FACTORS INFLUENCING ADOPTION OF IMPROVED MAIZE PRODUCTION TECHNOLOGIES AND PRACTICES IN THE NATIONAL EXTENSION INTERVENTION PROGRAMME (NEIP) IN AWASSA DISTRICT, ETHIOPIA

By

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ABSTRACT

Currently, the Ministry of Agriculture (MOA) of Ethiopia has been stressing peoples' involvement in development activities. This approach is believed to facilitate the attainment of sustainable self-reliant development. In this regard, MOA has launched the National Extension Intervention Programme (NEIP) in the country. Thus using the PAEP as a case study, adoption of improved maize production technologies and practices were studied. Here, the main objective of the study was to investigate factors influencing the adoption of improved maize production technologies and practices in Awassa district, Ethiopia. Specifically, the study sought to: determine the extent of adoption of the introduced technologies and practices; identify and analyze factors influencing adoption of the introduced technologies and practices; identify and analyze factors associated with involvement of farmers in the programme; and determine farmers' and extension workers' perceptions on the approach of the programme.

Data for the study were mainly collected through interviews of 120 farmers in six development centers, and through self-administered questionnaire from 31 extension workers in the region. The study used two analytical tools in assessing the data and information collected. These are descriptive and regression analyses.

From these analyses the study concluded that:

i) Farm size, number of draft oxen owned by the farmers, income, extension service, and credit were strongly associated with involvement in the programme and have significant influence on the adoption of the introduced technologies.

ii) Adoption of the introduced technologies and practices was strongly associated with involvement in the programme.

iii) Among the identified factors, credit was the highest predictor for involvement in the programme and adoption of purchased technologies.

iv) Improved maize variety was the least adopted technology among the components of the package.

v) In the study, according to respondent extension workers'perceptions, the extension workers involvement in input distribution and repayment collection, affects the performance of extension workers activities.

Recommendations from the study include:

i) The role of extension service is very important in the technology adoption process. Therefore it should be expanded specially to those disadvantaged areas. Here extension agents should also make efforts to ensure that female farmers are directly targeted as agricultural service beneficiaries.

ii) Input distribution and the financial administration should be strictly separated from the extension service in order to ensure good relations between extension workers and farmers. The extension agents should concentrate on their educational tasks of teaching farmers improved farm practices. Their attention should not be diverted by such chores as input distribution and loan collection, rather, they should teach their farmers, where they can get inputs and how they can get loans.

iii) One of the major reasons for the non-adoption of the introduced technologies was high input costs. Therefore, if poor farmers are to benefit from the programme, input costs should be subsidised.

Generally the findings from the study have shown that farmers with more resources (the minority) have been involved in the programme and then adopted the introduced technologies more than those with less resources (the majority).

DECLARATION

I SEBSIBE TEKLU ELALA do hereby declare to the Sokoine University of Agriculture that the work presented here is my own creation, and has not been submitted for a degree award in any other University.

Signature _____

Date 08/10/99

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DEDICATION

To my late father Ato Teklu Elala and my mother Woizero Mulunesh Mumecha who put a lot of efforts in laying down a good foundation for my education.

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AIDB	=	Agricultural and Industrial Development Bank
BOT	=	Bank of Tanzania
BPED	=	Bureau of Planning and Economic Development
CBE	=	Commercial Bank of Ethiopia
CIMMYT	=	International Maize and Wheat Improvement Center
CPP	=	Comprehensive Packages Programme
CSO	=	Central Statistical Office
EPHS	=	Ethiopian Pioneer Hybrid Seed
EPID	=	Extension and Project Implementation Department
ESC	=	Ethiopian Seed Corporation
ESE	=	Ethiopian Seed Enterprise
FAO	=	Food and Agriculture Organization
FDRE	=	Federal Democratic Republic of Ethiopia
GDP	=	Gross Domestic Product
IAR	=	Institute of Agricultural Research
MPP	=	Minimum Packages Programme
MOA	=	Ministry of Agriculture
NVRC	=	National Variety Release Committee
OLS	=	Ordinary Least Square

PADEP	=	Peasant Agricultural Development and Extension Project
NEIP	=	National Extension Intervention Programme
PDP	=	Participatory Demonstration Plots
RAB	=	Regional Agricultural Bureau
SG 2000	=	Sasakawa Global 2000
SNNPR	=	Southern Nation, Nationalities and Peoples' Region
SPSS	=	Statistical Package for Social Sciences
SUA	=	Sokoine University of Agriculture
T&V	=	Training and Visit
VEW	=	Village Extension Worker

CHAPTER ONE

INTRODUCTION

1.1 Background Information

In Ethiopia, as in other African countries, agriculture is the main activity for the majority of the population. Agricultural production accounts for 50% of Gross Domestic Product (GDP) and employs 80-85% of the population. The agricultural sector is entirely dominated by small-scale resource-poor farmers who produce 90-95% of all cereals, pulses and oilseeds. Ethiopia, with its population of 58 million, is the third most populous country in Africa. Its population is growing at 3 percent per year and the present population is expected to double by the year 2017 (Central Statistical Office (CSO), 1996). The country has an area of about 1.12 million square kilometers, out of which 66% is considered potentially suitable for agricultural production. Cultivated land accounts for only 14.8% of the total area, and out of this 96% is occupied by smallholders. The most important cereal grain crops as per area planted are *teff*, maize, sorghum, barley and wheat. When productivity is considered maize comes first followed by wheat, sorghum, barley and *teff* at the bottom (Sasakawa Global 2000 (SG 2000), 1995). The national average yield of maize is about 1.6 tons/hectare. According to Extension and Co-operative Promotion Department and SG 2000 (1996), maize is a relatively recent crop in Ethiopia, first introduced in the sixteenth century. Small farmers produce maize mainly for consumption. However, they market a substantial amount to meet their financial needs. Maize is usually sold through two channels:

(i) farmers sell their marketable surplus directly to consumers in open markets, and

(ii) they sell to private traders who may market the maize locally or transport it to other areas of the country.

The overall performance of Ethiopia's economy is highly influenced by the performance of the agricultural sector which itself is subject to vagaries of weather and related natural and man-made factors. Consequently, GDP growth has been registering yearly fluctuations which are highly correlated with fluctuations in GDP originating from agriculture. Despite its high agricultural potential, Ethiopia has been experiencing food shortages for the past several years. One of the problems constraining agricultural production and productivity is the low level of agricultural technology, dependence on traditional tools and farming practices, and low application of modern inputs like improved seeds and fertilizers. Lack of knowledge and resources are the major factors responsible for these technological constraints (Ministry of Agriculture (MOA), 1993).

The use of improved tools/implements in facilitating agricultural operations is known to contribute significantly to increased production. Most of the agricultural operations on peasant holdings are carried out with the help of traditional tools and implements. Land preparation is carried out by ox-drawn traditional plough. The improved ploughs have yet to be adopted by the farmers either because of their relatively high cost or because of the strain they put on the animals. Planting is generally done by broadcasting method which prevents organized movement in the crop for weeding and spraying activities. Weeding is done by hand which becomes difficult in a crop which has been broadcasted.

Generally, as is true of the cereal sector as a whole, the country's self-sufficiency in maize has been declining over the years. Substantial resources are being allocated to support research and extension in maize. However, socio-economic constraints tend to limit maize production and the adoption of new production technologies.

1.1.1 Agricultural Extension in Ethiopia

Agricultural extension is a process whereby new ideas, techniques or materials are communicated or introduced in a variety of ways to the farming community, and the problems, experiences and needs of the latter are communicated back to the sources (research and/or education institutions) and even to policy makers (Worku, 1996).

In Ethiopia, the MOA is vested with the responsibility of agricultural extension. According to Gryseels and Anderson (1983), and Nair (1984), until the late 1960s, the community development programme was a strategy to identify and tackle problems of a given community through self-help projects that emphasized the development of agriculture, the rural artisan, its infrastructure and social welfare. The Comprehensive Packages Programme (CPP) was introduced with the idea of removing selected barriers of production, in addition to introducing some agricultural innovations. The basic aim of the package programme approach was to promote agricultural development by concentrating inputs and activities in geographically delimited areas.

However, it was realized later that implementing such projects throughout the country is not feasible because of the large number of extension workers required and the high

costs involved. As a result, the Minimum Packages Programme (MPP) was initiated, and in 1971 the Extension and Project Implementation Department (EPID) was established, under the MOA, with the aim of increasing peasant production (Habtemariam, 1996). According to Habtemariam (1996), the idea of MPPs was that the farmer requires integrated supporting services, viz., extension advice, fertilizers, improved seeds, farm credits, better tools and implements, and improved storage conditions. Habtemariam (1996), commented that phase one of the MPP had two shortcomings, first, farmers far from the all-weather roads were not beneficiaries; and secondly, that MPP focused on only crop improvement, paying little attention to the livestock component, despite its tremendous importance in Ethiopian agriculture.

In 1981, the second phase of MPP was initiated and the Model Farmer Extension Approach was replaced by the Producers' Cooperative Approach. However, this was constrained by institutional changes and lack of support facilities and appropriate technologies.

The Peasant Agricultural Development and Extension Project (PADEP) came as a followup to the MPP II, to be implemented in surplus producing districts (Wube, 1995). According to Wube (1995), in 1983 a team of experts recommended the testing, in some selected districts, of the Training and Visit system as an extension management strategy. In 1989 the T&V system had already been established in nearly all districts.

1.1.2 National Extension Intervention Programme (NEIP)

"Participation" has become an accepted term in development vocabulary. It is, however, a difficult term to define as different people interpret it differently (Nanai, 1993). Oakley (1991), defined participation by way of two broad categories: Participation as a means and as an end.

According to Oakley (1991), when viewed as a means, participation is used to achieve some predetermined goal or objective. Through it, the existing physical, economic and social resources of rural people are harnessed in order to achieve the objectives of development programmes and projects. It stresses the results of participation, so that the achieving of predetermined targets is more important than the **act** of active participation. Nanai (1993), explained that governments and development agencies use participation as a means to improving the delivery systems of the projects they seek to implement. In this situation, the local population is mobilized, there is a direct involvement in the task at hand. Oakley (1991), described participation as an end as aiming at developing and strengthening the capabilities of rural people to intervene more directly in development initiatives. He contended that, unlike participation as a means, it is an active and dynamic form due to its enabling people to play an increasing role in development activities.

Clark and Thomas (1987) also tried to elaborate on different terms used to describe participation, in which facilitation is one. Clark and Thomas (1987), defined facilitation as assisting people to acquire practical skills, to improve their access to material

resources, and to undertake actions. Participatory extension and rural development strategies provide opportunity for the rural people to take active part in making decisions regarding their destiny of development. The key element on participatory extension and rural development is involvement of those affected in decision making related to their own development. Following two years of successful collaboration with the SG 2000 field programme in some parts of the country, the government of Ethiopia adopted the SG 2000 participatory extension model, and launched a national programme with the aim of attaining national food self reliance. The programme uses a technology transfer model. At the core of the model lies the demonstration plots. In line with this concept, the government of Ethiopia is sponsoring the establishment of large size demonstration plots on main crops, of which, among them is maize. These demonstration plots are called Participatory Demonstration Plots (PDP).

Takele (1997), reported that in 1995/96 and 1996/97 the programme has sponsored the establishment of close to 36,000 and almost half a million Participatory Demonstration Plots respectively, with the purpose of popularizing the use of improved agricultural technologies to a large number of small-scale farmers. The trend is that this number will keep growing for some years.

1.1.2.1 Elements of the Participatory Demonstration Plots

The programme has certain elements to follow in the implementation of the participatory demonstrations. These include:

(i) Realistic size: The Participatory Demonstration Plot is large in size, usually of half a hectare and is established on the farmer's own plot. According to SG 2000 (1995) the large size plot not only leads to a realistic test of the technological package being demonstrated, but also affords the participating farmers some economic return on their labour. It also eliminates unnecessary extrapolations which small plots always require and which small-scale farmers often distrust.

(ii) Availability of production inputs and credit provision:

An extension approach that relies mainly on the transfer of messages or information cannot by itself provide enough basis for adoption, and the adoption of productivity enhancing technologies will benefit from accessibility of credit (Teketel, 1996). In this respect, the programme makes production inputs physically available to client farmers on credit basis. They are required to pay 25% upfront for the inputs they receive. They pay the rest with additional 10% interest after harvest. For the programme, revolving fund is allocated by regional governments which is managed by Regional Agricultural Bureaus (RABs).

(iii) Training: In order to upgrade the skills of extension services for technology dissemination, the programme is engaged in providing training for extension staff in the various levels. This includes practical training in the field as part of the on-going activities related with the demonstration plot implementation. As a result of this training, farmers will be taught in groups in selected farmers plots.

(iv) Participation: The demonstrations are conducted on farmers' own plots, and the management of the plots is their responsibility, though they are back-stopped by the extension agents. According to Teketel (1996), the idea of the new approach is that by

letting farmers conduct the large demonstrations on their own, they will not only evaluate the technologies but will also improve their crop management skills.

1.1.2.2 Components of the package in improved maize production practices

The improved technological packages taken to the farmers have been assembled after discussing with the national research system and it is believed that, it sometimes incorporates insufficiently tested research information. According to SG 2000 (1995), one should not wait for a 'perfect' package to be developed before extending it to the farmers. Instead, production packages can be upgraded over time as more research information becomes available.

The components of the package for maize include:-

(i) Improved seed: Seed is one of the basic inputs of any plant production activity. It is a primordial input for crop production, it is the embodiment of past harvest and the promise of future ones (Tripp, 1995). Recognizing the importance of improved seeds to the attainment of higher agricultural production, the Government of Ethiopia established the Ethiopia Seed Corporation (ESC) in 1978. However, in order to facilitate the access of improved seeds to small-scale farmers, the government, has re-structured the former ESC into a more market-oriented Ethiopian Seed Enterprise (ESE) with a mandate to become profit-making enterprise. Thus, the programme purchases different types of seeds from ESE to distribute to participant farmers. The different maize varieties distributed to the farmers include: Composites: A-511, Beletch, Alemaya composite, Katumani, ACV-6, and ACV-3 and Hybrids: Phb-3253, Phb-3435, BH-140, BH-540, BH-660, and CG-4141.

For the last 4 years, 1993/94-1996/97, distributed maize improved seed through MOA for the programme was 89,700 kg; 332,000 kg; 992,900 kg; and 1,311,600 kg respectively (Mulat, personal communication, 1998).

(ii) Chemical Fertilizers: Although there are different ways in which agriculture intensification can be achieved, an increased use of fertilizer seems to provide an immediate alternative particularly in areas where fertilizer use is still low (Pinstrup-Anderson, 1982).

Fertilizers have been used in Ethiopia for a quarter of a century, however, Ethiopian farmers continue to use very low fertilizer rates which are estimated to be an average of 7 kg of nutrients per hectare, well below the African average of about 22 kg nutrients per hectare (SG 2000, 1995). SG 2000 (1995), asserted that given present knowledge, the rapid rate at which the country must increase food production means that farmers have little choice but to depend initially on external sources of nutrients. Currently, due to pressure by the international donor community and financial sources on Ethiopia, fertilizer subsidy is abolished. This apparently places fertilizer prices in this country, according to SG 2000 (1995), amongst the highest in the world.

In the National Extension Intervention Programme (NEIP), the type of fertilizers introduced on maize crop are DAP and UREA and the rate used, in most cases, is DAP 100 kg/ha; and UREA 50 kg/ha.

(iii) Pesticides: Pre and post-harvest crop losses due to various pests such as insects, diseases, rodents and weed infestation vary widely from crop to crop and from region to region. Indicative figures from limited experimental work and consultancy studies

suggest a loss ranging from a low of 5% to a high of 100% in some crops and under extreme conditions (MOA, 1993). In any case, there is a clear need to minimize such losses through various means, an important one of which is the use of crop protection chemicals. At the initial stage of the programme Marshall Chemical was used for seed dressing. Nowadays, pesticides are recommended by experts according to the pest type and intensity of the infestation.

(iv) Improved Cultural Practices: Improved cultural practices include:-

-Seed bed preparation

-Line planting: 2 seeds/hill.

-Proper spacing:- usually 50 by 80 cms.

-Planting depth:- 2-4 inches, depending on the soil type and soil moisture.

-Weeding:- 2-3 times, depending on weed infestation. Special attention is given during the first 2-3 weeks time after germination.

-Fertilizer application:

.Mode of application:- spot application.

.Time of application:- DAP during planting and UREA, usually, when the crop reaches knee height, at about 8-10 leaves stage. Split application is also practised, depending on the soil type specially when leaching is a problem.

-Pest control:- it is recommended to use pesticides if the infestation is above 5%, if it is less, to control by mechanical means for example uprooting the infected ones.

1.2 Problem statement

The programme strategy appears successful as revealed by increased yields and farmers' awareness for improved agricultural practices. However, the majority of the farmers in the study areas are either non-adopters or they have adopted only part of the introduced package. Farmers who are not in the programme are not copying the introduced package at the rate it was expected. Therefore, as it is observed, the diffusion rate is very low. As of now, no studies have been conducted to assess the adoption rate of the introduced technologies. Thus, the lack of empirical evidence as to why there is such a low rate of adoption of the technologies prompted an investigation to ascertain factors which influence the adoption of the introduced technologies and assess the perceptions' of farmers and extension workers on approaches of the programme.

1.3 Justification of the study

Because of low and stagnating agricultural production partly due to limited access to modern research, agricultural technologies and practices of Ethiopian farmers have remained at subsistence level for several generations (Teketel, 1995). However, as in many other developing countries, the country has given high priority to the development and application of improved farm technologies to raise farm output. Under the National Extension Intervention Programme (NEIP) the country already embarked upon the popularization of the technical agricultural package to the target group delivered through the on-farm technology demonstration plots. The programme's main objective is to assist small-scale farmers to increase the productivity of staple food crops in order to sustain food self-sufficiency and food security (Teketel, 1996). It is reported

that average maize yields from demonstrations have outperformed farmers' traditional plots by an average of more than 100 percent in 1995. However, inspite of yield increment and knowing the advantage of the technologies still the diffusion rate is very low. Therefore considering this commendable programme performance in the demonstrations and on the other hand the slow diffusion rate, the need to study in detail the factors that influence the adoption of advocated improved maize production practices can not be overemphasized. The results of this study will be of assistance not only in determining the extent of adoption of technologies, but also in making modifications in the approach to facilitate faster adoption of technologies by the target group.

1.4 Objectives of the study

1.4.1 General objective

The general objective of the study is to assess the influence of identified factors on the adoption of improved maize production technologies and practices introduced by the programme in Awassa woreda.

1.4.2 Specific objectives

(i) To determine the extent of adoption of the improved maize production technologies and practices promoted by the programme.

(ii) To identify and analyze factors that influence the adoption of the introduced technologies and practices.

(iii) To determine farmers' and extension workers' perceptions on the programme's approach.

(iv) To identify and analyze factors associated with involvement of farmers in the programme.

(v) To recommend how poor farmers can be assisted to make them benefit from the programme.

1.5 Hypothesis of the study

The hypothesis of the study was that, the adoption of the promoted technologies and practices were independent of farmers' characteristics, economic factors, community prestige and institutional factors.

CHAPTER TWO

LITERATURE REVIEW

2.1 Adoption of technologies

Development planners in Third World countries have traditionally introduced new technologies as an approach to overcome barriers to agricultural advancement. However, their rate of adoption by the farming community has varied considerably depending not only upon their merit, but also upon social and economic factors (CIMMYT,1993). In many situations, perhaps not enough importance has been attached to the relevance of these various socio-economic issues when introducing new technological innovations. Some reasons include poor planning, a lack of time and resources, and a conflict of interest such as between foreign donor's aid policies, national plans and local goals. Some judge that many failures have their origins in the problems of the farming communities being "identified" at a project planning and advisory level with perhaps a minimal involvement of the proposed targeted beneficiaries (Byerlee and Heisey, 1992).

The subject of adoption of technologies has often been researched and discussed with a view to finding appropriate strategies for bringing about a more rapid modernization of the agricultural sector (Benad, 1988; Mvena and Mattee, 1988). However, it is understandable that not everyone adopts technologies at the same rate. Some people who readily adopt technologies and those who play a waiting game are an interesting topic for investigation (Van den Ban and Hawkins, 1996).

Rogers (1995), defined a technology as an idea, practice, or object that is perceived as new by an individual or other unit of adoption. According to Rogers (1995), a technology usually has two components: (i) a hardware aspect, consisting of the tool that embodies the technology as a material or physical object, and (ii) a software aspect, consisting of the information base for the tool.

The individuals in a social system do not adopt an innovation at the same time. Rogers (1983), has provided a helpful summary of adopters based on evidence found in many empirical studies. He proposes five adopter categories: innovators, early adopters, early majority, late majority and laggards. According to Rogers (1995), adopter categories are the classifications of members of a social system on the basis of innovativeness, the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system. Van den Ban and Hawkins (1996), explained that for a long time it was thought that people adopted technologies only very slowly because of their traditional or conservative attitude towards life. They call this the "individual-blame" hypothesis. However, research among Latin American farmers has focused attention on the "system-blame" hypothesis which states that it is not sensible for farmers to adopt ideas in their present situation. Either they do not have sufficient resources, or the power relationships in the society are such that estate owners, money lenders, traders, and others profit from these technologies rather than the farmers themselves. It is also possible that technologies are not available in remote villages or inputs are sold only in much larger quantities than a small farmer can use and afford. According to Van den Ban and Hawkins (1996), it does not seem sensible to

state that either the individual-blame or system-blame hypothesis is correct. Each concrete case should be tested with both hypotheses. Both hypotheses can contribute to clarifying reality, despite the fact that the accent will lie more with one or the other.

Despite the available technologies, the majority of Ethiopian farmers use traditional agricultural practices. The major problem in the technology diffusion process is to make the products of technology physically available to farmers. Ethiopian farmers do not have easy access to the products necessary for science-based agriculture, such as improved varieties, fertilizers, and crop-protection products. Some agricultural technologies like improved seeds are not produced in sufficient quantities. There are also constraints on the farmers' side. Few farmers have cash resources to purchase agricultural inputs. Credit for input purchase exists, but it involves administratively cumbersome procedures that often repel farmers.

However to counteract this problem, the current Participatory Agricultural Extension Programme accesses technologies that are developed by the Institute of Agricultural Research and other inputs and makes them physically available through the provision of credit. In the programme, according to Teketel (1996), agricultural research and extension will be geared primarily to smallholder agriculture. He also emphasised that, the focus of short-term and medium-term research will be on packaging the best cultural practices for different parts of the country, therefore, its primary objective will be to provide economically optimum packages of technology to smallholders operating in different farming systems.

Van den Ban and Hawkins (1996), stated that in the adoption process technologies often are not viewed singularly by individuals. They may be perceived as an inter-related bundle of new ideas. The adoption of one new idea may trigger the adoption of several others. Van den Ban and Hawkins (1996), further explained that a *technology cluster* consists of one or more distinguishable elements of technology that are perceived as being closely interrelated. The boundaries around any given technology are often not very clear cut or distinct. In the minds of potential adopters, one technology may be perceived as closely related to another new idea. If this is the case, a change agency might find it useful to promote a cluster or package of technologies to clients, rather than to treat each new idea separately. There is need to analyze complexes of technologies in future research, to study new ideas in an evolutionary sequence, and to determine the degree of compatibility perceived by individuals among interrelated ideas. There would then be a sounder basis for the assembling of technologies in easier-to-adopt packages (Van den Ban and Hawkins, 1996).

However in reality, farmers all over the world, rarely adopt complete packages and rarely comply exactly to the recommendations made when it comes to their specific situations. Benad 1988, argued that, if some parts of a package are accepted and others are rejected, then the reasons for rejection have to be traced in the characteristics of the technology rather than in a general 'change resistant' attitude of farmers. Benad (1988), further asserted that in defining the criteria for adoption, it is also important to remember that although the recommendations may be presented to farmers as a package of several practices, some components of the package may be adopted first, others may

be adopted later, and some may never find widespread acceptance. The adoption study, therefore, asks specifically about each component of the package, bearing in mind that individual components may be adopted at different times and under different conditions.

2.2 Main components of the package in maize production in the programme

2.2.1 Improved maize varieties

Most seed planted by farmers in developing regions comes from local sources, i.e. the farmer's own crop, neighbours, relatives, or from local markets (Almekinders *et al*, 1994). However, according to them, whatever the source, farmers generally are very much aware of the need to sow seed of the best quality available. Farmers' priorities regarding quality may be better met by seed from local sources. Further they stressed that, the genetic quality of released varieties may not be adapted to the local agro-ecological conditions and specific consumer preferences in the area or it may be, even, that the analytical, physiological and sanitary properties of the 'official seed' are inferior to those of the local seed.

Tripp (1995), emphasised that the genetic composition of the seed determines the potential economic yield of the crop and it carries the genetic properties that are important for the farmer. According to him these properties are:

Producation values: yield potential and stability, i.e, crop tolerance of biotic and abiotic stresses that are common under the specific edaphic and climatic conditions of the farmer (drought, water-logging, wind, diseases, pests, weeds) and within his/her

economic and managerial capabilities (labour availability, cropping systems, etc.); and value of secondary products (e.g. straw).

Consumption values: shape, taste, colour and suitability for different methods of preparation: baking, boiling, frying, roasting or porridge.

Economic values: e.g. early maturity, production for market demand, longevity in storage, appearance of the produce and length of the harvesting period.

Cultural values: in some communities crop and product appearances are related to certain beliefs and rituals.

Therefore it is important to have good communication links with the farmers, to inform them of the availability and the quality characteristics of the seed and to create the desire and willingness to adopt the seed. Gregg (1983), summarised the above in the AID ME concept: Farmers should be made AWARE of the existence of improved seed; INTEREST should be aroused; and the potential should be DEMONSTRATED; then farmers should be MOTIVATED to try the improved seed and should be EDUCATED regarding how to combine it with other inputs and how to obtain the necessary credit.

In Ethiopia there are only two organizations with a legal mandate and the capacity to multiply and market improved varieties of food grains: the ESC later ESE, established in 1978, and the Ethiopian Pioneer Hybrid Seed, Inc. (EPHS), established in 1990 as a joint venture between ESE and Pioneer Hi-Bred Seed, Inc. Over the years, the various research organizations have carried out numerous studies on improved variety development among them, the Institute of Agricultural Research (IAR). According to

Getenet, *et. al* (1996), in respect to the institutional tasks, IAR goes through a series steps to generate new improved varieties. The basic mechanisms are:

(i) On-station Research: This is the initiation stage in the process of technology generation. A number of scientific investigations are undertaken over a certain period of time, mainly at research centers and cooperating institutions or organizations. The process is managed by researchers.

(ii) On-farm Research: Experiments with promising results are tested on larger farmers' plots by agricultural economists in collaboration with other researchers. The economics of inputs in relation to yield is a major consideration at this stage.

(iii) Verification and Release: In the early 1980s, the National Variety Release Committee (NVRC) was formed to verify and release crop varieties. Improved variety will be approved if it shows relative advantage over existing technologies. Verification trials are either multi-site or cover a considerable area or region. The verification step is essential to avoid unsustainable release of technologies. However, according to Getenet, *et. al*, (1996), not all technologies generated by IAR have gone through a formal technology release process.

2.2.2 Chemical Fertilizers

Evidence from recent research work indicates that the role of fertilizer in improving crop yields and hence agricultural production is generally the highest followed by the improved seeds and agricultural practices in soils of moderate fertility (Dapaah and Ontikorang, 1990). As reported by Pinstrup-Anderson (1982), an increase in fertilizer use was responsible for about 30% of the total increase in grain production and about

one-third of the total increase in grain production in Asia and one-fifth in Africa. Therefore the low contribution of fertilizer in increasing grain production in the case of Africa is largely due to the low levels of fertilizer consumption. As mentioned earlier, due to the structural adjustment programmes imposed by the World Bank and the International Monetary Fund, fertilizer subsidies are abolished in most African countries.

According to Schuuman (1994), and Fontaine and Sindzingre (1991), the fertilizer subsidy policies have been adopted to reduce farmers' cost, to encourage adoption of fertilizer, and to increase usage. It is also believed that one of the major reasons in implementing fertilizer subsidy was to transfer income to the small marginal farmers.
A longer catalogue of the major reasons for government intervention in the fertilizer sector has been given by Ellis (1992). It is argued that governments intervened in the fertilizer markets partly because the private sector was unable to deliver the inputs with sufficient competitiveness, timeliness, quality, accuracy of information, and geographical coverage. Involvement of the government in the fertilizer market was also aimed at combining the input delivery with the credit provision. This was intended to alleviate the working capital constraints on the adoption of fertilizer.

While the MOA (1993) asserts that, any increase in cost of fertilizers is bound to affect the crop output adversely, and it should therefore be compensated by proportionate increase in prices of farm products, Krishna (1967), on the other hand, has summarized

the arguments within a wider package of agricultural pricing policies, for utilizing input subsidization to achieve the initial period stimulus:

> If the aim is to accelerate innovation and the growth of agricultural output, it would be better to subsidize (lower the price of) the package inputs than to guarantee outputs. Several considerations can be adduced in support of this preference. If product prices are raised, peasants may or may not take to improved cultivation. They may simply spend the extra income on consumption, and government expenditure on support will be wasted. If, on the other hand, inputs are subsidized the benefit of government expenditure can be derived by the peasants only in proportion to their use of improved inputs. Input subsidization also avoids raising food and raw material prices against the growing industrial sector (Krishna, 1967: 526).

2.3 Factors associated with the adoption of technologies

2.3.1 Farmers' characteristics

2.3.1.1 Gender

Although the contribution of female farmers to agricultural production is highly recognised, in practice, they are less represented in most agricultural-oriented development projects (Boserup, 1983). Male farmers have much more contact with extension agents than female farmers, and as a result, female farmers usually have less access than male farmers to inputs, credit and other resources. Also due to lack of ownership of resources such as land and other assets, women can not afford some of the technologies recommended by extension and therefore lose interest in seeking further advice. This may be because of cultural constraints against male extension agents working with female farmers, because male farmers are responsible for the cash crops to which the extension service often gives more attention than to the food crops, or because female farmers are less educated (Van den Ban, 1996). Van den Ban (1996), further explained that in several cultures women are not supposed to speak in a meeting

unless asked. Such constraints mean that many female farmers have less exposure to the outside world than men. This can be related to what was explained by Shayo (1990) that in many rural societies, the social status of women is inferior to that of men. Due to this, they become a disadvantaged group especially when it comes to the introduction of new technology in their areas.

Rural women in Ethiopia are looked at merely as "wives of farmers" by recognizing only their reproductive role (MOA, 1993). They have no access to land. Land is a security for credit and a criterion for access to agricultural extension services and other farm technologies. Thus, rural women are deprived of credit, which is an important factor for increasing their agricultural productivity and output. As in other African countries, Ethiopian women do not have equal access to extension services. This is because the national agricultural extension system is not designed to reach women farmers. The extension education of the MOA so far targets the head of the household, which in most cases is the male. Most of the development agents are male, who have social, cultural and religious constraints in delivering extension education to rural women. On the other hand, women in Ethiopia have lower participation rate at all levels of education. According to MOA (1993), the low participation of women is attributed to such factors as society's attitude of relegating women to inferior status; early marriage; and the need for girls, to provide labour to the overloaded mothers at home.

Generally, social and cultural attitudes of the society towards women is one of the major factors that keep women in a subordinate position.

2.3.1.2 Education level

The farmers education background is an important factor in determining the readiness to accept and properly apply a technology. According to Madulu (1995), education broadens horizons beyond habits and traditions of individuals, encouraging involvement of an individual in development activities. Therefore through education, an individual becomes more critically aware of the need and scope for social change. More years of education is associated with high level of comprehension of new technologies, for example the use of high yielding variety, insecticides and pesticides (Machumu, 1995). CIMMYT (1993), asserted that many adoption studies show some relationship between technology adoption and the educational level of the farmer. The more complex the technology, the more likely it is that education will play a role. Thus according to Machumu (1995), the diffusion of a new variety among farmers may not depend at all on their education level, while the diffusion of a chemical input may be more rapid among farmers who have at least some minimum amount of schooling.

2.3.1.3 Age

Another farmer characteristic that is often examined in adoption studies is age. CIMMYT (1993), explained that a farmer's age may influence adoption in one of several ways. Older farmers may have more experience, resources, or authority that would allow them more possibilities for trying a new technology. CIMMYT (1993), suggests that experience in a particular farming area or with a given crop may not be strictly correlated with age however, and it may be worth asking more specifically about experience. On the other hand, it may be that younger farmers are more likely to adopt a

new technology, because they have had more schooling than the older generation or perhaps have been exposed to new ideas as migrant laborers (CIMMYT 1993).

2.3.2 Economic Factors

Access to land, capital, inputs, credit and so on determine, to a large extent, whether a particular innovation is possible, and farmers differ a great deal in access to these resources or to the institutions controlling them (Rolling, 1990). CIMMYT (1993), contended that wealthier farmers may be the first to try a new technology, especially if it involves purchased inputs. This may be because wealthier farmers are more able to take risks or have better access to extension information or to credit, or they may be able to use their own cash resources to experiment with a new technique. This is also contended by Bank of Tanzania, (1979), that the experience all over the world is that response to modern technology in agriculture is quicker in the case of relatively big and medium farmers than in respect of small farmers. According to BOT (1979), for the latter, agriculture is a way of life and not so much a business proposition and, therefore, they show considerable hesitation in taking a plunge in the unknown for fear of losing their very means of livelihood. Whether or not this pattern persists, and wealthier farmers are the ones that are the major adopters and users of a new technology, may be an important issue for an adoption survey.

2.3.2.1 Farm size

Farm size is a common variable for determining adoption (CIMMYT, 1993) and is often a good proxy for wealth (Feder *et al.*, 1985 Polson and Spencer, 1991). With

respect to the adoption of new technologies, it has been recognized that small and large farm operators differ in the speed of adoption (Ashby, 1982; Coughenour, 1984; Hefferman and Green, 1986; Polson and Spencer, 1991). On the other side, farmers who own large farms enjoy a high socio-economic status (Rogers, 1983). They also have ample mass communication opportunities, and are more innovative in adopting new agricultural technologies (Ockwell *et al.*, 1991). It is asserted by CIMMYT (1993) that sometimes a certain threshold of farm size is necessary before the investment in a technology is worthwhile.

Ethiopian agriculture is dominated by small-scale, resource-poor farmers, most of them holding only 1 to 2 hectares (Quinones and Takele, 1996). In the pre-1975 period, two types of land tenure prevailed in the country. The communal system of land tenure under which most peasant families had access to land was prevalent in the northern part of Ethiopia. In the south and south-western part of the country, the land tenure system was characterized by absentee landlords, and crop-sharing tenancy as the predominant feature (MOA, 1993). The Land Reform of 1975 provided for state ownership of land, and gave the peasants user right of land to incorporate the peasantry into the development process. Currently, the government of Ethiopia, continues to maintain public ownership of land and security of access and user right of land are assured; however, the issues of further fragmentation and redistribution of land are not entirely dealt with.

2.3.2.2 Income

In most cases, farmers with more income are early adopters of technologies. This may be because wealthier farmers have better access to extension information or to credit, or they may be able to use their own cash resources to experiment with a new technique (CIMMYT, 1993). Further, CIMMYT (1993) contended that many farmers who do not adopt, may complain of a lack of cash or credit as the principal factor limiting their adoption. Bwana (1997) in her study, pointed out that, in some cases, farmers with a more commercial orientation, who sell a large proportion of their harvest are the ones more likely to adopt particular technologies.

2.3.2.3 Farm implements

Farmers' ownership of equipment may influence adoption of technologies. Farmers who own draft animals can be more flexible in changing their tillage practices than farmers who must rent or borrow. According to CIMMYT (1993), if a recommendation involves a certain equipment or machinery, the degree of adoption may depend on the number of farmers who are able to acquire the equipment, and whether or not an effective rental market develops.

For the majority of Ethiopian farmers, the availability of improved animal drawn equipment as well as improved agricultural hand tools remains a critical factor in agricultural production. The overwhelming proportion (95%) of the annually cultivated land is under small-holder farmers who essentially rely on traditional agricultural tools and implements (MOA, 1993). The fabrication and distribution of improved tools and

implement thus assume significance to increase productivity and efficiency on small farms.

2.3.3 Community prestige

Community prestige is a status factor, and when alertness to new developments in farming and quick acceptance is a status factor, a person's standing in the community (community prestige) is almost certain to be positively related to the adoption of new practices (Lionberger, 1968).

Even though every innovation is judged on economic grounds to a certain degree by its potential adopters, every innovation also has, at least, some degree of status conferral (Rogers, 1995). Rogers (1995) also asserted that, one motivation for many individuals to adopt a technology is the desire to gain social status. Tarde (1903) observed that status seeking was a main reason for imitating the technology behavior of others. Rogers (1995), contended that certain individuals who adopt a technology at a particular time are more highly motivated by status seeking than are other individuals. According to him, status motivations for adoption seem to be more important for innovators, early adopters, and early majority, and less important for the late majority and laggards.

2.3.4 Institutional Factors

Institutional characteristics are derived from those publicly operated systems for providing extension services to farmers. Several researchers identified agricultural institutions such as research, extension, credit and marketing to be critical to agricultural

development (Machumu, 1995). For example, Kauzeni (1988), argued that the slow rate of adoption is frequently an indictment of the project methodology rather than the unwillingness of farmers to adopt the technology.

2.3.4.1 Extension service

In Ethiopia, concern for the country's ability to feed her own people has given way to a more positive tone of enhanced optimism about possibilities of self-sufficiency in food crop production (SG 2000, 1996). According to SG 2000 (1996), several conditions have contributed towards this positive outlook for a brighter future in food production in the country. As to the project's observation, more importantly, the Government of the Federal Democratic Republic of Ethiopia (FDRE) has launched a vigorous implementation of an ambitious Five Year Agricultural Development Programme. The very high priority given to agricultural development by FDRE is substantiated by the greater availability of fertilizers, the relative ease with which small-scale farmers have access to inputs, credit and also the very high recognition and support provided to the agricultural extension service of the Ministry of Agriculture.

The SG 2000 project in Ethiopia is very privileged to have been a witness to this increased government effort in food crop production. The project has contributed to this enhanced effort by way of pioneering the process of a much strengthened improved technology dissemination system through the establishment of large-scale on-farm extension demonstration plots. The productivities of these plots have attracted the attention of farmers as well as government decision makers. As a result, several

demonstration plots have been sponsored by the government in almost all parts of the country. Thus, based on this achievement, SG 2000 (1996) suggests that small-scale farmers who dominate the agriculture sector in the country must be provided with this kind of very vigorous extension service if agriculture, as the leading sector in the country's economy, has to truly become a sustainable source of food for the ever increasing population.

Agricultural extension is an on-going process of making available useful information to farmers in order to assist them to acquire the necessary knowledge, skills and attitudes that can be utilized effectively for improving their quality of life (Biswalo, 1992). Village extension workers (VEW) use educational media technologies when communicating with clientele in order to facilitate and induce change. Potential adopters of a new idea are aided in evaluating a technology if they are able to observe it in use under conditions similar to their own. Such observation often occurs naturally, when one individual views another's experience in using the technology. Extension implies communication of information and innovations to clientele. Without proper communication strategies, the whole process of extension would be quite difficult to implement (Rogers, 1995). One factor in change agent success, is the amount of effort spent in communication activities with clients. Rogers (1995), asserted that change agent success in securing the adoption of innovations by clients is positively related to the extent of change agent effort in contacting clients.

Change agents may try to increase the observability of a technology, and thus speed its rate of adoption, by organizing a demonstration of the technology (Rogers,1995). According to Myers (1978), there are two types of demonstrations, which are quite different in the functions that they perform. These are:

-Experimental demonstrations, which are conducted to evaluate the effectiveness of a technology under field conditions, and

-Exemplary demonstrations, which are conducted to facilitate diffusion of the technology to other units.

In his explanation, Myers (1978), observed that, an experimental demonstration is successful if the technology demonstrated is evaluated adequately, whether this evaluation is positive or negative. In either case, knowledge is advanced about the effectiveness of the technology. In contrast an exemplary demonstration, whose purpose is to facilitate the diffusion of a technology, is intended to persuade potential adopters: It should be conducted with high public visibility, and the demonstration's managers should have an attitude of optimistic assurance about the technology's effectiveness.

Progressive farmers usually have higher access to information, and to technology evaluating information by peers, than other farmers (Rogers, 1983). Roling (1990), asserted that 'Extension workers and progressive farmers attract each other like magnets'. For this common observation he sugested six sound reasons:

-Progressive farmers have relatively larger holdings so that production targets set by extension can be reached with relatively little effort through relatively few farmers.

-Progressive farmers have experienced success in controlling their environment. They are interested in extension advice. One does not waste time convincing them.

-Progressive farmers demand assistance. They complain if they are neglected and some are powerful enough to affect the career of the local extension worker.

-Progressive farmers usually have the economic means to try out new ideas. They can afford to run risks.

-Progressive farmers are often homophilous with extension workers in that it is easy for them to communicate with one another.

-Progressive farmers usually set the standard for good farming. They are a professional challenge to the extension worker. What is more, extension workers often learn from progressive farmers what to tell others. Therefore according to Roling (1990) because of these powerful reasons nearly every extension service in the world operates a progressive farmer strategy.

2.3.4.2 Credit

Small farmers in the vast majority of developing countries, including Ethiopia, are caught in a vicious circle of low level of income, low investment in improved technology, and low level of agricultural productivity (MOA, 1993). Lack of access to institutional credit is perhaps one of the most critical factors which impede peasant agricultural production and perpetuate rural poverty.

For farmers to utilize such inputs as improved seeds, fertilizers, insecticides and improved implements they must have ready access to credit. Credit can be an important

factor in determining adoption. If a recommendation implies a significant cash investment for farmers, its adoption may be facilitated by an efficient credit programme. According to CIMMYT (1993), if the majority of adopters use credit to acquire the technololgy, this is a strong indication of credit's role in diffusing the technology.

On the other hand, it is asserted that, rather than facilitating access to new technology, credit programmes are sometimes responsible for obligating farmers to use a particular technology. The credit may be offered as a package that provides a set of inputs to farmers. Parts of the package may be "adopted" simply because of this obligation, although farmers may feel that they are inappropriate or unprofitable (CIMMYT, 1993).

Vasthoff (1968), stated that two basic systems of administering agricultural smallholder credit have been developed. In one system, the credit is provided *through a special agricultural credit organization.* In the other system, the credit is provided *through the cooperative movement.* According to Vasthoff (1968), both systems proceed from the generally accepted idea that in developing countries, agricultural credit to smallholders should be combined with the provision of agricultural extension service. He further mentioned that, in recent years, more and more preference has been given to credit programmes operating in the context of cooperatives. FAO (1962), states that:

> "Co-operatives which combine credit and the supply of farm requisities to their members with the marketing of their produce representing a highly satisfactory method of extending loans to farmers at a minimum risk" (p 10).

However Vasthoff (1968), pointed out that, the administration of smallholder credit faces two main problems: the high administrative costs involved in dealing with a large

number of small farms, and the difficulty of loan collection and the risk of non-repayment.

According to him, these two problems are related in that, the repayment position can be influenced to a considerable extent by the administrative system and by administrative effort. Thus he suggested that, the question whether the unfavourable repayment position is due to the present method of loan collection or to the repayment capacity of the farmers, deserves careful investigation.

In Ethiopia, the supply of rural credit presently comes from two sources: the informal sector and formal sector. The former essentially comprises of relatives, friends, other farmers, traders, money lenders and the most popular and widely spread traditional social and economic associations. The formal sector includes the financial institutions dealing with rural credit. The two major financial institutions presently dealing with rural credit are: (i) Commercial Bank of Ethiopia (CBE), and (ii) Agricultural and Industrial Development Bank (AIDB). However according to MOA (1993), most of the small peasant producers did not have access to institutional credit because they could not meet the stringent eligibility criteria, provide downpayment nor meet security conditions. This exclusion of small farmers resulted in their dependence on the informal sector for credit at quite high interest rates, which acted as a disincentive for investment and a constraint to increasing production.

2.3.4.3 Cost of inputs

A farmer may be aware of the benefits associated with the adoption of technologies, however, if the technologies are not easily available at a price he can afford, the farmer will not adopt the technology (Byerlee and Heisey, 1992). Here the farmer may need to be convinced that the benefits would far outweight the costs involved. One of the methods used to create a more favourable farmer response to modernising his agriculture is to subsidise the cost of inputs of agriculture, thereby giving the farmer a better net return for his produce (BOT, 1979). According to BOT (1979), subsidies, to reduce the cost of production, serve two main purposes. Firstly, they are intended to overcome reservation in the mind of a traditional or conservative farmer to switch over to modern farming methods involving the use of high-yielding or better quality seeds, fertilizer and insecticides, and secondly, to go for capital investment in the land which will improve its productivity more or less permanently.

2.3.5 Characteristics of technologies

The characteristics of technologies, as perceived by individuals, help to explain their different rate of adoption (Rogers, 1995).

By using a standard classification skill for describing the perceived attribute of innovations in universal terms, Rogers (1983) came up with five attributes that are mutually exclusive. They are (i) relative advantage (ii) compatibility (iii) complexity (iv) trialability (v) observability.

According to Rogers (1995), relative advantage is the degree to which a technology is perceived as being better than the idea it supersedes and it is often expressed as economic profitability, social prestige, or other benefits. The nature of the technology determines what specific type of relative advantage is important to adopters, although the characteristics of the potential adopters also affect which subdimensions of relative advantage are most important. Potential adopters want to know the degree to which a new idea is better than an existing practice. Rogers (1995), mentioned that diffusion scholars have found relative advantage to be one of the best predictors of a technology's rate of adoption. He further stated that, relative advantage indicates the benefits and the costs resulting from adoption of a technology which includes the degree of economic profitability, low initial cost, a decrease in discomfort, social prestige, a saving in time and effort, and the immediacy of the reward.

Compatibility is the degree to which a technology is perceived as consistent with the existing values, past experience, and needs of potential adopters. Rogers (1995), explained that a technology can be compatible or incompatible with socio-cultural values and beliefs, with previously introduced ideas, or with client needs for the technology. Rogers (1995), contended that the compatibility of a technology, as perceived by members of a social system, is positively related to its rate of adoption.

Complexity is the degree to which a technology is perceived as relatively difficult to understand and use. Rogers (1995), explained that any new idea may be classified on the complexity-simplicity continuum. Some technologies are clear in their meaning to

potential adopters whereas others are not. He generalized that although the research evidence is not conclusive, the complexity of a technology, as perceived by members of a social system, is negatively related to its rate of adoption.

Trialability is the degree to which a technology may be experimented with on a limited basis. New ideas that can be tried on the installment plan are generally adopted more rapidly than technologies that are not divisible. Rogers (1995), stated that some technologies are more difficult to divide for trial than are others. The personal trying-out of a technology is a way to give meaning to a technology, to find out how it works under one's own conditions. This trial is a means to dispel uncertainity about the new idea. From this he generalized that, the trialability of a technology, as perceived by members of a social system, is positively related to its rate of adoption.

Relatively earlier adopters of a technology perceive trialability as more important than do later adopters (Gross, 1942; Ryan, 1948). According to Gross (1942), and Ryan (1948), more innovative individuals have no precedence to follow when they adopt, whereas later adopters are surrounded by peers who have already adopted the technology. These peers act as a kind of vicarious trial for later adopters, and hence their own personal trial of the new idea is less crucial for them.

Observability is the degree to which the results of a technology are visible to others. Rogers (1995), observed that the results of some ideas are easily observed and communicated to others, whereas some technologies are difficult to observe or to

describe to others. Thus he suggested the generalization of the observability of a technology, as perceived by members of a social system, is positively related to its rate of adoption.

Generally, a technology that is clearly profitable, reliable, and compatible with farmer's farming systems will be highly adopted and diffused (CIMMYT, 1993). According to CIMMYT (1993), farmers are also likely to adopt knowledge that is more visible and has positive attributes. In many cases technology generated by research stations may not fit the farmers' needs and priorities.

2.3.6 Environmental factors

Enviromental characteristics are derived from the influence of nature (Machumu, 1995). CIMMYT (1993), observed that climatic factors play an obvious role in the management of farming systems. Rainfall patterns limit the crops that can be grown and regulate planting and harvesting schedules. CIMMYT (1993), further explain that the possibility of drought or flooding makes farmers wary about investing in some technologies. Seasonal temperature changes also regulate cropping patterns, as when frosts at the end of the growing season dictate early planting and/or use of early maturing varieties. Thus according to CIMMYT (1993), climatic factors in one area may set limits on the acceptability of a technology, and farmers may be asked their opinions and experiences in this matter.

Land quality and soil type may be important factors influencing the acceptance of a new technology. Similarly, the adoption of technology may be affected by weeds, diseases and insect pests prevalent in the area or in specific fields (CIMMYT, 1993).

CHAPTER THREE

METHODOLOGY

3.1 Description of the study area

The study was conducted in the Southern Nation, Nationalities, and Peoples Region (SNNPR), Ethiopia. The region is located in the south-western part of the country bordering Kenya in the south, the Sudan Republic in the south-west and Oromiya Region in the north and east. For administrative purposes, the region is divided into nine zones (having 72 districts) and five special districts based on ethnicity and language identities. The region has an area of about 118.000 sq.km, and accounts for 10% of the total area of the country. Out of the total area, 23.3% is cultivated (Bureau of Planning and Economic Development (BPED), 1996).

Economic strength of any agricultural family is related to the size of the agricultural land holding that the family possesses. In general at the regional level, peasants having 0-0.5 ha., 0.5-1.5 ha., 1.5-2.0 ha., and more than 2 ha. are about 30%, 32.9%, 21.2%, and 15.9% respectively. Regarding farm oxen, about 54.68% of the peasants have no farm oxen, 31.16% have only one ox, 14.16% have two or more oxen per household (BPED, 1996).

According to Central Statistical Office (1996), the population of the region is estimated at about 11.31 million. With this number, the region accounts for 20% of the total population of the country. Out of the total population about 5.6 million or 49.8% are

males and about 5.7 million or 50.2% are females. Among the total population of the region, around 10.54 million or 93.2% are rural, while 6.8% are urban dwellers (BPED, 1996). Out of the rural population, 8.47 million or about 80.4% are involved in agriculture. The agricultural population which consists of 1.54 million family heads is organized in 4023 peasant associations (BPED, 1996). On the other hand, in the region there are 750 Service Cooperatives in which about 1.1 million household heads are beneficiaries. Maize, *teff*, *enset*, coffee, potato, and wheat are major crops of the region, out of which, maize is the most important food and cash crop in the region as a whole.

Meteorological data indicate that, the amount and distribution of rainfall and temperature varies from place to place within the region. The mean annual amount of rainfall and temperature ranges from 500–2200 mm., and 15°c–30°c respectively (BPED, 1996).

In the region, the primary responsibility for agricultural extension lies with the Bureau of Agriculture. Currently, there are 2744 development agents working at the grassroot levels (Simayehu, T. personal communication, 1998). The ratio of development agent to farmers in the region ranges from 1:471 to 1:870 with an average of 1:839.

The study was confined to one of the districts in the region, Awassa district. The district has an area of 92,000 ha, in which out of this, 42,405 ha. is cultivated. The average cultivated land per household is 0.68 ha. The population of the district is 363,924 and out of which 185,786 are males and 178,138 are females. Among the total population of

the district, 285,480 are rural while 78,444 are urban dwellers (Central Statistical Office, 1996). The agricultural population which consists of 47,580 family heads, is organized into 68 peasant associations (BPED, 1996).

The main crops of the district according to the area of land cultivated are maize, *enset*, *teff*, and barley. Maize and *enset* are the main food crops in the rural areas. The district, currently, has 63 development agents assigned at the development centers out of whom 57 are males and 6 are females (Abera, A. personal communication, 1998). Based on the number of the peasant associations, there are 68 development centers which comprise 544 farmer groups and 3264 contact farmers.

3.2 Research design

In designing a research, one has to consider the availability of time, manpower and financial resources. Thus, based on this, cross-sectional survey design was used. Such a design according to Babbie (1990): (i) allows data to be collected at one point in time from a sample selected to describe the larger population at that time. In this study data were collected within one period of the research without repetition; (ii) is used to determine relationships between variables at a particular time; and (iii) can be used for descriptive purposes.

3.3 Population and sampling procedures

The population consisted of heads of household in six villages and extension workers in the region. A purposive sampling technique was used to select the six villages for the

study. The selection of villages took into consideration the time at which the programme was introduced. In some villages the programme started earlier than in others. Accessibility to villages was another factor that was considered. Existence of a resident village extension worker, and high potential for maize production were their criteria used in the selection of the villages.

The sample sizes were 120 heads of household, 20 heads of household, i.e., from each village, and 31 extension workers from the regional office, four zones and two districts. The lists of the farmers were obtained from village leaders in the respective villages. These lists were treated as a sampling frame. Once a sampling frame was established stratified sampling and purposive random sampling were used, i.e., first, the researcher grouped farmers into two, (farmers who were in the programme and farmers who were not in the programme), then, using purposive sampling technique unit of sampling is determined from each group. On the other hand, the list of extension workers was obtained from the Regional Agricultural Bureau, and this was treated as the sampling frame. Then, purposive sampling technique was used to determine the unit of sampling (extension workers).

3.4 Instrumentation

Two sets of structured questionnaires were used in primary data collection. These are farmers' and extension workers' questionnaires. The instruments were structured with close and open-ended questions. The questionnaires were prepared to measure the following:

(i) Socio-economic factors influencing involvement of farmers in the programme.

(ii) Perceptions of farmers and extension workers on the components of the package in the programme.

(iii) Perceptions of farmers and extension workers on the approach used by the programme.

(iv) Involvement of extension workers in the package development.

3.5 Pre-testing

The first draft of the farmers questionnaire was pre-tested in five development centers. Two farmers from each development center making a total of 10 farmers participated in the pre-test. In addition to this, two extension workers were involved in the pre-testing of the extension workers' questionnaire.

Then the questionnaires were revised to produce the final draft after establishing that the instrument gives a reliable and valid information for the research. Both the farmers and extension workers who were involved in the pre-testing were excluded from the samples.

3.6 Data collection

Data collection was done by the researcher assisted by six enumerators. The enumerators were trained during the pre-testing of the research instruments. Each enumerator was conversant with both Amharic, the national language, and Sidamigna, the local language.

Data were collected from each respondent farmer by asking each question according to the interview schedule. Each response was carefully recorded in the interview schedule. In the case of extension workers, the questionnaire was self administered.

In addition to the structured schedules, secondary data pertinent to this study were obtained from Awassa district, Sidama zone and SNNP Regional Agricultural Bureaus, Regional Planning and Economic Development Bureau, Awassa Agricultural college library, Awassa Central Statistics Authority, Ministry of Agriculture, SG 2000 Office, and SUA library.

3.7 Data analysis

Data collected from the respondents were coded, summarized and analysed using the Statistical Package for Social Sciences (SPSS) computer programme at SUA, Morogoro.

3.7.1 Methods of analysis

Two methods of analysis were used. These are descriptive and regression analysis.

3.7.1.1 Descriptive analysis

A sub-programme "FREQUENCIES" was used for univariate analysis to obtain the variabilities of dependent and independent variables and a sub-programme "CROSS-TABS" was used for bivariate analysis to determine the associations of selected factors with participation in the programme and adoption of technologies. Here in the

frequency distribution tables, number of respondents falling in particular attributes and respective percentages were shown. These attributes are:

(i) Farmers' characteristics such as age, gender, education level.

(ii) Economic factors such as respondents farm size, annual income, and possession of draft animals (oxen).

(iii) Social factors such as respondents involvement in farmers organizations and other social committees.

(iv) Institutional factors such as respondents contact with extension workers and extent they benefit from credit schemes.

(v) Reasons for not being a beneficiary from the credit schemes.

(vi) Adoption of improved maize varieties, chemical fertilizers, pesticides and improved cultural practices.

(vii) Reasons for the non-adoption of technologies and practices.

In the "CROSS-TABS" sub-programme the relation of economic factors, institutional factors and community prestiges with participation in the programme and adoption of technologies was determined. Chi-square and t-test were used to test for the variables relationships and to determine mean differences. These were rejected or accepted on the basis of the Chi-square values computed for the dependency between the variables. Here, significance levels of 0.05, 0.01 and 0.001 were selected as the criterion for determining a significant dependency.

3.7.1.2 Regression analysis

Regression analysis was used to determine the effects of selected independent variables on dependent variables.

(i) Dependent Variable

The dependent variable is adoption of individual components of the package. Farmers who were found using improved varieties, chemical fertilizers, pesticides and improved cultural practices in 1997, were considered to be adopters of that particular technology and others not adopters.

(ii) Independent Variables

Independent variables for the adoption of improved maize varieties were credit, farm size, contact with VEW and annual income; in the case of adoption of chemical fertilizers were credit, farm size, contact with VEW, number of oxen owned by respondents and annual income; for the adoption of pesticides credit, farm size, contact with VEW, number of oxen owned by respondents and annual income; and for the adoption of cultural practices the selected factors are credit, contact with extension workers, farm size, number of oxen owned by the farmers, and annual income.

The number and type of independent variables selected for each dependent variable (adoption of individual components of the package) depended on:

(a) having significant association with dependent variables (b) according to coefficient of determination (R^2), i.e., the proportion to explain a given dependent variable.

Regression equations

Ordinary least square (OLS) model is used to estimate the adoption rate. Here, seven multiple regression equations were employed:

(i) influence of selected independent variables on adoption of improved maize varieties.

(ii) the influence of selected independent variables on adoption of chemical fertilizers.

(iii) the influence of selected independent variables on adoption of pesticides.

(iv) the influence of selected independent variables on adoption of improved cultural practices (proper seed bed preparation, line planting, proper spacing and timely weeding).

The F-test was used to test the degree of influence of the selected factors on the adoption of technologies.

(i) Adoption of improved maize varieties equation.

$Y = B_O + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + e$

Where Y= adoption of improved maize varieties in at least 0.25 ha., land size in the year 1997.

B_O= Intercept (Constant term).

X_1= Provision of improved maize varieties on credit basis in the year 1997.

X_2= Respondents' farm size.

X_3= Respondents' contact with village extension workers.

X_4= Respondents' estimated annual income.

e= Error term.

B_1-B_4= Partial regression coefficients.

(ii) Adoption of chemical fertilizers equation.

$Y= B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + e$

Where Y= adoption of chemical fertilizers in at least 0.25 ha., land size in the year 1997.

X_0= Intercept (Constant term).

X_1= Provision of chemical fertilizers on credit basis in the year 1997.

X_2= Respondents' farm size.

X_3= Respondents' contact with VEW.

X_4= Number of oxen possessed by respondents.

X_5= Respondents' estimated annual income.

e= Error term.

B_1-B_5= Partial regression coefficients.

(iii) Adoption of pesticides equation.

$Y= B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + e$

Where Y= adoption of pesticides in any amount and in the year 1997.

X_0= Intercept (Constant term).

X_1= Provision of pesticides on credit basis in any year.

X_2= Respondents' land size.

X_3= Respondents' contact with VEW.

X_4= Number of oxen possessed by respondents.

X_5= Respondents' estimated annual income.

e= Error term.

B_1-B_5= Partial regression coefficients.

(iv) Adoption of cultural practices equations (the same replication for each cultural practice).

$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + e$

Where Y = adoption of cultural practices in any area of land, results of four different equations for proper seedbed preparation, line planting, proper spacing and timely weeding, with the effect of the same selected independent variables.

B_0= Intercept (Constant term).

X_1= Credit given for the application of the package

X_2= Farm size

X_3= Contact with extension workers

X_4= Number of oxen owned

X_5= Annual income

e= Error term

B_1-B_5= Partial regression coefficients.

Postulates on partial regression coefficients, (B), for the selected independent variables in the adoption of technologies

(i) Credit: As the level of provision of inputs on credit increases, it is expected that the rate of adoption of technologies would increase. Therefore the partial regression coefficient of credit was expected to be positive.

(ii) Farm size: It is often assumed that larger-scale farmers will be more likely to adopt a technology, and in this respect farm size may be related to access to information or credit that would facilitate the adoption of a recommendation. Thus the larger the farm size the higher the probability to adopt technologies. Therefore, the partial regression coefficient of farm size was expected to be positive.

(iii) Income: One would expect a rise in income to result in higher rate of adoption of technologies. This implies possession of sufficient income allows one to use or to adopt technologies especially if the technologies require an extra cash investment. In this regard, partial regression coefficient of income was expected to be positive.

(iv) Oxen: A farmer who has substantial number of oxen is likely to have adequate draft power. Availability of draft power implies timely land preparation and planting compared to his counterpart who plants late because of problems of draft power. On the other hand this facilitates the adoption of purchased technologies. Thus the higher the number of draft animals the higher the probability to adopt technologies. Therefore partial regression coefficient of number of oxen owned by a farmer was expected to be positive.

(v) Extension visit (contact): It was expected that VEW contact with farmers affect adoption positively. This is because farmers are exposed to new information, in addition to what they get from their surrounding.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter discusses the results under five sections as follows (i) factors associated with participation in the programme (ii) adoption of technologies and practices introduced by the programme (iii) reasons for the non-adoption of the recommended technologies as perceived by respondent farmers (iv) desire to adopt technologies by non-participants and (v) factors influencing adoption of the introduced technologies and practices.

4.1 Factors associated with participation in the programme

4.1.1 Farmers' characteristics

4.1.1.1 Gender

In many rural societies the social status of women is inferior to that of men. Due to this, it is difficult for the extension service to hold meetings or address female farmers. Also due to lack of ownership of resources such land and other assets, women can not afford some of the technologies recommended by extension and therefore lose interest in seeking further advice. The men who own the farm resources are also the decision makers who dictate when advice is required (Shayo, 1991). Georges (1961) in Boserup (1970) contended that "....Although the woman plays such an important role in agricultural production, the extension services never approach her, but always her husband or brother....". This shows that female farmers are discriminated against in terms of provision of extension services, despite their significant contribution to agricultural production. Table 1 indicates that for the past 3 years i.e., 1995, 1996, and 1997 women farmers who have participated in the programme were only 0.89%, 0.47%

and 0.28% respectively. The data, therefore, show that women were marginalised in the provision of extension services.

Table 1: Participant farmers by gender in the programme

Year	Male		Female		Total	
	N	%	N	%	N	%
1995	334	99.11	3	0.89	337	100
1996	1473	99.53	7	0.47	1480	100
1997	3518	99.72	10	0.28	3528	100

Source: Awassa district Bureau of Agriculture

4.1.1.2 Age

A farmer's age may influence adoption in one of several ways. Older farmers may have more experience, resources, or authority that would allow them more possibilities for trying a new technology. On the other hand, it may be that younger farmers are more likely to adopt a new technology, because they have had more schooling than the older generation or perhaps have been exposed to new ideas as migrant labourers (CIMMYT,1993). The results in Table 2 show that 19.2% of the respondents were young (18-31 years), while 65% were middle aged (32-45 years), and 15.8% were old aged (above 45 years). Here more proportion account for the middle age. On the other hand, according to the findings given in Table 2, the relationship between age and participation was not significant (Chi-square=6.37, DF=4, P=.17335). This indicates that participation in the programme is independent of age differences (P>.05), and that participation in the programme was not influenced by the age of the farmers.

Table 2: Age distribution of respondent farmers (N=120)

Age group	Participants		Non-participants		Total	
	N	%	N	%	N	%
Young	11	18.3	12	20	23	19.2
Middle age	37	61.7	41	68.3	78	65.0
Old age	12	20.0	7	11.7	19	15.8
X^2=6.36722 DF=4 Sign.=.17335						

4.1.1.3 Education level

Education may make a farmer more receptive to advice from an extension agency or more able to deal with technical recommendations that require a certain level of numeracy or literacy. The more complex the technology, the more likely it is that education will play a role (CIMMYT, 1993). Table 3 indicates that 8.4% of the respondents have gone to high school, 40.8% had primary education, 10.8% can read and write, the rest, 40%, have no education. According to the results in Table 3, there was no significant difference in the level of education between participants and non-participants (Chi-square=2.21, DF=4, P=.69732). The results show that participation was independent of the level of education of the farmers (P>.05).

Table 3: Distribution of respondent farmers by education level (N=120)

Education level	Participant		Non-participant		Total	
	N	%	N	%	N	%
Senior high school	3	5.0	1	1.7	4	3.4
Junior high school	3	5.0	3	5.0	6	5.0
Primary education	26	43.3	23	38.3	49	40.8
Read & write	5	8.3	8	13.3	13	10.8
Illiterate	23	38.3	25	41.7	48	40.0
X^2=2.21 DF=4 Sign.=.69732						

4.1.2 Economic factors

4.1.2.1 Farm size

The distribution of the respondents' farm sizes is given in Table 4. The Table indicates that 45% of the participants and 80% non-participants have a farm of 1 ha. or less. About 27% of participant and only 5% of non-participant farmers have a farm of more than 1.5 ha.

It can be observed that the level of participation increased with the level of farm size (Chi-square=21.95, DF=4, P=.00020). That is, the influence of farm size on participation of farmers in the programme was highly significant (P<.001). As it was mentioned earlier, farm size is often a good proxy for wealth. Therefore these findings

were in line with the assumption made by Levinger and Drahman (1980) that poor people generally lack confidence in their ability to improve their lives and hence also lack confidence in participation. One way of explaining this is that wealthier farmers can afford to take risks and try out technologies. They are thus more progressive and more likely to receive the support and services of extension agents. The challenge to change agents is thus: how should they involve the disadvantaged (poor) farmers in the development process.

Table 4: The distribution of respondent farmers by farm size (N=120)

Farm size (ha)	Participants		Non-participants		Total	
	N	%	N	%	N	%
Less or equal to 0.5	6	10	23	38.3	29	24.2
0.6-1.0	21	35	25	41.7	46	38.3
1.1-1.5	17	28.3	9	15.0	26	21.7
1.6-2.0	7	11.7	2	3.3	9	7.5
Above 2	9	15.0	1	1.7	10	8.3
X^2=21.95 DF=4 Sign.=.00020						

4.1.2.2 Oxen

Use of improved tools/implements in facilitating agricultural operations is known to contribute significantly to increased production. According to CIMMYT (1993), farmers who own draft animals or tractors can be more flexible in changing their tillage practices than farmers who must rent or borrow equipment. Table 5 shows that 66.6%

of the participant and only 16.6% of the non-participant farmers have 2 or more oxen, and about 52% of non-participants had no oxen. This shows that there was significant difference between participant and non-participant farmers on the possession of draft oxen (Chi-square=39.42, DF=3, P=.00000). The results indicate that those farmers involved in the programme have greater number of oxen than those not involved. Therefore participation was highly associated with the possession of draft animals (P<.001). When the findings are compared to the average number of oxen owned by the farmers in the region, it is the non-participants who represent the population. The number of non-participant farmers who have no oxen, 52%, was very near to region's average, of 54.68%, unlike the participants, which was only 6.7%. Similarly, participant farmers who have two and more oxen, 66.6%, was very much deviating from the regional average, which is 14.16%, but more or less equal with the non-participant farmers', 16.6%. From these results at least we can predict that, participant farmers represent few and well to do farmers. On the other hand, the findings also show that, even though, there was shortage of draft oxen in the area, the majority of farmers have developed the use of draft oxen for land preparation and weeding. The results in the study indicate that, almost all participant farmers (97%), and non-participant farmers (72%) use ox-plough either using their own oxen, hiring, or borrowing from neighbours or relatives. This is an indication of the tendency to give up small tools like the hand hoe.

Table 5: The distribution of respondents by possession of oxen (N=120)

Number of oxen possessed	Participants		Non-participants	
	N	%	N	%
None	4	6.7	31	51.7
Only one	16	26.7	19	31.7
Two	38	63.3	10	16.6
More than two	2	3.3	-	-

X^2=39.42
DF=3
Sign.=.00000

4.1.2.3 Income

The results in Table 6 show that about 88% of participant and only 8% non-participant farmers get an estimated annual income of above 2000 *birr*. This means that more than 90% of the non-participants get less than 2000 *birr*. Whereas in the case of participant farmers, 31.7%, 25%, 10% were getting in the ranges of 3001-4000 *birr*, 4000-5000 *birr* and above 5000 *birr* respectively. This shows that there was a big difference in income between the participant and non-participant farmers (Chi-square=79.26, DF=5, P=.00000), and that there was significant association between income and participation of farmers in the programme (P<.001).

Table 6: The distribution of respondents by estimated annual income (N=120)

Income level (*birr*)	Participants		Non-participants	
	N	%	N	%
Below 1000	3	5	31	51.7
1001-2000	4	6.6	24	40.0
2001-3000	13	21.7	4	6.7
3001-4000	19	31.7	1	1.6
4001-5000	15	25	-	-
Above 5000	6	10	-	-
X^2=9.26 DF=5 Sign=.00000				

4.1.3 Community prestige

Results in Table 7 indicate that 48.3% of participant and 31.7% non-participant farmers have been involved in the leadership of farmers organizations (peasant associations and service cooperatives). In addition, 60% of the participant and 41.7% of non-participant farmers have been involved in the leadership of different social committees. According to the results, involvement in the leadership of farmers organizations did not have a significant contribution to the participation in the programme (Chi-square=3.47, DF=1, P=.06241). This means that farmers participation in the programme was independent of involvement in the leadership of farmers organizations (P>.05). On the other hand, involvement in social committees has shown a slightly significant relationship to the participation of the programme (Chi-square=4.03, DF=1, P=.04458). This shows that farmers involvement in the social committees has influenced participation in the

programme (P<.05). The findings indicate that people who have leadership responsibilities in the community tend to participate more in community activities.

Table 7: Distribution of respondent farmers by involvement in the leadership of farmers organizations and social committees (N=120)

Respondents	Farmers' organizations				Social committees			
	Involved		Not involved		Involved		Not involved	
	N	%	N	%	N	%	N	%
Participant	29	48	31	52	36	60	24	40
Non-participant	19	32	41	68	25	42	35	58
X^2=3.47* 4.03**								
DF=1* 1**								
Sign.=.06241*								
Sign.=.04458**								

* participation in the leadership in farmers' organizations.
** participation in the social committees.

4.1.4 Institutional Factors

4.1.4.1 Extension service

For farmers to adopt a technology they must first know about it. For this, extension is the most important source of information. Farmers also obtain information from other sources including other farmers. Given that the extension service is charged with the responsibility of extending information on new technologies, their low rates of contact with farmers may be acting as a constraint to the use of these technologies.

As shown in Table 8 all participant farmers, 100%, have contact with extension workers out of these, 62% have frequent contact. Whereas in the case of non-participant farmers,

68% have contact with extension agents and out of these, only 32% have frequent contact. Therefore there was a big difference between participant and non-participant farmers in terms of contact frequency. Thus the results show that extension service has influenced farmers participation in the programme (Chi-square=22.57 and 32.45, DF=1 and 2, P=.00000 for contact with extension VEW and contact frequency respectively). Thus farmers in the programme had significantly more contact with extension workers than the non-participant farmers.

Table 8: Respondent farmers' contact with extension workers (N=120)

Respondents	Contact with extension workers				Contact frequency			
	Yes		No		Frequent		In frequent	
	N	%	N	%	N	%	N	%
Participants	60	100	-	-	37	62	23	38
Non-participants	41	68	19	32	12	32	29	68
X^2=22.57* 32.45**								
DF=1* 2**								
Sign.=.00000*								
Sign.=.00000**								

* Existence of contact.
** contact frequency.

Even though there was significant difference in the extension contact between participants and non-participants, all non-participants (100%) were aware of the programme (Table 9). This shows that knowing is often quite different from using a new idea. This is asserted by Dowse and Hugges (1972) cited in Kabwegyene and Migot-Adholla (1981) that participation is influenced by the availability of

opportunities and conditions conducive to participation. According to Rogers (1995), consideration of a new idea does not go beyond the knowledge function if an individual does not define the information as relevant to his or her situation or if sufficient knowledge is not obtained to become adequately informed so that persuasion can take place. This is confirmed by the study. Table 9 shows that almost all participant farmers (98.3%) were given hands-on or practical field training by the programme, whereas, it is only 8.3% of the non-participant farmers who were involved in practical training.

Table 9: Respondent farmers awareness of the programme and involvement in the practical training (N=120)

Respondents	Who have awareness of the programme		Who were involved in the practical training	
	N	%	N	%
Participants	60	100	59	98.3
Non-participants	60	100	5	8.3

The findings in Table 10 indicate that about 84% of respondent extension workers agreed that the programme has closer supervision. They were also of the opinion that the programme uses both top-down and bottom-up approaches, at the same time. On the other hand all extension workers in the study replied that they were not involved in the package development, and it was agreed by 90.3% of the respondent extension workers that the package development in the future should be at zone and woreda level with technical assistance from the region, to increase participation at grassroots level.

Table 10: Opinion of respondent extension workers on the approach of the programme (N=31)

Approach	Opinion (%)		
	Agree	Disagree	Not decided
The programme has close supervision	83.9	16.1	-
The programme has top-down approach	45.2	51.6	3.2
Packages should be prepared at zone and woreda level	90.3	6.5	3.2

4.1.4.2 Credit

The low level of investment in the rural communities results mainly from lack of credit which should have been directed to the agricultural sector in order to tap development opportunities. According to SG 2000 (1995), the adoption of productivity-enhancing technologies will benefit from increased accessibility of credit to the rural sector.

In the study as indicated in Table 11, 90% of the participant farmers have obtained credit for input purchase, whereas none of the non-participant farmers have obtained any credit. Farmers in the study area have no other alternative to obtain credit apart from the programme. As mentioned earlier, credit is given only to those who have accepted to implement the whole package. This indicates that farmers who have reservations on any component of the package, will be deprived of the benefit of the credit service. The results in Table 11 also show that there was a highly significant difference in credit service between participant and non participant farmers (X^2=94.29,

DF=1, P=.00000). This indicates that the mere provision of credit worked as a motivation for farmers to adopt the whole package. This shows how important the credit was for the adoption of the recommended technologies.

Table 11: Distribution of respondents by access to credit (N=120)

Respondents	Obtained credit			
	Yes		No	
	N	%	N	%
Participant	54	90	6	10
Non-participant	-	-	60	100
X^2=94.29 DF=1 Sign.=.00000				

However Benad (1988), and Mvena and Mattee (1988), commented that not all farmers adopt a complete package at once. Benad (1988) further argued that if some parts of a technology are accepted and others rejected, then the reasons for rejection have to be traced in the characteristics of the technology rather than farmers' attitudes. This conforms with CIMMYT (1993) assertion that, although recommendations may be presented to farmers as a package of several practices some components may be adopted first and others later; and some may never find widespread acceptance. It should be borne in mind that individual components may be adopted at different times under different conditions.

On the other hand, Table 12 indicates that among participant respondent farmers, only 30% have extended the full package to other parts of their farm. About 57% have used part of the package on other plots, and among these only 11.7% and 3.3% have extended chemical fertilizers and pesticides respectively. None of the participant farmers have extended improved maize varieties to additional land other than the demonstration plots. This might be due to either the farmers using improved maize varieties in order to be included in the package, or improved maize seed was only available for the programme. In the study, about 77% of extension workers commented that, one of the reasons for non-adoption of improved maize varieties was fear of risk due to new varieties (not known before in the area) and also due to inferior seed qualities. This was also mentioned by the non-participant farmers. Table 13 shows that 53.4% of respondents have not accepted inputs on credit because of fear of risk due to lack of trust on the quality of the new varieties and 26.7% also fear risk due to bad weather. The other reasons given are shortage of land (those who do not meet the land size required by the programme), lack of knowledge and due to inability to afford the necessary downpayment.

Table 12: Adoption of technologies by respondent participant farmers on other additional land area (N=60)

Technologies	Respondents	
	N	%
Full package	18	30
Improved maize varieties	-	-
Chemical fertilizers	7	11.7
Pesticides	2	3.3
Proper seed bed preparation	35	58.3
Line planting	35	58.3
Proper spacing	35	58.3
Timely weeding	35	58.3

Therefore the findings show that, it is possible that farmers are merely initiated to use improved maize varieties by credit motivation. Thus, in this respect a lot should be done to convince farmers on the advantages of improved seeds.

Table 13: Reasons for not being in the credit scheme (non-participants) (N=60)

Reasons	Respondents	
	N	%
Lack of awareness of credit	2	3.3
Unable to pay downpayment	2	3.3
Afraid of risk due to new varieties	32	53.4
Afraid of risk due to bad weather	16	26.7
Shortage of land	8	13.3
Total	60	100

The process of providing credit to farmers by the programme involves the VEW in its delivery and recovery. Although this is a better way of integrating the extension staff with farmers, Axinn and Thorat (1972) argued that the involvement of extension staff in regulatory activities reduces their time to concentrate on their basic role of the dissemination of knowledge and training of farmers on which they are employed. Foster (1993) based on his experience, contended that extension workers should not deal with credit and input distribution operations directly. In this study, it was determined that there was difficulty of loan collection and the risk of non-repayment. Table 14 shows that 74.2% of the extension workers indicated that the state of repayment was bad, 6.5% have said that it was fair and 19.4% have mentioned that the repayment was good. This shows that the repayment process has problems.

Table 14: Loan recovery condition in the programme as perceived by respondent extension workers (N=31)

Condition of repayment	Respondent extension workers	
	N	%
Good	6	19.4
Fair	2	6.5
Bad	23	74.2
Total	31	100

The reasons given by extension workers for the problem in the repayment are first, the schedule for loan recovery does not coincide with the time farmers sell their produce, i.e., they are asked to repay at the time when the price for maize is very low; secondly, crop failure due to bad weather and some inferior quality seeds; thirdly, past bad experience of the farmers, i.e; in most cases, farmers who were taking inputs on credit, in the past, were not fulfilling their obligation to repay their debt. This is due to the expectation that the government would cancel the debt. Because of this even if they have enough money they were reluctant to repay. The last reason is lack of well developed mechanism for loan collection. There is no well designed provision of credit and collection of repayment. It is up to the extension workers to provide inputs on credit and to collect the repayment. Thus in the extension workers' opinion, loan collection should not be done by extension agents, rather, it should be handled by service cooperatives and rural credit institutions. For this, service cooperatives should be strengthened and rural credit institutions need to be established. However for immediate solution, as suggested by the extension workers, provision of credit and repayment

collection should be done either by local administration or by other MOA workers who do not have direct link with the extension activities.

On the other hand, concerning the repayment for those farmers whose crop fail due to weather conditions, about 93% of the respondent extension workers suggested that, the duration for payment should be extended without additional interest and at the same time they should be provided with another loan for the coming production season without down payment so that they can pay their debt.

4.1.4.3 Availability of production inputs

An extension approach that relies mainly on transfer of messages or information cannot by itself provide enough basis for adoption (Quinones and Takele, 1996). In line with this, the programme makes production inputs physically available to participant farmers. According to the findings, about 65% of respondent extension workers believed that one of the reasons for participation in the programme and accelerated adoption of technologies was making inputs available up to the farm gate. Here, since inputs provision is done on credit basis, the distribution of inputs is performed by extension workers. However, as perceived by respondent extension workers, input distribution by extension workers has negative impact on the time of extension work. Table 15 indicates that about 81% of extension workers did not agree with the involvement of extension workers in input distribution, and those who agreed with the involvement, had doubt on its sustainability. The reason given for this is that, when the programme expands in future, the amount of inputs to be distributed will increase, and this will be hard to manage by extension workers. For this the solutions suggested by

the respondent extension workers are: (i) to involve widely the private sector and service cooperatives, and (ii), to open additional sales centers in the remote rural areas by parastatals.

Table 15: Opinion of respondent extension workers on their involvement in input distribution (N=31)

Opinion scale	Response	
	N	%
Acceptable	6	19.4
Not acceptable	25	80.6
Undecided	-	-
Total	31	100

4.2 Adoption of technologies and practices introduced by the programme

The need for technological changes originates in the minds of people who are not satisfied with the status quo and who strive for better alternatives to existing situation (Office of Planning, Ethiopia, 1989). According to the Planning Office (1989), these changes may be developed in an organized set up or through informal structures that involve trial and error approaches.

The innovation-decision process can lead to either adoption, a decision to make full use of a technology as the best course of action available, or to rejection, a decision not to adopt a technology (Rogers, 1995). According to this study, adoption of technologies and practices is defined as using the practice on quarter of a hectare of improved maize

seed, chemical fertilizers and improved cultural practices, and any amount for pesticides, for the year 1997.

For comparison between participant and non-participant farmers, the study focused on each component of the package, bearing in mind that individual components may or may not be adopted under different conditions. Here, respondents were asked to indicate whether or not they used each component of the package.

The package included:

(i) use of improved maize seed: such as A-511, Beletch, Alemaya composite, BH-140, BH-660, CG 4141, Phb-3435, Phb-3253.

(ii) use of chemical fertilizers: DAP and UREA.

(iii) use of pesticides: such as symbush and actelic 2%.

(iv) improved cultural practices:

-proper seed bed preparation

-row planting

-proper spacing

-timely weeding

4.2.1 Improved maize varieties

Improved seed is among the major requirements to increase farm productivity. The results in Table 16 show that of the sampled farmers, 90% of the participant and only 3.3% of the non-participant farmers have adopted improved maize varieties. That

means about 97% of the non-participant farmers have not adopted. The results indicate that participation in the programme is highly associated/related to the adoption of improved maize varieties (X^2=90.54, DF=1, P=.00000). On the other hand participation, as already seen before, was highly associated with farmers income and land size. Thus, this shows a strong relationship of income and farm size with adoption of improved maize varieties.

Table 16: Adoption of improved maize varieties (N=120)

Respondents	Adopted		Not adopted	
	N	%	N	%
Participants	54	90	6	10
Non-participants	2	3.3	58	96.7
X^2=90.54 df=1 Sign.=.00000				

In addition to this explanation, an assessement of the history of first use of improved maize varieties in the study area indicates that more than 60% of the participant farmers were using improved varieties before the programme whereas, none of the non-participant farmers were using improved maize varieties. This asserts that once a farmer begins using the technology, he or she will keep using it (CIMMYT, 1993). This implies that improved varieties were being perceived as better than the local varieties by participating farmers, which is a reflection its relative advantage.

The programme success is measured by increased yield in the demonstration plots when compared to yields in other plots. About 97% of the participating farmers who have used improved varieties together with fertilizers and improved cultural practices have responded that, they have got 2–4 fold yield increment compared to previous levels. This was agreed by all respondent extension workers and non-participant farmers too. According to the extension workers' perception, one of the reasons for farmers to be attracted to the programme and also to continue to use the technologies was due to yield increment per unit area. Thus these findings are in line with what was observed by Dr. S.A. Knapp, (Quoted by Dowswell, 1994), "What farmers hear they often disbelieve, what they see on someone else's land they may also doubt; but what they do themselves they can not deny."

4.2.2 Chemical fertilizers

Fragility of the soil and incorrect soil fertility management are the main limiting factors constraining agricultural production. To increase agricultural production requires an expansion of a rational consumption of fertilizers by an increased number of farmers (SG 2000, 1995). In the study, almost all (96.7%) participant farmers and 56.7% of non-participant farmers have adopted chemical fertilizers (see Table 17). Before the initiation of the programme, 88.3% of the participant and 60% of the non-participant respondent farmers were using chemical fertilizers. Here, unlike the improved seed, there was no big difference between participant and non-participant farmers in the adoption of chemical fertilizers. Even on the participants side there was no significant difference in the adoption of chemical fertilizers before and after the programme. This

shows that, farmers in Awassa district were aware of the advantage of chemical fertilizers even before the programme.

Table 17: Distribution of respondent farmers' use of chemical fertilizers (N=120)

Respondents	Adopted		Not adopted	
	N	%	N	%
Participants	58	96.7	2	3.3
Non-participants	34	56.7	26	43.3
Total	92	76.7	28	23.3

As indicated in Table 18, 95% of the participant farmers were using both DAP and UREA, but on the non-participants side only 47% were using both fertilizers. Fifty percent of the non-participants were using only DAP. This means that, there was a difference between participant and non-participant farmers in the use of chemical fertilizers according to the recommendation. This shows that DAP is relatively better known than UREA in the study area. On the other side it can be asssumed that, the programme introduced and facilitated the adoption of UREA fertilizer which was not well known by the farmers before the programme.

Table 18: Distribution of respondents by type of fertilizers used (N=92)

Respondents	Fertilizer type					
	DAP		UREA		Both	
	N	%	N	%	N	%
Participants	3	5	-	-	55	95
Non-participants	17	50	1	3	16	47
X^2=58.79 DF=1 Sign.=.00000						

Therefore results in Table 18 show that, there was significant difference between participant and non-participant farmers on the adoption of chemical fertilizers according to the recommendation (X^2=58.79, DF=1, P=.00000). This indicates that the programme has succeded in introducing proper use of fertilizers.

4.2.3 Pesticides

All sampled farmers have responded that pests are a serious problem in their area. Stalk borer, aphids, and cutworm are the major pests. Table 19 shows that 79.3% of the participant and only 21.7% of the non-participant farmers have used pesticides to control pests, i.e. 78.3% of the non-participants did not use pesticides. This shows that there was a big difference in the adoption of pesticides between the participants and non-participants (X^2=41.22, DF=2, P=.00000).

Table 19: Distribution of use of pesticides (N=118)

Respondents	Adopted		Not adopted	
	N	%	N	%
Participants	46	79.3	12	20.7
Non-participants	13	21.7	47	78.3
X^2=41.22 DF=2 Sign.=.00000				

4.2.4 Cultural practices

All sampled participant farmers have adopted the recommended cultural practices namely, proper seed bed preparation, row planting, proper spacing and timely weeding, whereas in the case of non-participant farmers, proper seed bed preparation, row planting and timely weeding were adopted by 66.7%, 66.7% and 68.3% respectively. This shows that there was significant variation in the adoption of improved cultural practices between participant and non-participant farmers. In the case of proper spacing, 96.7% of the non participants have not adopted the recommended optimum spacing, which gave very high significant difference between participant and non-participant farmers (X^2=112.26, DF=1 and P=.00000).

It has been found that the adoption of these cultural practices, are directly related to the use of ox-plough by the farmers. As stated earlier, all participating farmers, and 72% of the non-participant farmers are using the ox-plough. Therefore the difference seen in the use of ox-plough contributes to the variation in the adoption of improved cultural

practices. Also the other explanation for this is that, since improved cultural practices are part of the package, farmers in the programme are obliged to follow, whereas, on the non-participants side it is up to them to accept or to reject. This is for those who have the knowledge and skill. This means that, apart from their decision to use or not to use, information about the technology is very essential for its adoption.

Table 20: Distribution of respondent farmers according to adoption of improved cultural practices (N=120)

Cultural practices	Adopted				Not adopted			
	Participa nts		Non-participants		Participants		Non-participants	
	N	%	N	%	N	%	N	%
Proper seed bed preparation	60	100	40	67	-	-	20	33
Row planting	60	100	40	67	-	-	20	33
Proper spacing	60	100	2	3	-	-	58	97
Timely weeding	60	100	41	68	-	-	19	32

4.3 Reasons for the non-adoption of the recommended technologies as perceived by respondent farmers

If diffusion scholars could more adequately see an innovation through the eyes of their respondents, including a better understanding of why the technology was adopted or rejected, diffusion research would be in a better position to shed the pro-innovation bias of the past (Rogers, 1995). In accordance with this, Eveland (1979) suggested that, if the researcher is to understand farmers' behaviour in adopting or rejecting the

technology, the researcher must be capable of taking their various points of view. Further he contended that, simply to regard adoption of the technology as rational and to classify rejection as wrong or stupid is to fail to understand that individual innovation-decisions are idiosyncratic and particularistic. They are based on the individuals' perceptions of the technology. CIMMYT (1993), asserted that farmers usually know what they like and what they do not like about a new technology and are able to express their opinions; and these opinions will reflect their own experience. According to the study, participation of farmers in the programme was highly associated with adoption of the introduced technologies. Therefore since participation and adoption of technologies were related, the reasons for the non-adoption of technologies more or less apply to non-participation in the programme. Thus the major reasons for non-adoption of recommended technologies are fear of risk, high input costs, lack of money and lack of knowledge or experience on improved practices.

Table 21: Opinion of respondent farmers for non-adoption of technologies

Reasons	Improved seed		Fertilizers		Pesticides	
	N	%	N	%	N	%
Fear of risk	30	46.9	-	-	-	-
Expensive	9	14.1	12	42.9	59	100
Lack of money	3	4.7	12	42.9	-	-
Shortage of land	15	23.4	-	-	-	-
Lack of knowledge	7	10.9	4	14.2	-	-
Total	64	100	28	100	59	100

(i) Risk

The failure of a new technology to be accepted is sometimes attributed to risk aversion on the part of farmers. Risk avoidance is an important economic objective of most farmers. Cromwell and Wiggins (1993), stress that the aversion small farmers feel towards risk should not be regarded as a sign of conservatism. Ellis (1988), and Mvena (1992), observed that risk avoidance attitude is a major reason which makes low income farmers avoid adoption of technology which they can afford.

Risk-avoiding techniques are normally associated with active farmers' experimentation. Table 21 shows that about 47% of the respondent farmers did not adopt improved seed due to fear of risk. It was also confirmed by 77% of the respondent extension workers that, the reason for the non-adoption of improved maize varieties was due to fear of risk. The reasons for perceiving improved varieties as risky was that, some maize varieties are new and also have not been tried/experimented with specifically in a given area, and even for some that are not new for the area, looking at the past performance, they might not be better than the local ones. In addition to this, most improved seeds have a lot of impurities and broken seeds. It was also observed by respondent extension workers that some of the distributed maize varieties have inferior qualities and some were also quite new to the area. Due to this, about 83% of the respondents were calling for improvement of seed quality by intensive seed test before distribution to farmers. It was also commented that packaging of improved seeds should be done in small amounts, so

that the small farmers are able to buy in the amount that fits their farm size and by the amount of money they can afford to spend.

(ii) Cost of technology

The cost of technology is a major constraint to its adoption. Technologies which require little cash outlay are easily taken up by farmers. Table 21 indicates that due to high cost, about 14%, 43% and 100% of respondents have not adopted improved seed, chemical fertilizers and pesticides respectively. On the other hand, as shown on Table 22, improved seed, chemical fertilizers and pesticides costs have been perceived as expensive by 76.7%, 91.6% and 67.5% of the respondents respectively. In addition to this, about 58% of the respondent extension workers have indicated that one of the reasons for the non-adoption of technologies was the high cost of inputs. Specifically in the case of pesticides, 58% of the respondent extension workers indicated that pesticides are not easily available, and 84% reported that the packaging size was not proper. Therefore, one of the reasons for non-adoption of technologies was that, technologies were either not available or they were sold only in much larger quantities than a small farmer could use or afford.

Table 22: Opinion of respondent farmers on the cost of technologies (N=120)

Cost of inputs	Improved seed		Fertilizers		Pesticides	
	N	%	N	%	N	%
Expensive	92	76.7	110	91.6	81	67.5
Reasonable	11	9.17	5	4.2	21	17.5
Cheap	-	-	-	-	2	1.7
Don't know	17	14.17	5	4.2	16	13.3
Total	120	100	120	100	120	100

(iii) Lack of money

It is often assumed that larger-scale farmers will be more likely to adopt a technology, especially if the technology requires an extra cash investment (CIMMYT, 1993). Table 21 shows that about 43% of the respondents did not use chemical fertilizers due to lack of money.

(iv) Lack of knowledge

Some farmers lack adequate knowledge and insight to recognize their problems, to think of a possible solution, or to select the most appropriate solution to achieve their goals. Their knowledge also may be based on incorrect information because of limited experience, upbringing or other cultural factors (Van den Ban, 1996).

For farmers to adopt a technology they must first know about it. Thus Table 21 shows that about 11% and 14% of respondents did not adopt improved seed and fertilizers respectively, due to lack of knowledge or experience of the improved practices.

4.4 Desire to adopt technologies by non-participants/non-adopters

According to Rogers (1995), adoption may be both an economic necessity for the late majority, and the result of increasing network pressure from peers. He contended that the pressure of peers is necessary to motivate adoption. Further he asserted that their relatively scarce resources mean that most of the uncertainty about a new idea must be removed before the late majority feel that it is safe to adopt. In line with this, as it was discussed earlier, farmers in the programme have reported a 2–4 fold increment over the yield obtained by traditional practices. This increase in yield has created positive attitude among non-participants. In this study, all respondents, including non-participants agreed that income of participant farmers has increased. Consequently, 83.3% of the non-participant farmers showed their agreement to join the programme in the coming production season. The reasons given for the desire to join in the programme by non-participant respondent farmers were:

(i) yield increment compared to the traditional one (48%);

(ii) due to the change of the minimum required farm size, (10%), (previously it was half a hectare, now it is also possible to join the programme with less than half a hectare);

(iii) being convinced that the introduced improved maize varieties are superior than the local ones (14%);

(iv) due to both yield increment and change in the required land size, (16%); and

(v) due to both, change made in the minimum required farm size and change in the attitude on the new maize varieties, (12%).

From this we can derive that:

(i) yield increment was the major motivation to want to participate in the programme;

(ii) farm size was one of the major constraints, which hindered participation in the programme and;

(iii) non-participant farmers were having doubts on the performance and quality of the new maize varieties.

4.5 Factors influencing adoption of the introduced technologies and practices

One way of assessing adoption is to look at those factors that influence the adoption rate of technologies. In this study multiple regression was used to examine the relationship between identified independent variables and adoption of individual package components, namely improved maize varieties, chemical fertilizers (DAP and UREA) pesticides and improved cultural practices. Factors identified and investigated as independent variables are land size, estimated annual income, contact with extension workers and credit. However, the number and type of independent variables vary with each dependent variables (adoption of individual technologies).

As earlier mentioned, the number and type of identified factors for each dependent variables were selected on the basis of:

(i) significance of the relation with the dependent variables and; (ii) according to coefficient of determination (R^2), i.e., the proportion explained by a given dependent variable.

Table 23: Regression of identified factors on adoption of improved maize varieties

Independent variables	B	SE	Beta	Sign.-t
Credit	.878144	.039802	.877041	.0000
Farm size	.023461	.014985	.054996	.1202
Contact with VEW	.032088	.042590	.023480	.4527
Annual income	.038515	.014655	.119793	.0098
Constant	-.076087	.083004		.3612

R^2=.90861
Adj.R^2=.90543
F-statistic $F_{4,115}$=285.84437
B=Unstandardized partial regression coefficient
SE=Standard error
Beta=Standardized partial regression coefficient

Results in Table 23 show that the four independent variables account for 90.5% (adjusted R^2=.90543) of the variation to adoption of improved seed. Thus only 9.5% of the variance remains unexplained. The critical value for 4 and 115 degrees of freedom at .001 significant level is 4.95. Since the observed F- value of 285.84 far exceeds the tabulated 4.95 the coefficient of determination (R^2) is significant with little chance of being wrong. Therefore, these results indicate that the combined effect of the respondent's farm size, annual income, contact with extension workers and provision of inputs on credit contributed significantly to the variation in the adoption of maize improved seed.

The results also show that provision of credit and annual income have significant partial regression coefficients at .001 and .05 level of significance respectively. Provision of

credit was the highest predictor of adoption of maize improved varieties (beta of .87704 and unstandardized regression coefficient (B) of .878144). This indicates that a unit change of the provision of credit accounts for about 87.8% change in the adoption of improved maize varieties within the explained variation (Adjusted R^2 = 90.5%). On the other hand, annual income contributed about 12% (standardized coefficient of .119793) on the variation of adoption of improved maize varieties. Here, in the case of combined effect of the four independent variables, as shown in the Table 23, respondents' farm size and contact with extension workers did not have significant contribution to the adoption of improved maize varieties which was having standardized coefficients of .054996 and .023480 respectively.

Table 24: Regression of respondent farmers' land size and contact with extension workers on adoption of improved maize varieties

Independent variables	B	SE	Beta	Sign. -t
Farm size	.134044	.037281	.314226	.0005
Contact with VEW	.554455	.114988	.405714	.0000
Constant	1.047423	.142004		.0000
	.891089*	.139652*		.0000*
$R^{2=}$.09874, .16460*				
Adj. R^2=.09110, .15752*				
F-statistics $F_{1,118}$=12.92751, 23.25037*				

* refers to the results of contact with extension workers.

On the other hand, Table 24 shows the individual effect of farm size and contact with extension workers whereby 9.11% variation of the adoption of improved maize

varieties is accounted for by land size and 15.75% accounted for by contact with extension workers with a standardized coefficients of .314226 and .405714 respectively, by which both of them were significant at .001 significance level for adjusted R^2 of .09110 and .15752 for farm size and contact with extension workers respectively.

According to the results, the effect of farm size and contact with extension workers compared to supply of improved maize varieties on credit basis was very minimal, however, they have significant influence on the proportion they covary with the adoption of improved maize varieties.

The positive regression coefficient for farm size implies that an increase in farm size leads to increase in adoption. Farmers with large farms are more likely to adopt improved maize varieties than farmers with smaller farms. This holds true for extension service. The results confirmed CIMMYT's (1993) assertion that, given the extension service is charged with the responsibility of extending information on new technologies, their low level of contact with farmers may be acting as a constraint to the use of improved technology. Therefore, from these findings, improved maize varieties was in most cases adopted merely due to provision of inputs on credit basis by the programme. Thus, credit has either of the following consequences:

(i) it has the power to obligate farmers to use technologies as a package, no matter how and to what extent farmers were convinced in applying the individual components in the package and;

(ii) it has also the role to motivate farmers, in that, it encourages farmers to decide to adopt the technology, even if they have some reservation.

Table 25: Regression of identified factors on adoption of chemical fertilizers

Independent variables	B	SE	Beta	Sign.-t
Credit	.588607	.089984	.600832	.0000
Land size	.033488	.034391	.080233	.3322
Contact with VEW	.253395	.094242	.189507	.0082
Oxen	.030348	.044916	.056182	.5006
Annual income	.012806	.033261	.040708	.7009
Constant	-.082800	.309603		.7896

R^2=.53667
Adj.R^2=.51635
F-statistics $F_{5,114}$ =26.40937

Multiple regression results in Table 25 show that five selected independent variables account for 51.6% (Adjusted R^2=.51635) for the variation in the adoption of chemical fertilizers. Provision of chemical fertilizers on credit was the highest predictor (standardized partial regression coefficient of .600832, significant at .0000 and unstandardized partial regression coefficient of .588607). However, compared to the effect on adoption of improved maize varieties credit has a smaller influence on the adoption of chemical fertilizers. This shows that even in the absence of credit, farmers have adopted chemical fertilizers. This can be justified by comparing the adoption rate of improved maize varieties and chemical fertilizers by respondent non-participant farmers, i.e., farmers who didn't take credit from any institution. Table 16 and 17 show that, 3.3% and 56.7% of the respondent non-participant farmers have adopted improved maize varieties and chemical fertilizers respectively.

According to the study, contribution of income on the adoption of chemical fertilizers was very small (standardized regression coefficient of .040708 not significant at .05 level of significance). This indicates that even farmers with lower income were using chemical fertilizers on their small maize plots. This is why respondents' farm size was also not significant in the adoption of chemical fertilizers (standardized regression coefficient of .080233, not significant at .05 level of significance). When the distribution of adoption of chemical fertilizers by income is examined, 38 farmers, 41%, of the respondents who used chemical fertilizers were in the annual income category of less than 2000 *birr*. On the other hand, 54 farmers, about 60% of the farmers who used chemical fertilizers, have a land size of less than 1 hectare. This also holds true for the influence of possession of oxen on the adoption of chemical fertilizers (standardized regression coefficient of .056182 which is not significant at .05 level of significance). On examining the distribution of number of oxen by adoption of chemical fertilizers, about 22% of the farmers who adopted fertilizers have no oxen and 28% have only one ox, which together account for 48% of the farmers who adopted chemical fertilizers. Here it can be observed that even though land size, annual income and possession of oxen are positively related and have a sort of influence on the adoption of chemical fertilizers, according to the study they were not the limiting factors for the adoption.

On the other hand next to credit, the highest predictor on the adoption of chemical fertilizers was respondents' contact with extension workers (standardized regression coefficient .189507 significant ($p<.01$) and unstandardized regression coefficient of .253395). Compared to the adoption of improved maize varieties agricultural extension

has had more influence on the adoption of chemical fertilizers. Considering the ratio of respondents who have adopted improved maize varieties and chemical fertilizers to the total respondents, they were 47.7% and 76.67% respectively. Thus keeping other independent variables constant, extension activities were more successful in the introduction of chemical fertilizers than improved maize varieties.

Table 26: Regression of identified factors on adoption of pesticides

Independent variables	B	SE	Beta	Sign.-t
Credit	.258461	.118935	.242205	.0318
Farm size	.078152	.045455	.171897	.0883
Contact with VEW	.204067	.124563	.140107	.1041
Oxen	.035321	.059367	.060030	.5530
Annual income	.045083	.043963	.131566	.3073
Constant	.230691	.209340		.2728

R^2=.31782
Adj.R^2=.28790
F-statistics $F_{5,114}$ (for R^2)=10.62251

Results in Table 26 show that the five identified factors account for only about 28.8% (adjusted R^2=.2879) of the variation to adoption of pesticides, i.e, about 71.2% of the variation was being attributed by other external factors. Thus 71.2% of the variance remains unexplained.

The observed F-value with 5 and 114 degrees of freedom is 10.62, which when compared to the critical value, 4.42, is significant at .001 level. Thus, the results indicate

that the combined effect of credit, land size, income, number of oxen owned by respondents and contact with extension workers contributed significantly (R^2=.2879) to the variation in the adoption of pesticides. In addition to this, all the five independent variables were positively related to the adoption of pesticides. This means that for an increase of a unit of the independent variables there was an increase in the rate of adoption of pesticides. However, as it can be observed in Table 26, the influence of each factor on the rate of adoption of pesticides varies. Here, among the independent variables, only two, credit and farm size, were significant at .05 significance level (standardized partial regression coefficients of .242205 and .171897 respectively). Like the influence on improved maize varieties and chemical fertilizers, credit was the highest predictor in the adoption of pesticides, but the influence was very much lower than for the other inputs.

From the findings in the study, it is clear that, there are other more influential factors in the adoption of pesticides but which were not included in the study. This was the reason why the large proportion, 71.2%, was unexplained by the identified factors.

Table 27: Regression of identified factors on the adoption of improved cultural practices

Cultural practices	R^2	DF	F-value	F-test
Proper seedbed preparation	.41055	5,114	14.81	.0000
Line planting	.08308	5,114	2.80	.0142
Proper spacing	.78396	5,114	87.36	.0000
Timely weeding	.28491	5,114	10.48	.0000

Results of the investigation indicate that the five selected independent variables,(credit, farm size, contact with VEW, number of oxen owned by respondents and annual income), account for 41.06%, 8.3%, 78.4% and 28.49% for the variation in the adoption of proper seedbed preparation, line planting, proper spacing and timely weeding respectively. Among the practices, line planting was the least to be explained by the identified factors (91.7% was unexplained). Therefore, the influence of the identified factors on adoption of line planting was very limited.

In proper seedbed preparation, contact with VEW and number of oxen owned by respondents were significant at .01 and .001 significance level respectively (standardized partial regression coefficient of .238889 and .495825 respectively). Thus, number of oxen owned by respondents was the highest predictor for the adoption of seedbed preparation.

Regarding the adoption of proper spacing, credit (P<.001), income (P<.001), and contact with extension workers (P<.05) have had significant influence (standardized partial regression coefficient of .608351, -.308290 and .091295 respectively). Here the highest predictor on adoption of proper spacing was credit.

On the other hand, on the adoption of timely weeding only contact with extension workers (P<.001), was significant (standardized partial regression coefficient of .390692).

From this we can deduce that unlike those technologies which need cash, (improved maize varieties, chemical fertilizers and pesticides), credit was not having a big role in adoption of cultural practices, except for proper spacing, which is, infact highly associated with improved maize varieties. Rather, extension service or contact with extension workers was more influential in the adoption of improved cultural practices.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study examined several factors that were thought to have relation with participation in the National Extension Intervention Programme and adoption of the introduced technologies and practices. According to the findings, essential conditions and opportunities were diagnosed as follows:

1) Participation in the programme and adoption of the introduced technologies were influenced dominantly by economic factors (farm size, number of draft oxen possessed by the farmers and annual income), and institutional factors (credit and extension service). Findings from the study have shown that people with more resources have participated and then adopted the introduced technologies more than those with less resources. Thus it was found that, the targeted poor farmers were not involved in the programme as it was expected.

2) The study showed that credit was the most influential factor in the adoption of purchased technologies (improved maize varieties, chemical fertilizers and pesticides). It was also found that, credit is highly associated with farmers involvement in the programme.

3) The findings have shown that, extension service is highly associated with participation in the programme. This means that there was a big difference in the rendering of extension services between participant and non-participant

farmers. And it was also observed that extension service has had great influence on adoption of the introduced technologies.

4) It was found that factors which accelerated the adoption of the introduced technologies, according to the perceptions' of respondent participant farmers and extension workers, were:

(i) Provision of inputs on credit. From the findings we can conclude that, credit was having a dual purpose first, for farmers it was a means to acquire the technologies, in case it was not possible to purchase on cash, and secondly, it also served as an incentive for farmers to adopt new technologies. That is why, inspite of some reservations on the quality of the seed for improved maize varieties, on the participant farmers side, they continue to use it.

(ii) Yield increment. The programme success is measured by increased yield in the demonstration plots compared to yields in other plots. From the findings, it has been observed that, the programme was successful in showing the possibility to increase yield per unit area. And it was found that, the most effective way of extension is demonstration in farmers' own field.

(iii) Supply of inputs up to the farm gate. Lack of reliable input distribution centers is one of the hindrances to agricultural development. Farmers are forced to travel long distances to town centers to buy some required inputs. This consumes much of their time that they would have used to work in the farms. It also increases the costs of such inputs because of the added expenses on transport and sometimes lodging. In the study it was indicated that inputs were provided by the programme up to the farm gate. And this accelerated the

adoption of the introduced technologies. However it was observed that, farmers are made to believe that the programme is a supplier of inputs for a long time. Therefore, the programme withdrawal is likely leave an input supply gap that may jeopardise the continued use of inputs.

5) The main reasons for non-adoption of technologies as perceived by respondent non-participant farmers and extension workers were:

(i) Fear of risk. It was found that the highest risk aversion was with respect to improved maize varieties.

(ii) High inputs cost. The cost of inputs was a major constraint to their adoption. As it was observed in the study, most of the non-participant respondent farmers were aware of the usefulness of the technologies, however, inputs were not sold at a price the poor farmers could afford.

(iii) Land shortage. In the study it was found that, farm size was a determinant factor for adoption of newly introduced technologies. This is because, in most cases, risk aversion goes with wealth of the farmer, and farm size is a good proxy for wealth. Therefore it was observed that, it is the larger farmers, with a larger farm size, who adopted the new technologies.

6) Involvement of extension workers in non-extension activities such as inputs distribution or credit arrangement interfere with the professionalism of extension services. It affects the performance of extension workers negatively. It was found that, in the programme, inputs distribution and credit supply are managed by extension workers. As to the perceptions of respondent extension

workers in the study, using extension workers for loan collection as they are in closest contact with the farmers has not proved successful, for two main reasons. Firstly, the incidence of misappropriation of the collected money, which has already happened in some parts of the region (Simayehu, T. personal communication, 1998). Secondly and the most important is, the concentration of extension service and loan collection in one person which tends to affect the good relations between the extension worker and the farmer, which is essential for successful extension work.

On the other hand regarding inputs distribution, government bureaucracies are often not very efficient at distributing inputs. This inefficiency may create serious problems for the farmers; for example, the inputs may not be available on time. Since the extension agents are responsible for this distribution, they are likely to lose the farmers' trust, and hence their effectiveness.

7) The programme recruits farmers irrespective of gender. However, the results in the study have shown that, almost all beneficiaries of the programme were males. This could be in line with the observation that information about new technologies developed in agricultural programmes tends to be communicated only through male information networks (Keregero and Biswalo, 1991). This affects women's level of involvement in development activities.

5.2 Recommendations

This section provides recommendations based on the conclusions from this study. In order to improve the performance of the National Extension Intervention Programme in the country, and to improve the adoption level of technologies, it is worth considering the following recommendations.

1) In the study it was realized that the role of the extension service is very important in the technology adoption process. Thus the extension services should be expanded especially to those disadvantaged areas. Here, the number of extension workers should be increased according to the number of farmers.

2) The extension agents should concentrate on their educational task of teaching farmers improved farm practices. Their attention should not be diverted by such chores as inputs distribution and loan collection. They should guide their farmers, where they can get inputs or how they can get loans, but should not perform these tasks themselves.

3) If extension agents have to enforce repayment of credit, they are unlikely to press farmers very hard in case they lose their trust. Thus the rate of credit repayment will be very low under these conditions. On the other hand, if loan collection and field services collide, the good relations between the advisor and the farmer might easily suffer. Therefore, the financial administration should be strictly separated from the extension service in order to avoid interference between the two functions and in order to ensure good relations between extension workers and farmers. So there must be an agency for the provision of credit to all farmers who need it.

4) In most cases the repayment problem is caused by crop failure, either from bad weather or from incompatibility of the technology to the specific conditions of a given area. However, crop failures are not uncommon in agriculture. A little lower than the average yield, therefore, should not make it difficult for the farmer to repay the loan. It is important, therefore, for the farmer and their leaders to know how the credit programme is operated. Here extension workers should make farmers understand that any failure on their part to honour their commitments will affect their credit-worthiness in the eyes of their own creditors, which may dry up the very source of the funds with which they accomodate the farmers. On the institutions' side, the system of lending, should be sufficiently flexible to take care of situations arising out of crop failure. This is because it is the poor who are most at risk.

5) Repayment position can be improved by introducing loan collection through marketing organizations (service cooperatives). This organization should consider payment in kind as another option for repayment. Farmers who are either too lazy or unwilling to make an effort to save in order to repay in cash, would probably have a better repayment record if their loans were collected through a marketing organization. Therefore the building-up of strong service cooperatives would mean a substantial contribution toward successful smallholder credit programmes. In light of these considerations, the programme should consider, an improved network of marketing service co-operatives.

6) Farmers should not be forced to pay their debt when the price for their produce is low. The repayment schedule should be adapted to the expected cash flow,

and to the time which farmers prefer, the right time to sell their produce. At the same time, applications for postponement of payments by farmers who have reduced yield, and are unable to meet their installments should be considered.

7) In the study it was observed that farmers were using individual technologies (components of the package separately) on their plots. This confirms the notion that, although the recommendations may be presented to farmers as a package of several practices, some components of the package may be adopted first, and others later, and some may never be adopted. Therefore bearing this in mind, credit should be available for those farmers who want to use the individual components of the package. And in the meantime, extension service should be strengthened to convince them to accept the whole package.

8) Improved varieties is one of the major components for increasing agricultural productivity. Effective utilization of improved varieties will enable farmers to become self-sufficient in food. However, the study revealed that, improved varieties was the least adopted technology among the individual components of the package. This was due to the fact that either the varieties were new for the area, they were inferior to the local ones or the good quality varieties seeds were not available in sufficient amounts. Therefore, one urgent issue that needs consideration is to produce seeds in response to demand i.e, seeds have to be available in sufficient quantities and qualities to meet the demands of the farmers. Hence, ESE, service cooperatives and private investors who want to enter into seed production should be encouraged and given support that will enable them produce the required quantities and qualities of seeds.

9) In the study it was found that, farm size was one of the limiting factors in the adoption of technologies. Thus, taking into consideration the target group of the programme (small-scale farmers) and the attempt to acquaint the small-holders with improved practices, the issue of land redistribution in particular attention to the small-holder sector needs proper assessment and early decision.

10) The cost of technology is a major constraint to its adoption. The study findings have shown that one of the reasons for the non-adoption of purchased technologies was high cost. If poor farmers are to benefit from the programme and adopt new technologies, the cost should be affordable. This means that the government should subsidise the cost of inputs. Subsidy policy is useful to reduce farmers' cost, to encourage adoption of technologies and to increase usage.

11) The study showed that it was mostly men who were involved in the programme. The involvement of women in projects has always been handicapped by many constraints. However, the important contribution of women to agricultural production and socio-economic life of the family and the community at large should not be overlooked. Therefore a way should be sought on how to improve women's involvement in development programmes. One way could be by increasing extension services to women. This can be achieved by training of more female extension agents so that increasing woman to woman interactions and hence sidestep social taboos which limit male-female interactions. On the other hand, there should be deliberate efforts by programmes and projects to reach more women. They should make efforts to ensure that female farmers are

directly targeted as beneficiaries. To facilitate this, women should be encouraged to form groups in order to increase their direct access to the extension services.

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APPENDIX I: FARMER'S QUESTIONNAIRE

TITLE: FACTORS INFLUENCING ADOPTION OF IMPROVED MAIZE PRODUCTION TECHNOLOGIES AND PRACTICES IN THE NATIONAL EXTENSION INTERVENTION PROGRAMME (PAEP)IN AWASSA DISTRICT, ETHIOPIA

Respondent's number ---------- Development center -------- Participant farmer --------Non-participant farmer -----

A. General Information

1. Gender

   1) Male ----- 2) Female -----

2. What is your age ?

   1) 18-24 years ----- 2) 25-31 years ----- 3) 32-38 years -----

   4) 39-45 years ----- 5) above 45 years -----

3. Marital status

   1) married ----- 2) single -----

   3) divorced ----- 4) widowed -----

4. What is your highest level of education ?

   1) illitrate ----- 2) read and write -----

   3) primary education ----- 4) Junior high school ------

5. Catagorize your household members by sex according to the following age groups (number).

Age group	Sex	
	Male	Female
Below 10 years 10-18 years 19-45 years Over 45 years		

6. The household members level of education (number)

   1) illitrate ----- 2) read and write ------

   3) primary education ----- 4) secondary education -----

7. Have you ever been in the leadership or committee member of farmer's organizations ?

   1) Yes ----- 2) No -----

8. Have you ever been member of any social committee?

   1) Yes ----- 2) No -----

9. What type of house do you have ?

1) grass thatched roofing with mud floor -------

2) corrugated iron roofing --------

3) Both -------

B. Agricultural Activities and Income

1. What is your farm size in hectare? ---------

2. What is the source of farm labour ? (Tick all which applies to you)

1) family members ----- 2) work groups -----

3) hired labour ----- 4) others (specify) -------

3. What is the source of power on your farm for land preparation ?

1) hand hoe ----- 2) hired oxen ----- 3) own oxen -----

4. What crop is your main family food source?

1) maize ----- 2) *enset*------ 3) *teff*-----

5. What are your main cash crops ?

crop	area (hectare)
1) ----------	----------
2) ----------	----------
3) ----------	----------
4) ----------	----------

6. Do you have a ready market for maize ?

1) Yes ----- 2) No -----

7. What kind and number of animals do you have ?

Type of animals	Number
Oxen	
Cows	
Heifers	
Bulls	
Calves	
Sheep	
Goats	
Donkeys	
Mules	
Horses	

8. How was the market price for maize for the last two years?

1) Increasing ----- 2) Decreasing -----

3) No change-----

9. What is your annual average income from the sale of

1) Food crops -------- *birr* 2) Cash crops ------- *birr*

3) Livestock -------- *birr*

10. What other income generating activities do you have, and what is the average annual income from these activities ?

Activities	Annual income (*birr*)
----------	----------
----------	----------
----------	----------

11. In 1996 income tax payment, in which farmers group have you been catagorized ?

1) highest farmers group --------

2) middle farmers group ---------

3) lower farmers group ----------

C. Rate of adoption of improved maize production technologies and practices

1.0 Improved seed

1. Did you use improved seed before 1996 ?

1) Yes ----- 2) No -----

2. Did you use in 1996 ?

1) Yes ----- 2) No -----

3. Did you use in 1996/97 ?

1) Yes ----- 2) No -----

4. If the answer is yes in question 3 above what was the source ?

   1) purchased on cash ----- 2) purchased on credit ---- 3) own production — 4) other (specify) --------

5. If the answer is yes in question 4 above, what type maize did you use and what is the variety ?

Type	Variety
1. Composite	1.---------- 2. ----------
2. Hybrid -	1.---------- 2. ----------

6. If you have used, what was your farm size covered by improved maize seed in 1997? -------- hectare.

7. If the answer is no in question 3 above, what was the reason ?

   ----

8. How do you compare the quality of the improved variety with the local one ?

   1) better ------ 2) equal ------ 3) Lower ------

9. What is your comment on the price of imprved maize seed?

   1) expensive ----- 2) reasonable ----- 3) cheap ----- 4) don' know ——

2.0 Chemical Fertilizers

1. Did you use chemical fertilizers before 1996 ?

   1) Yes ------ 2) No ------

2. If the answer is yes in question 1 above, what type?

   1) DAP ------ 2) UREA ------ 3) Both ------

3. Did you use in 1996 ?

   1) Yes ------ 2) No ------

4. If the answer is yes in question 3 above, what type?

   1) DAP ------ 2) UREA ------ 3) Both ------

5. If the answer is yes in question 3 what was the source ?

   1) purchased on cash ----- 2) purchased on credit ---- 3) other (specify) ---

6. Did you use in 1997 ?

   1) Yes ------ 2) No ------

7. If the answer is yes in question 6 above, what type of fertilizer did you use?

   1) DAP ------ 2) UREA ------ 3) Both ------

8. If the answer is yes in question 6 what was the source ?

   1) purchased on cash ----- 2) puchased on credit ----- 3) other (specify) -----

9. If you have used in 1997 what was your farm size covered by chemical fertlizers

   ? --------- hectare.

10. If the answer is no in question 6 above, what was the reason?

11. What is your comment on the selling price of chemical fertilizers?

    1) expensive ----- 2) reasonable ----- 3) cheap --- 4) don't know -----

12. How do you comment the recommended rate of fertilizer rate on maize crop?

1) appropriate ------ 2) needs modification ------

3) don't know ------

3.0 Pesticides/Insecticides

1. Are diseases and pests problem in your locality ?

1) Yes ------ 2) No ------

2. Did you use Pesticides before 1997?

1) Yes ------ 2) No ------

3. Did you use in 1997?

1) Yes ------ 2) No ------

4. If the answer is yes in question 3 what was the source ?

1) purchased on cash ----- 2) purchased on credit ---- 3) other (specify) ---

5. If the answer is no in question 3 what was the reason ?

---

6. What is your comment on selling price of pesticides?

1) expensive ------ 2) reasonable ------ 3) cheap --- 4) don't know -----

4.0 Improved cultural practices

Which of the following improved maize production practices have you used in 1997?

Just respond Yes or No

Practices	Yes	No
proper seed bed preparation line planting proper spacing proper weeding		

D. Agricultural extension service

1. Do you have any contact with extension worker?

1) Yes ------ 2) No ------

2. If yes in question 1 above, how frequently do you meet?

1) more frequently ------ 2) less frequently ------

3. Any source of knowledge you have come across other than the development agent to learn the improved practices?

1) Yes ------ 2) No ------

4. If yes in question 3 above, mention the source you have come across.

1) Neighbouring farmers ------ 2) Field days ------

3) Field trips ------

5. Have you ever attended a farming course at a training center ?

   1) Yes ------ 2) No ------

6. Have you attended practical training (how to implement the demonstration plot technically) in the programme ?

   1) Yes ------ 2) No ------

E. Credit

1. Apart the programme, is institutional credit available for input purchase in your area?

   1) Yes ------ 2) No ------

2. Did you get credit for input purchase before 1997?

   1) Yes ------ 2) No ------

3. How much of the loan did you pay back ?

   1) None at all ----- 2) 25% ----- 3) 50% -----

   4) 75% ----- 5) 100% --------

4. In question 3 above, if not you pay all what is the reason ?

   ---

5. Did you get credit for input purchase in 1997?

   1) Yes ------ 2) No ------

6. If yes in question 5 above, how much of the loan did you pay back ?

   1) none at all ---- 2) 25% ----- 3) 50% ---- 4) 75% ----- 5) 100 % -----

7. In question 6 above if not you pay all , what was the reason ?

---

8. In question 5 above if the answer was no, what was the reason ?

F. Package Programme

1.0 Participant farmers

1. When did you start to implement maize demonstration in your plot in the programme?

   1) before 1996 ----- 2) In 1996 ----- 3) In 1997 ----

2. Has the package programme increased your awareness of improved maize production practices, than what you knew before?

   1) Yes ------ 2) No ------

3. What is the average maize yield per hectare in your village ? ------- kg/ha

4. What is your opinion on the level of maize yield while you were in the programme compared to the traditional one?

   1) Increased ----- 2) Decreased ----- 3) No change -----

5. If the yield was increased, how do you estimate the increment?

   1) doubled ----- 2) tripled ------ 3) quadrupled -----

6. In question 1 above, if you have started before 1996 or in 1996 have you conducted the demonstration more than one time?

   1) Yes ------ 2) No ------

7. Did you adopt the full package on your other farms?

   1) Yes ------ 2) No ------

8. If the answer is no in question 7 above, did you adopt part of the package on your other farms?

   1) Yes ------ 2) No ------

9. If the answer is yes in question 8 above, which of the following technologies and practices have you adopted on your other farms? Just respond yes or no.

Improved maize production technologies and practices	Yes	No
Improved maize seed Chemical fertilizers Pesticides Proper seed bed preparition Line planting Proper spacing Timely weeding		

10. In question 1 above, if you have started before 1996 or in 1996 have you stopped to implement the demonstration plot in between?

    1) Yes ------ 2) No ------

11. If the answer is yes in question 10 above, what was the reason?

---

12. Any problem during the crop season like drought, flood etc.?

1) Yes ------ 2) No ------

13. If the answer is yes in question 12 above, in which year was it ?

1) In 1996 -------- 2) In 1997 --------

14. Have the recommended technical package advocated by the programme made you to incur any losses ?

1) Yes ------ 2) No ------

15. From your opinion, what are some of the good attributes of the programme that contributed to improved maize production that need to be sustained ?

---

16. From your opinion, what are some of the bad attributes of the programme (if any).

2.0 Non-participant farmers

1. Were you aware of the programme during its initial stage?

1) Yes ------ 2) No ------

2. If the answer is yes in question 1 above, why didn't you join?

---

3. Do you agree that farmers in the programme have improved their income due to the improved maize production practices?

   1) Yes ------ 2) No ------

4. Do you want to join the programme in coming season?

   1) Yes ------ 2) No ------

5. If the answer is yes in question 4 above, what motivated you to join the programme?

   ---

6. If the answer is no in question 4 above, what is the reason?

THANK YOU VERY MUCH

APPENDIX II: AGRICULTURAL EXTENSION WORKERS' QUESTIONNAIRE

TITLE: FACTORS INFLUENCING ADOPTION OF IMPROVED MAIZE PRODUCTION TECHNOLOGIES AND PRACTICES IN THE NATIONAL EXTENSION INTERVENTION PROGRAMME IN AWASSA DISTRICT, ETHIOPIA

IDENTIFICATION NO. ----------

WORK PLACE ----------

A. CHARACTERISTICS OF EXTENSION WORKERS

1. What is your gender ?

   1) Male ------ 2) Female ------

2. What is your age ? ------- (years)

3. What is your marital status ? ----------

4. What is your highest level of education ?

   1) Certificate ----- 2) Diploma ----- 3) BSc. -----

   4) MSc. -----

5. How long have you been working as an extension agent ?

   ------- (years)

B. PARTICIPATORY AGRICULTURAL EXTENSION PROGRAMME

1. Were you involved in any way in the process of developing the new technical package for maize production?

   1) Yes ------ 2) No ------

2. Has the package programme increased farmers awareness of using the improved maize production practices than what they knew before ?

   1) Yes ------ 2) No ------

3. What factors have accelerated the transfer and adoption of improved maize technologies among farmers in the programme ?

   ---

4. What factors have impaired the transfer and adoption of improved maize production technologies ?

   ---

5. How is the loan recovery in the programme?

   1) Good ------ 2) Fair ------ 3) Bad ------

6. If the answer is 'bad' in question 5 above, what was the reason?

   ---

7. Do you think village extension workers involvement in the debt collection will have negative impact on extension activities?

   1) Yes ------ 2) No ------

8. If the answer is yes in question 7 above, what alternatives should be taken?

---

9. Give your suggestion on loan recovery for those farmers in the programme who might face crop failure due to unforeseen conditions?

---

10. Is input distribution well done in the package programme?

1) Yes ------ 2) No ------

11. If the answer is yes in question 10 above, is it sustainable?

1) Yes ------ 2) No ------

12. If the input distribution has problem or not sustainable what do you suggest to be the solution?

---

13. What is your comment on the improved maize seeds' quality distributed by seed supplying organizations?

---

14. How do you comment fertilizer rate used on maize production in the package programme ?

---

15. Are pests problem in your area ?

1) Yes ------ 2) No ------

16. What are the common pests in the area?

---

17. Are pesticides available for farmers?

1) Yes ------ 2) No ------

18. What is your comment on Pesticides packaging size?

1) Appropriate ------ 2) Not appropriate ------

19. Opinion on the Participatory Agriculture Extension Programme.

(Choose from the opinion scale)

Opinion scales: (1) Agree (2) Disagree (3) Not decided

1) The programme has closer supervision ---------

2) The programme has top down approach ---------

3) Package should be defined at zone and woreda level -----

4) Extension workers involvement in input distribution doesn't affect the extension activities -------

5) Input distribution functions in the programme should be gradually transferred to private sectors and farmers' organizations -------

THANK YOU VERY MUCH