FACTORS INFLUENCING TRANSFER AND UTILIZATION OF SELECTED AGRICULTURAL TECHNOLOGIES IN ETHIOPIA: A CASE STUDY OF BOLOSSO SORE DISTRICT

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ABSTRACT

The overall objective of the study was to determine factors associated with transfer and utilization of selected agricultural technologies on enset, maize and tef in Bolosso Sore district. The specific objectives of the study were to: a) identify and describe improved agricultural technologies associated with the production of enset, maize and tef, b) identify improved agricultural technologies related to production of enset, maize and tef which were transferred to farmers in Bolosso Sore district, c) identify and describe factors which influenced transfer of technologies pertaining to enset, maize and tef crops, d) identify the extent of utilization of enset, maize, and tef technologies that were transferred to farmers in Bolosso Sore district, e) describe factors, which facilitated or impaired utilization of improved technologies related to enset, maize and tef crops, f) determine the perception of farmers' and village extension workers' on transfer and utilization of enset, maize and tef technologies.The design of the study was a cross-sectional survey, which involved collecting data at one point in time from a selected sample of respondents. Data was collected using an interview schedule and questionnaire supported by informal discussion, personal observation and informal interview with key informants. A simple random sample of 120 respondents was picked from a sampling frame of 2310 heads of household using table of random numbers. The study results show that technologies like land preparation, use of improved seed, proper spacing, use of fertilizers, and use of pesticides with regard to maize and tef were transferred to the study area and utilized by the respondents. However, in case of enset, no specific technology was transferred and utilized because of lack of relevant technology. The extent of utilization was

higher for technologies like land preparation, use of improved seed (specially CG 4141), use of fertilizers and proper weeding for maize. However, the extent of utilization for some of maize improved seeds (BH-660, BH-140 and Pioneer), tef improved seeds (Cross-37, DZ-01-196 and DZ-01-354) and pesticides for both maize and tef was found to be lower than expected. Major reasons given by the farmers for less utilization of these technologies were: low yield, late maturity, less tolerance to diseases and pests and lodging (in case of tef). The chi-square tests for relationship of factors such as sex, income, farm size and ownership of oxen and utilization of improved technologies were found to be statistically significant indicating that those who had larger farm sizes, higher income, who owned oxen and male respondents were better positioned to utilize the technologies. Factors which facilitated utilization of these technologies were, availability of credit, performance of technologies, availability of inputs and emphasis given by extension workers. The major factors which impaired utilization of technologies were unavailability of any technology (for enset), shortage of oxen, high cost of inputs, unreliable inputs supply, poor performance of some of the technologies (tef) and shortage of land. Farmers perception on enset, maize and tef technologies were that: some technologies (e.g. maze improved seed specifically CG-4141 and chemical fertilizer like DAP and urea) were very effective in addressing their production constraints. However, majority of the farmers were discontented with high cost of inputs, incompatibility of spacing with their previous practice, unreliable input supply and low price of the produce. The assessment of extension workers' perception on the technologies indicated that transfer and utilization of some of the technologies were facilitated by good performance of some of the technologies and availability of credit. However, they indicated their

Concern over lack of relevant technology for enset and high cost of inputs when compared to the purchasing power of farmers. Recommendations pertaining to the study are given in chapter five.

DECLARATION

I, Yisehak Baredo Bitire, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and has not been submitted for a degree award in any other university.

Signature _____

Date 06-09-2022

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DEDICATION

To my late father Baredo Bitire and my mother Bafane Ogo who laid foundation for my education.

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LIST OF ABBREVIATIONS

ABID	=	Area Based Integrated Development
ADLI	=	Agricultural Development Led Industrialization
ARDU	=	Arsi Rural Development Unit
BPED	=	Bureau of Planning and Economic Development
CADU	=	Chilalo Agricultural Development Unit
CBE	=	Commercial Bank of Ethiopia
CPAR	=	Canadian Physicians for Aid and Relief
CIMMYT	=	International Maize and Wheat Improvement Project
CPP	=	Comprehensive Package programmes
CSA	=	Central Statistics Authority
EARO	=	Ethiopian Agricultural Research Organization
EPID	=	Extension and project Implementation Department
FA	=	Farmers' Association
FAO	=	Food and Agricultural Organization
GDP	=	Gross Domestic Product
IAR	=	Institute of Agricultural Research
MPP	=	Minimum Package Programme
MOA	=	Ministry of Agriculture
PADEP	=	Peasant Agricultural Development and Extension Project
PADETES	=	Participatory Demonstration and Training Extension System
SG 2000	=	Sasakawa Global 2000
SNNPRS	=	Southern Nation Nationalities and Peoples Regiona

SPSS	=	Statistical Package for Social Science
T&V	=	Training and Visit
WADU	=	Wolaita Agricultural Development Unit

CHAPTER ONE

INTRODUCTION

1.0 Background information

Agriculture being the dominant economic sector for Ethiopia, accounts 50% of Gross Domestic Product (GDP), employs 85% of total population, contributes 90% of foreign currency and 70% of industrial raw material (CSA, 2000). The country has 1.2 million square kilometers of land out of which 66% is considered potentially suitable for agricultural production. Only 14.8% of the total area is under cultivation. The agricultural sector is entirely dominated by small-sale resource poor farmers who occupy about 96% of the total land producing 95% of all the cereals, pulses and oil seeds (CSA, 1997).

The country is endowed with natural resources especially agriculture, which has sustained its population for thousands of years without receiving any assistance from outside. According to Alemayehu (1988), the annual export of grains to the world market rose to 159,000 metric tones in 1947/48. However, since early 1960s domestic supply failed to meet the basic requirements of increasing population of the country basically due to lack of appropriate technologies, inefficient extension services, land shortage, low financial potential of small scale farmers and bad weather. The population was estimated to be around 61 million in 1997 and expected to double by the year 2017 (CSA, 1996). In recent years, the population has been growing at an accelerated pace and the growth rate has increased from 2.4% in 1970s to more than 3% in recent years (UNDP, 1998). On the other hand, growth of agricultural sector is,

on average, estimated to be 1.2% (FAO, 1995). Thus, population growth has resulted in land shortage. In addition, continuous cultivation of the land without proper soil management has lead to low yield in many parts of the country thereby widening the gap between production and consumption.

In trying to address recurrent food shortages in several parts of the country, the government adopted a number of development initiatives. Some of the initiatives included Comprehensive Package Programmes (CPPs), Minimum Package Programmes (MPPs) and National Extension Implementation Programme (NEIP). While undertaking agriculture oriented interventions, priority was given to vulnerable zones and districts like Bolosso Sore in Wolaita zone. Bolosso Sore district is constrained with high population pressure, limited farm land and food shortage every year.

In order to address issues facing Bolosso Sore, a number of programmes were launched. For example, Wolaita Agricultural Development Unit (WADU) was one of the two comprehensive programmes in the country that operated in the district for about 10 years. Other important agricultural initiatives like Area Based Integrated Development programme (ABID) supported by UNDP were also implemented in the district, while placing special emphasis on the transfer of various improved agricultural technologies. All the initiatives, focused on the introduction of improved maize, tef and at a later stage enset technologies because these crops are widely grown and are dominant food crops in the district.

Despite a number of interventions, Bolosso Sore district has not been able to feed its population. Many of the technologies introduced in the district could not address the problem effectively. MoA (1998) report indicated that nine maize and three tef improved varieties with accompanying packages appropriate to each variety were introduced in the southern region and in Bolosso Sore district as well. With the exception of few, many of the varieties did not do well, partly due to poor extension services, poor performance of some of the technologies, poor farmer's economic situation, technological know-how and environmental effects like drought (USAID, 1995). In some cases, failure of MOA to deliver the inputs on time and in the required quantities contributed to less utilization of technologies (MOA 1998).

1.1 Brief description of major food crops

Ethiopian farmers grow a variety of food crops. However, major food crops produced include cereals, pulses, oil crops, root and tuber crops. Cereal crop production share is about 94 % of total cultivated land. The most important cereal grains as per area planted are tef, maize, sorghum, barley and wheat. When productivity is considered, maize comes first followed by wheat, sorghum, barley and tef. Both maize and tef were the first major cereal crops considered in the national extension programme that was adopted in 1995. Among the root crops, enset covers quite considerable area. Besides, a significant number of the population particularly in SNNPRG and Bolosso Sore depend on enset for their food and also as source of cash income (Dessalegn, 1993). Consequently in 1997 enset was considered as a "national crop" and has received much attention in as far as research and resource allocation are concerned (AAAS, 1997).

1.1.1 Enset

Enset is a crop which belongs to the family of *Musaceae* and is cultivated for food and animal feed. Different plant parts and the by-product of the enset also provides various uses such as beds, eating plates and roofing for rural huts. According to Alula (1993) in the 1970s enset covered an area of 3.7 % of the national territory and 20.8% of the population was dependent on it as food and source of animal feed. Despite its enormous importance to large segments of community members less has been done to improve its productivity. Farmers are still using traditional means of production and productivity is low. Enset Bacterial Wilt (EBW) is still devastating a quite large area of the plantation. Improved cultural practices developed to control EBW are not being practised by enset growing farmers. Factors contributing to this situation include, poor extension services, unavailability of appropriate technologies and poor performance of some of the technologies developed for enset.

1.1.2 Maize

According to Banti (1992), maize is a relatively recent crop to Ethiopia. It was first introduced during late 16^{th} or early 17^{th} century. CSA (2000) report indicated that maize is cultivated on over 1, 407. 000 ha and over 87% of maize is produced by smallholder farmers. Smallholder production accounts for 91% of the production area and about 40% of the maize area is located in the southern part of the country which is part of the research area.

Maize is the most researched crop in Ethiopia and as a result a number of high yielding improved varieties were developed. However, according to Kebede (1993) in 1988, an area planted with improved maize varieties out of the total maize area was only 16% and the remaining 84% was occupied by unimproved low yielding local varieties. This indicates that the improved seeds have not reached the majority of smallholder farmers. The national average yield of maize is not more than 1795 kg/ha (CSA, 2000). The yield gap between small farmers production and research ranges from 1000 to 10000 kg/ha (Kebede, 1993). Actually all these show that low yield of maize could be raised with improved varieties to higher levels provided that all the necessary improved technologies are transferred and utilized as per recommendations.

1.1.3 Tef

Tef is a short-lived, annual grass which tillers freely. Considering the total area of production and consumption, tef stands first among cereals occupying an estimated area of 27.7% of the cultivated area in Ethiopia (Seifu, 1993). Although the grain yield per unit area obtained from tef is very low compared to other cereals, majority of the farmers grow it as staple food crop and cash crop as well. According to Seifu (1993), despite its low yield per unit area, farmers prefer to cultivate tef because of the following advantages: a) withstands low moisture condition, b) withstands water logging and toxicity, c) cattle prefer to feed themselves on tef straw than any other cereal straw, d) tef has high market price than any other cereals both for its straw and grain, e) tef is not attacked by storage pests specifically weevils which cause severe damage to stored crops in Ethiopia.

Despite its high food and cash crop value the productivity of tef has remained far below. The national average yield from smallholder farming system is 800kg/ha but in good tef areas farmers can get yield between 1000-1200kg/ha (UNDP/FAO, 1987). Under intensive management some of the improved tef varieties developed by research station can yield up to 3500 kg/ha. However, majority of smallholder farmers do not have access to these improved seeds because of high price and sometimes seeds are unavailable. The following sections provide highlights on efforts made by the government. In a way, these sections provide background to the problem of interest to the researcher.

1.2 Technology Transfer Efforts and Challenges in Ethiopia

Literature (e.g. CPAR, 1997) shows that the food supply situation of the country is not keeping pace with the demand of rapidly rising population. The agricultural sector is struggling to meet the increasing need for food and income. Thus, in the last three decades, the country has been forced to take some actions to speed up the production and productivity of farming community. As the result of land scarcity and continued decline in the productivity, the option of the country was to intensify agricultural production through establishing efficient extension system and other components needed for technology transfer and utilization.

The agricultural research and extension started operating in the country since 1953 when the then Alemaya College of Agriculture and Mechanical Arts was established (Tennnasie, 1985). The College was established with triple mandate of research, extension and training. The organization of research and extension under the College

fostered the development of a remarkable linkage particularly between research and extension. However, no mention has been made as to how the linkage took into consideration farmers views and opinions (EARO, 2000). However, the extension wing was detached from Alemaya College and transferred to the Ministry of Agriculture in 1963. Since then the extension service became government funded and public oriented service giving institution in Ethiopia under the Ministry of Agriculture. During this period on-farm fertilizer trials on some crop varieties like maize and wheat were conducted throughout the country with the assistance of FAO (EARO, 2000).

1.2.1 Comprehensive Package Programmes (CPPs)

When peasant agriculture gained more attention during the third five year development plan (1968-73), Comprehensive Package Programmes were initiated. These comprehensive package programmes (CPP) such as Chillalo Agricultural Development Unit (CADU), Arsi Rural Development Unit (ARDU) and Wolaita Agricultural Development Unit (WADU) were introduced with the idea of introducing some agricultural innovations and improving constraints to innovations transfer and utilization.

In general the organizational set up of CPPs consisted of agricultural extension service, agricultural research, seed multiplication and distribution, marketing and credit service, improved farm implement production and distribution, rural infrastructure and co-operative organization. Maize, tef and enset were among the top cereal and root crops considered for expansion by WADU phase I and phase II in Wolaita zone which includes Bolosso Sore district. Besides, WADU started enset research in Ethiopia for the first time. However, according to WADU phase II

evaluation report (1984), WADU was criticized for failure to fully translate its research results into effective field extension recommendations.

The CPPs ensured effective research-extension-farmer linkage by bringing different actors required for effective technology development and transfer under one umbrella (AERO 2000). When CPPs were established, the intention was to extend the same approach to the whole farming populations in the country in 15-20 years time. However, the comprehensive approach of extension was gradually phased out because the running cost were found to be too high to implement in other areas in terms of the large number of extension workers required and high costs involved (Adams, 1990; Gizaw, 1992)

1.2.2 Minimum Package Programmes (MPPs)

The high financial demand of the comprehensive packages and unwillingness of donors to fund such programmes led to the initiation of the Minimum Package Programmes (MMPs) in the late 1970 (Habtemariam, 1997). The minimum package extension approach which accommodated MPP I and MPP II, included limited extension components like inputs, credit and extension advise. It had wider coverage though limited to 10 kilometer on either side of all weather roads. However, this was constrained by institutional changes and lack of support and appropriate technologies. Adams (1990) and Gizaw and Amare (1992) contended that an appropriate technology, competent extension personnel, farm inputs from commercial suppliers and favorable price for produce were not easy to be assembled and coordinated in a package for smallholder farmers in MPP II. Thus, MPP II was officially terminated in

1985.

1.2.3 Peasant Agricultural Development and Extension Project (PADEP)

The Peasant Agricultural Development Project (PADEP) was initiated as follow up to the MPP, and was implemented in districts which were highly productive (Wube, 1995). PADEP aimed at bringing together the lessons learnt from the earlier projects. Overall available information on PADEP performance indicate that achievements remained far below the target initially set (MOA, 1995). Likewise, the (EC) 1992 mid-term review on PADEP as cited by MOA (1995) noted that at the beginning there were some reasonable achievements in the areas of crop production and road construction. However, the same report indicated that the performance of PADEP was slow and the overall achievements were much below expectations.

1.2.4 Training and Visit (T&V) approach

The training and visit (T&V) approach was initiated as a pilot project in 1983 with the assistance of the World Bank. The training and visit extension system is well known for its fixed field extension agents to farmers ratio, scheduled visit to farmers plots and continuous training of staff (MOA, 1998). However, according to SG-2000 (1995) the T&V system could not be implemented in the Ethiopian condition because the assumptions underlying the T&V approach (such as strong linkage among research, extension, input supply and farmers) were, under Ethiopian condition, found to be weak. Besides, the system was highly criticized for its top-down approach, poor use of group and mass communication methods, and small size demonstration plots (MOA. 1998).

Despite various extension efforts, the performance of agriculture in the country has not been improving. The main problem in the technology transfer and utilization process in Ethiopia was how to make the product of technology physically available to the farming community. The farmers have no access to the products of science based agriculture, mainly improved varieties, fertilizers and crop protection products due to lack of cash, unavailability of inputs and also high cost of inputs. Some agricultural technologies like improved seeds are not produced in sufficient quantities because of lack of efficient institutions to multiply and distribute the seeds (Getinet 1995). There are also constraints from the farmer's side. Only few farmers would have cash resource to purchase agricultural inputs. In the past credit for purchasing input existed but was poorly administered something which frustrated farmers.

1.2.5 Sasakawa Global -2000 project's input to Ethiopian new extension system

The Sasakawa Global (SG-200) Project was initiated in 1993 to strengthen the extension service for effective dissemination of proven research-led technologies to smaller farmers. Within a short period of time SG-2000 managed to effectively transfer available technologies to end users. The secret behind the SG-2000 aggressive technology transfer programme, according to Getinet (1995), is it's ability to fill the major gaps that had existed during the various extension systems of the past. These, among other things, included:

- improving access to technologies that are developed by the Institute of Agricultural Research (IAR) and make them physically available to farmers through the provision of credit.

- conducting intensive practical training of the extension staff from central down to the development agents.
- improving the mobility of extension workers by providing vehicles, motorcycles and bicycles.
- ensuring strong linkage between research, extension and input distributors, which is the key issue for successful agricultural technology transfer process.

1.2.6 Participatory Demonstration and Training Extension System (PADETES)

Drawing on lessons of the past experience, the government of Ethiopia formulated an "Agricultural Development-Led Industrialization (ADLI)" as national development strategy that will take agriculture as a development base (MOA 1998). Within this framework major focus was on raising the productivity of small-scale farmers who are the key actors and partners at the grass root level. Thus, within ADLI a new system of agricultural extension, termed "Participatory Demonstration and Training Extension System" was formulated in 1995 after critical evaluation of past extension approaches. The new extension system benefited from the strong extension management principle of the T&V system and was merged with most practical technology transfer experience of the SG 2000 project approach (MOA 1998). The potentials and constraints of PADETES in fulfilling agricultural sector vision of the country is to be determined.

1.3 Problem Statement

Despite efforts made by the government, the problem of technology transfer and utilization in Bolosso Sore is still a major challenge. Observations made in the study area show that majority of farmers are not utilizing improved technologies on enset, maize and tef. Some of the factors pointed out for low utilization of technologies include economic constraints such as cash, land, labour (USAID, 1995). These are undoubtedly real problems but have not been critically assessed to come up with empirical evidence. Besides, little attention has been given to periodic assessment of availability of appropriate technologies and challenges to transfer and utilization of technologies.

It can be argued that factors which facilitate or impair the transfer and utilization of improved agricultural technologies in the country are not clear. Thus, lack of empirical evidence as to why there is such a low rate of utilization of technologies prompted a researcher to investigate factors which influence the transfer and utilization of the introduced technologies. In particular, the study sought to determine the available relevant technologies to the farmers in Bolosso Sore district and to assess the extent of transfer and utilization of such innovations in the study area.

1.4 Justification of the Study

Given the magnitude of food shortage in Bolosso Sore district and elsewhere in the country, there is obvious a need of understanding the relative importance of factors that influence transfer and utilization of improved technologies by smallholder

farmers. Besides, the factors related to utilization mentioned above, reports and/or studies do not specify factors that have impaired or facilitated the transfer and utilization of technologies to smallholder farmers in the respective farmers' associations in Bolosso Sore district. Understanding these factors will contribute towards making efforts directed at reversing the trend of technology transfer and utilization. Thus, the knowledge of factors which will be generated through the findings of the study, can form a basis for designing an appropriate strategy for efficient transfer and utilization of agricultural technologies in Bolosso Sore and elsewhere in the country and hence to address issues related to increased crop productivity and production.

1.5 Objectives of the Study

1.5.1 General objective

The overall objective of the study was to determine factors associated with transfer and utilization of selected agricultural technologies on enset, maize and tef in Bolosso Sore district.

1.5.2 Specific objectives

The specific objectives of this study were to:

1. identify and describe improved agricultural technologies and practices associated with the production of enset, maize and tef.
2. identify improved agricultural technologies related to production of enset, maize and tef which have been transferred to farmers in Bolosso Sore district.

3. identify and describe factors which influenced transfer of technologies pertaining to enset, maize and tef crops.
4. identify the extent of utilization of enset, maize, and tef technologies that were transferred to farmers in Bolosso Sore district.
5. describe factors, which have facilitated or impaired utilization of improved technologies related to enset, maize and tef crops.
6. determine the perception of farmers and village extension workers on transfer and utilization of enset, maize and tef technologies.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

Technology transfer in its contemporary usage encompasses three main sub-systems: a) technology generation/research sub-system, b) the technology dissemination/extension sub-system and c) the technology utilization/clientele sub-system (Rutatora, 1995).

In Ethiopia the technology generation is undertaken by the then Institute of Agricultural Research (IAR) now restructured and named as Ethiopian Agricultural Research Organization (EARO). The national mandate to conduct and co-ordinate agricultural technology generation was given to IAR in 1966. Since then IAR in collaboration with institutions like WADU and ARDU play a great role in generating various technologies on crop, livestock, and soil and water conservation. This chapter reviews the literature pertinent to this study and covers sections such as transfer and utilization of agricultural technologies, while examining the role of some socio-economic factors in facilitating and/or impeding the transfer and utilization of selected agricultural technologies related to enset, maize and tef.

2.1 Technology Generation

From plants point of view "technology generation" is defined as incorporation of some genetic traits or characteristics that will enable plant to cope better with its

environment to respond more fully to other agricultural inputs and practices that would yield better economic return or to meet more effectively ecological or sociological needs (Dalrymple, 1994). According to Ekpere (1990) "agricultural technology" in specific terms may be defined as the overall combination of complimentary techniques employed in production of goods and making it more productive.

Small-scale farmers in Ethiopia have for many years, relied on traditional technologies and old practices that have been transferred from father to son over generation to generation. Although these traditional technologies and practices have some merits, they are inherently of low productivity (USAID, 1995). Consequently, productivity of agricultural sector was extremely low (MOA, 1995). USAID (1995) report indicated that the establishment of IAR and regional research stations in collaboration with International Livestock Centre for Africa (ILCA) and zonal research programmes were positive steps towards generating new technologies for uplifting agricultural productivity.

Because of their central position in Ethiopian diet, the food crops composing cereals and pulses dominated the research agenda. Root/tuber crops and vegetables were also covered in the research programme although the scope and content of research varied from crop to crop. In general, the main aims of research programme were identification of better performing varieties, the development of improved crop management practices and the identification or development of effective crop protection techniques (MOA, 1993). USAID (1995), after assessing the current status

of technology generation contended that research system has made significant progress in the generation of technologies which if properly incorporated into farming practices and utilized by farmers could substantially increase production. These technologies cover development of improved seeds, fertilizer rate, chemicals and improved cultural practices.

Despite efforts made by the research institutions to strengthen technology generation programme the results have not been encouraging. MOA (1993) contended that the success of the programme was below expectations because of:

- poor performances of some of the generated technologies.
- inadequate qualified research personnel.
- extensive commodity and discipline coverage which resulted in stretching limited resources.
- lack of linkage with the extension department.

2.2 Technology Transfer

The term technology transfer generally refers to the process by which technology produced or generated in one place becomes directly implemented in another (Anderson, 1994). The extension service plays a major role in technology transfer. URT/World Bank (1994) argued that researchers can take care of generating appropriate technologies to Tanzanian condition in a well controlled micro-climate conditions but agricultural extension service is most necessary to disseminate what has been generated to the farming community.

The extension service in general covers institutional set up including staffing and strategy and/or approach adopted to transfer technologies. The professional and technical competence of extension workers are probably the most important input to any country's extension system. In this connection, World Bank (1995) contended that public extension service in Ethiopia has been constrained by quality of field and technical staff and unresponsiveness of extension message to the farmers' needs. MOA (1998) also contended that national extension programme performance in the country was threatened by inadequate skills of front line staff. This report further elaborated that, field extension workers trained for six or nine months in agricultural training centres, could not cope with dynamic nature of new technologies.

Besides the above observations, the involvement of extension workers in non-extension activities has retarded the effectiveness and efficiency of extension service. According to MOA (1993) and Kedir (1999), problems constraining extension service in Ethiopia were: a) confused role of extension staff, b) constantly changing extension system, extension organization and extension strategy, c) poor linkage between research and extension and d) engagement of extension workers in non-extension activities. A confused role of extension staff arises from lack of clear guide on what any field extension staff should and should not be involved in.

Cohen (1987) noted that extension workers who were engaged in rural credit management spent more than 50% of their time on facilitating provision and collection of credit. He also explained that apart from sharing time, involvement of extension workers in rural credit collection has brought negative impact on the nature of trust

that must exist between extension workers and farmers. MOA (1993) report also explained challenges faced in relation to extension workers involvement in non-extension activities. The report emphasized that involvement of extension workers in activities like tax collection, grain purchase on behalf of agricultural crops marketing corporation and involvement in credit repayment collection are some of the major factors which damage the relationship between farmers and extension workers and impair extension service delivery to the farmers in Ethiopia in general.

Successful technology delivery and use are highly dependent on functional and meaningful linkage between research, and extension service as well as users of the service. Efficient linkage between research, extension and farmers can strengthen provision of extension service. In Ethiopia, an attempt has been made to establish research extension linkage some years back. This was realized when extension service was established under Alemaya College with responsibility for agricultural research, extension as well as education in 1963. However, it lacked consistency and continuity. EARO (2000) after reviewing the issue of linkages in CPPs implemented in Ethiopia reported that CPPs ensured effective research-extension-farmer linkage as the different actions required for effective technology development and transfer.

World Bank (1992) also reported that in Ethiopia, research-extension linkage in the context of PADEP was established through Regional Research Extension Linkage Committee (RELC) and a national committee with the objective of facilitating smooth flow of technologies to extension service and feed-back between extension and research. According to World Bank report, close collaboration between researchers

and MOA staff resulted in a rapid identification and dissemination of improved wheat varieties only in Shoa region. In other regions, however, co-operation and interaction between local leadership, research and extension staff was less developed and consequently the performance of PADEP was inadequate. According to Beyene and Abera, (1997) and USAID (1995), the linkage in Ethiopia is challenged with: a) lack of common perception, b) lack of real commitment, c) insufficient representation and participation of actors, d) absence of monitoring and evaluation mechanisms, e) instability of organizational structures, f) lack of financial and human resource and g) inability of extension system to practically evaluate recommended technologies.

2.3 Technology Utilization

The term " technology utilization" is defined as a decision to apply an innovation and to continue to use it (Van den Ban and Hawkins, 1996). There are a number of factors that may influence the farmer's decision to accept and utilize or reject a particular technology. However, from the perspective of this study these factors are classified into three major categories: a) farmer's characteristics which include age, level of education, farm size, gender and income level, b) characteristics of the innovation such as cost of inputs, labour requirements, compatibility of the innovation with the existing system, complexity of the innovation and c) institutional characteristics such as accessibility of the technology, availability of credit and market for the products (Anosike and Coughenour, 1990; Rogers, 1995). Other factors include how technology is delivered by extension service, other information systems and how it is supported by other institutions responsible to supplying inputs, credits, and market (Van den Ban and Hawkins, 1996; CIMMYT, 1993).

2.3.1 Farmers' characteristics

2.3.1.1 Age

Several literature (CIMMYT, 1993; Nanai, 1993; John. 1995) reveal that age has significant influence in utilization or non-utilization of technologies. CIMMYT (1993), contended that younger farmers are more likely to adopt a new technology. because they have had more schooling than older generation or perhaps have been exposed to new ideas as migrant labourers. According to Nanai (1993) young are energetic people, have proved to be more active and ready to try innovations. John (1995), further argued that older people have more experience but their receptivity to new ideas and technologies typically decreases with age.

2.3.1.2 Sex

It is known that women play major role in agricultural practices in developing countries. UNFPA (1996) asserted that in developing countries 80% of food crop production activities are undertaken by women. but rarely do have the title to the land they cultivate. Shayo (1991) also contended that in many rural societies, the social status of women is inferior to that of men.

Like many other developing countries. Ethiopian women also do not have right over resources as well as decision making power because of cultural constraints. Rural women in Ethiopia are looked at merely as "Wives of farmers" and become disadvantaged group especially when it comes to the information of new technology, access to resources and services such as credit and extension (MOA, 1993). The report further explained that the extension education of MOA so far targets the head of the

household, who in most cases are men. Besides, most of the development agents are male and these have social, cultural, and religious constraints or stereotypes when delivering extension education to rural women.

However, Moshi (1999), contended that if women are endowed and/or equipped with resources they can increase productivity through utilizing innovations and ensure greater return on their labour. Likewise, World Bank (1992), argued that when women are given an opportunity to own resources and decision making power, they can maximize productivity through utilization of new innovations. Janice *et al.*(1997), after assessing women farmers in Kenya concluded that when women have access to agricultural resources and services in their own right as in part of the Kenyan highlands, women farmers alone or with sporadic assistance from migrant husbands have proved themselves more than capable of increasing farm productivity and efficiency in improved technology utilization.

2.3.1.3 Education

The farmers educational background is an important factor in determining the readiness o accept and properly apply technologies. Education helps an individual to become more critically aware of the need and scope for social change. Nkonoki (1994) in his study of technology and agriculture observed that level of education predisposes a farmer to take interest in a new technology utilization. In addition, the same findings illustrated that literate farmers are good at contacts made by village extension workers as they can easily understand and try innovations.

Education was seen to make a farmer more enlightened and receptive to advise from extension workers or more able to deal with technical recommendations that require a certain level of numeracy or literacy. CIMMYT (1993), asserted that the more complex the technology to be utilized, the more likely it is that education will play a role.

2.3.1.4 Income

Level of income of a household determines to a larger extent whether particular innovation is possible to be utilized or not by a given household. 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 risk or have better access to extension information or to credit or they may be able to use their own cash resource to experiment with a new technique. Bwana (1996) also pointed out that farmers who are in a position to sell a large proportion of their harvest are the ones who are more likely to utilize a particular technology.

CIMMYT (1993) contended that many farmers who do not utilize technologies may complain lack of cash or credit as a principal factor limiting their utilization. Small-scale farmers in Ethiopia are also constrained by lack of cash due to very limited income resulting from low production. USAID (1995), in its study on main constraints to utilization of agricultural technologies in Ethiopia, revealed that although quite large segments of the farming population has an interest on improved technologies, they could not purchase it due to lack of cash. Likewise, MOA (1993) report

ascertained that majority of small holder farmers are not benefiting from agricultural technologies generated because of lack of cash money.

2.3.1.5 Farm size

Farm size is one of the factors that can influence utilisation of innovations. Hussain *et al* (1994), argued that larger farmers are more likely to adopt new technologies as they can spread the cost over wider range of outputs than is possible for small farmers. Kebede *et al.*, (1992), pointed out that size of a farm of a household can determine the level of a given household's economy and utilization of a new agricultural technologies respectively. Ethiopian agriculture is dominated by small-scale resource poor farmers most of them holding 1-2 hectares (Quinones and Takele, 1996). When it comes to farm size of Wolaita zone, Wolaita zone of Planning and Economic Development (PEDD) (2001) report shows that the highest land holding as 0.5 hectare and the lowest being 0.125 hectares per household. This implies that there is a problem of land shortage in the study area. Consequently the farmers are compelled to grow variety of crops on limited piece of land and less willing to accept and utilize new technologies which demand larger farm size and extra cost or threatens their survival in case of crop failure.

2.3.1.6 Farm implements

Owning farm equipment may also have impact on the utilization or non-utilization of innovations. CIMMYT (1993), pointed out that farmers who own draught animals can be more flexible in changing their tillage practice than farmers who must rent or borrow. For majority of Ethiopian farmers the oxen drawn equipment plays a major

role in crop production. Major cultural practices like land preparation, planting, treshing as well as weeding in case of maize are practised using oxen drawn plow. However, Wolaita zone PEDD (2001) report indicated that the majority (62.7 %) of the total population do not own oxen. This implies that majority of the farmers in the Wolaita zone and Bolosso Sore district as well, may not be in a position to use improved technologies which needs adequate and timely land preparation, weeding and planting.

2.3.2 Innovations Characteristics

In many instances farmers fail to adopt technologies because of the failure of technologies to fit into their farming practice or their needs (Adugna, *et al*, 1991). USAID (1995), asserted that in an effort to introduce sorghum improved technologies in Ethiopia, that is short stalked sorghum varieties were not accepted by many sorghum growing farmers particularly in the areas where there is a high demand for sorghum stalk for fuel. In their wheat technology utilization study, Hailu and Chilot (1992), also contended that farmers in Addis Alem and Wolemera district could not adopt the recommended rate of fertilizer and herbicide on wheat because of high cost, unavailability and also failure to make the inputs available on time. Moreover, MOA (2000), in its national extension program review report, stressed that inferior performance of some of tef varieties (D2-01-354) and maize varieties (BH-660) have been major challenge in utilization of crop packages in many of the regions.

2.3.3 Institutional Characteristics

Institutional factors such as credit, extension service, market and input could have significant bearing on technology utilization (Kashuliza, 1992; Syvert, 1991: Freshwater, 1989; Jugal, 1992). Credit is an important element in modernizing agriculture because it allows the use of other factors of production such as improved seed and fertilizer (Gizaw, 1992). Freshwater (1989) argued that the low income realized by small farmers is not sufficient to try out and use required resources for the utilization of improved agricultural technologies in order to realize higher productivity and thus higher income. According to Jugal (1992) credit facilitates the utilization process of improved agricultural technologies for it enables small farmers to satisfy the cash needs that can be caused by the use of improved inputs and production techniques.

Vast majority of small farmers have poor and/or no access to credit in developing countries including Ethiopia. In case of Ethiopia, the two major financial institutions presently dealing with the rural credit are, the Commercial Bank of Ethiopia (CBE) and Agricultural and Industrial Development Bank (AIDB). Stephanos (1995) stressed that until very recently, major activities of CBE and AIDB were in coffee growing regions forcing small farmers in non-coffee growing areas to resort to borrowing from informal sources at high interest rates. In terms of geographical distribution of the branches, majority of the branches (nearly 84% for CBE and 94% for AIDB) are located in cash crop or surplus grain producing districts of the country. This is an indicative of the neglect of low productivity regions where the need for developmental credit for improved technology utilisation perhaps the greatest. The recently

established private banks and micro-financial institutions are not willing to serve the rural farming community.

Agricultural extension assists farmers to enable them identify and analyse their production constraints and become aware of opportunities for improvement by changing their outlook towards their difficulties. In Ethiopia, there has been a deliberate effort in institution building including the development of human resources, laying out the basis for extension work and the creation of awareness for the effective extension service. According to MOA (1993), the impact of the service in raising the awareness of farmers through the development of simple but effective extension message in influencing the productivity of farmers can only be considered as qualified success so far. However, the Ministry observed that there are financial limitations and ineffectiveness in using mass media as well as farmers organization to transfer extension message.

Input supply and access to potential market are also factors which can influence utilization of technologies. CIMMYT (1993), argued that a technology may tend to increase yield, but if extra production can not be utilized or marketed effectively that technology may not be utilized. Likewise Syvert (1991), pointed that low price of produce and unreliable market for the crops produced by farmers means low capital to invest on new technologies and hence less utilization of new technologies. Failure to supply inputs has been reported as a constraint in technology utilization. USAID (1995) report contended that single most important constraint to utilization of

technologies for farmers in most parts of the country is physical unavailability of fertilizer, improved seed and chemicals.

This chapter has summarized the background information about technology generation, dissemination and utilization sub-systems bringing to light challenges and potentials. The literature has showed that technology transfer and utilization can be enhanced or impaired depending on various factors such as performance of the technology, nature of extension services and socio-economic characteristics of clients or farmers.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter gives description of the study area, research design, study population, sampling procedure, data collection and analysis.

3.1 Description of the Study Area

The study was conducted in Bolosso Sore district in Wolaita zone under Southern Nations Nationalities People's Regional Government (SNNPRG). The region has an area of about 118000 sq.km and accounts for about 10% of the total area of the country. Out of the total area 23.3% is under cultivation (Bureau of Planning and Economic Development (BPED), 1996). According to the CSA (2000), the population of the region is estimated at about 12,903,000. The region accounts for 20% of the total population of the country and out of the total population 49.8% are male and the rest 50.2% are female. Among the total population of the region around 93.2% are rural, while the rest 6.8% are urban dwellers. More than 80.4% of the population are involved in farming (BPED, 1996). The region has 13 zones with 72 districts and 5 special districts based on ethnicity and language identities. Wolaita zone is one of these 13 zones in SNNPRG.

Wolaita zone shares its boundaries with Gamo Gofa zone in south, KAT zone in the north, Sidama zone in the east and Dawaro zone in the west. Total area of Wolaita

zone is estimated to be 447210 hectares out of which 56%, 35% and 9% are mid - altitude, low land and high land respectively (PEDD, 2001). The altitude range varies between 1200 masl and 2950 masl. The Wolaita zone population is 1.116,187 and the projected population for the year 2001 was 1,447,775 (PEDD, 2001). Wolaita pollution accounts 12% of the SNNRG population. It has seven districts and Bolosso Sore is one of the seven districts.

The study focused on Bolosso Sore one of the district in Wolaita Zone. The district is 420 km away from Addis Ababa the capital of Ethiopia and 160 km from Awassa the capital city of SNNPRG. Bolosso Sore district has an area of 57128 hectare out of which 5.3% is highland (ranging between 2301-4200 masl), 81.6% is mid altitude (ranging between 1500- 2300 masl) and 13.2% is lowland (ranging between 500- 1500 masl) (District Agricultural Office (DAO), 2001). The population of Bolosso Sore district is estimated to be 310,497 occupying an area of 632.66 square kilometres with a population density of 490.9 per square kilometres (CSA, 2000). About 83% of the district population are settled in the mid-altitude. Among the total population, men account for 154,350 or 49%, while women account for 51% or 160,650.

There are two growing seasons in the district namely *Belg* (short rainy season) which extends from February to April and *Meher* (long rainy season) which extends from June to September. Farming community in Bolosso Sore practice mixed agriculture and the main food crops grown in the district include, cereals (maize tef, wheat) root and tubers (enset, sweet potato, taro, and yam). Coffee and ginger are grown as cash crops. However, maize and tef are also used as cash crop for majority of Bolosso Sore

farmers. Among the crops grown in the district, enset, maize and tef occupy larger proportion in area as well as in terms of production.

Currently, the district has 40 farmers' associations organized under 8 service co-operatives. A farmers' association is an association comprising farmers occupying approximately in 800 hectares of land. Agricultural extension services are rendered to all farming community members by 60 development agents stationed in 60 development centres. The ratio of development agent to farmers in the district is 1: 979 (DAO, 2001). The district has received intensive extension service since 1970's under CPPS, MPPs and many other projects and programmes including Area Based Integrated Development (ABID) programmes sponsored by UNDP.

3.2 Research Design

The design of this study was a cross-sectional survey, which involved collecting data at one point in time from a selected sample of respondents. In line with the purpose of the study, the design is said to be most appropriate for descriptive interpretations as well as determination of relationships between and within variables (Babbie, 1994).

3.3 The study population

The population of the study consisted of heads of households in five Farmers' Associations (FAs) in the district. A purposive sampling technique was used to select five farmers associations for the study. The selection of five FAs took into consideration the following criteria: a) intensity of extesion service, b) high potential

for enset, maize and tef production and c) accessiblity. The intensity of extension service is measured by presence of development centers and extension agents. According to DAO (2001), Bombe, Dubo, Areka and Hancho developmet centres to which these five farmers' associations belong were established during the establishment of WADU in late 1970s. Since then, extension workers were rendering extension service to farmers stationed in these development centres.

3.4 The Sampling Procedure and Sample Size

Simple random sampling procedure was employed. There are 40 Farmers' Associations in Bolosso Sore district. From these 40 Farmers' Associations 5 Farmers' Associations which could fulfil the criteria above were selected with the aid of Bolosso Sore district and Wolaita Zone extension officers. From the selected five Farmers' Associations a complete list of farmers was obtained from FA leaders. From this list with the help of FA leaders and field extension workers a sampling frame of 2310 heads of household was prepared. Given the nature of study and time availability to carry out the study, a sample size of 120 heads of household was picked with the aid of the table of random numbers. The unit of analysis was the individual householder farmer.

3.5 Preparation of Instruments

Primary data were collected using interview schedules, (for farmers) and questionnaires (for extension workers) supported by personal observations, informal discussion and interview with key informants. The two instruments, namely the

interview schedule (for farmers) and self administered questionnaires (for extension workers) were constructed using closed and open ended questions considered relevant for this study. In addition, secondary data pertinent to this study were obtained from Bolosso Sore District, Areka research station, Omo micro financing Areka office. Federal Ministry of Agricultural, Central Statistic Office, Ethiopian Agricultural Research Organization, SG 2000 office. Wolaita zone Agricultural office. Wolaita zone Planning and Economic Development Department and SUA library.

3.6 Pre-testing.

The research instruments both the interview schedule and questionnaire were prepared after consulting and getting ideas from Sokoine University of Agriculture professionals and later adjusted to fit the condition of Bolosso Sore district with the help of zonal and district extension officers. The research instruments were translated by the researcher into Amharic the national language of Ethiopia. The first drafts of farmers' questionnaires were pre-tested in 3 development centres. Three farmers from each development centre, making a total of 9 farmers participated during pre-testing of the instruments. In addition, three extension workers were involved in the pre-testing of the extension workers' questionnaire. The overall validity of both the English and Amharic version of the instruments was established after pre-testing. The initial drafts of questionnaires and interview schedules were revised to incorporate changes made after pre-testing. Thereafter, the final draft of the interview schedules and questionnaires were prepared and used for data collection.

3.7 Date Collection Methods

The primary data were collected by the researcher assisted by five enumerators. The enumerators were trained before pre-testing of the research instruments. Each enumerator was conversant with both Amharic, the national language and Wolaitgna the local language used by Wolaita ethnic group. Personal interviews with the selected households were conducted by asking each question according to interview schedule and each response was carefully recorded on the interview schedule. In case of extension workers the questionnaire was self-administered.

3.8 Data Analysis

The response of each interview was inspected for its accuracy every evening and possible corrections were made before proceeding to the next respondent. Data were verified by the researcher himself in order to make sure that interview schedule had been filled in accurately and completely. Data collected from the respondents were summarized and analyzed using the Statistical Package for Social Science (SPSS) computer programme at SUA, Morogoro. Sub-programme "FREQUENCIES" was used for descriptive statistics such as frequencies, percentage and means to obtain the variability and central tendencies of variables. All the qualitative data were categorized, summarized and presented in a relevant format (e.g. verbatim responses or in boxes) and described accordingly. Chi-square tests were used to test relationships between factors.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

Chapter four presents and describes the findings of the study. It is divided into seven main sections. Section one presents the socio-economic characteristics of respondents, while section two covers types of agricultural technologies which were generated and transferred in the selected FAs in Bolosso Sore district. Section three presents factors which influenced transfer of technologies and section four covers extent of utilization of introduced technologies. Section five describes relationships of identified factors and utilization of technologies. In section six factors which facilitated or impaired utilization of introduced technologies are presented. Section seven presents perception of farmers and village extension workers on selected agricultural technologies for enset, maize and tef.

4.1 Characteristics of the respondents

This section describes the characteristics of respondents such as age, sex, education level, source of farm labour, annual income, farm size, main crops grown and draught animals owned by the respondents. According to literature (e.g Anoski and Coughenour, 1990; Rogers, 1995), these factors have in most cases been associated with the level of technology utilization by smallholder farmers.

4.1.1 Age

From Table 1 it is clear that majority (75.5%) of the respondents were in the age categories of between 26 and 55 years. Similarly according to PEDD (2001) report, the working age group of the population also lies within this range. The age category of 18-25 years which could be regarded as the youth groups accounted the lowest percent. The respondents attributed the low percent of youth group in farming due to land shortage. In addition, it was reported that majority of the youth had either migrated to urban centres looking for waged labour or engaged in petty-trading. This implies that farming activity in the study area is no more an enterprise to absorb youth labour force.

Table 1: Distribution of the respondents according to age (N= 120)

Age group	n	%
18-25	8	6.7
26-35	44	36.7
36-45	28	23.3
46-55	21	17.5
>55	19	15.8
Total	120	100

Source: Survey data, 2002

4.1.2 Sex

Table 2 shows that majority (80%) of the respondents were male while 20% were female. In this case, men show much greater representation in agriculture than women. However, PEDD (2001) report on population status of Wolaita zone shows that women represent 51% of the population. Thus, low percent of women respondents could be attributed to cultural barrier in the study area where women are considered as household heads only when they are widowed or legally divorced and entitled for land

ownership. The Ethiopian culture generally do not allow women to participate in what is considered to be men's activities (See chapter 2).

Table 2: Distribution of respondents according to sex (N=120)

Sex	n	%
Male	96	80.0
Female	24	20.0
Total	120	100

Source: Survey data, 2002

4.1.3 Education

The findings in Table 3 show that the majority (57.5%) of the respondents had no formal education. However, 11.7% could read and write their mother language namely Wolaitgna as well as the national language which is Amharic. This high rate of illiteracy has a lots of implications in terms of technology utilization specially in easiness to getting access to information disseminated by extension officers and/or media like news papers, booklets, brochures, etc. (Rutatora, 1995). Low rate of education was mainly due to less emphasis given to value of education by the successive governments.

Table 3: Distribution of respondents according to education level (N= 120)

Education level	n	%
No education	69	57.5
Adult literacy	14	11.7
Elementary school (grade 1 to grade 6)	27	22.5
Junior secondary (grade 7 to grade 8)	6	5.0
High school (grade 9 to grade 12)	4	3.3
Total	120	100

Source: Survey data, 2002

4.1.4 Family size

Table 4 shows that the majority (56.6%) of the respondents had family sizes of between 4 and 6 persons. The average family size of the respondents was found to be 5.3 persons per household. According to DAO (2001) report, there are on the average 5.8 persons per household in the district .

Table 4: Distribution of respondents according to family size (N=120)

Family Size	n	%
1 - 3	18	15.0
4 - 6	68	56.7
7 - 9	27	22.5
10 – 12	7	5.8
Total	120	100

Source: Survey data, 2002

4.1.5 Source of farm labour

Major source of farm labour for majority (60%) of respondents was family labour (Table 5). The rest of the respondents claimed that in addition to family labour there were established work groups which assist them during peak seasons of major farm activities like weeding and harvesting. Starkey (1996), in his study on networking for sustainable agriculture, found out that labour availability has influence on utilization of technologies. No respondents indicated use of hired labour due to lack of cash. Considering high number of family members (section 4.1.4) one can assume availability of adequate labour force in each family. However, this is not the case because most family members in productive age move out looking for other options since farming activity can not accommodate them.

Table 5: Distribution of respondents according to source of farm labour (N=120)

Labour source	n	%
Family labour	72	60.0
Family labour and work group	48	40.0
Hired labour	-	-
Total	120	100

Source: Survey data, 2002

4.1.6 Ownership of oxen

According to Table 6 majority (54.2%) of the farmers do not own oxen. This is mainly due to lack of cash to purchase oxen. It is known that ownership of oxen has an influence on utilization of technologies (Bier *et al.* 1990). According to studies done elsewhere (e.g. in Tanzania, Bier *et al.*, 1990) found out that small farmers in the

Ufipa plateau were able to cultivate two or more hectares per person due to ownership of oxen. That is they could cultivate more land than those using a hand hoe. Besides. USAID (1995) argued that among household constraints which impair utilization of improved technologies in Ethiopia, shortage of oxen is the first.

Table 6: Distribution of respondents according to number of oxen owned (N=120)

Ownership of oxen	n	%
No ox	65	54.2
One ox	35	29.1
Two or more ox	20	16.7
Total	120	100

Source: Survey data, 2002

4.1.7 Farm size

The findings in Table 7 show that majority of the respondents (64.1%) own farm size ranging between 0.25 and 0.5 hectares. Those who owned farms below 0.25 and above 1 hectare accounted for 6.7% and 2.5% respectively. Kihiyo (1996). pointed out that the utilization of technology inevitably requires resources and especially land. Some of the respondents also indicated that land shortage was major reason that prevented them from using improved technologies. This implies that some of the farmers in the study area were constrained from utilizing technologies due to land shortage.

Table 7: Distribution of respondents according to farm size (N=120)

Farm size (ha)	n	%
<0.25	8	6.7
0.25-0.5	77	64.1
0.5-1.0	32	26.7
>1.0	3	2.5
Total	120	100

Source: Survey data, 2002

4.1.8 Crops grown by the respondents

Major crops grown by the respondents are presented in Table 8. None of the farmers reported growing of a particular crop or specialized in monocropping. All respondents practiced mixed cropping and is the characteristics of Ethiopian or African farmers in general. The farmers indicated three reasons for practising/growing number of crops on their small piece of land as: a) risk aversion, b) as means of food security and c) they consider having all kinds of food crops from their own farm as a prestige. Among the cereal crops, maize, tef and wheat were reported to be dominant food crops. Among the root and tuber crops, enset and sweet potato were reported to be an important food crops.

Table 8: Major crops grown by the respondents (N=120)

Major crops	N	%
Cereals		
Maize	120	100.0
Tef	84	70.0
Wheat	32	26.7
Root and tuber		
Enset	75	81.7
Sweet potato	104	62.5
Irish potato	35	86.7
Taro	48	29.2
Yam	28	40.0
Pulses		
Beans	53	23.3
Peas	16	44.2
Cash crop		
Coffee	89	74.2
Ginger	67	55.3

Source: Survey data, 2002
*Percentage do not add up 100 because respondents grow more than one crop

4.1.9 Estimated annual income

The study results (Table 9) show that 50% of the respondents were in the incom group of less than 500 birr. No respondents earned more than 1400 birr. Th respondents attributed low income to low production, low market price and shortag of land.

Table 9: Distribution of respondents according to income (in Eth. Birr) (N=120)

Income level (Eth. Birr)	n	%
<500	60	50.0
500-900	38	31.7
1000-1400	22	18.3
1500-1900	-	-
>2000	-	-
Total	120	100

Source: Survey data, 2002

4.2 Agricultural Technologies Generated and Transferred

This section describes the agricultural technologies which were generated and transferred to Bolosso Sore district. Table 10 shows the major agricultural technologies which were generated by Ethiopian Institute of Agricultural Research (IAR). In addition, some technologies like improved sweet potato and maize varieties generated outside Ethiopia were introduced into the district by institutions like FAO and Pioneer seed Enterprise.

Major agricultural technologies which were generated and transferred to the study area were mainly related to maize, tef, wheat, sweet potato and coffee. These were mainly related to development of improved seed varieties as shown in Table 10. However, efforts were also made to develop such accompanying practices like land preparation, proper spacing, proper weeding, use of chemical fertilizers and pesticides for each crop mentioned above.

Table 10 Major agricultural technologies generated and transferred

Technology	Institutions
Maize varieties	
Beletch	IAR
BH-660	IAR
BH-140	IAR
CG-4141	IAR
Pioneer Seed	Pioneers*
Tef varieties	
Cross-37	IAR
DZ-01-196	IAR
DZ-01-354	IAR
Wheat varieties	
HAR-1522	IAR
HAR-604	IAR
K6295/4A	IAR
Sweet potato varieties	
Ogonsecan	FAO*
Gadessa	NA
Coffee Varieties	
7-41	IAR
74-4	IAR

Source: Bolosso Sore district agricultural office
*FAO and Pioneer introduced improved maize and sweet potato variety generate somewhere else

4.2.1 Technologies which were not transferred

Although most technologies were transferred, still there were some technologie which were not transferred (Table 11). According to extension workers, th technologies which they could not transfer were mainly related to enset. Reasons fc failure to transfer these technologies were mainly due to lack of appropriate trainin for extension workers on the technologies, failure of the technologies to perform we and lack of improved varieties and cultural practice generated for enset.

However, through personal communication with research centre and from literatu (Endale, 1993; Bezuayehu, 1993; Admasu, 2000) the researcher learnt that there a

agronomic practices recommended for enset. This implies that there is a gap between technology generating unit and extension service in which generated technologies failed to reach the beneficiaries. This finding is also in agreement with Rutatora and Rutacholozibwa (1995) who argued that agricultural technologies dissemination sub-system lacks impact because, perhaps, there are no new technologies to transfer to small farmers or where there have been new technologies to disseminate they have not been disseminated and where the innovation has been disseminated they have been found to be inappropriate.

Table 11: Technologies which were not transferred

Agricultural technology	Reasons for not being transferred
Enset	
• Improved variety	• Not available
• Agronomic practices	• Not available
• Cultural control of enset bacterial wilt (EBW)	• no consolidated guidance. • No training on EBW control techniques for VEWs
• Enset processing equipment	• Farmers found it less efficient
Improved grain storage	• Most farmers could not produce surplus to store in • Cost of storage construction is unaffordable by farmers • Farmers complained it as tiresome • Unworthy
Preparation and use of compost	• No materials for compost preparation

Source: Survey data, 2002

4.3 Factors which Influenced Transfer of Technologies

4.3.1 Factors that facilitated transfer of technologies

Literature (e.g. Jugal, 1992; Van den Ban and Hawken, 1996)) show that technology transfer is influenced by several factors such as access to credit, comparative advantage and performance of the technology. Jugal (1992) argued that credit facilitates the transfering process of improved technologies for it enables small farmers to satisfy the cash needs that can be caused by the use of improved inputs and production techniques.

According to the experience and views of village extension workers the factors which facilitated transfer of technologies were:

- easy access to credit.
- better performance of some of the technologies in terms of yield (e.g. maize improved seed).
- availability of required inputs such as fertilizers and improved seeds.
- emphasis given by the government and non-government organizations.

4.3.2 Factors that impaired transfer of technologies

Table 12 presents factors which impaired transfer of technologies related to enset, maize and tef as spelt out by village extension workers.

Table 12: Factors which impaired transfer of agricultural technologies (N=15)

Constraints	n	%
Lack of transport	13	86.7
Involvement in non-extension activities like input distribution and repayment collection	8	53.3
Lack of technologies for enset	7	46.7
Lack of adequate training	9	60.0
Lack of incentives	6	40.0
Poor performance of some of the technologies like tef varieties	8	53.3
Others	5	33.3

Source: Survey data, 2002

*Percentage do not add up to 100 because respondents responded to more than one categories

The findings show that major constraints in transferring agricultural technologies were:

a) lack of transport facilities (i.e. for extension workers)

b) engagement of VEWs in non-extension activities like input distribution and loan repayment collection

c) inadequate training for VEWs

d) poor performance of some of the technologies

e) lack of available technologies especially for enset

f) lack of incentives for VEWs

a) Lack of transport

Extension workers indicated that they had no transport to reach the farmers who are scattered in many places. In this connection Rutatora and Rutachokozibwa (1995,) argued that local scientists and extension workers must be provided with necessary tools, adequate funds, library services and other good working conditions. These are essential because they are the ones responsible for initiating and facilitating the

process of technology utilization. Campbell and Barker (1997), also pointed out that if extension workers do not have transport, they may not be able to conduct farm visits as frequently as might be desired or needed. Field extension workers are likely not to have initiatives to render good service if they lack adequate transport facilities.

b) lack of in-service training

The study also tried to investigate further the extent of in-service training offered to extension field workers to up date their technical skills. According to Table 13, more than 40% of the extension workers had received no in-service training or refresher courses. The findings revealed that in-service training offered to extension workers was low or not adequate compared to what is expected of them. MOA (1998), report pointed out that the field extension workers trained for six or nine months in agricultural training centres could not cope with dynamic nature of new technologies being transferred.

Table 13: Distribution of VEWs according to in-service training offered (N=15)

In-service training	n	%
None	6	40.0
Once	2	13.3
Twice	3	20.0
More than twice	4	26.7
Total	15	100

Source: Survey data, 2002

It would appear from these findings that it is necessary for every extension worker to undergo a continuous training and other similar programmes. Wambura (1988), contended that extension workers attending refresher courses and other similar professional development programmes would: a) continuously update their technical

knowledge, b) expose them to new extension methods and techniques, c) increase moral and group sprit and d) generally provide professional reorientation to their work. Thus, failure to transfer some of the technologies mentioned above might have been attributed to lack of appropriate training.

c) Involvement in non-extension activities like input distribution loan repayment and tax collection

The extension workers argue that they were assigned other duties like input distribution, tax collection, and loan repayment collection and in different administration activities such as facilitating election of farmers' association leaders, recruiting of militia and attending political meetings in the village. The study results revealed that involvement in many other non-extension duties, appears to affect the quality of extension services. In this case, contrary to the job description of the extension workers, little time is actually spent on assisting farmers on improved agricultural practices. Ryoba (1996), contended that village extension workers with additional tasks contrary to the advisory job, resulted in dilution of efforts, incompetence and unwarranted interruptions in the extension work programme. Kedir (1999), in his study of role of SG-2000 credit on adoption of wheat technology also found out that involvement of extension workers in no-extension activities has caused extra work load and damaged relations with their client farmers.

d) Other factors which impaired transfer of technologies

The category labelled "others" included constraints like interference by district council, cadres and FA leaders in the extension activities, bad weather, lack of inputs,

lack of transparency in the management of the district agricultural office. too many farmers to work with and conducting extension activities on ad hoc basis i.e. lack of clearly defined work programme. The extension workers further explained that improved maize planting was monitored by an ad hoc committee composed of non-professionals from different Ministerial offices in the district.

The problem of interference by district council, farmers association leaders and cadres arose from the fact that village leaders engage themselves in extension work. The current Ethiopian government policy with major focus on Agricultural Development Led Industrialisation (ADLI) development strategy, gave mandate to local governments and district party leaders to engage themselves actively in extension activities in their localities. The mandate included the privilege of hiring and promoting of extension workers, among others.

Through informal discussion with technical and administrative MOA staff in the district, the researcher learnt that any steps, be it technical or administrative, that should be taken by the district agricultural office must go through district council. Thus, field extension workers as well as some technical staff have to maintain loyalty to the party cadres and farmers' leaders who are more important for their promotion and other benefits. The researcher also observed that this has created lots of confusion concerning accountability, authority and resource use in the district in general. It was realised that many of the resources including technical staff could not be mobilized according to plan and programme of the district agricultural office.

4.4 Extent of Utilization of Technologies

The study focused on the extent of use of recommended technologies for enset, maize and tef. Based on the list of technologies given in Table 10, improved technologies and practices selected for in-depth study with regard to the extent of utilization were: a) land preparation, b) use of improved seed, c) proper spacing, d) proper weeding, e) use of chemical fertilizers and f) use of pesticides. The specific practices recommended for each crop are presented in Table 14. Although the study focused on three crops, there were no technologies related to enset that were transferred to farmers. Details of these were described under section 4.2

Table 14: Recommended technologies for enset, maize and tef

	Recommendations		
Practices	Enset	Maize	Tef
Land preparation		• 3 to 4 times plowing	• 4 to 5 times plowing
Improved seed	-	• CG-4141, BH-140, BH-660, Beletch, Pioneer, • 25 kg seed per ha.	• Cross-37, DZ-01-196, DZ-01-3545, • 30 kg seed per ha.
Proper spacing	-	• 80 cm. between rows and 50 cm. between plants	• Broadcasting
Proper weeding	-	• 2 to 3 times weeding	• 2 times weeding
Use of fertilizers	-	• 100 kg DAP and 100 kg urea/ha	• 100 kg DAP and 100 kg urea/ha
Use of pesticides	-	• Various	• Various

Source: Bolosso Sore district agricultural office, 2001

4.4.1 Land preparation

Table 15 shows the extent of utilization of maize and tef technologies by farmers. More than 75% of the respondents accepted proper land preparation as advised by extension workers because of its better impact on the yield compared to the traditional and also it was not far away from traditional. However, only 22.5% of the respondents used recommended land preparation for tef that is 4 to 5 times plowing.

Table 15: Extent of utilization of maize and tef improved technologies (N=120)

Recommended Technology	% distribution	
	Maize	Tef
	Utilized	Utilized
Land preparation	75.0	22.5
Use of improved seed	78.3	32.5
Proper spacing	34.2	-
Proper weeding	65.8	46.7
Use of fertilizers	80.0	53.3
Use of pesticides	11.8	-

Source: Survey data, 2002

4.4.2 Use of improved seed

The majority (78.3%) utilized maize improved seed specifically CG-4141. Other improved seeds like maize varieties (e.g. BH-140, BH-660) and also all tef varieties (e.g. Cross-37, DZ 01-196 and DZ 01-3545) were not widely utilized. The respondents attributed less utilization of these maize and tef varieties to poor yield, late maturity, less tolerance to diseases and pests and lodging (tef).

4.4.3 Proper spacing

Proper spacing included maintaining recommended spacing between and within the row which is 80cm. x 50cm. for maize. However, only 34.2% of the respondents accepted and utilized the recommended spacing. This shows that the extent of utilization was below expectation. However, this does not mean that the farmers were using traditional broadcasting method. According to the respondents, use of oxen drawn implements (which regarded to be easier practice) made them not to follow the recommended spacing of 80 x 50 cm. Perhaps if implements are manufactured according to the recommended spacing, majority of farmers may utilize the proper spacing.

Respondents pointed out that the operations were tedious and labour demanding especially during the peak labour period. This finding is in line with Kedir (1999) who found out that farmers could not use row planting for wheat because it is tiresome and labour demanding operation.

4.4.4 Proper weeding

More than 65% of the respondents used proper weeding according to recommendations or advice given by the extension workers. In case of tef, only 46.7% of the respondents used the recommended weeding. Second weeding for maize is performed using oxen drawn implement which is not possible as far as tef is concerned because it is broadcasted. Usually weeding of tef is performed manually and thus less utilization of recommended weeding could be attributed to the nature of weeding operation for tef which is very tedious.

4.4.5 Use of chemical fertilizers

The majority (80%) of the respondents used chemical fertilizers with regard to maize. The respondents attributed the acceptance and utilization of chemical fertilizer to significant increment in yield both with improved and local seeds and access to credit. Besides, they confirmed that their land could not bear any yield without fertilizers due to continuous cultivation for a number of years. As evidenced in section 4.1.7, because of severe land shortage, the district farming community have to farm the same piece of land throughout the year. Thus, due to decline in soil fertility they were forced to use fertilizers.

4.4.6 Use of pesticide

In case of pesticide the lowest extent of acceptance and utilization (11.8%) for maize. Through probing the researcher learned that some of the farmers who reported about the use of pesticides referred to the use of malthione, a pesticide which was used for the control of army worm and normally fully funded by the government. Reasons which made most respondents not to use pesticides were extremely high cost, lack of know-how and failure to supply in small packages that farmers can afford.

4.5 The Relationship of Identified Factors and Utilization of Agricultural Technologies

The aim of this section is to describe the relationships between identified factors and utilization of maize and tef improved technologies that were transferred to the farmers in the study area.

4.5.1 Relationship of identified factors and utilization of maize improved technologies

4.5.1.1 Sex

The relationship between sex and utilization of maize improved technologies is give in Table 16. According to Table 16 there were significant relationships between se and use of improved seed (Chi-square = 10.323, df. = 1, Sign.= .001) and prope weeding (Chi-square 7.789, df = 1, Sign = 0.005). As it could be seen from the table out of 24 women engaged in agriculture only 13 women (50.3%) utilized maiz improved seed compared to 84.5% of men. In addition, out of 96 men engaged i agriculture 69 men (71%) utilized proper weeding which is higher compared t women (42%). Less utilization of maize improved seed and proper weeding by wome could be attributed to constraints such as less access to resources and services. In lir with this, MOA (1993), report indicated that women in Ethiopia a disadvantaged group specially when it comes to information of new technologie access to resources and services such as credit

andextension.

Table 16: Relationship between sex and utilization of maize improved technologies N=120)

Sex	Level of utilization											
	Land preparation.		Improved seed		Spacing		Weeding		Fertilizers		Pesticides	
	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not
Male	69	27	81	15	30	66	69	27	84	22	12	84
Female	15	9	13	11	11	13	10	14	12	12	2	22
Total	84	36	94	26	41	79	79	41	96	34	14	106
X^2	.804		10.323		1.815		7.789		2.552		.323	
df.	1		1		1		1		1		1	
Sign.	.370		.001		.178		.005		.110		.570	

Source: Survey data. 2002

4.5.1.2 Income

The relationship between income and utilization of maize improved technology is indicated in Table 17. From Table 17 it is clear that there was statistical significant relationship between income and utilization of maize improved seed (Chi-square = 33.191, df. = 3, Sign. = .000). The majority who utilized maize improved seed were those who had relatively better annual income. This finding is in line with CIMMYT (1993), finding which states that wealthier farmers may be the first to try a new technology especially if it involves purchased inputs. Machumu (1995) and Rogers(1995) also contended that richer farmers have more access to credit and extension information because they can afford to make a down payment for the credit and are more likely to take risks and to try out innovations.

Table 17: Relationship between income and utilization of maize improved technologies (N=120)

Income Categories	Level of utilization											
	Land prepa.		Seed		Spacing		Weeding		Fertilizer		Pesticide	
	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not
<500	40	20	34	26	23	37	34	26	46	14	1	59
500-900	29	9	38	-	14	24	31	7	31	7	7	31
1000-1400	15	7	22	-	4	18	14	8	19	3	6	16
1500-1900	-	-	-	-	-	-	-	-	-	-	-	-
Total	84	36	94	26	41	79	79	41	96	24	14	106
X^2	1.074		33.191		3.083		6.477		1.033		2.927	
Df.	3		3		3		3		3		3	
Sign.	.585		.000		.214		.039		.597		.231	

Source: Survey data, 2002

4.5.1.3 Farm size

Farm size is a common variable examined in adoption and/or utilization studies and is often a good proxy indicator for wealth (CIMMYT, 1993; Feder *et al.*, 1985). In respect to utilization of new technologies, it has been recognized that small and large farmers differ in the extent of utilization (Coughenous, 1994, Polson and Spencer, 991). It is assumed that large scale farmers will be more likely to accept and utilize a technology faster than small-scale farmers. According to CIMMYT (1993), a certain threshold of land is necessary before investment in a technology is worthwhile.

Based on the results (Table 18) there were statistically significant relationships between farm size and utilization of maize improved seed and pesticides. The Chi-square test was highly significant for maize improved seed utilization (Chi-square = 31.888, df = 3, Sign.=.000) and use of pesticide (Chi-square= 8.813, df.=3, Sign.=.032). As could be seen from Table 18 the majority who utilized maize improved seed and pesticides were those who had larger farm size. The findings are in line with Ockwell *et al.* (1991), who contended that farmers who own larger farm sizes are more innovative in utilizing agricultural technologies.

Table 18: Relationship between farm size and utilization of maize improved technology (N=120)

Farm size (ha)	Level of utilization											
	Land prep.		Seed		Spacing		Weeding		Fertilizer		Pesticide	
	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not
<0.25	6	2	-	8	2	68	3	5	5	3	-	8
0.25-0.5	58	19	63	14	24	53	52	25	64	13	9	68
0.5-1.0	19	13	28	4	14	18	21	11	24	8	4	28
>1	1	2	3	-	1	2	3	-	3	-	1	2
Total	84	36	94	26	41	79	79	41	96	24	14	106
X2	4.776	31	31.888		1.914		4.512		3.249		8.813	
df.	3		3		3		3		3		3	
Sign	.189		.000		.590		.211		.355		.032	

Source: Survey data, 2002

4.5.1.4 Ownership of Oxen

Owning oxen is one of the factors assumed to influence acceptance and utilization of technologies. According to the results given in Table 19 there were statistical significant relationships between ownership of oxen and land preparation (Chi-square = 11.552 df.=2, Sign. =. 003) and, use of maize improved seed (Chi-square = 11.181. df = 2, Sign. = .004). The result also showed statistical significant relationship between ownership of oxen and proper weed control (Chi-square = 17.382, df.=2, Sign.=.000). This implies that utilization of improved seed, proper land preparation and proper weeding were dependent on ownership of oxen.

In Bolosso Sore district, owning oxen facilitates land preparation, timely sowing and weeding because all these operations are performed by oxen drawn implements. Thus, those who own oxen are better placed to follow the recommended practices. The findings are in line with the finding of CIMMYT (1993), which contended that if recommendations involve certain equipment or machinery, the degree of utilization may depend on the number of farmers who are able to acquire the equipment and whether or not an effective rental market develops.

Table 19: Relationship between ownership of oxen and utilization of maize improved technologies (N=120)

Oxen	Utilization level											
	Land prep.		Seed		Spacing		Weeding		Fertilizer		Pesticide	
	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not	Utilized	Not
No ox	37	28	36	29	20	45	32	33	49	16	5	60
Only one ox	30	5	30	5	13	22	30	5	30	5	6	29
Two or more	17	3	16	4	8	12	17	3	17	3	3	17
Total	84	36	94	26	41	79	79	41	96	24	14	106
X2	11.552		11.181		.774		17.382		1.892		2.230	
df.	2		2		2		2		2		2	
Sign	.003		.004		.679		.000		.388		.328	

Source: Survey data, 2002

4.5.2 The relationships of identified factors and utilization of tef improved technologies

The relationships between respondents gender, income level, farm size and possession of oxen and utilization of tef improved technologies was also tested by the Chi-square statistics for independence. Statistical significant relationship was observed between ownership of oxen and utilization of proper land preparation for tef (Chi-square = 14.578, df.=2, Sign. = .001) indicating that utilization of proper land preparation for tef is dependent on possession of oxen (Table 20). As indicated in section 4.4. tef needs a thorough land preparation (i.e. 4-5 times plowing). This needs an easy access to oxen by which those who own may have better opportunity compared to those who do not have oxen. However, sex, income and farm size did not show any statistical significant relationship with utilization of tef improved technologies.

Table 20 Relationship between ownership oxen and utilization of tef improved technologies (N=120)

Oxen	Land prep.		Improved seed		Weeding		fertilisers		Pesticide	
	Adop.	Not	Adop.	Not	Adop.	Not	Adop.	Not	Adop.	Not
No ox	10	55	22	43	4	61	34	31	-	65
Only one ox	6	29	12	23	1	34	15	20	-	35
Two or more	11	9	5	15	1	19	7	13	-	20
Total	27	93	39	81	6	114	56	64	-	120
X^2	14.578		.617		.521		2.129		-	-
df.	2		2		2		2		-	-
Sign	.001		.734		.771		.345		-	-

Source: Survey data, 2002

4.6. Factors which Facilitated/impaired utilization of enset, maize and tef technologies

4.6.1 Factors which facilitated utilization of technologies

The following are factors which facilitated utilization of technologies in Bolosso Sore district

4.6.1.1 Extension service

Literature reveals that agricultural extension service facilitates the utilization of technologies (Starkey, 1996; Fischer, 1994) According to Fischer (1994). extension service is important when it comes to utilization of technologies because it provides knowledge that facilitates utilization. To determine whether extension service has facilitated the utilization of maize and tef improved technologies the following factors were examined: a) source knowledge, b) contact with village extension workers. c) use of demonstration plots and d) advisory service

a) Source of knowledge

With regard to source of knowledge Table 21 indicates that 75% of the respondents came to know about the transferred technology from village extension workers and 18.3% from the fellow farmers or neighbours. Only 6.7% of the respondents indicated that their source of knowledge was visits paid to different locations on their own initiatives. The findings indicate that for the majority of respondents source of information on the transferred technologies were village extension workers. This implies that village workers have facilitated utilization of maize and tef technologies.

Table 21: Distribution of respondents according to source of knowledge (N=120)

Source of knowledge	n	%
Neighbour	22	18.3
Visits	8	6.7
Village extension worker	90	75.0
Total	120	1000

Source: Survey data, 2001

b) Contact with village extension workers

From Table 22 it is clear that the majority (54.2%) of the respondents pointed out that they were visited once in three months. About 22.5% and 10.0% of the respondents indicated that the they were visited once per month and once per week respectively. When compared with T&V system of extension which emphasizes the need of village extension workers to visit frequently the achievements are still far from the expectations. This is probably due to lack of facilities and motivation on the part of extension workers and also too many farmers to work with. It was observed that extension workers had registered their concern over poor transportation facilities and uncomfortable working conditions.

Table 22: Distribution of respondents according to the number of contact with VEW's (N=120)

Number of contact	n	%
Once per week	12	10.0
Once per month	27	22.5
Once in three months	65	54.2
Don't remember	9	7.5
Never	7	5.8
Total	120	100.0

Source: Survey data, 2002

c) Advisory service

Although there was less number of contacts between village extension workers and the farmers they are serving, the majority (81.2 %) of respondents pointed out that they had received advice on maize and tef improved technologies. They also indicated that the advice was useful in as far as utilization of technologies are concerned (Table 23).

Table 23: Distribution of respondents according to advice given by VEWs

(N=120)

Received advice	n	%
Yes	98	81.7
No	22	18.3
Total	120	100

Source: Survey data, 2002

d) On-farm demonstration plots

Farmers were asked to indicate the extent to which they benefited from demonstration plots. Table 24 indicates that 75.5% of the respondents agree that the demonstration plots were more educative and influenced them to utilize the technologies. They emphasized that the demonstration plots have substantially contributed to the utilization of land preparation, use of improved seed, weeding and use of fertilizer for maize.

Even the respondents who did not utilize some or all of the technologies transferred on maize and tef appreciated that demonstration plots were educative more than any other extension approach. Majority said that changes brought about by improved seeds, fertilizers and other cultural practices could easily be observed on their own farms.

Table 24: Respondent's views on demonstration plots (N=120)

Responses	n	%
Educative	87	75.0
Not educative	33	25.0
Total	120	100

Source: Survey data, 2002

4.6.1.2 Credit service

According to the results in Table 25, about 65% of the respondents indicated that they had access to credit and it helped them to utilize the technologies. The researcher also observed that credit service particularly on maize and tef improved seeds and on use of fertilisers was widely offered to farmers in the study area. In this connection, Kedir (1999), found out that SG-2000 credit assisted SG credit group members to apply higher quantity of fertilizers than that of non-SG credit group members. However, it was realised that credit services for other items like oxen was insignificant and cumbersome.

Table 25: Distribution of respondents according to access to credit (N=120)

Access to credit	n	%
Yes	78	65.0
No	42	35.0
Total	120	100

Source: Survey data, 2002

4.6.1. 3 Performance of maize and tef improved seeds

About 66.8% (Table 26) of the respondents indicated that yield performance of maize improved seed was superior. In the case of maize the respondents indicated that yield performance of the maize improved seeds had facilitated the utilization of maize technologies. However, 61.7% of the respondents claimed that yield performance of tef was inferior to the local and its performance could not influence them to utilize tef technologies.

Table 26: Views of respondents on yield performance of maize and tef improved seeds (N=120)

Opinion	Maize		Tef	
	n	%	n	%
Better than local	80	66.7	36	30.00
The same	27	22.5	10	8.3
Inferior to the local	13	10.8	74	61.7
Total	120	100	120	100

Source: Survey data, 2002

4.6.2 Factors which impaired utilization of enset, maize and tef technologies

In this section, attempts were made to look into factors which impaired utilization of technologies related to production of enset, maize and tef. In general, the results of the study discussed in the previous sections show that farmers did not utilize part or all of the technologies as recommended. According to Table 27, there were many factors that prohibited farmers from utilizing enset, maize and tef improved technologies that were transferred. From Table 27, it can be observed that in the case of enset, lack of appropriate improved technologies was the major cause which impaired utilization.

On the other hand, lack of market, shortage of oxen, high cost of inputs, land shortage. unavailability of inputs were indicated by respondents as major factors which impaired them from utilizing the technologies. Besides, poor performance of tef improved seed posed challenge to technology utilization in the study area. Thus, it could be seen from the table that the factors investigated could not convince majority of the respondents to utilize tef technologies.

Table 27: Factors which inhibited farmers from using technologies (N=120)

	Enset		Maize		Tef	
Factors	n	%	n	%	n	%
Fear of risk	-	-	23	19.2	45	37.5
Unavailability of inputs	-	-	25	20.8	32	26.7
Lack of technologies	111	92.50	16	13.3	13	10.8
Poor performance of technologies	-		12	10.0	76	63.3
Lack of market	-	-	114	95.0	112	93.3
Land shortage	-		26	21.7	35	29.2
shortage of oxen	-		48	40.0	39	33.5
High cost of inputs			46	38.3	36	30.0
Bad weather	-	-	12	10.0	18	15.0

Source: Survey data

*Percentage do not add up to 100 because respondents responded to more than one categories.

4.7 Farmers' and Extension Worker's Perception on the Technologies Transferred and Utilized

4.7.1 Farmers' perception

It was felt that understanding farmers perception on the utilization of improved technologies could provide some indication on the extent of acceptance or rejection of

improved technologies. Rogers (1995) contended that if diffusion scholars could more adequately see an innovation through the eyes of their respondents. including a better understanding of why the technology was utilized or rejected, diffusion research would be in a better position to shade the pro-innovation bias of the past. Farmers perceptions on the characteristics of six technologies transferred were analyzed and presented in Table 28.

4.7.1.1 Land preparation

The majority (74.2% for maize and 63.3% for tef) of respondents felt that the recommended land preparation practice for maize and tef was compatible with their previous practice. As indicated earlier it was not far away from traditional and it was not a tedious operation for them.

4.7.1.2 Use of improved seed

The majority (71.7%) appreciated the high yield performance of maize improved seed. Even though the yield performance of tef was considered to be low by some of the respondents still, 27.5% of the respondents acknowledge that it had increased yields. However, about 78.3 % and 74.2% for maize and tef respectively perceived that the cost of maize and tef improved seed was high. Moreover, 87.5% and 64.2% of respondents for maize and tef respectively have negative feelings towards the price of produce in the market. Some of the respondents expressed their feelings that they may withdraw from using the technologies if the price of tef and maize continues to be low.

Table 28: Distribution of respondents according to their perception on transferred technologies (N= 120)

Technologies	Enset		Maize		Tef	
	n	%	n	%	n	%
Land preparation						
Compatible with previous practice	-	-	89	74.2	76	63.3
Not compatible	-	-	31	24.8	44	36.7
Labour intensive			-	-	-	-
Improved seed						
Increased yield	-	-	86	71.7	33	27.5
Did not increase Yield	-	-	34	28.3	87	72.5
Cost of improved seed						
High	-	-	94	78.3	89	74.2
Reasonable	-	-	26	21.7	31	25.8
Proper spacing						
Not compatible with previous practice	-	-	98	81.2	-	-
Not easy to practice			68	56.7	-	-
Labour intensive			69	57.5		
Timely weeding						
Not compatible with previous practice	-	-	31	25.8	18	15.0
Compatible	-	-	31	25.8	102	85.0
Soil fertility is a problem						
Yes	-	-	108	90.0	104	86.7
No	-	-	12	10.0	16	13.3
Cost of fertilizer						
High	-	-	93	77.5	87	72.5
Reasonable	-	-	27	22.5	33	27.5
Pests damage is a problem						
Yes			78	65.0	56	46.7
No			42	35.0	64	53.3
Cost of chemicals						
High	-	-	109	90.8	102	85.0
Reasonable	-	-	11	9.2	18	15.0
Input supply						
Reliable	-	-	33	27.5	77	64.2
Unreliable	-	-	87	72.5	43	35.8
Market for produce						
Available	-	-	15	12.5	57	47.5
Not available	-	-	105	87.5	77	64. 2

Source: Survey data, 2002

*Percentage do not add up to 100 because respondents responded to more than one

4.7.1.3 Use of proper spacing

This refers to recommended spacing between and within rows. It is applicable only for maize as with regard to tef broadcasting, which is more or less similar to traditional, is recommended. About 81.7% of the respondents, perceived that proper

spacing technology for maize was incompatible with their previous experience which utilizes oxen drawn implements. They also felt that the operation was labour demanding. This means that despite the yield increment, the recommended proper spacing was not perceived to have obvious advantage over the old practice. As discussed earlier, appreciating yield gain through proper spacing. farmers have started using oxen drawn implement to make the operation less tedious and less labour demanding. However, the capability of oxen drawn implements to maintain the recommended spacing as well as its influence on yield performance has not been investigated.

4.7.1.4 Use of fertilizers

Majority of the respondents (90% for maize and 86.7% for tef) claimed that fertility of their soil was a major problem and they acknowledged the importance of fertilizer use in maize and tef production. However, the majority complained high cost of fertilizer as a major constraint which impaired them from using fertilizer for maize and tef.

4.7.1.5 Use of pesticide

As could be seen from table 28, the majority (65%)of the respondents in case of maize and 46.7% of the respondents with respect to tef complained that pest damage was a problem. On the other hand 90.8% and 85.0% of the respondents with regard to maize and tef production respectively claimed that the cost of pesticides was very expensive. The other reason commonly indicated by respondents for less or no utilization of pesticide was unavailability. The respondents indicated that unlike other

input pesticides were not available through ministry of agriculture or any other institutions in their village.

4.7.2 Perception of Extension workers' on transferred and utilized technologies

This section examined extension workers' views on enset, maize and tef technologies which were transferred and utilized in the study area. In case of enset, almost all field extension workers indicated that there were no technologies officially released and incorporated in the extension packages for transfering to farmers. They expressed their deep concern regarding their failure to extend any viable technology that could have assisted farmers in improving enset crop production and productivity. They also stressed that cost of inputs for both maize and tef improved seeds and fertilizers was not affordable by majority of farmers they are working with. The extension workers felt that poor performance of tef improved seed, unavailability of pesticides, failure to supply pesticides in smaller packages were constraints observed in technologies transferred. They also indicated that sometimes improved seeds failed to meet the quality standard there by causing poor performance and dissatisfaction on the part of farmers.

Besides, they noted that failure to make the inputs available on time remained as a challenge. Improved seed production was dominantly undertaken by Ethiopian Seed Enterprise (ESE) and the capacity of this agency was not coping with the increased demand by farmers particularly for maize improved seed. It was also reported that small-scale seed enterprises managed by individual farmers were emerging in different areas but could not make any difference. This is so because the management skills of

producer farmers are still low, lack reliable market and other inputs needed for seed production. There are also very limited fertilizer and pesticide distributing agencies. Stephanos (1995), contended that efficient and timely procurement and distribution of inputs in Ethiopia are constrained by lengthy procurement and pricing policy, weak institutional arrangements and limited private sector participation.

The extension workers also pointed out that there was poor communication with research institutions. An effort was made to see the level of extension workers participation in research problem identification and prioritisation. According to Table 29, more than 86% of field extension workers indicated that they had no say on research problem identification and prioritisation. This has a bearing on extension-research linkage.

Table 29: VEWs perception on involvement and pointing out research agenda

(N=15)

Level of participation	n	%
Non	13	86.8
Low	2	13.2
Medium	-	-
High	-	-
Total	15	100

Source: Survey data, 2002

The extension workers reported that some of the constraints such as poor performance of tef and some maize improved varieties need reassessment by researchers to enhance utilization. However, according to the extension workers report, the constraints indicated above have remained unsolved for number of years.

Despite the above constraints, extension workers claimed that some of the technologies had good qualities. They stressed that the outstanding yield performance of some maize varieties like CG-4141 has contributed much in persuading farmers to utilize the technologies. Besides, they also felt that large on-farm demonstration plots extension approach which emphasizes farmers participation, convinced the farmers to utilize the technologies. Village extension workers also pointed out that farmers were eager and ready to utilize technologies which outperformed their traditional crops and/or practices, hence such a technologies have a better chance for acceptance by small holder farmers.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.0 Overview

The overall objective of the study was to determine the factors influencing transfer and utilization of selected agricultural technologies on enset, maize and tef in Bolosso Sore district. This chapter provides the conclusions and recommendations derived from the study.

5.1 Conclusions

Based on the findings of the study the following conclusions are made.

1. With regard to characteristics of respondents the majority (75.5%) were in the age category of between 26 and 55 years and more than 57% of them were illiterate. Men and women accounted for 80 % and 20 % of the respondents respectively. Most of the respondents were in the income brackets of below 500 birr per year and the majority (64%) had farm sizes ranging between 0.25 and 0.5 hectares per household.
2. The study revealed that several agricultural technologies and/or practices were introduced in the five farmers' associations namely Sunkale, Tadisa, Sorehomba, Adila and Bombe in Bolosso Sore district. The study revealed further that most of the agricultural technologies introduced were transferred to the end users. Besides, the study findings indicated that most of the agricultural technologies which were generated and transferred to farmers in the study area were mainly

related to improved maize and tef varieties. The technologies also included major accompanying technologies like cultural control of EBW. land preparation. proper spacing, proper weeding, use of chemical fertilizers and use of pesticides. Major improved varieties of maize that were introduced included CG-4141. BH-660. Beletch, HB-3435 and Pioneers seed. In case of tef, improved varieties such as DZ-01-354, DZ-01-196 and Cross-37 were transferred.

3. On the other hand, the study also revealed that despite the importance of enset as one of the major food crops in the study area, there were no improved varieties and/or agronomic practices that were developed and transferred. This could be attributed partly to the fact that enset drew the attention of researchers and extension worker very lately compared to maize and tef (see chapter 1).

4. Major factors which facilitated transfer of technologies included:
   - good performance of some of the technologies
   - availability of credit service
   - emphasis given by the extension workers.

5. On the other hand, there were factors which in a way impaired the extent to which technologies could be transferred to farmers and these were:
   - lack of transportation facilities for VEWs.
   - inadequate training of VEWs
   - involvement of VEWs in non-extension activities.
   - poor performance of some of the technologies like tef improved seed.
   - lack of appropriate technologies for enset
   - interference of district council and cadres.

6. The study also showed that many of the agricultural technologies were accepted and utilized by majority of the respondents. The technologies which were mostly utilized were such as land preparation, use of improved seed. use of fertilizers, and proper weeding. In addition, majority of farmers preferred CG-4141 maize improved seed overall other maize varieties.
7. Some of the technologies like maize improved varieties (BH-660. BH-140, Pioneer) and tef improved varieties (Cross-37, DZ-01-196, DZ-01-354). proper spacing and pesticides were less utilized due to constraints like late maturity. less tolerance to disease and pests, low yield, lodging (tef), tedious operation and high cost.
8. From the study it is clear that some of maize and tef technologies were utilized more by the respondents who had oxen, larger farm size, higher income. and were mainly male. The results of Chi-square test for the relationship between sex, farm size, ownership oxen, income and utilization of technologies were also found to be statistically significant.
9. The major factors which facilitated the utilization of technologies included:
    - much emphasis and advice by the extension workers.
    - credit offered to acquire the inputs.
    - outstanding performance of these technologies compared to traditional practice.
    - availability of inputs (e.g. improved seeds and fertilizers) for crops such as maize and tef.
    - larger on-farm demonstration plots.

10. Besides factors which enhanced or facilitated the extent of utilization of identified technologies, the following factors in a way constrained the extent to which technologies could be utilized;
    - lack of viable technologies in case of enset.
    - lack of market for the produce
    - Shortage of oxen
    - High cost of inputs
    - poor performance of some of the technologies such as tef improved seed.
    - Unreliable inputs supply (sometimes inputs were not supplied in the right time as well as in required volume)
    - land shortage
11. When assessing farmers' perception on the transferred and utilized of technologies, majority appreciated the performance of improved seeds, use of fertilizers, proper land preparation and proper weeding. However, majority had negative feelings on:
    - high cost of inputs (improved seeds, fertilizers and pesticides).
    - incompatibility of spacing for maize with their previous practices.
    - unreliable input supply.
    - low market price for the produce.

12. Similarly, the extension workers also perceived the performance of some of the technologies and some of the extension methods like on farm demonstration plots very positively. However, extension workers pointed out that there were no improved technologies for enset to transfer to farmers and cost of inputs were generally high compared to the financial position of the farmers.

5.2 Recommendations

In view of the findings of the study, the following recommendations are made.

1. Some of the technologies (maize improved varieties and accompanying practices) were effective in addressing farmers problems and found to have significant impact in improving food production. In such cases it is recommended that the researchers as well as the extension personnel need to look for strategies for harnessing the positive attributes of such technologies so that more farmers could utilize them.
2. Despite enset being one of the important food crops for Bolosso Sore district population, no significant technologies like improved varieties and agronomic practices were developed and transferred. In view of this situation it is recommended that researchers should give priority to developing enset varieties suitable to the locality and to make sure that they are transferred so that enset crop production constraints in Bolosso Sore district could be alleviated.
3. A number of factors (e.g. engagement of extension workers in non-extension activities, lack of transport facilities, inadequate training, high cost of inputs,

shortage of oxen, low price for produce and unreliable input supply) were found to constrain transfer and utilization of technologies. In this regard it is recommended that these factors should be thoroughly examined and strategies such as encouraging farmers co-operatives and private investors to take part in seed production and inputs distribution, resuming subsidies for imported inputs, increasing access of transport facilities and timely training to extension workers should be given due consideration. In the case of low market price of produce, an effort initiated by SNNPR to absorb excess production should be encouraged and strengthened.

Overall

From the findings it is clear that neither farmers nor extension workers were involved in technology development, something which impaired the extent to which technologies could be transferred and utilized. Although researchers claim that something was done in case of enset agronomic practices, extension workers argue that nothing was brought to their attention.

In order to avoid such confusion, and also to promote harmonious technology development, transfer and utilization, it is recommended that research institutions and extension service should adopt a participatory approach to technology development and transfer. This is essential for all stakeholders, and farmers in particular, to be able to identify themselves with the entire process of technology development and dissemination. Besides empowerment, farmers will also be accountable and responsible for the success or failure of the introduced technologies. In this case the

recent EARO initiatives on linkage policy and strategy should be appreciated and implemented with due consideration of grass root stakeholders.

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APPENDICES

APPENDIX : I FARMERS QUESTIONNAIRE

TITLE: FACTORS INFLUENCING TRANSFER AND UTILIZATION OF SELECTED AGRICULTURAL TECHNOLOGIES IN ETHIOPIA: A CASE STUDY OF BOLOSSO SORE DISTRICT

Farmers No. ____

Name of farmers' association_____Development center_____

A. General Information

1. What is your age? (Put X)

   1) 18-25 years _____ 2) 26-35 years _____ 3) 36-45 years_____

   4) 46-55 years_____ 5) Above 55 years_____

2. Sex (Put X)

   1) Male_____ 2) Female_____

3. Marital status (put X)

   1)Married ____ 2) Never married_____

   3)Divorced_____ 4) Widowed_____

4 What is your highest level of education? (Put X)

   1) No education____ 2)Read and write____3) Primary education____

   4) Junior high school_____ 5) High school_____

5. What is your average annual income in Birr? (Put X)

   1) Less than 500_____ 2) 500-900_____ 3) 1000-1400_____

   4) 1500-1900_____ 5) >2000_____

6. What is your family size? (Put X)

   1) 1-3_____ 2) 4-6_____ 3) 7-9_____ 4) 10-12 _____

7. Do you have livestock? (put X)

1) Yes_____ 2) No____

8. If yes, pleas indicate the number of livestock you have. (Put X)

1) Ox number____ 2) Cow number_____ 3) Sheep number __

4) Goats number____ 5) Donkey number ____

7) Horse number ____ 8)Poultry number____

9. What is your source of farm labour? (Put X)

1) Family labour_____2) Hiring labour____ 3) Work group____

B. Agricultural activities

1. What is the size of your land holding?

Timad _____ or Hectare _____

2. What are your main food crops? (Put X)

1)Enset_____ 2) Maize____ 3) Teff_____

4) Others (Specify)_____

3. What are your cash crops? (Put X)

1) Enset_____ 2) Maize_____ 3) Tef _____

4) Others (specify)_____

4. How much of your land is allocated for each crop? (Indicate in Timad and hectare)

Crops	Timad	Hectare
1) Enset	_____	_____
2) Maize	_____	_____
3) Tef	_____	_____
4) Others	_____	_____

5. In the last 5 years, how was your harvest for the following crops ? (Put X)

	Enset	Maize	Tef
1) Increasing	_____	_____	_____
2) Decreasing	_____	_____	_____
3) No change	_____	_____	_____

6. If it is increasing/decreasing for which crop and for what reasons? (Put X for increasing/decreasing and write down the reasons)

Crop type	1)Increasing	2) Decreasing	Reasons
Enset	_____	_____	_____
Maize	_____	_____	_____
Tef	_____	_____	_____

7. What source of power do you use in preparing land for planting of crops listed in question No. 2 (Put X)

Power source	Enset	Maize	Tef
1) Hoe	____	____	____
2) Ox	____	____	____
3) Hoe and Ox	____	____	____

8. Do you have ready market for the following crops? (Yes/No)

1) Enset_____ 2) Maize_____ 3) Tef_____

9. How was the market price for the following crops for the last 5 years? (Put X)

	Enset	Maize	Tef
1) Increasing	____	____	____
2) Decreasing	____	____	____
3) No change	____	____	____

10. Please indicate improved practices/ technologies you received in the last 5 to 10 years

Cereals_____

Pulses_____

Oil crops_____

Root and tubers_____

Cash crops_____

C. Utilization of maize, tef and enset, improved technologies

I. Improved seed

1. Do you know anything about improved seed varieties? ____(YES/NO)
2. If yes, for which crops are you using improved seed varieties? (Put X)

   1) Enset varieties___ 2) Maize varieties ____ 3) Tef varieties____
3. If the answer in question 1 above is yes. how do you get the seeds? (Put X)

   1. Purchased on cash ____ 2. Purchased on credit____

   3. Own production____

   4. Others (Specify)_____
4. Who supplies you with improved seed? (Put X)

   1) MOA_____2) Private enterprise_____ 3)Cooperatives_____

   4. Others (specify) _____
5. What problems do you face in getting improved seed.(Put X)

   1) Not available on time ____ 3) Price is high_____

   2)Not Available in required quantity____ 4) Price is high____

   5) Others (specify) _____

6. What are the specific varieties you used for each crop? (Write the names of the varieties)

1) Enset	2) Maize	3) Tef
_____	_____	_____
_____	_____	_____
_____	_____	_____

7. What is the seed rate per hectare (or per timid) you use for each crop?

Crop	Seed rate/ha	Seed rate/ timad
Enset	_____	_____
Maize	_____	_____
Tef	_____	_____

8. When did you start using these varieties? (Write the year)

Crops	Year
Enset	_____
Maize varieties	_____
Tef varieties	_____

9. If the answer in question 1 above is No. what are the reasons?

1).Enset_____

2). Maize_____

3). Tef_____

10. How do you compare the quality of improved varieties with the local ones? (Put X)

	Enset	Maize	Tef
1) Better	____	____	____
2) The same	____	____	____
3)Inferior	____	____	____

II Proper spacing

1. Do you know anything about proper spacing? _____ (Yes/No)

2. If yes , for which crops are you using proper spicing? (put X)

   1. Enset _____ 2. Maize_____ Tef _____

3. If yes please indicate proper spacing you use for each crop.

	Between plants	Between rows
1. Enset	_____	_____
2. Maize	_____	_____
3.Tef	_____	_____

4. If the answer in question 1 above is no why are you not using the recommended spacing

Crop	Reasons
1. Enset	_____
2. Maize	_____
3.Tef	_____

III Proper weeding:

1. Do you know any know any thing about proper weeding ?_____ (YES/NO)

2. If yes, please indicate time of weeding and frequency you use for each crop.

	Time of weeding	Frequency of weeding
1)Enset	_____	_____
2) Maize	_____	_____
3)Tef	_____	_____

3. If not, why didn't you practice the recommended weeding?

1. Enset _____

2.Maize_____

3.Tef _____

IV) Use of chemical fertilizers

1. Do you know any thing about chemical fertilizers?____ (YES/NO)

2. If yes please indicate the crop you use fertilizer frequently. (Put X)

1) Enset____ 2) Maize____ 3) Tef____

3. If yes, mention the type of fertilizers you are using in the following crops. (Put X)

	Enset	Maize	Tef
1) DAP	____	____	____
2) URA	____	____	____
3) Both	____	____	____

4. For the crops you use fertilizers. please indicate the rate you are using per ha or per timad.

	Enset	Maize	Tef
1)DAP	_____	_____	_____
2) UREA	_____	_____	_____

5. How do you get fertilizers? (Put X)

1) Purchased on cash ____ 2) On credit____ 3) Others specify)___

6. If the answer in question 1 is no, why were you not useing chemical fertilizers on the following crops?

1. Enset _____

2. Maize_____

3. Tef _____

7. What is your opinion on the price of fertilizers? (Put X)

1.Expensive____ 2. Reasonable____ 3. Cheap____4. Don't know____

V) Use of insecticides:

1. Do you know anything about pesticides? ____(YES/NO)

2. If yes, for which crop were you using pesticide frequently? (Put X)

1. Enset____ 2. Maize____ 3. Tef____

3. Please indicate type of pesticide and rate you are using for each crop.

	Type	Rate
Enset	_____	_____
Maize	_____	_____
Tef	_____	_____

4. If not, why were you not using insecticide in the following crops ?

1. Enset _____

2. Maize_____

3. tef_____

5. What is your opinion on the price of insecticides? (Put X)

1.Expensive____ 2. Reasonable____3. Cheap____4. Don't know____

6. Do you have EBW disease problem in your farm?____ (Yes/No)

7. If your answer is yes in question 6 above, what method of control are you using. (Put X)

1.Traditional____ 2. Improved____ 3. Non____

8. If the answer in question 6 is non, why are you not using any control method.

_____

C. Extension services

1. Have you ever received any extension advice from any source? _____

   (Yes/No)

2. If yes, who was you source of information?

   1. VEW_____ 2.Neighbour ____ 3.Other specify) _____

3. On which crops are you mostly adviced (Put X)

   1. Enset___ 2.Maize____ 3.Tef_____ 4. Others (Specify)_____

4. If your answer in question No. 1 is yes, through which ways are you advised on agricultural practices? (Put X)

   1 Face- to -Face____ 2 At a meeting ____ 3 Training/workshops ____

   4 Through provision of prints_____ 5 Others (Specify) _____

5. If your answer in question No. 1 is no, would you accept advice on agricultural practices if opportunities are available? _____ (YES/NO)
6. If you are advised face- to - face by an extension agents, which of the following statements correctly describe the frequency of contact with village extension worker

   1.Once per week____ 2. Once per month_____

   4. Once in three months____ 5. Don't remember____

   6. Never_____

7. If you were advised through meetings, in which ways the new ideas presented?

   (Put X)

   1. Through two-ways discussion_____ 2. Commend type____

   3.Prescription____ 4 Demonstration____

8. Which one of the information transfer methods were more educative to you?

	Educative	Non-educatve
1. On-farm demonstrations plots	____	____
2. Prscriptions	____	____
3. Training	____	____
4. Field tour	____	____

9. Indicate whether you will continue applying the following recommended agricultural practices for enset, maize and tef. (Put X)

Recommended technologies	Enset		Maize		Tef	
	Yes	No	Yes	No	Yes	No
Land preparation						
Use of improved seed						
Proper spacing						
Proper weeding						
Use of chemical fertilizers						
Use of organic manure						
Use of insecticide						
EBW cultural control (for enset only)						

10. If the answer in question 6 above is no please give your reasons?

1. Enset_____
2. Maize_____
3. Tef _____

D. Credit

1. Are credit services available in your area? (Yes/No)_____

2. If yes, for which crop did you use credit? (Put X)

1. Enset____ 2. Maize____ 3. Tef____

3. If the answer question 2 is yes, how much of the loan did you pay back?(Put X)

1. Non at all ____ 2. 25% ____ 3. 50%____4. 75%____5. 100% ___

4. If the answer in question 2 above is no, what is your reason?

_____

5. If you your answer in question 3 is "not at all" what was the reason?

_____

E. Farmers' perceptions on introduced technologies.

1. Which of the following statements accurately describe the major reason for your continued rejection or failure to use the following improved practice for enset, maize and tef (Put X)

a) Improved technologies and practices

Characteristics of technologies	Enset		Maize		Tef	
	Agree	Disagr	Agree	Disagr	Agree	Disagr
Land preparation						
Compatible with our practice						
Not compatible						
Use of improved seed						
Increased yield						
Did not increase yield						
Proper weeding						
Compatible with previous practice						
Labour demanding						
Proper spacing						
Incompatible with our practice						
Not easy to practice						
Labour intensive						

b) Inputs

Characteristics of technologies	Enset		Maize		Tef	
	Agree	Disagre	Agree	Disagre	Agree	Disagre
Fertility is our problem						
Yes						
No						
Cost of fertilizers						
High						
Reasonable						
Pests are our problems						
Yes						
No						
Cost of chemicals						
High						
Reasonable						
Input supply						
Reliable						
Unreliable						
Market for the produce						
Available						
Not available						

2. Please describe other reasons which facilitated utilization of technologies on enset, maize and tef.

   1. Eset_____

   2.Maize_____

   3.Tef_____

3. Please describe other reasons which contributed to no or low utilization of technologies on enset, maize and tef.

   1. Eset_____

   2.Maize_____

   3. Tef_____

THANKS VERY MUCH FOR YOUR CO-OPERATION

Interviewer's name_____ Date:_____

Remark:_____

APPENDIX: II EXTENSION FIELD WORKERS' QUESTIONNAIRE

Extension workers No._____ Woreda_____Development center_____

A. Characteristics of extension workers

1. What is your age ____ Sex____

2. What is your martial status

   1. Married____ 3. Never married ____

   2. Divorced ____ 4. Widow ____

3. What is your highest level of education?

   1. Junior secondary _____ 2. Secondary _____

   3. Junior college _____ 4. Others (Specify) _____

4. When did you complete your pre-service training? _____ (Year)

5. How long did you service as an extension worker_____(Years)

6. What is your current rank/positive _____

7. When were you promoted to your current rank _____

8. How many villages do you serve? _____

9. How many in-service training courses did you attend since your employment?

   1. Non ____ 2. One ____ 3. two ____ 4. More than two ____

10. Indicate major field activities in which you have been engaged.

1. _____

2. _____

3. _____

11. Below is a list of extension methods. Put (X) against methods which you frequently use in advising farmers in the following agricultural field practices.

Agricultural practices	Extension methods		
	Individual	Group	Mass
Land preparation			
Use of improved seed			
Proper spacing			
Proper weeding			
Use of chemical Fertilizer			
Use of organic manure			
Use of insecticide			
Use of EBW cultural control			

12. Put (X) against the crop in which you put more emphasis in terms of time spen on advising farmers in relation to agricultural practices indicated.

Agricultural practices	Crop type			
	Enset	Maize	Enset	others
Land preparation				
Use of improved seed				
Proper spacing				
Proper weeding				
Use of chemical Fertilizer				
Use of organic manure				
Use of insecticide				
Use of EBW cultural control				

13. What are your reasons for emphasizing on these activities?

Practice	Reasons
_____	_____
_____	_____
_____	_____

14. What are your opinions towards the farmers with whom you work? (Put X)

Statements	opinion		
	Agree	Disagree	Undecided
They are friendly and co-operative			
They practice what they are advised and are quick to adopt			
They practice what they are advised but not quick to adopt			
They are hard to convince by words, they need practical demonstration			

15. What are factors which inhibited your performance? (Put X)

Factors	Yes	No
1. VEW has many duties other than agricultural extension per se		
2. I have too many farmers to work with		
3. Most of the activities of a VEW come on ad-hoc-basis		
4. I do not have adequate technologies to teach farmers		
5. Training is not adequate		
6. My Chance for promotion is not influenced by how well I perform		
7. Too much interference from district officials		
8. I have no facilities like transport to perform my job effectively		
9. Always bad weather affects my performance		
10.Inputs are not available on time		

16. From your own experience are there any innovations on enset, maize and tef which were brought to your attention for dissemination to farmers and were not able to do? _____(Yes/No)

17. If yes, Can you list them and give the reasons?

	crop	Technologies	Reasons
1	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____

18. What are your views about traditional and recommended practices with .

regard to enset, maize and tef

1. Enset

	Traditional		Recommended	
	Mostly used	Not mostly	Mostly used	Not mostly
Land preparation				
Use of improved seed				
Proper spacing				
Proper weeding				
Use of chemical Fertilizer				
Use of insecticide				

2. Maize

	Traditional		Recommended	
	Mostly used	Not mostly used	Mostly used	Not mostly used
Land preparation				
Use of improved seed				
Proper spacing				
Proper weeding				
Use of chemical Fertilizer				
Use of insecticide				

3. Tef

	Traditional		Recommended	
	Mostly used	Not mostly used	Mostly used	Not mostly used
Land preparation				
Use of improved seed				
Proper spacing				
Proper weeding				
Use of chemical Fertilizer				
Use of insecticide				

19. Why do you think some farmers do not mostly use recommended practices? (Put X)_____

1. high price of input____ 2. Poor performances

4. Not easy to apply_____ 3. Unavailability ____

5. Others (specify)_____

20. What are technical recommendations for the following crops

a. Enset

1. Land preparation _____

2. Seed rate /ha _____

3. Spacing _____

4. Weeding frequency ant time_____

5. Chemical fertilizer rate/ha DAP_____ UREA_____

6. Use of insecticide

	Type	Rate/ha
a	_____	_____
b	_____	_____
c	_____	_____

b. Maize

1. Land preparation _____

2. Seed rate /ha_____

3. Spacing _____

4. Weeding frequency _____

5. Chemical fertilizer rate/ha DAP_____ UREA _____

6. Use of insecticide

Type Rate/ha

a_____ _____

b_____ _____

8. Planting time_____

c. Tef

1. Land preparation_____

2. Seed rate /ha_____

3. Spacing _____

4. Weeding frequency _____

5. Chemical fertilizer rate/ha DAP_____ UREA _____

7. Use of insecticide

Type Rate/ha

a_____ _____

b_____ _____

c_____ _____

8. planting date_____

21. To what extent are you involved in research propriety settings?

1.High____ 2. Medium____, 3.Low____ 4. Non

22. List factors that facilitated transfer of technologies for you.

1._____

2._____

3._____

23. List factors that inhibited farmers from utilizing technologies.

1. _____

2. _____

3. _____

4. _____

THANKS VERY MUCH FOR YOUR CO-OPERATION