importantly, the number of farmers who attained the food security target of at least 5 bags / season increased from 32% before FIPS-Africa's intervention to 73% in the 2005 long rains season.

This result agreed with the findings of Helen and Olufemi, (2012) who demonstrated that 120 kg N ha-1 of NPK 15-15-15 fertiliser had the highest yield of 32.97 ton ha-1 while the lowest yield, 4.07 ton ha-1 was recorded in control which was without fertiliser. The titratable acidity and the lycopene content of tomatoes grown with 20 ton ha-1 of chicken manure were significantly higher than those grown with other treatments. This result showed that nutrient sources play major roles in determining the levels of titratable acidity and the nutrient antioxidant component of tomatoes.

Group Extension Methods and Farmers' Yield

According to Godtland, Sadoulet, Janvry, Murgai, and Ortiz (2004) the impact of a pilot farmer field- school (FFS) program on farmers' knowledge of integrated pest management (IPM) practices related to potato cultivation and the result revealed that farmer field school participation would have resulted in an increase of 2.5 points in the output/input ratio. This corresponds to a 32% increase over the average observed output/input ratio of 7.9, which corresponds to the value in a normal year. Kaihura, Temi and Julianus (2006) exmined the farmer field school experiences in improved land, water and agro-ecosystems management for sustainable livelihoods and food security in Tanzanias and the project strengthened the farmers' knowledge of land management, and farmer started applying integrated land management on their own fields.

Farmers (both farmer field school members and non-members) in Bukoba district widely adopted technologies to replenish soil nutrients, conserve water, control erosion and improve the soil biodiversity (Kaihura, Temi & Julianus, 2006). Maize grain yields rose from an average of 1 ton/ha to 4.5 tons/ha. The project strengthened the farmers' knowledge of land management, and farmers started applying integrated land management on their own fields. Farmers (both farmer field school members and non-members) in Bukoba district widely adopted technologies to replenish soil nutrients, conserve water, control erosion and improve the soil biodiversity. Maize grain yields rose from an average of 1 ton/ha to 4.5 tons/ha. Four hundred farmers from the Mkindo area formally graduated in rice production; so did another 200 from neighbouring villages. Still more have graduated informally Kaihura, Temi and Julianus (2006). Their new skills according to them have enabled them to raise their paddy rice yields from about 1 t/ha to an average of 5.5 t/ha.

In another study, (Alliance for a Green Revolution in Africa (AGRA) 2013) reported that Joseph Ambiya from Emalomba Village, Nambale District hails the impact demonstration plots on his farming. Through them, he has learned crop rotation, intercropping, right spacing of crops when planting and fertilizers amounts to apply and which ones. "Before I did all that without planning," he says. Of particular interest is how using dry maize stalks as compost is reducing his DAP top dressing fertilizer application per acre by half where he applies a 50kg bag. The stalk and homemade compost from his assessment has made the soil compact and have more organic matter. "I used to burn maize stalks before now I don't," says Ambiya, appreciating their value. And the results are evident, per acre before attending the demonstration plots trainings for a year, the most harvest he got per acre was 5, 90kg bags of maize, today he gets at least 10 bags on the same plot (AGRA, 2013).

In another research, Satyanarayana and Satyanaraya (2004) evaluates on-Farm Evaluation of the System of Rice Intensification (SRI) in Andhra Pradesh, India Uphoff, (2002) compared SRI with conventional cultivation methods on 1000 m^{-2} plots, without replication. Seed bed preparation and planting were done under the supervision of research staff. Trials were continuously monitored. The yields under SRI and conventional cultivation ranged, respectively, from 4214 kg ha^{-1} to 10655 kg ha^{-1}, and 3887 kg ha^{-1} to 8730 kg ha^{-1}. Mean grain yields were 7227 kg ha^{-1} and 5657 kg ha^{-1}, respectively, with SRI methods having an overall yield advantage of 1570 kg ha^{-1}. Yields over 8 t ha^{-1} were achieved by 31 farmers using SRI; only 3 achieved this with conventional cultivation. Maximum yield advantage recorded for SRI was 4036 kg ha^{-1} (70%). Yield increases were due to increased numbers of panicles m^{-2} and increased numbers of grains panicle^{-1}. Three of the 10 varieties used by the farmers were found to perform very well with SRI (Satyanarayana & Satyanaraya 2004)).

Liang , Lü , Xia, Wang , Qin, Yang and Lü (2000) while analyzing the results of an on-farm demonstration covering 7 farms applying recommended management practices and a formal survey of 120 practicing wheat farmers. The crop performance in the demonstration farms reveals that yield of winter wheat can exceed 9000 kg ha^{-1} that is much greater than achieved in most the farmers' fields where the average yield was only 69% of that of the demonstration plots. Over seeding, untimely sowing, confusion in variety use and poor irrigation practice, together with unbalanced fertilization, are the major technical problems responsible for the yield gap. The crop yield in farmers' fields can be increased by 43% through improving field management practices without additional cost while obtaining an extra net profit of 4748 CNY ha^{-}

Challenges of Group-Based Extension Approach

To set up a group-based extension delivery method that will give a voice to resource-poor and less privileged farmers is a major challenge. These challenges associated with the transformation of the present supply driven to demand driven or farmer-led extension approaches include:

Farmers' Competency: The competency of the farmers to effectively p lay their roles as the key players in the group-based extension delivery system is very important since their competency depend on many factors such as past experience, exposure level of education and financial strength of the individual farmers. Farmers found it difficult to take on all the responsibilities as key players in the delivery system since the new roles require skills, adequate information channels, financial resources and time which poor farmers lack (Akinnagbe & Ajayi, 2010). According to Amanuel (2007), many farmers are constrained with resource limitations, apparently not able to take risks and carry out experiment with their meagre resources. This could be one of the reasons farmers adhere strictly to the traditional experiences of agriculture practices or simply wait for the outcome of the extension agents' efforts.

Identification and Promotion of Farmers' Organisations: Another major challenge facing the group-based extension delivery system is how to promote the formation of farmers groups. Farmers lack a collective voice because they find it difficult to come together to form vibrant farmers' organisation which could grant them access to affordable production inputs such as finance, technology, land and water. As a result, many farmers live in poverty and therefore cannot influence policies that affect their livelihoods. Most groups are hastily formed, usually without any regard for the socio-cultural and economic structures of the farming communities. Such groups are not viable and incapable of serving as channels through which farmer groups can take part in decision making (Akinnagbe & Ajayi, 2010).

Village Leaders: Most farmer-groups are still being dominated by village leaders or a number of influential wealthy farmers. The voice of the poor farmers is thus neglected. This will make majority of the farmers not to be enthusiastic about the group thereby defeating the aim of group-led extension delivery method (Akinnagbe & Ajayi, 2010).

Farmers' Acceptability: The inability of the farmers to get accepted by fellow farmers and the farming community in general is another challenge facing the group-based extension delivery system. It is the belief of many people that it is only literate and intelligent people (like extension agents) that could bring something new and important to farmers. The poor farmers are not expected to be sources of agricultural innovations that may change the lives of other farmers. This is the main reason many farmers do not support and also discourage the innovative ones, considering them as wasting time for no good reasons (Akinnagbe & Ajayi, 2010).

Fiscal Sustainability: There is no extension delivery approach that is costless the group-based extension approach inclusive. The question of who should bear the financial responsibility of the farmers group is another challenge facing this extension approach (Akinnagbe & Ajayi, 2010). Ordinarily, farmers should bear the responsibility but in a situation where farmers are poor and are even demanding compensations for the time they spent in group meetings is not in the best interest of the participants in the group-based extension delivery system (Nalukwago, 2004).

Logistics: According to Hakiza, Odogola, Mugisha, Semana, Nalukwago, Okoth and Ekwaru (2004), logistics issues affect quality of group-based extension approach. The location of the group meetings, maintenance of schedule for each meetings, control over the study fields, relationship of group lesson to local needs, inadequate material and or late arrival of funds and other unforeseen interruptions. Irregular attendance and late arrival of farmers at meetings limit their ability to follow and understand some of the concepts during the training because the training is designed in a chronological order. Illiteracy is another challenge facing the group-based extension method.

2.2 The Concept of Dry Season Farming

Dry farming, as presently understood, is the profitable production of useful crops, without irrigation, on lands that receive annually a rainfall of 20 inches or less (Widstoe, 2012). Dry season farming is a farming system that takes place in areas with low amount of annual rainfall. It is the growing of crops (mostly vegetables) during the season in such a way that water is applied to the soil for the purpose of supplying moisture essential for plant growth.

Dry season farming is one of the most important rural development investments that can have direct and indirect impacts on poverty and food security in the semi-arid tropical countries (International Food Policy Research Institute (IFPRI), 2002; Bhattarai &

Narayanamoorthy, 2004). At the moment, climate change represents an additional challenge to rain fed farming in the south-western states and this is another reason for investment in irrigation farming. The limited adaptive capacity of small scale and pastoral farmers has made them to be the most vulnerable to the impact of climate change. According to Orionye (2011), dependence on rainfall represents a major constraint on agricultural productivity and rural poverty reduction. He further submits that without investment in irrigation, it will be difficult to increase food production, reduce the financial burden of agricultural food imports and increase food security in the country. Our failure to invest in irrigation contributes to the expansion of rain fed agriculture on to marginal lands with erratic rainfall. This is compelling millions of peasant farmers to farm in ecologically fragile areas.

One of the major problems facing the country is how to provide adequate food for her ever-increasing population about 140 million. National Population Commission (NPC) (2006) and Food and Agricultural Organisations (FAO), (2000) listed Nigeria among the countries that are technically unable to meet their food needs from rain fed agriculture at low level inputs. Second, the devastating effects of desertification and drought on the dry sub-humid and semi arid agro-ecological zones of Nigeria have made the Nigerian government embark on massive investment in small-holder irrigation (Adeolu & Taiwo, 2004). Third, the rapid growing demand for agricultural products coupled with seasonal variations, unpredictable and unreliable pattern of rainfall in Nigeria have necessitated the supplementation of rain-fed agriculture with irrigation.

The role of agriculture in developing countries is a crucial one. Without dynamic growth in agriculture, sustained economic growth is unlikely and population growth rates will continue to be very high (Yahaya, 2002). Agricultural development will bring about widespread increase in economic wellbeing and effective demand which is essential for the removal of the food problem which in turn will bring about industrial development.

The benefits of dry season farming are numerous; Norman (1996) lists some of the benefits as follows:

Increasing the range of choice of crops, thus providing flexibility in decision making;
Focusing more complete and efficient resource use;
Lessening the danger of crop failure and the range of yield fluctuations, hence reducing uncertainties;
Increase the capacity of the land for input of other factors;
Increasing the size of total business;
Shifting the factor-product curves towards higher input greater production.
Dry season farming has double advantage of crop diversification such that if a crop fails or are damaged, other crops will ensure food security and economic returns or dry season crops allow farmers improve household economic security and investment on one hand and money to buy food in case of crop failure on the other (Yahaya,2002). This according to him will boost economic fortunes of farmers and alleviate their problem in the event of adverse conditions or disasters.

Dry season or irrigation farming in Nigeria makes use of traditional and modern irrigation technologies. Some of the traditional techniques adopted in many dry season farm sites include Shadoof pump, Gravity or Natural flow (channel irrigation) and calabash/bucket methods. These are generally referred to as small-scale dry season farming covering small land area. Under this system, water sources are mainly residual soil moisture, brooks, streams, rivers, locally dug shallow wells, ponds and other depressions. The system is under local people in response to their wishes and felt needs (Umar, 1994).

Modern agriculture, however, depends on damming major streams and rivers to reserve and control the flow of water in order to make it (water) available whenever it is needed in the desired quality. Examples of modern irrigation according to Cox and Akin (1979) are drip irrigation, corrugation and sprinkler irrigation. These are generally referred to as large-scale dry season farming. However, whether small or large scale dry season farming, the aim is to produce crop with little or no rain water. The water is thus supplied to the crops artificially through whatever type of irrigation adopted.

Challenges of Dry Season Farming

The greatest challenges facing dry season vegetable production according to Nsiah-Gyaabah (2003) include:

Inadequate supply of water for irrigation

Soil fertility decline

Inadequate storage, processing and marketing facilities

Lack of credit

Lack of credit

Lack of processing technologies

High post-harvest loses

Inadequate supply of water

The overriding problems facing vegetable producers include inadequate supply of water. Declining rainfall coupled with increasing irregular pattern of rainfall distribution affect vegetable production especially during the dry season. The irregularity is most pronounced at the beginning and end of the rainy season. Irrigation through the provision of wells, boreholes and hand pumps in the transition zone, is a valuable investment to improve vegetable production (Nsiah-Gyaabah, 2003).

In addition, rainwater harvesting in the forest transition zone, an area that is characterized by low and variable rainfall, would be an important strategy to improve vegetable production. They will also reduce competition for water and conflicts that arise from using community drinking water sources to irrigate vegetable farms. Moreover, pollution of drinking water sources would be reduced (Nsiah-Gyaabah, 2003).

Inadequate storage, processing and marketing facilities

As a result of inadequate storage and processing facilities, seasonal glut occurs especially during the major rainy season. Seasonal glut leads to very low producer prices. During the dry season, farmers receive very high prices for vegetables especially tomatoes. However, dry seaso production is risky because of the possibility of crop failure. High post harvest loses during seasonal gluts is the result of inadequacies in storage, processing and marketing and generally indicative of underdeveloped post-harvest system and gaps in technology dissemination to farmers. Dissemination of technologies to improve storage, processing and marketing therefore remains essential tools of interventions if the results of research would be translated into improved productivity higher incomes for farmers (Nsiah-Gyaabah, 2003).

Decreasing soil fertility

Access to credit means that many poor farmers have no alternative, but to continue the unsustainable practices of continuously deplete fertility of the soil. Some farmers, in order to avoid the risk of crop failure, plant only during the rainy season (Nsiah-Gyaabah, 2003).

Lack of credit

Availability of capital is an important constraint that affects technology adoption rates of agricultural innovation. Most vegetable farmers have limited capital for financing farm operations. The low capital availability means that farmers find it difficult to adopt new knowledge and technologies disseminated. Better access and timely disbursement of crdit are important issues that must be taken into account in strategies to disseminate technology to farmers to improve vegetable production (Nsiah-Gyaabah, 2003).

High post-harvest losses

High cost of transport of vegetables especially tomatoes and high post-harvest loses affect pricing as well as farmers income. In order to improve the income levels of farmers, technology should be transferred to farmers so that they would be able to increase the shelf life of vegetables. The surest way to ensure that when there is a glut, farmers would be able to obtain a far price for vegetables is to invest in processing and disseminate new technology and information to them(Nsiah-Gyaabah, 2003).

2.2.1 Dry Season Farming and Vegetable Production

Dry season vegetable production also called vegetable farming or fadama involves the production of vegetable outside the normal growing season using certain infrastructures such as green houses, irrigation and watering can. In Nigeria, there are two distinct seasons, the rainy and the dry season. The rainy season is the normal cropping season, this starts from April and stops in October, while the dry season starts from November and ends in March (Ibekwe and Adesope, 2009). During the rainy season, the production of vegetable is high resulting in the saturation of the market, but during the dry season there is usually the scarcity of this important farm product thereby leading to a high price due to short supply. This seasonality according to them has resulted in food insecurity which is a challenge to sustainable food production. It has also been found that most farmers do not want to go into large scale production because they are apprehensive of high risk (Ibekwe and Adesope, 2009). This has made the farmer grow vegetables as intercrop of low significance as a way of avoiding risk.

Fadama Projects in Nigeria

Fadama, the Hausa name for irrigable land refers to flood plains and low-lying areas used for farming during the dry season and sometimes defined as alluvial lowlands formed by erosion and depositing action of rivers, streams etc (Ingawa et al, 2004; Abdullahi et al., 2006; Nwachukwu and Onyenweaku, 2007). Similarly, Kolawale and Scoones (1994) defined fadama as an hausa word meaning valley bottom, flood plains along major savannah, rivers and /or depression on the adjacent low terraces. However, fadama is low-lying flood plains consisting of alluvial deposits with extensive exploitable acquifers ideal for irrigated crop production (World Bank, 1992).

Fadama areas are typically waterlogged in the rainy season but retain moisture during the dry seasons. Fadama areas are considered to be of high potential for economic development through appropriate investments in productive assets, rural infrastructure and technical assistance. The desire to harness the verse potentials of Fadama in Nigeria culminated in the design of National Fadama Development Project I, II and III. Fadama I (Phase I of the National Fadama Development Project) was implemented during the

1993-1999 period (Iwala, 2014). While Fadama I focused mainly on crop production, down stream activities such as processing, preservation and marketing were largely neglected. The design did not take into cognizance of need for spatial integration of the markets (creating of physical and market infrastructure) (Iwala, 2014). It also failed to take into consideration other Fadama resource users such as livestock producers, fishing folks, pastoralists, hunters etc. The project did not also support post-harvest technology, which manifested in reduced crop prices and increased storage losses during the period (Momoh et al, 2007).

Some of the lessons learnt in Fadama I informed the brith of Fadama II. Fadama was targeted at dry season farming agro-processing, preservation and marketing (Iwala, 2014). It also allowed for acquisition of productive assets, provision of rural infrastructure to ensure the efficient transportation of farm output to markets as well as marketing activities. The project development objective was to sustainably increase the incomes of the beneficiaries through empowering communities to take charge of their own development agenda through Community Drive Development (CDD) approach in project implementation in a socially inclusive manner. Fadama II also provides special preferences to groups of youths, women (especially widows), physically challenged, the elderly and people with HIV/AIDs (ADF, 2003).

Fadama III project is a follow-up to the Fadama II project which was assessed to have impacted the lives of rural farmers, raising their incomes by 63 percent (Iwala, 2014). The project according to him like Fadama II takes the CDD approach, which places beneficiaries in driver's seat. Local community members under the umbrella of Fadama Community Associations (FCAs and Fadama Users Groups (FUGs), oversee the design and implementation of the project and are empowered through skills and capacity building to improve their livelihoods by increasing income generating activities.

Fadama III project established standardized procedures and steps to guide the local people on how to take part in the decision-making process. It established platforms for participation, such as local consultation meetings to identify and select the needed infrastructure to be funded by the project. Beneficiaries (participants) were trained to identify the needed infrastructure, execute and manage small-scale development projects in their communities. Community people through the FUGs and FCAs were designated to be the executing agencies of local development projects. Capacity building activities were conducted to ensure that they have the ability to manage the different aspects of project implementation including financial management, procurement management and quality control at a level acceptable to the project (Iwala, (2014).

According to International Development Agency (IDA, 2010), the project was designed to focus on increasing the incomes of rural poor, the project will help reduce rural poverty, increase food security and contribute to the achievement of a key Millenium Development Goal (MDG).

The importance of vegetables as major and efficient sources of micronutrients in African diet cannot be over stressed. Vegetables are nourishing foods because they contain a little of all the substances man needs: protein, mineral salts, sugar, vitamins, aromatics, colouring agencies, iron and essential oils that increase man's resistance to disease. In this class of food, man finds the wide range of nutritive elements he needs. Vegetables are therefore complementary foods of the first order, and are much more important for man's health than products of animal origin (Hugues & Philippe, 1995). Vegetable growers could make an important contribution to the national food supply where a healthy and expanding market gardening industry is a safeguard against the lowering of health standards necessary for productive output in an expanding economy (Tyndal, 1998). Shortage of animal protein causes illness, but this may be prevented by proper mixture of different vegetable protein that is equal in quality with animal protein.

Growing vegetable is particularly suited for small scale farmers and their families, and because of their limited resources they can meet the cultivation requirement of irrigation by the use of watering can (Robert, 2003). Vegetable according to Baffourm (2005) is the edible portion of an herbaceous annual or perennial crop which could either be served raw (green/fresh) or after a little cooking.

2.2.2 Farmers' Age and Dry Season Farming

Age classification has been found to be relevant to agriculture in that physical ability, productivity and agility depends on age and this will determine predisposition or susceptibility of farmers produce to pilferage. The age of the farmer according to Adewumi and Omotesho (2002) is expected to affect his productivity and output. It also affects the adoption of innovation in traditional farming. The mean age of the respondents is 43.33 years and the modal age is 41 to 50 years which constituted about one-third of the total respondents. This agrees with findings of (Tsoho, 2004). This might have implication for available family labour force. Given the ageing nature of the sample, there might be a reduction in the effective labour force for agricultural production in the study area.

Also, Emokaro and Ekunwe (2007) in their study of efficiency of resource-use and marginal productivities in dry season amaranth production in Edo south, Nigeria submit that most of the farmers (75%) were aged 46 years and above, with the remaining 25% aged below 46 years. This indicates that a high percentage of the dry season amaranth growers in the study area are in their most productive years. This however differs from the findings of Ebojei, Odekina Mosimabale, and Abdullahi (2011) from their studies on socio-economic factors predisposing farmers' produce to pilferage in Idah local government area of Kogi State, Nigeria that majority of the sampled farmers were middle age. About 74% of the sampled farmers were between the ages of 2049 years. It implies they are still in their economic active age which could result in positive effect on production. In a similar study by Ehirim, Okunmadewa, Michael, and Obih (2005), studied the economic impact of common agronomic practices associated with risk control in cassava production in Owerri, Nigeria and reported a predominantly male farming community (71%) with over 12 years farming experience, and an age distribution which showed that over 40% of the farmers were within the age range of 42 and 54 years, while 30% were above 62 years.

2.2.3 Farmers' Sex and Dry Season Farming

In Nigeria, it is generally believed that more men engaged in agriculture than women simply because farming is perceived as being tedious and laborious. Tsoho and Salau

(2012) observed during their study of dry season farming in Sokoto State that all the one hundred and fifty five (155) sampled respondents in the study area were male. This may be due to cultural and religious (Islamic) belief of the people in the area, which prohibits women from going out freely and engaging in certain activities such as farming. Where the women own land, they usually delegate its administration to their senior male child or one of their male relations. The study revealed that more than 90% of the respondents were married, while the remaining were either single or widow(er)s, respectively. This, coupled with the polygamous nature of the area probably explained the large family size recorded in the area. The mean family size was 10 persons per respondent it ranged from 1 to 40. In Zambia, about 4.4 million economically active persons aged twelve (12) years and above in agricultural households, 49.3 per cent were males while 50.7 per cent were females (Agricultural Report, 2000).

In all the provinces, there were consistently more females than males in the agricultural households. Thus at national level, the proportion of males (48.9 per cent) and females (51.1 per cent) reflected this pattern (Agricultural Report, 2000). Emokaro and Ekunwe (2007) in their study of efficiency of resource-use and marginal productivities in dry season amaranth production in Edo south, Nigeria submitted that more males (118 or 92 per cent of the respondents) were involved in dry season amaranth production than females, who constituted only eight per cent of the respondents. The large disparity could be attributable to the drudgery associated with dry season amaranth production, as attested to by the farmers. Ebojei, et al. (2011) from their studies on socio-economic factors predisposing farmers' produce to pilferage in Idah LGA of Kogi State, Nigeria found out that six farmers representing about 33per cent were female while majority of the farmers seventy four in number (74) representing about 67 per cent of respondents were male. This gender categorisation was done based on household head.

2.2.4 Farmers' Literacy Level and Dry Season Farming

Education is an important tool for any development including agricultural development. In developing nations of the world, farming is being perceived as the work for the illiterates who could not be engaged in any other sector than agricultural sector, this accounts for poor development of agriculture in most developing nations because farmers finds it difficult to access and interpret research results, credit facilities , government policies and programmes. According to Ibekwe and Adesope (2009), the level of education is positively correlated and significant at five per cent level of significance. This means an increase in the level of education will lead to an increase in the income from vegetable production. This is in line with a priori expectation. It is well known that formal education aids managerial ability of farmers.

In their studies, Tsoho and Salau (2012) examine smallholder vegetable farmers in Sokoto State of Nigeria, they observe that although all the respondents (100per cent) have one form of ducation or the other, 15.49 per cent have attained between primary and tertiary education. More than two-third of the respondents had quranic education. This shows that less than 20 per cent of the respondents are literates while more than 80 per cent are illiterate. Majority of the respondents (76 per cent) had one form of education or the other. Twenty six respondents representing about 24 per cent had no formal education. 43 respondents representing 39 per cent had primary education. Education plays a major role in creating awareness among farmers and influences the adoption of strategies and techniques that can prevent or curb pilferage. It has been observed generally that formal education has a positive influence on the adoption of innovation. Most studies dealing with agricultural production argue that schooling or the level of education of a farmer helps the farmer in the use of production information leading to increase in yield.

In his study of the effects of education in agriculture: Evidence from Nepa, .Pudasaini (1983) documents that education contributed to agricultural production through worker and allocative effects. He also found that though education enhances agricultural production mainly by improving farmers' decision making ability, the way in it is done differs from environment to environment. Thus, in a technologically dynamic agricultural system, education improves farmers' allocative ability, enabling them to select improved inputs and optimally allocate existing and new inputs among competing uses. On the other hand, in traditional agriculture, it enhances their decision making ability mainly by increasing their ability to better allocate existing farm resources.

In the same vein, Kumbhakar (1991) investigated the determinants of technical and allocative inefficiency in US dairy farms. The stochastic frontier approach was used involving a single-step maximum likelihood procedure. The findings were two. First, that levels of education of the farmer are important factors determining technical inefficiency. Second, that largef arms are more efficient (technically) than small and medium-size farms. The conclusion was that technical and allocative inefficiencies decrease with an increase in the level of education of the farmer. This is similar to the conclusion reached by Ajibefun and Daramola (2003), that education is an important policy variable and could be used by policy makers to improve technical and allocative efficiency.

However, Kalirajan and Shand (1985) argue that although schooling is a productive factor, farmers' education is not necessarily related significantly to their yield achievement. Illiterate farmers, without the training to read and write, can understand a modern production technology as well as their educated counterparts, provided the technology is communicated properly. Using Tamil Nadu rice farmers as a case study, Kalirajan and Shand (1985) conducted a quantitative analysis of various types of education in relation to productivity in order to determine whether schooling of farmers had a greater influence on yield than non-formal education (defined as a farmer's understanding of the technology). The findings revealed that schooling (education) of farmers had an independent effect on yield, but it was not significant. On the other hand, a farmer's non-formal education was found to have a significant and greater influence on yield. Kalirajan and Shand conclude that farmers' schooling and productive capacity need not be significantly related under all circumstances.

Further, Adesina and Djato (1996) investigated the extent to which education affects inefficiency in agriculture using a sample of 410 rice farmers in northern Côte d'Ivoire. The objective was to examine the relative differences in technical, allocative and economic efficiency between educated and non-educated rice farmers. The analysis was based on a duality method, using the normalised restricted profit function approach with factor share equations. The authors found that there is no difference in either relative technical, allocative or economic efficiencies between educated (defined as those who had at least one year of formal schooling) and non-educated farmers. The analysis was repeated for an education threshold of six years of formal schooling, but this did not alter the results (considered as the minimum for literacy in Côte d'Ivoire). The conclusion was that educated farmers are not more efficient than non-educated ones because the latter may have an empirical knowledge obtained from cumulative farming experience. Adesina and Djato recommend that rural development efforts should not be biased towards "educated" farmers as "non-educated" farmers are just as efficient.

For Weirs (1999), at least four years of primary schooling is required to have a significant effect on farm productivity. It was discovered all the farmers sampled had one form of education or the other. It shows that majority of them, about 59 per cent had Quranic education which is a form of religious education that can enable them read some instructions written in Arabic language. This means a few farm chemicals, seeds and fertilisers with Arabic instructions could be understood by these farmers. On the other hand, about 26 per cent of these farmers claimed they posses primary education while about 13 per cent claim they posse's secondary education and about 2 per cent posses tertiary education. The implication is that about 41 per cent of these farmers have western education and could there fore read and understand farm production instructions. It also means this group of farmers could easily be open to understanding and accepting production innovations that could enhance better productivity.

2.2.3 Farmers' Social-Economic Status and Dry Season Farming

The coefficient of the household size variable is positively related to technical efficiency, suggesting that a large family size enhances technical efficiency on non irrigated lands. The significance of the household size variable for non-irrigators seems plausible. First, larger farm families provide farmers with a variety of labour (children, youth, men and women), which leads to division of labour and specialisations. It can be productive for the household to employ its own children in order to avoid the hassle of hiring workers each season, spending extra money and supervising them. These findings confirm the conclusions reached by Ogundele and Okoruwa (2004) that farm size significantly determines levels of technical efficiency and the results of Parikh and Shah (1995) that land fragmentation leads to technical inefficiency.

In their studies on farmer's experience, Omolehin, Adeniji, Maiangwa and Oguntolu (2008) also found that all the farmers sampled were experienced in farming. About 13 per cent claimed they had 7 years experience in farming, about 17 per cent had 12 years experience in farming, about 40 per cent had 15 years experience in farming and about 28 percent had as much as 20 years of experience in farming. Experience could contribute positively or negatively to technology adoption while at times, farmers that are used to doing things in a particular old way may find it difficult to change and as such experience could become an impediment to adoption of innovation.

In their studies on the Influence of Farmers' Demographic Characteristics on Knowledge Gap of Recommended Fadama Technologies in Ilaro Agricultural Zone of Ogun State, Agwu and Edun (2007) submitted that 49.4% of the respondents had small household size (1-5 people), 47% had household sizes of 6 to 10 people while 3.6% of them had 11 people or more in their households. The average household size was approximately six. This relatively large household size of the farmers may likely enable them to use family labour in carrying out some fadama farming operations, thereby reducing the incidence of reliance on hired labour. Their studies also reveals that 9.6% of the respondents did not belong to any farmers' co-operative organizations, 24.1% were members of one farmer co-operative organization, 36.1% belonged to 2, while 22.9% of the respondents participated in/belonged to 3 farmers' co-operative organizations. Also, 6.0% belonged to 4 farmers' co-operative organizations while 1.2% of them belonged to 5 farmers' cooperative organizations. The implication is that a greater percentage (90.4%) of the farmers' belonged to at least one farmer co-operative organization.When farmers belong to cooperative organizations, it will be easier for them to share ideas and information about developments in their dry season farming. Such information and ideas will help farmers to disseminate new technologies within themselves. On the farm size of dry season farmers, their studies shows that majority (95.2%) of the fadama farmers devoted less than I hectare of land to dry season farming. This implies that majority of the fadama farmers were subsistent farmers.

The study by Agwu and Eleghasim (2002) also indicated that majority (81.7%) of the fadama farmers in Okigwe agricultural zone of Imo State cultivated less than 1 hectare of land, showing the predominance of small-scale farmers in the fadama programme of the two states. show that 33.7% of the farmers earned below N10, 001 annually, 22.9% earned more than N 50,000 and above while 12% of them earned between N 20,001 and N 30,000. About 11% of the respondents indicated that they earned between N40,001 to N 50,000. The implication is that most of the respondents in the area realized reasonable income from fadama farming, in that about 23% of them earned more than N 50,000 as their annual income from fadama enterprises

In another study conducted by Sani, Abubakar, Yakubu , Atala and Abubakar. (2014) on socio-economic factors influencing adoption of dual-purpose cowpea croduction technologies in bichi local government area of Kano state, the result showed that most rural households in Nigeria are large because of the kinship structure and the extended family system (Gbadegesin & Olorunfemi 2007)., It is not surprising therefore that more than half (51.0%) of the farmers had between 6 and 10 members in their households. Furthermore, another 24.5% had 11-15 members, 22.0% had 1-5 while 2.5% had 16 and above members in their households, with an average of 8 members. This is in agreement with the findings of Ofuoku, Egho & Enujeke. (2009). TO, reported 8 persons as average household size of integrated pest management adopters. Ekwe and Nwachukwu. (2006) also reported that the average household size in Africa was 8-9 persons per household. This is highly indicative of the extended family system in the study area where parents and other relations dwell together as a household. Implication of this finding is that large family size of the farmers probably necessitated them to learn new agricultural technologies for augmenting production and increasing returns. More family labour would also be readily available since relatively large household size is an obvious advantage in terms of labour supply. The results also show that the highest proportion of the farmers (46.0%) had 2.1-3 hectares of land while only 10.5% had more than 3 hectares of land. The mean farm size was 2.2 hectares. This implies that the study area comprises of small-scale farmers. This finding agrees with Olayide, (1992) that Nigerian farmers are small-scale farmers that cultivate small area of land. Similarly, Oluyole & Sanusi (2009); Onweremadu, and Mathews-Njoku, (2007) in their studies found the average farm size of their respondents to be 2 and 2.5 hectares, respectively. This relatively small farm size will inevitably lead to subsistence farming which do not encourage commercial farming. It could also constitute a major constraint to full technology adoption. Majority (90.5%) of the farmers had 5-10 years of farming experience. The mean farming experience was 8 years. This indicates that the farmers were experienced enough to be able to understand the technology and adopt it. The length of experience in farming is probably an indicator of a farmer's commitment to agriculture. It may not necessarily pre-dispose him to adoption of new practices; it is more logical to expect veteran farmers to be less receptive to innovation. Long farming experience is an advantage for increase in farm productivity since it encourages rapid adoption of farm innovation. Long farming experience according to Obinne, (1999) is an advantage for increase in farm productivity since it encourages rapid adoption of farm innovation.

In another study by Sabo and Zira (2009) on the awareness and effectiveness of vegetable technology information packages by vegetable farmers in Adamawa State, it was discovered that most farmers cultivate lees than five acres. This trend may be associated with the lack of capital. Expectedly, farmers in the study area use primitive tools and this are in line with conclusions of Mofeke, Ahmada and Mudiane (2003) in a similar study among farmers in south western Nigeria. Because most of the farmers operate on a small scale, the use of Ox-drawn plough was common as compared with mechanized farming. Vegetable farmers interviewed have had substantial experience in vegetable production, and in most cases the land used for vegetable production are rented.

2.3 Concept of Farm Demonstrations

There are two principal types of demonstration used by extension agents - method demonstration and result demonstration.

Method demonstrations are group extension events conducted over one or two hours to demonstrate and practice a specific skill, step by step. Method demonstrations are low cost and relatively efficient as they involve one extension worker and several farmers. They are participatory and enable farmers learn by doing (Government of the People of Bangladesh (GPRB), 1999).

Topics for demonstrations should be identified on the basis of farmer's needs or problems and are shown in the group plan. They are defined in detail in consultation with farmers. When a specific topic is agreed, a task analysis should be conducted. A task analysis is a breakdown of the method into series of small steps, and a summary of the main learning points for each step. The task analysis provides the format for the demonstration.

Once a task analysis has been prepared, an appropriate venue and time should be arranged. This should be done in consultation with the farmers group. A day and time which is convenient for farmers and a location near their homes should be chosen. Ideally not more than 20 farmers should attend otherwise it is difficult for somebody to see what is happening, or difficult for somebody to practice some of the stages (GPRB 1999).

During implementation, the extension agent responsible for organising the demonstration should arrive early with all the necessary materials and ensure everything is in order. Successful implementation of demonstration according to GPRB (1999) requires:

- an informal atmosphere where people are free to ask questions;
- an introduction to every session where the purpose of the method demonstration is explained;
- an overview of materials that will be used (seeds, live samples and tools); that the method demonstration is followed according to the task analysis;
- that each of the important learning points in each step are explained a summary at the end of the session;

- that each participant is confident enough to use the method on his or her own farm or homestead after the event;
- that a record of all activities is taken and recorded .

Participants and the extension agent or facilitator agree on any follow-up action that may have arisen.

Result Demonstrations with Farmer's Groups

Result demonstrations show what happens as a result of using a particular technology in the field or homestead. Result demonstrations can be conducted over a single season, two seasons, or a whole year. Although some result demonstrations are conducted with an individual farmer, others are conducted with groups. Those which are conducted with individuals are only really effective when combined with group extension events at the demonstration site (GPRB, 1999). The different types of result demonstrations include:

-cropping pattern demonstrations;

-block demonstrations;

- single season demonstrations;

-single intervention demonstrations; and

- package demonstrations (GPRB, 1999).

Single Season Demonstrations

Single season demonstrations last for only one season. They are usually conducted with a single crop, unless the demonstration involves intercropping. Single season demonstrations are used to demonstrate a single aspect of crop production.

A single season demonstration can be any size, so it could be a block demonstration (GPRB, 1999).

Single Intervention Demonstrations

Single intervention demonstrations are conducted on a crop which is already being grown in an area. They show only one adjustment to the farmers practice. A single intervention demonstration has two plots, one control plot which is the farmers' normal practice (variety, fertiliser, water management, or pest and disease management), and one demonstration plot. There is only one difference between the control and the demonstration plot. For example, a different timing to fertiliser applications or the use of a different water management practises. This is so that the farmer clearly understands the precise benefits of a single change. Single intervention demonstrations also usually show ideas which farmers can adopt at little cost. In theory, a single intervention demonstration could be of any size or duration, so it could be a cropping pattern demonstration, a single season demonstration, a block demonstration, or a single farmer demonstration (GPRB, 1999).

Package Demonstrations

Package demonstrations are conducted mainly for crops which are new in an area. For new crops, a package demonstration shows which variety to plant and when, what fertiliser to use and when, what water management procedures to use, how to control pests and diseases and all other aspects of production. There is no control plot, as the crop is new to the area. A package demonstration could be of any size or duration, so it could form part of a cropping pattern demonstration, be a single season demonstration, or a block demonstration (GPRB, 1999).

Single Farmer Demonstrations

Result demonstrations can also be conducted as an individual event. Single farmer demonstrations are conducted with one farmer, as opposed to block demonstrations which are conducted with a group of farmers over several hectares of land. Single farmer demonstrations are smaller, and often comprise two plots, a demonstration and a control, each of which perhaps cover 200 m2 or 400 m2.

Result demonstrations are planned by: selecting the demonstration site; planning the inputs required; and training the farmers (GPRB, 1999).

2.3.1 Demonstration and Dry Season Farming

Demonstration can be used to teach dry season farmers such skills like method of planting, fertiliser application, method of diseases and pests control, method of weeding and harvesting (GPRB, 1999).

Typical Analysis for a Demonstration

Table 2.1: Topic: Drilling Method of leafy vegetable planting (Amaranthus species)

Step	Method	Main learning points
Seed selection	Select viable seeds and remove unwanted materials	Removal of unwanted materials from seeds.
Land preparation	Clearing the land and seed bed preparation	Land clearing without burning
Drilling preparation	Use the hoe to make the planting lines on the prepared seed bed.	How to make drilling holes
Seeds drilling	Put vegetable seeds in drilling holes already made.	Drilling of seeds
Covering of seeds	The drilled seeds are covered with soil usually by hand.	Covering of drilled seeds.
Wetting	The planted seedbed is wet immediately.	Immediate wetting of planted seeds.

Materials: Cutlass, hoe, seed tray, seeds, watering can.

Evaluation: A method demonstration can only be evaluated by re-visiting the farmers who participated in it to see if they have tried the technology.

2.4 Concept of Farmers Field School

The Farmer Field School is a form of adult education, which evolved from the concept that farmers learn optimally from field observation and experimentation (Pontius & Bartlett, (2002). Farmers field school consists of groups of people with common interest, who get together on a regular basis to study the "how and why" of a part.icular agricultural topic (Braun & Duveskog 2008). The farmer field school is particularly developed for field studies, where hands-on management skills and conceptual understanding (based on non-formal adult education principles) is required. The essential and original elements of farmers' field school according to Braun and Duveskog (2008) include:

The Group: A group of people with common interest from the core of the farmer field school. The group may be mixed with men and women or separated, depending on culture and topic. The group could be an established one, such as self-help, women's or youth groups. The FFS tend to strengthen existing groups or may lead to the formation of new groups. The FFs is not developed with the intention of creating a long-term organisation although it often becomes one (Gallagher, 2003).

The Field: Farmer field school was about practical, hands-on topics. In the FFs, the field is the teacher, and it provides most of the training materials like plants, pests, soil particles and real problems. Any new "language" learned in the course of the studies can be applied directly to real object and local names can be used and agreed on. Farmers are usually much more comfortable in field situations than in classrooms. In most cases, communities can provide a study site with a shaded area for follow-up discussions (Gallagher, 2003).

The Facilitator: Each farmer field school needs a technically competent facilitator to lead members through the hands-on exercises. There is no lecturing involved, so the farmers field school graduate. In most programmes, a key objective is to move towards better facilitators than outside extension staff – they know the community and its members, speak a similar language, are recognised by members as colleagues, and know the area very well (Gallagher, 2003).

The Curriculum: The farmers field school curriculum follows the natural cycle of its subject be it crop, animal, soil or handicrafts. For example, the cycle may be "seed to seed" or "egg to egg". This approach allows all aspects of the subject to be covered, parallel with what is happening in the FES member's field. For example, application of organic manure to dry season leafy vegetables takes place at the same time as farmers are applying fertiliser to their own crops (Gallagher, 2003). The lesson learned can be applied directly. One key factor in the success of FFs has been that there are no lectures – all activities are based on experimental (learning-by-doing), participatory, hands-on-work. Thus builds an adult learning theory and practice. Each activity has a procedure for action, observation, analysis, and decision-making. The emphasis is not only on "how" but also on “why”. Experience has shown that structured, hands-on activities provide a sound basis for continued innovation and local adaptation, after the FFS have been completed (Gallagher, 2003).

The Programme Header: Most FFS programmes exist within a larger programme, run by government or a civil society organisation. It is essential to have a good programme leader who can support the training of facilitators, get materials organised for the field, solve problems in participatory ways and nurture field staff facilitators. This person needs to keep a close watch on the FFs for potential technical or human relations problems. He or she is likely to be responsible for monitoring and evaluation.

Financing: Farmer field school needs a sort of financing to support the group learning activities. They can be expensive or low-cost, depending on who implements them and how they are conducted (Gallagher, 2003).

2.4.1 Farmer Field School and Dry Season Farming

Farmer field school approach can be used to design a programme for dry season farmers that could lead to the adoption of new technologies in dry season farming (Gallapher, 2003). The programme could be the introduction and growing of improved varieties of leafy vegetables with organic manure. This programme will be broken down into different FFs sessions until all aspects of the subject are covered. A typical FFs session for dry season farmers in an area could be as follows:

According to Gallapher, (2003), atypical FFS session is as follows:

8.00am	-	Opening (often with prayer)
	-	Attendance call
	-	Day’s briefing activities
	-	Stretching exercises
8.30am	-	Go to the field in small teams
-	-	Make observation that is noted by the facilitator and one person in the group writes or records. Facilitator points out interesting new development.

9.30am - Return to shade. Discuss on the observation and discuss management decisions.

10:15am - Each team presents results and the group arrives at a consensus on management needs for the next meeting.

11:00am - Short tea/coffee/water break/snacks

11:15am - Energiser or group building exercise

11:30am - Special study topic or second crop study. Anything that could be of special interest to the group could be discussed here.

12.30pm - Closing (often with prayer)

2.5 Concept of Organic Manure

Manures are plant and animal wastes that are used as sources of plant nutrients (Reddy 2005). They release nutrients after their decomposition. The art of collecting and using wastes from animal, human and vegetable sources for improving crop productivity is as old as agriculture. Manures are the organic materials derived from animal, human and plant residues which contain plant nutrients in complex organic forms (Reddy 2005). Naturally occurring or synthetic chemicals containing plant nutrients are called fertilisers. Manures with low nutrient, content per unit quantity have longer residual effect besides improving soil physical properties compared to fertiliser with high nutrient content. Major sources of manures according to (Reddy 2005) are:

- Cattle shed wastes-dung, urine and slurry from biogas plants
- Human habitation wastes-night soil, human urine, town refuse, sewage, sludge and sullage
- Poultry litter, droppings of sheep and goat
- Slaughterhouse wastes-bone meal, meat meal, blood meal, horn and hoof meal, Fish wastes
- By-products of agro industries-oil cakes, bagasse and press mud, fruit and vegetable processing wastes etc
- Crop wastes-sugarcane trash, stubbles and other related material
- Water hyacinth, weeds and tank silt, and
- Green manure crops and green leaf manuring material

- Manures can also be grouped, into bulky organic manures and concentrated organic manures based on concentration of the nutrients.

Bulky organic manures

Bulky organic manures contain small percentage of nutrients and they are applied in large quantities (Reddy, 2005). Farmyard manure (FYM), green-manure and compost are the most important and widely used bulky organic manures. Use of bulky organic manures according to Reddy, (2005) has several advantages such as;

They supply plant nutrients including micronutrients

They improve soil physical properties like structure and water holding capacity.

They increase the availability of nutrients

Carbon dioxide released during decomposition acts as a CO2 fertilizer and Plant parasitic nematodes and fungi are controlled to some extent by altering the balance of microorganisms in the soil http://www.idrc.ca/openebooks/337-9/f0026-03.jpg

Farmyard manure

Farmyard manure refers to the decomposed mixture of dung and urine of farm animals along with litter and left over material from roughages or fodder fed to the cattle (Reddy, 2005). On an average well decomposed farmyard manure contains 0.5 per cent N, 0.2 per cent P2O5and .0.5 per cent K2O.The present method of preparing farmyard manure by farmers is defective. Urine, which is wasted, contains one per cent nitrogen and 1.35 per cent potassium. Nitrogen present in urine is mostly in the form of urea which is subjected to volatilisation losses (http://www.komitkompost.co.uk/images.jpg). Even during storage, nutrients are lost due to leaching and volatilization. However, it is practically impossible to avoid losses, but can be reduced by following improved method of preparation of farmyard manure. Trenches of size 6 m to 7.5 m length, 1.5 m to 2.0 m width and 1.0 m deep are dug. All available litter and refuse arf mixed with soil and spread in the shed so as to absorb urine. The next morning, urine soaked refuse along with dung is collected and placed in the trench. A section of the trench from one end should be taken up for filling with daily collection. When the section is filled up to a height of 45 cm to 60 cm above the ground level, the top of the heap is made into a dome and plastered with cow dung earth slurry. The process is continued and when the first trench is completely filled, second trench is prepared.

The manure becomes ready for use in about four to five months after plastering. If urine is not collected in the bedding, it can be collected along with washings of the cattle shed in a cemented pit from which it is later added to the farmyard manure pit. Chemical preservatives can also be used to reduce losses and enrich farmyard manure (Reddy, 2005). The commonly used chemicals are gypsum and superphosphate. Gypsum is spread in the cattle shed which absorbs urine and prevents volatilisation loss of urea present in the urine and also adds calcium and sulphur. Superphosphate also acts similarly in reducing losses and also increases phosphorus content. Partially rotten farmyard manure has to be applied three to four weeks before sowing while well rotten manure can be applied immediately before sowing (http://swastikbone.com/images/products/large/Bone-Meal.j).
Generally 10 to 20 t/ha is applied, but more than 20 t/ha is applied to fodder grasses and vegetables (http://www.idrc.ca/openebooks/337-9/f0026-03.jpg) In such cases farmyard manure should be applied at least 15 days in advance to avoid immobilisation of nitrogen. The existing practice of leaving manure in small heaps scattered in the field for a very long period leads to loss of nutrients. These losses can be reduced by spreading the manure and incorporating by ploughing immediately after application.

Vegetable crops like potato, tomato, sweet-potato, carrot, raddish and onion, respond well to the farmyard manur (http://www.idrc.ca/openebooks/337-9/f0026-03.jpg). The other responsive crops are sugarcane, rice, napier grass and orchard crops like oranges, banana, mango and plantation crop like coconut. The entire amount of nutrients present in farmyard manure is not available immediately. About 30 per cent of nitrogen, 60 to 70 per cent of phosphorus and 70 per cent of potassium are available to the first crop.

Sheep and Goat Manure: The droppings of sheep and goats contain higher nutrients than farmyard manure and compost (http://.komitkompost.co.uk/images/pile32124.jpg) on an average, the manure contains 3 per cent N, 1 per cent P_2O_5 and 2 per cent K_2O. It is applied to the field in two ways. The sweeping of sheep or goat sheds are placed in pits for decomposition and it is applied later to the field. The nutrients present in the urine are wasted in this method. The second method is sheep penning, wherein sheep and goats are kept overnight in the field and urine and fecal matter added to the soil is incorporated to a shallow depth by working blade harrow or cultivator.

Poultry Manure: The excreta of birds ferment very quickly. If left exposed, 50 per cent of its nitrogen is lost within 30 days. Poultry manure contains higher nitrogen and phosphorus compared to other bulky organic manures (.komitkompost.co.uk/images.jpg) The average nutrient content is 3.03 per cent N; 2.63 per cent P2O5 and 1.4 per cent K2O.

Concentrated organic manures: Concentrated organic manures have higher nutrient content than bulky organic manure (Reddy, 2005). The important concentrated organic manures are oilcakes, blood meal, fish manure etc. These are also known as organic nitrogen fertiliser. Before their organic nitrogen is used by the crops, it is converted through bacterial action into readily usable ammoniacal nitrogen and nitrate nitrogen. These organic fertilisers are, therefore, relatively slow acting, but they supply available nitrogen for a longer period (Reddy, 2005).

Oil cakes: After oil is extracted from oilseeds, the remaining solid portion is dried as cake which can be used as manure. The oil cakes are of two types:

- Edible oil cakes which can be safely fed to livestock; for example Groundnut cake, Coconut cake and
- Non edible oil cakes which are not fit for feeding livestock; e.g.: Castor cake, Neem cake, Mahua cake

Both edible and non-edible oil cakes can be used as manures. However, edible oil cakes are fed to cattle and non-edible oil cakes are used as manures especially for horticultural crops. Nutrients present in oil cakes, after mineralisation, are made available to crops 7 to 10 days after application. Oilcakes need to be well powdered before application for even distribution and quicker decomposition (www.komitkompost.co.uk/images/pile3212.jpg)

2.5.1 Organic Manure and Dry season Faming

Farmers apply the Zaï technique to recover crusted land called “Zippelle”. Zaï is a planting pit with a diameter of 20to40 cm and a depth of 10to20 cm - the dimensions vary according to the type of soil. Pits are dug during the dry season from November until May and the number of Zaï pits per hectare varies from 12,000 to 25,000. After digging the pits, organic matter is added at an average, recommended rate of 0.6 kg/pit and, after the first rainfall, the matter is covered with a thin layer of soil and the seeds placed in the middle of the pit (Essama, 2005).The yield for sorghum grain was evaluated in the Zaï and the non-Zaï plots during two growing seasons. Data are from 16 villages in 2002 and 32 villages in 2003. The results show significant differences between the Zaï and non-Zaï field. The findings are consistent with those from other studies on Zaï in other regions which show the effect of the practice on the yield of sorghum (Kabore, 1991; Bamboo, 1996; Dakuo; 2000; Sawadogo, 2001; Essama 2005). The yield increase is attributed to a better use of rainfall and improvement of soil fertility as results of the application of organic matters in the pits. In majority of villages, the surplus production realised by farmers in one hectare was higher than 0.5 ton. This validates the effectiveness of the technique in increasing the productive capacity of the plots.

In a research carried out by Ofosu-Anim and Leitch (2009) on the relative efficacy of organic manures in spring barley (Hordeum vulgare L.) production, the experiment was studied in a pot experiment in a heated glasshouse at the University of Wales, Aberyswyth from November 2006 to March 2007. Spring barley seeds were sown in 120 pots containing a mixture of peat and 180g dry weight of poultry manure, cow dung, chicken manure pellet, sheep manure and horse manure. Chicken manure pellet was applied at 3.0 g pot-1 as top dressing. Mineralisation pattern of the organic manures was monitored in a parallel experiment with 24 pots containing only the growth media. In this study, organic manures significantly increased plant height and chlorophyll content of leaves over the control plants. The application of inorganic fertiliser increased plant height over chicken manure and compost. In addition chlorophyll content was higher with inorganic fertiliser than cow dung at six weeks after germination. N mineralisation significantly varied among organic manure sources with compost having the highest mineralised N and sheep manure the least. Plant tissue analysis revealed significant differences in plant tissue nutrient composition under organic manure treatment. Growing plants in organic manure resulted in 1.2 to1.6-folds, 1.1 to 4-fold and 1.1 to 4.1-fold increases in total N content of plant tissue at four weeks, eight weeks and twelve weeks after germination, respectively. Dry matter production by plants was also significantly increased under organic manure treatments. Organic manure application had the potential of increasing spring barley yield by 1.5 to 4-fold. Cow dung appeared to be the best source of organic manure for spring barley production.

In another study by Malligawad, Lokanath, Mamle Desai, Bentur and Parameshwarappa (2007) worked on the effect of organics on the productivity of large seeded (Confectionery) groundnut under rain-fed farming situations, the results indicated that organic farming with heavy application of farmyard manure (FYM) (75 t/ha) during kharif 2004 produced higher dry pod yield (3510 kg/ha) as compared to inorganic farming involving applications of recommended dose of NPK fertilisers (2970 kg/ha). However, during 2005 and 2006, inorganic fertiliser amended plots produced higher pod yield of groundnut (1660 to 2333 kg/ha) compared to organically amended plots (1597 to 1937 kg/ha). The study indicated that the groundnut showed greater response to the application of organic manures (i.e., organic farming) under low rainfall with dry spell situations occurring at early growth stages. They also applied organic amendments to a groundnut crop during kharif and no organic manures and fertilisers to safflower during rabi in groundnut safflower sequence cropping system (double cropping system) produced 13.24 to 22.69 % higher seed yield of safflower over treatment with the inorganic fertilizers to groundnut crop during kharif and no organic manures and fertilisers to safflower during rabi (816 to 1437 kg/ha).This revealed that if properly applied, organic manure has the tendency of increasing dry season crop yield than inorganic fertilisers.

2.6 Drilling Method of Planting and Dry Season Farming

Drilling or row seeding is a method of planting where seeds are put in drills, made with a pointed stick or with a hoe (Waaijenberg, 2003). After sowing, the edges of the drill are turned over with a rake so the seeds are covered. To make straight drills, use a string stretched between two stakes as a guideline. By using a marker you can quickly make several parallel drills at once. On sloping ground, the drills should be made across the slope, to prevent the earth from being washed away by rain. Row seeding ensures each plant has the same surface area available and makes weeding easier (Waaijenberg, 2003). Watering is also easier if ditches are made between the rows of plants.

The drill method of planting crops is done, either manually or mechanically, by releasing seeds continuously, as if pouring water from a bottle with a small opening. Manual drilling applies to small seeds like rice, millet, and mungbean and is usually done by hand. It can also be accomplished by placing small, roundish seeds in a bottle with a hole on the cover. The seeds are simply released by tilting and slightly shaking the bottle so that the seeds drop one after the other or in a cascade through the hole and toward the ground (Bareja, 2011).

The seeds are drilled with or without furrows. In rice, drilling in puddled soil in linear direction is a modification of seed broadcasting in which plants are dispersed without plant-to-plant spacing. But in rain-fed sorghum, mungbean, and other grain legumes, the seeds are always drilled at the bottom of the furrow, covered with soil by raking or by foot, and stepped on to press the soil. Just like in the hill method of planting crops, an even distribution of drilled seeds is intended but varies with the seeding rate per hectare and row distance. With a seeding rate of 100 kg per hectare in rows 20 cm apart, the calculated average seeding rate per linear meter in the row is 2 grams. With 1000 grain weight of 29 grams for rice, this is equivalent to a seeding rate of about 70 seeds per linear meter. But if the row distance is widened to 25 cm, the average seeding rate will increase to 2.5 grams or 86to87 seeds per linear meter (Bareja, 2011).

2.7 Vegetables: Concepts, Types, Nature and Characteristics

A vegetable is an edible plant or its part, intended for cooking or eating raw Harri and Franca, (2003). Vegetables are the fresh and edible portions of herbaceous plants. They are important food and highly beneficial for the maintenance of health and prevention of diseases. They contain valuable food ingredients which can be successfully utilized to build up and repair the body. Vegetables are valuable in maintaining alkaline reserve of the body. They are valued mainly for their high carbohydrate, vitamin and mineral contents. There are different kinds of vegetables. They may be edible roots, stems, leaves, fruits or seeds. Each group contributes to diet in its own way (Robinson, 1990).

Why Vegetables Are Important

The average person gets three servings of vegetables a day, which is far less than the recommended five to 13 servings, according to the Harvard School of Public Health, eating vegetables can prevent heart disease, maintain a healthy blood pressure, prevent certain types of cancer and even prevent cataracts and macular degeneration. Still, people do not eat enough vegetables (Peete, 2010). He listed other importance of vegetables as follows:

Nutrients: Vegetables are low-fat, low-calorie and contain no cholesterol, according to the United States Department of Agriculture's MyPryamid website. Vegetables are excellent sources of vitamins A, E and C, fibre, folic acid and potassium. Potassium is essential in controlling blood pressure. Folic acid helps form red blood cells in the body. Vitamin A is essential for skin and eye health. Vitamin C helps the body heal cuts and wounds and keeps gums and teeth healthy. Vitamin E guards vitamin A and essential fatty acids from cell oxidation.

Cardiovascular Health: People who eat more vegetables have a lower risk of heart disease or stroke. According to a study conducted at the Harvard School of Public health, persons who eat more than five servings of leafy green vegetables such as spinach, greens, broccoli, cabbage and cauliflower have a 20 percent lower risk of developing coronary heart disease compared with those who eat fewer than three servings per day (Hung, et al., 2004).

Gastrointestinal Health: Vegetables provide fibre, which aids digestion. Fiber soaks up fluid and expands as it passes through the digestive system. This action calms an irritable bowel and provides relief from constipation (Lemb & Camilleri, 2003). The softening and bulking action of the insoluble fibre in vegetables also prevents diverticulosis and diverticulitis by decreasing pressure within the intestinal tract (Aldoori, 1998).

Vision: The vitamin A in vegetables maintains the health of your eyes. Carrots keep your night vision sharp. The lutein and zeaxanthin in leafy green vegetables such as kale and spinach protect your eyes from free radicals--air pollution, cigarette smoke and sunlight--that over time can cause macular degeneration and cataracts (Chriten, 2004).

Other Health Benefits: Eating vegetables can reduce risk of diabetes, prevent kidney stones and decrease or prevent bone, loss, according to the MyPyramid website; vegetables are a great low-calorie substitute for high-calorie foods or snacks.

Agricinfo, (2010) lists other importance of vegetables as;

Importance as Food:

Food production is increasing. It is essential to sustain increased production besides nutritional standard of people. It can be increased by increasing production of vegetables which will solve food problems as yield of vegetable crops is 4 to 10 times more than cereals. Thus, vegetables play a vital role on food front as they are cheapest-sources of natural foods and can admirably supplement the main cereals of the country.

Importance to Growers: Nature is in providing us-with all kinds of vegetable crops that can be grown in different seasons of the year in region. Different kinds of vegetables provide leaf, stem, flower, fruit or seed for consumption.' Considering vividness in the requirement of soil and season, farmers can grow vegetable crops throughout the year for earning regular and steady income to meet daily expenditure. There are vegetables of very short duration that can be grown as rained and intercrops in either agronomical crops or vegetable crops. There 'are vegetables which will improve soil and also provide fodder to catties. Thus farmer has wide choice to select suitable crop to adjust in his cropping pattern in a given situation. Climate and soil conditions of this region are conducive to grow different vegetables.

Employment: Since cultivation of vegetable crops involves intensive cultural operations starting from sowing to marketing, it provides more and regular employment opportunities in rural areas.

Industrial importance: The perishable nature of vegetables demand comprehensive planning for movement, storage, processing and distribution of vegetable products. The growth of vegetable industry as a commercial proposition largely depends mainly on allied enterprises like storage, processing marketing and maintenance and service enterprises to encourage vegetable growing (Agricinfo, 2010).

Importance of Vegetables in Farmers' Economy

Vegetables are important .sources of farm income:

a. Vegetables are sold at a higher rate than other crops. It provides regular as well as good source of income in addition to the income from the agronomic crops.

b. It provides regular work throughout the year to the fanners and his family labours.

c. Per acre yielded vegetables is very high: Vegetables give very high quantity of food per acre and they grow quickly. It is found that vegetables give higher yields in comparison to other crops.

d. More Vegetables can be raised in one year: Most vegetables are short duration crops compared to other crops, it can be raised throughout the year Some of Vegetables (i.e. potato, brinjal, spinach, pumpkin, lady's finger etc.) can be grown twice and even thrice a year, some green vegetables become ready for harvesting within 15to60 days of sowing (Agric info, 2011.)

2.7.1 Celosia species

Celosia is a small genus of edible and ornamental plants in the amaranth family, "Amaranthaceae". The generic name is derived from the Greek word) meaning "burned," and refers to the flame-like flower heads. Species are commonly known as woolflowers, or, if the flower heads are crested by fasciation, cockscombs (Sunset1985). . Common Names: cockscomb, feathered amaranth, woolflower, red fox, celosia, prince

Chromosome number

2n = 36, 72, 108

Vernacular names

Celosia, Lagos spinach, *soko*, quail grass, cock's comb (En). C*élosie, célosie argentée, crête de coq (Fr). Amaranto branco (Po). mfungu (Sw)*

Origin and geographic distribution

The wide diversity of Celosia argentea in tropical Africa points to an origin in this region. Celosia argentea is a widespread weed throughout tropical Africa (Denton, 2004), from Senegal east to Somalia and south to northern South Africa and the Indian Ocean islands, and a traditional vegetable in West and Central Africa. It is one of the leading leaf vegetables in south-western Nigeria, where it is known as 'soko yòkòtò' in the Yoruba language, meaning 'make husbands fat and happy (Denton, 2004)'. It is extremely important as well in southern Benin, also popular in Togo, Ghana and Cameroon, and recorded as a vegetable from several other West and Central African countries. Outside Africa, it occurs in tropical and subtropical Asia and America (Denton, 2004). The ornamental forms of Celosia argentea with fasciated inflorescences (cock's comb) probably originate from India. These are widely grown as an ornamental in the tropics and subtropics, and in summer in temperate regions (Denton, 2004)

Description: The celosias or cockscombs are erect, branching plants with oval or lance-shaped, strongly veined leaves 2 to 6 in (5.1-to15.2 cm) long and hundreds of tiny flowers packed in dense, brightly colored flowerheads which usually stand above the foliage. The wild form, Celosia argentea var. argentea is a weedy annual or short-lived perennial 6 ft (1.8 m) tall, with erect plumes of silvery white flowers. C. argentea var. cristata (a.k.a. C. cristata) is a tetraploid cultigen of garden origin with many cultivars classified into several groups. These cultivars come with flower heads in a variety of shapes (some rather weird), and brilliant hot colors including red, orange, yellow, purple and creamy white (Denton, 2004).

Culture of Celosia

Moisture: The celosias require constant moisture, but a well drained soil. Plants that survive periods of drought may become stunted and flower only poorly. Hardiness: Celosias are warm weather annuals. They can be stunted if exposed to temperatures below about 60ºF (15.5ºC). Celosias thrive in hot, humid weather(Denton, 2004).

Propagation: Many gardeners purchase their celosias in the bedding plant section at their local garden centre. The best plants to get are those that have not flowered yet. Celosias are easy to start from seed. Sow shallowly in soil or potting mix at 70 to75ºF (21to24ºC), and set out when nighttime temperatures stay above 45º or 50ºF (7 to 10ºC). Six week old seedlings should bloom in about two months (Denton, 2004).

Growth and development

The seedling emerges 5 to 7 days after sowing. Early vegetative growth is slow but flowering may occur 6 to 7 weeks after sowing. Improved cultivars have a more rapid early vegetative development but flower later, 12to14 weeks after sowing. The early flowering of local cultivars or wild types make them less attractive to consumers and more amenable to once-over harvesting by uprooting, whereas the improved cultivars can be harvested by uprooting as well as by repeated cutting. Flowering is delayed by repeated cutting of the tender vegetative parts. Pollination is by wind and insects, especially bees and flies, which visit the flowers regularly. Seed maturity starts from the basal part of the inflorescence and gradually moves up to the tip. Consequently, seeds from the basal parts of the inflorescence are more vigorous than those from the middle and apical regions. Seeds are mature in 10to20 weeks from sowing and shatter when the inflorescence is dry. They remain dormant on the soil surface until the start of the next rainy season (Denton, 2004).

Ecology

Celosia grows well in the lowland humid forest zone at day temperatures of 30to35°C and night temperatures of 23to28°C and at an altitude up to 1700 m. Growth is greatly retarded by temperatures below 20°C, consequently it does not grow well in the savanna region of West Africa during the harmattan period. Celosia performs well under partial shade, especially in dry conditions. Photosynthesis in celosia follows the C_3-cycle pathway; therefore about 60% of full sunlight is adequate for optimal growth, making celosia especially suitable for production in shady home gardens (Denton, 2004).

A well-drained sandy loam soil allows optimum growth, but celosia also grows well on marshy soils. In Nigeria and Benin it is frequently produced during the dry season in so-called ‘fadama’ cropping systems that are on hydromorphic soils of river banks and seasonally flooded areas. An additional advantage is that the flooding eliminates the *Meloidogyne* root-knot nematode problem. Celosia tolerates moderately saline soils of 25to50 mM NaCl. It is moderately resistant to drought and performs well under low water supply of the dry season, but severe drought promotes early flowering. The rainfall requirement during the rainy season is 500to1000 mm (Denton, 2004).

Propagation and planting

Celosia is grown on raised beds, ridges or flat beds. It is propagated by seed, either direct sown or transplanted. The 1000-seed weight is 1.0to1.1 g. For direct sowing, used for harvesting by uprooting whole young plants, a seed rate of 6to9 g per 10 m^2 is used for sowing in rows or broadcasting. Seed is sometimes mixed with dry fine sand to obtain an even seed distribution. Direct sowing is prone to excessive use of seed, excessively high plant densities, difficult management, poor vegetative growth and low yield. With transplanting, less seed is required. Seed is then first sown in nursery beds and after 2to3 weeks the seedlings are transplanted. For harvesting by pruning the seedlings are widely spaced (15 cm × 15 cm on the beds), for once-over harvest by uprooting a spacing of 10 cm × 10 cm is adequate. Compared to direct sowing, transplanting gives more uniform and vigorous plants. Crop management, for example weeding and fertiliser application, is also easier using transplanting; the yield is high and the plant quality is better. Celosia is often grown in intercropping systems with other vegetables, cassava or yam. For seed production, a number of plants are set aside after the first harvest. These plants are cut at a lower height to encourage the production of lateral shoots. The seed yield is 200to700 kg/ha (Denton, 2004).

Management

No weeding is required if the land is well prepared before sowing, harvesting is by uprooting. In case of wider planting for repeated harvesting with improved cultivars, 1to2 weedings are needed before the start of flowering. In mixed cropping celosia competes better with weeds than Jew’s mallow (*Corchorus olitorius* L.), but less so than amaranth. Irrigation is optional during the rainy season. During the dry season, depending on the severity of heat and evapotranspiration, two irrigations per week are recommended, applying a total of 45 mm water. Celosia tolerates dry soil better than amaranth. It responds well to nutrients; a basal fertiliser treatment is not necessary if it is grown on rich soils. For optimum vegetative growth on poor or moderately fertile soils, application of complete NPK fertiliser at a rate of 400 kg/ha in a single dose is needed if the crop is harvested by uprooting, and 600 kg/ha split into two equal applications if the crop is harvested by successive cuttings. Organic manure, for example poultry manure, cow dung or domestic refuse, at a rate of 25–40 t/ha is a suitable alternative for inorganic fertilisers. Organic manure will not only increase growth but also reduce the population and effects of root-knot nematodes (Denton, 2004).

Diseases and pests

Celosia is susceptible to several leaf fungi, which can be severe when air humidity is high and during rainy weather and result in poor leaf quality. *Cercospora celosiae* causes red-rimmed grey spots on the leaves. White rust (*Albugo bliti*) forms white pustules on the underside of the leaves. Other diseases affecting the leaf quality are Alternaria leaf spot (*Alternaria* spp.) and charcoal rot (*Macrophomina phaseolina*, *Curvularia* spp.), which cause dark spots on the leaves. Wet rot or stem rot caused by *Choanephora cucurbitarum*, the main disease of amaranth during the wet season, is sometimes serious in densely planted celosia. *Rhizoctonia solani* and *Pythium aphanidermatum* cause damping-off of seedlings. Celosia is highly susceptible to root-knot nematodes (*Meloidogyne* spp.) causing galls on roots, unthrifty growth, small and chocolate-coloured leaves as well as reductions in yield of up to 40%. It is therefore recommended that celosia shall not be grown continuously and that it is not be followed by other crops susceptible to root-knot nematodes such as okra, gboma eggplant, Jew's mallow, lettuce or tomato. Variation in degree of susceptibility to root-knot nematodes exists among cultivars, but no resistant cultivars have been reported. However, the application of large quantity of organic manure reduces the nematode population, as well as annual flooding. Caterpillars of *Hymenia recurvalis* and *Psara bipunctalis* feed on the leaves. The use of appropriate pesticides can control them. Spraying should start at detection of the caterpillars and should be applied once a week for three weeks. Grasshoppers and aphids cause minor damage in celosia (Denton, 2004).

Harvesting

Celosia is harvested either by uprooting or by repeated pruning of the stem which encourages production of side shoots for further cuttings. Growers at times combine the two methods, first uprooting as a thinning operation to encourage vigorous growth among the remaining plants, which are then harvested by repeated cutting. Depending on soil fertility and moisture, the crop is ready for uprooting 4–5 weeks after direct seeding or about 4 weeks after transplanting. The first cutting is carried out at a height of 10–15 cm leaving a sufficient number of auxiliary buds for the production of lateral shoots. Subsequent cuttings are carried out at 2-weekly intervals, allowing 4–5 harvests before the start of flowering. Flowering is delayed by regular cutting. Traditional cultivars flower earlier than improved ones and are therefore not suitable for harvesting by repeated cutting (Denton, 2004).

Yield

In an experiment in Nigeria a yield of a well-managed crop harvested by uprooting was 47 t/ha, while repeated cuttings yielded 57 t/ha. Repeated cuttings also resulted in a better quality of the produce and less inedible waste and gave a higher economic return. Although celosia is a productive leafy vegetable, its yields are lower than those of amaranth (Denton, 2004).

Handling after harvest

Harvested plants are bundled and tied after washing of soil from the roots. They are then sprinkled with water to keep them fresh for marketing. If harvested late in the evening, the plants are spread on a roof overnight and kept fresh by the night dew. In the market, the plants are tied into small-sized bundles of 0.5to1.0 kg for sale. They are covered with jute cloth and regularly watered. Shelf life of uprooted plants is extended by 2to3 days by keeping the roots in a basin of water Denton, (2004).

Prospects

Celosia argentea is a nutritious and easy to cultivate vegetable, important for southern Nigeria and Benin and with potential for other lowland areas. Improved Nigerian cultivars are late maturing and suitable for repeated cuttings, and have a high yield under proper management. Suitable cultivars with rapid early vegetative growth should be selected for harvesting by uprooting. Breeding and selection work should aim at the development of cultivars with resistance to diseases and pests, particularly root-knot nematodes. Research should also focus on the development of adequate cultural practices in sole and intercropping systems, including irrigation. Simple and cheap storage systems that can be used to prolong the shelf life of harvested seedlings as well as ensure good leaf quality for marketing are also required (Denton, 2004).

Uses of Celosia

Medicinal: It is used as a treatment for intestinal worms (particularly tapeworm), blood diseases, mouth sores, eye problems. The seeds treat are used in chest complaints and the flowers, diarrhea. The leaves are used as dressings for boils and sores, and the boiled vegetables are said to be slightly diuretic.

As a garden plant: Seed production in these species can be very high, 200to700 kg per hectare. One ounce of seed may contain up to 43,000 seeds. One thousand seeds can weigh 1.0to1.2 grams. Depending upon the location and fertility of the soil, blossoms can last 8to10 weeks.

As food: Celosia argentea var. argentea or Lagos spinach (a.k.a. quail grass, Soko, Celosia, feather cockscomb) is a broadleaf annual leaf vegetable. It grows widespread across Mexico, where it is known as "Velvet flower", northern South America, tropical Africa, the West Indies, South, East and Southeast Asia where it is grown as a native or naturalised wildflower, and is cultivated as a nutritious leafy green vegetable. It is traditional fare in the countries of Central and West Africa, and is one of the leading leafy green vegetables in Nigeria, where it is known as 'soko yokoto', meaning "make husbands fat and happy" .In Spain it is known as "Rooster comb" because of its appearance. These leaves, young stems and young inflorescences are used for stew, as they soften up readily in cooking. The leaves also have a soft texture and have a mild spinach-like taste. They are also pepped up with such things as hot pepper, garlic, fresh lime, and red palm oil and eaten as a side dish.

2.7.2 Amaranthus species.

Origin and Geographic Distribution

Amaranthus hypochondriacus originates from North America, possibly as a hybrid between the north American wild *Amaranthus powellii* S.Wats. and the cultivated *Amaranthus cruentus* L. *Amaranthus hypochondriacus* is now widely cultivated worldwide, in tropical, subtropical and temperate climates, but mainly as a grain and ornamental crop. It is also found in tropical Africa (e.g. Kenya), but its exact distribution is unknown because of confusion with related species (Jansen, 2004).

Amaranths are plants of the genus Amaranthus. There are approximately 60 species; all are annuals with small seeds (approximately 0.07 grams per 100 seeds). The cultivated forms are useful for producing nutritious grain and foliage, and are colorful ornamentals (Brenner Battemspenger, Kuhkwo, Lehmam, Myers, Slabbert & Stengh, 2000). The plants are tolerant of heat and drought. Pollination is by wind or insects, most species are monoecious, some are dioecious.

Amaranthus Grain

Forms with white seeds were cultivated in prehistory for use as a grain crop. The grain has an unusually nutritious balance of amino acids making it an excellent protein food (Segura- Niet, Barba-de Rosa & Paredes Lopez, 1994). In the United States, breakfast cereals, pastas, breads, etc. containing amaranth grain or flour are available in health food stores. In India, Mexico, Nepal, Peru, and some other countries, amaranth grain is a traditional food used as gruel or in confectionery products. In the United States, 2,000 to 3,000 ha are in production, Nebraska is the most important state (Stallknecht & Schulz-Schaeffer, 1991). The grain is also potentially useful as a source of small-grained specialty starch and as a source of squalene oil.

Amaranthus Vegetable

Amarantus foliage is used as a vegetable and as an animal food especially in the tropics and subtropics. It is an excellent source of bio-available iron, up to 57 ppm (Rangarajan &Kelly 1994), and vitamin A, averaging 250 ppm. It is also high in protein (Segura-Nieto et al, 1994).

Botany

Annual herb, erect or less commonly ascending, up to 2 m tall, often reddish tinted throughout; stem stout, branched, angular, glabrous or sparsely to moderately densely furnished with multicellular hairs. Leaves arranged spirally, simple, without stipules, long-petiolate; blade broadly lanceolate to rhombic-ovate, 2–18 cm × 2–15 cm, attenuate or shortly cuneate at base, obtuse to subacute at apex, mucronate, entire, glabrous to sparsely pilose, pinnately veined. Inflorescence stiff with thick branches, large and complex, consisting of numerous agglomerated cymes arranged in axillary and terminal spikes, the terminal one up to 45 cm long, usually with many lateral, perpendicular, thin branches. Flowers unisexual, subsessile; bracteoles 3–5 mm long and always longer than the tepals; tepals 5, lanceolate, 1–2 mm long with one equal to or longer than the fruit, the other 4 shorter; male flowers with 5 stamens c. 1 mm long; female flowers with superior, 1-celled ovary crowned by 3 thick, spreading stigma branches about 1.7 mm long. Fruit an obovoid to rhombic capsule 1.5–2 mm long, circumscissile, with a short beak, 1-seeded. Seed obovoid to ellipsoid, compressed, c. 1 mm long, whitish to yellowish or blackish. Seedling with epigeal germination; hypocotyl 10–12 mm long; cotyledons about 18 mm × 5 mm, fleshy, petiolate (Jansen, 2004).

Amaranthus comprises about 70 species, of which about 40 are native to the Americas. It includes at least 17 species with edible leaves and 3 grain amaranths. *Amaranthus hypochondriacus* belongs to both categories. *Amaranthus hypochondriacus* is part of the so-called *Amaranthus hybridus* complex, a group of species in which taxonomic problems are far from clarified because of apparently common hybridization and nomenclatural disorder caused by misapplication of names. Several cultivars of *Amaranthus hypochondriacus* exist; most of these have pale seeds, but some have black seeds (Jansen, 2004).

Other vegetable amaranths are represented by A. dubius, A. blitum and A. cruentus (purple amaranth); weedy species are represented by A. retroflexus (redroot pigweed), A. albus (tumbleweed) and A. spinosus (spiny amaranth). There are not many genetic differences in amaranth species. They are easily cross-bred, even weedy types will cross with the intended crop if not rogued from the field. In a personal conversation, Dr. David Baltensperger, amaranth breeder at the University of Nebraska, shared that it is possible that amaranths may all be of one specie. Because of this, and the fact that cultivation techniques are basically the same for all, we include them together in this technical note. For cultural purposes, grain, vegetable, ornamental and weedy types do have some distinct variations. The leaves and grain of all types are edible and equally nutritious. The seed or grain of the grain type is of a pale color, varying from off-white to pale pink. The seed of the vegetable, ornamental and weedy types is black and shiny. Both types are edible and may be used as flour sources, but if the black seed types are mixed in with the pale types, it is often considered contamination (Yarger, 2008).

Climatic requirements

Temperature

Amaranth is highly tolerant in an arid environment. Amaranth seeds need soil temperatures of between 18 °C and 25 °C to germinate and an air temperature above 25 °C for optimum growth. The growth ceases at temperatures below 18 °C. The number of growing degree days during the growing season is a major determinant of amaranth plant growth. Lower temperatures and shorter days will induce flowering with a subsequent reduction in leaf yield. Frost damage should not be a problem because the crop grows during summer with the start of the rains. However, frost plays an important role in the harvesting of the crop. Because amaranth is an annual crop, it does not mature completely in areas with short growing season. Frost is necessary to terminate the crop's growth (Department of Agriculture, Forestry and Fisheries, 2010).

Water

Grain amaranth is reported to be drought-tolerant compared to most vegetables. Although amaranth is regarded as being drought-tolerant, the precise mechanism involved is not well understood. One trait that helps it in extremely dry conditions is the ability to wilt temporarily and then be revived after rainfall occurs. The crop cannot withstand water logging as it has a relatively low capacity for water consumption. The exposure of the plant to severe drought induces early flowering and halts the production of leaves (Department of Agriculture, Forestry and Fisheries, 2010).

Soil requirements

It is a crop that is adapted to a variety of soil types, including marginal soils, but will do best on fertile, well-drained soils and deeper soils. Loose and friable soils with high organic matter content are ideal for an early and heavy yield. Selecting soils that are low in clay and managing the seedbed to minimise the possibility of crusting can help ensure good stands. Amaranth requires good seed-soil contact for rapid germination and emergence and adequate soil moisture must be maintained at the seeding depth throughout initial establishment. The growth of vegetable amaranth is adversely affected by a soil pH of between 4,7 and 5,3. A soil with a pH of 6,4 could produce high yields. If the plants are treated correctly, it should be possible to harvest leaves every two weeks (Department of Agriculture, Forestry and Fisheries, 2010).

Cultivation

Sowing: To initiate amaranth production, a well-worked, firm and moist seed bed is required. It is important to firm the soil over the seed to make good contact between the seed and the soil. Seed sown at a depth of 1.3 cm (.5 in) or less in soil 15^0C will establish a good plant stand. Seed will germinate within 3 to 4 days with soil temperature of 20^0C (68^0F) (Yarger, 2008).

When sowing vegetable amaranth, there appears to be considerable latitude in choice of plant densities. One approach is to plant dense stands at 5 to10 cm (2 to 4 in) spacing, and harvest by uprooting when the plants are 5to7 weeks old. Another common approach is to sow less densely at 15to30 cm (6 to 12 in), and harvest by cutting the stem tips and tender leaves periodically beginning when the plants are about 15 cm tall (6 in) (4 to 6 weeks). In 1990, Singh, et. al. conducted research comparing the growth of vegetable amaranth planted in rows 90 cm apart at six in-row plant spacing's of 4, 8, 16, 24, 32, and 40 cm (1.5, 3, 6, 9.5, 13 and 16 in). Results concluded higher yield with closer plant spacing (Yarger, 2008).

On a large scale, grain amaranth is direct-seeded into the field otherwise transplanting is subject to the same considerations for vegetable amaranth. Since amaranth seedlings are easily blocked from emergence by the soil crusting over after rain, it is important to select soil and management practices that will minimise crusting. A loose (but firmly packed), friable soil is preferred, and soil cultivation is essential until plants have reached around 25 to 30 cm (10 to 12 in) to prevent crusting and to shade out weeds. Seeding rate recommendations range from 1.2 to 3.5 kg/ha (1 to 3 lbs/a) depending on soil and soil moisture. Standard recommended seeding rate for commercial growers is 2 kilograms of seed per hectare (2 lbs/a). This rate produces so many seedlings that a large number can be lost without reducing yield. For dry sland production, 0.5 to 1 kg/ha (0.5 to 1 lb/a) is recommended. Field studies have shown that amaranth yields remain constant across a range of 0.3 to 4.5 kg/ha (0.25 to 4 lbs/a). There are approximately from 1,000 to 3,000 amaranth seeds per gram (1,000,000 to 2,500,000 /kg). (Sooby, Myers, Baltensperger, Brenner, Wilson & Block, 1998).

Recommendations for plant spacing vary widely for grain amaranth. One recommendation is to space 23 cm (9 in) between plants and 75 cm (30 in) between rows. This corresponds to a planting density of 38,000 plants per hectare (15,400 per acre). Seeding rates up to nine times this density have been used successfully! It would seem that if harvesting is to be done by hand, the less dense spacings are advisable. This results in fewer but larger heads that can be harvested more quickly. A study conducted comparing 20, 38 and 76 cm (7.5, 15 and 30 in) between-row spacings found that the wider rows gave the highest yields (Myer, 2003). After plants are about 30 cm tall (1 ft), it is helpful to hill the soil from the centres of the rows up around the plants. This helps to reduce lodging (plants blown over in the wind), suffocates weeds around the plant and uproots weeds between rows (Myer, 2003).

A number of mechanical planters have been successfully used with amaranth. Some farmers using row crop planters will put the seed into the insecticide box, running a tube down between the discs to sow the seed. Grain drills have been used by stopping up the appropriate seed holes, and vegetable planters can be used with a celery plate. No-till planting has been done, but insects eating the seedlings were a problem (Yarger, 2008).

Transplanting: Seeds may be planted in a nursery for subsequent transplanting or sown directly where plants are to be grown. Transplanting is a very efficient use of seeds and allows the growing area to be weeded just before the seedlings are transplanted. The very small size of the seeds, however, means that a few seeds go a long way. The number of seeds saved may not be a sufficient justification for the extra work involved in transplanting. On the other hand, gaining a two-week jump on the weeds could be significant because amaranth seedlings are not vigorous growers when very young. Planting in a nursery also reduces risk of loss due to disease such as damping off (Yarger, 2008).

Direct seeding involves much less labour, but incurs a greater risk of poor stand due to diseases and predators of young seedlings and to poor competition with weeds in the crucial initial couple of weeks. If direct seeding is used, sowing should probably be in rows to facilitate cultivation. Whether sown in the nursery or field, seeds need to be planted about 1.3 cm deep (0.5 in) (or covered with 1.3 of soil) for good germination. Because of the shallow depth, special care must be taken to prevent the soil from drying out until plants are established. Transplanting or thinning is crucial. It may be done within about two weeks of when plants are 5 to10 cm tall (2 to 4 in). However, any delay in transplanting, even for one week can reduce total yield (Yarger, 2008).

Irrigation: Although amaranth does well in semi-arid conditions, if irrigation is available, it will produce better. In irrigated fields, it is recommended that the farmer increase the quantity of seed sown, (up to twice the quantity) to better compete with weeds and take full advantage of available moisture (Sooby, et.al.)

Diseases and pests

Stemrot caused by the fungus *Choanephora cucurbitarum* is the main disease. It is favoured by wet conditions, poor soil fertility and high nitrogen doses. Chemical control by repeated spraying with fungicides such as maneb or carbatene reduces the losses, but is seldom applied. Damping-off caused by *Pythium* and *Rhizoctonia* may be serious in seedbeds. It is controlled by good drainage. Over-dense sowing should be avoided. Fungicides such as dithiocarbamates have some effect. No damage by virus diseases has been reported. *Amaranthus blitum* is a natural host for turnip mosaic virus and tobacco leaf curl virus (Jansen, 2004).

Insects are a serious problem for amaranth growers. Caterpillars (*Hymenia recurvalis*, *Spodoptera litura*, *Helicoverpa armigera)* and sometimes grasshoppers are the most harmful. Thess larvae of the stem borer *Lixus truncatulus* may cause much damage, sometimes already in the seedbed. The basal part of the plant containing the pupae swells and the plant growth is much retarded. Many other insects such as aphids, leafminers, stinkbugs, mole crickets and mites also attack amaranth but generally cause only minor damage. Commercial growers spray insecticides to dispel insects instead of the traditional control method of spreading wood ash. Amaranth is not very susceptible to nematode damage (Jansen, 2004).

Other insects that can injure the developing amaranth include fall armyworm (Spodoptera frugiperda), cabbage looper (Trichoplusia ni), corn earworm (Heliothis zea) and the cowpea aphid (Aphis craccavora). The amaranth weevil (Conotrachelus seniculus) can damage roots, resulting in lodging or other root diseases. The potato flea beetle (Epitrix cucumeris) can damage seedlings and the beet leafhopper (Circulifer temellus) can transmit curly top virus, but this has been seen only in areas near large areas of sugar beet production. (Stallknecht & Schulz-Schaeffer, 1993.) Generally, amaranth does not have problems with viruses.

Harvesting and Seed Production

The plants are harvested by hand only. Young plants can be pulled up or cut six to eight weeks after sowing when they are about 20 cm tall. This is done in cases where seeds were broadcasted. Plants may be cut back to 15 cm to encourage lateral growth for successive harvesting. When the plants are harvested at regular intervals, start picking the leaves eight weeks after sowing or four weeks after transplanting. Small quantities of leaves can be harvested on a daily basis. In the case of large quantities, intervals of two weeks are recommended. Leaf production can be sustained by the removal of flowers (Department of Agriculture, Forestry and Fisheries, 2010).

Leaves can be harvested in two ways:

• Picking of individual leaves when these are the size of the palm of your hand.

• Breaking off the leaves around the terminal growth tips of the stems. This is done by pulling one hand up towards the growth tip and breaking off the leaves with the other hand. Though amaranth can be harvested by hand, combine harvesters are also commonly used. A regular combine can be used if fitted with appropriatelysized separator screens. When reel heads are used it may be helpful to remove several reel bats or raise the height of the reel. Row headers perform better at harvesting amaranth than reel heads do for combining amaranth (Department of Agriculture, Forestry and Fisheries, 2010).

During harvest, if the stems and leaves are too wet, the seeds become sticky and adhere to the inside of the combine as well as the straw discharge. Shattering during the cutting process can also cause losses, so adjustment should be made to minimise shattering of the hands. Care
should also be taken to balance against getting it combined before preharvest
losses from lodging or seed shatter from wind occurrence.

Grain harvesting

Harvesting amaranth seeds is a basic process. Cut the seed heads just before these become dry and brittle. Lay the seed heads on a cloth or place them inside paper or cloth bags with the heads down and leave in the shade to finish drying. When the seed heads are dry, the seeds can be removed in several ways:

• by rubbing gently with your hands (wearing gloves is recommended);

• by enclosing the seed heads between two cloths and treading on them without shoes on;

• by beating the seed heads off a bag; or by beating them together over cloth (Department of Agriculture, Forestry and Fisheries, 2010).

Post-Harvest Handling planning in terms of handling, grading, packing and storage of products should be done (Department of Agriculture, Forestry and Fisheries, 2010).

Screening

Once the dry seeds are removed they can be placed in a shallow bowl and swirled around until the large pieces of flowers rise to the top where they are easy to remove. By tipping the bowl you can rake out much of the chaff that is left. Remove any small particles of flowers or dirt that remain by shaking the seed through a small mesh screen about the size of a window screen. Winnowing the seed in a light breeze will also remove the flowers and chaffeffectivelly The seeds are very light so it is important winnow carefully in a light breeze only (Department of Agriculture, Forestry and Fisheries, 2010)

Grading

A gravity table can be used to separate particles of the same size but of different weight, such as the dark pigweed seeds (Department of Agriculture, Forestry and Fisheries, 2010).

Packing

After harvesting, the leaves are kept in a bag and usually sold on the day of harvest to avoid quality loss. However, where there is cooling storage the leaves can be kept in such containers (Department of Agriculture, Forestry and Fisheries, 2010).

Storage

Maximum moisture for storing the grain is approximately 11 %. Dry small quantities of grain by blowing air across the amaranth; heated air may be necessary at certain times. The optimum way to store the grain after cleaning and drying is in wooden storage bins or in heavy duty (4- or 5-ply) paper bags. It is important to keep properly dried seeds in a closed container to avoid contamination (Department of Agriculture, Forestry and Fisheries, 2010).

Preserving methods

Washed leaves may be dried in the shade and stored for up to a year for consumption during winter. Cooked leaves may be dried and stored. Fresh leaves may be kept in the refrigerator (Department of Agriculture, Forestry and Fisheries, 2010).

Uses

The main use of *Amaranthus blitum* is as a cooked leaf vegetable. In most African countries it is collected as a pot herb from the wild, and is very much liked for its soft taste. Leaves are sometimes preserved by drying. Vegetable amaranths in general are recommended as a good food with medicinal properties for young children, lactating mothers and for patients with fever, haemorrhage, anaemia or kidney complaints. The leaves are used as a febrifuge and poultice to treat inflammations, boils and abscesses. In Nigeria *Amaranthus blitum* is used as a medicine against lung disorders. It is used as fodder but only as a rather moderate part of the daily portion (Jansen, 2004).

2.8 Empirical Studies

Here, recent research findings on group-based extension methods, the use of farmers field school and demonstration methods of agricultural extension as well as dry season farming were sought for and analysed to support the study that there has been past researches done elsewhere in relation to the research topic.

A study was carried out by Adenuga, Muhammad-Lawal and Rotimi (2013) to examine the economics of dry season tomato production in Kwara state, Nigeria. It estimated the costs and returns and assessed the technical efficiency of dry season tomato production. A two-stage random sampling technique was used to select 105 respondents for the study. A well-structured questionnaire was used to collect data from the respondents. Major tools of analysis used for the study were the gross margin analysis and the stochastic frontiers model. Results of the study showed that a gross margin of N 18,956.75/ha (US$ 120.74/ha) was realised from dry season tomato production. Emokaro, Ekunwe and Osifo (2007) conclude that dry season amaranth producers in Edo South are smallholder farmers, predominantly males, with mean farm size ranging between 0.046 hectare, 0.067 hectare and 0.093 hectare. The gross margin estimates were N285,757.55, N180,943.75, N128,252.00 profit estimates were N 269,316.15, N168,403.00 and N117,547.00, while estimates of returns per Naira invested were N1.01k, N1.05k and N1.43k, for mean farm sizes of 0.046, 0.067 and 0.093 ha respectively. This shows that dry season amaranth production is highly profitable in the region. The most important production constraints faced by the farmers were difficulty in acquiring farmland, high cost of labour, unavailability of irrigation facilities, marketing constraints and drudgery.

In another study, Nakuja, Sarpong, Kuwornu and Felix (2012) examine and analyse the determinants of farmers' adaptive capacity in dry season vegetable farming using an Ordered Logit Model. The effects of adaptive capacities on farm income were also analyse using log-linear production function. The empirical results reveal that sex, access to land near a reservoir site, engaging in off-farm business activity, access to credit and number of years of formal education determines farmers' decision to venture into dry season vegetable farming. Besides, about 31.3% of farmers are of low adaptive capacity, 26.0% are of moderate adaptive capacity and 42.7% being high adaptive capacity. Inaizumi, Singh, Sanginga, Manyong, Adesina, and Tarawali (1999) examine the patterns, levels, rate of adoption, and the impact of one of the most promising varieties (IT89KD-288) introduced to farmers in Kano State, Nigeria. The diffusion and uptake of this variety had been very impressive as it reached over 1500 farmers in 1997, only four years after its accidental release to one farmer. The results show that farmers derived substantial benefits from adopting dry-season dual-purpose cowpea. These include food security during a critical period of the year, cash income crop diversification, fodder, and in situ grazing after harvesting, in periods when the prices of cowpea grain peak, and when good quality fodder is scarce. Dry season dual-purpose cowpea is thus a profitable technology that will find economic and ecological niches in the mixed crop/livestock farming systems of the semi-arid zones of West and Central Africa.

The findings of Tsoho1, Omotesho, Salau and Adewumi (2012) reveal that four variables (extension visits, source of irrigation water, crop diversification and location of the farm), two variables (extension visits and location of the farm) and three variables (extension contact, source of irrigation water and crop diversification) were found to be significant at different levels of significance for technical, allocative and economic efficiency, respectively. These variables were therefore the important policy determinants of inefficiency in study area. These results suggest that farmers' location in vegetable farming and increased investment in extension services could jointly contribute to an improvement in efficiency of vegetable farmers in the study area.

According to Emokaro and Ekunwe (2007) in their study of efficiency of resource-use and marginal productivities in dry season amaranth production in Edo south, Nigeria conclude that dry season amaranth producers in Edo South are smallholder farmers, predominantly males, with mean farm sizes ranging between 0.046, 0.067 and 0.093 hectares. It was also shown in the study that none of the resources employed in the production process was efficiently utilised. While land and fertiliser were underutilised (with efficiency estimate of 5.57 and 1.78, respectively), labour was shown to be over-utilised (with an efficiency estimate of 0.27).

Various studies have demonstrated that on-farm demonstration far the most effective extension teaching method (Obahayujie & Hillison 1988; Riesenberg & Gor, 1989; Martin & Sajilan 1989; Umeh 1990; Agahi 1993; Ford, 1995; Chizari et al 1998; Chizari et al 1999; Eke & Emah 2001; Ajayi, 2001). All extension clientele seems to like to learn and gain new knowledge in this type of transferring knowledge (Riesenberg & Gor, 1989). But, considering the widespread use of on-farm demonstration, evaluations of educational effectiveness are surprisingly rare. Educational programmes need to be evaluated to allow educators choose among various teaching methods techniques and activities or delivery styles, because monetary resources are limited in extension education, they should be spent only for programmmes that have been demonstrated to be popular and effective (Pigg, 1980).

A study on impact of the demonstrations by Chapke (2012) on the farmers' behaviour was conducted. Results of the study revealed that demonstrated technologies increased the fibre yield of jute by 4.45 q ha-1 over the farmer's practice (25.10 q ha-1), the post-demonstration yield was 29.55 q ha-1 as the farmers adopted many components of the technology package that were used in demonstrations. Economic surplus increased production of jute fibre by about 4.45 q ha-1 provided additional Rs. 5570 ha-1 to the farmers. The results further indicated that additional income that accrued due to increased harvest of jute by adopting improved practices was utilised by the farmers by increasing expenditure by about 50%, on food, health care of the family members, education of children, and purchase of farm implements or essential items and attending social and entertainment programmes. Impact of the demonstrated technologies to increase fibre yield of jute by contact farmers up to 3 q ha-1 in nearby villages within radius of 3 to 7 km distance from the adopted villages was also found.

The post-demonstration period falls mostly under the year 2005 and 2006 in which the market price of the jute fibre was higher as compared to other years with an average of Rs. 1250 per quintal (100 kg). The increase in fibre yield due to adoption of the improved jute cultivation practices by the beneficiary (adopted) farmers resulted into dissemination of the technologies also at nearby villages in addition to the same village. Technology dissemination flow was found from adopted farmers of the same village to non-adopted farmers of the same and nearby villages within the radius of 3 to 7 km distance. Reason to attract non-adopted farmers of the nearby village was due to obtaining more fibre yield, which ranged between 2.00 and 3.00 q ha-1. It was the strength of the technology, which enabled them build up confidence among the farmers to boost up adoption of the demonstrated technologies (Chapke, 2012).

Four studies illustrate why FFS is an attractive model and why there is a need for more research on the short-, medium- and long term impact of the model. The Sri Lanka Department of Agriculture, with support from FAO (2005) and a number of donors, ran an IPM programme in Sri Lanka from 1995 to 2002 carried out a survey of FFS in southern Sri Lanka and found that FFS farmers growing rice who adopted FFS knowledge derived from IPM practices were able to reduce the number of applications of insecticides by 81 per cent, surprisingly, farmers completing the FFS did not adopt other recommended farm practices and the study provided little evidence of farmer to farmer transmission of the principal practices of the FFS. The authors have called for more rigorous impact assessment because of insufficient assessment of FFS programmes (and their alternatives) is a significant part of the problem.

In another study, Barbur (2009) concludes that there is a significant difference in knowledge, attitude and practice level in coffee management practice particularly with reference to coffee wilt disease by FFS compared to non-FFS respondents. About 67% of the FFS respondents had acquired high level of knowledge while 8.6% and 57.1% of the non-FFS respondents had acquired high to moderate knowledge of coffee management practices respectively, especially with reference to the knowledge of coffee wilt disease. It can be observed from the data, 81% and 18.6% of the FFS respondents were grouped under high and moderate attitude respectively, while nearly 55.7% and 38.6% of the non-FFS respondents were placed in high and moderate attitude towards promoting coffee management practices. Similarly, apart from gaining knowledge, according to Ajayi, Babarinde and Okafor (2008), 63% of those trained transferred the knowledge to others and participation of farmer field school had significant influence on respondents' competence on cocoa integrated pest management.

In another development, Babur, (2009) clearly indicates that there was highly significant difference between mean score of knowledge of FFS and NFFS members with respect to promote coffee management practices in the selected districts. Based on knowledge difference, the FFS members gained more knowledge as compared to NFFS members. About 32.9% and 67.1% of the FFS respondents had acquired medium to high level of knowledge respectively, while 57.1% and 8.6% of the NFFS farmers had acquired medium to high level of knowledge of the same practices, especially with reference to the knowledge of coffee wilt disease. It was interesting to note that none of the FFS respondents in the sample was reported with low level of knowledge about improved coffee management practices. On attitude, he concludes that FFS respondents, 18.6% had moderate attitude followed by 81.4% with more favorable attitude about coffee management practice. Whereas, 38.6% of the NFFS respondents were found to have moderate attitude followed by 55.7% with more favorable attitude and 5.7% respondents were found to have less favourable attitude about improved coffee management practice. The practice wise comparison of knowledge among FFS and NFFS members by him showed that the mean scores of 10.63 and 11.86 practices of FFS respondents were significantly higher than that of NFFS respondents, 7.03 and 7.91. This may be due to the fact that FFS respondents might have attended the coffee FFS participatory 'learning by doing' programmes, thereby comparing the traditional and improved coffee management practices resulting to higher knowledge about various practices of coffee as compared to NFFS members.These data indicate that the yields achieved within the FFS study-fields were significantly higher than farmers' traditional yields. The percentages of such increases within the FFS study-fields were found to range between 100 and 280 per cent with the mean increase of 158 per cent.

This agreed with the report of IFPRI (2010) on the impact of FFSs on agricultural productivity and poverty in East Africa that the FFSs participants had significant differences in outcomes with respect to value of crops produced per acre, livestock value gain per capital, and agricultural income per those in the middle land area (land poverty) tercile. Participants in FFSs increased income by 61 per cent when pooling the three countries. FFSs improved income and productivity overall; differences were seen at the country level. Participation in FFSs increased production, productivity, and income positively in nearly all cases: Kenya, Tanzania, and at the project level (all the three countries combined). The most significant change was seen in Kenya for crops (80 per cent increase) and in Tanzania for agricultural income (more than 100 per cent increase). The average potato price paid to the Cajamarca farmers in the field in recent years has been between US$85 and US$90 per tonne. Considering the additional yield obtained per year (2.7 t/ha), the prices obtained (US$87.5/ton) and the average potato area per family (0.2 ha), the average additional gain per participant as a result of this FFS project was about US$47.30 per year. And due to the yield increase there has been a reduction in the cost per unit produced, so the potential competitiveness has increased.

A study was conducted by Hassan, Hussain and Akbar (2005) for four consecutive years (2000 to 2004) in farmers' fields near Mardan to compare soil and water productivity in permanent raised beds versus the traditional basin system under maize–wheat double cropping. The results indicated that for the maize crop there were increases of 30%, 32% and 65% in grain yield, water saving and water productivity, respectively, under permanent raised beds compared to basins. Similarly, permanent raised beds demonstrated 13%, 36% and 50% higher grain yield, water saving and water productivity, respectively, for the wheat crop. Weed infestation was also 24% and 31% lower for maize and wheat crops, respectively, under permanent raised beds, which maintained lower soil bulk density and high infiltration rates. Partial budgeting showed that raised beds generated 54% and 35% increased net benefit for maize and wheat, respectively. District farmers' experience with raised beds demonstrated similar results, with 34% water saving, and 32% and 19% higher yields for maize and wheat, respectively.

In another study conducted by Hamayun (2010) on the adaptation and adoption of the system of rice intensification (sri) in Myanmar using the farmer field school (ffs) approach on different sites submit that on these sites, farmers' traditional rice yields, considered as the baseline, ranged from 1.5 t/ha to 3 t/ha with a mean of 2.1 t/ha. Compared to these, the average SRI yields obtained within the FFS fields of all the 10 FFS ranged from 3 t/ha to 7.8 t/ha where the mean average was 5.4 t/ha. The pattern of yield increase observed in the second year of the study, within the 2002 FFS, was found to be very similar to the one in 2001. According to the yield data presented , farmers' average baseline yields in the selected sites ranged from 1.2to3 t/ha with a mean average of 1.9 t/ha, while the average SRI yields obtained within the FFS study-fields ranged from 2.9 to12.4 t/ha, with the mean of 6.7 t/ha. This was a mean increase of 257 per cent over farmers' baseline yield. The increases among individual FFSs ranged from 100 to 520 per cent.

In their studies on vegetables, Khan, Pervaiz, Khan, Ahmad and Nigar (2009) submit that the post-demonstration yields are higher compared to pre-demonstration yields of the three crops of the respondent farmers. Increase in productivity of vegetables is more significant (40%) than wheat and maize (30% each).The result further showed that the average income of the respondents after adopting the improved methods of production, as demonstrated, has increased from Rs.3650 to Rs.5137, showing 40 per cent increase on the average. The post-demonstration impacts include increased number of users/adopters of improved practices, yields and income of the sampled farmers indicating betterment of their livelihood.

In her study of home demonstration gardens for improved design and interpretation, Price (1986) concludes, "demonstration gardens have enormous potential as a teaching tool. They bring immediacy to their subject through their walk-through, real-life character and their ability to engage all of the senses. A text or mock-up exhibit, no matter how well conceived, is unlikely to convey the immediacy of a growing, changing garden. In a demonstration garden, visitors see living plants in an environment that suggests their own yard. Based on this reality, it is a small leap of faith for visitors to implement the concepts or innovate on their own property." This tangible, real life nature of gardens contributes to short and long term learning and changes in attitudes (Butler & Serrell, 2000; Falk & Dierking, 2000), both of which are necessary for the behaviour changes extension education programmes seek to affect. Gardens can support self directed learning (Price, 1986; Butler& Serrell, 2000; Falk & Dierking, 2000 Hamilton & DeMarrais, 2001).

In addition to hands on experiences, agents are using gardens to support self directed learning, with 97% of agents reporting at least one feature, technique or practice being employed in the garden to support this type of learning. Falk and Dierking (2000) point out that self directed learning in gardens, as a type of museum, is beneficial for reaffirming knowledge necessary for long term learning. Self directed learning is likely to occur with planned interpretation (Veverka, 2005), which can include static and dynamic methods, such as tours and demonstrations (Osland, 2006). Seventy-seven per cent of agents reported utilising the garden to provide educational opportunities, such as garden tours and demonstrations, which would not have been possible without the gardens (Glen. 2010).

Framework for the Study

The Diffusion of Innovation and Transformative Innovation Theories are discussed here. Brief history of each of the two theories as well as their relevance to the research topic is also discussed.

2.9.1 Diffusion of Innovation Theory

Diffusion is the "process by which an innovation is communicated through certain channels over a period of time among the members of a social system" (Rogers, 1995). An innovation is "an idea, practice, or object that is perceived to be new by an individual or other unit of adoption". "Communication is a process in which participants create and share information with one another to reach a mutual understanding" (Rogers, 1995). In 1962 Everett Rogers, a professor of rural sociology published Diffusion of Innovations. In the book, Rogers synthesised research from over 508 diffusion studies and produced a theory for the adoption of innovations among individuals and organisations.

The book proposed four main elements that influence the spread of a new idea: the innovation, communication channels, time, and a social system. That is, diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. Individuals progress through 5 stages: knowledge, persuasion, decision, implementation, and confirmation. If the innovation is adopted, it spreads via various communication channels. During communication, the idea is rarely evaluated from a scientific standpoint; rather, subjective perceptions of the innovation influence diffusion. The process occurs over time. Finally, social systems determine diffusion, norms on diffusion, roles of opinion leaders and change agents, types of innovation decisions and innovation consequences. To use Rogers' model in agricultural extension requires us to assume that the innovation in classical diffusion theory is equivalent to scientific research findings in the context of practice, an assumption that has not been rigorously tested. The key elements in diffusion research are:

Innovaton: Rogers, (1962) defines an innovation as an idea, practice, or object that is perceived as new by an individual or other unit of adoption.

Communication Channels: A communication channel is the means by which messages get from one individual to another.

Time: The innovation-decision period is the length of time required to pass through the innovation-decision process. Rate of adoption is the relative speed with which an innovation is adopted by members of a social system.

Social System: A social system is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal.

Diffusion of an innovation occurs through a five–step process. This process is a type of decision-making. It occurs through a series of communication channels over a period of time among the members of a similar social system. Ryan and Gross first indicated the identification of adoption as a process in 1943 (Rogers, 1962). Rogers categorises the five stages (steps) as: awareness, interest, evaluation, trial, and adoption. An individual might reject an innovation at any time during or after the adoption process. In later editions of the Diffusion of Innovations, Rogers changes the terminology of the five stages to: knowledge, persuasion, decision, implementation, and confirmation. However the descriptions of the categories have remained similar throughout the editions.

Five stages of the adoption process

Knowledge: In this stage the individual is first exposed to an innovation but lacks information about the innovation. During this stage of the process the individual has not been inspired to find more information about the innovation.

Persuasion: At this stage the individual is interested in the innovation and actively seeks information/detail about the innovation.

Decision: At this stage the individual takes the concept of the change and weighs the advantages/disadvantages of using the innovation and decides whether to adopt or reject the innovation. Due to the individualistic nature of this stage, Rogers notes that it is the difficult stage to acquire empirical evidence (Rogers, 1964).

Implementation: At this stage the individual employs the innovation to a varying degree depending on the situation. During this stage the individual determines the usefulness of the innovation and may search for further information about it.

Confirmation: Although the name of this stage may be misleading, at this stage the individual finalises his/her decision to continue using the innovation and may end up using it to its fullest potential.

The rate of adoption is defined as the relative speed with which members of a social system adopt an innovation. It is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation (Rogers 1962). The rates of adoption for innovations are determined by an individual's adopter category. In general, individuals who first adopt an innovation require a shorter adoption period (adoption process) than late adopters.

Within the rate of adoption, there is a point at which an innovation reaches critical mass. This is a point in time within the adoption curve that enough individuals have adopted an innovation in order that the continued adoption of the innovation is self-sustaining. In describing how an innovation reaches critical mass, Rogers outlines several strategies in order to help an innovation reach this stage. These strategies are: have an innovation adopted by a highly respected individual within a social network, creating an instinctive desire for a specific innovation. Inject an innovation into a group of individuals who would readily use an innovation and provide positive reactions and benefits for early adopters of an innovation. Rogers' five factors of diffusion are:

Rogers (1962) defines several intrinsic characteristics of innovations that influence an individual's decision to adopt or reject an innovation.

Relative Advantage: How improved is an innovation over the previous generation?

Compatibility: The level of compatibility that an innovation has to be assimilated into an individual's life.

Complexity or Simplicity: If the innovation is difficult to use, an individual will not likely adopt it.

Trialbility: How easily an innovation may be experimented with as it is being adopted. If a user has a hard time using and trying an innovation, he or she will be less likely to adopt it.

Observability: The extent that an innovation is visible to others. An innovation that is visible will drive communication among the individual's peers and personal networks and will in turn create more positive or negative reactions.

Rogers defines adopter category as a classification of individuals within a social system on the basis of innovativeness. In the book, Diffusion of Innovations, Rogers (1962) suggests a total of five categories of adopters in order to standardise the usage of adopter categories in diffusion research. The adoption of an innovation follows an S curve when plotted over a length of time. The categories of adopters are: innovators, early adopters, early majority, late majority, and laggards (Rogers, 1962)

Innovators: Innovators are the first individuals to adopt an innovation. Innovators are willing to take risks; young have high social class, have great financial lucidity, very social and have close contact to scientific sources and interaction with other innovators. Risk tolerance has them adopting technologies which may ultimately fail. Financial resources help absorb these failures.

Early Adopters: This is the second fastest category of individuals who adopt an innovation. These individuals have the highest degree of opinion leadership among the other adopter categories. Early adopters are typically younger in age, have a higher social status, have more financial lucidity, advanced education, and are more socially forward than late adopters. Realise judicious choice of adoption will help them maintain central communication position.

Laggards: Individuals in this category are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change-agents and tend to be advanced in age. Laggards typically tend to be focused on "traditions", likely to have lowest social status, lowest financial fluidity, oldest of all other adopters.

Early Majority: They adopt an innovation after a varying degree of time that is significantly longer than the innovators and early adopters. Early Majority have above average social status, contact with early adopters and seldom hold positions of opinion leadership in a system (Rogers 1962, p. 283).

Late Majority: They adopt an innovation after the average participant. These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. Late Majority are typically skeptical about an innovation, have below average social status, little financial liquidity, in contact with others in late majority and early majority and little opinion leadership

Relevance of the Theory to the Study

Diffusion research has focused on five elements: the characteristics of an innovation which may influence its adoption; the decision-making process that occurs when individuals consider adopting a new idea, product or practice; the characteristics of individuals that make them likely to adopt an innovation; the consequences for individuals and society of adopting an innovation; and communication channels used in the adoption process.

The model is relevant to this study because the aim of the researcher is to disseminate information about new technologies to dry season farmers in order to increase the knowledge of the farmers about how to solve production problems facing them on the field. The innovations will be introduced using persuasive method by explaining to them the advantages to be derived from the new technology as well as their compatibility to their local environment. The method demonstration and farmer field school are the communication methods through which the new ideas will be communicated to the farmers. After the farmers have been exposed to these new innovations, they will be left individually to take a decision on whether to adopt or reject the new innovations. The confirmation of their decision or the adoption level shall be known after the evaluation of the dry season farmers' response.

2.9.2 Transformative Learning Theory

The theoretical basis of this study is also embedded in transformative learning theory.

Transformative learning theory focuses on a process through which adults reach an autonomous and socially responsible way of thinking and acting (Merriam & Cafarella, 1999; Belenky & Stanton, 2000 Shcugurensky, 2002). To reach this ultimate stage of autonomous thinking and social responsibility, adults need to establish a certain level of instrumental and communicative competence.

Instrumental learning, which refers to obtaining skills and information, occurs through determining cause-effect relationships, grasping information and through learning of skills, such as communication or farming skills (Mezirow, 2000). As adults increasingly involve themselves in instrumental learning, they sharpen their instrumental competence: their ability to control natural variables and other people (Mezirow, 2000).

Communicative learning, however, pertains to learning at the abstract level on abstract issues such as values, intentions and feelings (Mezirow, 2000). As adults increasingly engage in learning at the abstract level, they develop communicative competence: ability to negotiate meaning for one self instead of passively internalising meaning communicated or interpreted by others (Mezirow, 2000).

As adults establish their communicative and instrumental competence, they experience an epistemological change, in which they are actively seeking other points of view, reflecting and acting on consequent learning within their society, hence a transformation in meaning perspective (Mezirow, 2000). Such change in meaning making and consequent action is emancipatory: it frees adults from oppressive social structures and personal biases passively internalised from parents and society that were distorting one's life (Mezirow, 2000).

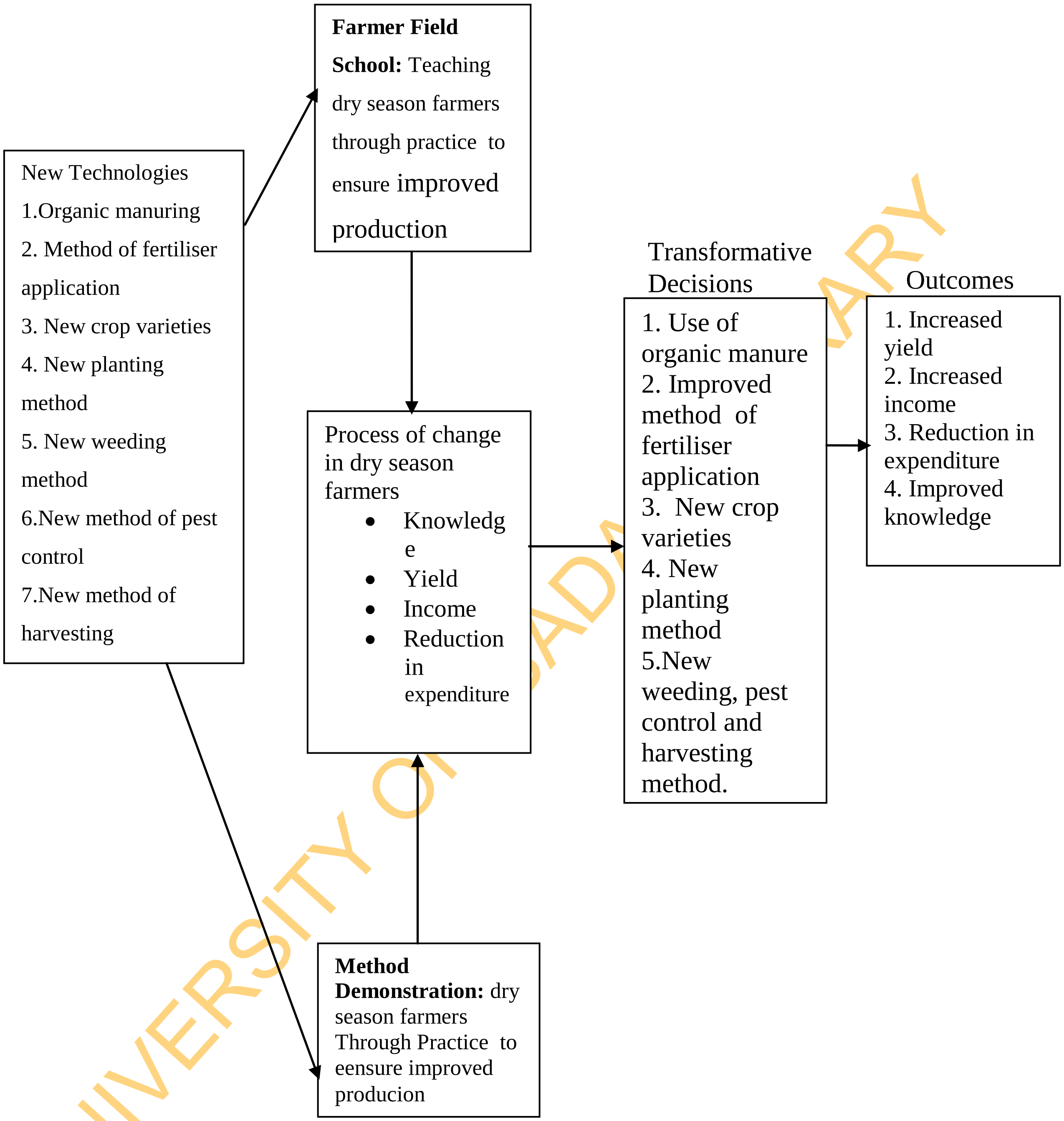
The theory focuses mainly on rational discourse for learning in adulthood and calls adult educators for a sustained focus on rational discourse (Merriam & Cafarella, 1999;

Schugurensky, 2002; Percy, 2005). Rational discourse refers to dialogue between adults which occurs alongside the ideal conditions of learning: the provision of accurate and complete information, freedom from coercion, openness to alternative point of views, ability to weigh evidence and assess arguments, greater awareness of the context of ideas, equal opportunity to participate in various roles of discourse and willingness to seek and accept a best judgment (Mezirow, 2000).

It is now realised that sustainable practices, solutions to cite specific problems and community development efforts are adopted, sustained and created only when local people in their own local conditions are the main participants and contributors in the processes of extension services (Duegd et al., 1998; Rolling & Wagemakers, 1998; Leeuwis, 2004). Extension work through PR&E methods recognises this (Percy, 2005). Transformative learning outcomes of social responsibility and autonomous thinking are a match with the current agricultural extension intentions in SSA of devolving agricultural decision making, technology innovation and dissemination to the farmers.The theory is relevant to this study because the focus of the theory is on how adults can reach ultimate stage of autonomous thinking and social responsibility which can only be achieved when adults attain certain level of instrumental and communicative competence. Instrumental learning occurs when adults (farmers) obtain farming skills and information which will enable them control natural variables and other people. These skills and agricultural information is what this study will pass to the farmers in order to develop their instrumental competence.

2.10 Framework for the study

The framework for the study shows the new technologies or the improved methods of vegetable production (innovations), the two group methods used to present the new technologies to the dry season farmers, the transformative decisions expected from the farmers as well as the outcomes of the transformative decisions made by the farmers.



Source: Researcher

Figure 2.1: Framework for the study

The study introduced three new innovations that is, use of organic manure, drilling method of fertiliser application and new crop varieties to dry season farmers using Farmers field school and Method demonstration extension methods. The introduction of these innovations is expected to bring about changes in the attitude and knowledge of dry season farmers; which will in turn bring about transformative decisions of adopting the use of organic manure, drilling method of fertiliser application and new crop varieties. The final outcomes are expected to be increase in farmer's yield, increase in income as well as better standard of living for dry season farmers.

2.11 Appraisal of Literature

This study covers a comprehensive review of past and present literature in the fields of agricultural extension, extension methods and dry season farming. Various theoretical frameworks, principles and perceptions under which the adoption of improved technologies by farmers in the past were based came under focus while, a detailed review of extension approaches and methods adopted in the past in the transfer of technologies to farmers in Nigeria was equally reviewed. Notable among these extension approaches are: the conventional ministry operated extension system, project based extension, sectoral/commodity extension, university-based extension, integrated rural development approach and farmers-focused extension. All these were done with a view to linking the study to the practice of group extension by Demonstration Method and Farmer School Field in the transfer of new technologies to farmers in the study areas of South West Nigeria. In the theoretical framework, two theories,

Diffusion of Innovation and Transformative Learning theories were examined and their relevance to this study was extensively discussed. The key elements in diffusion research are.

Innovaton which is the new method of vegetable production taken to the farmers, communication channels which is the means by which messages get from one individual to another and in this case the Demonstration and FSS methods are the communication channels through which the innovation is taken to the dry season farmers. The time which is the innovation-decision period is the length of time required to pass through the innovation-decision process and the rate of adoption which is the relative speed with which an innovation is adopted by members of a social system. The social system which is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The social system in this study is the farmers' group established during the FFS and Demonstration meetings.

From the literature, it was observed that despite past government efforts to ensure effective diffusion of new agricultural technologies to farmers to ensure food security via agricultural extension, farmers are yet to adopt in full scale such improved technologies. It shows that despite the fact that there are several research institutions as well as Faculties of Agriculture in most Federal and state universities, the farmers especially the dry season farmers are yet be aware of the results of research findings from these institutions talkless of adopting the findings. The outcome is that Nigeria still depends on the importation of food from other countries to feed her ever- increasing population. The literature also traced the history of past efforts of agricultural extension in transferring new technologies to farmers in Nigeria and the attendant failures since early 1950s, with the conclusion that the top-down extension systems which forced new ideas on the farmers be discarded for bottom-down extension systems which allow full participation of farmers. Under participatory extension systems, farmers are no longer the objects of development but as the co-initiators, co-researchers as well as co-developers of improved technologies which they would readily adopt to enhance their productivity and their well-being.

The participatory approach makes use of group-based extension methods to disseminate new technologies to farmers. It was established that group-based extension methods are the appropriate extension methods suitable for the dissemination of new technologies to farmers. The literature also reviewed dry season farming as a type of farming that ensures the production of vegetables under irrigation in the absence of rainfall. Despite several efforts of the government and individuals to improve farmers' productivity, dry season farming is being hindered by a lot of problems such as lack of extension services, poor storage facilities Inadequate supply of water for irrigation, soil fertility decline, inadequate storage, processing and marketing facilities, lack of credit, lack of credit, lack of processing technologies, high post-harvest loses. It was established that dry season farming is important for the development of our country Nigerian.

2:12 Research Hypotheses

Seven hypotheses were raised from the research objectives and each was later analysed in chapter four to determine the effects of FFS and demonstration extension methods on the knowledge and production of dry season farmers.

Ho_1: There is no significant main effect of the two group-based Extension methods (treatments) on the knowledge of vegetable production among dry season farmers.

Ho_2: There is no significant main effect of the two group-Based extension methods (treatments) on adoptions of organic fertiliser application, improved varieties of crops and crop planting methods.

Ho_3: There is no significant main effect of the two group-based Extension methods (treatments) on dry season farmers' yield (production) and income.

Ho_4: There is no significant main effect of the two group-based Extension methods (treatments) on dry season farmers' income

Ho_5: There is no significant main effect of the two group-based Extension methods (treatments) on dry season farmers' expenditure

Ho_6: There is no significant main and interactive effect of farmers' age, sex, level of literacy and social status on the effects of the two group-based Extension methods on dry season farmers' adoptions of organic fertiliser application, improved varieties of crops and crop planting methods.

Ho_7: There is no significant main and interactive effect of farmers' age, sex, educationl status and social status on the effects of the two group-based Extension methods on dry season farmers' yield (production) and income.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

This study adopts pretest, posttest, control group, quasi-experimental design. It examined possible effect of group-based extension methods on knowledge and production of vegetables among dry season farmers in southwest Nigeria.

Diagrammatically the design is represented below

0_1	X_1	0_2	E_1
0_3	X_2	0_4	E_2

Where, 01, 0_3 represent the pre-test for both experimental and control group respectively. 0_2, 0_4, represent the post-test for the experimental and control groups respectively.

X_1 represents the treatment for experimental group E_1-Two group-based extension method

X_2 represent the treatment for control group E2– Traditional method of Vegetable production

A 2x2x3 factorial matrix was adopted with instructional strategy as treatment at two levels, Age at two levels (young and old) and Educational level at three levels (low, medium and high). The factorial matrix, which is the analytical design of the study, is represented in the table 3.1.1.

Table 3.1: Schematic Representation of the Matrix.

Treatment/strategies	**Age**		**Educational Level**		
	Young	Old	Low	Medium	High
Two group-based extension method E_1	10	124	54	69	11
Traditional method E_2	9	90	38	54	7

3.2 Variables of the Study

The variable of the study are;

Independent variables

Group-based extension method

Traditional method

Dependent variables

(i) Knowledge of vegetable production

(ii) Adoption of modern vegetable production methods

(iii) Farmers vegetable yield

(iv) Farmers vegetable income

(v) Farmers' expenditure

Moderating Variables

(i) Age at two levels (young and old)

(ii) Educational level at three levels (low, medium and high)

3.3 Population

The population of the study comprised all dry season vegetable farmers in Oyo, Osun and Ogun States. The actual figure was not available due to lack of proper records and enumentation of dry season farmers in the the three states covered in the study.

3.4 Sample and Sampling Techniques

The participants for the study were purposively randomised into dry season farmers in each of the three states (Oyo, Ogun and Osun) involved in the study.

Table 3.2: Distribution of Participants by Locations

Experimental	Control
Oyo State – Ijaye 38	Oyo State-- Omi Adio 40
Osun State–Oke Osun Farm Settlement 43	Osun State—Ikire 35
Ogun State-Ilugun 45	Ogun State—Imasai/ Igbogila 32

Note: All famers in each dry season farming location were selected to make up for the number required for the study.

3.5 Inclusion Criteria

The criteria used in selecting the farmers include:

- All are practicing dry season vegetable farmers in the study area.
- Willingness or voluntary participation of the farmers in the study without any form of cohesion.
- Planting of *'Amaranthus spp*', and' *Celosia*' spp leafy vegetables by the farmers for at least two years..

3.6 Instruments:

The major Instrument used to evaluate the effect of group-based extension methods on farmers' productivity is the Participatory Group Extension Methods Evaluation Questionnaire (PGEMEQ). The PGEMEQ was in two parts, namely: "A" and ''B''. Section A focused on the demographic variables such as age, sex, marital status, size of family, education, and experience in farming. Section B was designed to obtain data on the effectiveness of group- based extension method as introduced to them by the researcher. The instrument helped to elicit crucial information from the participating farmers on the credibility of Group Extension Methods, its ability to influence farmers to acquire new knowledge and assist dry season farmers improve their productivity.

The Participatory Group Extension Methods Evaluation Questionnaire was also used to collect data from the control group for the pre-test and post-test.

The instrument was made up of two parts, part A contains items to obtain information on demographic variables from participating farmers, part B is made up of five sections.

Section B 1- contains items to collect information on knowledge of organic manure application. Section B 2- is to seek information on the knowledge of drilling method of manure application.

Section B3- contains items to collect data on the knowledge of new varieties of crops.

Section B4-contains items to collect information on the drilling method of planting.

Section B5- contains items to collect data on the yield and income of farmers before and after the intervention or treatment.

The questionnaire was constructed using a four-point-Likert rating scale with responses ranging from Srongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). There were few open-ended questions that sought information about farmers' expenditure, income and acreage cultivated in hectares.

The importance of administering this same instrument was to infer that since the control group farmers were not involved in group extension methods they were not likely to be aware of the improved technologies being introduced by the researcher to their counterparts who were involved in group extension method interactions. To this effect, if their crop yields and sales were equal to or better than those in the experimental groups, it would be safe to conclude that the new innovations introduced were not beneficial to farmers. If however, farmers who were in the experimental groups had better results in terms of crop yields and sales, it would be safe to conclude that the newly introduced innovations were profitable. The standardised unit used to determine the yield of vegetable crops was kilogrammes (Kg). Where farmers sell their produce in bundles, a bundle was weighed with a weighing machine in kilogrammes (KG) to determine the weight of the total sale.

The questionnaire was validated in content and construct through the use of experts peer group reviews, especially from the Departments of Adult Education and Agricultural Extension of the University of Ibadan as well as my supervisor, This was complimented by internal specialists at the Department of Communication and Language Arts, University of Ibadan and agricultural extension experts at the headquarters of Oyo State Ministry of Agriculture. The validity process helped to identify potential needs for modification of some of the questions raised where clarification is necessary.

The reliability of the instruments was done using pre-test method conducted on sampled dry season farmers in Odogbo army barracks, Ojoo, Ibadan. The results of the tests were analysed using cobats alpha at 0.05 level of significance and reliability coefficient of r = 0.86 and r =0.65 were obtained.

3.6 Procedure of Research

The researcher visited the dry season farming locations in each of three states with the aim of introducing and familiarising himself with the farmers, their leaders as well as the extension agents covering the locations of the study, disclosing the benefits and aims of the study. The researcher exposed the dry season farmers in the experimental groups I, II,and III to new methods of vegetable production during extension training seasons on experimental plots on each location. Two different group-based extension methods (farmer field school and demonstration) were used in experimental locations to introduce new technologies to farmers (See Plates 1&2 on Appendix V). At the end of the sessions, the participating farmers were evaluated to determine how many of them adopted the new technologies introduced to them and under which group extension method is the rate of adoption highest.

There were also control groups where the traditional method of growing amaranthus and celosia was adopted .The result of the experimental groups was then compared with the control group to determine the effect of the intervention. The questionnaires were personally administered by this researcher with the assistance of the research assistants (RAs) were recruited and trained among the extension agents of the three states' agricultural development projects. They (the RAs) assisted farmers who can not understand some aspects of the questionnaires. The researcher ensured an excellent administration of the questionnaires in all the states.

3.7 Method of Data Analysis

The researcher used descriptive statistics of percentages and frequency counts to analyse the demographic data collected from the farmers. Data on the pre-test and the post-test conducted on farmers was analysed using the mean, standard deviation, Analysis of Co-Variance (ANCOVA) and Schiffe post Hoc.

Table 3.3: Summary of Research Work Plan

WK	Activity	CONTROL	EXPERIMENTAL GROUP 1	EXPERIMENTAL GROUP 2
I	Gathering of interested farmers and explanation of the aim and purpose of the experiment.	Same	Same	Same
Ii	The facilitator and the farmers agreed on where to meet and area of land to use for the project. Land preparation of experimental and participating farmers do the same on their farms.	Two 4mx4m plots of land are Selected, cleared and seed bed made.	Two 4mx4m plots of land are Selected, cleared and seed bed made.	Two 4mx4m plots of land are Selected, cleared and seed bed made.
Iii	Teaching of drilling method of planting and introduction of new varieties of crops. See Plates 7&8	Planting of traditional crop varieties amaranthus and celosia using old broadcasting planting method	Teaching of drilling method of planting and introduction of new varieties of celosia and amaranthus	Demonstration of drilling method of planting and introduction of new varieties of celosia and amaranthus
Iv	Teaching of wetting and spot weeding. See Pate 12	Teaching of wetting and spot weeding.	Teaching of wetting and spot weeding.	Demonstration of wetting and spot weeding.
V	Teaching of wetting, organic manure importance and drilling method of organic manure application. See Plates 9,10&11	-	Teaching of organic manure importance and drilling method of organic manure application.	Demonstration of organic manure importances and drilling method of organic manure application.
Vi	Teaching of wetting, diseases and pest control	wetting, diseases and pest control	Teaching of wetting, diseases and pest control	Demonstration of wetting, diseases and pest control
Vii	Teaching of wetting and spot weeding. See Plates 13&14	Teaching of wetting and spot weeding.	Teaching of wetting and spot weeding.	Teaching of wetting and spot weeding.
Viii	Teaching of wettingand Harvesting of amaranthus See Plates 15&16	Teaching of weeding and Harvesting of amaranthus	Teaching of wetting and Harvesting of amaranthus	Teaching of wetting andHarvesting of amaranthus
Ix	Teaching of weeding of celosia plot.	Teaching of weeding of celosia plot.	Teaching of weeding of celosia plot.	Teaching of weeding of celosia plot.
X	Harvesting of celosia See Plates 15 &16	Harvesting of celosia	Harvesting of celosia	Harvesting of celosia
xi&xii	Post test	Post test	Post test	Post test

CHAPTER FOUR

RESULTS AND DISCUSSION OF FINDINGS

This chapter contains the presentation of results from the analysis of data collected through the research instruments and their discussions thereof. The findings are presented in Tables, followed by interpretations and discussions. This was done in two parts: the first (Part A) dealt with the demographic information of the respondents used in this study, while the second (Part B) dealt with the core results of the main variables studied.

4.1 Demographic Characteristics of the Respondents

The characteristics of the respondents for the study is one of the basic requirements for understanding issues on the effects of two group-based extension approaches on the knowledge and production of dry season vegetable farmers in south-west Nigeria. Also, the characteristics provide the demographic elements that define the appropriateness of the participants for the study.

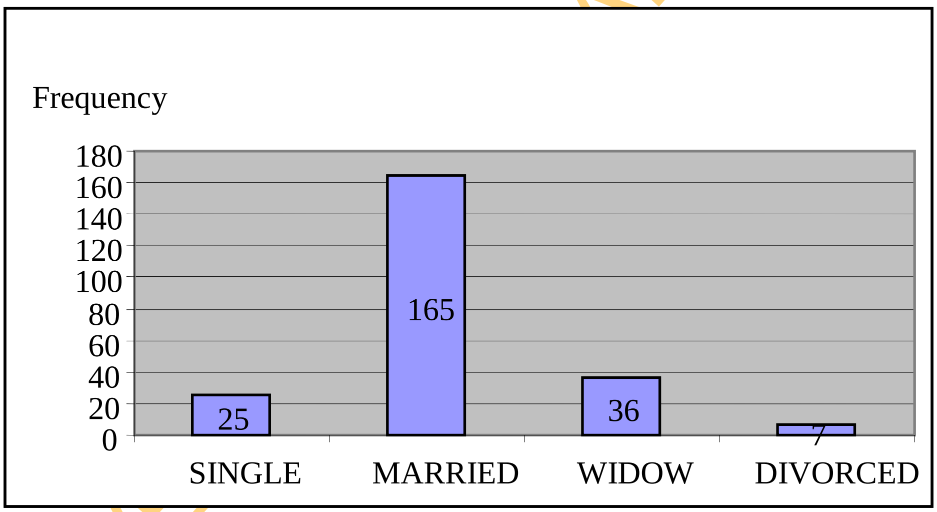


Fig 4.1: Distribution of Participants by Marital Status

This result reveals that 10.0 % of the participants awee single, 68.0 % werre married, 15.0% were widows while .03% is divorcees. Farmers need their wives and children to assist them on their farms in order to reduce the cost of labour.

Fig4. 2: Distribution of Participants by Number of Wife (ives)

Fig **4.2** shows that 11.6% of the respondents were not married, 66.0% married only one wife, 17.5% married two wives, 0.05% married three wives, 0.017% married four wives while 4.3% of married five wives. Wives often give helping hands to their husbands on the farm, especially during harvesting, transportation and grading of dry season crops.

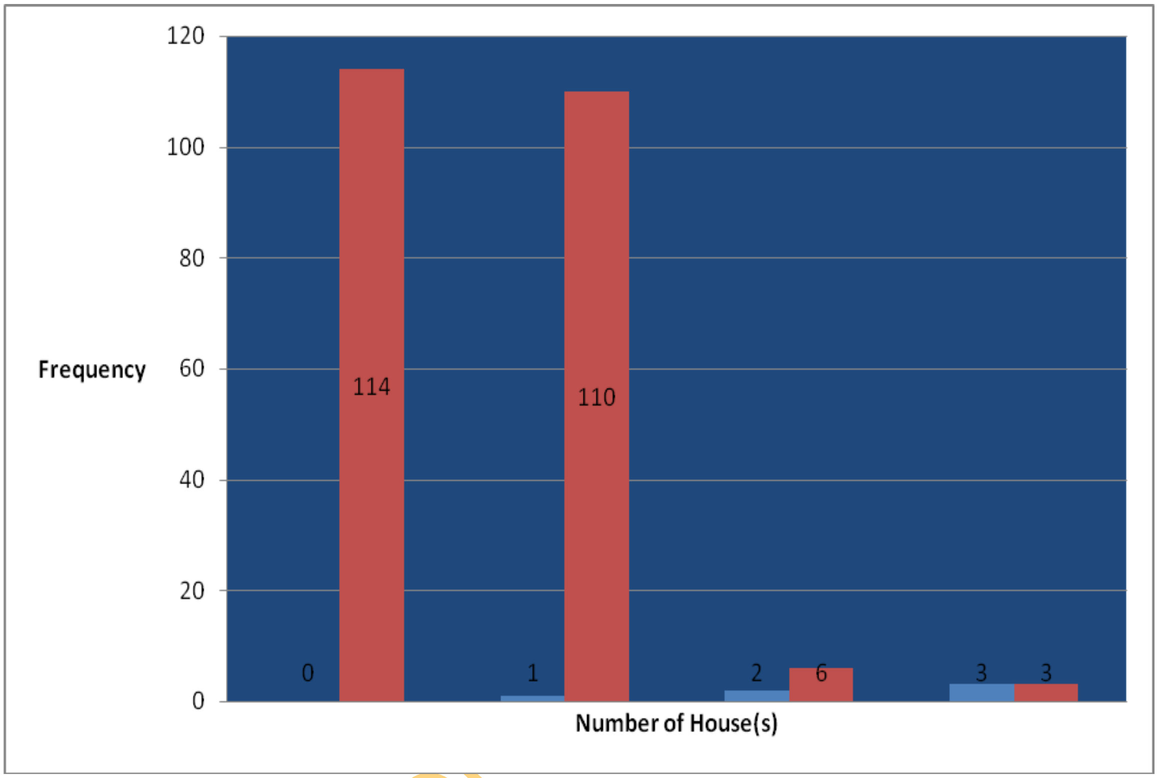


Fig 4.3: Distribution of Participants by Number of House(s)

The result shows that 48.9% participants had no house of their own, 47.2% had built one house each, 0.03% had built two houses each, while 0.02% had three houses each. This reveals that farmers too have houses of their own contrary to general belief that farmers are poor.

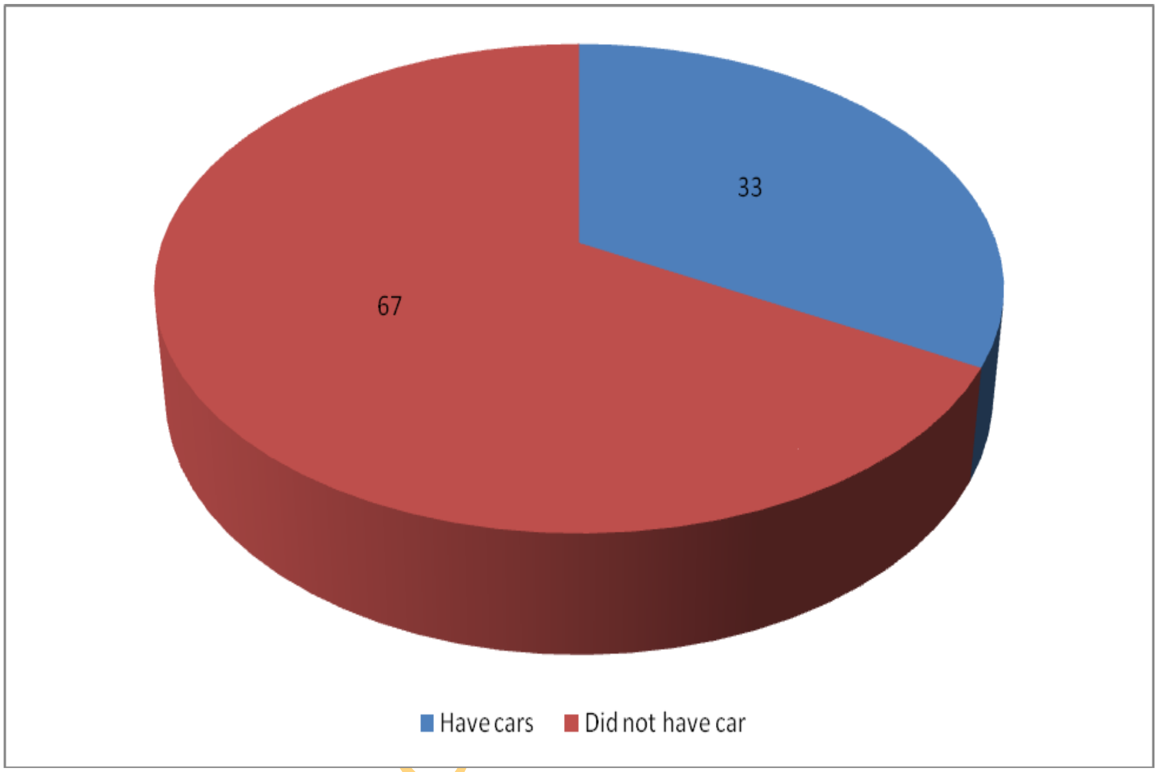


Fig 4.4: Distribution of Participants by Number of Cars

Figure 4.4 shows that 33.0% of the participants had cars, while 67.0% did not have. These cars are being used for the transportation of the farmer, the labourers, farm inputs as well as farm products to and fro the farm. It also reveals that dry season farmers are not poor and that some of them cold afford to buy cars which are not a luxury but a necessity.

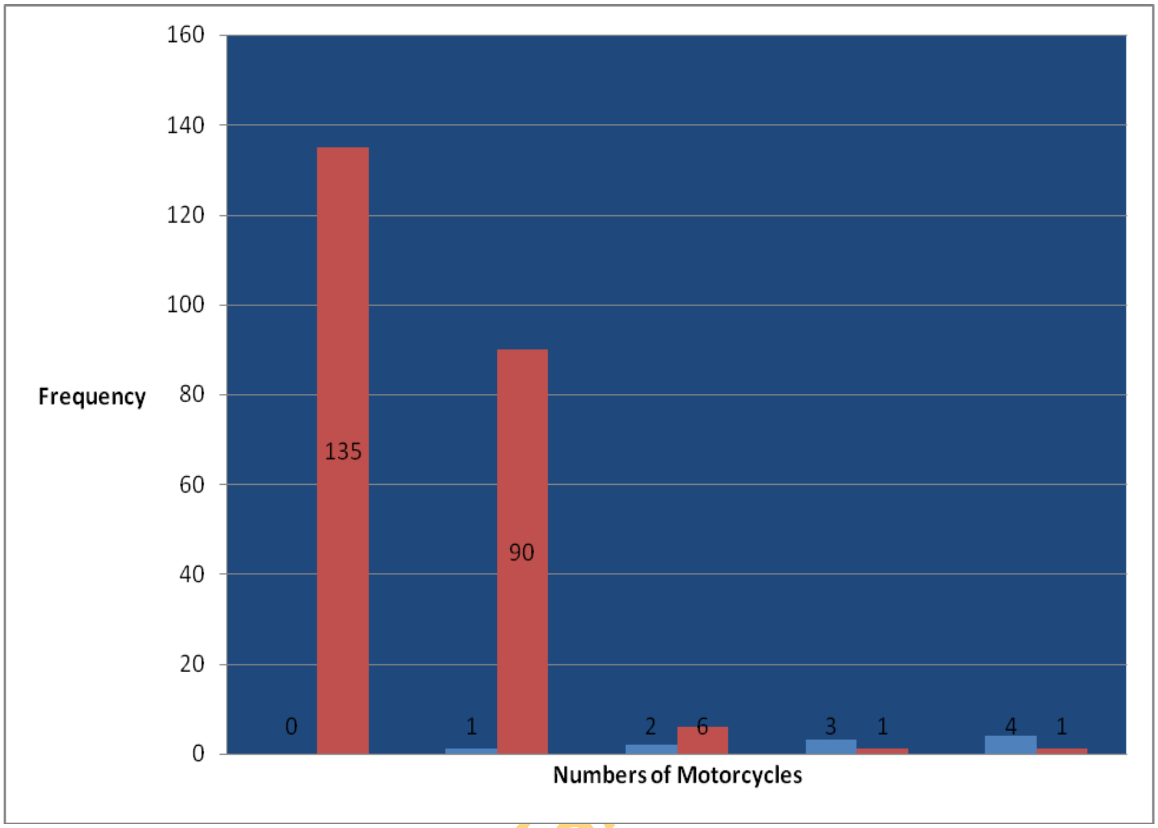


Fig 4.5 : Distribution of Participants by Number of Motorcycles

This result shows that 57.5% of the participants do not have motorcycles, 38.6% of them had one each, 0.03 had two each, while 0.06% had more than two. Dry season farmers make use of these motor cycles as a means of transportation to and fro the farm. The motorcycles are also used for the transportation of farm inputs and produce.

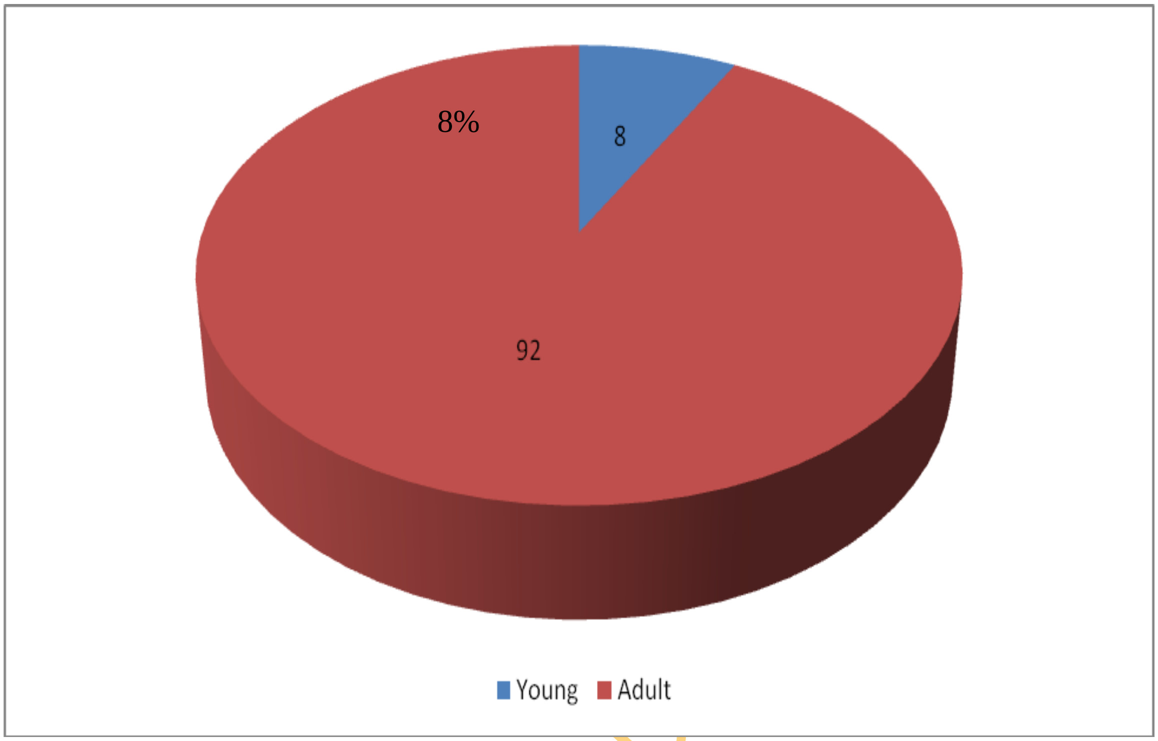


Fig 4.6 Distribution of Participants by Age

Fgure 4.6 shows that 8.0% of the participants were young or less than 25 years of age while 92.0% of the participants were adult or more than 25 years of age. This reveals that most farmers were old and that young people are not taking to farming . This result is in line with the findings of Bawja (2010) who reports that, 36.4% respondents are 41 years and above.

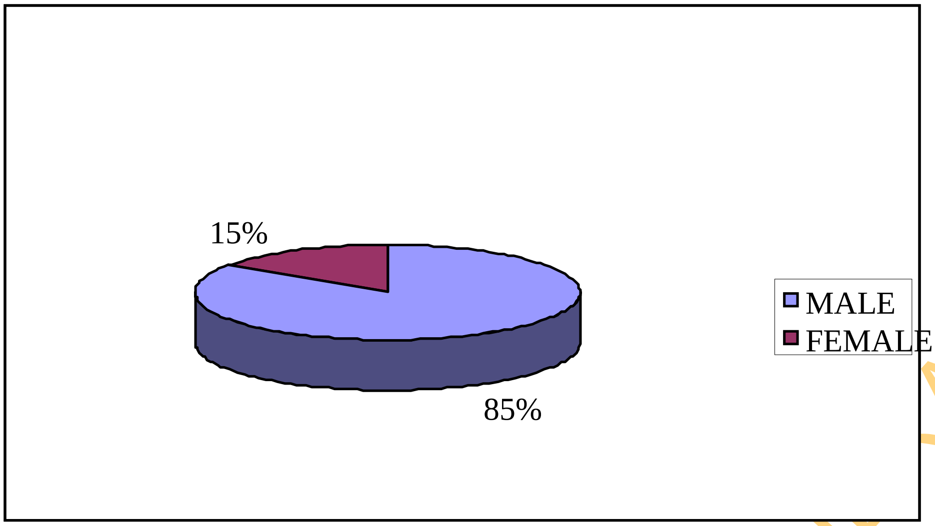


Fig 4.7: Distribution of Participants by sex

F**igure4.7** shows that 15.0% of the participants were females, while 85.0% were male. This reveals that majority of dry season farmers were male while only few of them were female. The reason for this could be the that when dry season farming is not done mechanically it is laborious and requires a lot of physical energy which most females may not be able to with provide.

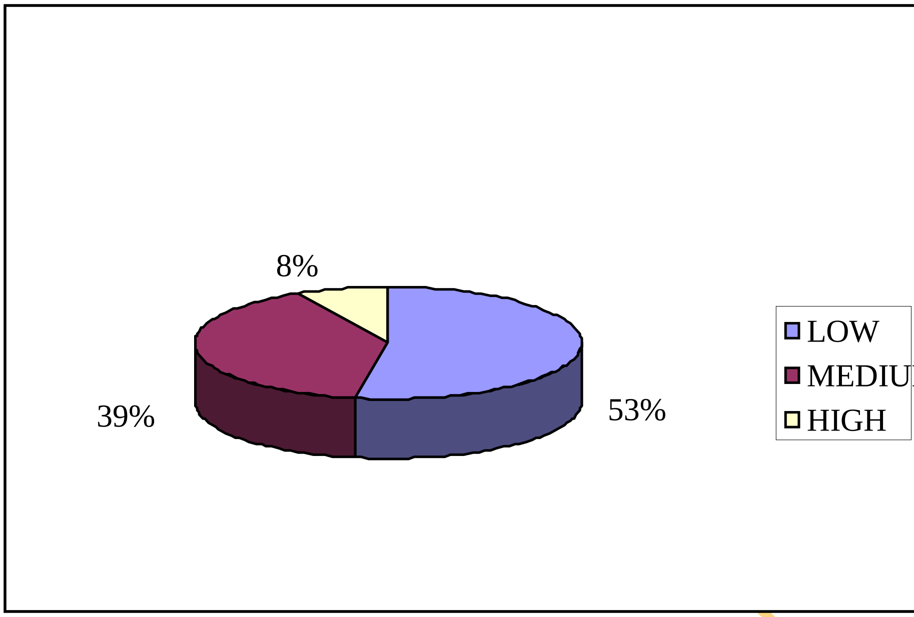


Fig 4.8 Distribution of Participants by Educational Level

Level of education and efficiency of farmers were positively correlated, the higher the level of education, the more will be the efficiency of the farmers. Education motivates and creates awareness amongst farmers to adopt new agricultural technologies. In their studies on the adoption of improved agroforestry technologies among contact farmers in Imo State, Nigeria Orisakwe l. and Agomuo, (2011) reported that farmers' educational level has a positive relationship with adoption rate of agroforestry technologies implying that the more educated farmers adopted agroforestry technologies more than the less educated farmers. This shows that 53.0% of the participants had primary and adult education certificates, 39.0% had secondary school education while 8.0% had tertiary education. This reveals that most dry season farmers could read and write in their local and English languages. This makes it easier for them to read and interpret instructions on agro-chemicals, inputs as well as research findings on leaflets, posters and other print media. This result supports Bawja (2010)'s findings that only 14.67% of respondents were illiterate.

On the relationship between age and adoption, Caswel et. al (2001) note that increasing age reduces the probability of adopting technologies. Older farmers, perhaps because of investing several years in a particular practice, may not want to jeopardise it by trying out a completely new method. In addition, farmers' perception that technology development and the subsequent benefits require a lot of time to realise, can reduce their interest in the new technology because of farmers' advanced age, and the possibility of not living long enough to enjoy it (Caswell et al., 2001; Khanna, 2001). Further, elderly farmers often have different goals other than profit maximisation, in which case, they will not be expected to adopt an income –enhancing technology. As a matter of fact, it is expected that the old that adopt technology do so at a slow pace because of their tendency to adapt less swiftly to a new phenomenon (Tjornhom, 1995). On the other hand, young farmers tend to have more education and are often hypothesised to be more willing to innovate (Ejembi, Omoregbee & Ejembi, 2006).

These findings seem to agree with previous findings from an Integrated Household Survey Report (GoM, 2005) in which the North registered higher literacy levels (90%) compared with the Southern and Central regions which registered 71% and 75% respectively. That majority of farmers are literate means these farmers would be more receptive to information pertaining to new improved farming practices. Education has been found (Caswel et. al., 2001) to create a favourable mental attitude for the acceptance of new practices especially of information-intensive and management-intensive practices on adoption. Similarly, Adesina and Zinnah (1992) have also echoed that education contributes to general awareness and thus, favours adoption. If the amount of complexity perceived in a technology is reduced, the likelihood of a technology's adoption

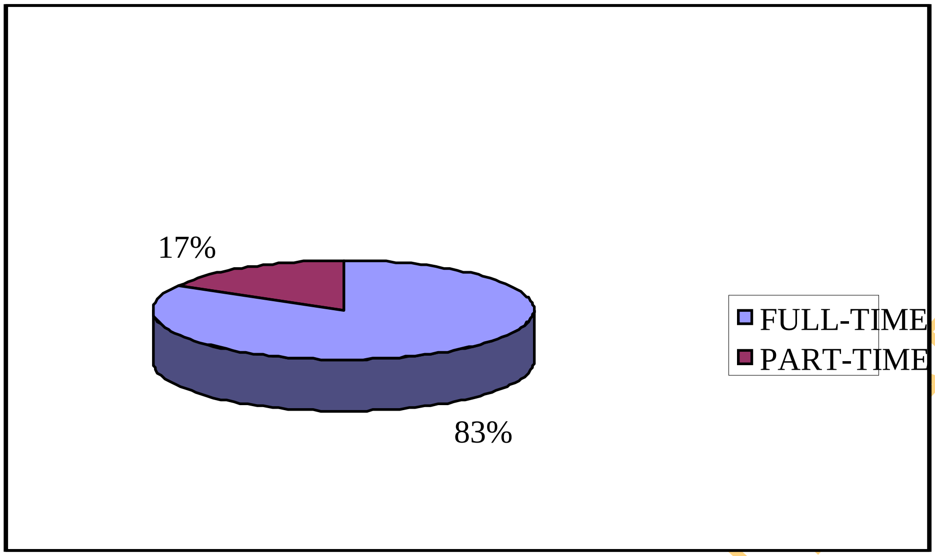


Fig 4.9 Distribution of Participants by Status of Farming

Figure 4.9 shows that 83.0 % of the dry season farmers covered in the study were full-time farmers, while 17.0% were not full-time farmers but have other jobs so they were doing dry season farming on part-time basis. This reveals that dry season farming can be practiced on full time and part-time bases. It also reveals that full-time farmers engage in dry season farming to keep them busy throughout the year and to earn additional income.

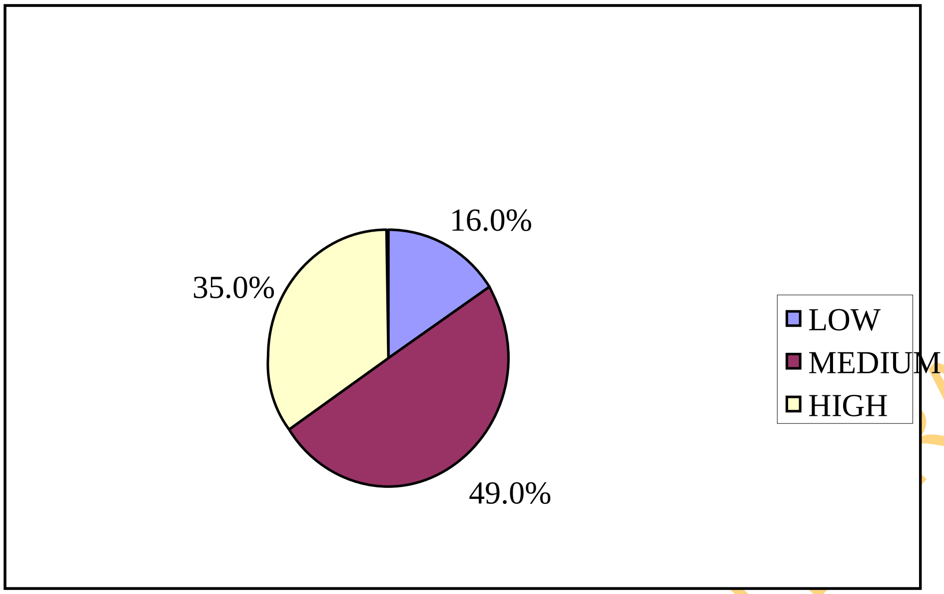


Fig 4.10: Distribution of Participants by Scale of Operation (farm size)

Figure 4.10 that 16.0% of the participating farmers can be regarded as low scale farmers because they cultivate less than one hectare or 2.5 acres of dry season land, 49.0% are ranked medium scale farmers because they cultivate between 1and 2 hectares or 2.5and5 acres of dry season land while 35.0% were regarded as large scale farmers for having cultivated more than 2 hectares or 5 acres of land.

Part B Analysis of Hypotheses

Part B contains the analysis of the result obtained from the pre-test and post-test questions as answered by the participating farmers. Each hypothesis is analysed using the mean and standard deviation scores, graphical representation of the mean plots, ANCOVA and Scheffe Pairwise Multiple comparison Tables. The results obtained were compared with previous results from similar studies.

Hypothesis 1: There is no significant main effect of the two group-based extension methods (treatments) on the knowledge of vegetable production among dry season farmers.

Here, the result of the effects of group-based extension approaches on the farmers' of improved knowledge of vegetable production is discussed. The result is analysed using mean, standard deviation and ANCOVA.

Table 4.1a: Mean and Standard Deviation Scores of the Treatment Groups Based on Knowledge of Vegetable Production

Treatment groups	Mean	Std deviation	n
Experimental Group I (Oyo)	126.8421	12.4608	38
Control Group I (Oyo)	120.3000	25.2578	40
Experimental Group II (Osun)	125.4186	12.9325	43
Control Group II (Osun)	108.9714	12.2822	35
Experimental Group III (Ogun)	119.2222	26.972n 1	45
Control Group III (Ogun)	117.4688	15.3811	32
Total	120.0129	19.6584	233

From Table 4.1a, there is a significant main effect of the treatment groups on improved knowledge of vegetable production in the study ($F_{(6, 226)}$=4.268 (Sig. .001 $P < .05$, η^2 = .086). Thus, the null hypothesis is rejected. Table4,1a shows the respective mean and standard deviation scores of Experimental Group I (Oyo),Control I (Oyo), Experimental Group II (Osun), Control II (Osun), Experimental Group III (Ogun) and Control III (Ogun) to be 126.8421, 120.3000, 125.4186, 108.9714, 119.2222 and 117.4688 respectively.

This indicates that the two group extension methods bring about increase in the knowledge of the participating farmers. This result supports the findings of Thomas, (1994), and Tengnas (1994) that the more varied the methods of extension used in an area, the more people change their attitudes and practices. The result also corroborates the findings of Nair (1993) who concludes that farmers learn in different ways, for instance, by listening, observing, discussion, and different extension methods have been employed by service providers when extending agro forestry technologies.

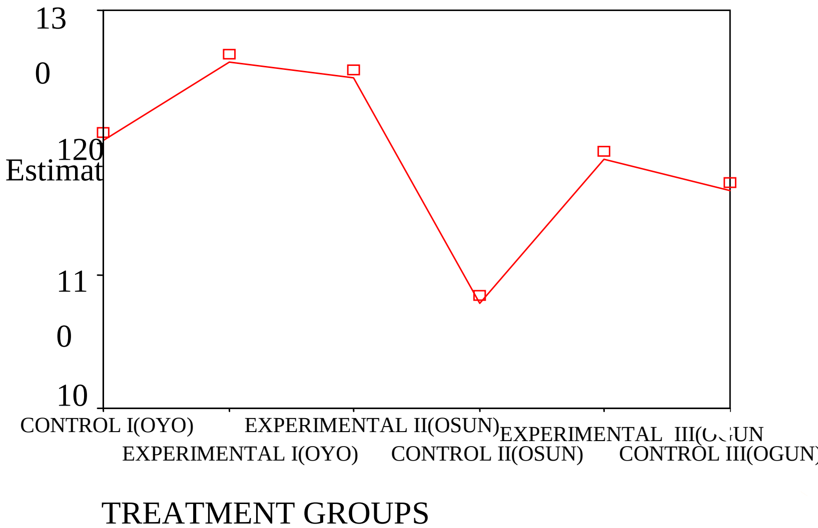


Figure 4.11: Mean Plots of Post-test of the Treatment Groups Based on Knowledge of Vegetable Production.

Figure 4.11 shows that Oyo state experimental group had the highest level of increase in knowledge of improved method of vegetable production, followed by Osun state experimental group while the least level of increase in knowledge was recorded in Ogun State experimental group. There is no control group with high level of knowledge of improved method of vegetable production. This revealed that research findings or improved method of vegetable production need to get to the farmers before they (vegetable farmers) can have the knowledge.

Table 4.1b: The Significant Main Effect of the Treatment Groups on Improved Knowledge of Vegetable Production

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Square/Effect Size (η^2)
Corrected model	7736.043	6	1289.341	3.557	.002	.086
Pretest(Knowledge)	201.718	1	201.718	.556	.456	.002
Treatment Groups	7734.702	5	1546.940	4.268	.001	.086
Error	81920.918	226	362.482			
Total	89656.961	232				

Interpretation and Discussion:

The result on Table 4.1a,b, c and Fig 4.1 shows that the highest level of knowledge was recorded in Experimental Group I (Oyo) with mean score of $\bar{x}$=126.8421, followed by Experimental Group II (Osun), Experimental Group I (Oyo) $\bar{x}$=125.4186, while the least was recorded in Experimental Group III (Ogun) $\bar{x}$= 119.2222. However, when each experimental group was compared with its control group, the highest gap was recorded from Experimental Group II (Osun) (16.447), followed by Experimental Group I (Oyo) (6. 5421), while the lowest gap was recorded from Experimental Group III (Ogun) (1.7534). The highest result recorded in Experimental Group I (Oyo) may be due to the fact that most of the farmers in this group were full time farmers who stayed on their farms most of the day and again it was the only group where there was no pest infestation. The widest gap recorded from Experimental Group II (Osun) could be as a result of the fact that most of the dry season farmers in this group were large- scale dry season farmers with huge investment and possibly huge profit.

The lowest gap recorded in Experimental Group III (Ogun) might not be unconnected with the pest infestation and three heavy rainfalls experienced by the group during the research.

Similarly, there was significant and positive relationship for knowledge and practice of group extension participants with the independent variable of information sharing (Babur 2009). This implies that, group extension approaches favours knowledge and practice through group learning condition by comparing the improved and traditional coffee management practices in the learning plot. Hence, information sharing is one of the main components in group extension participants.

The group extension participants shared information on an informal note continually with their colleagues outside field school or experimental farm and they also shared information with non-member farmers who sought advice and they began incorporating some aspects of the new farming system in their fields. During data collection period, participants acknowledged that sharing information by all farmers helped enhance the farmers' knowledge base. This led to the improvement of their crop management system as many ideas were put together.

The Eta Square/ effect size **(η^{2})** for the knowledge of modern method of vegetable production are corrected model η^2= .086; Pretest η^2 0'002 and treatment groups η^2= 0.86.

Table: 4.2 Knowledge of New Technologies

S/N	Questionnaire- Items	% D	% SA
1.	Group-based extension methods has increased my knowledge of dry season farming in the areas of organic manure application	3.0	97.0
2.	Group-based extension methods has increased my knowledge of dry season farming in the areas of drilling method of manure application.	7.0	93.0
3.	Group-based extension methods has increased my knowledge of dry season farming in the areas of available new celosia and amaranthus varieties on my farm.	2.0	98.0
4	Group-based extension methods has increased my knowledge of dry season farming in the areas of drilling method of planting	23.2	76.8
5	Group-based extension methods has increased my knowledge of dry season farming in the areas of using of hand fork for weeding.	6.5	93.5
6.	Use of hand fork reduces damage to seedlings during weeding	21.0	79.0
7.	Group-based extension methods has increased my knowledge of dry season farming in the areas of spraying my vegetables with insecticides.	15.4	84.6
8.	Group-based extension methods has increased my knowledge of dry season farming in the areas of wetting my vegetable beds before harvesting.	22.0	88.0
9.	Partial harvesting increases vegetable yields	15	85

The results on Table 4.2 show that 97.0% of the participating farmers strongly agree, while 3.0% disagree, none of the participating farmers disagreed that the two group-based extension approaches used to introduce new technologies introduced to them increased their knowledge of vegetable production especially in the areas of organic manure application, 93.0% strongly agree and 7.o% disagree that the two extension approaches used increase their knowledge of vegetable production in the areas of drilling method of organic manure application, while 87.0% strongly agree and 13.% disagree that they acquired the knowledge of available new varieties of celosia and amarantus species. This implies that the new technologies introduced to them were completely new

so all of them acquired new knowledge as a result of the intervention. Lack of access to extension services represents a crucial limitation to innovation adoption in the villages studied. Yet, increased extension intensity has proved to foster innovation diffusion only in situations of group extension, whereas intensified individual extension services do not considerably increase horizontal farmer-to-farmer knowledge exchange. On the drilling method of planting, 76.8.0% agree that the group extension methods has increasedtheir knowledges in the area of drilling method of planting while 13.2% disagree.
Majority of the farmers, 93.5%) have not seen hand fork before, while (6.5%) of them have seen it before but none of them have used the implement on their farm before the research. The post test reveals that 79.0% of the participating farmers agree that hand fork reduces damage to crops during planting and that it helps to pulverise the soil which enhance good crop growth while 21.0% disagree.

On pest control, only 84.6% farmers indicated that group-based extension methods increased their knowledge of new pest contro method while 15.4% submitted that they have been spraying their vegetables before. None of them was aware that they should not harvest their crops until seven days after spraying the insecticides. Non- availability of insecticides could be one of the factors why many farmers have not been using it on their farms. On the issue of new method of harvesting, 88% farmers agreed that group-based extension methods increased their knowledge of new method of harvesting (wetting beforeharvesting and partial harvesting) while 22% disagreed Also, 85.0% agree that partial harvesting increases yield on the long run because it enables weak and younger leafy vegetables grow faster after the harvesting of stronger ones while 15.0% disagree.

The result contradicts the findings of Semana (1985) who scores the individual method as the best approach through which farmers learn better. Feder and Quizon (2004) also reported similar findings which are familiar to that of this study and conclude that group extension participants benefited more from the significantly higher knowledge acquisition of better pest management in Indonesia.

Group extension approaches seem to be an appropriate strategy to overcome constraints to IPM adoption identified in the lack of farmers' biological and ecological knowledge, because it allows farmers develop a deep understanding of the crop systems and a strong confidence in the method. In the case of this study, such confidence was expressed in the decision to take fewer but likely more targeted pesticide applications. Solanki (2001) also reports that knowledge of group extension on benefits about breeding, feeding, health care and management practices of dairy animals was higher than the non-beneficiaries. Fasika (2004/5) reports that participation in Group extension on approaches can increase understanding of farmers about potato late blight disease and helped them improve their controlling practices of the disease. It has also demonstrated that group extension approaches can help improve farmers' knowledge and affect their agricultural practice on knowledge intensive technologies.

In another study, Babur (2009) indicated that there is highly significant difference between mean score of knowledge of group extension participants and none- group extension participants with respect to promoting coffee management practices in selected districts. Based on knowledge difference, the group extension participants gained more knowledge when compared to non- group extension Participants. About 32.9% and 67.1% of the group extension participants had acquired medium and high levels of knowledge respectively, while 57.1% and 8.6% of the non- group extension vegetable farmers had acquired medium to high level of knowledge respectively of the same practices, especially with reference to the knowledge of coffee wilt disease. It is interesting to note that none of the group extension participants' respondents in the sample was reported with low level of knowledge about improved coffee management practices.

The findings of the study are in line with the findings of Solanki (2001) who reports that knowledge of dairy cooperative members in breeding, feeding, health care and management practices of dairy animals was higher than the non- members. These findings are also similar to the findings of Bunyatta et al, (2005) that about 50% of group extension participants (farmers) had acquired high to very high knowledge of the technologies disseminated while more than 80% of the Group Extension Participants (farmers) had acquired moderate to very low level of the technologies. There appeared to be some crucial differences in the level of knowledge acquisition among the participants. In a study to assess whether Group extension participants retain and share what they have learnt in Philippines.

The positive and strong relationship of knowledge and practice towards group extension participants experience reveal that, the more the knowledge and experience of the farmer; the better the respondent can acquire crop management practices through group extension (Babur, 2009). The positive and significant relationship of knowledge and practice of group extension participants with creativity of the respondents revealed that when the respondents' exposure increase through participatory learning in group extension participants, their creativity towards crop disease management also increases, which is in agreement with the creativity of IPM.

Table 4. 3: Scheffe Pairwise Multiple comparison – Modern Knowledge of Treatment Groups

Treatment Groups	Treatment Groups	Sig.
Experimental Group1 (Oyo)	Control II (Osun)	.008
ExperimentalnGroup II(Osun)	Control III (Ogun)	.015

Table 4.3 shows there were significant differences between experimental Group I (Oyo) and Control II (Osun) and between Experimental Group II (Osun) and Control Group III (Ogun).

Adoption of Improved Method of Vegetable Production

Ho2: There is no significant main effect of the two group-based extension methods (treatments) on adoptions of organic fertiliser application, improved varieties of crops and crop planting methods

In this section, the result of the effect of two group-based extension approaches on the adoption of improved method of vegetable production is discussed, using mean, standard deviation and ANCOVA.

Table4. 4a: Mean and Standard Deviation Score of The Treatment Groups Based on Improved Adoption of Modern Knowledge of Vegetable Production.

Treatment groups	Mean	Std deviation	n
Control Group I (Oyo)	51.5526	4.1309	38
Experimental Group I (Oyo)	51.9500	11.5247	40
Experimental Group II (Osun)	54.7674	6.1483	43
Control Group II (Osun)	43.4571	4.6988	35
Experimental Group III (Ogun)	51.8000	11.5868	45
Control Group III (Ogun)	53.4688	5.4948	32
Total	51.3090	8.7700	233

Table 4.4a and Figure 4.12 (Mean Plot) show that the mean score for the level of adoption was higher in Experimental Group II (Osun) with a mean score of $\bar{x}$=54.7674, followed by Experimental Group III (Ogun) $\bar{x}$= 51.8000 and Experimental Group I (Oyo) $\bar{x}$= 51.9500. This result indicates that the highest adoption level was recorded in Experimental Group II(Osun) (11.3103) group followed by Experimental Group I (Oyo) (0.3974) and Experimental Group III (Ogun) (-1.6688) . The reason for this could be due to the fact that most participating farmers in Osun State were well- educated with large farm size. The negative result recorded from Ogun Experimental group could be as a result of the infestation of pest experienced by the experimental groupIII, Ogun.

Similar studies from Western Kenya showed that CARE was working effectively by mainly using the group approaches to pass on technologies to the beneficiaries (Bo Tengnas, 1994). Many farmers were able to get agro forestry information probably because of different tools being used in group method as compared to individual method.

The fact that in Kkingo subcounty, groups were common could also explain why group approach was more feasible than individual approach. This was in line with the prediction made by Tengnas (1994) that the more varied the methods of extension used in an area; the more people change their attitudes and practices. There were significant difference ($t = 17.68$, $p < 0.05$) between group and individual extension methods. About 78% of respondents were very enthusiastic about group methods with respect to farmers' preference as the most significant approach in disseminating agro-forestry technologies. The significant difference was attributed to more benefits through group extension methods. Many respondents 61.5% stressed that since farmers perceive information differently, group methods increased opportunities for sharing of knowledge and experiences by discussing agro forestry technologies and practices. In, addition, the extension workers said group extension methods were more economical in disseminating agro forestry knowledge. Group members reported that their income and food security icreased tremendously. In people's participation programme villages, there was a stronger feeling of cooperation and unity. This is in line with what was found out with Vi- projects extensionists, that more farmers were interested in group methods as the benefits of working and learning agro-forestry technologies together with fellow farmers (as a unit) became obvious.

Another effect of apparent benefits of the group methods is that farmers who were using individual approaches commented on group methods favourably and referred to them as the best mode of delivery through which farmers can benefit (buyinza@forest.mak.ac.ug) It is also interesting to note that among the reasons why group membership was declining in some villages where the people's participation programme worked is that the members felt the profit realized was marginal and that they would be better off working on their own and that no extension agents visited villages. Vi-agro forestry Project introduced group approach in Uganda in 1997 with a focus on extending extension service. Vi-Agro forestry Project has adopted a programmme where farmers are taken of other projects. For instance, there is a project in Sierra Leone called People's Participation Programme, which aims at improving the lives of the poor through the formation of small farmers' groups which serve as a vehicle for self-development, empowerment and cooperation while ensuring project sustainability. The groups formed proved to be successful and attracted development assistance (Thomas, 1994). Onduru , Jager , Hiller , Van den Bosch (2012) conclude that the group extension approach significantly increased the knowledge of the group- extension farmers ($p < 0.01$; t-test) with group extension farmers having an average score of 6.5 versus 5.1 for their non- group extension counterparts. The knowledge gains on good agricultural practices (GAP) on tea were higher for group extension members than their non- group extension counterparts irrespective of whether the non- group extension were close to group- extension site (same tea buying centre) or far away.

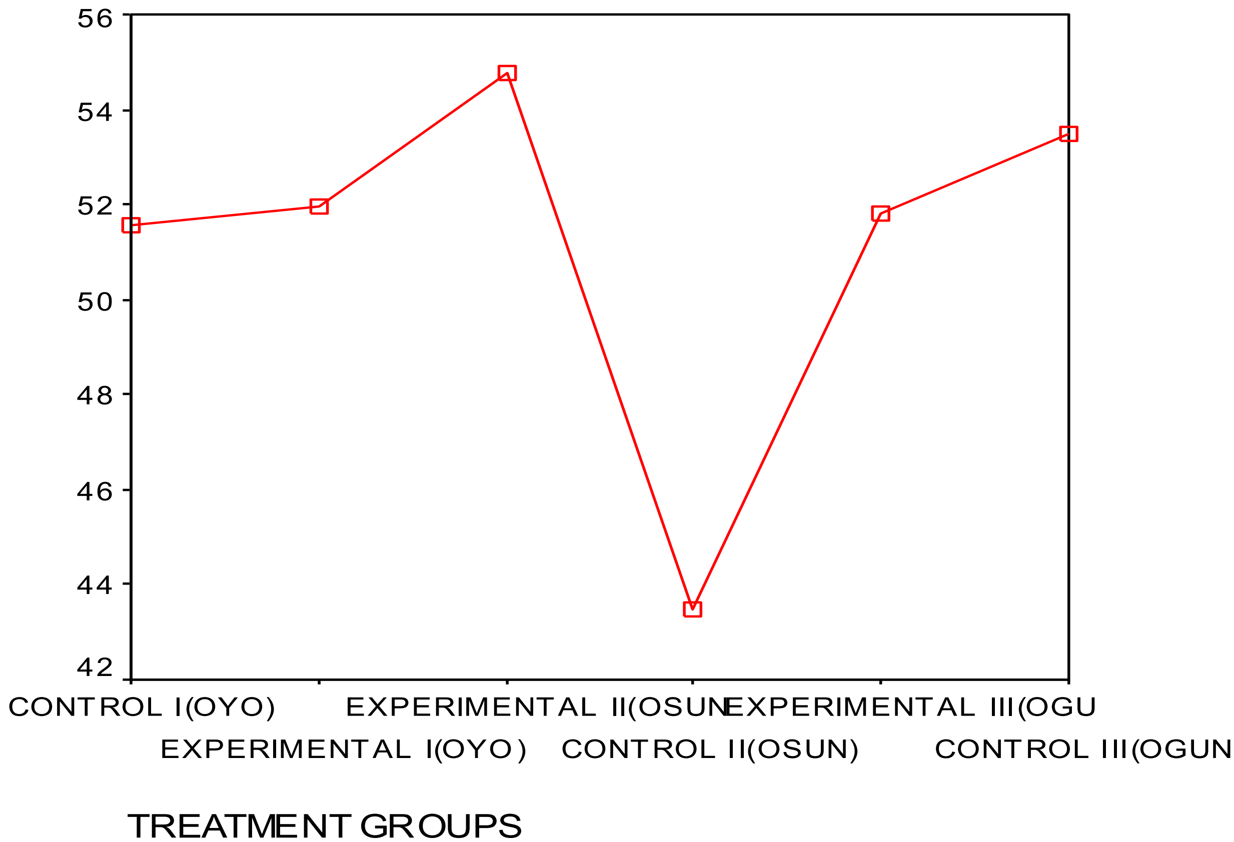


Figure 4.12: Mean Plots of Post.test of the Treatment Groups on Adoption of Modern Knowledge of Vegetable Producion.

The mean plots in Figure 4.12 shows that the two group-based extension approaches used to disseminate improved dry season technologies to farmers helped in all the three experimental groups to adopt the new improved dry season technologies introduced to them. The level of adoption in Osun State was higher than the result obtained from Oyo and Ogun States. This higher adoption level recorded in Osun State could be as a result of yhe fact that the highest level of knowledge was obtained from this same Osun state experimental group.

Table 4.4b The significant main effect of the treatment groups on Improved adoption of modern knowledge of vegetable production

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Square/Effect Size **(η^2)**
Corrected model	2916.474	6	486.079	7.359	.000	163
Pretest(Knowledge)	65.546	1	65.546	.992	.320	.004
Treatment Groups	2915.944	5	583.189	8.830	.000	.163
Error	14927.277	226	66.050			
Total	17843.751	232				

Interpretation and Discussion:

From Table 4.4b, there is a significant main effect of the treatment groups on improved adoption of modern knowledge of vegetable production in the study $_{F(6,\ 226,}$ = 8.830, Sig..000 P < .05). Thus, the null hypothesis is rejected. Table4.2a shows the respective mean andg standard deviation score of Experimental Group I (Oyo),Control I (Oyo), Experimental Group II (Osun), Control Group II (Osun), Experimental vIII (Ogun) and Control Group III (Ogun) to be 51.9500; 51.5526; 54.7674; 43.4571; 51.8000; 53.4688, respectively.

Table 4.2b shows that the all the control groups in the three states are not aware of the modern knowledge of vegetable production $_{(F\ (6,226,)}$ =.992, P> 0.5). On the other hand, the experimental groups adopted the modern knowledge of vegetable production when the two group-based extension approaches (Demonstration method and Farmer Field School

Approach) were used to introduce the modern methods of vegetable production to them $_{(F(6,226,)}$ = 8.830, P< .05. The result supports the findings of Mwagi and Onyango (2003) who observe that the adoption of technology on organic and inorganic fertiliser combinations by group- extension farmers was significantly higher than that of non-group- extension farmers. In general, this finding is in line with Loevinsohn (2000) who reports that 80% of what was learned on crop management in the group- extension was adopted showing farmers' satisfaction with the technical options learned during the group- extension sessions than their counterparts. The variance in preference could be explained by the assertion that the opportunities associated with group method outweighed their limitations. Therefore, this explains why there were significant variations ($p<0.05$) in preference between group and individual methods. The extension method that has more opportunities than limitations will definitely prompt farmers to adopt extension method. The variety of opportunities associated with group method such as: - farmers having chance to travel to new environment to see things; exposed to new ideas in practices through visits to research stations; exchange of ideas and experiences among groups; a lot of information being presented, or techniques demonstrated to several people at one time; discussion can take place between the group members and the extensionist, contributes to high adoption of information and implementation. This might explain why farmers developed positive attitude towards group method and regarded it as a better provider of agro- forestry information.

Tabl: 4.5 Adoption of Improved Methods of Vegetable Producton

		%D	%A
1	Application of animal wastes increases the yield of amaranthus and celosia	16.8	83.2
2	I will be using organic manure for my dry season crops.	18.7	81.3
3	I will adopt drilling method of manure application on my farm.	18.7	81.3
4	I will be planting new crop varieties on my farm from now on.	28.5	71.5
5	I will always adopt drilling method of planting on my farm.		100
6	I will expose other farmers to the skill of drilling.	37.7	62.7
7	Henceforth I will be using hand fork for weeding my vegetable beds.	12.3	87.7
8	I will introduce the new method of weeding to other vegetable growers.	16.1	83.9
9	I shall henceforth be practicing partial harvesting and wetting before harvesting.	1.8	98.2
	I will always control insect pests by spraying my crops from now on.	8.0	92.0
	I will introduce the spraying method of pest control to other vegetable growers.	10.5	89.5
10	I will expose other farmers to partial harvesting and wetting before harvesting.	8.0	92.0

Table 4.5 shows that Eigthy-three percent (83%) agreed that application of animal wastes increases the yield of amaranthus and celosia when they applied it on their farms as against 17 %, 81.3%), adopted the use of organic manure application and drilling method of organic manure application, while 18.7% did not, 71.5% adopted new varieties of celosia and amaranthus, while 28.5 did not. All the participating dry season farmers adopted the drilling method of planting, 72.7% submitted that they will teach other vegetable farmers the skill of drilling method of planting while 27.3 did not.87. 6% adopted new method of harvesting while22.4% did not. About 87.7% adopted the use of hand-fork for weeding while 12.3 did not, 98.1% adopted new method of pest control while 1.9% did not.

The dry season farmers who did not adopt the use of organic manure complained about the foul smell of the manure, those who did not adopt the use of hand-fork complained of non-availability of the instrument as at when they wanted to use it, while those who did not adopt the new method of harvesting complained it is time consuming.

On the use of hand fork for weeding, 92.2% participants adopted the new method of weeding while 7.8% did not show interest; some 83.9% farmers indicate their willingness to introduce the new method of weeding to the students while 16.1% did not. On pest control, 89.5 % of the dry season farmers agreed that will be spraying their crops to control pests henceforth while 10.5% d1sagreed, on the other hand, 92.0% of the farmers promised to teach their friends in the skill of spraying while 8.0% were not willing to expose their friends to the skill of spraying.
On the new method of harvesting (wetting before harvesting), 98.2% participants adopted the method while 1.8% did not show interest; 92.0% participants indicated their willingness to introduce the use of handfork to their co farmers while 8.0% did not show interest.

In this section, the result of the effect of the two group-based extension approaches on the yields of the treatment groups is analysed and discussed using the mean, standard deviation and ANCOVA. The result was also compared with past studies similar to the research topic.

Effects of two Group-based Extension Approaches on yields of Dry Season Farmers

Ho3: There is no significant main effect of the treatment groups on yields (Kg) of vegetable production

Table 4.6a: Mean and std. Deviation Scores of the Treatment Groups based on the Yields (kg) of Vegetable Production

Treatment groups	Mean	Std deviation	N
Control Group I (Oyo)	4479.5000	2091.9783	38
Experimental Group I (Oyo)	5664.7308	1617.6935	40
Experimental Group II (Osun)	42963.744	227092.2434	43
Control Group II (Osun)	2558.1143	1334.2565	35
Experimental GroupIII (Ogun)	51942.467	169374.7773	45
Control Group III (Ogun)	24787.187	1193.9365	32
Total	20388.477	123438.6915	233

Table 4.6a shows the respective mean and standard deviation scores of Control I (Oyo), Experimental Group I (Oyo), Experimental Group II (Osun), Control Group II (Osun), Experimental Group III (Ogun) and Control Group III (Ogun) to be 4479.5000, 5664.7308, 42963.744, 2558.1143, 51942.467, 2478.7187 and 20388.477, respectively

Table 4. 6b: The significant Main Effect of the Treatment Groups on Yields (kg) of Vegetable Production

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Squared Size (η^{2})
Corrected model	2.2579E+	6	3.7632E+11	66.597	.000	.639
Pretest(yield)	2.1515E+12	1	2.1515E+12	380.752	.000	.628
Treatment Groups	81315095126	5	16263019025	2.878	.015	.060
Error	1.2771E+12	226	5650755846.2			
Total	3.5350E+12	232				

Table above 4.6b a significant difference between the pretest yield (Kg) $\bar{x}$=2.15 and the post-test yield (Kg) $\bar{x}$= 16,263,019,025 of the three experimental groups with the eta squared size η^2 =.628 and .060 for the pretest and post-test respectively.

Interpretation and Discussion:

Table 4.6b, shows that there is significant main effect of the treatment groups on yields (kg) of vegetable production in the study ($F(6, 226)=2.878$, Sig.0.15 $P < .05$, $\eta^2 = .060$). Thus, null hypothesis is rejected. The result indicates that the group extension and demonstration extension approaches used to disseminate improved vegetable production techniques to dry season farmers help increase their yields when compared with the pre-test result. The farmers when exposed to the new methods of dry season vegetable production, adopted and applied these new technologies on their farms and confirmed that their yield was greatly increased when calculated in kilogrammes.

The result corroborates the findings of Chapke (2012) which reveals that demonstrated technologies increased the fibre yield of jute by 4.45 q ha-1 over farmers' practice (25.10 q ha-1), the post-demonstration yield was 29.55 q ha-1 as the farmers adopted many components of the technology package that used in demonstrations. Economic surplus from increased production of jute fibre by about 4.45 q ha-1 provided additional Rs. 5570 ha-1 to the farmers. In order to have an in depth analysis of Front Line Demonstration (FLD) and its impact on castor growers, a study was undertaken on impact of FLD on castor growers by Rani, Palanisamy and Venkatesan (2010). Results reveal increased yield, decreased cost of cultivation and increased income as reported by majority of the farmers under direct impact. Indirect impact includes increase in confidence, decision-making power, and participation in training, investment and consultation by fellow farmers.

Table 4.7: Farmers' Yield

	Year	Acreage in (Ha)	Yield in (Kg)	% Yiekd Increase
Osun	2009-2011	4.2ha	1,309,068	
	2012	4.2ha	536718s	23
Ogun	2009-2011	3.8ha	1562215	
	2012	3.8ha	671753	29
Oyo	2009-2911	5.1ha	1,855,600	
	2912	5.1	841205	36

Table 4.7 shows that the percentage increase in yield of farmers when the 2012 yield is compared with the previous years (2011, 2010 and 2009) ranges from 23% Experimental Group II (Osun) being the lowest, followed by 29% from Experimental Group III (Ogun), and 36% being the highest from Experimental Group I (Oyo). However, when each experimental group was compared with its control group, the highest increase in yield was recorded from Experimental Group III (Ogun) $\bar{x}$=27155.287 followed by Experimental Group II (Osun) $\bar{x}$=42963.744 while Experimental Group I (Oyo) $\bar{x}$=1185.2308 had the lowest increase in yields.

The result corroborates Van den Berg (2004) who reports that substantial and consistent reductions in pesticide use were attributed to the effect of training. In a number of cases, there was also a convincing increase in yield due to training. This finding also supports the submission of Habib, Zafarullah, Iqbal, Nawab and Ali (2007) that before a farmer field school, the sugar cane farmers in the study area obtained yield 17830.5 kg acre-1 with net income of Rs.44575. After farmer field school, the farmers were able to obtain sugarcane yield of 21300 kg -1 acre with a net income of Rs.53250. Statistical analysis of the data for sugarcane shows a significant enhancement for yield and income with a difference in yield 3469.5 kg acre-1 and in income Rs 8675. These results of high yield in sugarcane agrees with the findings of Loesin et al. (2000), Mutandwa and Mpangwa (2004), assessing the impact of group- extension on integrated pest management (IPM) dissemination and its usefulness reveal that scores with regard to crop yield, income from cotton and technical knowledge for group- extension participants were higher than those of non- group- extension participants. Kabamba and Muimba-Kankolongo (2009) report increased maize yield after group extension participation adoption was recorded among 65.7% of the respondents with a gain in yield amounting to two tons/ha on average, three times more than the yield from conventional farming. It is therefore, concluded that group extension currently constitutes one of the major keys to increasing crop yield and productivity in Zambia. Yield increase is higher for farmers who switch from Local Varieties (LV) to High Yielding Varieties (HYV) in the Boro seasonbecause of group extension training. Recent monitoring data show that before their training, 37% of the FFS farmers used to grow HYV. This increased to 97% farmers growing HYV after the training. A local variety yielded 12to16 kg per decimel while HYV yielded 25to32 kg per decimel.

Effects of two Group-based Extension Approaches on Income of Dry Season Farmers

Ho 4: There is no significant main effect of the treatment groups on the income on vegetable production.

In this section, effect of the two group-based extension approaches on the income of the farmer's treatment groups is analysed, the result is discussed using the mean, standard deviation and ANCOVA. The result is also compared with past studies similar to the research topic.

Table 4.8a: Mean and Standard Deviation scores of the treatment groups based on the income on vegetable production

Treatment groups	Mean	Std deviation	`n
Control Group I (Oyo)	561749.21	5912575.0217	38
Experimental Group I (Oyo)	962994.25	903361.7698	40
Experimental Group II (Osun)	1084876.7	1661334.3891	43
Control Group Group II (Osun)	317738.86	146048.9655	35
Experimental Group III (Ogun)	1267970.4	1488310.9604	45
Control Group III (Ogun)	504154.94	412239.5335	32
Total	819006.12	1121038.2891	233

Table 4.8a shows the respective mean and standard deviation scores of Control I (Oyo), Experimental Group I (Oyo), Experimental Group II (Osun, Control Group II (Osun), Experimental Group III (Ogun). and Control Group III (Ogun) to be 561749.21, 962994.25, 1084876.7, 317738.86, 1267970.4 and 504154.94, respectively.

Interpretation and Discussion

Table4. 8a shows the significant main effect of the treatment groups on the income on vegetable production in the study $_{(F(6, 226)}$ = 3.406,Sig. .005 $P < .05$, $\eta^2 = .070$). Thus, the null hypothesis is rejected. The results show that the two group-based extension approaches significantly increase the income of farmers in the treatment groups.

The results support Chapke (2012) who indicates that additional income that accrued due to increased harvest of jute by adopting improved practices was utilised by the farmers by increasing expenditure by about 50.5% on food. In evaluating the impact of FFS in Bangladesh agriculture, the International Development Association concludes that the impact of group extension on household income is statistically highly significant. Bijlmakers, (2011) submits that while income in group extension households on average has risen from BDT 52,000 before group extension to BDT 72,000 after FFS participation in 2010, the increase within control village households within the same period was only from BDT 47,000 to BDT 57,000. The income increase within group extension households is significant for the households at the lowest income levels.

The result obtained in In Phu Tho district, by Le Toan (2002), similar to this findings shows a 54% yield increase and a 54% increase in profits was observed after training. Non-FFS farmers increased their yield by 36% and their profit by 17% during the same period. That impact which is the sum of the value of crop production income and livestock income per household, differs across the three countries. Comparison across countries by Davis, Nkonya, Kato, Mekonnen, Odendo, Miiro, and Nkuba (2011) show that group extension had the largest impact on agricultural income in Tanzania, and the smallest (nonsignificant) impact in Uganda Agricultural income of group extension members in Tanzania doubled due to participation in a field school In Kenya, agricultural income increased by 21 per cent. Consistent with the results in Tanzania and Uganda, crops contributed the largest share of the change.

The agricultural income of group-extension participants in Uganda increased by only 18 per cent and was not significant this shows the impact of group extension participation on value of crops produced per acre, livestock value gain per capita, and agricultural income per capita. It is evident that such participation led to increased production, productivity, and income in nearly all cases. It also corroborates Khan, Pervaiz, Khan, Ahmad and Nigar, (2009) that the average income of the respondents after adopting the improved methods of production, as demonstrated, has increased from Rs.3650 to Rs.5137, showing 40 per cent increase on the average. The post-demonstration impacts include increased number of users/adopters of improved practices, yields and income of the sampled farmers indicating betterment of their livelihood.

Table4.8b The Significant Main Effect of the Treatment Groups on the Income on Vegetable Production.

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Squared Effect (η^2)
Corrected model	9.3806E+13	6	1.5634E+13	17.867	.000	.322
Pretest(Knowledge)	6.6385E+13	1	6.6385E+13	75.866	.000	.251
Treatment Groups	1.4903E+13	5	2.9807E+12	3.406	.005	.070
Error	1.9776E+14	226	8.7502E+12			
Total	2.9156E+14	232				

Table 4.8b, shows that there is a significant main effect of the treatment groups on the income made on vegetable production in the study $_{(F(6,\ 226)}$ = 3.406,Sig.005 $P < .05$, η^2 = .070). Thus, the null hypothesis is rejected. This result reveals that the two group extension approaches used to disseminate agricultural information to dry season farmers significantly increased the income of farmers under experimental groups. When the pretest income is compared with the posttest income, the posttest income was higher than the pretest income.

Table4. 8c: Scheffe Pairwise Multiple comparison – Income

Treatment Groups	Treatment Groups	Sig.
Control Group I (Osun)	Experimental Group III (Ogun)	.011

Table 4. 8c shows that there was a significant difference of 0.11 between Control Group I Osun and Experimetal Group III Ogun. When each experimental group was compared with its control group, the highest increase in yield was recorded from Experimental Group III (Ogun) $\bar{x}$=763815. 46, followed by Experimental Group II (Osun) $\bar{x}$=767137.84 while Experimental Group I (Oyo) $\bar{x}$= 401245.04 had the lowest increase

in income. The widest gap recorded in Ogun State experimental group could be due to the fact that farmers in this group sold their vegetables directly to buyers that come from Lagos and Abeokuta which made their produce to be sold at higher prices.

Table 4.9: Farmers Income

State	Year	Income in (N)	Increase in income (N)	% Increase in income
Oyo	2009-2011	860,350.00		
	2012	552866.00	65,960.00	23
Osun	2009-2011	920,500.00		
	2012	405,020.00	98287.00	32
Ogun	2009-2011	880,200.00		
	2012	413,694.00	120,294.00	41

Table 4.9 shows that all the participating farmers in the treatment groups recorded increase in their income at various degrees and percentages. The income of the year 2012 (intervention year) was compared with the average income of the farmers in the years 2011, 2010 and 2009 and the result shows that the average increase in the income of the dry season farmers ranges from N65,960.00 being the minimum from Experimental Group I (Oyo) with the mean of 962994.25 followed by N98287.00 from Experimental Group II(Osun) (1084876.70)and N120,294.00(317738.86) from Experimental Group III (Ogun) being the maximum. The percentage increase in dry season farmers' income ranges from 23% being the minimum, followed by 32% and 41% being the highest.

Effects of two Group-based Extension Approaches on the Expenditure of Dry Season Farmers

Ho 5: There is no significant main effect of the treatment on the expenditure made by treatment groups on vegetable production.

In this section, of the data generated on the significance of two group-based extension approaches on the expenditure of farmers in the treatment groups is analysed. The result of the effect is discussed using the mean, standard deviation and ANCOVA. The result is also compared with past studies similar to the hypothesis

Table 4.10a: Mean and Std. Deviation Score of the Treatment Groups Based on the Expenditure made on Vegetable Production

Treatment groups	Mean	Std deviation	n
Control Group I (Oyo)	196829.08	183106.9206	38
Experimental Group I (Oyo)	240767.63	176526.7564	40
Experimental Group II (Osun)	159645.35	139961.6422	43
Control Group II (Osun)	98533.429	39517.0507	35
Experimental Group III (Ogun)	181565.33	144041.0927	45
Control Group III (Ogun)	164699.59	190316.4308	32
Total	175383.94	157822.4248	233

Table 4.10a shows the respective mean and standard deviation scores of Control I (Oyo), Experimental Group I (Oyo), Experimental Group II (Osun), Control Group II (Osun), Experimental Group III (Ogun) and Control Group III (Ogun) to be 196829.08, 240767.63, 159645.35, 98533.429, 181565.33 and 164699.59.

Table 4. 10b: The Significant Main Effect of the Treatment on the Expenditure made by treatment groups on Vegetable Production

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Squared Effect **(η^{2})**
Corrected model	5.6925E+12	6	9.4875E+11	2488.766	.000	.985
Pretest(Knowledge)	5.2813E+12	1	5.2813E+12	13853.905	.000	.984
Treatment Groups	8385859739	5	167171947.9	4.400	.001	.089
Error	86153870381	226	381211815.84			
Total	5.7786E+12	232				

Table 4.10b, shows that there is a significant main effect of the treatment groups on the expenditure made on vegetable production in the study $_{(F(6,\ 226)}$ = 4.400,Sig.001 P < .05, η^2 = .089). Thus, the null hypothesis is rejected. This result reveals that the two group extension approaches used to disseminate agricultural information to dry season farmers significantly reduced the expenditure of farmers under experimental groups.

Table 4.10c: Scheffe Pairwise Multiple comparison – Expenditure

Treatment Groups	Treatment Groups	Sig.
Experimental Group I (Oyo)	Control II Group (Osun)	.008

The Table shows a significant difference between Control I (Osun) and Experimental II (Ogun).

When the mean of reduction in expenditure of the experimental groups were compared with that of control groups, the highest difference in mean was recorded from Experimental Group II (Osun) ($\bar{x}$=61,111.921), followed by Experimental Group I (Oyo) ($\bar{x}$= 43,938.55) while the lowest was recorded from Experimental Group III (Ogun) ($\bar{x}$=16,865.74). This means that Experimental Group lI Osun had more difference on money spent on fertilszer than other groups.

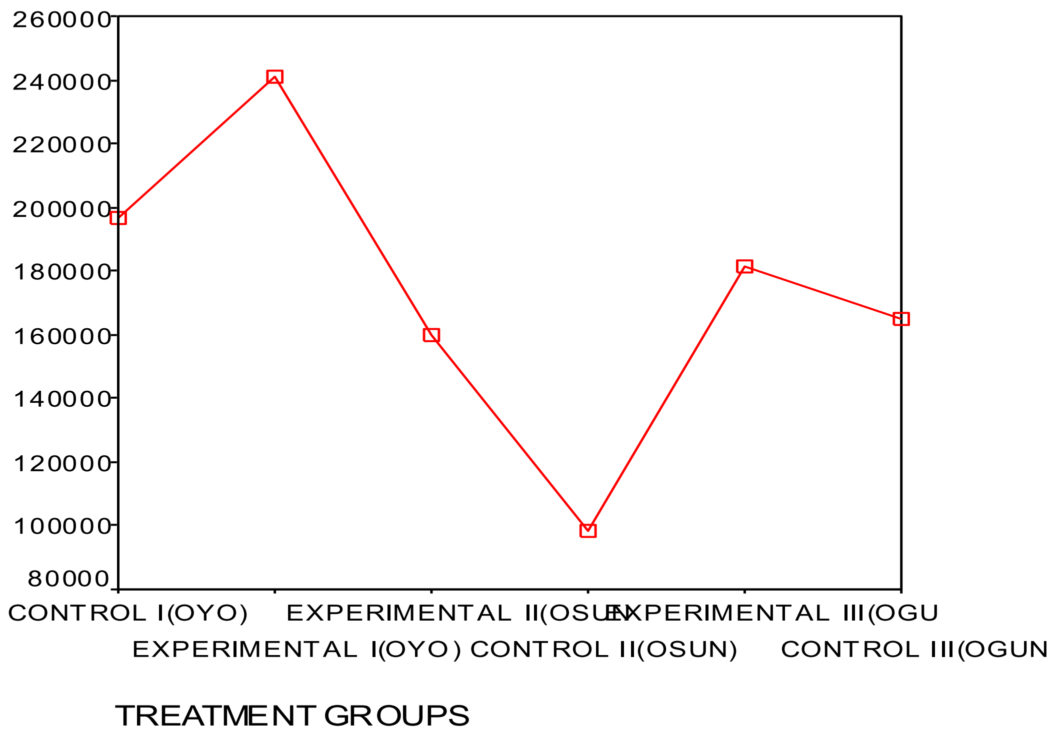


Fig 4.15 Mean Plots of Post-test- of the Treatment Groups Based on the Expenditure made on Vegetable Production

The mean plots in Figure 4.15 shows that group-based extension approaches used to disseminate improved dry season technologies to farmers helped in the reduction of expenditure of all vegetable farmers in the three experimental groups. However, Oyo state experimental group recorded the highest reduction in expenditure, followed by Osun state and Ogun state Experimental Group respectively.

Interpretation and Discussion

These findings support van den Berg (2004), where he submit that IPM has the potential to substantially reduce pesticide use in vegetables while improved agronomic practices can help increase yield. For cabbage, insecticide use could be reduced by 70% in IPM treatments compared to the farmer's practice. Fungicide use was reduced by 40%. For tomato, insecticide use was reduced by 38%, fungicide use by 47%. For beans, insecticide use was reduced by 52%, fungicide use by 27%. Nitrogen fertiliser was reduced by 20 to 26% while thev use of potassium fertiliser was increased by 9 to 34% in the three vegetable crops. Yield was increased by 14% for cabbage, 27% for tomato and 14% for beans.

Table 4.11: Farmers' Expenditure

State	Year	Expenditure (N)	Reuction in Expenditure	% Reuction in Expenditure
OSUN	2009-2911	385,600.00		
	2012	101,541.00	26,992.00	21
OGUN	2009-2011	565,300.00		
	2012	137,557.00	50,877.00	27
OYO	2009-2011	466,800.00		
	20112	105,88.00	49,792.00	32

Table 4.11 shows that all the dry season farmers that participated in the experimental groups recorded reduction in their expenditure although the average reduction varied from N26,992.00 being the lowest and N50,877.00 being the maximum. The percentage reduction in expenditure ranges from 21% being the minimum from Experimental Group II (Osun), followed by 27% from Experimental Group III (Ogun) and 32% being the highest from Experimental Group I (Oyo). However, the highest reduction in expenditure was recorded in Oyo State. This reduction in expenditure was as a result of the fact that dry season farmers did not buy poultry wastes as 95.6% of the dry season vegetable farmers in the treatment groups agreed that poultry wastes is abundantly available in their locality while only 3.4% disagree.

These findings are in line with the findings of Berg (2004) who submits that following a group training, a reduction in pesticide applications of 53% and 68% was reported from Thai Nguyen and Phu Tho district, respectively. Non-group farmers reduced spraying by 44% but still sprayed twice as often as group extension farmers. In Thai Nguyen district, a slight decrease in yield was reported in group extension farmers in the year after training. However, due to reduced pesticide expenditure, profits increased by 13%. In Phu Tho district, a 54% yield increase and a 54% increase in profits was observed after training. Non- group extension farmers increased their yield by 36% and their profit by 17% during the same period. In Peru and Bolivia, the result of group extension participation was compared with non-participating tomato farmers by Thiele, Nelson, Ortiz & Sherwood (2001), Torrez, Tenorio, Valencia, Orrego, Ortiz, Nelson & Thiele (1999) , and Godtland, Sadoulet, de Janvry, Murgai & Ortiz (2003) and the result shows an increased knowledge about the principles of late-blight management. Immediately after training, farmers had significantly more knowledge than those trained with conventional methods or than non participants of net economic benefits fromwere doubled $2500 for non-participants to $5000 for group extension graduates. Accordingly, a high recovery rate of project costs was reported.

The result from Vietnam rice farmers indicate a sharp reduction in insecticide use from 1.7 to 0.3 applications per season (pooled by province, but considerable differences in levels between provinces). This decline was linked to improved farmer knowledge. Fungicide use was reduced in the North (-76%), but increased in the South (+47%) Farmers saved on average $8 on pesticide expenditures per season. group- extension farmers spent 21% less on pesticides, 12% more on fertilisers and 4% more on labour than non- group- extension farmers (recalculated from pooled data). In total group-extension farmers had 5% lower production costs than non- Group- Extension farmers. However, this cost difference is small compared to the difference in revenue from harvested produce, highest for group- extension farmers due to higher yield. A high internal rate of return was recorded. The eta squared effect **(η^2)** for reduction in expenditure are corrected model η^2=.965; pre-test (expenditure) η^2= .984; treatment groups η^2= 0.89

Effects of Gender and Educational Levels on Improved Knowledge of Vegetable Production

Ho6 : There is no Significant main and Interaction Effect of Gender and Educational Levels on Improved knowledge of vegetable production.

Table4. 11a: Mean and Standard Deviation scores from the analysis of the effect of Gender and Educational Levels on Improved knowledge of vegetable production.

Gender	Educational Level	Mean	Std. Dev.	n
Male	Low	122.0792	18.8083	101
	Medium	118.8987	20.1778	79
	High	125.1176	9.2796	17
	Total	121.0660	18.7986	197
Female	Low	116.2273	19.0536	22
	Medium	116.6154	21.7621	13
	High	40.0000	00.0000	1
	Total	114.2500	23.2863	36
Total	Low	121.0325	18.9083	123
	Medium	118.5761	20.2995	92
	High	120.3889	21.9897	18
	Total	120.0129	19.6584	233

The mean result on Table 4.11a shows that dry season farmers with higher educational level gain more knowledge of modern methods of vegetable production with $\bar{x}$= 125.1176, followed by farmers with medium educational level with $\bar{x}$= 122.0792 while the least level of knowledge was recorded from farmers with low level of eduction $\bar{x}$= 118.8987. The implication of this is that the higher the educational level of farmers, the higher the level of modern methods of vegetable production acquired by them from being exposed tothe teaching and demonstration of modern methods of vegetative production using the two group-based extension methods.

Table4. 11b: The Significant Main and Interaction Effect of Gender and Educational Levels on Improved Knowledge of Vegetable Production

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Square Effect (η^2)
Corrected Model	7847.164	6	1307.861	3.613	.002	.088
Pretest Knowledge	7.464	1	7.464	.021	.886	.000
Gender	7231.433	1	7231.433	19.977	.000	.081
Educational Levels	4817.492	2	2408.746	6.654	.002	.056
Gender x Education	6042.031	2	3021.016	8.346	.000	.069
Error	81809.798	226	361.990			
Total	89656.961	232				

Intepretation and Discussion

Table 4.11a and b show that there is a significant main and interaction effect of gender and educational levels on improved knowledge of vegetable production, $_{(F(8,226)}$ = (8.346, Sig .002 P <.05,) for gender and $_{(F(8,226)}$ =6.654 Sig .002 P<.O5) educational levels. Hence, the null hypothesis is rejected. The result indicates that gender and educational level significantly affect the level of awareness of improved knowledge of vegetable production.

This result corroborates Jibowo (1992) that more men engage in farming activities than women, confirming why sex is significantly related to adoption. This findings show there is need for introduction of adult education programme as extension package for farmers. Jibowo (1992) states that men engage more in farming than women in western Nigeria. The Eta Square Effect (**η^2**) Corrected Model.(**$\eta^{2=}$** =088), Pre-test Knowledge **η^2**= .000, Gender **η^2**=.081 and Educational Levels **η^2**= .05

Effect of Gender and Educational Levels on Adoption of Improved Knowledge of Vegetable Production.

Ho 7: There is no significant main and interaction effect of gender and educational levels on adoption of improved knowledge of vegetable production

In this section, the data generated on gender and educational levels of farmer's adoption of improved methods of vegetable production of the treatment groups farmers is analysed, and the result of the effects is and discussed using the mean, standard deviation and ANCOVA. The result is also compared with past studies similar to this hypothesis.

Table4. 12a: Mean and Standard Deviation Scores from the Analysis of Main and Interaction Effect of Gender and Educational Levels on Improved Knowledge of Vegetable Production.

Gender	Educational Level	Mean	Std. Dev.	n
Male	Medium	51.9109	8.1377	101
	Low	50.7595	8.8899	79
	High	55.4706	3.5376	17
	Total	51.7563	8.2383	197
Female	High	50.0000	8.9176	22
	Medium	49.4615	11.1924	13
	Low	16.0000	0.0000	1
	Total	48.8611	11.0664	36
Total	Medium	51.5691	8.2770	123
	Low	50.5761	9.1906	92
	High	53.2778	9.9162	18
	Total	51.3090	8.7700	233

The mean result on Table 4.a shows that dry season farmers with high educational level adopted more modern methods of vegetable production with $\bar{x}$= 53.2778, followed by farmers with medium educational level with $\bar{x}$=51.5691 while the least level of knowledge was recorded from farmers with low level of eduction $\bar{x}$= 50.5761. The implication of this is that the higher the educational level of farmers, the higher the level of modern methods of vegetable production adopted by them from the teaching and demonstration of modern methods of vegetative production using the two group-based extension methods.

Table 4.11b: The Significant Main and Interaction Effect of Gender and Educational Levels on the Adoption of Improved Knowledge of Vegetable Production

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Square Effect **(η^{2})**
Corrected Model	1684.888	6	280.815	3.928	.001	.094
Pretest	1.232	1	1.232	.017	.0896	.000
Adoption	1514.418	1	1514.418	21.181	.000	.086
Gender	833.107	2	416.553	5.826	.003	.049
Educational Levels	1310.614	2	655.307	9.165	.000	.075
Gender x Education	16158.863	226	71.499			
Error	17843.751	232				
Total						

The results from Table 4.11b shows thatthere is a significant main and interaction effects of Gender and educational levels on improved knowledge of vegetable production. ($F(8,226) = 8.346$, Sig .003P $<.05$,) for gender and $_{(F(8,226)}$=Sig.000 P $<.05$) for educational level respectifully. The Eta Square Effect **(η^{2})** for Corrected Model η^2 = .094 Pretest η^2 = .000; Adoption η^2 = .086 Gender η^2 = .049, Educational Levels η^2 = .075. Hence, the null hypothesis is rejected. Empirical studies show that their use and adoption among rural women has not always been high and usually much lower than men (Pender & Gebremedhin, 2006; Horrell & Krishnan 2007; Oladele and Monkhei, 2008; Babatunde et al. 2008; Carr and Hartl, 2010). Three reasons are commonly highlighted for this gender difference: culturaly-appropriateness; physically accessibility; and affordability. Several studies indicate that adoption of improved technologies have increased women's burdens as additional and highly time-consuming tasks or processes are often required atthe onset of these new technologies (Berio 1984; Suda 1996; Quisumbing & Pandolfelli, 2008). For example, in Malawi and Zambia, women who were engage in processing reported that adopting hybrid maize gave them more time-consuming tasks as the hybrids were difficult to pound (Hirschmann & Vaughan 1984;

Jha, Hojjati, & Vosti 1991). Formal education in this study was measured by the highest educational qualification attained.

Onoh and Peter-Onoh (2012) submit that majority of the farmers only completed their primary school education.Okoye (1991) states that technological changes are achieved through formal education. Asiabaka (2002) and Rogers (2003) view formal education as means of facilitating farmers use of written information sources and increasing their knowledge and comprehension of new farm practices.

Table 4.7b shows a positive correlation between educational qualification and agricultural information use. This is consistent with results of previous studies such as those of Voh (1979), Osuji (1983), and Atala (1984). However, it is inconsistent with the finding of Chikwendu et al (1996). All the same, the result of the present study is not surprising, considering the fact that exposure to education permits an individual to control the rate of message input and develop the ability to store and retrieve information for later use (Sheba, 1997). For certain technical information such as dealing with agricultural innovations, this retrieval ability may be quite important (Mohamedah, 1977). Education enables individual farmers know how to seek for and apply information on improved farm practices. This is because as the individual gained the ability to read, he/she is able to extend the scope of his/her experience through the print media. An illiterate farmer is generally apathetic, and lacks choice, according to Flyvberg (1990, and Mabogunje (1999), lack of choice is due largely to lack of knowledge which can be technical or prudential. Prudential knowledge is knowledge of what to do under different circumstances and involves understanding the social, economic, political and cultural context in which one lives (Ohuwatosin, n.d.). Lack of literacy excludes the small scale farmers from being active participants in development. The most important effect of lack of literacy on society is that it works as an inhibitor. That is, the more non-literate people there are in a country, the harder it will be for the country to develop.

The most disturbing aspect of illiteracy is that it has the potential to be 'regenerative' because it has a kind of 'genetic' effect. The children of illiterate people are more likely to be illiterate than those who are not. Ozowa (1995) is of the view that a general lack of awareness among traditional farmers in Nigeria can be attributed to the high level of illiteracy, which in turn contributes to the low level of adoption of agricultural production technology. It is widely acknowledged that farmers with basic education, are more likely to adopt new technology, and become more productive. With basic education they are better equipped to make more informed decisions for their and communities as well as to be active participants in promoting economic, social and cultural dimension of development (UNESCO, n.d.). It is therefore possible to expect educated farmers to have favourable attitude towards change. Education then becomes a catalyst of modernisation by giving the individual access to information.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The primary purpose of this study is to investigate the effects of two group-based extension approaches (farmer field school and demonstration method) on knowledge and production of vegetables among dry season farmers in southwest Nigeria.

Chapter two dwells on the literature review and theoretical framework. The literature review covers comprehensive review of about twenty-five (25) different concepts and terminologies related to the research topic, as well as the empirical studies. The theoretical framework provided propositions on which the study is premised, and the conceptual model used is predicated on the theoretical framework. The two theories reviewed are the diffusion of innovation theory and the transformative learning theory. The chapter is concluded with the appraisal of literature and the hypothesis formulated for the study.

Chapter three deals with research methodology which comprised the research design, study population, sample and sampling techniques, research instruments, validity and reliability of instruments, procedure for administration of questionnaire and method of data analysis.

Chapter four presents the findings and discussions. The data collected are analysed using descriptive statistics of simple percentage and the inferential statistics of ANCOVA, mean, standard deviation Scheff post Hoc is used to answer research questions and to test the hypothesis of the study at .05 alpha level. The demographic characteristics of the respondents were analysed and found useful in this study. The major findings of the study are:

There is a relative significant main effect of the treatment groups on improved knowledge of vegetable production in the study. This means that field school and demonstration approaches increase the knowledge of dry season farmers in the three experimental groups. The result shows that Osun experimental group recorded the highest level of knowledge.

There is a significant main effect of the treatment groups on improved adoption of modern knowledge of vegetable production in the study.
This means the two group-based extension approaches (farmer field schools and demonstration) used to disseminate new technologies to dry season farmers led to the adoption of new technologies by dry season farmers in all experimental groups in all the three states covered the study.

The highest adoption level is recorded in Osun experimental III group followed by Oyo experimental I and Ogun experimental II. On the other hand, Ogun Control III mostly embraced the traditional methods of vegetable production followed by Osun Control II and Oyo Control I.

There is significant main effect of the treatment groups on yields (kg) of vegetable production in the study. Thus, the null hypothesis is rejected. The result indicates that the group-extension and demonstration extension approaches used to disseminate improved vegetable production techniques to dry season farmers help increase their yields when compared with the pre-test result.

There is significant main effect of the treatment groups on the income of vegetable production in the study. Thus, null hypothesis is rejected. The results shows that the two group-based extension approaches significantly increase the income of farmers in the treatment groups.
There is a significant main effect of the treatment groups on the expenditure made on vegetable production in the study. Thus, the null hypothesis is rejected. This result reveals that the two group extension approaches used to disseminate agricultural information to dry season farmers significantly reduced the expenditure under experimental groups.

The results from Tables 4.6a and 4. 6b show thatthere is a significant main and interactive Effects of gender and educational levels on improved knowledge of vegetable production. The result indicates that gender and educational level significantly improve the knowledge of vegetable production. Group-based extension approaches are effective means of disseminating improved knowledge of vegetable production to farmers in Southwest Nigeria.

The rate of adoption of improved knowledge of vegetable production by dry season farmers will be higher when group methods of extension are used to disseminate agricultural information to them.

The use of group-based extension approaches to disseminate improved knowledge of vegetable production can bring about increase in the yield of dry season vegetables farmers. There is a significant main and interactive effects of gender and educational levels on improved knowledge of vegetable production. Dry season farmers are not familiar with group extension approaches in southwest Nigeria. They are only familiar with individual extension method.

Dry season farmers are not familiar with improved knowledge of vegetable production so they adhere strictly to the traditional method of vegetable production. The yield of dry season vegetable farmers was generally poor in Southwest Nigeria because they were not aware of improved method of vegetable production that can bring about good yield.

Majority of dry season farmers in Southwest Nigeria have primary and secondary education. This is contrary to the general belief that farmers are non-literates. Majority of dry season farmers in Southwest Nigeria are males while only few are females. This may be due to the fact that dry season farming require physical energy especially during land clearing, wetting and harvesting.

5.2 Conclusions

In view of the findings of this study, it is evident that group-based extension approaches enhanced the knowledge of dry season farmers. Farmers' field school and demonstration methods were found to be relevant in the dissemination of agricultural information to farmers.

The use of individual extension methods did not adequately reach all farmers, especially when we consider the fact that the extension- farmer ratio is too small, which makes it difficult for all farmers to be reached by the limited available extension agents

It is also evident that the use of farmers field school and demonstration methods were very appropriate extension methods to demonstrate practical skills to farmers and to form groups that can be sustained by information sharing, group meeting and group purchase of inputs.

The use of organic manure for production of vegetables increases the yields and income of vegetable farmers.

Drilling methods of planting and fertiliser application increase the yield and income of vegetable farmers

5.3 Policy Implications of the Study

Policy has to do with guidelines on the implementation of extension education and services. This study has a number of policy implications:

- The Federal Government through her ministry of agriculture is to make national policy on group methods of extension for the states ministries of agriculture and state agricultural development programmes which should be implemented in order to ensure national uniformity. Observably, the states and local governments can also make complementary policies based on local peculiarities for improved agriculture.
- Agricultural extension unit or department in each state should adopt group-based extension methods (farmer field school and demonstration method) to enhance effective agricultural extension delivery and high productivity of dry season farmers. More extension officers should be employed to improve on extension-farmer ratio. There is also the need for the training and retraining of extension

officers to equip them with latest developments in agriculture for onward delivery of same to the farmers.

- There is also the need for government at all levels to ensure that the right extension method or approach is adopted (such as farmers field school approach and demonstration method) for effective delivery of research findings to farmers.
- Government should encourage and promotes the use of organic manures which has no side effect on the soil, crops or man.

5.4 Recommendations

Extension agents should be encouraged to adopt group-based extension methods to present new technologies to farmers to enhance the adoption of such new technologies.

Governments should give attention to the use of organic manures by establishing organic manure processing centres where animal wastes can be processed into portable bags that farmers can easily transport to their farms.

The responsibilities shouldered by states' ministries of agriculture are no doubt enormous, and the goals of the state ministries particularly that of eradicating hunger is crucial. It is necessary for the state governments to assist them with a view to finding solutions to some of their fundamental problems as it relates to extension methods and the use of organic manures to enhance their performance.

Based on the importance of the grop extension methodsto dry season vegetable production, there is the need to provide capacity building programmes for agricultural extension officers.

State governments through their ministries of agriculture should create awareness that will encourage more females to embrace vegetable farming and provide incetives for female farmers through Women in Agriculture (WIA).

Exension departments or units should encourage extension agents to introduce drilling methods of planttng and fertilizerapplication to dry season farmers to increase their productivity.

Improved knowledge of vegetable production should be introducved to vegetable farmers to increase their productivity.

5.5 Contributions to Knowledge

The study has scientifically established that a significant relationship exists between group-based extension approaches and farmers' knowledge and adoption of improved vegetable production practices. It has also been established that a significant relationship exists between group-based extension approaches and farmers' yields, income as well as expenditure.

The study also established that the use of two or more extension methods to disseminate or teach new agricultural knowledge to farmers will enhance the adoption of such knowledge that will enhance their performance and productivity.

The study also established that the overall effectiveness of agricultural extension delivery will be influenced by choosing appropriate extension delivery methods or approaches such as farmers school field and demonstration methods. Attention must also be given to socio-technical requirements of the agricultural extension and meeting the food needs of the people. A badly designed extension structure can have a number of negative effects and is likely to give rise to inefficiency. The more the participation of farmers and other stakeholders in setting the agricultural extension goals, the more likely the goals will be achieved.

5.6 Limitations to the Study

This study covered three states in south Nigeria, namely Oyo, Osun and Ogun. The difficult location of some dry season centres was a constraint on the movement of the researcher. The three heavy rain downpour experienced in the three states prolonged the period of the research as the researcher had to start all over again in Ogun State. The unusual appearance of strange insect pests in Osun and Ogun states experimental locations are setbacks for the research (See Plates 16, 17 &18). The uncooperative attitudes of some farmers and their unwillingness to take photographs under the pretext that some people used their names and pictures to collect group money in the past without sharing the money with them also limited the number of participants that appeared on the pictures. The stolen of a digital camera with some pictures of the research activities also reduced the number of pictures on Appendix V. Nonetheless, it is pertinent to remark that all identified problems did not have any negative effect on the findings of the study as they are authentic, cogent and empirical and could be generalised for dry season farmers in the south west Nigeria.

5.7 Suggestions for Further Studies

A comparative study of the effects of group-based extension methods on knowledge and adoption of new technologies by other categories of farmers, such as arable, cocoa, fish, and livestock farmers.

A comparative study of individual extension and group extension methods.

Constraints militating against agricultural extension in Nigeria and the way out.

The study was carried out in south-west geopolitical zone of Nigeria. Similar studies should be carried out in other geopolitical zones of the country to establish if the results can be generalised for the whole country.

Farmers' field school and demonstration methods can be used separately on different experimental groups and the result compared with another group where the two group methods are jointly used.

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APPENDIX I

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RESEARCH ACTIVITES

PROCEDURE: The researcher and the farmers will gather on the plots set aside for the experiment and control in the study areas where farmers will introduce the new varieties of amaranthus and celosia to them. All the farmers will receive seeds that will be enough to plant on their plots.

The procedure involved in drilling of seeds is then explained to the farmers by the facilitators after which he will demonstrate the drilling of seeds on the demonstration plot on one line while some of the farmers will be made to perform the drilling of other lines. The process is explained again before the farmers are made to go and practice the method on their farms. The planted plot is then wet immediately after planting.

WEEK FOUR

ACTIVITIES: i. Wetting of the plot

ii. Spot weeding with hand fork

PROCEDURE: The researcher willsupervise the wetting of the vegetables on the experimental plot, control plot and farmers' plots. He will then explains and demonstrate how hand fork can be used remove weeds from vegetable beds.

WEEK FIVE

ACTIVITY: I .Wetting of vegetables

Application of organic manure using drilling method of fertiliser application.

PROCEDURE: The wetting of vegetables continue on daily basis.

Poultry wastes from deep battery cage system of poultry is collected , drilling lines are made at a depth of 6to10cm in between the two rows of crops and the organic manure is drilled put in the dug lines and lightly covered with soil.

WEEK SIX

ACTIVITY: i. Daily wetting of vegetables

ii. Pests and Diseases control

PROCEDURE: Daily wetting of vegetables. Spraying of "karate" insecticides to control pests and diseases.

WEEK SEVEN

ACTIVITY; i. . Daily wetting of vegetables

ii. Spot weeding

PROCEDURE: The wetting of vegetables continue on daily basis. The weeding of vegetable plot using hand fork.

WEEK EIGHT

ACTIVITY; i. Daily wetting of vegetables

ii. Harvesting of amaranthus

PROCEDURE: The wetting of vegetables continue on daily basis. Selective harvesting of amaranthus after wetting to ease the uprooting of the plant.

WEEK NINE

ACTIVITY; i. Daily wetting of vegetables

PROCEDURE: The wetting of vegetables continue on daily basis.

WEEK TEN

ACTIVITY; i. Daily wetting of vegetables

ii. Harvesting of amaranthus and celosia

PROCEDURE: The wetting of vegetables continue on daily basis. Complete harvesting of amaranthus and selective harvesting of celosia.

WEEK ELEVEN AND TWELVE

ACTIVITY; i. Complete harvesting of celosia

ii. Posttest questionnaires are administered on farmers.

The farmers are to carry out all weekly activities on their plots immediately after the group demonstration and farmer field school meetings.

APPENDIX II

QUESTIONNAIRE

Participatory Group Extension Methods Evaluation Questionnaire (PGEMEQ).

The purpose of this research is to assess the effectiveness of the Group-Based Extension methods to transfer improved technologies to dry season farmers, and their impact in the adoption of improved technologies in the South-Western Nigeria. Information gathered will be treated in strict confidence and used only for the purpose of this research. The utmost sincerity and cooperation of respondents will be of paramount importance to enable the researcher obtain factual information for the success of this research.

Thank you.

Identification

SECTION A

Identification/Demographic Information

Date:____

State____

LGA:____

Town:_________________________Village/Community_________________________

Number of wife/wives________ Number of children________ Male_____Female _____

Number of House/Houses______________ Number of Cars_____________________

Number of Motorcycles_____________ Size of Your Dry Season Land(ha)__________

Age___________

Gender: (a)[Male]_________ [Female]______________

Educational Level:(a) Arabic School_________ (b) Primary School___________

(c) Secondary_____(d) Tertiary______ (e)Adult Literacy_____ (f) Illiterate_____

Marital Status: (a)Single____ (b) Married_____ (c) Widow(er)____ (d) Divorced____

(e)Single Parent______ (f) Others(state)__________

Major Occupation: (a) Farming (b)Others(specify)---

Farm Location i. State------------------------- ii, Local Government-----------------------------

Years of Farming Experience -____________

Have you participated in group extension activities before? Yes/No

Section B: Knowledge of Organic Manure Application

S/N	Questionnaire- Items	Responses			
		SD	D	A	SA
1.	Group-based extension methods has increased my knowledge of dry season farming in the areas of organic manure application				
2.	I am aware that animal wastes are being used in the production of vegetables.				
3.	I have been using animal wastes on my farm before now.				
4.	Animal wastes are abundantly available in my locality.				
5.	Animal wastes are abundantly available in my locality.				
6.	Animal wastes are not as expensive as other type of fertilizer.				
7.	I am not aware of any side effect of organic manure				
8.	Application of animal wastes increases the yield of amaranthus and celosia				
9.	I will be using organic manure for my dry season crops.				

Section C: Drilling Method of Manure Application

S/N	Questionnaire- Items	Responses			
		SD	D	A	SA
1	Group-based extension methods has increased my knowledge of dry season farming in the areas of drilling method of manure application.				
2.	I am aware of the drilling method of manure application				
3.	I have been practicing drilling method of manure application before now.				
4.	I am aware of the distance that should be maintained between crops and the manure.				
5.	Crops perform better whenever drilling method of manure application is adopted.				
6.	Drilling method of fertilizer application does not have any negative impact on crop plants.				

7.	Animal wastes cannot be easily washed away by erosion .				
8.	Post planting operations can easily be carried out without removing the manure.				
9.	I will adopt drilling method of fertilizer application on my farm.				

Section D: Knowledge of New Varieties of Crops

S/N	Questionnaire- Items	Responses			
		SD	D	A	SA
1.	Group-based extension methods has increased my knowledge of dry season farming in the areas of new varieties of crops.				
2.	New varieties of amaranthus and celosia are not new to me.				
3.	I have been planting these new varieties on my farm.				
4.	Growing of new varieties of of crops usually bring about increase in yield.				
5.	There is no discrimination against the new varieties in the market.				
6.	Seeds of new crop varieties should are readily available in my locality.				
7.	Extension agents usually bring seeds of new crop varieties to farmers.				
8.	I will be planting new crop varieties on my farm from now on.				

Section E: Drilling Method of Planting

S/N	Questionnaire- Items	Responses			
		SD	D	A	SA
1.	Group-based extension methods has increased my knowledge of drilling method of planting				
2.	I have been using the method on my farm for				

	some time now.				
3.	The skill of drilling is not new to me.				
4.	Other post planting operations can easily be performed under drilling method of planting.				
5.	.Drilling method of planting is not as tedious as other methods of planting.				
6.	Amaranthus and celosia grow faster under drilling planting methods.				
7.	Drilling method of planting is suitable for Amaranthus and celosia.				
8.	I will always adopt drilling method of planting on my farm.				
9.	I will expose other farmers to the skill of drilling.				

Section F: New Method of Weeding.

S/N	**Questionnaire- Items**	**Responses**			
		SD	**D**	**A**	**SA**
1.	Group-based extension methods has increased my knowledge of new method of weeding				
2.	Using of hand fork for weeding is not new to me .				
3.	Using hand fork reduces damage to plants during weeding.				
4.	Using of hand fork helps in pulverizing the soil better.				
5.	Hand fork is not very expensive to buy.				
5.	Hand fork is readily available in my locality.				
6.	Henceforth I will be using hand fork for weeding my vegetable beds.				
7.	I will introduce the new method of weeding to other vegetable growers.				

Section G: Spraying Method of Pest Control.

S/N	Questionnaire- Items	Responses			
		SD	D	A	SA
1.	Group-based extension methods has increased my knowledge of new method of pest control				
2.	I have been spraying my vegetables with insecticides before.				
3.	Spraying with insecticides is a very effective method of pest's control.				
4.	Insecticides are not readily available in my locality.				
5.	I am aware that harvesting should not be done until seven days after spraying.				
6.	Application of insecticides increases the yield of vegetables greatly.				
7.	I will always control insect pests by spraying from now on.				
8.	I will introduce the spraying method of pest control to other vegetable growers.				

Section H: New Method of Harvesting.

S/N	Questionnaire- Items	Responses			
		SD	D	A	SA
1.	Group-based extension methods has increased my knowledge of new method of vegetable harvesting.				
2.	I have been wetting my vegetable beds before harvesting.				
3.	I have been practicing partial harvesting before now.				

4.	Wetting before harvesting makes harvesting easier.				
5.	Wetting before harvesting makes partial harvesting possible.				
5.	Weak vegetables grow faster after harvesting the stronger ones.				
6.	Partial harvesting increases vegetable yield.				
7.	I shall henceforth be practicing partial harvesting and wetting before harvesting.				
8.	I will expose other farmers to partial harvesting and wetting before harvesting.				

Section F: Farmers' Yield and Income.

1. State your yield in the following years in kilogramme

Year	Acreage in (Ha)	Yield in (Kg)	Income in (N)
2009			
2010			
2011			
2012			

2. Suggestions: Suggest ways by which GBEMs can be improved to ensure sustainability of the knowledge you have acquired, better productivity, enhanced income, and better living standard for you?

(a)---

(b)---

(c)---

(d)--

(e)--

(f)--

APPENDIX III

IWE IBEERE FUN IWADI

Group Based Extension Methods Participatory Evaluation Questionnaire (GBEMPEQ).

Eredi iwadi ijile yi ni lati sofin toto ipa ti ikoni awon egbegbe agbe alakuro ti ngbin efo lati mo ati lati lo awon abayori iwadi ijinle nipa ilana idako tuntun igbalode, ati ipa ti lilo awon ona ona idako igbalode yi lee ni lori ikore awon agbe ti won ba lo ona idako igblode wonyi lati dako. Gbogbo idahun ti e ba fun wa ni ao lo fun ise iwadi yii nikan ni idkonko. A fe ki e je olooto ki e si fowosowopo pelu oluwadi ijnle yii ki o lee ri arigbamu iroyin ti yio mu otito pombele jade nipa ise iwadi yii.

E se pupo fun ifowosowopo yin.

APA KINNI **Idanimo** Ibeere nipa eni ti a je.

Ojo:_____________________Osu__________________Odun_______________

Agbegbe Ijoba Ibilere____

3.Ilu re:_________________________ 4Ileto tabi adugbo re______________________

4. Iyawo melo leni_________________ 6. Iye Omo_________________

5. Ile melo le ti oko______________

6.Sare oko melo loma nda ni akoko eerun_____________

7.Omo odun melo niyin?___________

8.Se okunrin niyin abi obinrin? (a)[Okunrin]_________ [Obinrin]______________

9.Iwe eri:(a) Ile keu_________(b) Ile iwe alakober___________ (c) Ile iwe girama_____(d) Ile iwe giga______ (e)Eko agba____ (f) Koleko kolekae_____

10. Nipa Igbeyawo: (a) Apon____ (b)E ni toti loko tabi gbeyawo _____ (c) Opo____ (d)Iya tabi Baba ndagbe____

11Omo melo:______Omokunrin melo________ Omobinrin melo______________

Kinni ise yin gan?: (a) Agbe (b)Ise miran(se alaye)_________________________

13Ibo ni oko yin wa?: Ipinle wo?______ Ilu wo?______ Abule tabi ileto wo?__________

14Odun melo leti nsise agbe?____________

15Se e ti kopa nibi ikoni nipa ise agbe lona igbalode legbegbe ri? Beni/Beko

APA KEJI IBEERE NIPA IKOPA IKONI NISE OLO LEGBEGBE

Abala A: Imo nipa lili igbe adie fun efo gbigbin

Onka	Awon Ibeere	Awon Idahun			
		Beeko Rara	Beeko	Beeni	Beeni Gan an
1.	Ikoni ni egbegbe fikun imo mi nipa lilo igbe adie fun efo gbingbin dipo ajile				
2.	.Mo ti gbo rip e won nlo igbe adie fun efo gbigbin.				
3.	Mo tin lo igbe adie fun efo gbigbin teletele.				
4.	Igbe adie po dada ladugbo oko mi.				
5	Igbe adie ko won lati bi orisi ajile mi				
6.	Nko mo akoba Kankan ti lilo igbe adie nse fun ohun ogbin.				
7.	Lilo ajile igbe adie ma mu ki kore efo tete po dada si.				
8.	Lilo ajile igbe adie ma mu ki ikore efo soko po dada si.				
9.	Un o ma lo ajile igbe adie niinu oko mi.				
10.	Mo setan lati maa so fun awon agbe lati maa lo ajile igbe adie.				

Abala B: Lilo ajile igbe adie ni riri mole gboro

Onka	Awon Ibeere	Awon Idahun			
		Beeko Rara	Beeko	Beeni	Beeni Gan an
1.	Ikoni ni egbegbe fikun imo mi nipa riri igbe adie mole lori ila gboro				

2.	Mo mo pe won ma nlo ajile igbe adie ni riri mole gnooro si idi ila efo.				
3.	Mo ti nlo ajile igbe adie ni riri mole gnooro si idi ila efo loko mi tele.				
4.	Mo ti mo iye aaye to ye lati fi sile laarin efo ati ajile igbe adie.				
5.	Awon efo ma nse dada si nigbati mo ba lo igbe adie gbooro si idi ila efo ti mo ba gbin.				
6.	Lilo igbe adie lona gbooro si idi ila efo ko ni akoba Kankan tin se fun efo ti lo fun un.				
7.	Ojo ki tete san igbe adie danu kuro nidi efo bi awon ajile yoku.				
8.	Ise sise laarin efo ma nrorun lati se pelu liana ajile lilo yii.				
9.	Mo setan lati ma lo ajile lona gbooro si idi awon efo mi.				
10.	Mo setan lati so fun awon agbe miran lati ma gbin efo won ni ila ila.				

Abala D: Iru efo gbigbin tuntun

Onka	Awon Ibeere	Awon Idahun			
		Beeko Rara	Beeko	Beeni	Beeni Gan an
1.	Ikoni ni egbegbe fikun imo mi nipa gbigbin iru efo titun				
2.	Iru efo tete ati soko tintiu ki se ajoji si mi rar.				
3.	Moti ngbin irugbin tete ati soko titun teletele.				
4.	Gbigbin irugbin efo titun ma nmu ki ikore efo tete ati soko po yanturu.				
5.	Won kid eye si efo tete titun loja.				

6.	Irugbin efo tete ati soko titun wa repete fun tita ladugbo mi.				
7.	Awon oludanileko nipa ise agbe ma nko irgbin eso efo tete ati soko wa fun wa.				
8.	Mo setan lati maa gbin irugbin efo titun ninu oko mi.				

Abala E: Gbigbin efo lori ila gbooro

Onka	Awon Ibeere	Awon Idahun			
		BEEKO RARA	**BEEKO**	**BEENI**	**BEENI GAN AN**
1.	Ikoni ni egbegbe fikun imo mi nipa gbigbin efo lori ila gbooro				
2.	Gbingbin efo ninu ila gbooro ki ise ohun titun si mi.				
3.	Mo ti ngbin efo mi sinu ila gboorogbooro tele.				
4.	Mo mo nipa aaye to ye lati fi sile laarin efo kan si ekeji.				
5.	O ma nrorun lati se ise itoju awon efo ti a gbin ni ila ila.				
6.	.Gbingbin efo ni ila ila ko nira rara beeni ko soro lati gbin.				
7.	Efo tete ati soko ma ntete dagba nigba ti a bag bin won ni ila ila.				
8.	Gbingbin efo ni ila ila ma nmu ki ikore efo tete ati soko po si.				
9	Mo gba lati maa gbin efo mi ni ila ila.				
10.	Ma gba awon agbe miran nimoran				

	lati ma lo iana gbigbin efo ni ila ila.				

Abala E: Ona titu epo titun.

Onka	Awon Ibeere	Awon Idahun			
		BEEKO RARA	BEEKO	BEENI	BEENI GAN AN
1.	Ikoni ni egbegbe fikun imo mi nipa ona titu epo titun				
2.	Mo ti ma nlo fooku iroko olowo fun titu epo tele.				
3.	Lilo fooku iroko olowo din titu ati gige efo lakoko itu epo ku jojo.				
4.	Lil fooku iroko olowo nhu ile idi efo daada.				
5.	Fooku iroko olowo ko won pupo lati ra.				
6.	Fooku olowo iroko wa lagbegbe mi fun tita.				
7.	Lai akokoyi lo,fooku iroko olowo ni maama lo lati fir o oko efo mi.				
8.	Ma ko awon agbe elefo miran ni ona iroko titun yii.				

Abala F: Fifin Oko Pelu Oogun apakokoro.

Onka	Awon Ibeere	Awon Idahun			
		BEEKO RARA	BEEKO	BEENI	BEENI GAN AN
1.	Ikoni ni egbegbe fikun imo mi nipa fifin oko pelu oogun apakokoro titun				
2.	Mo ti ma nfin efo mi pelu ogun apakokoro tele.				
3.	Fifin efo pelu oogun apakokoro je ona to dara julo lati dekun kokoro loko efo.				

4.	Oogun apakokoro wa fun tita nilu ti mo ngbe.				
5.	Mo mo tele pe lehin ojo meje ti mo fin oko pelu oogun apakokoro ni mo gbodo to kore efo mi.				
6.	Fifin oogun apakokoro jeki ikore mi posi gidgidi.				
7.	Gbogbo igba ni un o ma lo oogun apakokoro lati akoko yi lo.				
8.	Maa ko awon agbe elefo miran bi ase nfin oogun apkokoro si efo.				

Abala G. Ona Ikore efo titun

Onka	Awon Ibeere	Awon Idahun			
		BEEKO RARA	BEEKO	BEENI	BEENI GAN AN
1.	Ikoni ni egbegbe fikun imo mi nipa ona ikore efo titun				
2.	Mo ma nbomirin efo mi tele ki nto kore won.				
3.	I maa nkore efo mi diedie tele.				
4.	Bibomirin ebe efo kato kore efo mu ki ikore efo rorun.				
5.	Bibomirin ebe efo mu ki ikore efo diedie rorun.				
6.	Awon efo to kere tele tete dagba lehin ti mo tit u awon to dagba.				
7.	Ki kore efo die die mu ki ikore mi posi daradara.				

8.	Un o ma kore efo mi diedie beni un o si mabomirin efo mi ki ntoma kore efo mi.				
9.	Maa ko awon agbe elefo miran bi aati kore efo diedie ati bi aati bomirin efo saaju ikore.				

29. Eko ikore oko yin fun awon odun wonyi sile ni iwon kilogiramu

Odun	**Sare oko ni (Ha)**	**Ikore oko ni (Kg)**	**Iye owo ni (N)**
2009			
2010			
2011			
2012			

30. Aba fun itesiwaju .Daba awon ona ti ero pee eto ikoni ni ise agbe lelegbe jegbe le gba mu ki imo ati eko re duro pe titi fun ikore yanturu, owo repete ati igbe aye to dara si.

(a)--

(b)--

(d)--

(e)--

(e)--

(f)---

APPENDIX IV

Plalte 1: Familiralisation visit to Ijaye

Plate 2: Breafing at Osogbo

Plate 3: Demontration of drilling line preparation at Osogbo

Plate 4: Demontration of drilling preparation at Ijaye

Plate 5: Land preparation at Ijaye

Plate 6: Land preparation at Ilugun

Plate 7: Demonstration of drilling method of planting at Ijaye

Plate 8: Land preparation at Ilugun

Plate 9: Drilling of Organic Manure at Ilugun

Plate 10: Drilling of Organic Manure at Ijaye

Plate 11: Drilling Organic Manure and Drilling Vegetables

Plate 12: Wetting of Vegetables at Ijaye

Pate 13: Hand Weeding at Osogbo

Pate 14: Hand Weeding at Osogbo

Plate 15: Harvesting at Ilugun

Plate 16: Harvesting at Ijaye

Plate 17, 18: Infestation of Insects Pest at Osogbo

Plate 19: Insect infestation at Ilugun

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Plate 20: A farmer Adopting Modern Methods on His Farm