Comparative analysis of gender related farm households in the Arsi-Negele farming zone in Ethiopia

by

YESHI CHICHE

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

M Sc Agricultural Extension

In the
Department of Agricultural Economics Extension & Rural Development

Faculty of Natural and Agricultural Sciences

University of Pretoria

Pretoria

Supervisor: **Prof. Gustav H. Düvel**

October 2002

UNIVERSITEIT VAN PRETORIA
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YUNIBESITHI YA PRETORIA

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To our heavenly father	To our heavenly father through the Son and the Holy Sprit. Thank you Lord for your grace in protecting me, and for giving me the strength and commitment to do this work. To God be the Glory.

ABSTRACT

COMPARATIVE ANALYSIS OF GENDER RELATED FARM HOUSEHOLDS IN THE ARSI-NEGELE FARMING ZONE IN ETHIOPIA

By

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DEGREE: MSc (Agricultural Extension)

Gender issues have been of much interest in the focus of rural development and food security in developing countries since the early eighties. The problems of female farmers have not adequately addressed and little or no evidences have been available in identifying constraints facing them for increasing their efficiency in agriculture. This study reported results from a field survey conducted in Ethiopia on maize production of male and female farmers.

The purpose of the study was to identify major factors influencing farm level productivity of maize for male-headed and female-headed households. The behaviour model formulated by Düvel, (1975) was used to guide the investigation. The Ethiopian Central Statistics Authority survey procedure was used to derive 120 male headed and 33 female heads of households (N=2148). Random sampling procedure was used to select farmers. Data were collected through interviews using a structured formal survey questionnaire. Non-parametric statistical procedures were used to determine the interrelationship between variables and test the level of significance. The study considers the use and non-use of improved seed and fertilizer as an indication of farmers' behaviour and identify the determinant factors influencing this behaviour.

The study area is located about 225 km south of the capital Addis Ababa. The geographical and environmental condition of the area is suitable for agricultural production in general. The farming is characterized by fragmented, small-scale and rainfed agriculture with a more or less similar agro-ecology and socio-economic situation.

According to the results, significant maize yield differences were observed (t=4.129, d.f. = 134, P = 0.000) between male-headed and female-headed households supporting the hypothesis that yield is a function of use of improved seed and fertilizer. Findings also show that the use of improved seed and fertilizer increase maize yield in both male and female farmers, however the use of improved seed and fertilizer were significantly associated with access to credit facilities and number of extension contacts where most of the female respondents were not included. Factors such as age and household size had no direct influence on maize yields for both male and female respondents; however, education, larger number of oxen and farmland seemed to encourage the use of improved seed and fertilizer in the case of male respondents. Generally the model confirmed that there is a positive and significant influence between use of inputs (behaviour) and maize yield (consequences of behaviour). The influence of intervening variables on practice adoption was not confirmed due to the multi-dimensionality of some of the intervening variables. Integrated rural development approaches and support services based on need assessment and long-term impacts are necessary to improve farmers (male/female) access to the possible achievable potential.

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CHAPTER 1

1. INTRODUCTION

1.1 PREFACE

The purpose of this study was to identify some of the different factors that affect crop productivity in small-scale farmers with particular attention to constraints faced by women farmers in the rural households. It is assumed that the productivity of the female-headed households is relatively lower than male-headed households. The background problem of this study is therefore based on the hypothesis that female farmers are not actively participating in the national extension package programmes due to their more limited access to new information and practices.

The recent global shift in rural development strategies strongly emphasizes the importance of mainstreaming gender as a focus of analysis in different development agendas (Botha 1999). Gender disaggregated information will then facilitate to implement and or supplement the mainstreaming part effectively. Nevertheless, agricultural information distinct by gender is scarce in many parts of Ethiopia to lead the direction of research extension, and policy towards a more sustained and efficient production.

Extension policy in Ethiopia is gender neutral, and provides equal chance of participation in the economy and equal access to productive resources. However, those who are vulnerable (marginalized) are receiving less benefit and are further marginalized due to less access to productive resources. Gender related studies therefore would help to understand the farmers' resource availability, management practices, and decision-making process. This can be used in sound extension intervention and development planning (Doss 1999).

This particular study deals with the identification of factors influencing farm level productivity for male-headed and female-headed households and evaluate their access to technology and credit facilities in the context of crop farming specific to maize.

Maize is one of the most widely grown crops in the study area in particular and in the country at large. Maize is also a crop that has relatively better applied technologies in terms of scientific research. A comparison is made between female household heads and male household heads in terms of their productivity (maize yield), and the related other socio-economic characteristics such as education, types of technology used and access to information and credit. The information was collected from household heads only.

About 85% of the Ethiopian population is rural and highly dependent on agriculture. The sector is dominated by rainfed fragment, subsistence and traditional agriculture where food production is much less than the population growth (FAO 2001). Increased production and productivity is one of the main goals for the sector in order to ensure food security and food self-sufficiency in the household. To this effect, the Ministry implemented a new extension package approach where the focus basically emphasizes intensification of crop production through provision of improved technology. Remarkable successes have been registered in the attempt, particularly in maize and wheat production. However, it has been observed that there is still a gap in addressing gender needs in terms of access to extension services, credit and other productive resources. Therefore this study was initiated in order to generate information on gender gaps with respect to maize production.

1.2 PROBLEM STATEMENT

In the need for long-term vision of agricultural transformation, effective planning of strategies and actions for developing effective research and efficient dissemination of technologies are important.

Currently the agricultural policy in Ethiopia puts much emphasis on agricultural development, and makes a considerable effort to facilitate and support agricultural research and extension services in order to develop national capacity for producing enough food and to increase household income. Increased production and productivity will be enhanced through the adoption of technology, which in turn is the outcome of an effective assessed need. In other words, extension programmes in the rural development context should be based on the need(s) of clients for the services to be

accepted and implemented effectively.

In spite of rapid advances in agricultural technology and expenditures by governments and donors on agricultural extension, almost one fifth of the population in developing countries still suffer from hunger. Extension programmes can increase agricultural productivity and rural income by bridging the gap between new technical knowledge and the farmer's practices, but research & extension services usually assume that farmers are men. In fact women play a critical role in a wide range of agricultural activities and as men move into off-farm employment. Women farmers must be addressed in the design and implementation of agricultural projects (Katrine & Daphne, 1992).

In addition to their usual reproductive and domestic roles, women also play a critical role in the production of food for the household by managing both crop and livestock enterprises. Women are expected to have a wider range of tasks, objectives and constraints as compared to men within the same household. Therefore, a reorientation of extension approaches and messages is necessary to improve the balance of technical messages and communication strategies with the reality of small-scale agriculture where usually small-scale farmers are female (Katrine & Daphne, 1992).

In the past three decades, different extension strategies have been implemented in Ethiopia in assisting small-scale farmers to operate effectively. Along the line different lessons have been learnt experiences have been made. The focuses of extension services targeted on women farmers were associated with their traditionally accepted domestic roles. The services were provided through the Home Economics section in the Ministry. The focus was related mostly to nutrition, sanitation, family planning, fuel efficiency etc. Only recently, the Ministry of Agriculture modified the extension services, which have been adapted in an endeavour to benefit resource poor farmers. However, due to the complexity of the households and dynamics of the system, the gender roles and responsibilities change from time to time depending on circumstances. It is for this reason that an investigation of women farmers' circumstances is essential, because only with a better understanding of their situation and the dynamics influencing them, can extension approaches and strategies be appropriately adopted and improved. It is therefore important to produce empirical

information that can provide a clear understanding of the situation and to subsequently formulate appropriate recommendations.

CHAPTER 2

2. BACKGROUND OF THE STUDY

2.1 INTRODUCTION

This chapter gives a brief background of Ethiopia as a whole with the major emphasis on agriculture and its contribution to the national economy. The overview of the farming systems, national agricultural policy, linkages of the research and extension and the status of women are also discussed in this chapter. The main purpose is to guide the reader to understand the overall picture of the agricultural set up in the country. The experience of different countries in terms of agricultural production activities is also indicated and similarities and trends in small-scale production shown. A theoretical exposition culminates in the formulation of the research hypothesis to conclude the chapter.

2.2 GEOGRAPHICAL LOCATION

Ethiopia is located in East Africa, (8^0 'N, 38^0 'E) north of Kenya, west of Somalia and east of the Sudan (Fig 2.1). In terms of area coverage Ethiopia is the fourth largest country and it has the second highest population in Sub-Saharan Africa with diversified climatic and agro ecological zones, extreme topographical variation and a wide range of different ethnic groups. The elevation ranges from 125 meters below see level in the Dankel Depression; to the highest point of 4620 meters above see level in the Ras Dashen area. The total population is close to 66 million, where male and female constitute almost 50% each (Ethiopian reporter 2002). The country is predominantly agrarian and agriculture is the dominant sector in terms of output employment, and export earnings.

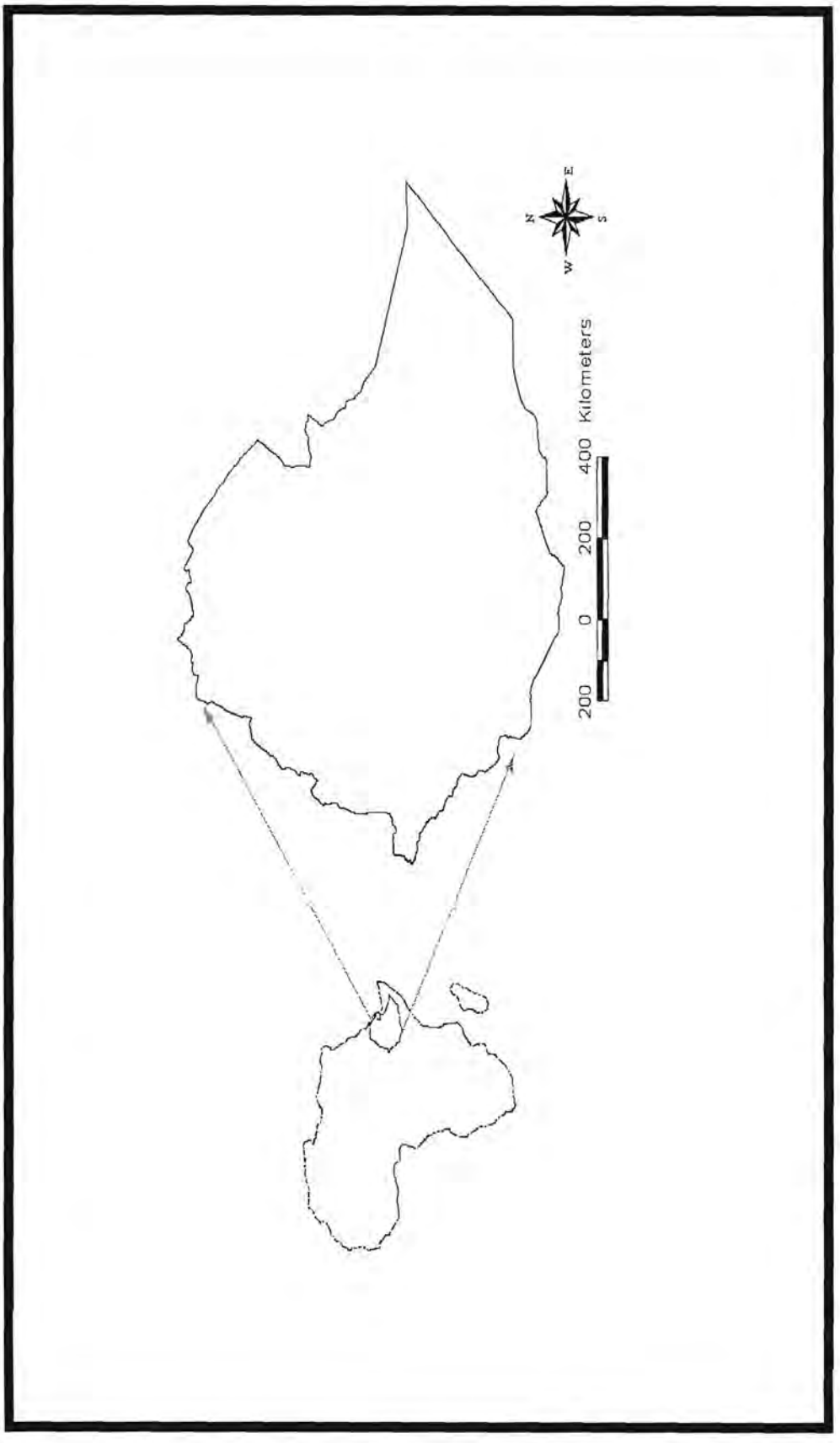


Figure 2.1: Location map of Ethiopia

2.3 AGRICULTURE AND THE ETHIOPIAN ECONOMY

The economy depends almost entirely on agriculture. The agricultural sector is dominated by mixed farming where crops and livestock play major roles in serving dual purposes for domestic consumption and foreign currency earnings. Agriculture contributes about 50% of the Gross Domestic Product and 90% of the national export earnings. In general the livelihood of more than 85% of the labour force is based on agriculture. Although the main source of the national earnings is obtained from this sector, the sector is dominated by traditional subsistence and fragmented type of smallholder farmers (Alene et al. 2000; Ethiopian reporter 2002).

The farming system varies from region to region based on the different agro-ecological set ups. Based on temperature and moisture regimes the country has been classified into 18 major and 49 sub agro-ecological zones, with the sub agro-ecologies being more homogeneous in terms of climate, soils, farming systems etc. About 65% of the land area is concentrated in moist, sub-humid, humid and per-humid agro-ecologies. The remaining 35% is confined to semi-arid zones, and is less productive (EARO/ARTP, 1999).

The landholding size varies from place to place and depending on the agro ecologies, the farming system and population pressure. According to the EARO/ARTP (1999), the average land- holding size is less than 2 hectares ranging from 0.3 to 1.38 hectares (EARO/ARTP, 1999).

Wide range of crops is grown in the country. Maize, tef (*Eeragrostis tef*), sorghum, wheat, and barley are the most important cereals grown widely. Tef is a small cereal indigenous to Ethiopia. Livestock is also an important component of the farming system contributing about 18% off the total annual export revenue (EARO 1999).

In general, the food crop production and productivity does not keep pace with the ever-increasing population, which is 3.3% per annum. Despite the substantial contribution to the economy, the agriculture sector in Ethiopia is not yet exhaustively commercialized to meet the increasing population pressure, which demands a rapid change in production increase and secure food provision. Some of the major

underlying causes of low productivity are traditional farming systems, the unavailability and non adoption of relevant technology, lack of access to technology due to lack of working capital and absence of infrastructure and basic services.

2.4 RESEARCH AND EXTENSION APPROACHES

The Agriculture Development Led Industrialization (ADLI) approach was adopted in Ethiopia as a new economic policy in 1992. The main objective was to promote agricultural production from subsistence farming to commercial agricultural production through improving the productivity of smallholder agriculture, by providing the necessary agricultural support services (Takele, 1997; Ethiopian reporter 2002). The national policy made a substantial effort and progress in establishing an effective extension programme towards this end in terms of crop and livestock production. The strategy mainly focuses on the distribution of agricultural inputs in the form of a package programme. The package includes improved seeds, fertilizers and pesticides in the crop production sector.

The history of extension service in Ethiopia dates back to the early 1950's with the establishment of the Alemya Agricultural College. Later on the extension service programme was transferred to the Ministry of Agriculture (MoA) and encompassed different extension approaches. The following are some of these approaches: Chilalo Agricultural Development Unit (CADU), Wolaita Agricultural Development Unit (WADU), Minimum Package Program (MPP), Extension and Project Implementation Department (EPID), Training and Visit (T&V) approach; Peasant Agricultural Development and Extension Project (PADEP). Currently the Participatory Demonstration and Training System (PADETES) is popular (EARO/ARTP, 1999). The first two CADU and WADU were also relevant in other development activities besides input distribution and package testing (Getinet et al. 1996; Lisa & Jakob. 1992; Lele 1975).

In the late 1970's the then Institute of Agricultural Research (IAR) and now Ethiopian Agricultural Research Organization (EARO) launched a Farming Systems Research (FSR) programme. The aim at large was to bring about change in production and productivity within the National Agrarian System with the attempt to ensure more

effective research-extension-farmer linkage, which is based on identification of needs and production constraints of the smallholders (EARO/ARTP, 1999; Getinet et al. 1996; Demese, 2000).

The recent research extension linkage is formalized in a form that extension can really make a change through enhancing farmers participation in technology generation and transfer processes. Significant efforts have been made in terms of improving the extension-farmer contacts, in providing technical back-ups and in covering wider areas in different parts of the country. The effort has also shown a considerable change in yield increase, particularly in maize and wheat crops.

The conventional agricultural extension approach to female farmers was related to the reproductive and domestic roles that underestimated the productive role (Mtshali, 2000). The gender aspect was not recognized as a significant factor in designing the rural development strategy. The focus was more on household management, nutrition, cooking, vegetable gardening, poultry husbandry, and family planning. The home economics extension programme was an important branch of the ministry to reach women farmers, and could have been more effective if it had been addressing the productive role of women as well. According to the national legislation, males and females in Ethiopia have equal political and social rights (Ethiopian Government, 1993; Bogalech, 2000). Thus the female farmers have the right to be members of farmers' associations and share all the benefits and or associated costs.

CHAPTER 3

3. THEORETICAL BACKGROUND

3.1 INTRODUCTION

As part of broader theoretical orientation, this chapter describes the concept of gender with particular emphasis on agriculture and rural development, covering also some empirical findings in Africa. In view of the role of women as focus and instruments of change, a model revealing the various change related variables is presented and serves to be instrumental in the identification and formulation of the research hypotheses which is listed at the end of this chapter.

3.2 CONCEPTS OF GENDER

Gender among others is a socio-cultural construct that refers to roles, responsibilities, characteristics, attitudes and beliefs relating to men and women. Gender roles and responsibilities are socially constructed and learned through social structures. Gender roles and responsibilities are dynamic, and have undergone changes through time, and vary from culture to culture. Factors like education, level of technology, famine and war cause change in gender roles. The paradigm shift from Women in Development (WID) to Gender and Development (GAD) brought focus more on both men and women's central role in rural development components. Gender analysis will therefore facilitate the classification of information on availability, access and allocation of resources, and extent of routine domestic tasks between men and women (Moser, 1991; 1993; Ostergaard, 1992).

3.3 GENDER IN RURAL DEVELOPMENT AND AGRICULTURE

Mainstreaming gender analysis in agricultural production is often mentioned as one of the important strategies to promote development efforts. The role of women in agriculture varies from place to place, based on culture, ethnicity, socio-economic circumstances etc. However, in addition to their domestic contribution, women have multiple roles in agricultural production, securing food for the family and for natural

resource management irrespective of location. Different literature sources indicate that women produce more than 50% of the food grown worldwide (Bogalech, 2000; FAO, 1998). Rural women are the main producers of the world's staple crops, providing about 90% of the rural poor food intake (FAO, 1998). Rural women perform the farm activities such as sowing, weeding, applying fertilizer and pesticides, harvesting and threshing of the crops. Women also have a great share of responsibilities in managing and processing the livestock sector, they feed and milk the larger animals, raise poultry, sheep, goats, rabbits and guinea pigs (FAO, 1998). In Asia, women's contribution to the agricultural labour force is 50%, and 71% in the Pacific (FAO, 1998). In Sub Saharan Africa, women constitute 60-80% of the labour force. Though there is a remarkable variation by location, rural women in Africa in general play a major role in crop and livestock production.

About 88% of the Ethiopian women live in rural areas; nearly 85% of their labour is spent on agricultural activities such as food processing, storage, weeding, harvesting, marketing of produces, preparing threshing fields and animal husbandry (Bogalech, 2000; Woudnesh, 2000). As in many other parts of the world, the roles and responsibilities of men and women in Ethiopia vary from location to location as well. Women and men have complimentary roles, shared tasks and distinctly different tasks in the farm management practices. In most parts of the country, men are mainly responsible for plowing with oxen, planting and fertilizer application (Chiche, 1997) and share the rest of other agricultural activities along with women and children. The workload, roles, responsibilities and decision-making power of women vary even among the women themselves, depending on their marital status, socio-economic and cultural background.

3.4 EMPIRICAL STUDIES ON GENDER DIFFERENCES IN AGRICULTURAL PRODUCTION

Several studies reviewed by Doss (1999), indicate different constraints faced by men and women smallholders in Africa. He emphasized the complexity and diversity among African households and summarized the possible causes of non-adoption of maize technologies into three major categories. Doss (1999), found that: firstly, access to productive resources such as land, labour and inputs influence women farmers to

adopt new technologies and secondly, the choices of technologies are specific to needs related to roles and responsibilities and thirdly, technology adoption is also affected by the dynamics of household decision-making (Doss, 1999).

Literature reviewed on gender studies in agriculture shows similarities with the views of Doss. The findings are more or less consistent regarding the factors affecting the choices of technology preferences (Due and Gladwin 1991; FAO, 1998). Due to lack of gender-disaggregated information, the contribution of women to agriculture is overlooked and can't be considered as a subject of focus for technology generation. Nevertheless it is generally accepted that women are the majority amongst the world's agricultural producers, also in Africa, women carry out most of the agricultural activities. According to FAO, (1998) women's' contribution to agriculture was about 60-80% in Benin, 48% in Burkina Faso, 80% in Congo, and 30% in Sudan. Rural women in Asia and Latin America also make a greater contribution to the food production (FAO, 1998). Almaz (2000), cited that 30-40% of agricultural labour is done by rural women in Ethiopia. As noted by Frank (1999), it is also estimated that about 79% of rural women in Ethiopia work 13-17 hours per day almost two fold of men.

Different case studies conducted on gender analysis of small-scale farms in different parts of Africa indicate that crop and livestock production are major sources of livelihood. Off-farm activities, part-time jobs, pensions and remittances are some of the means to maintain the farm family. References also indicate the heavy workload and lower productivity of women. Kalinda et al. (2000), reported that in Choma, southern district of Zambia, male-headed households tend to own larger farms and more cattle and ox ploughs. The use of technological packages is related to wealth (livestock), particularly cattle in rural households. (Kalinda et al. 2000).

A study conducted in the Northern Province of South Africa (Ngqaleni & Makhura. 1996), indicates that the majority of small-scale women farmers in the Limpopo province are at subsistence & low levels of production due to the small size of their lands. The study also indicates that women's income from agriculture is quite low and women's labour time is also used in various types of household and community activities. (Ngqaleni & Makhura 1996).

Gender studies conducted on agricultural productivity among smallholders of the Ada, Lume and Gimbichu "woradas" of Ethiopia also indicate that male-headed households have more land, labour, capital, particularly livestock (cattle), and more access to formal education compared to female-headed households (Addis et al. 2000).

In all the cases, women are associated with smaller average farm sizes, and more limited to access other production resources, which hinder their efficiency and prevent them for producing a surplus for marketing. This results in low level of consumption or not enough food to support the household. The means of subsistence or the livelihood is supplemented by different activities in different household types to support the family. According to Perret et al. (2000) it is important to understand the complexity and diversity of the system and means of subsistence in order to draw relevant recommendations based on the causes of inefficiency under given circumstances

3.5 CONCEPTUAL FRAMEWORK

Given the complexity and wide diversity of a system, reviews of empirical findings indicate that there is no standard way of identifying the factors influencing decision-making. Most appropriate and useful seems the focusing on the relationships of key variables that influence behaviour (Düvel 1991, 1998, 2000). Düvel (1975) indicates that understanding the determining factors of behaviour is important in order to understand the behaviour itself. In this case, the focus of attention is to identify the behaviour leading towards low productivity in different household types.

In the context of household comparisons, it is assumed that different factors affect farm productivity or the output of maize among the male and female household heads. The behaviour model formulated by (Düvel, 1975) is found to be appropriate to explain the situation in this particular study as shown in Fig. 3.1. This is supported by findings of Botha (1993) that the model is suitable to predict behaviour through identification of the interrelationship between different independent, intermediating, and dependent variable. The model in Figure 3.1 is adopted and derived from Düvel's

model and implemented to explain some of the many factors that influence maize productivity among male-headed and female-headed households. This model implies that the present state of maize yield, which is a criterion of efficiency of male-headed and female-headed households is a result of their own personal decision-making and behaviour regarding the adoption of production practices such as seed and fertilizer. These in turn are a function of individuals' cognitive field (Lewin, 1951) influenced by socio-economic and institutional factors.

3.6 HYPOTHESES

Findings of Düvel, (2002), FAO, (1998), Doss, (1999), indicate that there is a significant association between the gender of household head (decision maker) and the adoption of different practices. The findings in Ethiopia also indicate that there are higher chances of adoption of agricultural technologies in male–headed households than female-headed households. According to Düvel (2000) there are a number of factors that can influence the situation.

In this particular study it is assumed that there is a discrepancy between male-headed and female-headed households in terms of maize yield because of the differences in production practices such as use of fertilizers and improved seed. Different factors like education, contacts with extension advice and access to credit influence the choices and decisions. Against the above background, the following research hypotheses were formulated:

1 Production efficiency (yield) is a function of the adoption of improved practices and in particular:

1.1 the recommended use of fertilizer, and

1.2 the use of improved seed.

2. Production efficiency and practice adoption are influenced by gender and other socio-economic factors

3. The influence of gender on agricultural production is a function of

3.1 level of education

3.2 access to extension

3.3 access to credit

3.4 access to production resources such as land, farm labour, draft power etc.

CHAPTER 4

4. METHODOLOGY

4.1 INTRODUCTION

This chapter discusses the statistical procedure and survey design followed to identify different factors that affect crop productivity in different household types. Procedures used to select the study area, sampling method, determination of sample size, number of Peasant Associations, design of the questionnaire, interviewing procedure and method of data analysis are discussed under each respective sub-title. Although efforts were made to collect adequate information, it was difficult to attain 100% precision because of personal bias and circumstances beyond control. Hence this information is not an end in itself; instead it is a beginning for further detailed analytical studies.

4.2 PLANNING OF THE STUDY

The planning of this study was started in February 2001 with groundwork of writing a research proposal and questionnaire development. This was completed in June 2001 and followed by the field survey from July 2001 to December 2001.

The study was conducted at a district under the mandate area of the Melkassa Agricultural Research Center in Ethiopia. The logical reason for selecting the district is because of the area being one of the mandate areas of Melkassa Agricultural Research Centre. Secondly, no prior information is available concerning gender studies related to agricultural research and, thirdly, the ease of access to the area.

The Melkassa Agricultural Research Centre is one of the oldest and largest research centres in Ethiopia located about 100 km east of the capital city. This centre is responsible for agricultural research in the central and eastern rift valleys of the country.

Melkasa Agricultural Research centre has an established link with the zonal Ministry of Agriculture (MoA). The zonal extension agents and the staff of the sub-centre for

research were helpful with the identification & selection of the Peasant Associations (PA's) and farmers. Peasant Association is a union of farmers in the villages where farmers are organized collectively in groups for social and economic purposes. The list of Peasant Associations (PAs') was obtained from MoA office while the list of households was obtained from each respective PA.

The actual field survey took about six months from July to December 2001. The first step performed was organizing financial and transport logistics to facilitate the field trips from the research centre to the study site. Prior to the actual field survey, two different visits were made to the district office of the Ministry of Agriculture in order to collect secondary information and background of the study area. One week was devoted to decide on the statistical method and sampling procedure. A biometrician of the Ethiopian Agricultural Research Organization (EARO) was consulted for the setting of designing and sampling methods. The district extension officers, researchers in the sub-centre, chief of the PA's were consulted to collect additional information about the specific area.

4.3 DEVELOPING A QUESTIONNAIRE

There are different types of data collection methods among which a structured formal survey questionnaire is one that can be used as personal interview method (Düvel, 1999). As cited by Steyn (1988), the personal interview method is preferred for its flexibility. Personal interview method allows collecting complete information that is more appropriate to conduct valid statistical analysis (Düvel, 1999; Steyn, 1988). However information might be distorted due to the methods and approaches used in the process of carrying-out interviews (Steyn, 1988; Düvel, 1999).

A structured formal survey questionnaire was developed in order to collect the required data. The questionnaire was developed in a logical flow where information could be collected in personal, institutional and different farm characteristics of different household heads with special focus on crop production, use and non-use of improved agricultural practices and actual production levels. This was designed in order to analyze and understand the differences and similarities among male and female household heads and make a sound response on deficiencies depending on the

household characteristics. Each question had options of possible responses, while some were left open-ended to the farmers.

The questionnaires were pre-coded by placing variables after each respective question in order to maintain sequences in flows of ideas and avoid unnecessary complications. The questionnaire was pre-tested before conducting the actual field survey.

In order to minimize the level of distortion, the survey team discussed the questionnaire before the actual implementation to understand the content and make sure that the responses would be recorded in the same manner and the group did a cross check of responses after the end of every day's task. This helped to check the completeness of the information collected and to detect problems right on the spot and on time.

4.4 CONDUCTING THE INTERVIEWS

Farmers were interviewed using a structured questionnaire administered by four enumerators under the researchers' close supervision.

The aim of the study and procedure was clearly explained to all relevant members of the community such as head of the Ministry of Agriculture, head of the administration in the district, and the leaders of each selected PA. The chief of each PA at each respective location arranged the time and place for the interview. Each individual household head was interviewed separately. The interview was done in farmers' fields or where it was convenient for them.

Four enumerators assisted with the data collection process. Enumerators who were familiar with conducting different surveys and were able to communicate in the local language were recruited to avoid the problem of etiquette and protocol in communication with the farmers. However, the enumerators were updated with the objective of the specific study and refreshed with the principles, procedures and techniques of formal survey methods.

4.5 SAMPLING FRAME

Formal statistical procedure is used to produce more informative and defined information about individual members in the rural society, which helps to understand the significance of any social construct (Düvel 1999, Tiruneh et al. 2001). The statistical analysis will also help to analyze, compare and test effects of different variables with corresponding coefficients (Hassan, 2000). It can also be used as a means to understand the effects of social factors on social constructs. The identification of barriers and influencing factors to men and women in their participation and utilization of technologies will help to produce empirical evidences that are disaggregated by gender and look for solutions accordingly. Therefore the gender analysis, like any other social science, also requires investigation on the effects and benefits of new technologies to female and male farmers. According to Tiruneh et al. (2001) and Düvel, (1999), there are no hard and fast rules to determine the type of research methodology, it all depends on the goals of the particular study, time frame, financial constraints and all other associated problems

The most common and widely applied statistical technique and random sampling method was used to conduct the study. This method was selected to ensure that every unit in the population would be fairly represented, having an equal and independent chance of being selected for the sample (Hopkins et al, 1996; Hassan, 2000; Düvel, 1999). According to the basic principle, the availability of prior information about the target population, the size of the target population in the study area and the overall objective of a given study determine the decision of choosing a specific sampling technique (Girma, 2001 Personal communication). Considering the objective of the study, and representativeness of the sample, the population was divided up into three different homogeneous groups (Table 4.1) based on estimated altitude range and major types of crops grown. However, because of the limitations in time - frame, and inaccessibility of some of the areas, this study focused only on one agro-ecology that had a higher number of farmers. The National Statistical Standard set was used to determine the sampling frame and the sample size. This is discussed in the following sub-sections.

4.5.1 Sampling method

The Arsi-Negele farming zone has wide range of climatic conditions under different agro-ecologies. However, the study was conducted at the woina dega type with a wide area coverage and higher number of PA's in the district (Table 4.1). Five PA's, namely Kerssa Ellalla, Kerssa Gara, Edo Jigessa, Woyo Rafu, and Gorbi Dererra were randomly selected. The selection was based on homogeneity in socio-economic and physical characteristics such as types of crops grown, and altitude. Accessibility was also one of the criterions to select different sites.

Table 4.1 Total numbers of Peasant Associations under different agro-ecologies of the Arsi-Negele area, 2001

Traditional Agro-ecological Classification	Estimated range of altitude range	Number of peasant Associations (PA)	Male headed households	Female headed households	Total
Dega	1960 – 2200	12	9,784	171	9,955
Woina Dega	1600 - 1960	14	7,016	128	7,144
Kola	1500 - 1600	7	4,660	100	4,760
Total		33	21,460	399	21,859

Source: Personal contact with head MoA Arsi-Negele

The population was sub-divided into groups based on types of crops grown and agro-ecologies. This makes strata less homogenous in terms of major enterprises and agro-ecologies. As mentioned earlier, the study concentrated only in one agro-ecology due to the logistical limitations particularly time. A total of 153 farmers were randomly selected from the five PA's. The sample size and their distribution among the zones are given in Table 4.2. Sampling was done using a complete list of the population, which was obtained from the MoA office while the list of households were obtained from each respective village.

4.5.2 Sample size

The National Standard of sampling procedure, which is set by the Central Statistics

Authority (CSA), of Ethiopia was used to determine the sample size. As indicated by Düvel (2000) and Hassan (2000) the precision in sampling can be increased by reducing the variance, (which is a measure of the spread) or increase the sample size. Given all statistical measures and parameters, the Central Statistics Office of Ethiopia has developed a standard set of population survey across the country. One can draw a sample of 1200 households **(Np)** out of a total population of 75,000 **(Nc)**. This standard set by CSA is often used as base information for determining sample sizes for different agricultural surveys conducted in the country (CSA 1999). The sample size **(n)** for this particular study is therefore determined using the standard formula of CSA. The sample size **(n)** that is equivalent to that of CSA's, from a given domain of interest for this research purpose was determined using the following formula.

$$\frac{N \times Np}{Nc} = n$$

$$\frac{7144 \times 1200}{7500} = 115$$

$$n = 115$$

Where **:**

N = **Total number of farmers for the specific survey site**
Np = **Sample size of farmers estimated by CSA**
Nc = **Total number of farmers estimated by CSA**
n = **New sample size**

A sample size of **(n = 115)** was drawn using the above given formula and is considered as an **initial sample size.** However, further refinement is processed towards increasing the level of precision, in order to gain more accurate information. The higher the sample sizes the better improvement in the level of precision (Düvel,

2000; Hassan, 2000). Therefore the initial sample size needs to be refined based on the predetermined level of precision. The CSA again suggest that it is always important to increase the level of precision using a Coefficient of Variation **(CVp)** of 23. However the Coefficient of Variation is reduced to 20 **(CVf)** in order to better improve the level of precision more than already suggested. Therefore finally a sample size of 153 farmers was calculated using the suggested procedure.

$$Nf = Np \times \frac{[CVp]^2}{[CVf]^2}$$

$$= \frac{115 \times [23]^2}{[20]^2}$$

$$Nf = 153$$

Where **:**

Nf **= Sample Size for the new survey**

Np **= Projected initial samples size**

CVp **= Coefficient of Variation standard for the CSA (CSA' standard is 23)**

CVf **= Desired Coefficient of Variation for current survey (estimated to be 20)**

4.5.3 Number of peasant associations

After the overall sample size was determined, (153), the next step was to distribute the sample over the enumeration area in order to pick a fair number of representative samples from different PA's. CSA, for this reason, also developed an enumeration area. The CSA's enumeration area is 25–40 household samples per PA based on the size of different PA. As a result, five PA's, which are assumed to represent the

locality, were randomly selected using the CSA's suggestion.

Consequently, the total sample size **(153)** was proportionally allocated to male and female, where **120** and **33** samples were selected from male-headed households and female-headed households respectively. As noted by Due and Gladwin (1991); Starkey, et al. (1994) Female-headed households were households that are managed by a widow, divorced or single woman without the mediation of a husband, or male relative in the routine day-to-day activities of that household. Male-headed households were those where a husband was present and was the final decision-maker in the important issues pertaining to the household. The samples were proportionally allocated to the five PA's as follows (Table 4.2).

Table 4.2 Sample sizes of the different Peasant Associations in the Arsi-Negele farming area, 2001

PA	Male	(prop)	Nf	Female	(prop)	Nf	Total	Proportion	n
1	366	0.15	(13)	26	0.36	(12)	392	0.16	25
2	590	0.25	(31)	13	0.18	(6)	603	0.24	37
3	589	0.25	(31)	13	0.18	(6)	602	0.24	37
4	585	0.24	(31)	13	0.18	(6)	598	0.24	37
5	278	0.11	(14)	8	0.10	(3)	286	0.12	17
Total	2408		120	73		33	2481		153

4.6 DATA ANALYSIS

Different types of analytical methods can be used to evaluate different research results and make a sound conclusion for a given survey information. Literature reveals that each and every analytical method has their advantages and limitations; it is always advisable to select the one that can better suit to answer the specific purpose (Pallant, 2001; Hopkins et al. 1996; Düvel 1999). In this particular study statistical methods such as frequencies, correlations, and T-tests were used to analyze the data. The attempt was to describe characteristics of the sample farmers, explore the predictive ability of independent variables over the other dependent measure and address the

research question sufficiently. The Statistical Package for Social Scientists (SPSS 10.0, 1999) was used for data analysis (Pallant 2001).

4.7 RELIABILITY OF INFORMATION

Efforts were made to obtain valid information. However, some possible biases and errors were observed during the cross checking of the information. The following are some of the problems encountered.

1. There were no clear delineation in classification of agro-ecologies and the number of PA's. It was quite difficult to make a distinct differentiation between the PA's using the secondary information.
2. There were information gaps between some of the PA's and the MoA records in terms of the total number of farmers.
3. The survey was conducted when farmers were busy with different farm activities and caused time constraints.

Although some slight and usual errors have been observed, the data is good enough to produce reasonable information.

CHAPTER 5

5. DISCRIPTION OF THE STUDY AREA

5.1 INTRODUCTION

The purpose of this chapter is to give a brief description of the study area, so that the reader can acquire the image of the situation by reading the physical and biological information about the specific location. The geographical location, rainfall, temperature, and soils of the specific study site are indicated in addition to the information about the agricultural activities and extension services.

5.2 LOCATION

Arsi-Negele farming zone is located in the southern section of the rift system of Oromyia region (Eastern Shoa zone) about 225 km south of the capital Addis Ababa (Fig 5.1). The area is sub-divided into three major climatic zones known to be Dega (High land), Woyna-dega (Mid-altitude) and Kolla (Low land). The climatic zones are set traditionally based on the differences in altitude variation ranging between 1500 up to 2300 meters above sea level. Recently these were further classified into different sub agro-ecologies for ease of agricultural resource management and to conduct intensive research. However, the PA's were not yet distinctly set under each respective agro-ecologies.

5.3 POPULATION

The total population of the district is 170,539 composed of 84,005 males and 86,534 females. There are about 33 Peasant Associations with 21,859 household heads where female-headed households make up about 3 % of the rural population registered in the peasant association. Of the total 153 farmers interviewed, 78% were male and 22% were female.

The PA's are structured based on the convenience of administrative arrangements made by the MoA office. The majority of the ethnic composition of the population in

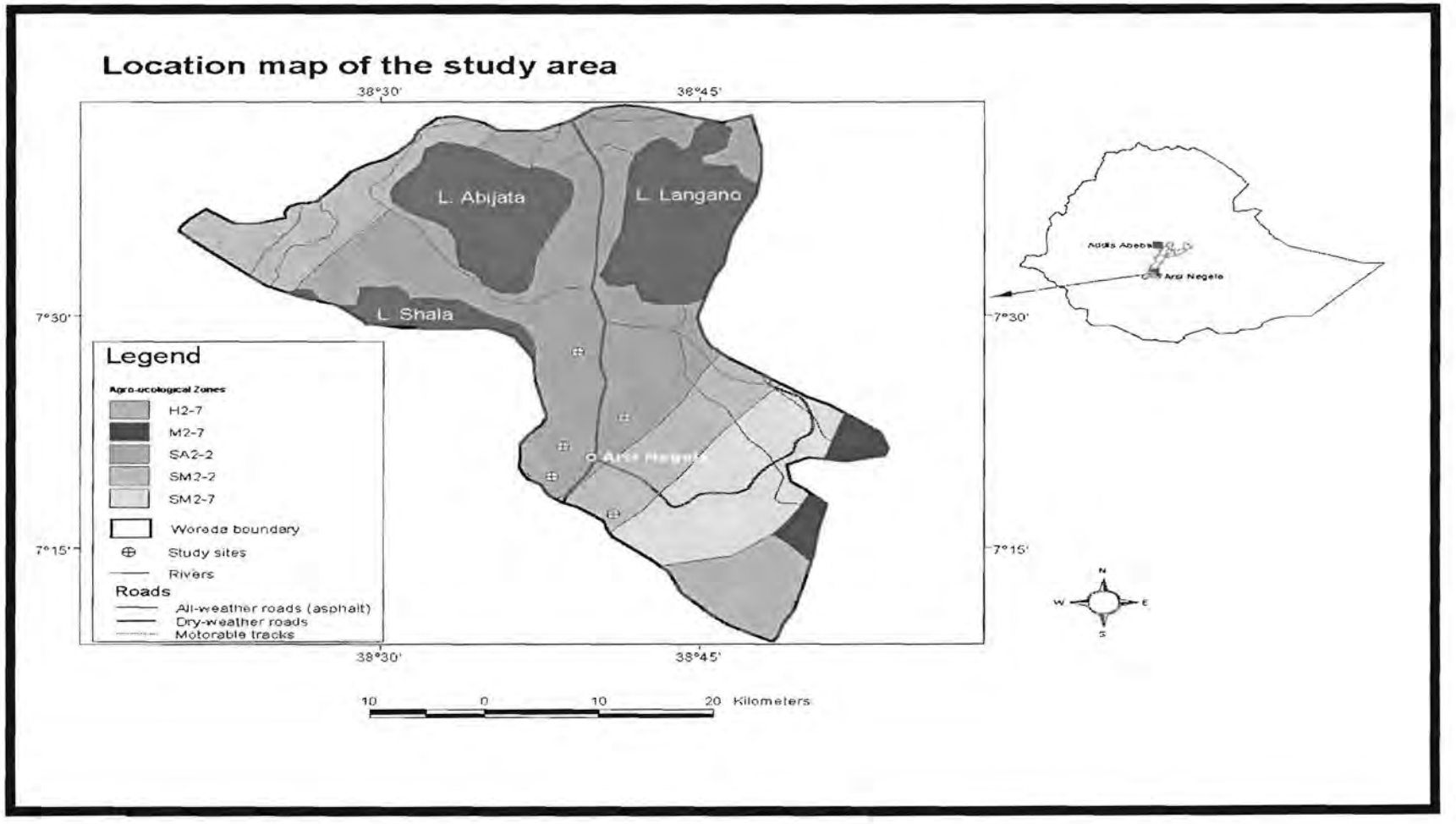
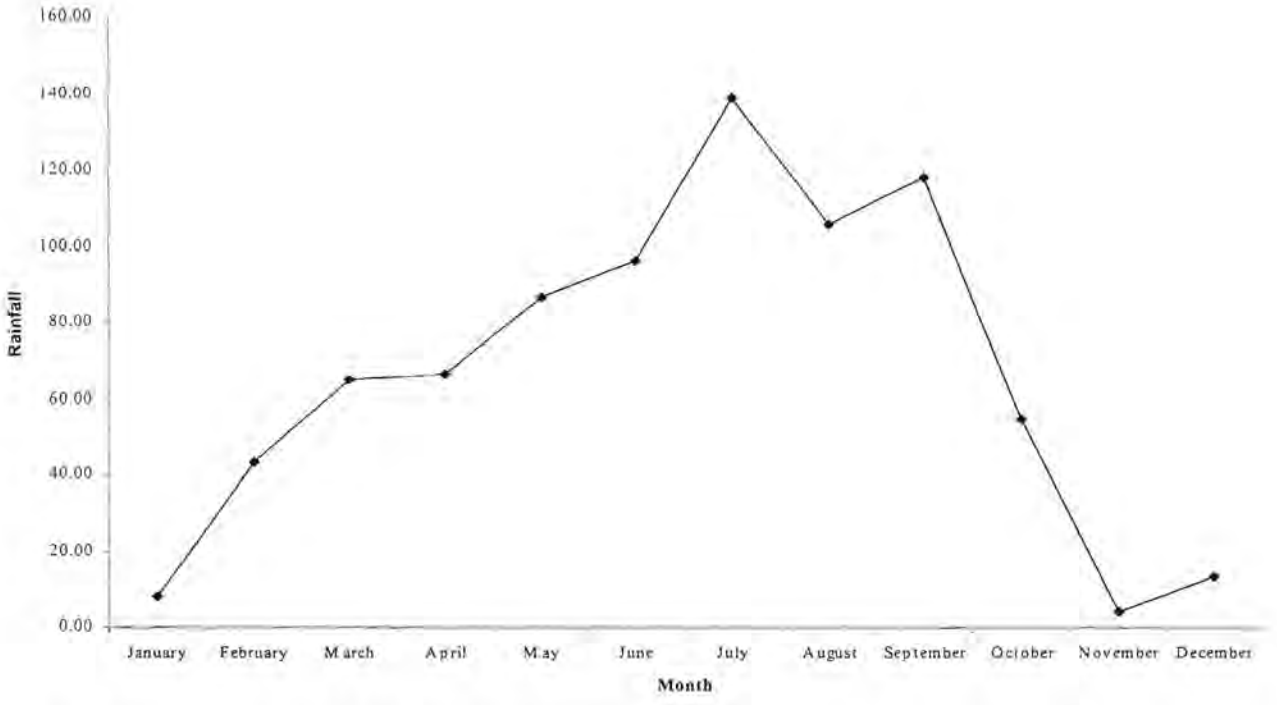


Figure 5.1 Geographical location of the study area (2001)

the study area is the Oromo's dominated by Islamic religion. A study conducted by Legesse (1992) in the same area also confirmed a similar situation (Legesse 1992).

5.4 RAINFALL

The rainfall figures are given in Fig. 5.2 below.



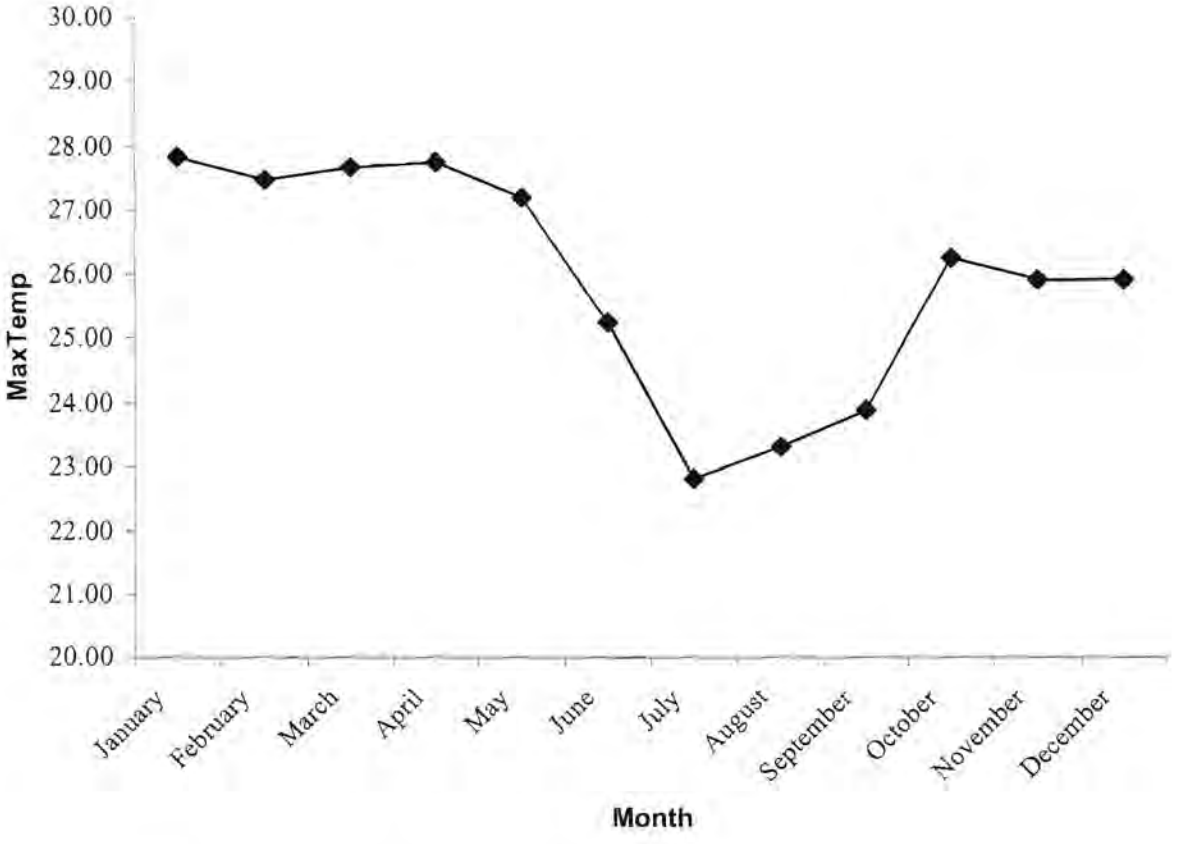
Source: National Meteorology agency

Figure 5.2 Average monthly rainfall of Arsi-Negele (1988-1992, 1998 - 2001)

The rainfall data for the past 9 years (Fig 5.2) indicate that the mean annual rainfall is 799 ml. the highest precipitation is received between June to September while the minimum rain is obtained between February and April. The months November to January are the dry spell of the year.

5.5 TEMPERATURE / CLIMATE

The area experiences a wide range of climatic conditions, however, the temperature in general is fairly moderate. The mean monthly maximum temperature ranges from 23^0 C to 28^0 C with an average of 26^0 C (Fig 5.3).



Source: National Meteorology agency

Figure 5.3 Average monthly temperature of Arsi-Negele (1988-1992, 1998 - 2001)

5.6 TOPOGRAPHY AND SOILS

The topography is predominantly undulated with few hills. The dominant soils are classified as Chromic Cambisol and Umbric Andisol, which are developed from pumice (volcanic ash). The colour is dark in the surface and changes to whitish in the sub-surface. The surface of these soils contains relatively high organic matter as compared to other Rift Valley soils. The texture of the soils is silty to silty loam texture with low water holding capacity and high infiltration. In the dry season, the area is exposed to wind erosion due to the low bulk density of the soils (Eyilachew 2001).

5.7 LAND USE PATTERN

As shown in Fig 5.3 the area is rich in water resources. More than half (52%) of the study area is covered by water of the rift valley lakes. The forest and bush area has decreased to (5%) as compared to the findings reported by Legesse, (1992) which was 13.4% in 1992. The arable land of the area is only 31%, which includes annual and perennial crop production (Table 5.1).

Table 5.1 Land use pattern in the Arsi-Negele farming zone for the year 2001

Total area	1395.87 km sq
Arable land	30.77%
Covered by water	51.97%
Forest and bushes	4.99%
Others	12.27%

Source: MoA, Arsi-Negele office

5.8 AGRICULTURE

5.8.1 Major crops grown

The Arsi-Negele farming zone is one of the potential areas for maize and wheat production in Ethiopia. Crop and livestock production is the major source of livelihood for the farmers. Both are used as a source of food and a source of income. According to the result of the sample interviewed, both crop and livestock are of major importance as a source of income (Table 5.2).

Table 5.2 Distribution of major source of household income in the Arsi-Negele farming zone, 2001

Income source	Male		Female	
	Number	Percentage	Number	Percentage
Food crop sale	31	26	14	42
Livestock sale	2	2	1	3
Both	87	72	18	55
Total	120	100	33	100

Findings of Legesse, (1992) also indicates similar findings that mixed farming (crop and livestock production) are both important enterprises at the Arsi-Negele farming zone.

A wide range of crops such as maize, wheat, barley, tef, sorghum, finger millet, haricot bean and faba-bean are grown in the area (Table 5.3). Maize and wheat are the most important and widely grown crops (Tables 5.3 & 5.4). Maize is a more important food crop especially in female-headed households (Table 5.5), while wheat is used more to earn cash. Some households also grow shallot mainly for cash purposes. From results shown in Tables 5.3, 5.4, & 5.5 it was confirmed that both male and female respondents depend on agriculture for their livelihoods. This is generally true for the country at large (Franzel & Houten 1992; Alene et al. 2000; Wolday, 1999).

Table 5.3 Major crops grown and area coverage in the Arsi-Negele farming zone for the year 2001

Type of crop	Area (hectare)	Total yield kg	Yield kg per hectare
Maize	15,975	58123150	3600
Wheat	15,170	36876600	2400
Tef	4075	4075000	1000
Haricot bean	4028	4845600	1200
Barley	2400	3360000	1400
Sorghum	1825	3650000	2000
Faba bean	840	680200	800
Finger millet	85	102000	1200

Source: MoA Arsi-Negele office

Table 5.4 Number of sample farmers growing different crops in Arsi-Negele, 2001(multiple response).

Type of crops	Number of growers	
	Male	Female
Maize	114	25
Wheat	113	23
Sorghum	61	9
Tef	50	4
Barley	37	10
Shallot	20	4
Total	120	33

As indicated in Table 5.5, most male and female-headed households grow crops for both consumption and as a means of income. None of the farmers grow maize only for sale. However, about 43% of the male respondents produce maize only for consumption, while 64% of the female respondents produce maize for consumption. Ninety three percent of the male respondents and 78% of the female respondents produce sorghum only for consumption. Although maize and wheat are the two most important crops grown widely (Tables 5.3 & 5.4), most of the production is for household consumption particularly in the female-headed households (Table 5.5). In general it has been observed that Sorghum, Barley, Tef, and maize are produced mainly for consumption while wheat and shallot are basically grown for earning cash.

Table 5.5 Major crops grown and percent consumed in the Arsi-Negele, 2001

Type of crop	Male				Female			
	Percent consumed				Percent consumed			
	100%	50%	0%	N	100%	50%	0%	N
Sorghum	93	2	-	61	78	11	-	9
Barley	76	13	-	37	80	20	-	10
Tef	48	22	2	50	50	-	50	4
Maize	43	17	-	114	64	12	-	25
Shallot	15	5	35	20	-	-	100	4
Wheat	4	17	6	113	4	39	9	23

Farmers are also involved in some other non-farm activities to obtain extra earnings and supplement the family income. The kinds of activities are sale of charcoal, sale of firewood, brewing and crafts. As shown on Table 5.6, it appears that the female-headed households have more involvement in other sources of income earning activities than the male-headed households. This can be because the adult female member of the household (usually the wife) are involved in looking for additional income for the family, meaning that in the household where both male and female are allied together, there are better chances of earning relatively more income.

Table 5.6 Distribution of farmers according to main occupation in Arsi-Negele, 2001

Type of occupation	Male		Female	
	Number	Percentage	Number	Percentage
Farming only	97	81	17	52
Farmer + other less than 25%	21	17	14	42
Farming + other less than 50%	2	2	2	6
Total	120	100	33	100

5.8.2 Cropping patterns

There are two major cropping seasons following the main rain pattern. The farming in general is rainfed agriculture and follows the main rainy season. The short cropping season locally known as "belg" is usually from April to June for growing some cereals and shallot. The long and major growing season is locally known as "Meher" and is from June to September where the rest of the crops are grown. The period from November to February is normally a dry spell. The average landholding size is 2 "timad", which is about 0.5 hectare for the farming area as a whole.

5.8.3 Crop production

The improved maize is planted in rows about 30 cm x 75 cm between plants and rows respectively under the supervision of the extension agent following the ox drawn furrow by putting two seeds per hole. Planting two seeds per hole is to avoid risk in case the seeds can't emerge properly. Fertilizer DAP is applied (about 10 gram) per

hole before the seeds. Hand weeding is done during the two-leaf stage about one month after planting. Oxen cultivation locally known as 'shilshallo' is done at 4 -5 leaf stages (traditionally at a knee-high stage). Fertilizer UREA is applied simultaneously following the ridges. Thinning could be done in case the plants appear to be over populated. None of the respondents, either male or female, have used herbicide to control weeds. Additional removal of weeds could be done as required. Harvesting is done manually starting from the green stage to supplement the food requirements and income by selling green maize.

All household members, male, female and children, are involved in the management of the farm. However, there are specific and shared tasks. Land preparation using an ox ploough is done by the male, usually the adult member of the household, while the remaining activities, planting, fertilizer application, weeding and harvesting is shared by all household members. Tesfaye (1999) reported that, in many parts of Ethiopia, activities such as ploughing, seeding are usually done by men. While women play a key role in agricultural production through their involvement in all farm activities in addition to their domestic roles (Tesfaye 1999).

The adult son assists female-headed households (if available and out of school hours) in the land preparation and all other required farm activities. If there is no adult son member in the household the female farmers use different types of strategies like sharecropping and or exchange labour, while few use a hired labour. The traditional method of overcoming labour shortage known as "Debo" is now ceasing, because of associated higher costs of preparing food. Debo is a kind of exchanging labour in time of peak season and overlapping of farm activities, where food and drink is prepared by the organizer. Both male and female respondents reported that they face labour shortages especially during the peak seasons, particularly weeding and harvesting (Table 5.7).

Table 5.7 Frequency distribution of farmers according to their labour problems for agricultural activities in Arsi-Negele, 2001

Farmers' response	Male		Female	
	Number	Percentage	Number	Percentage
Yes	67	56	19	58
Sometimes	25	21	10	30
No	28	23	4	12
Total	120	100	33	100

Major agricultural decisions on what to grow, how much to grow and allocation of income by the female respondents are decided by themselves fully, while the male respondents (81%) reported that major decisions are shared among the wife especially on the allocation of household income and crop livestock sale (Table 5.8). How ever the level of influence by the wives are usually less.

Table 5.8 Frequency distribution of farmers decision-making within households in Arsi-Negele, 2001

Decision making ability	Types of crop to grow				Allocating household income				Crop sale decision			
	Male		Female		Male		Female		Male		Female	
	No	%	No	%	No.	%	No	%	No.	%	No	%
Full decision	34	28	28	85	18	15	33	100	10	8	33	100
Share decision	80	67	5	15	97	81			106	89		
Some influence	4	3			4	3			3	2		
No influence									1	1		
Influence but no decision	2	2			1	1						
Total	120	100	33	100	120	100	33	100	120	100	33	100

5.9 AVAILABLE MAJOR CROP EXTENSION PACKAGES

Different extension packages are rendered to the farmers through the MoA office. The number of farmers provided with extension packages for the year 2001 was 11, 263. Criteria to be a part or user of the package programme is to be a member of a given Peasant Association, physically and mentally capable, free from previous input debt and being able to pay the collateral.

Types of crop packages

- Different maize varieties, BH 660, A-511, Pioneer 3253, and BH 140 at the rate of 25 kg/ha

- Fertilizer named as UREA (mainly nitrogen) and DAP (Die - Ammonium Phosphate) at the rate of 100 kg/ha each, DAP at planting and UREA at five-leaf stage or time of cultivation.

- Wheat varieties HAR–16–85, locally known as Kufsa , HAR–710 (Wabe), HAR– 604 (Galema) and Pavan–76 with a recommended seed rate of 150 kg/ha .

- Fertilizer UREA and DAP each at the rate of 100 kg/ha, both mixed and applied at time of planting for wheat.

- Herbicide U-46 & 2– 4D is recommended for wheat at the rate of one liter per hectare.

Other improved agronomic packages such as seed rate, fertilizer rate and time of application are provided using the local seed varieties of teff, and sorghum. Minimum tillage and other livestock packages are also provided to the area.

There are 24 extension workers, usually referred to Development Agents (DA's), in the district and only four of them are female. The qualification of a DA is a nine-month agricultural training in addition to the 12 grade academic career. The salary is 285 Ethiopian Birr per month that is less than $50 USD. Housing according to the local standard is provided at each respective village where the extension agents are stationed.

CHAPTER 6

6. ANALYSIS OF PRODUCTIVITY

6.1 INTRODUCTION

This chapter covers the analysis of maize yield among male-headed and female-headed households, and their use of different practices especially improved maize seed and commercial fertilizer.

The dependent variable used for the analysis is the amount of maize yield in kilograms per hectare reported by each individual respondent. It has been observed that farmers (both male and female) were reluctant to provide the genuine information concerning actual yield. This is assumed to be due to fear of tax and or paying debt of previous input costs. Legesse (1992) also revealed similar observations that the inquiries of yield, income and livestock are sensitive and are usually underestimated by the farmers.

Given the same circumstances in terms of climate, agro-ecology and rainfall pattern (natural circumstances), variations can appear in practices due to low adoption and or lack of knowledge. This is motivated by other influential factors such as personal, socio-economic and other institutional factors. This chapter is therefore to test the first hypothesis, which states that:

1. Production efficiency (yield) is a function of the adoption of improved practices and in particular:
1.1 the recommended use of fertilizer, and
1.2 the use of improved seed

6.2 MAIZE YIELD

Increasing production and obtaining better yields can lead to sustain sufficient income and maintain food requirements in the farm household. In other words farm efficiency has a direct impact on household income and family food requirements. The primary goal of farmers is to secure food for the farm family and maintain the household food security for the whole year. Low productivity will lead to lack of adequate income and lower purchasing power. Farmers in the Arsi-Negele area grow a range of different types of crops for food as well as for cash. Farmers grow multiple crops to avoid risk in case of crop failure due to uncertainty in the natural circumstances. Maize and wheat are the predominant and widely grown cereals by both men and women respondents as discussed earlier in Table 6.1. A study conducted eight years ago also reflects similar findings that maize and wheat were the most important crops grown in the same area (Legesse 1992).

The results of descriptive statistics show that maize yields for female respondents are lower than those of male respondents as indicated in Table 6.1. A t-test analysis was conducted to confirm the yield differences between male respondents and female respondents. These findings are supported by frequency distributions that show there was a highly significant yield difference (t = 4.129, d.f. 134, P = 0.000).

Table 6.1 Farmers' maize yield kg per hectare in Arsi-Negele, 2001

Maize yield	Male	Female
	N= 110	N = 26
Maximum	5000	3600
Minimum	600	500
Mean	2558.5	1628.92
Std. Deviation	1063.6074	883.8007
Mean yield	929.6072	
difference	(t = 4.129, d.f. = 134, P = 0.000)	

The yield differences are assumed to be due to the minimum use of improved technologies. It is assumed that female-headed households are relatively deprived of

the use of primary inputs, particularly improved maize and fertilizer due to various limiting factors. The use of improved technologies and some of the associated limitations are discussed in the following chapters.

6.3 USE OF IMPROVED TECHNOLOGY

6.3.1 Maize seed

Improved seeds provided by the extension package programme have proved to enhance maize production in the particular area and in many parts of the country. Different types of hybrid maize are supplied to the farmers through the Ministry office at the district level. As shown in Table 6.2, the variety A-511 is the most widely grown by both male and female respondents.

This variety was introduced to the area more than two decades ago. Breeders assumed that the local maize varieties are no longer considered as local due to the high probability that out-crossing might have mixed up varieties. It has also been observed that farmers use the name local sometimes interchangeably with the variety A511 that was kept at home for a long time (Hailesilase Kidane 2001, personal communication,).

Table 6.2 Farmers' use of improved and local maize varieties in Arsi-Negele, 2001

	Male		Female	
Variety	Number	Percentage	Number	Percentage
A - 511	63	54	20	63
BH - 160	2	2	-	-
BH - 140	8	7	2	6
PBH 325	37	31	3	9
Local	7	6	7	22
Total	117	100	32	100

6.3.2 Sources of maize seed

As indicated in Table 6.3, the major source of seed for the respondents using the variety A-511 is own seed. This draws attention to the fact that the variety A-511 should only be considered as improved, certified clean seed when the source is from MoA. When the source of seed is considered as a measure of improved technology, only four out of the 32 female respondents grow the improved maize A-511. In general 61% of the male respondents and 25% of the female respondents grow improved maize (Table 6.3).

Table 6.3 Sources of improved maize varieties for the respondents in Arsi-Negele, 2001

Maize varieties and source of seed		Male		Female	
		Number	Percentage	Number	Percentage
A-511	MoA	29	25	4	12.5
	Own seed	31	26	12	38
	Local market	3	3	-	
	Share cropper	-		4	12.5
BH-160	MoA	2	2	-	-
BH-140	MoA	8	7	1	3
	Local market	-		1	3
PBH 325	MoA	33	27	3	9
	Own seed	2	2	-	
	Local	2	2	-	
Local	Own	7	6	5	16
	Local market	-		1	3
	Share cropper			1	3
Total		117	100	33	100

In Table 6.4 the relationship between yield and different types (sources) is shown. According to the findings there are significant positive correlations in the case of both male ($r = 0.796$, $p = 0.000$) and female farmers ($r = 0.572$, $p = 0.001$), indicating that

the use of improved seed is associated with higher yield. The variation in mean maize yield among different sources is indicated in Fig 6.1.

Table 6.4 Yield variations among different maize varieties and sources of seed in the Arsi-Negele farming zone, 2001

Average maize yield kg per hectare								
Seed Source	MoA		Own seed		Local market		Share cropper	
Variety	Male	Female	Male	Female	Male	Female	Male	Female
A-511	2977	1975	1510	1221	1500	-	-	1600
BH - 160	2800							
BH – 140	3386	2000	1400	-	1993	-		
PBH – 325	3384	3026						
LOCAL	-	-	1140	1275	-	880		

Pearson correlation: (a) males r = 0.796, p = 0.000 (b) females: r =0.572, p = 0.001

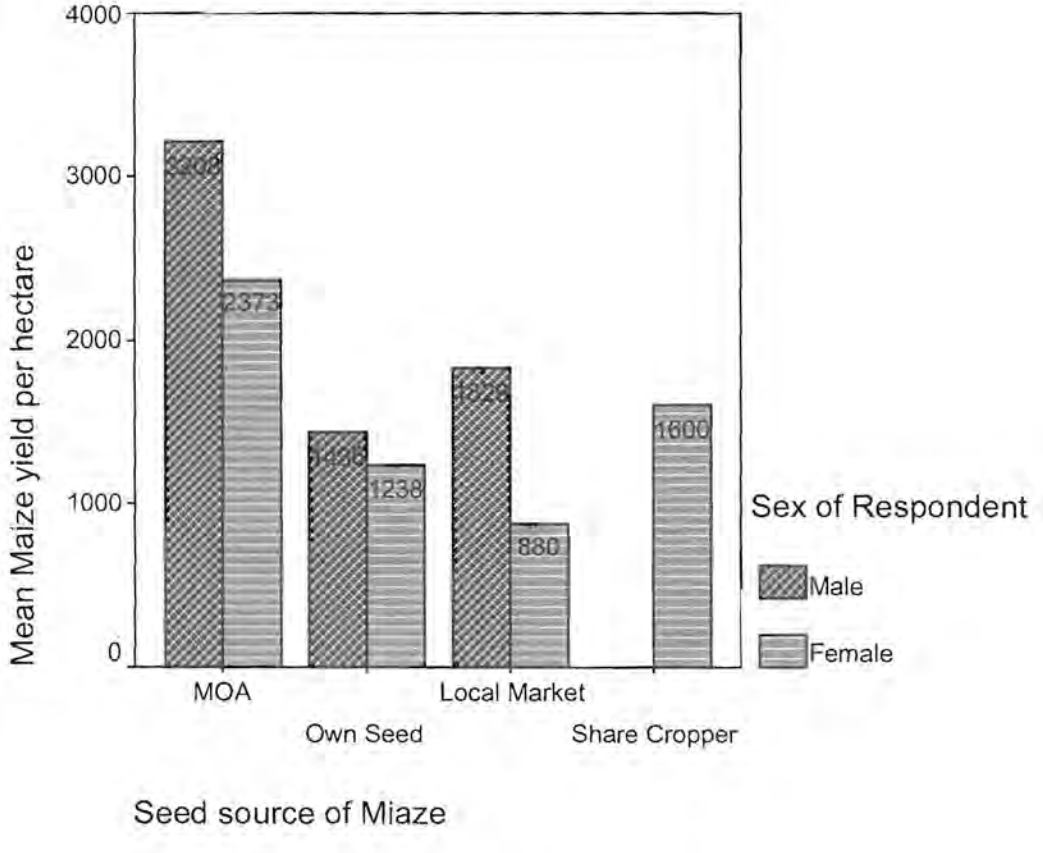


Figure 6.1 Mean yield of maize from different sources in Arsi-Negele, 2001.

6.3.3 Maize seed rate

A recommended seed rate of 25 kg/ha is provided from the ministry to the farmers. Therefore those farmers who obtained seed from the MoA office used the recommended seed rates irrespective of gender, while the seed rate for other sources depended upon individuals, varying from 10 kg/ha to 50kg/ha for male respondents and 13kg/ha to 50 kg/ha for the female respondent. As shown in Table 6.5 both male and female respondents (51% of the male and 30% of the female respondents) used the recommended seed rates.

In Table 6.5 the relationship between yield and different seed rate is shown. According to the findings there are significant negative correlations in the case of both male ($r = -0.284$ $p = 0.001$) and female farmers ($r = -0.409$, $p = 0.021$), indicating that the use of recommended seed rate is associated with higher yield.

Table 6.5 Frequency distribution of male and female respondents according to the seed rate of maize in Arsi-Negele, 2001

Seed rate kg/ha	Male		Female	
	Number	Percentage	Number	Percentage
10 - 25	28	25	5	17
25	58	51	9	30
25 - 35	12	10	7	23
35 - 45	8	7	8	27
More than 45	8	7	1	3
Total	114	100	30	100

Pearson correlation: (a) males $r = -0.284$, $p = 0.001$ (b) females: $r = -0.409$, $p = 0.021$

6.4 USE OF FERTILIZER FOR MAIZE PRODUCTION

Fertilizer UREA (46% Nitrogen) and DAP (Di-Ammonium Phosphate) are the two major fertilizer types widely used in the country. Just as in the case of improved seed, fertilizer is also distributed to the farmers through the Ministry of Agriculture in a form of credit. According to the results shown in Table 6.6, the percentage of female

respondents who used fertilizer for maize production in the 2001 cropping season are also lower compared to male respondents. More than half of the female respondents did not use any fertilizer and the mean amount of fertilizer used for maize was also lower in the case of female respondents. The mean amount of fertilizer used (both by male and female respondents) was lower than the research recommendations namely 100kg of urea and 100kg of dap per hectare. Only those farmers who received fertilizer from the ministry used the recommended fertilizer rate. The trend showed that both men and women used almost equal proportions of DAP and UREA (Table 6.6). According to the results shown on table 6.6, the use of fertilizer resulted in significant yield difference for both male and female respondents. In the case of female farmers the correlation 0.57, (p=0.001.) and 0.68 (p=0.000) in the case of men (see Table 6.6)

Table 6.6 The use of commercial fertilizer by male and female farmers in maize production in Arsi-Negele, 2001

Use of fertilizer	Male		Female	
	Number	Percentage	Number	Percentage
Yes	87	79	12	46
No	23	21	14	54
Total	110	100	26	100
Mean amount of UREA kg/ha	89 kg/ha		75 kg/ha	
n	64		12	
Mean amount of DAP kg/ha	83kg/ha		78kg/ha	
n	86		11	

Pearson correlation: (a) males r = 0.678, p = 0.000 (b) females: r =0.573, p = 0.001

The results revealed that almost all the respondents (male & female) were aware of the benefits of fertilizer but do not use fertilizer because of cash shortage. Farmers were also asked about the advantages of fertilizer in order to learn about their attitude and awareness towards the importance of fertilizer. Eighty two percent of the female and 84% of the male respondents indicated that fertilizer could increase maize yield. Although they have the knowledge and awareness about the use of fertilizer, the majority of the female respondents were not benefiting from the advantages. This could be due to their inability to afford higher costs of fertilizer.

6.5 CONCLUSION

The hypothesis **(H1)** that states production efficiency (yield) is a function of the adoption of improved practices, in particular the use of recommended seed and fertilizer, is supported by findings in Tables 6.4 and 6.6. The observation considered only two variables, improved seed and fertilizer, as practice adoption showing the behaviour of farmers. The reason for this is that they are considered to be the most limiting and are consequently also included in the extension package distributed to farmers. The yield differences between male and female farmers can therefore be largely attributed to their differences in the adoption of the seed and fertilizer used. However the contribution of other practices and the differential adoption regarding them cannot be ruled out.

As shown in Tables 6.1, remarkable differences are observed in the reported maize yield of male and female-headed households. This is confirmed by the statistical analysis showing significant differences between farmers' reported maize yield and their use of improved seed and fertilizer. As shown in Fig 6.2, close to half of the male respondents (49%) obtained maize yield ranging between 2200 to 3500 kg per hectare. About 19% obtained more than 3500 kg per hectare. Seventy seven percent of the female respondents obtained maize yields less than 2200 kg/ha. Only one out of 26 respondents obtained more than 3500 kg per hectare. The maximum yield of the female respondents is 3600 kg per hectare. It has been observed that maize yield can be raised up to more than 5000 kg per hectare, which is greater than twice the total respondents' average yield of 2200 kg per hectare. The National average maize yield is about 1800kg /ha (CSA 1990 - 2001).

An increment in maize yield was observed in response to the use of improved seed and fertilizer. According to different research findings, use of fertilizer can increase maize yield by more than 60 % in some parts of Africa (Antwi 1998). The findings of Sitotaw et al. (2000) also indicate that the uses of fertilizer had a significant yield difference in major crops at Arsi, Ethiopia.

Evidences from different parts of developing countries indicate that the productivity of women farmers is less than that of men in small scale rural households (Squire,

2002; Mudukuti & Miller 2002), and the probability of adoption of improved practices such as fertilizer and seed is higher among male-headed households as compared to female-headed households.

The most relevant finding in this case is that there is a significant relationship in maize yield and the use of improved seed and fertilizer. However, the majority of the female-headed households were deprived of such opportunity and prospects. The amount of seed and fertilizer use by farmers varies from individual to individual and is based on the sources. Those farmers who obtained the inputs from the ministry used recommended amount.

Respondents were found to be conversant with the advantages of improved maize seed and fertilizer. The problem seemed to be more on how to access the technologies. Looking for a means of improving their access to the possible achievable potential through analyzing the adverse effects, relative advantages and long term impacts of technologies could reduce this gap (Lilja & Sanders 1998).

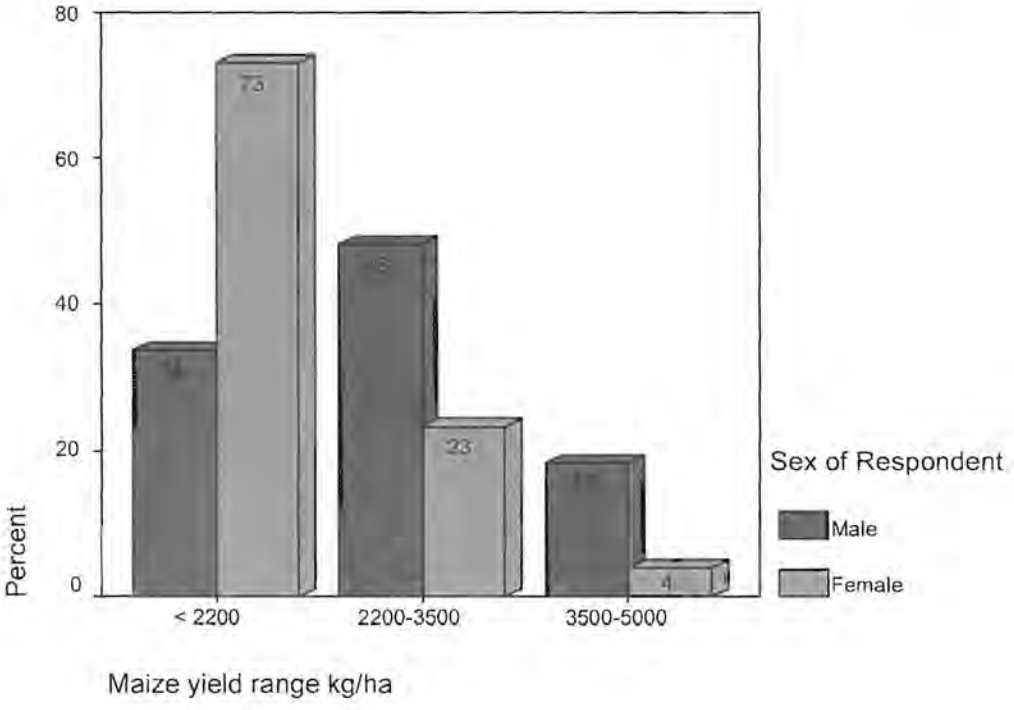


Figure 6.2 Range of maize yield as compared by sex of respondents in Arsi-Negele, 2001

CHAPTER 7

7. INFLUENCE OF THE PERSONAL AND ENVIRONMENTAL FACTORS ON MAIZE PRODUCTION

7.1 INTRODUCTION

The personal and socio-economic characteristics of respondents are discussed in this chapter. The personal characteristics include the marital status, age and their level of formal education, while the socio-economic characteristics comprise farm size, number of oxen and family size. Summaries of the personal and socio-economic characteristics of male and female-headed households are shown under each respective title.

7. 2 PERSONAL CHARATERISTICS

7.2.1 Farmers' age

The mean age of male respondents is 43 years and 39 years for female respondents. More than half of the female respondents were not certain about their age. Almost 90% of the male respondents knew their age. As shown in Table 7.1, only 12% of the female and 25% of the male respondents were more than 50 years old. The majority (88%) of the female respondents and (75%) of the male respondents were at the productive age, meaning that they have the physical ability for agricultural production.

Age is one of the important parameters that influence the adoption behaviour. However, consistent results were not observed across different ranges of findings. For instance, Hassan et al. (1998); Itana (1985) reported that age is negatively associated with adoption decisions. Asfaw et al. (1997) reported that there is a positive relation between age and the adoption rate but that it is not significant. Legesse (1992) reported that there is a positive association between experience in farming and

adoption decisions. Addis et al. (2000) reported that age is negatively associated to gross output for the male-headed households.

Table 7.1 Farmers' age variation in Arsi-Negele, 2001

Age category	Male		Female	
	Number	Percentage	Number	Percentage
20 - 30	21	18	2	6
30 - 40	39	33	14	42
40 - 50	29	24	13	40
50 - 60	18	15	3	9
> 60	13	10	1	3
Total	120	100	33	100

In Table 7.2 the relationship between maize yield and different age category is shown. According to the findings there is no significant correlations in the case of both male (Chi^2 = 3.651, d.f. = 4, P = .455) and female farmers (Chi^2 = 7.595, d.f., = 4, P = .108), indicating that no significant difference in maize yield among the different age groups. However, the trend shows that the majority of the male respondents producing 2200kg/ha–3500kg/ha fall in the age category of less than 40 years old while the young adults of the females were found at the lower yield of maize production producing less than 2200kg (Table 7.2).

Table 7.2 Distribution of farmers by different age category and maize yield Arsi-Negele, 2001

Age category	Maize yield range kg/ha											
	Male						Female					
	500-2200		2200-3500		3500-5000		500-2200		2200-3500		3500-5000	
	n	%	n	%	n	%	n	%	n	%	n	%
20 - 30	4	21	10	53	5	26	0	0	2	100	0	0
30 - 50	25	39	28	43	12	18	16	80	3	15	1	5
>50	8	31	15	58	3	11	3	75	1	25	0	0
Total	37	34	53	48	20	18	19	73	6	23	1	4

Chi-square Test: (a) males Chi^2 = 3.651, d.f. = 4, P = .455 and (b) females Chi^2 = 7.595, d.f., = 4, P = .108

As shown in Tables 7.3, and 7.4 there is no significant correlation between age and the use of inputs (fertilizer and improved seed) for both male and female respondents.

Table 7.3 Distribution of farmers by different age category and use of improved seed Arsi-Negele, 2001

	Use of improved seed							
	Male				Female			
Age category	Yes		No		Yes		No	
	Number	%	Number	%	Number	%	Number	%
20 - 30	15	78.9	4	21.1	1	50	1	50
30 - 50	40	58.8	28	41.2	5	19.2	21	80.8
> 50	17	56.7	13	43.3	2	50	2	50

Chi-square Test: (a) males $Chi^2 = 2.945$, d.f. = 2, P = .229 and (b) females $Chi^2 = 2.462$, d.f., = 2, P = .292

Table 7.4 Distribution of farmers by different age category and use of fertilizer Arsi-Negele, 2001

	Fertilizer use							
	Male				Female			
Age category	Yes		No		Yes		No	
	Number	%	Number	%	Number	%	Number	%
20 - 30	17	89.5	2	10.5	2	100	0	0
30 - 50	50	76.9	15	23.1	7	35	13	65
> 50	20	76.9	6	23.1	3	75	1	25

Chi-square Test: (a) males $Chi^2 = 1.497$, d.f. = 2, P = .473 and (b) females $Chi^2 = 4.674$, d.f., = 2, P = .197

7.2.2 Education

Education is believed to be the most influential factor to improve the ability to acquire and analyze information. According to Hassan et al. (1998); Asfaw et al., (19997);

Itana (1985); and Tesfaye et al. (2001), the better the education the better the ability of the farmers to make optimal adoption decisions. However, Legesse (1992) reported that education does not influence farmers' adoption decisions; but that the probability of adoption of improved varieties increases with increased farming experiences. Mwangi et al. (2000) reported that in Mbeya, Tanzania, the level of education had a significant influence only for male respondents. Similar to Mwangi's finding, this study also reflects that education had a significant influence only for male respondents but at 10% probability.

The level of education for the respondent is shown in Fig 7.1. Eighty two percent of the female respondents had no formal education. Only one out of the 33 respondents had a formal education up to grade 8.

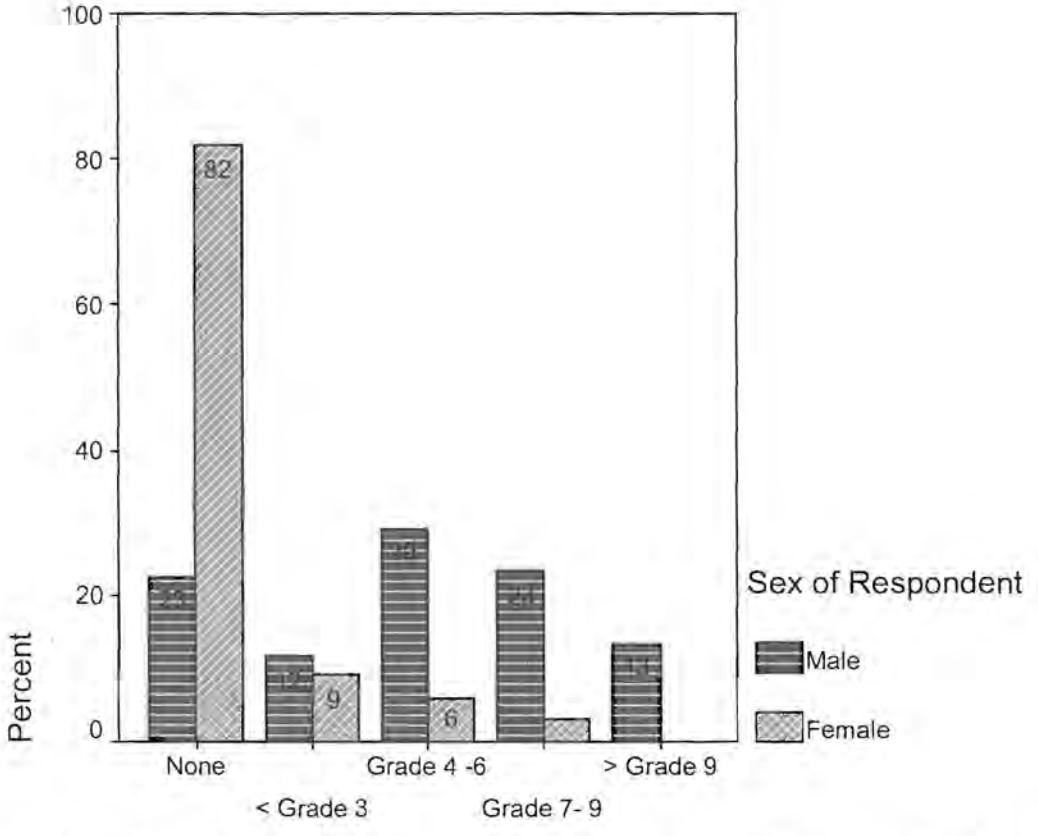


Figure 7.1 Level of formal education for male and female respondents in Arsi-Negele, 2001

According to the results shown in Table 7.5, there was no significant yield difference among the different level of education for both male and female respondents. In the

case of male farmers the chi-square is 6.923, (p=0.140.) and 6.112 (p=0.191) in the case of female.

Table 7.5 Distribution of farmers by different level of education and maize yield Arsi-Negele, 2001

Level of education	Maize yield (kg/ha)											
	Male						Female					
	500-2200		2200-3500		3500-5000		500-2200		2200-3500		3500-5000	
	n	%	n	%	n	%	n	%	n	%	n	%
None	10	44	12	52	1	4	17	80	4	20	0	0
Grade 1-6	16	35	23	50	7	15	2	40	2	40	1	20
> Grade 7	11	27	18	44	12	29	1	100	0	0	0	0

Chi-square Test: (a) males Chi^2 = 6.923, d.f. = 4, P = .140 and (b) females Chi^2 = 6.112, d.f., = 4, P = .191

Tables 7.6 and 7.7 show the relationship between education and use of improved maize seed and fertilizer respectively. According to the results, the differences (chi-square) are significant for male respondents and non-significant for the case of female respondents. The Chi-square for improved seed is 5.044, (p=0.080) for male and .985 (p=0.611), for the female. The Chi-square for the use of fertilizer is 7.346, (p=. 025) for male and 1.2554, (p= .534) for the females.

Table 7.6 Distribution of farmers by level of education and use of improved seed Arsi-Negele, 2001

Level of education	Use of improved seed							
	Male				Female			
	Yes		No		Yes		No	
	Number	%	Number	%	Number	%	Number	%
None	13	50	13	50	6	23.1	20	76.9
Grade 1-6	27	56.3	21	43.8	2	40	60	60
> Grade 7	32	74.4	25.6	25.6	0	0	1	100

Chi-square Test: (a) males Chi^2 = 5.044, d.f. = 2, P = .080 and (b) females Chi^2 = .985, d.f., = 2, P = .611

Table 7.7 Distribution of farmers by level of education and use of fertilizer Arsi-Negele, 2001

Level of education	Use of fertilizer							
	Male				Female			
	Yes		No		Yes		No	
	Number	%	Number	%	Number	%	Number	%
None	16	69.6	7	30.4	9	45	11	55
Grade 1- 6	33	71.7	13	28.3	3	60	2	40
> Grade 7	38	92.7	3	7.3	0	0	1	100

Chi-square Test: (a) males Chi^2 = 7.346, d.f. = 2, P = .025 and (b) females Chi^2 = 1.254, d.f., = 2, P = .534

The observation that education has an influence, albeit weak, in the case of the adoption of improved fertilization and seed, while it is not significant in the case of female farmers, can be attributed to the lack of variation among female farmers. As indicated in Figure 7.1, eighty-two percent of the female farmers fall in the category of no formal education.

7.2.3 Marital status

As shown in Table 7.8, there are distinct differences between male and female-headed households. Almost all of the female respondents were widowed. Almaz (2000) reported that the number of female-headed households in Ethiopia to be 21%. However, the current global trend indicates that the number of female-headed households is increasing Tiruneh et al. (2001). In the case of male-headed households, the dominant type of marital status was monogamy, and yet polygamy was also quite common. However, no significant association was found in terms of using improved maize seed, fertilizer use and marital status.

Informal discussions were held in relation to this to understand how they rate their standard of living as compared to the other women colleagues living with husbands. Most of them indicated that their life style was much more adversely affected than those women whose husbands were around. It is assumed that this was mainly due to

the absence of their partners to support and share the burdens and additional tasks of productive roles and responsibilities and missing joint household decision-making.

Table 7.8 The distribution of farmers according to marital status in Arsi-Negele 2001

Marital status	Male		Female	
	Number	%	Number	%
Single	5	4		
Married one wife	70	58		
Married two wives	39	33		
Married more than two wives	6	5		
Widowed			31	6
Absentee husband			2	94
Total	120	100	33	100

7.3 SOCIO-ECONOMIC CHARACTERISTICS

7.3.1 Household size

The average household size of male-headed households was 10 persons and 7 persons in female-headed households. It appeared that female-headed households were relatively smaller in size (Table 7.9). This is similar to the findings of Addis et al. (2000) in the central parts of Ethiopia that the female-headed households were smaller in size.

Table 7.9 Farmers' family size Arsi-Negele, 2001

Family size	Male	Female
Maximum	28	13
Minimum	4	3
Mean	10.44	7.09
n	119	33

Findings of Mwangi et al. (2000) showed that a larger household size had a significantly negative influence on the adoption of fertilizer for male-headed

households in Tanzania. In Ethiopia, Yohannes et al. (1990) reported that family size had a significant effect on the adoption of fertilizer.

Farmers reported that there is a seasonal labour shortage more especially during the time of weeding, and harvesting as indicated in chapter five. Farmers use hired labour, exchange labour and sharecropping to avoid the peak season labour problem. Female respondents use the sharecropping arrangement more frequently. It is expected that those farmers with large families might have more family labour assistance on the farm and will be encouraged to use more improved practices. There is, however, no significant association between family size and the use of improved maize seed or fertilizer and maize yield.

7.3.2 Farm size

In Ethiopia, as per the land reform act in 1975 land was nationalized by the state and allocated to farmers according to their family size. Land cannot be sold or rented officially. The land allocation was done by the chiefs of each PA. There was no gender discrimination in allocation of land in the study area. However the respondents reported that no reallocation was done since 1975, and the same plot of land is mostly shared among the adult family members passing from generation to generation.

Male respondents tend to have bigger farms as compared to the female respondents (Table 7.10). The mean land holding for female respondents was 1.1 hectares. The range of land holding size for the male respondents was .25 ha to 5.25 ha with an average size of 1.67 ha. Some of the male respondents hired additional land to grow improved maize. The findings of Yohannes et al. (1990) show that farm size was significantly related to the use of improved practices in some parts of Ethiopia. Addis et al. (2000) also reported similar results, namely that farm size had a significant impact in gross value of output for both male and female-headed households. However, Legesse (1992) found that farm size was not an important factor affecting the probability of the adoption of improved maize seed or fertilizer.

Table 7.10 Farm size for respondents in Arsi-Negele, 2001

Farm size (hectares)	Male	Female
Maximum	5.25	2
Minimum	.25	.25
Mean	1.67	1.1
n	119	33

Similarly there was no significant association between farm size and maize yield. However, according to the results shown in Table 7.11, the trend revealed that the male respondents who owned relatively larger farms had the tendency of using fertilizer and improved seed. It was also observed that most of the male respondents with a bigger family were more likely to have bigger plots. Unlike the male respondents, the pattern for females did not show differences in farm size.

Table 7.11 Distribution of farmers according different farm size and maize yield in Arsi-Negele, 2001

Farm size (ha)	Maize yield (kg/ha)											
	Male						Female					
	500-2200		2200-3500		3500-5000		500-2200		2200-3500		3500-5000	
	n	%	n	%	n	%	n	%	n	%	n	%
< or = 1.5	8	26	17	55	6	19	14	74	4	21	1	5
> 1.5	29	37	36	46	13	17	5	71	2	29	0	0

Chi-square Test: (a) males $Chi^2 = 1.28$ d.f. = 2, P = .527 and (b) females $Chi^2 = .479$, d.f., = 2, P = .780

7.3.3 Draft power

According to the result shown in Table 7.12, female respondents tended to have fewer oxen compared to the male respondents. Addis et al. (2000) reported that cattle ownership significantly and positively influences gross value of output for both male and female respondents, while Mwangi et al. (2000) indicated that the number of livestock had a positive and significant impact on the adoption of maize seed in male-headed households only. Similarly, according to the results shown in Table 7.13, it was also observed that the number of oxen as draft power had a positive and significant impact on maize yield and use of inputs in the case of male respondents.

Table 7.12 Farmers' ownership of oxen at Arsi-Negele farming zone 2001

Number of oxen	Male		Female	
	Number	Percentage	Number	Percentage
0	23	21	18	58
1	26	23	9	29
2	55	50	4	13
3	1	1	0	0
4	6	5	0	0
Total	111	100	31	100

Table 7.13 indicates that the correlation between ownership of oxen and maize yield, as well as use of inputs. Respondents with more number of oxen tend to use inputs, and obtain more maize yield.

Table 7.13 Correlation between number of oxen and the use of improved seed and fertilizer as well as yield in Arsi-negele, 2001

Relationship	Male	Female
	Use of improved seed	
Coefficient	.475**	.419
n	108	30
Significance	.000	.114
	Use of fertilizer	
Coefficient	.263	.175
n	101	26
Significance	.004	.206
	Maize yield	
Coefficient	.429**	.144
n	101	24
Significance	.000	.262

* Correlation is significant at 0.05 level (1-tailed)

** Correlation is significant at 0.01 level (1-tailed)

7.4 SUMMARY OF FINDINGS

As in many other developing countries, both men and women farmers in Ethiopia also do not have access to adequate production resources, but women's access is even more constrained as a result of cultural, traditional and sociological factors.

The results reflect that male respondents had relatively more land, and draft power and also had a relatively better standard of formal education compared to the female respondents. In terms of age, both male and female respondents were more or less in the similar age group. Among the different personal and socio-economic factors, higher level of education, larger farm size, larger number of oxen, tend to be important factors that contribute to production efficiency, particularly in the case of male respondents as assumed in Hypothesis **H2**, namely that the production efficiency and practice adoption are influenced by gender and other socioeconomic factors There is a significant correlation between level of education and practice adoption, and also between number of oxen and practice adoption and amount of maize yield. The hypothesis could not be verified in the case of other variables such as age, marital status and family size.

CHAPTER 8

8. INSTITUTIONAL FACTORS

8.1 INTRODUCTION

Like personal and socio-economic factors, the institutional factors also play a major role in influencing the behaviour in decision making to use different practices. In many developing countries the adoption of improved agricultural technologies are mainly affected by institutional factors such as the availability and contact with extension services, training, access to credit, access to product and input markets, pricing policy of inputs and outputs, etc. (Feder et al. 1985; Sahn and Haddad 1991; Bembridge 1993).

This chapter assesses the extent of participation of male and female-headed households in agricultural extension, and credit services. It is assumed that less opportunity to participate in productive activities will affect the maize yield, which in turn affects the income and family well-being as a whole. The focus of extension service in this aspect is the provision of improved seeds and fertilizer, and other agricultural advisory and support services that are provided to promote agricultural production through the office of MoA at Arsi-Negele District.

The agricultural extension service in Ethiopia is rendered by the public sector. The Ministry of Agriculture (MoA) is mandated to carry out extension activities such as disseminating research results and inputs to the farmers. In the process of this particular study, the respondents were requested to explain the extent of their contact with the extension officer and how they received agricultural information. All household heads were asked how many times extension officers had visited them within the last six months (the main cropping season in the year 2001) before the study was conducted. The respondents were also asked how they received agricultural information for their farming activities. Results are presented under each respective sub-title.

8.2 ACCESS TO AGRICULTURAL EXTENSION SERVICES

According to the information obtained from the respondents (Table 8.1), the two major sources for obtaining agricultural information were through the DA's and sharing information with the neighbouring farmers. As shown in Table 8.1, male respondents had a better chance of obtaining information from the extension workers than the female respondents.

In order to measure the access to extension services, respondents were asked the frequency of contacts they had with the extension workers and their intensity of exposure to listening to agricultural programmes on radio. It is believed that the probability of adoption of new technologies increases as the frequency of contact with extension workers is increased. As cited by Mwangi et al. (2000), male-headed households had more extension contact/training compared to female-headed households in Africa. Mwangi et al. (2000) also reported that access to extension had a positive impact on the adoption of improved practices. Addis et al. (2000) reported similar findings that extension contacts significantly affected gross value of output of female-headed households in central highlands of Ethiopia. On the other hand Legesse (1992) emphasized the importance of direct extension contact, supported by extensive demonstrations as an important factor. Similarly, a highly significant association was observed between the frequency of the extension contact and use of improved seed, fertilizer use by both male and female respondents in this study (Table 8.3). Significant association was also revealed in the maize yield and number of extension contacts. This can be true because the number of contacts is usually related to the follow-up of the inputs provided to the farmers.

Table 8.1 Farmers' sources of agricultural information in Arsi-Negele, 2001

Sources	Male		Female	
	Number	Percentage	Number	Percentage
Neighbouring farmers	20	17	26	79
Extension agents	81	67	5	21
During demonstration	17	14	-	-
During field day	2	2		
Total	120	100	31	100

Sixty percent of the male respondents had no particular preference while 33% of them preferred male development agents. Their justification for choosing male extension agents was that males were physically stronger to work under difficult conditions and walk a long distance in remote areas (Table 8.5).

8.2.2 Access to radio

Access to radio was also considered as one of the important factors to provide agricultural information. As shown in Table 8.6, the female-headed households have less access to agricultural information through a radio. A study conducted by Mwangi et al. 2000 revealed that radio ownership has a positive and significant influence on the adoption of improved maize varieties, particularly for female-headed households in the highlands of Tanzania. Legesse 1992 reported that radio ownership was not significantly related to the rate of adoption of improved inputs such as seed, fertilizer and herbicide.

Table 8.6 Farmers' access to radio to receive agricultural information at Arsi-Negele farming zone 2001

Access to sources of information	Male		Female	
	Number	Percentage	Number	Percentage
Have no radio	49	41	25	76
Have radio but no time to listen	10	8	1	3
Attend sometimes	49	41	6	18
Attend regularly	12	10	1	3
Total	120	100	33	100

8.2.3 Participation of farmers in different extension activities

The ministry in collaboration with research seldom organizes training for farmers on crops and livestock management, cultivation techniques and other improved technologies. The involvement of female farmers in such training was minimal

The sample respondents were also asked if they had attended any agricultural activities organized by the Ministry of Agriculture or the nearby Agricultural Research sub-centre. As shown in Table 8.7 only 9% of female respondents indicated that they had participated in agricultural activities in the last three years, while more than half of the male respondents attended at least once. None of the female respondents had ever been a contact farmer. It is believed that such type of participation and training would help to increase awareness and perception of improved practices. Legesse (1992) suggested that extensive demonstration was a strong means of promoting agricultural technologies.

Table 8.7 Frequency distribution of participation of farmers in different agricultural extension activities at Arsi-Negele farming zone 2001

Activities	Male		Female	
	Number	Percentage	Number	Percentage
Field days	42	35	1	3
Demonstrations	65	54	2	6
Contact farmer	30	25	0	0
n	120		33	

8.2.4 Training of extension staff

The minimum qualification for recruiting field level extension staff is the completion of the Ethiopian School Leaving Certificate (ESLC) in grade 12. Thereafter a nine-month vocational training is provided before starting the actual fieldwork. The extension workers are generally called Development Agents (DA's), and are obliged to live right in the village close to the farmers as a permanent employee. The research in collaboration with the ministry once in a while organizes training for the DA's in relation to agronomy, crop protection, breeding and agricultural related topics. However, there is only little or no gender awareness in the training process.

8.3 ACCESS TO CREDIT

Although the availability and access to credit facilities play a vital role in terms of increasing farm productivity, there are no formal credit facilities in terms of cash in this particular study area. The major type of credit is provided in terms of inputs, which includes improved seed, fertilizer and pesticide. The major source of these inputs is the Ministry of Agriculture (the government) under the extension package programme as discussed earlier.

According to Table 8.8, more than 82% of the male respondents have used the input credit at least once. Only 18 % of male respondents have not had credit, while 64 % of the female respondents had not made use of credit services. According to Legesse (1992), credit is an important factor affecting probability of adoption of improved seed.

Table 8.8 Use of agricultural credit services in the Arsi-Negele farming zone, 2001

Practices	Male		Female	
	Number	Percentage	Number	Percentage
Use fertilizer and seed for the last three years	80	67	8	24
Use fertilizer and seed credit twice and discontinued	4	3	1	3
Use fertilizer and seed credit only once and discontinued	14	12	3	9
Never used any credit	22	18	21	64
Total	120	100	33	100

8.4 SUMMARY OF RESULTS

The results discussed earlier indicate that there is a significant difference between male and female heads of households in terms of receiving advice and services from extension. Improved seeds of maize and wheat and fertilizer (UREA and DAP) are provided to the farmers through the Ministry of Agriculture office as a form of credit. Farmers have to pay a collateral of about 25% of the total cost in order to obtain the input. The extension officer makes a follow-up in giving advice about the proper use of the inputs to ensure better yields and guarantee repayment of the debt. This is done

through frequent visits and contacts. However, the female farmers usually cannot pay the collateral because of the shortage of finance.

The analysis conducted to determine whether there was a difference in access to extension contacts based on the characteristics of household heads reveals that there was a significant difference in the number of extension contacts with respect to the use of improved seed. The source of improved seed was significantly associated with the number of extension contacts. This supports the findings of Tesfaye et al. (2001) namely that access to information and access to credit facilities are some of the many factors influencing adoption of improved maize and fertilizer.

It was clearly observed that the knowledge system (agricultural information through extension) is directly connected to the real situation through the development agents who facilitate the input delivery system. However, according to the secondary information and personal communications with the development agents, the efforts of the DA were undermined due to wide coverage, lack of incentives, low level of training, and infrastructural problems.

The result shows a significant and positive correlation between number of extension contacts and practice adoption. This is evidence supporting the hypothesis **(H3)** stating that the influence of gender on agricultural production is largely a function of the access to extension and access to credit. The increase in maize yield is influenced by the adoption of different practices, which usually is improved maize seed and fertilizer and goes along with extension contact. The results are found to be supportive to this hypothesis.

For male respondents, the significant factors affecting maize production were found to be higher level of education, larger number of oxen higher frequency of extension contacts and use of improved practices. In the case of female respondents, higher extension contacts and use of inputs were observed as limiting factors of maize production. In general male respondents have a relatively better education, larger farm size, more number of oxen, and better extension contacts.

CHAPTER 9

9. INTERVENING VARIABLES

9.1 INTRODUCTION

In the background theory it has been stated that efficiency is a result of behaviour as affected by different independent and intervening factors. Yield being the subject of efficiency; the different relevant independent factors affecting efficiency were discussed in the preceding chapters. In this chapter, relevant intervening cognitive factors of behaviour are discussed. It is assumed that the cognitive factors are more relevant and have a direct impact on the behaviour itself. Farmers' long-term plan and their knowledge about improved maize seeds, and use of fertilizer are discussed.

9.2 FARMERS' LONG-TERM PLAN

Farmers were asked an open-ended question about their long-term plan for their future life. According to the respondents' view, the most important long-term goal of farmers, both male and female respondents was found to be increase in productivity, improvement of their standard of living and education of their children (Table 9.1). Obtaining inputs at lower costs, access to better farm implements, and land, availability of credit facilities, were the major solutions suggested by respondents to enable them to meet their goals successfully.

An additional question was also forwarded to respondents on how they perceived their current standard of living. According to the information obtained, the majority of the respondents were dissatisfied with their current standard of living. Only 24 % of the female respondents and 32% of the male respondents reported that they were satisfied with their current living situation (Table 9.2). As mentioned earlier, female respondents complained bitterly about the hardship and difficulties of farm and family burdens because of the lack of assistance. It is obvious that male respondents have assistance and share responsibilities with their wives. However, some of the female respondents indicate that they would be able to manage their farm and family more successfully if they had access to cash to purchase required inputs.

Table 9.1 Farmers' long-term aspirations in Arsi-Negele, 2001

Aspirations	Percentage of respondent (multiple response)	
	Male	Female
Increase productivity	34	20
Improve standard of living and secure food for the family	41	59
Educate children	15	15
Improve level of education for own self	5	
Use improved inputs and farm implements	5	3
Getting rid of human diseases		3

Table 9.2 Farmers' perception of their current standard of living in Arsi-Negele, 2001

Level of satisfaction	Male		Female	
	Number	Percentage	Number	Percentage
Very dissatisfied	2	2	8	24
Dissatisfied	50	42	15	46
Neutral	30	25	2	6
Satisfied	31	26	7	21
Very satisfied	7	6	1	3
Total	120	100	33	100

9.3 FARMERS' KNOWLEDGE

Farmers' perception about their knowledge of maize production was investigated by asking a question how they rated their knowledge concerning maize production. About half the male respondents (48%) reported that their knowledge about maize production was average while almost half of them reported that their knowledge about maize production was good to fairly good as indicated in Table 9.3. Almost half of the female respondents (49%) reported that their knowledge about maize production was less than average. More than half of the male and female respondents consider their efficiency to be less than average (Table 9.4).

However, results indicate that both male and female respondents were aware about advantage (high yielding) of improved maize and use of fertilizer to increase crop

productivity. Both male and female also had similar attitudes about the importance of obtaining fertilizer at a lower cost and timely, and training about agronomic practices as a means of improving their productivity.

Table 9.3 Frequency distribution of farmers perception about their knowledge of maize production in Arsi Negel, 2001

Perception	Male		Female	
	Number	Percentage	Number	Percentage
Very poor	-	-	1	3
Poor	3	2	15	46
Average	57	48	6	18
Good	47	39	10	30
Very good	13	11	1	3
Total	120	100	33	100

Table 9.4 Frequency distribution of farmers perception about their own efficiency in Arsi-Negele, 2001

Perception	Male		Female	
	Number	Percentage	Number	Percentage
Very poor	0	0	2	6
Poor	5	4	14	43
Average	68	57	8	24
Good	41	34	6	18
Very good	6	5	3	9
Total	120	100	120	100

9.4 SUMMARY OF RESULTS

In this section it has been observed that both male and female-headed farmers were conscious about the advantages of using agricultural technology. This could be due to the influence of the introduction of the improved hybrid maize, which was introduced to the area two decades ago. The package programme, which started in 1993, could also have helped as a demonstration since maize yield obtained was as high as 5000 kg/ha. It has also been observed that farmers have a long-term goal to improve their life standard by improving their productivity. However, most farmers, particularly the female respondents, were found to be disadvantaged in terms of getting access to productive resources to meet their goal. None of the female respondents have mentioned improving their level of education as a way out of their subsistence and

traditional farming practices. At least 5% of the male respondents did. This is a reflection of the reality and motherly attachment to the domestic domain confirming the obvious character of mothers, caring more for the children than for themselves.

Farmers mentioned a wide range of problems as priority factors inhibiting their agricultural productivity in general and maize productivity in particular. Cash shortages limited their access to inputs. Higher costs of inputs, particularly seed and fertilizer, shortage of oxen, shortage of land, unpredictable rainfall conditions were mentioned as the major factors limiting productivity. One farmer expressed his worry about a kind of weed that has been recently observed (not scientifically identified) in maize farms and is increasing progressively. Farmers also mentioned the problem of Malaria as being an important human disease directly affecting productivity due to its impact on weakening physical farm labour.

Unavailability of a clean source of water and medical centre nearby and the costs of medical fees, unavailability of a grinding mills close by and their higher charges are some of the many non-agricultural problems reported by the respondents (both male and female) as constraining factors to agricultural production.

The overall goal of a given development strategy in general is to improve efficiency. Efficiency on the other hand is a result of behaviour, which is influenced by behaviour determinants. Therefore whenever any development strategy seeks to bring in a change in efficiency, a systematic understanding of causes and interaction of behavioural determinants will be very crucial. The study revealed that farmers' need to improve their living standard through improving their productivity. They have positive attitude towards recommended practices and aware about the relative advantages of the technology. The technology has also proved to be compatible with the local system. Nevertheless the lack of investment capital and alternative source remain to affect farmers' efficiency in general and female-headed households in particular.

CHAPTER 10

10. RESULTS AND DISCUSSION

10.1 INTRODUCTION

This chapter briefly discusses major findings in particular and gives an overview of the study in general. Findings that are considered to be important and related policy implications are also mentioned. The survey findings and other similar empirical evidence from different literature support the conclusion. It is believed that the results could form the basis for further research work and future extension planning.

10.2 SUMMARY OF RESULTS

The overall goal of a given development strategy in general is to improve efficiency. Efficiency on the other hand is a result of behaviour, which is influenced by different associated factors. Hence whenever any development strategy seeks to bring in a change in efficiency, a systematic understanding of causes and interaction of behavioural determinants will be very crucial. The study revealed that farmers' need to improve their living standard through improving their productivity. They have a positive attitude towards recommended practices and are aware of the relative advantages of the technology. The technology has also proved to be compatible with local system. Nevertheless the lack of investment capital and an alternative source remain a negative influence on farmers' efficiency in general and female-headed households in particular.

The study was conducted in the Arsi-Negele, Central Rift Valley of Ethiopia. The area is considered to be one of the best maize and wheat producing areas with an average annual rainfall of over 800mm per annum. The total population of the area, namely 170,539 consists of 49% males and 51% females. The farm families comprises 21, 859 household heads organized under 31 Peasant Associations. Agriculture crop and livestock production is the main economic activity.

The purpose of the study was to identify major factors influencing farm level productivity for male-headed and female-headed households and evaluate their access to technology and credit facilities in the context of crop farming specific to maize. It was assumed that different factors affected farm productivity or the output of maize among the male and female household heads.

The behaviour model formulated by Düvel, (1975) is found to be appropriate to explain the situation in this particular study. The model was based on Düvel's model and adjusted to explain some of the many factors that influence maize productivity among male-headed and female-headed households.

A random sampling procedure was used to constitute the sample. All the information was obtained by personal face-to-face interview using a structured formal survey questionnaire. Non-parametric statistics were used to observe the interrelationship between variables. The Statistical Package for Social Scientists (SPSS 10.0, 1999) was used to analyze the data.

Crop and livestock production is the major source of livelihood. Farmers grow different types of crops such as maize wheat, tef, sorghum, haricot Ben and shallot. maize and wheat are the most widely grown for food as well as earning income. Shallot and wheat are the major sources of income.

In this particular study it is observed that the women household heads have less access to agricultural services such as credit and extension services. It is clearly observed that women are deprived in terms of education, farm size, and number of oxen that are used as draft power. This is supported by other research findings already mentioned in chapter 7.

Since the majority of the respondents (both male and female) are in the age group of 30-50 years, it can be assumed that they have the physical capability to perform the agricultural activities. The male respondents were found to be at a relatively higher literacy level, but not beyond grade 12. Female-headed households were found to be relatively smaller in size (7) as compared to the male-headed households (10). The polygamy family style of the male-headed households contributed to the increased

number of household members. Both male and female respondents use traditional farming methods (oxen cultivation) for crop production.

The findings shows remarkable yield difference between male respondents and female respondents. It was observed that male respondents obtain relatively higher maize yields as compared to the female respondents. Comparisons between the male and female respondents revealed significant yield differences the average yield for the male respondents was 2559 kg/ha and 1629 kg/ha for the female respondents.

It was found that 61% of the male and 25% of the female respondents have used the improved certified seed from the ministry. Those farmers who obtained seed and fertilizer from the ministry used the recommended maze seed rate, which is 25kg/ha and 100kg of UREA and 100kg of DAP. According to the results, a wide yield gap was observed between male and female technology users. Women who used improved seed and fertilizer did not produce yields as high as the male respondents. The maximum yield for female respondents was 3600kg/ha, while the maximum yield for the males was as high as 5000kg/ha.

Highly significant association was observed between the frequency of the extension contact and type of maize seed used by both male and female-headed households Significant association was also revealed in the maize yield and number of extension contacts. Farm size and number of oxen were also found to be factors that encourage the use of improved seed and fertilizer in particularly in the case of male respondents.

Findings also indicate that female respondents engaged in sharecropping arrangements of farming to overcome their cash, oxen and labour problems. Female respondents expressed their suffering in life due to their many tasks and responsibilities that they are in charge of. They are engaged in domestic responsibilities as a mother and housekeeper, and productive responsibilities as a farm manager without assistance of a partner. Twenty-five out of thirty three (76%) of the female respondents reported that they were dissatisfied with their current living status and expressed their dissatisfaction with their situation. Only eleven out of thirty-three (33%) assumed that they had good knowledge about maize production.

Maize yields were positively influenced by factors such as the availability of information, access to extension services and credit facilities. According to the Chi-square test factors such as age and household size had no direct impact on maize yields for both male and female respondents.

The major sources of information were found to be through the development agents, and neighbouring farmers where the latter was found to be a more important source of information to the female respondents. Mass media, the use of radio had a minimal or no impact on transforming agricultural messages for female respondents. It appeared that more than half (57%) of the female respondents were not aware of the existence of a development agent in their villages. The majority of the female respondents preferred female DA's, due to more effective communication and understanding.

Credit was provided to farmers in terms of fertilizer and seed but not in cash. Significant association was observed between the number of extension contacts, and the use of improved maize seed and fertilizer use. This is directly related to the number of extension contacts because of the follow-up made by the development agents to ensure the appropriate implementation of agricultural practices of technologies.

The knowledge system (agricultural information through extension) is directly connected to the real situation through the development agents who facilitate the input delivery system. However, according to the secondary information and personal communication with the development agents, the efforts of the DA could not be effectively operational due to lack of incentives, wide coverage, low level of training, and infrastructural problems.

The participation of female respondents in different agricultural training activities was minimal as compared to their fellow colleague male respondents. Formal agricultural training for the farmers (both male and female) and for the development agents was generally minimal. Although the current extension programme in Ethiopia is gender neutral, it was reflected in the study that most female-headed households were not benefiting from the services. There seemed to be imbalances and inadequacies in the distribution of inputs, between those who were relatively resource poor. In general the

study reflected that the present agricultural extension package advantaged those farmers who were able to pay the collateral, whereas the majority of the female respondents were excluded.

In the responses of farmers about their objectives and long-term determinations, 59% of the female respondents and 41% of the male respondents reported that their main aim was to secure food for the family. None of the female respondents mentioned that improving their level of education was a means of overcoming problems while at least a few (5%) of the male respondents confirmed this.

Farmers mentioned various problems as factors affecting the productivity of agriculture in general and maize production in particular. High costs of inputs, particularly seed and fertilizer, shortage of oxen, shortage of land; unpredictable rainfall conditions and weeds were mentioned as the major factors limiting productivity. Farmers also mentioned the problem of Malaria as being an important human disease directly affecting productivity due to its impact on weakening the physical ability of the farm labour.

Unavailability of water for domestic consumption, unavailability and high costs of grinding mill operations, high costs of medical fees, are some among the many non-agricultural problems reported by farmers as factors inhibiting agricultural production. This indicates the complexity and diversity of a system and is also an alarm signal for the need for an integrated rural development approach.

The model confirmed that there is a positive and significant influence between use of improved inputs (behaviour) and maize yield (consequences of behaviour). It was not possible to find evidence of the influence of the intervening variables on the practice adoption or efficiency (yield). This was due to the multi-dimensionality of some of the intervening variables. For example, the perceived efficiency (which is a function of both the current efficiency and the perception) was used rather than the differential perception regarding the efficiency. In line with Duvel, (2000), it is also been proved that it is important to understand the determinant factors of behviour in order to understand the behaviour itself. Hence in this case it has been observed that the farmers' ability to access inputs in terms of physical and socioeconomic capability are

found to be related to technical efficiency. It has also been observed that none agricultural problems affect the maize productivity direct or indirectly and the extent of their effect varies by gender. The findings of this study are informative in identifying factors affecting maize productivity in terms of gender. However it would be important to conduct extensive gender analysis case studies based on the behaviour model of Duvel, which deals on the recognition of positive and negative forces of behaviour determinants.

10.3 POLICY IMPLICATIONS

The findings of this study are not an end by itself but provide a sound basis for further detailed gender studies.

As discussed earlier, certain discrepancies existed in maize yields among male-headed and female-headed households, which suggests lower efficiency of female-headed households for the many different reasons already mentioned. The differences in productivity and resources among the farmers are the reflection of socio-economic differences, which adversely affect the well being of the children who will be responsible for the next generation and contribute to the national income as a whole. The results of the study in general revealed that the rural farming system is complex and widely diversified and the rural problems affecting agricultural productivity in subsistence farming are interrelated to one another. A systematic and integrated rural development planning is appropriate to achieve a sustained outcome. The following suggestions are made as policy implication.

- Needs and priorities of women have rarely in the past been considered in the research and development of agricultural technology. There is a need to re-orientate the researchers and the DA's in such a way that they could accommodate the needs and requirements of males and females consistently. This will help to create gender awareness among the researchers and extension workers to recognize the roles and needs of men and women farmers and give adequate attention to their needs.

- The current extension policy in Ethiopia had recorded success in terms of increasing crop yield through distribution of inputs. Although these benefits cannot be denied, many resource-poor farmers, especially the majority of the female farmers still do not have access to these resources. Hence increasing productivity should combine other segments of rural development strategies such as agricultural support programmes, rural infrastructure and efficient marketing system.

- The prevailing attitude indicates that agricultural training is not gender oriented and the participation of female farmers in different agricultural activities is minimal. Extension services should play a greater role in organizing women farmers to become full beneficiaries of the farmers associations. This will help to group farmers according to their social and economic status, level of achievements and aspiration. This in turn will facilitate the identification of specific needs and address the primary concern of women and their demands for labour-time using a multi dimensional participatory approach.

- Systematic arrangements of farmer training should be implemented in order to acquaint farmers with different agricultural technology. Upgrading the level of education for DA's through short and long-term training and capacity building will also be important.

- The traditional home economics extension programme that targeted rural women made a substantial contribution though it was focusing on the domestic domain only. It will be of great importance if this section could be reorganized and structured in a new approach by incorporating the productive dimension of the gender aspect. Increasing the number of female development agents will also be important to improve the communication between extension, female farmers and researchers.

- Credit was also found to be a major constraint limiting the access to productive resources. This could be addressed through initiation and implementation of micro finances through existing local institutions and / or formation of small-scale credit and / or saving associations.

- Interventions in terms of labour saving technology are also needed to improve productivity by reducing the workload and relieve women from the routine domestic activities.

- Finally launching a systematic and valid monitoring and evaluation mechanism is important to evaluate the new extension methods and technology for its appropriateness, relevance, effectiveness, efficiency, consistency, sustainability and gender sensitiveness.