# IDENTIFICATION OF URBAN AGRICULTURAL ACTIVITIES AND ESTIMATION OF THE PRODUCTION USING TWO STAGES SAMPLING DESIGN

## THE CASE OF EAST GOJAM ZONE (AMHARA REGION)


**BY**

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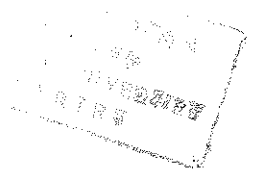

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## *ABSTRACT*

*Agriculture is the major sector of the Ethiopian economy and it contributes about 50 percent of Gross Domestic Product (GDP). So far all the concerned agencies have been estimating the national agricultural production by considering only the rural areas. That is, they disregard the contribution from the urban areas.*

*Agriculture in urban areas has been studied in different countries in their Agricultural Census or as ad hoc survey for the purpose of estimating agricultural production, for concerns about hygiene problems and urban development. Urban agriculture in Ethiopia has not been studied yet, and as a result there is a statistical gap in the agricultural sector. This study is a preliminary baseline survey and is based on primary data which were collected from selected towns of East Gojam Zone.*

*The main objective of this study is to identify the type of agricultural activities in urban areas of East Gojam Zone and obtain information on these activities. In general it provides benchmark data for agricultural researchers and policy makers.*

*To get this information, a probability two stage stratified sampling design was used. Using this design information was collected from 405 urban agricultural holders.*

*The main results of the study indicate that in East Gojam Zone urban agricultural holders are estimated to be 6188, estimated crop production is 12,820.82 quintals with a cultivated area of 1,614.79 hectares. The estimated total land use area is 2,827.90 hectares, estimated*

*domestic animals are 47,480, and other estimates are also obtained. Based on these findings recommendations are provided which may be useful for agricultural researchers, policy makers and other interested agricultural data users.*

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background of the Study

The history of agriculture in Ethiopia is quite a long one, and for agricultural development purposes a follow-up study is essential to determine the extent of agricultural change from year to year. As a result, the collection of agricultural data on various aspects of the agricultural sector based on a statistical approach is quite valuable. Timely statistical data are needed by various government ministries, the private sector and other organizations for decision making, policy formulation, for the development of soci-economic programs, etc. In order to achieve this goal, the Imperial Ethiopian government established the Central Statistical Office (CSO) in 1960 and the CSO has been conducting various socio-economic surveys since its inception. In 1980 the Socialist Ethiopian government gave the responsibility to the CSO to collect data on the agricultural sector. In 1987 CSO changed its name to the Central Statistical Authority (CSA).

To meet the data requirement on agricultural area, yield and production and livestock CSA has been conducting annual Agricultural Sample Surveys (AgSS) in rural areas since 1980/81; and providing the results to interested data users. The AgSS covered the important economic activities of rural population, that is, cultivating land, crop farming, tillage, husbandry farming and the production of crops, livestock, chickens and beehives, which are referred to as agricultural activities.

In Ethiopia agricultural production is highly dependent on rainfall and it can vary drastically from year to year and from region to region. The 1987 report of International Service for National Agricultural Research (Isnar) stated that in Ethiopia the estimated total area under cultivation was 12 to 13 million hectares, but surveys indicate that annually about 6 million hectares are under cultivation and 3 to 4 million hectares are fallow land. The 1998/99 CSA's rural AgSS survey report indicated that the total production of major crops (cereals, pulses and oilseeds) in the rural sector is about 85,838,420 quintals and the cultivated area was 8,016,310 hectares. The AgSS report of production of permanent crops and vegetables is not yet available. The estimated total livestock, chickens and beehives are 61,945,290, 30,157,320 and 569,970, respectively. From AgSS conducted in 1997/98 by CSA, the total agricultural households and holders engaged in agricultural activity were estimated to be 9,292,870 and 9,513,910, respectively. The same survey indicated that a total area of land used was 9,060,640 hectares. Of this total, 7,008,740 hectares were under temporary crops, 558,210 hectares were under permanent crops, 503,990 hectares were reported as fallow land, 597,710 hectares were used as grazing land, 35,300 hectares were under forestry and 356,700 hectares were under different land uses. Different studies conducted by CSA have shown that, next to the Oromia Region, the Amhara Region is the largest agricultural production region in Ethiopia, with East Gojam Zone having the highest agricultural production among all of the Zones of Amhara region.

The above statistics illustrate the extent to which agriculture is the basic economic sector in Ethiopia and highlight its importance in providing the necessary means for the livelihood of

the rural and urban population of Ethiopia. Thus agriculture plays a crucial role in the overall economic development of the country.

According to a report of Ministry of Economic Development and Cooperation (MEDaC, 1999), the Task Force for the Medium Term Statistical Program for Ethiopia, explains the role and importance of agriculture in Ethiopia and its economic position as the major sector of the Ethiopian economy. Agriculture contributes about 50 per cent of Gross Domestic Product (GDP), employs about 80 percent of the labor force of the country, provides about 85 per cent of export earnings where coffee accounts for about 60 percent the export. The agricultural sector provides the raw materials for about 70 per cent of the country's cottage and large scale industries. Crop production is estimated to contribute around 60 per cent, livestock including chickens and beehives contribute about 10 per cent of the total sectoral output of agricultural products.

Government needs agricultural information for food security of the population, for identification of the deficit and surplus food producing areas, for trade policies or imports and exports, public policy decisions, budget allocation, etc. For decisions on these matters, the government needs to get agricultural information on rural as well as urban agricultural households. However, statistical information on urban agricultural is not yet available.

Larson and Narain (1998) describe urban agriculture and stated that urban agriculture is called an "informal sector", as adopted by the Fifteenth International Conference of Labor Statistics held in January 1993. The urban sector covers household units that are engaged in

the economic production of goods or services but operate at low level of organized production. According to this definition the informal (urban) agricultural sector consists of agricultural activities of households living in urban or small towns areas. These households often maintain small scale plots of land for garden to produce vegetables, a small pond to grow fish, or raise domestic animals (cows, sheep, goats, equine, chickens), etc., as a means of a regular supply of food products. These activities are mainly intended for consumption by the household and the surplus often is sold in the neighborhood for supplementary income. Agricultural activity can be undertaken by households either as their principal activity, as a secondary activity, or as one of the normal ways of life, that is, without taking it as a regular economic activity, in combination with other economic activities.

The agricultural data gap, particularly that of livestock, is a serious problem. The session of the African Commission on Agricultural Statistics which was held in 1966 in Uganda, discussed the inadequacy of livestock data as one of its agenda items. One conclusion derived from the Commission's report is that livestock data tend to be inaccurate due to the undercoverage of urban areas during surveys or census.

Zarkovich (1975) described the incompleteness of sampling units in agricultural surveys or census. To minimize the incompleteness, his conclusion is to cover urban areas in either sample surveys or census of agriculture because it is necessary to estimate the extent of agricultural activities of urban households even if it involves a costly approach and considerable effort.

The Food and Agricultural Organization (FAO, 1986) recommended that during any agricultural census, omission of urban areas with gardens used mainly for vegetable production or intensive animal husbandry activities, such as dairing or chickens farming may result in loss of valuable information. Regarding this David (1998) showed that the 1997 Agricultural Census Of China. China covered 60 thousand towns and over 2 thousand township enterprises. Larson and Narian (1998) report that the Philippines 1991 Agricultural Census covered all the 1600 towns in the country and produced the results at the town level.

From the above explanation about urban ugriculture, we can realize the importance of obtaining information on urban agriculture. In Ethiopia there is lack of sound statistical study on urban agriculture, therefore, this study as the first in Ethiopia is indispensable for estimating the total agricultural production in East Gojam Zone. Hence in Ethiopia, since the influence of rural tradition is considerable, it is important to estimate the total agricultural production by including both the urban and rural agricultural households when conducting an agricultural survey or census.

This study is based on primary data from urban households sampled to collect agricultural information. The information about sampling frame is taken from CSA which is given for private holding at zonal, urban and small towns area groups.

## 1.2 Statement of the Problem

The CSA conducts its AgSS using a sample of Primary Sampling Units (PSUs) only from the rural domain of the sampling frame. This represents coverage of only the sedentary rural

areas. According to a report of the Ministry of Economic Development and Cooperation (MEDaC) on Medium Term Statistical Program for Ethiopia, urban areas are omitted due to shortage of human and financial resources. This statement acknowledges the existence of statistical gaps. The statistical data gaps, especially for livestock data are believed to be considerable. The MEDaC's Medium Term Statistical Program for Ethiopia regards the urban problem as an issue that must be addressed. The CSA's sampling frame derived from the 1994 Population and Housing Census indicates that a large number of agricultural households, 224,827 or 15 per cent, of the total urban households are identified as agricultural households (excluding the Somali and Afar regions). This indicates that the 1994 census results show agriculture as an important activity in urban or small towns areas. However, the issue is undermined by the fact that households engaged in agriculture in the urban domain use only a portion of their agricultural production as a source of income (by selling eggs, milk, livestock or crops), or supplemental source of food. Although urban agriculture often acts as supplemental family employment for the household, its contribution to the household's economic well being is not negligible.

## 1.3 Review of the study of African countries

Estimation of urban agriculture is not only a problem in Ethiopia but also in other countries. Studies on urban agriculture had been conducted in African countries to determine the contribution of urban agriculture to the total economy. The following are some of the studies conducted in different African countries:

The Isnar (1983, p.5) undertook a study in Somali urban areas. The report considered livestock production in and around the major urban centers and estimated the number of livestock in Mogadishu at 40,000 cattle. Urban herds and flocks are the chief source of milk and eggs for Somali cities. In addition, private chicken farms are increasing in size.

Mbiba (1996) conducted studies on urban agriculture in selected cities in Zimbabwe and found that i) urban agriculture is implemented by the rich and the poor ii) women are more engaged in this sector than men iii) maize cultivation is dominantly in the towns iv) cattle are raised by urban households as a result this contributes for environmental pollution and road degradation. Some of the studies which was conducted in African Countries as cited in Mbiba's work are:

The pioneer study in Zimbabwe, Mazambani (1982) looked at the activity of urban agriculture, wood-fuel collection and energy in the city of Harare (page19)

In Kenya, the Mazingira study reported that 29 per cent of urban households grow crops in town, 17 per cent keep livestock in town and $ 17,000,000 worth of livestock were kept in Kenyan towns in 1985. In Lilongwe, Malawi, goats are prevalent in towns. The growth of trees is promoted and the trees are later used for fuel by urban residents (page 19).

Freeman (1992) also working in Nairobi utilized and extended the Mazingera studies. The research focused on the spatial distribution, the practices; and the motives and problems

faced by cultivators in urban Nairobi. The value of urban agriculture for low income households was again emphatically and enthusiastically documented (page 19).

Rakodi (1987) reported similar occurrences for cities in Zambia and drew parallels with Indian cities where cows are prevalent in the cities (page 19).

The town of Maseru, capital of Lesotho is even more diverse in its urban agriculture. Dairy cows, maize cultivation, sheep and pig rearing, vegetable and fruit production are dominant and conspicuous activities (page 20).

Work was done in Tanzania in the late 1980's with the major objective to investigate the nature and origin of food production activities within the urban centers and their peripheries. Six towns were surveyed and local authorities were reported to have initiated some form of structure to accommodate urban agriculture. The poor were identified as needing a more positive environment which encourages them to engage in urban agriculture (page 20).

In general, the issue of urban agriculture in agricultural, hygiene and social aspects is very crucial. Unlike other African countries, there is limited information for researchers or policy formulators in Ethiopia concerning this issue. This case study in East Gojam Zone is believed to provide some useful information on urban agriculture in Ethiopia since East Gojam Zone is the number one agricultural producing Zone of Amhara Region.

## 1.4 Objectives of the Study

The main objective of this study is to identify the type of urban agricultural activities and obtain information on the major agricultural activities such as crop production and the raising of livestock in urban areas. In addition to the general objective there are other specific objectives including the following:

a) To answer the question "Are agricultural activities in urban areas significant enough to be included in annual estimates of Ethiopian agricultural production and inventory of livestock, and if so, can these estimates be obtained through sample survey procedures?"

b) To obtain some information in the form of statistical evidence on the extent to which the total agricultural production of the Zone is underestimated when the urban agricultural domain is omitted from the survey sample design.

Also the study has the following ancillary objectives:

i. To estimate crop production and the number of livestock by type in the urban domain of the Zone.

ii. To estimate the total number of households and holders who are involved in urban and semi- rural agricultural activities.

iii. To identify the number of holders by their main working status and their type of work.

iv. To estimate the proportion of holders who use their agricultural production for selling, or own consumption, or both.

v. To estimate the number of holders by type of holding, and their educational status.

vi. To estimate total cultivated area and the total area under different land use within the urban domain of the Zone.

vii. To estimate the cultivated area applied agricultural inputs.

viii. To estimate the total receipts from agricultural products and total expenditures related to agricultural production.

ix. To estimate the total land area by type of tenure (owned or rented).

## 1.5 The Study Variables

This study attempts to focus on critical items that are relevant to agricultural researches and policy formulation. With this as a major consideration, the first task was to decide on the most important variables that could be assessed with sufficient statistical confidence. In order to attempt to meet the requirements set forth in the primary objectives of this study, the study variables which are identified for the urban domain are the following:

- Number, educational attainment and sex of holders.
- Land utilization (cultivated land, permanent crop land, fallow land, grazing land, forest land, others (parks, houses, gardens, water bodies, etc. )).
- Cultivated land by temporary crops and permanent crops.

- Land associated with permanent crops.
- Land classified by type of tenure (owned or rented).
- Agricultural practice or farm management (use of irrigation, fertilizer, pesticide, improved/local seed).
- Number and type of livestock.
- The main working status of holders (fully engaged in agricultural activity, engaged in agriculture and trade (formal or informal), and civil servant and engaged in agriculture, and any other non-agricultural activity.
- Usage of agricultural production (entirely for the household consumption, entirely for selling or both).
- Receipts from crop and livestock production (selling of livestock, milk/butter, eggs, crop production sold, miscellaneous ).
- Expenditures on crop and livestock related agricultural activities (for livestock, wages for laborer, for livestock feeding, for fertilizer, seeds or pesticides, miscellaneous).

## 1.6 Significance of the Study

It was mentioned above that the Ethiopian government has identified that statistical gaps exist due to the exclusion of the urban domain from the annual AgSS. Therefore, this study can be extremely useful for the following purposes:

a) This study can serve as a baseline survey and can be useful for gaining insight into the estimation of agricultural crop production, number of livestock, chickens and beehives for the urban domain.

b) Researchers in the agricultural area, the government and other organizations can use the results of the study for estimating agricultural characteristics of the Zone. Therefore, the statistics derived from the survey can be used to obtain improved estimates for the Zone.

c) Provide general agricultural information for decision makers and planners in urban areas and for those engaged in supporting associated agricultural activities.

d) To gain experience for the purpose of conducting future nationwide urban agricultural surveys in the country.

## 1.7 Scope and Coverage

The study is primarily concerned with the collection of agricultural data required for achieving the study objectives. Therefore, the scope of the study is the collection of statistical data on crop production, area of land use, livestock, demographic and economic information on holders to be carried out in the urban domain of the CSA sampling frame for the East Gojam Zone. To provide a measure of statistical reliability of the estimates, an estimate of the coefficient of variation (CV) and the design effect (Deff) is calculated for each estimate.

The East Gojam Zone was chosen for the study because of its proximity, its significant contribution to the agricultural production of the Amhara Region and the convenience and low cost of enumeration as far as this study is concerned.

According to the 1994 Population and Housing Census, the East Gojam Zone has an urban domain consisting of 26 towns with 186 EAs and a total of 5570 agricultural households. The agricultural households in the urban domain are 16.4 per cent of the total households. The study covered 11 towns and it consists of a sample of 15 EAs. This is a sampling fraction of 0.08 or 8 per cent of the total EAs in the urban domain. From these 15 sample EAs a total of 391 sample agricultural households were randomly selected and 405 agricultural holders were covered. This is a sampling fraction of 0.07 or 7 per cent of the total agricultural households in the urban domain. The CSA conducts the annual AgSS in the rural domain of the Zone by sampling 1.6 per cent of the total EAs and 0.37 per cent of the total agricultural households of the rural domain in the Zone. Therefore, the sample is comparable in terms of reliability with agricultural surveys conducted by the CSA in the rural areas of the Zone.

## 1.8 Questionnaire Design

The focus of the questionnaire design stage was on presenting the questions such that they are easy to understand for both respondents and the field enumerators. Particular emphasis was placed on insuring the clarity of items and the ease of data processing. Most

questionnaire items are closed-end questions while a few questions were open. Attention was paid to avoid leading questions as much as possible. A concentrated effort was made to include important items and avoid sensitive questions. To avoid respondent and interviewer fatigue care is taken to limit the length of the questionnaire. The questionnaire has three parts:

- The first part inquiries about demographic characteristics and economic activities.

- The second part inquiries about type of crops, amount of cultivated land, farm management and land utilization practice.

- The third part inquiries about the holder's number of livestock by type.

In addition to the questionnaire, a listing form is used for listing households as part of the screening process to identify agricultural households for sample selection.

## 1.9 Recruitment and Training of Enumerators

The other task considered in the planning of the study is recruitment and training of field enumerators. The enumerators were briefed on proper interview techniques that insure the accurate completion of the questionnaire. To support the training and to gain proper reference material to all survey instructions, the instruction manuals were prepared in

Amharic language. The material included the concepts and definitions of all items that were used in the survey.

Fifteen enumerators were recruited. All had completed the 12th grade and work experience in data collection. A one-day training session was given in the chief town of the Zone (Debre Markos) by the researcher.

## 1.10 Data Collection

The quality of survey data is measured by the method of the data collection. To obtain data of acceptable quality, the data collection process should be carefully planned and implemented. The main data collection method was personal interview but the respondents were also asked to provide estimates of the production and area data subjectively as they are familiar with the metric units. The field work was organized by transporting field enumerators to their assigned sample enumeration area. Before the deployment of the enumerators, each enumerator had to make sure that he/she has the appropriate enumeration area map for the assigned sample enumeration area obtained from CSA. The enumerators identified the selected enumeration area boundaries as indicated on the enumeration area map with the assistance of a local guide. After identifying the enumeration area boundaries the enumerator carried out the screening process by listing the households within the sample enumeration area by numbering and listing the secondary sampling units serially. After finishing the listing of the households and screening of agricultural households and holders, the field enumerators selected twenty six agricultural households by using a systematic

sampling with a randomly selected starting point. From the twenty six selected holders within the primary sampling units the enumerators collected the data following the instructions in the questionnaire. The agricultural information collected from the sample holders covered the following items.

- Holders' demographic characteristics.
- Usage of agricultural productions and working status of holders.
- Receipts from agricultural production and expenditure on agricultural activities.
- Area by type of crop and production, farm management practice (use of fertilizer, seed type, use of irrigation, pesticides, herbicides) and total land use.
- Inventory of livestock by type.

To reduce measurement errors the researcher paid particular attention to check whether the field work was conducted honestly and according to the instructions. The researcher participated directly and supervised the work effectively. To verify the reliability of the enumerator interviews, the researcher re-interviewed some of the households as a double check to insure data quality.

Due to time constraints the data collected was limited to 1999/2000 Meher season crops. The definition of Meher season follows that used by CSA for conducting the AgSS. According to the definition, the Meher season begins on the first of September and ends in mid-February. For this study the training, deployment of field enumerators and data

collection began on January 21, 2000 and ended on February 1, 2000. This period is considered as optimum due to the fact that actual harvesting time for most crops in East Gojam Zone is between December and January. It increases the chance that the holders will respond accurately as the timing of the survey is close to the harvest time, minimizing recall errors.

The reference period for inventory of livestock, chickens and beehives was January 23, 2000. All livestock, chickens and beehives that the respondent has on this reference date were recorded on the questionnaire. The period for considering receipts and expenditure from or for agricultural commodities or activities was one calendar year from January 24,1999 to January 23,2000. The total length of fieldwork including administration, training, deployment, listing and data collection took a total of 14 days.

It should be noted that before conducting the actual survey a pilot study was implemented by the researcher. The pilot was felt necessary since there was no previous study on urban agriculture in Ethiopia. The researcher conducted this pilot study to gain estimates for the determination of an appropriate sample size. The pilot study was conducted in the chief town of the Zone, and consisted of a sample of 48 households. The actual data collection required 4 days ( September -5 /1999). The pilot study was conducted not only to estimate standard errors but also to pre-test the questionnaire. The process of making improvement for the final questionnaire also allowed the researcher to proceed with preparation of the questionnaire coding instruction. The pre-test also allowed the researcher valuable insight into potential problems of getting holder's cooperation. As a result of the pre-test a few

changes were made in the questionnaire, that involved including additional occupations for the holders; and some questions were determined to be pre-coded in the questionnaire.

## 1.11 The Study Area

East Gojam Zone is one of ten Zones in the Amhara Region. It extends from longitude 37 degree, 6 minutes to 38 degree, 30 minutes east and latitude 9 degree, 48 minutes to 11 degree, 12 minutes north. It is bounded in the east, south and west by the Blue Nile (Abay) river and on the north by West Gojam Zone and has a total area of 14,103.62 square kilometers (CSA abstract 1998). Debre Markos, the administrative of capital the Zone, is approximately 300 km north west of Addis Ababa. The main road of the Zone from Addis Ababa is an asphalt road, while the remaining roads which link the other towns are covered with a hardened gravel surface. A few towns have no road and are inaccessible by vehicle. The Zone comprises 13 Weredas and 26 towns.

The central portion of East Gojam Zone is at an elevation of about 1800 meters. Higher peaks within the plateau range to more than 2750 meters with Chock Mountain ranging to about 4100 meters. The administrative capital, Debre Markos is located at an elevation of 2440 meters above sea level. The soils of this Zone are typical of highland soils with some red soil except in the Blue Nile Gorge which has gravel type soils (Murphy, 1968).

The 1994 Population and Housing Census report indicated that this Zone has a total population of 1,700,331, with 145,295 or 8.5 per cent found in the urban domain and the

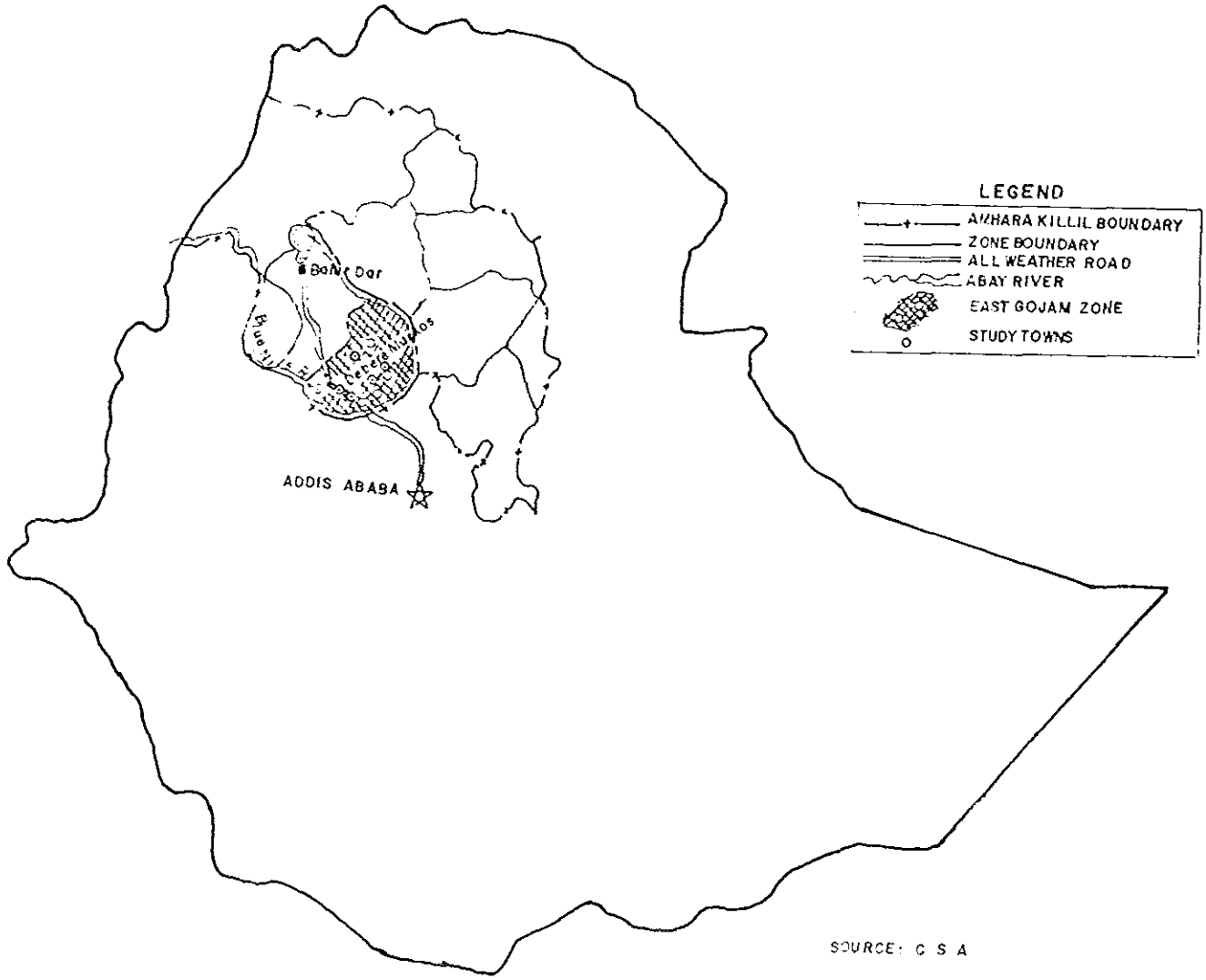
remaining is in rural domain. Debre Markos has the largest population (49,000), whereas Liga town has the smallest (331). Of the 26 towns, 16 towns (62 percent) have a population size of less than 2000 while the remaining 10 towns (38 per cent) have 2000 or more.

With regard to agriculture, the East Gojam Zone is a very important area of crop production and livestock. The report of the 1997/98 AgSS showed that the Zone has a total area of 410,250 hectare devoted to all land use, with 379,410 agricultural households and 390,910 agricultural holders. The 1998/99 AgSS estimates were 1,244,140 cattle, 708,260 sheep, 221,310 goats, 242,850 equins, 714,800 chickens and 65,360 beehives as well as 4,543,780 quintals of cereals, 853,850 quintals of pulses, and 62,040 quintals of oil seeds from a total of 357,450 hectare, 83,140 hectare, and 20,870 hectare, respectively. In addition, the area for permanent crops and vegetables were 2,440 hectare and 3,520 hectare, respectively, as estimated from the 1997/98 AgSS.

Except for an edible oil factory in Debre Markos, there is neither small nor large scale industry in this Zone. The majority of the people who are living in these towns are involved in the informal economic sector including agricultural activity for their livelihood. The 1994 Population and Housing Census reported that, of the 26 towns 34 per cent have electricity with about half of these towns having 24 hours of electricity service. The census also indicated that 34 per cent of the towns have tap water facility, only three towns have direct telephone access, two towns have hospitals, and a few towns have health centers. Regarding school facilities, only six towns have senior secondary schools.

The people are almost entirely of the same ethnic group and speak the same language, "Amharigna", and have the same culture characteristics. The people are sedentary and almost all are agrarian.

LOCATION OF THE STUDY AREA (EAST GOJAM ZONE)



## 1.12 Problems encountered in the survey

One lesson learned from this study is that it is important to explain the purpose of the study to the local administrators. In order to minimize this problem the researcher had an official letter from the AAU Department of Statistics which was addressed to the Chairperson of the Zone. The Chairperson of the Zone also wrote official letters to the Chairpersons of the Weredas and the Weredas to the Kebeles. As a result, Kebeles Chairpersons assigned local administration official to accompany the enumerators during the data collections. Due to this cooperation, there were no difficulties encountered during the data collection. However, several other major problems were encountered at the time of the enumeration and these are explained as follows.

a) Suspicion of the enumerators. At the beginning of the screening procedure when the field enumerator began listing of the EA households, some of the households suspected the enumerators being fearful that the questions would affect their taxes because they felt that the enumerators are government employees. Initially it was a natural reaction to this suspicion that households attempted to underreport their holdings. The researcher discovered this situation immediately through his supervision activities and had discussions with the holders and explained the purpose so that they understood the objective of the survey as having academic purposes, thus alleviating the problems.

b) Deficit of budget. The University did not provide their portion of the needed funds at the time of the data collection. Therefore, the researcher could not hire the supervisors as originally intended due to shortage of money. To overcome this problem the

researcher was forced to perform the jobs of both supervisor and coordinator. The consequence of this problem was that the researcher had to bear an overly burdensome workload imposed on him.

**c)** Failure to collect production of vegetables and permanent crops. The researcher had made the assumption at the beginning of the data collection that the amount of production of vegetables and permanent crops could easily and accurately be obtained using interview methods. However, it was discovered that the households could not correctly report the production values of the items and, after noticing the problem on the spot, the researcher decided to ignore the reporting of the amount of production. Only cultivated areas of these items is reported in order to reduce non-sampling errors.

**d)** Inadequacy of training hall: At first the training of enumerators was difficult because of lack of convenient training facilities. With the help of the Head of the CSA's East and West Gojam Zone, Agewawi Zone and Metekel Zone Branch Statistical Offices, this problem was resolved in time.

## 1.13 Organization of the Thesis

This thesis comprises five chapters. The first chapter is devoted to basic ideas of the thesis topic which gives the background of the study, statement of the problem, significance of the study, objective of the study, scope and coverage, methods of data collection, the study area and problems encountered in the survey. The second chapter deals with concepts and definitions related to the survey. The third chapter introduces the sampling methodology and the design used, that is, two-stage stratified sample. The fourth chapter deals with

results of the study and discussions on the results of the survey. The last chapter is concerned with conclusion of the study and recommendations for future activities.

# CHAPTER 2

# OPERATIONAL DEFINITIONS AND CONCEPTS

## 2.1 Introduction

The use of standard concepts and definitions is important to insure comparability of the results of this study with those of other surveys. The FAO has provided the standardization concepts and definitions for agricultural statistics for all countries. The key concepts that are used for conducting the present survey are adopted from the definitions of FAO in conjunction with the researcher's view as to which are suitable for this study. This chapter presents in detail the definitions and explanation of specific items of information needed for conceptualizing and conducting the survey.

## 2.2 Urban Agriculture

Urban agriculture can be defined as the production of crops, livestock, chickens, beehives items or any combination of such items on land which is administratively and legally considered as an urban area (Mbiba, 1996). This agricultural activity is conducted within the Zones at the outer margin of urban areas, that is to say, that it is land likely to be extended into urban Zone from the surrounding rural agricultural area by law. On the other hand the household is located in the urban area but the actual holding either in the form of rented or land in possession can be found in the rural administrative area with this household operating the land regularly. It is also understood that the working status of the

urban household not only includes engagement in agricultural activities but also may include involvement in other activities that can be part of either the formal or informal sectors. If the urban household has any type of land holding or livestock in the rural area but managed by a rural household, this type of holding is not considered as an urban agricultural activity. Such activity is common due to the nature of rural to urban migration of the household to participate in trade or other informal activities while assigning the agricultural activity in the rural area to the other household.

## 2.3 Household

The concept of household is based on the arrangements made by persons, individually or in a group, for providing themselves with food, shelter, and/ or other essentials for living purpose. A household may be either a one person household or a multi-person household (FAO, 1986).

As cited in FAO (1986), UN defines the head of the household as that person in the household who is acknowledged as such by the other members of that household. The head has the primary authority and responsibility for household affairs.

## 2.4 Agricultural holder

The holder is the person who exercises control over the operation of the agricultural holding and is responsible for the utilization of available resources. The holder may not be necessarily the owner of the land, livestock, chickens and bees (FAO, 1986). The FAO in

describing and explaining the definition of a holder states that the " agricultural operations carried out and commodities produced by different members of a household will normally be sufficiently pooled so that there is only one holder, and it will usually be necessary to determine one holder in each household in many of the developing countries". The present survey collected information from each holder found in the sample household. Survey results indicate that some households have more than one holder.

## 2.5 Agricultural holding

The FAO defines the agricultural holding as a statistical unit. Thus, the "holding" is generally different from an "establishment" which relates to some sort of economic industry. The holding is much more easily recognized in terms of land and livestock and defined as a unit of agricultural production comprising all the land used completely or partly for agricultural purposes and all livestock kept and operated under the management of an individual or group without regard to legal ownership. The holding normally includes the land occupied by the farm house, farmyard and farm buildings. Communal land, commercial and/or land never used for agricultural purposes, and natural forest land are not considered part of an agricultural holding (FAO,1986).

For this study the holding is classified into one of three categories. The first category is "engaged only in crop cultivation", that is, a holder is engaged only in crop production and raises no livestock, chickens and bees. The second is raising "livestock, chickens and/or bees" only, that is, a holder raising these items exclusively of cultivated crops. The third is

raising both "livestock, chickens and/or bees and cultivating crops" that is, a holder produces crops and also raises livestock.

## 2.6 Educational Attainment

"Educational attainment" refers primarily to the highest grade completed. This refers to the most advanced grade level attended in the educational system of the country where the education was received, but it should also take into account any adult education measurable in level and grades, or their equivalent, even if it was provided outside of the regular school and university system (FAO, 1986). This study is interested in relating the effect of education on agricultural activities. For this reason information is collected based on the educational attainments of the holders and grouped into five categories, that is, illiterate, educated in informal education center (traditional schools such as in church or mosque), completed grades 1-6, grades 7-12 and completed grade 12 and has at least certificate level training.

## 2.7 Working Status / Main Occupation

The "occupation" of an economically active person refers to the kind of person engaged in work during the reference period. If a holder participates in more than one occupation, the occupation is based on the main activity representing the largest proportion of working time during the reference period. For some urban holders the agricultural activities are not their main occupation status but the holder can spend a considerable portion of his time performing a variety of tasks related to growing crops and raising livestock. In such instances the holder is refereed to as an agricultural holder.

Two classes of agricultural workers are identified, "permanent" and "occasional". A permanent agricultural worker is one who provides services to agriculture on a regular and continuing basis throughout the agricultural year, although he/she may be engaged in other work during slack periods of time. The occasional worker is not expected to work in agriculture regularly and on continual basis, even though he/she may be hired on several occasions during the agricultural year to participate in agricultural activities (FAO,1986).

Based on the above concepts the present study developed four classifications of "working status": engaged mainly in agricultural activities, mainly in trade (either formal or informal), mainly engaged in governmental or private organizations, and mainly engaged in other activities during the agricultural year.

## 2.8 Agricultural Income and Expenditure

An agricultural holder receives income through the sale of his/her agricultural products. In order to receive this income the holder is expend money to facilitate the agricultural activities. Due to the erratic nature of income expenditures, the data related to income and expenditures could not be recorded by the day, or week, month. Therefore, this study used a fixed reference date that is, annual, for recording the actual annual income/expenditure that was earned/spent from/on agricultural activities throughout the reference period (a calendar year). It is important to note that this study did not attempt to collect the total income and expenditure that are related to exchanges in the form of payment-in-kind. Due to the

difficulties related to conversion of payment in kind into equivalent local currency, this study considered exclusively the income and expenditure data reported in the form of cash payments.

## 2.9 Land Use

### 2.9.1 Crop Land

According to the classification of FAO (1986), the total area of a holding related to crops should consist of land in the following two classification:

a) Temporary crops. Theses are crops with a growing cycle of under one year, that require being newly sown or planted for further production after the harvest of the preceding crop. These include cereals, pulses, oilseeds, spices, tuber, root, bulb crops, vegetables, etc.

b) Permanent crops: These are crops that occupy the land for a long period of time and do not require planting for several years after each harvest. These include fruits, nuts, sugarcane, spices, coffee, Gesho, etc.

### 2.9.2 Grazing, Fallow, Forestry and Other land

FAO (1986) provides classification of the land use on the basis of land utilization, that is, other than planting of crop. A brief description of these four additional classifications of land utilization are as follows:

Grazing land. This is land reserved for permanent meadows and pastures mainly for livestock grazing purpose.

Fallow land. This is land that has a maximum period of idleness, usually less than five years for the purpose of fertilizing the soil.

Wood land and forest. This refers to land under which woody plants are grown and will have value as wood, timber or other forest products or for the protection of such trees.

Other land. This is primarily land occupied by buildings, parks, gardens, roads, land under water (ponds, lakes, rivers) and any other use that is not specified in one of the above categories.

## 2.10 Agricultural Inputs

### 2.10.1 Fertilizers

Fertilizers refer to anything added to the soil to increase the amount of plant nutrients available for plant growth. They are classified into inorganic fertilizers, organic manure or other fertilizers. This study collected data only on the primary source of inorganic fertilizers, those commonly referred to as Urea and DAP. These fertilizers are widely used throughout the country.

### 2.10.2 Pesticides

Materials used for mitigation, control or elimination of pests that are troublesome or harmful to crops include insecticides, fungicides, fumigant herbicides and rodenticides (FAO,1986). The pesticide information collected for this study is about industrial products that can be applied on crops.

### 2.10.3 Irrigated Area

"Irrigation" refers to land purposely and actually provided with water, other than by rain, for the purpose of improving crop production. The uncontrolled flooding of land by random overflow of rivers or streams should not be considered irrigation. However, rain water that is collected for latter use from uncontrolled over flow of rivers and streams may be considered for irrigation use (FAO, 1986).

### 2.10.4 Seeds

In order to plant either permanent or temporary crops, agricultural holders must sow seeds. These seeds are classified into two categories, that is, local seed and improved seed. Improved seed is produced by the Improved Seed Enterprise which also distributes its seed to farmers. Local seed is all seed that is produced by local farmers. This study collected information on the types of seed used to determine the urban holders awareness of the advantage of the different types of seed that are available.

## 2.11 Land Tenure

As cited in FAO (1992), for the 1980 World Census of Agriculture, it was recommended that the following definition be used for the tenure of land:

"Land tenure refers to the arrangements or rights under which the holder operates or uses the land of the holding. A holding may be operated under one or more forms of tenure. The

holders may have the land in the form of owned or held in an ownership-like possession and rented from others."

Land area considered owned is the total area of the holding operated by the holders for which they possess the ownership; and consequently the right to determine the nature and extent of its use. Land area owned but rented to others should be excluded. Land area of the holding is considered as an ownership-like when the land area is held under conditions that enable the holders to operate the land as if they were the owners, although the operator does not possess title of ownership. Land area held an ownership-like possession that is rented to others was excluded because it will be reported as owned land.

Land area of the holding rented from others includes the total area of all parcels of the holding that are rented or leased by the holder from other persons, usually for a limited period of time. This may be in the form of land rented for an agreed amount of money and/or payment-in-kind, land rented for a share of the production, land rented in exchange for services rendered and land rented under other rental agreements.

## 2.12 Livestock, Chickens and Beehives

Livestock refers to all domesticated animals kept or reared mainly for agricultural purposes, including cattle, buffaloes, sheep, goats, pig, horses, mules, asses, camels, chickens, bees, etc.. However, FAO (1992) states that countries may want to collect and report data separately on various types of livestock that are reared commonly.

From recent CSA's annual AgSS report, the result shows that, in East Gojam Zone the typical livestock estimated are for cattle, sheep, goats, horses, asses, mules, chickens and bees. Therefore, the CSA report was the basis for deciding which items would be included in this study for data on livestock, chickens and bees.

# CHAPTER 3

# SPECIFICATION OF SAMPLING DESIGN

## 3.1 Introduction

Sampling is defined with synonymous words by different statisticians. It is defined as a scientific and objective procedure of selecting units from a population and provides a sample that is expected to be representative of the population as a whole (Sukhatme et al., 1984). In sample survey, the sample selection and the design are based on either non-probability sampling or probability sampling methods. In order to eliminate the judgment or selection bias of the researcher's opinion, this study is based on probability sampling which selects the samples according to certain laws of probability in which each unit both primary sampling units (PSUs) and secondary sampling units (SSUs) have some definite probabilities. This probability sampling is carried out in two sages.

The size of PSUs (EAs) are differ considerably, the selection of the first stage units is based on probability proportionate to size (PPS) and having varying probabilities. PPS sampling is the probability of selection with proportional to the size (agricultural household) of the PSUs. The PPS sampling can be either with replacement or sampling without replacement.

Work has been done in the field of sampling with varying probabilities without replacement for variance estimation but most procedures are more complex and not easily applicable in

large surveys as explained by different statisticians. Due to its complexity different samplers, as cited in Singh and Chaudhary (1986), have devised simplest variance estimators. However, the cumbersome calculation of a variance estimate needs joint inclusion probability (since the selection is dependent) to be computed. Singh and Chaudhary (1986) described PPS sampling without replacement and reported that the procedures are more complex and not easily applicable in large scale surveys. Similar conclusions were forwarded by Cochran (1977), Som (1976).

Sarndal et al. (1991) recommended that no heavy calculations are needed to compute the variance estimate of the PPS with replacement estimator but the calculation of variance estimate for the PPS without replacement is cumbersome and complex when the PSUs are larger than two units. Hence the variance of the without replacement is estimated by the PPS with replacement formulae even if some loss of efficiency is encountered using that of PPS with replacement but it is compensated by a reduction in the computation required for the variance estimates.

To summarize, the researcher considered all the pros and cons of the above scholars views and designed this survey PPS without replacement selection and used PPS with replacement for variance estimation. In addition, selection of proper sampling design is the preliminary step in survey design and therefore the researcher emphasized on the size of sample, procedure of selection and estimation of parameters along with the amount of risk and considering the cost and length of time of the survey and the precision required. The 1970, 1980 and 1990 World Census of Agriculture was designed using multistage stratified

by most countries. This is also supported by Statistical Commission of the United Nations (Pacan and Davies, 1951) and the third Session of the African Commission on Agricultural Statistics (FAO, 1967) recommended that sampling design for Agricultural Survey/Census be multistage with stratification. In addition Mbiba (1996) used stratified sample design on selected Zimbabwe towns in an urban agricultural study. Hence, this study used a stratified two stage design.

## 3.2 Sampling Units

The sampling unit is the entity for which the required data items are collected. For this study the sampling units are the enumeration areas (EAs) and agricultural households. The principal criterion for sampling units are distinct, unambiguous and non-overlapping such as every element of the population belongs to one and only one sampling unit. The sample design used is a household based two stage stratified sample design with EA's delineated for the 1994 population and housing census of Ethiopia. EA's are primary sampling units (PSUs) and agricultural households used as secondary sampling units (SSUs). There are 186 PSUs and 5570 SSUs in the urban domain frame for this Zone.

## 3.3 Sampling Frame

### 3.3.1 Construction and use of the Frame

Sarndal et al. (1991) define the frame as the material or devices which delimit, identify and allow access to the elements of the target population applying the probability sampling scheme.

The main requirement of sample survey is to fix up the sampling frame, that is, the listing of all sampling units with reference to which relevant data are to be collected. Therefore, the sampling frames for primary sampling units (PSUs) consist of the lists of enumeration areas (EAs) where the measure of size is agricultural households as available from the 1994 Population and Housing Census prepared by CSA. The CSA's sampling frame is area frame and every population element belongs to an enumeration area. The construction of this frame is described as follows.

For frame construction during 1992/93 map work, an urban area was defined as a locality with 2000 or more inhabitants. However, for the purpose of census map work urban areas include the following regardless of the number of inhabitants:-

a) All administrative capitals

i) Regional capitals

ii)Awraja (province) capitals not included in (i)

iii)Wereda (district) capitals not include in (i) & (ii)

iv) localities (inhabited places) with urban dwellers association (urban center with its own jurisdiction) not included in (i - iii )

b) Municipal towns not included in item 'a' above

c) All localities which are not included either in items 'a' or 'b' above having a population of 1000 or more persons, and whose inhabitants are primarily engaged in

non-agricultural activities. The locality with population less than 1000 person should be considered as rural (CSA, manual for census map work,1992).

The delineation of EAs in urban centers were based on Kebeles. Each EA comprised 150-200 housing units. Therefore, the frame is the list of areas (EA) with households as the measure of size (agricultural and non agricultural households).

For purpose of constructing the frame, according to CSA 1994 population and housing census manual, an agricultural household in urban areas was defined as one engaged at least in one of :

1. Cultivating on 250 $m^2$ or more area used for the production of agricultural products or
2. Raising 2 or more cattle or
3. Raising 4 or more sheep or goats or
4. Raising 5 or more chickens or
5. Raising 2 or more equine for agricultural purpose or
6. Raising 2 or more combinations of the above livestock or
7. Having 1 or more beehives with bees colonies.

The survey was carried out as follows:

1) Enumerators interviewed all agricultural households of the EA without restriction on the size of holding ( those raising at least one livestock or chickens or bees).

2) From the listed agricultural households, enumerators screened out agricultural households that satisfy the above CSA's cut-off size of holdings.

3) And from these enumerators selected a sample of 26 agricultural households.

4) Finally, the needed information was collected from these 26 sample agricultural households.

### 3.3.2 Problems of the Frame

One of the decisive factors in sampling design is the nature of the sampling frames available from which the sample can be selected at each sampling stage. The population coverage, the stages of sampling, the stratification used, the process of selection itself and every aspect of design is influenced by the sampling frame. Yates (1971) pointed out the basic types of defects of a sampling frame are: inaccuracy, being incomplete, duplication of units, inadequacy, or outdatedness.

The CSA frame has one of the above problems. It is inadequate since it does not cover all the categories of agricultural households by type of holding. It is out of date since the frame or maps showing boundaries of the EA's and its measure of size (households ) has not been updated up to now. For this survey the same frame is used but care is taken in its use. Before selecting EA's duplication of EA's or incompleteness were avoided to reduce frame errors. Thus the EA frame in the 1994 Population and Housing Census was used to sample agricultural households as urban .

## 3.4 Sample size determination

In order to have precise as well as accurate estimates the sample should be large enough and also good representative of the population. Determination of the sample size for survey statistician is challenging.

Zarkovich (1975) explained that the problem of size of sample is much more complex when the survey involves many variables. In sample survey a large number of variables come into play with distribution that differ in varying degrees. Calculation of the size of the sample for all the items on the survey program is not practical. The practical steps remaining to be taken in such cases are to select a certain number of items that are considered as basic to the study and to calculate the size of the sample for these items.

In addition to the explanation of Zarkovich, Cochran (1977) suggested that in surveys where information is collected on more than one item, one way to determine the sample size is to specify the margin of error for the items that are regarded as most vital to the survey. An estimation of the sample size needed is first made separately for each of these important items. When the single item estimations of sample size have been completed, and if the largest of the sample sizes falls within the limits of the budget, this sample size is selected.

Therefore, the estimate of the sample size to use for this study follows the techniques of Zarkovich and Cochran. For this study the vital items of interest are livestock, crop production and area of total land use. For remaining items it will not be critical to have

estimates with precision lower or higher than those items used as the standards for sample size determination.

To determine the sample size either the variance with certain precision or the cost should be used. However, the variance is not known since there has not been any similar survey that had been conducted on urban agricultural activities. To overcome this problem and as explained above, a pilot study was conducted by the researcher. Hence, for estimating the sample size, the essential standard errors were calculated for these basic variables from the pilot study data.

To decide the total sample sizes of the second stage units (agricultural households), one can consider variance with stated margin of error and level of confidence.

The sample size is determined such that the acceptable risk that the universe mean will lie outside the limits $\bar{Y} \pm B$ is $\alpha$. It is assumed that the sample mean $\bar{y}$ is normally distributed with mean $\bar{Y}$ and standard deviation $\delta_{\bar{y}} = \delta\sqrt{\frac{N-n}{nN}}$, where N is total agricultural household in the frame, n is sample agricultural household and $\delta$ is standard error of the number of livestock, crop production or cultivated area.

The (1-$\alpha$) 100 percent probability limit of the universe mean $\bar{Y}$ for $\alpha = 0.05$ is

$$P\left\{\left|\hat{\bar{Y}} - \bar{Y}\right| \geq Z_{\alpha}\delta\sqrt{\frac{N-n}{nN}}\right\} = \alpha \qquad (1)$$

where $Z_\alpha$ is the upper $\alpha$ point of the standard normal distribution and $Z_{0.05}$=1.96 from the normal distribution table and the permissible margin of error is

$$B = Z_\alpha \delta_{\bar{y}} = Z_\alpha \delta \sqrt{\frac{N-n}{nN}} \tag{2}$$

For universe total Y the permissible margin of error is

$$B = NZ_\alpha \delta \sqrt{\frac{N-n}{nN}} \tag{3}$$

Therefore, the total sample size required becomes

$$n = \frac{N\delta^2}{ND + \delta^2} \tag{4}$$

where, $D = \frac{B^2}{(NZ_\alpha)^2}$

(Mendenhall et al., 1971 ; Som, 1976 )

Since the sample selection of second stage units is without replacement the sampling fraction is not ignored and the adjusted sample size is given as

$$n_0 = \frac{n}{1 + \frac{n}{N}} \tag{5}$$

From the result of the pilot study, the standard error for the basic variables livestock, crop production and area of total land are 3.935, 2.307 and 0.2416, respectively. Taking into consideration the budget, resource and time, the permissible margin of error is not more than 2000 livestock with 95 percent confidence probability (or 0.05 risk of the error) for the zonal estimates, hence the total sample size (second sage unit) is

$$n = \frac{5570x15.483}{(5570)x.034 + 15.483} = \frac{86240.31}{204.863} = 421 \text{ , where}$$

$$D = (\frac{2000}{Z_{0.05}(5570)})^2 = (\frac{2000}{1.96(5570)})^2 = 0.034$$

Since the sampling fraction is not ignored, using (5) it is given by

$$n_0 = \frac{421}{1 + \frac{421}{5570}} = \frac{421}{1 + 0.076} = 391.268 \approx 391$$

Applying the same procedure as the above, the sample sizes for the remaining vital items are as follows.

| Critical Items | Zonal Margin of error | Confidence Probability | Sample size | Adjusted Sample Size |
|---|---|---|---|---|
| Livestock | 2000 | 95% | 421 | 391 |
| Production | 1200qt | 95% | 408 | 380 |
| Area (land use) | 130hec. | 95% | 384 | 359 |

From this table one can see that the sizes of samples determined for these critical items do not vary considerably. Based on the Cochran approach the largest sample size (391) is required to gain the desired precision of the estimates of the major items with margins of error 2000,1229.9 quintals and 128.8 hectares for the livestock, crop production and total land, respectively.

Thus the total sample size (SSUs) becomes 391 agricultural households for the Zone.

To determine the sample size of primary sampling units (PSUs), the total sample size is calculated as follows

$$n_0 = mn' \tag{6}$$

where, m = number of sample SSUs per EA

$n'$ = number of sample PSUs(EA);

m is fixed by considering time and cost to accomplish the survey and to avoid enumerators' fatigue as we use one enumerator for a given EA. The suggested value of m is 26. Therefore, the total sample PSUs are:

$$n' = \frac{n_0}{m} = \frac{391}{26} = 15.04 \approx 15 \text{ enumeration areas(EAs).}$$

## 3.5 Stratified Sampling

### 3.5.1 Formation of Strata

Stratification is the process of dividing the population into groups or strata with similar characteristics within each stratum. This method is used because of the following reasons.

a) To decrease the variance of the sample estimate.

b) To employ different methods and procedures within strata.

c) Strata may be established because the sub population within them are also designated as domains of study. A domain is a part of a population for which separate estimates are planned in the sample design (Kish,1965).

In order to obtain a more representative sample of agricultural households and to improve the quality of the survey results the towns were stratified by making them relatively homogeneous. Therefore, for the zonal urban population domain, based on the above facts, the 26 towns in the study Zone are grouped using the principle that strata should be more similar to each other with respect to degree of urbanization. The 1994 Population and Housing Census analytical report shows the distribution of infrastructures such as availability of electricity, tap water of the towns to form strata. Using this information and personal judgment of the present facilities such as school, health center, hotels, telephones and other activities of the town and other pertinent information about the study area, the towns are stratified into two strata:

Stratum I – large towns

Stratum II – small towns

Stratum I consists of four large towns which have the above facilities while stratum II consists of twenty two small towns which have no the above facilities .

### 3.5.2 Allocation of primary sampling units

Once each of the 26 towns are classified into one of the two strata, the total size of sample (PSUs) are allocated to each stratum. In order to allocate the first stage units, Singh and Chaudhary (1986) suggest to use one of the following allocation techniques:

i) equal allocation

ii) proportional allocation

iii) Neyman allocation

iv) optimum allocation

Of these approaches, the Neyman and optimum allocation require the variance and cost for each stratum. However, as explained before there was no prior study on the urban domain to acquire these estimates. On the other hand, to fill this gap conducting pilot survey for each stratum incurs much cost and time. Equal allocation does not distribute the sample units to strata according to the total sampling units. Therefore, a design used to allocate the primary sampling units is the proportional allocation.

The Proportional allocation, also known as, the Bowley allocation is used when there is no information on variance ($v_h$) for each stratum. Thus the allocation used in this study is:

$$n_h' = n' \frac{N_h'}{N'} \tag{7}$$

where $n_h'$ is proportional to $N_h'$ or that the sample is allocated to different strata in proportion to the number of universe units $N_h'$, $n'$ is total sample EAs, $N_h'$ is the total EAs in the $h^{th}$ stratum, $N'$ is the total EAs in all strata, $n_h'$ is sample EAs in the $h^{th}$ stratum (Som,1976). This gives the same allocation as Neyman allocation if strata variances are equal.

In the urban domain frame there are a total of 186 PSUs. Stratum I has 100 PSUs and stratum II has 86 PSUs. Therefore, the 15 sample PSUs allocated to the two strata are :

$$n_1' = 15\frac{100}{186} \approx 8 \text{ EAs}$$

$$n_2' = 15\frac{86}{186} \approx 7 \text{ EAs}$$

### 3.5.3 Selection of primary Sampling units

The study, as described above, is a two stage stratified sampling design with units as PSUs or EAs selected in the first stage. A sample of PSUs was drawn independently in each stratum with PPS without replacement. The sample was drawn in the following way.

For each PSU, its measure of size (the 1994 recorded agricultural households) is found. The selection of units was done by selecting numbers at random from the totality of the measures of size. The PSUs were selected using probability proportionate to size (PPS) sample selection methodology.

Singh and Chaudhary (1986) pointed that there are two methods of selection of PSUs with PPS.

1) Cumulative total method

2) Lahiri's method

Of the two, the cumulating method needs computing of successive cumulative totals, which becomes time consuming and therefore the researcher did not use it. However the Lahiri's method is less difficult than the cumulating and this study used the method.

As cited in Singh and Chaudhary (1986) Lahiri developed the method in 1951 and avoids cumulating. It consists of selecting a number at random number between 1 and $N_h$ , where $N_h$ is number of PSUs in stratum h, that is, $N_1$ =100 and $N_2$=86. Another random number is chosen between 1 and $N_{hi}$ ,where $N_{hi}$ is the maximum size of the $N_h$ units of the population (the measure size of EAs). If the second random number is smaller than the size of the unit provisionally selected, the unit is included into the sample. If not, the entire procedure is repeated until a unit is finally selected. For selecting a sample of $n_h$ units, the procedure is to be repeated until $n_h$ units are selected. This gives a sample where the units are selected with unequal probabilities. The probability that the $i^{th}$ unit in stratum h is selected equals $N_{hi}/N_h$, where $N_{hi}$ is the measure of size of the $i^{th}$ EA of stratum h, that is, the agricultural households and $N_h$ is the total agricultural households in the $h^{th}$ stratum. As a result, using $N_1$=100 and $N_{1i}$= 101 the first pair of random numbers selected is (15,27). As the size of the first unit (38 in the frame) is greater than the second number of the random pair that is, 27, the unit with serial number 15 is selected. The remaining units are numbered again from 1 to 99 and one random number from 1 to 99 is drawn to select the second unit in the sample. Proceeding in this way 8 PSUs were selected from stratum I and similarly 7 PSUs were selected from stratum II. This part of the selection procedure was done by the researcher.

### 3.5.4 Selection of Secondary Sampling Units

After the PSUs are selected the first operation to be performed by the survey enumerators consists of making a systematic inventory of all households in the selected enumeration area and to make a complete list of households which practice agriculture.

In each sample enumeration area secondary sampling units are selected with equal probability without replacement using systematic sampling method. In each enumeration area 26 agricultural households are selected and the survey questionnaires are completed. If an enumeration area has less than 26 agricultural households, all households were enumerated. It is to be noted that the sample selection of the households is done by the enumerators.

## 3.6 Methods of Estimation

The design is a two stage stratified with PPS sampling at the first stage and a systematic sampling at the second stage. The PPS sampling increases the efficiency of estimators using ancillary information. The estimation procedure is the following .

Notations

N = Total number of agricultural households in all urban areas taken from sampling frame.

$N_h$ = Total number of agricultural households in the $h^{th}$ stratum taken from sampling frame.

$N_{hi}$ = Total number of agricultural households in the $i^{th}$ EA and $h^{th}$ stratum taken from sampling frame.

$M_{hi}$ = Total number of agricultural households in the $i^{th}$ EA and $h^{th}$ stratum taken from fresh listing.

$m_{hi}$ = Total number of sample agricultural households to be covered in the i $^{th}$ EA and h$^{th}$ stratum.

$y_{hij}$ = The value of the study variables in the h$^{th}$ stratum , i $^{th}$ EA and j $^{th}$ selected households for specific items.

Y = The universe total of the study variable.

$P_{hi} = \frac{N_{hi}}{N_h}$ , probability of selection of i $^{th}$ EA in the h$^{th}$ stratum.

$P'_{hi} = \frac{m_{hi}}{M_{hi}}$ , sampling rate of second stage unit( SSU) for the i $^{th}$ EA in the h$^{th}$ stratum.

L = 2, number of strata used.

$N = \sum_{h=1}^{L} N_h$

$n_h$ = number of sample PSU in the h$^{th}$ stratum.

$n = \sum_{h=1}^{L} n_h$ , total number of sample PSU in all strata.

$W_{hij} = \frac{1}{n_h p_{hi} p'_{hi}} = \frac{N_h M_h}{n_h N_{hi} m_{hi}}$ = The sampling weight for the element, includes all the stages of selection.

q= The total number of observation units in the sample.

Q= The total number of observation units in the population.

$f_q$= q/Q = The overall sampling rate.

Estimators

The combined unbiased estimator of $Y_h$ is :

$$y'_h = \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} W_{hij} y_{hij} \tag{8}$$

And an unbiased estimator of the overall total Y is :

$$y = \sum_{h=1}^{L} y'_h \tag{9}$$

The components of the true variance at both stages (the first and second stages) is given by:

$$\delta_{Y_h}^2 = \frac{1}{n_h} \sum_{i=1}^{N_h} P_{hi} \left( \frac{Y_{hi}}{P_{hi}} - Y_h \right)^2 + \frac{1}{n_h} \sum_{i=1}^{M_{hi}} M_{hi}^2 \left( 1 - \frac{m_{hi}}{M_{hi}} \right) \frac{S_{2hi}^2}{m_{hi} P_{hi}} \tag{10}$$

where, $S_{hi}^2 = \sum_{j=1}^{M_{hi}} \frac{\left( Y_{hij} - \overline{Y_{hi}} \right)^2}{M_{hi} - 1}$

An unbiased variance estimator of (10) is :

$$V_{y'_h} = \frac{n_h}{(n_h - 1)} \sum_{i=1}^{n_h} (y^*_{hi} - \frac{y'_h}{n_h})^2 \tag{11}$$

where, $y^*_{hi} = \sum_{j=1}^{m_{hi}} W_{hij} y_{hij}$

And for all the strata combined, an unbiased estimator of the variance of total of y is:

$$V_y = \sum_{h=1}^{L} V_{y'_h} \tag{12}$$

To compare the reliability of different estimates, the coefficient of variation(CV) is given as:

$$CV(y) = \frac{\sqrt{V_y}}{|y|} x100 \tag{13}$$

In order to determine the bound on the error of the estimate, a confidence interval should be constructed. Thus the 100(1-$\alpha$) percent confidence limits of the universe parameter Y for each stratum total and the population total are given ($\alpha$=0.05) as follows:

(For total of stratum h)

$$Y_{hL} = y'_h - (t_{0.05}, n_h - 1)\sqrt{V_{y'_h}} \tag{14}$$

$$Y_{hU} = y'_h + (t_{0.05}, n_h - 1)\sqrt{V_{y'_h}} \tag{15}$$

(For population total)

$$Y_L = y - (t_{0.05}, n')\sqrt{V_{y'}} \tag{16}$$

$$Y_U = y + (t_{0.05}, n')\sqrt{V_{y'}} \tag{17}$$

Since the variance estimators in the different strata are based on small number of degrees of freedom, the normal distribution cannot be used. The t – distribution can be used by computing the effective number of degrees of freedom. The adjusted degree of freedom is

$$n' = \frac{\left(\sum_{h=1}^{L} V_{y'_h}\right)^2}{\sum_{h=1}^{L} \frac{V_{y'_h}^{\ 2}}{n_h - 1}} \tag{18}$$

where, $n_h$ is greater than 1 (Som,1976).

The U.S. Bureau of the Census (1994) provides the design effect (Deff) as follows

Deff = (variance of estimation of the complex design)/(variance of estimator under simple random sampling, SRS)

where, the complex design for this study is the two stage stratified design then

$$Deff = \frac{Var_{twostage}(\theta)}{Var_{SRS}(\theta)} \tag{19}$$

where, $\theta$ is estimator of the sub-population domains, and

$$Var_{SRS}(\theta) = (1 - f_q)\frac{S^2{}_\theta}{q} \tag{20}$$

For the estimation of the total of characterstic y, an estimator of the appropriate simple random sampling variance($S^2{}_\theta$) is

$$S^2{}_\theta = Q^2 Var(Y) \tag{21}$$

where Var(Y) is given as :

$$Var(Y) = \frac{q}{(q-1)Q}\sum_{h=1}^{L}\sum_{i=1}^{n_h}\sum_{j=1}^{q_{hi}} W_{hij}(Y_{hij} - \bar{Y})^2 \tag{22}$$

with, $Q = \sum_{h=1}^{L}\sum_{i=1}^{n_h}\sum_{j=1}^{q_{hi}} W_{hij}$

$$\bar{Y} = \frac{1}{Q}\sum_{h=1}^{L}\sum_{i=1}^{n_h}\sum_{j=1}^{q_{hi}} W_{hij}Y_{hij}$$

$$q = \sum_{h=1}^{L}\sum_{i=1}^{n_h} q_{hi}$$

# CHAPTER 4

# RESULTS OF THE STUDY AND DISCUSSIONS

## 4.1 Results of the study

Before the data are processed using computers, manual data editing, coding and verification had been performed. After completing the editing process the data were encoded on computers by data entry clerks. For the validation of the data a computer program was used for data cleaning or checking for inconsistency. The automatic detection of the errors was done, and impossible codes or entries were detected. This was done by checking, for example, whether all crops are in the right codes, whether the entry for sex is either code 1 or 2, that of educational status is in the range 1 to 5, that of holding type is within 1 to 3, etc.

The survey data were analyzed using the Integrated Micro Computer Processing System (IMPS), SPSS and Microsoft Excel computer software packages.

Using the computational formulae given in Chapter 3, all the desired estimates are produced and the results are reported separately by Zone, Large towns stratum and Small towns stratum. The results are provided from Table 1A to Table 12C in the annex part.

## 4.2 Discussion

### I ) Measure of precision

As shown in the tables (see annex) various population characteristics were estimated using the survey data. These include the crop production for different types of crops, size of livestock, holder by sex, etc. for the urban domain. Also the standard errors of the estimates, their coefficient of variation, the design effect ( Deff) and the associated 95 % confidence intervals are given.

Items whose Deff values are below 1 are the ones for which the use of the two-stage design resulted in more efficient estimations as compared to that of using simple random sampling. The reverse is true for items whose Deff values are greater than one. It can be seen that for some of the items the C.V. is above the desirable level, that is, much larger than 15 percent. This shows that the sample size is too small for some of the items to achieve an adequate level of precision in these estimates.

The confidence interval estimates also agree with the results explained earlier in relation to the coefficients of variation, that means, some of the confidence intervals are much wider than the others, again showing that the estimates of these items are not as reliable as those of the others.

### II ) Socio-demographic and economic structure

a) Agricultural households, holders by sex and holding. The total estimated urban agricultural households in the Zone is 5,567 whereas the number of holders or farmers is 6,188. Of the estimated agricultural households 73 percent are operated by males and 27 percent by females. Of the total agricultural holders, male holders consist of 72 percent with females representing the remaining 28 percent. This study indicates that males dominate the

urban agricultural activity. While this is consistent with rural figures, the actual percentages are higher for female holders in the urban areas compared to the percentage across the country and in this Zone in the rural domain. In rural domain across the country and the Zone the percentages of female holders are 15 percent and 11 percent, respectively. Similar interpretations can be given for the different entries of the tables where the estimated number of households and numbers of holders were displayed for the categories of gender, type of holding, etc..

b) The relation between urban agricultural holders and educational attainment. One of the main objectives of this study was to see the association between educational status of the holder and the holder's performance in the urban agriculture sector of the economy. In this regard, the total estimated agricultural holders in the Zone for educational attainment groups, and the estimates were 29 per cent illiterate, 21 per cent have an informal education, 22 per cent completed grades 1-6, 20 per cent completed grades 7-12, and only 8 per cent completed grade 12 or above. The results indicate that urban agricultural holders were predominantly illiterate. The other three groups, informal education, grades 1-6 and grades 7-12, also account for significant proportions.

Comparison can be made between the strata regarding the educational attainment of agricultural holders. In the small towns stratum 33 percent of the holders were illiterate whereas in the large towns stratum the predominant group of holders are those that completed grades 7-12, which is 28 per cent of the total agricultural holders. In the small towns stratum of the Zone illiterates constitute the largest educational group among those engaged in agriculture as compared to the other educational groups. Those who are above grade 12 constitute the smallest of the educational groups.

The results of this study indicate that the largest group of illiterate holders in this Zone's are found in urban domain as compared to other educational categories. As the level of educational attainment increases the chance of being engaged in urban agricultural activity becomes less (Table 2A to 2C).

c) Working status of the holders. It is known that agriculture in urban area is an informal economic sector which is implemented irregularly by the holders whose livelihood is not solely dependent on agriculture. In the discussion of this study it is mentioned that for the purposes of conducting the survey of urban households that each household must be classified as to its main occupation. These classifications of the holder are agriculture, either formal or informal economic sector, governmental and non-governmental employee or classified as "other" activities. Tables 10A to 10C provide estimates of the number of holders based on these work classifications. The survey results indicate that of the total agricultural holders in the Zone, 33 percent are considered as working primarily in the formal and informal economic sector such as trade (exchange of goods) as their true work for livelihood, selling of alcohol and food, etc. with urban agricultural activity as a secondary activity, 28 percent are completely engaged in urban agricultural activity, 24 percent are engaged in agricultural activities as a part time activity with their primary work being governmental and non-governmental employment, while the remaining percentage falls under the broad categories of activities of unskilled workers with agricultural activity as the secondary major activity. The same conclusion is arrived at by examining the results of the two strata. It can be concluded from the data for the Zone as well as for the large towns stratum that the largest classification group of holders is that whose primary working status is in the informal and formal economic sector while agriculture is a secondary activity to supplement household consumption. On the other hand in the small towns stratum the largest group of holders are those whose primary working status is agricultural activity which is their main source of generating household income. A small percentage of holders

are engaged in agricultural activity as a secondary work activity to help subsidize the needs of the household.

d) Usage of agricultural production. In order to examine the intended purpose of the holders for their agricultural production, the usage categories, home consumption and commercial, commercial only, and home consumption only, were used. The estimated percentages for the three categories were 26, 2 and 72 percent, respectively ( Table 11A to 11C).

e) Farm income and expenditure. The total income received from the sale of agricultural production in the Zone is estimated to be 931,026 Birr and average annual income per holder is 547 Birr. The cost of various agricultural inputs is estimated to be 2,561,453 Birr and average annual expenditure per holder is 414 Birr. The majority of sales are attributable to the selling of livestock and chickens (38 percent), followed by sales of milk or butter at 27 percent, and 19 percent from the sale of crops. At the zonal level (in the urban domain) the largest percentage of income is received from the sale of livestock. This is also true in the small towns stratum. But in the large towns stratum the largest portion of income is received from the sale of dairy products, that is, milk and butter (47 percent). The largest expense for the holder in each stratum is the cost associated with the initial purchase of livestock (Table 12A to 12C).

**III ) Types of crops grown**

The major crops grown in the Zone by urban agricultural holders are cereals (teff, maize, barley, wheat and sorghum), pulses (vetch, horse beans, field peas and chick peas), oilseeds (neug, linseed, rape seed), permanent crops (Gesho, chat and cock) and vegetables. For cereals, pulses and oilseeds the total estimated production is 12,821 quintals with estimated cultivated area, 1,615 hectare, for the entire Zone. The largest production is obtained from cereals (85 percent) with teff contributing the highest proportion (50 percent). Following

cereals the production of pulses (13 percent) was the next highest with vetch taking the largest portion (59 percent). Oilseeds contribute 2 percent, 46 percent of which is linseed. Of the total production, 75 percent is produced in small towns stratum whereas the remaining portion produced in the large towns stratum. Holders in the small towns stratum earn 30 percent of their income from selling of crops whereas for large towns stratum it is only 5 percent. With regard to the expenditure buying of fertilizer accounts for 21 percent in the small towns stratum and only 9 percent in the large towns stratum. The cost of buying seed is estimated to be 5 percent in the small towns stratum and 3 percent in the large towns stratum. From this one can conclude that the rural and small towns holders are more alike as compared to the large towns holders in terms of the type of activities and the income and expenditure associated with the activity. The estimated zonal level average production per holder is 5.3 quintals and the average yield per hectare of major crops to be between 4.8 -11.0 quintals per hectare (Table 3A to 3C).

**IV ) Land utilization**

Another interesting finding of this study is that urban agricultural holders used their land for varying purposes. The total land used by the holders in the Zone is estimated to be 2,828 hectare. Of this total land, 61 percent is under temporary crops, 2 percent is under permanent crops, 10 percent is under fallow land, 4 percent is grazing land, 3 percent is woodland and 20 percent is considered as part of their homestead, barn and other land. Of the 61 percent under temporary crops, cereals, pulses, oilseeds and vegetables contribute 79 percent, 12 percent, 2 percent and 7 percent, respectively. Of the 2 percent under permanent crops, Gesho occupies 99 percent of the permanent crop land, cock occupied 0.1 percent and 0.6 percent is under chat. Comparing the two strata, 80 percent of the total land is used for agricultural purposes in small towns stratum where the remaining proportion is found in the large towns stratum. From these results it can be concluded that in the urban area the cultivation of cereal crops takes the largest proportion among temporary crops and Gesho,

which is used for the purpose of alcoholic production, has the largest proportion among permanent crops.

The study found out that the size of grazing land is small as compared to all other types of land classifications (except woodland). This shows that the holders with livestock in urban areas use the communal grazing land in the peripheral areas of the town or open land which belongs to the adjacent rural areas and kept for the pasturing of the livestock of the rural areas. Of the total crop land, the average land holding size per holder is 0.74 hectare and of the total land holding (excluding crop land ) average land holding per holder is 0.17 hectare. This result agrees with the rural holding size per holder which at National level is 0.81 hectare and 0.12 hectare, in Amhara Region is 0.9 hectare and 0.09 hectare and in this Zone is 1 hectare and .05 hectare, respectively (Table 4A to 4C).

**V) Usage of agricultural inputs and land tenure**

The study found out that all urban agricultural holders use agricultural inputs to help increase the yield of their crop production. These inputs are in the form of seeds, fertilizers, irrigation, and pesticides. Considering the total cultivated land in the Zone, 57 percent of the cultivated land received of inorganic fertilizer, 10 percent is under irrigation, 90 percent is planted using improved seed whereas only 10 percent is planted with local seed, and 12 percent of the cultivated land received chemical pesticides. Generally speaking, holders in the small towns stratum used these inputs in a greater proportion than those in the large towns stratum.

Land use for agricultural purposes in the urban domain comes from varying sources. The urban agricultural holder may obtain their plots either by law or from their private residence through the use of their homestead land. Often the less fortunate poor can obtain the legal use of open areas with permission of the local municipality. Those with the financial means

can often obtain the amount of needed land through rental agreement either within urban boundaries or in the rural localities. Of the total land area in the Zone, 87 percent of the land is owned and only13 percent is rented from other holders. The proportion of land owned is larger for the holders in the small towns stratum (84 percent) compared to those in the large towns stratum (16 percent). On the other hand land rented is the same for the large towns stratum (50 percent) and small towns stratum (50 percent).

The results of this study would lead one to conclude that the urban agricultural holder is very conscious of the need for and the use of agricultural inputs. In a general sense it can be said that as the degree of urbanization increases the land owned by the holders will decrease which may be the result of the reduction of open space as it will be occupied by new dwellers. This has the consequence that boundaries of the town will keep extending into the open areas surrounding the town for the purpose of home construction (Table 5A to 6C).

**VI ) Number of livestock, chickens and beehives**

As it is expected the study indicated that the number of holders raising livestock, chickens and bees is larger than that who concentrate on crop cultivation in urban areas. The survey estimates for the Zone are 26,979 livestock (cattle, sheep, goats, horses, mules and asses), 15,193 chickens and 756 beehives. Raising of livestock is positively related with literacy. Chickens are more prevalent than any other livestock component. Among the livestock items estimated in the total population, the share of cattle is the highest (51 percent), followed by sheep (41 percent), equine (5 percent) and goats (3 percent). Households in the large towns stratum tend to be more likely to raise goats, equine and chickens than those in the small towns stratum. The reason for this may be the geographical location or convenience of large towns stratum for raising of goats. Concerning chickens and equine, the raising of chickens does not require a large open space and the expenditure for feeding is minimum as compared to other livestock. In the large towns stratum the use of horses or

mules (equine) for drawing carriage seems to be the reason for their prevalence. Often the holder will use equine for dual purposes. At the beginning of agricultural season equine are used for soil preparation and later on for transportation of production while during slack periods they are used for carriage and other purposes. This may be the reason why the large towns stratum has more equine compared to the small towns stratum. The study showed that average number of domestic animals raising per holder is 8 livestock and chickens combined (Table 7A to 7C).

**VII ) Appraisal of CSA's urban agricultural size of holdings**

It was explained in Chapter 3 in the methodology section that in the selected EAs, first all holders are listed and then those who satisfy the CSA's definition of agricultural holders were identified. The total number of domestic animals and agricultural holders are estimated on all- holders basis, that is, by disregarding the CSA's definition. It should be pointed out that the CSA's cut-off procedure ultimately underestimates the total number of livestock and chickens. The following table is useful to illustrate the degree to which the estimates are underestimates, that is, estimates based on holders included using the CSA's cut-off values and estimates computed on all holders basis.

Table A. Number of urban agricultural holders

| Methods | Estimates |
|---|---|
| Above CSA's cut-off values (planned to cover) | 6,188 |
| Below CSA's cut-off values (not covered) | 2,540 |
| Total | 8,728 |
| Percentage ( under-estimate) | 29.1 |

Table B. Number of livestock and chickens

| Items | CSA's cut-off value | Below CSA's cut-off value | Total | Percentage (understimate) |
|---|---|---|---|---|
| Cattle | 13,724 | 316 | 14,040 | 2.3 |
| Sheep | 11,168 | 1,786 | 12,954 | 13.8 |
| Goats | 737 | 106 | 843 | 12.6 |
| Equine | 1,347 | 112 | 1,459 | 7.7 |
| Chickens | 15,193 | 2,991 | 18,184 | 16.5 |
| Total domestic animals | 4,1629 | 5,311 | 47,480 | 11.2 |

From this table it can be concluded that the cut-off value developed by CSA in all cases results in an underestimation of the livestock numbers and the percentage of underestimation ranges from 2.3 to 29.1 percent. It is also striking to note that 29.1 percent of the total holders participating in some sort of agricultural activity and 11.2 percent of the total domestic animals will be excluded if the CSA's cut-off value is applied.

**VIII ) Rural- Urban agricultural production of the Zone**

One of the main objectives of this study was to obtain the total production of the Zone. As a result, the content of the body of this paper illustrates and discusses the findings with respect to the estimates of the total number agricultural holders, agricultural outputs and livestock, chickens and beehives. The CSA conducts an annual AgSS of the rural domain in this Zone. The 1998/99 survey report shows that the total estimated number of livestock were

1,244140 cattle, 708,260 sheep, 221,310 goats, 242,850 equine, 714,800 chickens and 65,360 beehives. Therefore, the total livestock number of the urban and rural domain of the Zone are 1,258,180 cattle (1.12 percent belonging to the urban domain), 721,214 sheep (1.8 percent belonging to the urban domain), 222,153 goats (0.40 percent belonging to the urban domain), 244,309 equine (0.6 percent from the urban domain), 732,984 chickens ( 2.5 percent is raised in the urban domain) and 66,362 beehives (1.5 percent in the urban area).

Concerning the total land area, the 1997/98 rural AgSS report shows that the total estimated area of all land use was 410,250 hectare and from this survey the total area of all land use is 4,770 hectare, therefore, the total area of all land use is 415,020 hectare (1.2 percent is under urban holders).

Regarding crop production, 1998/1999 rural AgSS estimated it as 5,459,670 quintals and from this survey that of urban areas is estimated 12,821 quintals. Thus the total estimated crop production of the main crops is 5,472,491 quintals (urban holders contribute 0.23 percent).

The 1997/98 rural AgSS report shows the total number of agricultural households and holders are 379,410 and 390,910, respectively. From this survey the estimates 8,107 and 8,728 agricultural households and holders, respectively are obtained. Therefore, the total agricultural household and holder for this Zone is respectively 387,517 or (2.1 percent are urban agricultural households), and 399,638 or (2.2 percent are urban agricultural holders).

# CHAPTER 5

# CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Conclusions

The main objective of the study was to obtain the estimates of the important characteristics of urban agricultural activities of the Zone. To this effect the purposes of the study were clearly set and the variables of interest, cost of the study, desired precision of the estimates, items of the questionnaire were specified.

Measures were taken to minimize the sources of non-sampling errors. The main sources of non-sampling errors were errors during recording, responses, the use of subjective methods for measuring the quantities, uses of outdated frame.

The study is based on a sample of 391 urban agricultural households selected from the Zone. A total of 405 agricultural holders were included in the survey. Urban agricultural activities are distinct from those in rural areas. Agriculture in rural areas is called formal agricultural economic sector, that is, the holders are engaged regularly in agricultural activities, whereas agriculture in urban areas is called informal agricultural sector. Urban agriculture is informal because of the fact that most of the people use this sector as an additional means of livelihood. In Ethiopia, particularly in the study area, urban agriculture is more of formal than informal. The result shows that 28.2 percent of the total urban

agricultural holders are engaged regularly in agricultural activity. This figure indicates that agriculture is a formal economic sector in the urban areas. This shows that urbanization in the Zone does not seem to be absorb manpower away from agriculture as much as it should.

Larson and Narain (1998) explain that this informal sector provides food which raises the level of nutrition not only for the population living below the poverty line but also for the households in the middle and higher income groups. The output of such activities are included in estimating national income. Therefore, the results of this study can be used for estimating the GDP of the country by accounting for contribution of urban agriculture and using some adjustments. One of the limitation of this study is that it does not identify as to which type of households, that is, the rich, poor or both is/are engaged in agricultural activity. The research aimed only at estimating the items covered in most agricultural surveys such as crop production, area of land use, number of holders, number of livestock, etc.

The most vital items of interest in this study are crop production, land utilization and number of domestic animals that are bred for agricultural purpose. The results show that the total estimated urban agricultural crop production in East Gojam Zone is 12,820.82 quintals of which cereals are the dominant crops. The total estimated land use is 2,827.9 hectares, the total estimated domestic animals is 42,169 and the total number of beehives is estimated at 756. Chickens are more prevalent as compared to other livestock groups. The estimate is 42,169 domestic animals when the CSA's cut-off size of holding is used while

the total domestic animals estimated without this restriction on the size of holding is 47,480 in the Zone. Thus, the need for including urban strata in agricultural surveys is apparent.

In general, the estimates obtained from the urban domain of the Zone appear to be significant to have an impact on the national production. However, it should be noted that the country has 53 Zones and the exclusion of this domain from agricultural surveys does not seem justifiable unless similar studies are conducted nationwide.

## 5.2 Recommendations

Based on the experience gained from conducting this study and from its findings, the researcher forwards the following recommendations for the benefit of other interested agricultural researchers:

1. It is important that policy makers and agricultural researchers give adequate attention to urban agricultural activities, conduct urban agricultural researches and address other policy issues.

2. The CSA should reconsider its cut-off value on the size of holding urban holders by considering economic importance of the holdings to the holders. Attention should be given especially to households raising cattle, sheep and chickens for the up-coming National Agricultural Census (NAC).

3. Some of the small towns which can easily be classified as belonging to the small towns stratum are really very similar to the rural domain; therefore, CSA should include these towns in its annual AgSS.

4. This researcher found out that the total number of agricultural household recorded in the field as compared to the numbers recorded on the CSA sampling frame to be very different. It is necessary that CSA considers updating its sampling frame to reduce the use of incorrect measures of sizes for each listed sampling unit (PSU) before the preparation for future sample selection of PSUs for the AgSS or NAC.

5. It is possible to estimate urban agriculture through sampling methods. The study has its limitations. It does not cover the data on agricultural mechanization, holders living status, types of livestock by hybrid, etc. Therefore, other researchers may improve upon this study in future studies of other urban areas of the country.

6. Urban agriculture can be an obstacle to future urban development. Therefore, the government should consider formulation of strategies for agricultural holders to raise their food self-sufficiency instead of subsidizing from urban agriculture in order to up-grade and develop urbanization.

7. Different theories indicate that due to crowded and limiting nature of the town environment, the raising of livestock can cause health risks, degradation of roads, and traffic jams. If this is the case, urban planners and health specialists should take into consideration the size and impact of livestock because of the extent of urban agriculture. One can lessen this problem through restrictions on urban agricultural holders to settle on the margin of the towns or by providing effective waste disposal mechanisms such as sewerage systems.

8. If there are no alternatives to agriculture in urban areas then it would be appropriate to provide facilities such as agricultural extension services especially for those raising livestock.

9. This researcher is aware of the limitation of the results for some of the items estimated, especially the estimates with large coefficient of variation. Hence the estimates should be used with care.

Finally, all the above discussions, conclusions and recommendations underline the significance of urban agricultural activities in Ethiopia particularly in the studied Zone.

## REFERENCES


CSA (1992). Manual For Census Map work. Addis Ababa.

_____ (1994). Enumerators manual for Census. Addis Ababa.

_____ (1999). Statistical Abstract 1998. Addis Ababa.

_____ (1999). The 1998/99 Agricultural Sample Survey (private peasant holding); report on Livestock, chickens and beehives population, Volume II. Addis Ababa.

_____ (1998). The 1997/98 Agricultural Sample Survey (private peasant holding); report on land utilization , Volume IV. Addis Ababa.

_____ (1999). The 1998/1999 Agricultural Sample Survey (private peasant holding); report on Area and production, Volume I. Addis Ababa.

_____ (1995). The 1994 Population and Housing Census of Ethiopia, Amhara Region, Volume I Part IV Statistical report on housing characteristics. Addis Ababa.

Cochran,W.G. (1977). Sampling Techniques. Third ed. Wiley. New York.

David, I.P. (1998). Sampling strategy for Agricultural Census and Survey in developing countries. An International Conference on Agricultural Statistics (March 18-20, 1998). Washington, D.C.

FAO (1967). Report of the third session of the African Commission on Agricultural Statistics, Uganda 17-23. Rome.

_____ (1986). Food and agricultural statistics in the context of a national Information system. Rome.

_____ (1992). The 1980 World Census of Agriculture, Methodological Review. Rome.

Isnar (1987). Review of Research Program management and Manpower Planning at the institute of Agricultural research in Ethiopia. The Hague, Netherlands.

____ (1983). Development of an Agricultural Research System in Somalia. The Hague, Netherlands.

Kish, L. (1965). Survey sampling. Wiley. New York.

Larson, L.O and Narain, P. (1998). International standards and definitions for agricultural Statistics and requirements for World Census of Agriculture. An International Conference on Agricultural Statistics (March 18-20,1998), Washington, DC.

Mbiba, B. (1996). Urban Agriculture in Zimbabwe, implementations for urban management and poverty. Ipswich Book Co.Ltd. Ipswich. Great Britain.

MEDaC (1999). Medium Statistical Program. Addis Ababa.

Mendenhall, W., Ott, L. and Scheaffer, R.L. (1971). Elementary Survey Sampling. Wadsworth publishing company Inc. Belmont, California.

Murthy, H.F (1968). Report on the Fertility Status and other Data On some Soils of Ethiopia. Experimental Station bulletin No. 4. An Ochlahoma State University- USAID contract publication.

Pacan, H. and Davies, I.G.R (1951). Earnings and conditions of employment in agriculture. Journal of the Royal Statistical Society, Volume CXIV. London.

Sarndal, C.E, Swensson, B. and Wretman, J. (1991). Model Assisted Survey Sampling. Springer. New York.

Singh, D. and Chaudhary, F.S (1986). Theory and analysis of sample survey designs. Wiley Eastern. New Delhi.

Som, R.K. (1976). A manual of sampling techniques. Heinemann Educational Books Ltd. London.

Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984). Sampling theory of surveys with application. Indian society of Agricultural Statistics, New Delhi. Indian and the Iowa State Universty Press, Iowa, USA.

U.S. Bureau of the Census (1994). Variance calculation system. IMPS Version 3.1, International statistical program center, Washington D.C.20223-3600.

Yates, F. (1971). Sampling methods for censuses and surveys. Third edition, Charles Griffin. London.

Zarkovich, S.S (1975). Sampling Methods and Census, FAO, Rome.

# ANNEX I

TABLES OF RESULTS

TABLE 1 A. Number of agricultural households and holders by type of holding and sex in the zone.

| Type of holding | | | Household | | | Holder | | |
|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total | Male | Female | Total |
| Crop only | | Estimate | 287 | 385 | 672 | 287 | 412 | 699 |
| | | Standard error | 85 | 132 | 157 | 85 | 134 | 158.69 |
| | | CV % | 29.58 | 34.39 | 23.36 | 29.58 | 32.43 | 22.70 |
| | | Deff | 1.72 | 3.17 | 3.61 | 1.72 | 3.03 | 3.48 |
| | | Sex composition(%) | 42.7 | 57.3 | 100.0 | 41.1 | 58.9 | 100.0 |
| | 95% confdence interval | Lower limit | 131 | 135 | 374 | 133 | 158 | 397 |
| | | Upper limit | 443 | 635 | 970 | 441 | 666 | 1000 |
| Livestock only | | Estimate | 2492 | 816 | 3308 | 2807 | 968 | 3775 |
| | | Standard error | 511 | 191 | 545.53 | 530 | 220 | 573.85 |
| | | CV % | 20.5 | 23.35 | 16.49 | 18.89 | 22.78 | 15.20 |
| | | Deff | 11.45 | 3.35 | 11.93 | 11.98 | 3.89 | 12.60 |
| | | Sex composition(%) | 75.3 | 24.7 | 100.0 | 74.4 | 25.6 | 100.0 |
| | 95% confidence interval | Lower limit | 1581 | 473 | 2342 | 1868 | 569 | 2759 |
| | | Upper limit | 3403 | 1159 | 4274 | 3746 | 1367 | 4791 |
| Livestock and crop | | Estimate | 1270 | 317 | 1587 | 1341 | 372 | 1713 |
| | | Standard error | 356 | 110 | 372.61 | 335 | 102 | 350.18 |
| | | CV % | 28.04 | 34.59 | 23.48 | 25 | 27.34 | 20.44 |
| | | Deff | 8.2 | 2.61 | 8.61 | 6.99 | 1.93 | 7.25 |
| | | Sex composition(%) | 80.0 | 20.0 | 100.0 | 78.3 | 21.7 | 100.0 |
| | 95% confidence interval | Lower limit | 595 | 118 | 894 | 706 | 189 | 1061 |
| | | Upper limit | 1945 | 516 | 2280 | 1976 | 555 | 2364 |
| Total | | | 4049 | 1518 | 5567 | 4436 | 1752 | 6188 |

CV= Coefficient of variation
Deff= Design effect

TABLE 1 B. Number of agricultural households and holders by type of holding and sex in the large towns stratum

| Type of holding | | | Household | | | Holder | | |
|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total | Male | Female | Total |
| Crop only | | Estimate | 88 | 50 | 138 | 88 | 56 | 144 |
| | | Standard error | 41 | 27 | 49.09 | 41 | 29 | 50.22 |
| | | CV % | 46.75 | 53.36 | 35.57 | 46.75 | 51.01 | 34.87 |
| | | Deff | 1.27 | 0.94 | 1.58 | 1.27 | 0.96 | 1.59 |
| | | Sex composition(%) | 63.8 | 36.2 | 100.0 | 61.1 | 38.9 | 100.0 |
| | 95% confdence interval | Lower limit | 10 | 0 | 45 | 10 | 1 | 49 |
| | | Upper limit | 166 | 101 | 231 | 166 | 111 | 239 |
| Livestock only | | Estimate | 1684 | 425 | 2109 | 1770 | 442 | 2212 |
| | | Standard error | 422 | 110 | 436.10 | 413 | 109 | 427.14 |
| | | CV % | 25.06 | 25.79 | 20.68 | 23.31 | 24.64 | 19.31 |
| | | Deff | 9.49 | 1.98 | 9.69 | 8.8 | 1.89 | 9.00 |
| | | Sex composition(%) | 79.8 | 20.2 | 100.0 | 80.0 | 20.0 | 100.0 |
| | 95% confidence interval | Lower limit | 884 | 217 | 1283 | 987 | 235 | 1403 |
| | | Upper limit | 2484 | 633 | 2935 | 2553 | 649 | 3021 |
| Livestock and crop | | Estimate | 259 | 90 | 349 | 259 | 90 | 349 |
| | | Standard error | 109 | 57 | 123.00 | 109 | 57 | 123.00 |
| | | CV % | 42.02 | 63.47 | 35.24 | 42.02 | 63.47 | 35.24 |
| | | Deff | 3.11 | 2.4 | 3.93 | 3.11 | 2.4 | 3.93 |
| | | Sex composition(%) | 74.2 | 25.8 | 100.0 | 74.2 | 25.8 | 100.0 |
| | 95% confidence interval | Lower limit | 52 | 0 | 116 | 52 | 0 | 116 |
| | | Upper limit | 466 | 198 | 582 | 466 | 198 | 582 |
| Total | | | 2031 | 565 | 2596 | 2117 | 588 | 2705 |

TABLE 1 C. Number of agricultural households and holders by type of holding and sex in the small towns stratum.

| Type of holding | | | Household | | | Holder | | |
|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total | Male | Female | Total |
| Crop only | | Estimate | 199 | 335 | 534 | 199 | 356 | 555 |
| | | Standard error | 74 | 130 | 149.59 | 74 | 131 | 150.46 |
| | | CV % | 37.3 | 38.75 | 28.01 | 37.3 | 36.66 | 27.11 |
| | | Deff | 1.87 | 3.47 | 3.94 | 1.87 | 3.32 | 3.81 |
| | | Sex composition(%) | 37.3 | 62.7 | 100.0 | 35.9 | 64.1 | 100.0 |
| | 95% confdence interval | Lower limit | 55 | 82 | 243 | 55 | 101 | 263 |
| | | Upper limit | 343 | 588 | 825 | 343 | 611 | 847 |
| Livestock only | | Estimate | 808 | 391 | 1199 | 1037 | 526 | 1563 |
| | | Standard error | 288 | 156 | 327.54 | 333 | 192 | 384.39 |
| | | CV % | 35.62 | 39.89 | 27.32 | 32.12 | 36.45 | 24.59 |
| | | Deff | 7.7 | 4.33 | 8.83 | 8.39 | 4.99 | 9.76 |
| | | Sex composition(%) | 67.4 | 32.6 | 100.0 | 66.3 | 33.7 | 100.0 |
| | 95% confidence interval | Lower limit | 248 | 88 | 563 | 390 | 153 | 816 |
| | | Upper limit | 1368 | 694 | 1835 | 1684 | 899 | 2310 |
| Livestock and crop | | Estimate | 1011 | 227 | 1238 | 1083 | 282 | 1365 |
| | | Standard error | 339 | 94 | 351.79 | 317 | 84 | 327.94 |
| | | CV % | 33.53 | 41.24 | 28.42 | 29.31 | 29.84 | 24.02 |
| | | Deff | 8.87 | 2.62 | 9.25 | 7.36 | 1.72 | 7.56 |
| | | Sex composition(%) | 81.7 | 21.0 | 100.0 | 79.3 | 20.7 | 100.0 |
| | 95% confidence interval | Lower limit | 352 | 44 | 554 | 467 | 119 | 728 |
| | | Upper limit | 1670 | 410 | 1922 | 1699 | 445 | 2002 |
| Total | | | 2018 | 953 | 2971 | 2319 | 1164 | 3483 |

TABLE 2 A. Number of holders by Educational attainment and holding type in the zone.

| Type of holding | | | Illitrate | Informal education | 1-6 grade complet | 7-12 grade complet | above 12 grade | Total |
|---|---|---|---|---|---|---|---|---|
| Crop only | | Estimate | 285 | 145 | 132 | 138 | - | 700 |
| | | Standard error | 71 | 89 | 58 | 74 | - | 158.69 |
| | | CV % | 24.91 | 61.32 | 44.28 | 53.46 | - | 22.7 |
| | | Deff | 1.21 | 3.64 | 1.72 | 2.63 | - | 3.48 |
| | | % of Estimate | 40.7 | 20.7 | 18.9 | 19.7 | - | 100.0 |
| | 95% confdence interval | Lower limit | 150 | 0 | 29 | 0 | - | 399 |
| | | Upper limit | 420 | 318 | 235 | 278 | - | 1001 |
| Livestock only | | Estimate | 982 | 732 | 788 | 897 | 376 | 3775 |
| | | Standard error | 188 | 119 | 186 | 222 | 141 | 573.85 |
| | | CV % | 19.15 | 16.3 | 23.58 | 24.72 | 37.64 | 15.2 |
| | | Deff | 2.79 | 1.44 | 3.28 | 4.19 | 3.7 | 12.6 |
| | | % of Estimate | 26.0 | 19.4 | 20.9 | 23.8 | 10.0 | 100.0 |
| | 95% confidence interval | Lower limit | 647 | 521 | 454 | 490 | 118 | 2759 |
| | | Upper limit | 1317 | 943 | 1122 | 1304 | 634 | 4791 |
| Livestock and crop | | Estimate | 543 | 426 | 465 | 175 | 104 | 1713 |
| | | Standard error | 71 | 138 | 114 | 50 | 80 | 350.18 |
| | | CV % | 13.05 | 32.47 | 24.49 | 28.83 | 76.92 | 20.44 |
| | | Deff | 0.66 | 3.15 | 1.97 | 0.98 | 4.09 | 7.75 |
| | | % of Estimate | 31.7 | 24.9 | 27.1 | 10.2 | 6.1 | 100.0 |
| | 95% confidence interval | Lower limit | 417 | 164 | 249 | 86 | 0 | 1062 |
| | | Upper limit | 669 | 688 | 681 | 264 | 253 | 2364 |
| Total | | | 1810 | 1303 | 1385 | 1210 | 480 | 6188 |

TABLE 2 B. Number of holders by Educational attainment and holding type in the large towns stratum.

| Type of holding | | | Illitrate | Informal education | 1-6 grade complet | 7-12 grade complet | above 12 grade | Total |
|---|---|---|---|---|---|---|---|---|
| Crop only | | Estimate | 22 | 25 | 70 | 27 | - | 144 |
| | | Standard error | 22 | 13 | 49 | 14 | - | 50.22 |
| | | CV % | 100 | 51.6 | 70.34 | 53.05 | - | 34.87 |
| | | Deff | 1.45 | 0.43 | 2.28 | 0.5 | - | 1.59 |
| | | % of Estimate | 15.3 | 17.4 | 48.6 | 18.8 | - | 100.0 |
| | 95% confdence interval | Lower limit | 0 | 0 | 0 | 0 | - | 49 |
| | | Upper limit | 64 | 50 | 163 | 54 | - | 239 |
| Livestock only | | Estimate | 494 | 398 | 399 | 646 | 276 | 2213 |
| | | Standard error | 115 | 86 | 103 | 209 | 130 | 427.14 |
| | | CV % | 23.33 | 21.52 | 25.8 | 32.41 | 47.32 | 19.31 |
| | | Deff | 1.91 | 1.29 | 1.85 | 4.22 | 4.22 | 9 |
| | | % of Estimate | 22.3 | 18.0 | 18.0 | 29.2 | 12.5 | 100.0 |
| | 95% confidence interval | Lower limit | 276 | 235 | 204 | 250 | 30 | 1404 |
| | | Upper limit | 712 | 561 | 594 | 1042 | 522 | 3022 |
| Livestock and crop | | Estimate | 147 | 65 | 35 | 72 | 30 | 349 |
| | | Standard error | 53 | 31 | 30 | 36 | 30 | 123 |
| | | CV % | 36.01 | 47.81 | 83.58 | 50.61 | 100 | 35.24 |
| | | Deff | 1.28 | 0.98 | 1.62 | 1.21 | 1.96 | 3.93 |
| | | % of Estimate | 42.1 | 18.6 | 10.0 | 20.6 | 8.6 | 100.0 |
| | 95% confidence interval | Lower limit | 47 | 6 | 0 | 4 | 0 | 116 |
| | | Upper limit | 247 | 124 | 92 | 140 | 87 | 582 |
| Total | | | 663 | 488 | 504 | 745 | 306 | 2706 |

TABLE 2 C. Number of holders by Educational attainment and holding type in the small towns stratum.

| Type of holding | | | Illitrate | Informal education | 1-6 grade complet | 7-12 grade complet | above 12 grade | Total |
|---|---|---|---|---|---|---|---|---|
| Crop only | | Estimate | 263 | 120 | 62 | 111 | - | 556 |
| | | Standard error | 67 | 88 | 32 | 72 | - | 150.46 |
| | | CV % | 25.66 | 73.25 | 50.91 | 65.24 | - | 27.11 |
| | | Deff | 1.18 | 4.28 | 1.06 | 3.13 | - | 3.81 |
| | | % of Estimate | 47.3 | 21.6 | 11.2 | 20.0 | - | 100.0 |
| | 95% confidence interval | Lower limit | 133 | 0 | 0 | 0 | - | 264 |
| | | Upper limit | 393 | 291 | 124 | 251 | - | 848 |
| Livestock only | | Estimate | 488 | 334 | 390 | 251 | 100 | 1563 |
| | | Standard error | 148 | 83 | 155 | 73 | 55 | 384.39 |
| | | CV % | 30.45 | 24.88 | 39.73 | 29.21 | 54.73 | 24.59 |
| | | Deff | 3.2 | 1.43 | 4.29 | 1.46 | 2 | 9.76 |
| | | % of Estimate | 31.2 | 21.4 | 25.0 | 16.1 | 6.4 | 100.0 |
| | 95% confidence interval | Lower limit | 200 | 173 | 89 | 109 | 0 | 816 |
| | | Upper limit | 776 | 495 | 691 | 393 | 207 | 2310 |
| Livestock and crop | | Estimate | 396 | 361 | 430 | 103 | 74 | 1364 |
| | | Standard error | 47 | 135 | 110 | 35 | 74 | 327.94 |
| | | CV % | 11.89 | 37.32 | 25.6 | 33.95 | 100 | 24.02 |
| | | Deff | 0.39 | 3.49 | 1.98 | 0.79 | 4.29 | 7.56 |
| | | % of Estimate | 29.0 | 26.5 | 31.5 | 7.6 | 5.4 | 100.0 |
| | 95% confidence interval | Lower limit | 305 | 99 | 216 | 35 | 0 | 727 |
| | | Upper limit | 487 | 623 | 644 | 171 | 218 | 2001 |
| Total | | | 1147 | 815 | 882 | 465 | 174 | 3483 |

Table 3 A . Total Production and Cultivated Area by type of crops in the zone.

| Type of crops | Production in quintals | | | | | | | Cultivated Area in hectare | | | | | | | Yield (Qt./he.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 95% confidence interval | | | | | | | 95% confidence interval | | |
| | Esimate | Standard Error | CV % | Deff | % of Estimate | Lower limit | Upper limit | Esimate | Standard Error | CV % | Deff | % of Estimate | Lower limit | Upper limit | |
| Cereals | 10,940.25 | 2,586.27 | 23.64 | 5.66 | 85.3 | 6,359.97 | 15,520.53 | 1,371.95 | 390.65 | 28.47 | 9.33 | 85.0 | 645.34 | 2,098.56 | 7.97 |
| Teff | 5,524.82 | 1,638.47 | 29.66 | 7.02 | 50.5 | 2,623.09 | 8,426.55 | 615.368 | 168.6 | 27.4 | 5.45 | 44.9 | 301.77 | 928.96 | 8.98 |
| Maize | 1,452.66 | 416.94 | 28.7 | 4.45 | 13.3 | 642.55 | 2,262.77 | 193.15 | 78.22 | 40.5 | 4.47 | 14.1 | 41.17 | 345.13 | 7.52 |
| Barley | 1,357.87 | 876.55 | 64.55 | 11.42 | 12.4 | 0.00 | 3,018.93 | 307.498 | 235.2 | 76.49 | 18.24 | 22.4 | 0.00 | 753.20 | 4.42 |
| Wheat | 2,505.66 | 1,017.24 | 40.6 | 3.95 | 22.9 | 613.59 | 4,397.73 | 235.26 | 94.07 | 39.99 | 5.28 | 17.1 | 57.00 | 413.52 | 10.65 |
| Sorghum | 99.24 | 78.44 | 79.04 | 2.33 | 0.9 | 0.00 | 247.88 | 20.67 | 18.71 | 90.54 | 4.57 | 1.5 | 0.00 | 57.02 | 4.80 |
| Pulses | 1645.22 | 784.68 | 47.69 | 6.63 | 12.8 | 120.59 | 3,169.85 | 216.821 | 115.73 | 53.37 | 9.06 | 13.4 | 0.00 | 441.68 | 7.59 |
| Vetch | 969.46 | 559.28 | 57.69 | 7.63 | 58.9 | 0.00 | 2,056.14 | 132.689 | 85.26 | 64.26 | 8.53 | 61.2 | 0.00 | 298.35 | 7.31 |
| Horse Beans | 229.13 | 107.05 | 46.72 | 1.63 | 13.9 | 26.27 | 431.99 | 23.439 | 11.5 | 49.04 | 1.68 | 10.8 | 1.65 | 45.23 | 9.78 |
| Field peas | 68.7 | 50.56 | 73.6 | 0.92 | 4.2 | 0.00 | 166.94 | 8.133 | 5.76 | 70.84 | 0.82 | 3.8 | 0.00 | 19.05 | 8.45 |
| Chick peas | 377.93 | 207.47 | 54.9 | 3.36 | 23.0 | 0.00 | 771.09 | 52.56 | 33.38 | 63.5 | 4.35 | 24.2 | 0.00 | 114.65 | 7.19 |
| Oilseeds | 235.35 | 112.03 | 47.6 | 1.21 | 1.8 | 34.14 | 436.56 | 26.024 | 12.76 | 49.03 | 1.44 | 1.6 | 3.11 | 48.94 | 9.04 |
| Neug | 102.63 | 78.57 | 76.55 | 1.73 | 43.6 | 0.00 | 248.77 | 11.55 | 8.43 | 73.01 | 1.73 | 44.4 | 0.00 | 26.83 | 8.89 |
| Lin seed | 108.72 | 81.93 | 75.36 | 1.65 | 46.2 | 0.00 | 258.90 | 12.303 | 9.77 | 79.43 | 1.99 | 47.3 | 0.00 | 30.82 | 8.84 |
| Rape seed | 24 | 15.55 | 64.79 | 0.61 | 10.2 | 0.00 | 51.54 | 2.171 | 1.6 | 73.48 | 0.69 | 8.3 | 0.00 | 5.10 | 11.05 |
| Total | 12,820.82 | 2,965.76 | 23.13 | 5.66 | 100.0 | 7,535.84 | 18,105.80 | 1,614.79 | 430.12 | 771.76 | 8.38 | 100.0 | 814.77 | 2,414.81 | 7.94 |

Table 3B. Total Production and Cultivated Area by type of crops in the large towns stratum

| Type of crops | Production in quintals | | | | | | | Cultivated Area in hectare | | | | | | | Yield (Qt./hec.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 95% confidence interval | | | | | | | 95% confidence interval | | |
| | Esimate | Standard Error | CV % | Deff | % of Estimate | Lower limit | Upper limit | Esimate | Standard Error | CV % | Deff | % of Estimate | Lower limit | Upper limit | |
| Cereals | 2,959.77 | 1,805.32 | 61 | 10.63 | 92.3 | 0.00 | 6380.85 | 322.863 | 141.54 | 43.84 | 5.02 | 89.4 | 54.64 | 591.08 | 9.17 |
| Teff | 1,996.73 | 1,113.22 | 55.75 | 8.44 | 67.5 | 0.00 | 4106.28 | 202.797 | 63.72 | 31.42 | 2.73 | 62.8 | 82.05 | 323.55 | 9.85 |
| Maize | 134.85 | 78.32 | 58.08 | 1.6 | 4.6 | 0.00 | 283.27 | 17.763 | 9.34 | 52.56 | 1.2 | 5.5 | 0.06 | 35.46 | 7.59 |
| Barley | 272.35 | 267.64 | 98.27 | 7.34 | 9.2 | 0.00 | 779.53 | 53.518 | 51.97 | 97.11 | 6.72 | 16.6 | 0.00 | 152.00 | 5.09 |
| Wheat | 531 | 383.44 | 72.21 | 5.15 | 17.9 | 0.00 | 1257.62 | 46.715 | 30.8 | 65.93 | 2.8 | 14.5 | 0.00 | 105.08 | 11.37 |
| Sorghum | 24.84 | 24.84 | 100 | 0.48 | 0.8 | 0.00 | 71.91 | 2.07 | 2.07 | 100 | 0.48 | 0.6 | 0.00 | 5.99 | 12.00 |
| | | | | | | | 0.00 | | | | | | | | |
| Pulses | 172.79 | 105.45 | 61.03 | 2.11 | 5.4 | 0.00 | 372.62 | 30.233 | 20.45 | 67.63 | 2.23 | 8.4 | 0.00 | 68.99 | 5.72 |
| Vetch | 37.47 | 37.47 | 100 | 1.3 | 21.7 | 0.00 | 108.48 | 7.585 | 7.59 | 100 | 1.77 | 25.1 | 0.00 | 21.97 | 4.94 |
| Horse Beans | 35.88 | 24.31 | 67.75 | 0.82 | 20.8 | 0.00 | 81.95 | 4.968 | 3.28 | 66 | 0.71 | 16.4 | 0.00 | 11.18 | 7.22 |
| Field peas | 5.52 | 5.52 | 100 | 0.48 | 3.2 | 0.00 | 15.98 | 2.07 | 2.07 | 100 | 0.48 | 6.8 | 0.00 | 5.99 | 2.67 |
| Chick peas | 93.92 | 68.1 | 72.5 | 2.11 | 54.4 | 0.00 | 222.97 | 15.61 | 12.75 | 81.69 | 2.41 | 51.6 | 0.00 | 39.77 | 6.02 |
| Oilseeds | 75.39 | 63.72 | 84.52 | 0.89 | 2.4 | 0.00 | 196.14 | 7.983 | 7.23 | 90.53 | 1.22 | 2.2 | 0.00 | 21.68 | 9.44 |
| Neug | 30.03 | 30.03 | 100 | 1.25 | 39.8 | 0.00 | 86.94 | 4.29 | 4.29 | 100 | 1.48 | 53.7 | 0.00 | 12.42 | 7.00 |
| Lin seed | 34.32 | 34.32 | 100 | 0.74 | 45.5 | 0.00 | 99.36 | 3.003 | 3 | 100 | 0.74 | 37.6 | 0.00 | 8.69 | 11.43 |
| Rape seed | 11.04 | 11.04 | 100 | 0.48 | 14.6 | 0.00 | 31.96 | 0.69 | 0.69 | 100 | 0.48 | 8.6 | 0.00 | 2.00 | 16.00 |
| Total | 3,207.95 | 1,781.67 | 55.54 | 9.49 | 100.0 | 0.00 | 6584.21 | 361.079 | 142.46 | 39.86 | 4.21 | 100.0 | 91.12 | 631.04 | 8.88 |

Table 3 C . Total Production and Cultivated Area by type of crops in the small towns stratum.

| Type of crops | Production in quintals | | | | | | | Cultivated Area in hectare | | | | | | | Yield (Qt./he.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 95% confidence interval | | | | | | | 95% confidence interval | | |
| | Esimate | Standard Error | CV % | Deff | % of Estimate | Lower limit | Upper limit | Esimate | Standard Error | CV % | Deff | % of Estimate | Lower limit | Upper limit | |
| Cereals | 7,980.48 | 1,851.92 | 23.21 | 3.65 | 83.0 | 4382.20 | 11578.76 | 1,049.08 | 364.1 | 34.71 | 10.16 | 83.7 | 341.64 | 1756.53 | 7.61 |
| Teff | 3,528.09 | 1,202.22 | 34.08 | 5.93 | 44.2 | 1192.18 | 5864.00 | 412.571 | 156.1 | 37.83 | 5.99 | 39.3 | 109.27 | 715.87 | 8.55 |
| Maize | 1,317.81 | 409.52 | 31.08 | 4.3 | 16.5 | 522.11 | 2113.51 | 175.387 | 77.66 | 44.28 | 4 | 16.7 | 24.49 | 326.28 | 7.51 |
| Barley | 1,085.52 | 834.69 | 76.89 | 10.54 | 13.6 | 0.00 | 2707.32 | 253.98 | 229.38 | 90.32 | 17.46 | 24.2 | 0.00 | 699.67 | 4.27 |
| Wheat | 1,974.66 | 942.21 | 47.72 | 3.26 | 24.7 | 143.95 | 3805.37 | 188.545 | 88.89 | 47.14 | 5.28 | 18.0 | 15.83 | 361.26 | 10.47 |
| Sorghum | 74.4 | 74.4 | 100 | 4.36 | 0.9 | 0.00 | 218.96 | 18.6 | 18.6 | 100 | 4.36 | 1.8 | 0.00 | 54.74 | 4.00 |
| Pulses | 1,472.43 | 777.57 | 52.81 | 5.94 | 15.3 | 0.00 | 2983.25 | 186.588 | 113.91 | 61.05 | 8.83 | 14.9 | 0.00 | 407.92 | 7.89 |
| Vetch | 931.99 | 558.02 | 59.87 | 6.69 | 63.3 | 0.00 | 2016.22 | 125.104 | 84.92 | 67.88 | 7.51 | 67.0 | 0.00 | 290.10 | 7.45 |
| Horse Beans | 193.25 | 104.26 | 53.95 | 1.46 | 13.1 | 0.00 | 395.83 | 18.471 | 11.02 | 59.65 | 1.66 | 9.9 | 0.00 | 39.88 | 10.46 |
| Field peas | 63.18 | 50.26 | 79.55 | 0.77 | 4.3 | 0.00 | 160.84 | 6.063 | 5.38 | 88.68 | 0.8 | 3.2 | 0.00 | 16.52 | 10.42 |
| Chick peas | 284.01 | 195.97 | 69 | 3.14 | 19.3 | 0.00 | 664.78 | 36.95 | 30.85 | 83.48 | 4.53 | 19.8 | 0.00 | 96.89 | 7.69 |
| Oilseeds | 159.96 | 92.14 | 57.6 | 1.45 | 1.7 | 0.00 | 338.99 | 18.041 | 10.52 | 58.29 | 1.5 | 1.4 | 0.00 | 38.48 | 8.87 |
| Neug | 72.6 | 72.6 | 100 | 1.62 | 45.4 | 0.00 | 213.66 | 7.26 | 7.26 | 100 | 1.68 | 40.2 | 0.00 | 21.37 | 10.00 |
| Lin seed | 74.4 | 74.4 | 100 | 2.16 | 46.5 | 0.00 | 218.96 | 9.3 | 9.3 | 100 | 2.16 | 51.5 | 0.00 | 27.37 | 8.00 |
| Rape seed | 12.96 | 10.95 | 84.5 | 1.22 | 8.1 | 0.00 | 34.24 | 1.48 | 1.44 | 97.11 | 0.69 | 8.2 | 0.00 | 4.28 | 8.76 |
| | | | | | | | 0.00 | | | | | | | | |
| Total | 9,612.87 | 2,370.95 | 24.66 | 4.25 | 100.0 | 5006.11 | 14219.63 | 1,253.71 | 405.84 | 32.37 | 9.01 | 100.0 | 465.16 | 2042.26 | 7.67 |

Table 4 A.Total area in hectare by type of land utilization in the zone.

| Type of land use | Estimate | Standard Error | CV % | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Temporary crops | 1,733.38 | 503.16 | 29.03 | 9.52 | 61.3 | 779.89 | 2686.87 |
| Cereals | 1,371.95 | 390.65 | 28.47 | 8.72 | 79.1 | 645.34 | 2098.56 |
| Pulses | 216.821 | 115.73 | 53.37 | 8.47 | 12.5 | 0.00 | 441.68 |
| Oilseeds | 26.024 | 12.76 | 49.03 | 1.34 | 1.5 | 3.11 | 48.94 |
| Vegitables | 118.589 | 100.77 | 84.97 | 10.41 | 6.8 | 0.00 | 314.39 |
| Permanent crops | 54.694 | 45.4 | 83 | 8.02 | 1.9 | 0.00 | 142.91 |
| Gesho | 54.283 | 45.4 | 83.7 | 8.03 | 99.2 | 0.00 | 142.50 |
| Cock | 0.062 | 0.06 | 100 | 0.81 | 0.1 | 0.00 | 0.18 |
| Chat | 0.349 | 0.25 | 70.84 | 0.91 | 0.6 | 0.00 | 0.79 |
| Fallow land | 294.533 | 194.24 | 65.95 | 20.79 | 10.4 | 0.00 | 671.94 |
| Grazing land | 101.477 | 63.29 | 62.37 | 0.52 | 3.6 | 0.00 | 221.41 |
| Wood land | 72.323 | 31.37 | 43.37 | 3.02 | 2.6 | 11.37 | 133.27 |
| Homestead & barn | 571.491 | 171.57 | 30.02 | 20.31 | 20.2 | 238.13 | 904.85 |
| Total | 2,827.90 | 678.41 | 28.75 | 13.65 | 100.0 | 1542.31 | 4113.49 |

Table 4 B.Total area in hectare by type of land utilization in the large towns stratum.

| Type of land use | Estimate | Standard Error | CV % | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Temporary crops | 362.131 | 142.34 | 39.31 | 3.84 | 62.5 | 92.40 | 631.87 |
| Cereals | 322.863 | 141.54 | 43.84 | 4.62 | 89.2 | 54.64 | 591.08 |
| Pulses | 30.233 | 20.45 | 67.63 | 2.05 | 8.3 | 0.00 | 68.99 |
| Oilseeds | 7.983 | 7.23 | 90.53 | 1.12 | 2.2 | 0.00 | 21.68 |
| Vegitables | 1.052 | 0.73 | 69.57 | 0.45 | 0.3 | 0.00 | 2.44 |
| Permanent crops | 0.702 | 0.46 | 65.14 | 0.98 | 0.1 | 0.00 | 1.57 |
| Gesho | 0.517 | 0.31 | 58.97 | 0.85 | 73.6 | 0.00 | 1.10 |
| Cock | - | - | - | - | - | - | - |
| Chat | 0.185 | 0.18 | 100 | 0.98 | 26.4 | 0.00 | 0.53 |
| Fallow land | 4.011 | 2.39 | 59.47 | 1.12 | 0.7 | 0.00 | 8.54 |
| Grazing land | 96.327 | 63.19 | 65.59 | 0.63 | 16.6 | 0.00 | 216.07 |
| Wood land | 1.976 | 1.36 | 68.62 | 0.41 | 0.3 | 0.00 | 4.55 |
| Homestead & barn | 114.368 | 23.16 | 20.25 | 4.54 | 19.7 | 70.48 | 158.26 |
| Total | 579.515 | 156.12 | 32.72 | 4.39 | 100.0 | 283.67 | 875.36 |

Table 4 C.Total area in hectare by type of land utilization in the small towns

| Type of land use | Estimate | Standard Error | CV % | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Temporary crops | 1,371.25 | 482.6 | 35.19 | 10.39 | 61.0 | 433.56 | 2308.94 |
| Cereals | 1,049.08 | 364.1 | 34.71 | 9.61 | 76.5 | 341.64 | 1756.53 |
| Pulses | 186.588 | 113.91 | 61.05 | 8.35 | 13.6 | 0.00 | 407.92 |
| Oilseeds | 18.041 | 10.52 | 58.29 | 1.42 | 1.3 | 0.00 | 38.48 |
| Vegitables | 117.537 | 100.77 | 85.73 | 8.9 | 8.6 | 0.00 | 313.33 |
| Permanent crops | 53.992 | 45.39 | 84.08 | 6.81 | 2.4 | 0.00 | 142.18 |
| Gesho | 53.766 | 45.43 | 84.5 | 6.83 | 99.6 | 0.00 | 142.04 |
| Cock | 0.062 | 0.06 | 100 | 0.67 | 0.1 | 0.00 | 0.18 |
| Chat | 0.164 | 0.16 | 100 | 0.89 | 0.3 | 0.00 | 0.47 |
| Fallow land | 290.522 | 194.23 | 66.86 | 18.98 | 12.9 | 0.00 | 667.91 |
| Grazing land | 5.15 | 3.6 | 69.94 | 0.76 | 0.2 | 0.00 | 12.14 |
| Wood land | 70.347 | 31.34 | 44.55 | 2.62 | 3.1 | 9.45 | 131.24 |
| Homestead & barn | 457.123 | 170 | 37.19 | 21.41 | 20.3 | 126.81 | 787.43 |
| Total | 2,248.38 | 660.2 | 35.07 | 15.16 | 100.0 | 965.62 | 3531.15 |

Table 5 A. Total area by type of applied agricultural inputs in hectare in the zone.

| Type of inputs | Estimate | Standard Error | CV% | Deff | 95% confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| Chemical fertilizer | 1,017.72 | 286.85 | 28.19 | 5.11 | 497.94 | 1537.49 |
| Irrigation | 169.457 | 114.21 | 67.4 | 3.72 | 0.00 | 385.88 |
| Improved seed | 1,603.30 | 492.69 | 30.73 | 10.38 | 646.00 | 2560.59 |
| Local seed | 184.617 | 82.63 | 44.76 | 2.77 | 38.28 | 330.95 |
| Pesticide | 221.7 | 122.03 | 55.04 | 3.85 | 4.24 | 439.16 |

Table 5 B. Total area by type of applied agricultural inputs in hectare in the large towns stratum.

| Type of inputs | Estimate | Standard Error | CV% | Deff | 95% confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| Chemical fertilizer | 332.218 | 146.25 | 44.02 | 3.49 | 55.07 | 609.36 |
| Irrigation | 39.052 | 31.03 | 79.46 | 1.74 | 0.00 | 97.85 |
| Improved seed | 298.298 | 89.55 | 30.02 | 1.65 | 128.60 | 468.00 |
| Local seed | 64.535 | 61.44 | 95.21 | 3.76 | 0.00 | 180.96 |
| Pesticide | 116.275 | 98.06 | 84.33 | 3.83 | 0.00 | 302.10 |

Table 5 C. Total area by type of applied agricultural inputs in hectare in small towns stratum.

| Type of inputs | Estimate | Standard Error | CV% | Deff | 95% confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| Chemical fertilizer | 685.498 | 246.77 | 36 | 5.49 | 206.02 | 1164.97 |
| Irrigation | 130.405 | 109.91 | 84.29 | 4.05 | 0.00 | 343.96 |
| Improved seed | 1,304.99 | 484.49 | 37.13 | 11.48 | 363.63 | 2246.35 |
| Local seed | 120.082 | 55.26 | 46.01 | 2.03 | 12.71 | 227.45 |
| Pesticide | 105.425 | 72.64 | 68.9 | 3.73 | 0.00 | 246.56 |

Table 6 A. Area of total land in hectare by tenure in the zone.

| Type of Possession | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Land owned | 2,455.23 | 806.98 | 32.87 | 14.18 | 86.8 | 887.27 | 4023.19 |
| Land rented | 373.046 | 151.12 | 40.51 | 3.54 | 13.2 | 96.04 | 650.05 |
| Total | 2,828.28 | 678.41 | 28.75 | 13.65 | 100 | 1542.31 | 4113.49 |

Table 6 B. Area of total land in hectare by tenure in the large towns stratun.

| Type of Possession | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Land owned | 392.54 | 69.32 | 17.66 | 0.38 | 67.7 | 261.18 | 523.90 |
| Land rented | 187.355 | 140.54 | 75.01 | 5.8 | 32.3 | 0.00 | 453.68 |
| Total | 579.90 | 156.12 | 32.72 | 4.39 | 100 | 284.05 | 875.74 |

Table 6 C. Area of total land in hectare by tenure in the small towns stratum.

| Type of Possession | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Land owned | 2,062.69 | 804 | 38.98 | 17.32 | 91.7 | 500.52 | 3624.86 |
| Land rented | 185.691 | 55.54 | 29.91 | 0.96 | 8.3 | 77.78 | 293.61 |
| Total | 2,248.38 | 660.2 | 35.07 | 15.16 | 100 | 965.61 | 3531.15 |

Table 7 A.Number of domestic animals by type of species in the zone.

| Type of animals | Estimate | Standar error | CV% | Deff | % of Estimate | 95% Confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Livestock | | | | | | | |
| Cattle | 13,724 | 881 | 6.42 | 0.65 | 50.9 | 12,164 | 15,284 |
| Sheep | 11,168 | 1,732 | 15.5 | 4.5 | 41.4 | 8,082 | 14,254 |
| Goats | 737 | 287 | 38.94 | 1.64 | 2.7 | 222 | 1,252 |
| Equins | 1,347 | 309 | 22.93 | 1.69 | 5.0 | 792 | 1,902 |
| Chickens | 15,193 | 4,948 | 32.57 | 16.6 | 100.0 | 6,227 | 24,159 |
| Beehives | 756 | 402 | 53.12 | 1.85 | 100.0 | 0 | 1,518 |

Table 7 B.Number of domestic animals by type of species in the large towns stratum.

| Type of animals | Estimate | Standar error | CV% | Deff | % of Estimate | 95% Confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Livestock | | | | | | | |
| Cattle | 5,600 | 623 | 11.13 | 0.49 | 50.1 | 4419 | 6781 |
| Sheep | 4,298 | 1,132 | 26.34 | 4.87 | 38.5 | 2153 | 6443 |
| Goats | 506 | 250 | 49.38 | 1.84 | 4.5 | 32 | 980 |
| Equins | 779 | 268 | 34.45 | 1.73 | 7.0 | 271 | 1287 |
| Chickens | 8,184 | 4,382 | 53.55 | 18.75 | 100.0 | 0 | 16488 |
| Beehives | 172 | 96 | 55.98 | 0.96 | 100.0 | 0 | 354 |

Table 7 C.Number of domestic animals by type of species in the small towns stratum.

| Type of animals | Estimate | Standar error | CV% | Deff | % of Estimate | 95% Confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Livestock | | | | | | | |
| Cattle | 8,124 | 622 | 7.66 | 0.63 | 51.4 | 6915 | 9303 |
| Sheep | 6,870 | 1310 | 19.07 | 3.12 | 43.5 | 4325 | 9352 |
| Goats | 231 | 141 | 61.15 | 1.19 | 1.5 | 0 | 498 |
| Equins | 568 | 153 | 26.89 | 1.38 | 3.6 | 271 | 858 |
| Chickens | 7,009 | 2,298 | 32.79 | 7.19 | 100.0 | 2544 | 11364 |
| Beehives | 584 | 390 | 66.77 | 1.95 | 100.0 | 0 | 1323 |

Table 8 A. Number of holders raising livestock,Chickens and beehives in the zone.

| Type of animals | Estimate | Standard Error | CV% | Deff | 95% Confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| Cattle | 3,187 | 337 | 10.58 | 4.8 | 2,569 | 3,805 |
| Sheep | 2,808 | 585 | 20.81 | 14.55 | 1,772 | 3,844 |
| Goat | 199 | 89 | 44.8 | 2.7 | 36 | 362 |
| Equins | 616 | 137 | 22.23 | 2.21 | 373 | 859 |
| Chickens | 2,693 | 667 | 24.76 | 19.09 | 1,504 | 3,882 |
| Beehives | 153 | 50 | 32.63 | 1.09 | 64 | 242 |

Table 8 B. Number of holders raising livestock, Chickens and beehives in the large towns stratum.

| Type of animals | Estimate | Standard Error | CV% | Deff | 95% Confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| Cattle | 1,280 | 148 | 11.6 | 1.42 | 1000 | 1560 |
| Sheep | 1,269 | 455 | 35.84 | 13.39 | 407 | 2131 |
| Goat | 139 | 84 | 60.61 | 3.41 | 0 | 298 |
| Equins | 292 | 104 | 35.68 | 2.55 | 95 | 489 |
| Chickens | 1,378 | 540 | 39.21 | 17.8 | 355 | 2401 |
| Beehives | 64 | 34 | 52.37 | 1.16 | 0 | 128 |

Table 8 C. Number of holders raising livestock, Chickens and beehives in the small towns stratum.

| Type of animals | Estimate | Standard Error | CV% | Deff | 95% Confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| Cattle | 1,907 | 303 | 15.87 | 4.53 | 1318 | 2496 |
| Sheep | 1,539 | 367 | 23.85 | 7.61 | 826 | 2252 |
| Goat | 60 | 30 | 49.21 | 0.96 | 2 | 118 |
| Equins | 324 | 89 | 27.43 | 1.68 | 151 | 497 |
| Chickens | 1,315 | 391 | 29.7 | 9.62 | 555 | 2075 |
| Beehives | 89 | 37 | 41.59 | 1.02 | 17 | 161 |

Table 9 A. Number of holders by educational status and type of raising livestock in the zone.

| Type of Livestock | Litrate | | | | | | | Illitrate | | | | | | | Total holder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | Standard Error | CV% | Deff | % of Estimate | 95% confidence interval | | Estimate | Standard Error | CV% | Deff | % of Estimate | 95% confidence interval | | |
| | | | | | | Lower limit | Upper limit | | | | | | Lower limit | Upper limit | |
| Cattle | 2363 | 311 | 13.16 | 4.32 | 74.1 | 1793 | 2933 | 824 | 110 | 13.31 | 1.1 | 25.9 | 629 | 1019 | 3187 |
| Sheep | 2093 | 468 | 22.35 | 10.32 | 74.5 | 1264 | 2922 | 716 | 161 | 22.48 | 2.67 | 25.5 | 429 | 1003 | 2809 |
| Goat | 144 | 65 | 44.63 | 1.93 | 72.4 | 27 | 261 | 55 | 33 | 60.83 | 1.34 | 27.6 | 0 | 115 | 199 |
| Equins | 426 | 116 | 27.34 | 2.23 | 69.2 | 216 | 636 | 190 | 78 | 40.95 | 2.15 | 30.8 | 52 | 328 | 616 |
| Poultry | 2181 | 546 | 25.04 | 13.78 | 81.0 | 1214 | 3148 | 513 | 161 | 31.4 | 3.6 | 19.0 | 226 | 800 | 2694 |
| Beehives | 102 | 42 | 40.92 | 1.14 | 66.7 | 27 | 177 | 51 | 37 | 73.32 | 1.81 | 33.3 | 0 | 123 | 153 |

Table 9 B. Number of holders by educational status and type of raising livestock in the large towns stratum.

| Type of Livestock | Litrate | | | | | | | Illitrate | | | | | | | Total Holder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | Standard Error | CV% | Deff | % of Estimate | 95% confidence interval | | Estimate | Standard Error | CV % | Deff | % of Estimate | 95% confidence interval | | |
| | | | | | | Lower limit | Upper limit | | | | | | Lower limit | Upper limit | |
| Cattle | 1003 | 138 | 13.77 | 1.48 | 78.4 | 741 | 1265 | 277 | 53 | 18.95 | 0.63 | 21.6 | 177 | 377 | 1280 |
| Sheep | 985 | 341 | 34.65 | 9.19 | 77.6 | 339 | 1631 | 284 | 135 | 47.49 | 4.38 | 22.4 | 28 | 540 | 1269 |
| Goat | 98 | 57 | 58.19 | 2.2 | 70.5 | 0 | 206 | 41 | 30 | 74.1 | 1.47 | 29.5 | 0 | 98 | 139 |
| Equins | 179 | 60 | 33.29 | 1.34 | 61.3 | 65 | 293 | 113 | 54 | 47.77 | 1.72 | 38.7 | 11 | 215 | 292 |
| Poultry | 1077 | 414 | 38.5 | 12.61 | 78.1 | 292 | 1862 | 302 | 132 | 43.82 | 3.98 | 21.9 | 52 | 552 | 1379 |
| Beehives | 64 | 34 | 52.37 | 1.16 | 100.0 | 0 | 128 | - | - | - | | - | - | - | 64 |

Table 9 C. Number of holders by educational status and type of raising livestock in the small towns stratum.

| Type of Livestock | Litrate | | | | | | | Illitrate | | | | | | | Total holder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | Standard Error | CV% | Deff | % of Estimate | 95% confidence interval | | Estimate | Standard Error | CV % | Deff | % of Estimate | 95% confidence interval | | |
| | | | | | | Lower limit | Upper limit | | | | | | Lower limit | Upper limit | |
| Cattle | 1360 | 279 | 20.48 | 4.77 | 71.3 | 818 | 1902 | 547 | 96 | 17.6 | 1.21 | 28.7 | 360 | 734 | 1907 |
| Sheep | 1108 | 320 | 28.87 | 7.35 | 71.9 | 486 | 1730 | 432 | 88 | 20.33 | 1.25 | 28.1 | 261 | 603 | 1540 |
| Goat | 46 | 30 | 64.73 | 1.28 | 76.7 | 0 | 104 | 14 | 14 | 100 | 0.91 | 23.3 | 0 | 41 | 60 |
| Equins | 247 | 100 | 40.53 | 2.76 | 76.2 | 53 | 441 | 77 | 56 | 72.7 | 2.71 | 23.8 | 0 | 186 | 324 |
| Poultry | 1104 | 355 | 32.19 | 9.09 | 84.0 | 414 | 1794 | 211 | 92 | 43.55 | 2.71 | 16.0 | 32 | 390 | 1315 |
| Beehives | 38 | 25 | 65.45 | 1.07 | 42.7 | 0 | 87 | 51 | 37 | 73.32 | 1.81 | 57.3 | 0 | 123 | 89 |

Table 10 A. Number of holders by type of primary working status in the zone.

| Working status | Estimate | Standard Error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Fully engaged in Agriculture | 1742 | 470 | 26.99 | 11.54 | 28.2 | 868 | 2616 |
| Trade(formal or informal) | 2023 | 355 | 17.52 | 6.03 | 32.7 | 1394 | 2652 |
| Governmental and Non gover.employ | 1516 | 394 | 25.96 | 8.84 | 24.5 | 808 | 2224 |
| Others | 905 | 341 | 37.65 | 9.81 | 14.6 | 271 | 1539 |
| Total | 6186 | 787 | 12.72 | 10.83 | 100.0 | 4722 | 7650 |

Table 10 B. Number of holders by type of primary working status in the large towns stratum.

| Working status | Estimate | Standard Error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Fully engaged in Agriculture | 511 | 185 | 36.14 | 4.75 | 18.9 | 160 | 862 |
| Trade(formal or informal) | 940 | 246 | 26.14 | 4.95 | 34.8 | 474 | 1406 |
| Governmental and Non gover.employ | 818 | 227 | 27.69 | 4.72 | 30.3 | 388 | 1248 |
| Others | 435 | 128 | 29.39 | 2.64 | 16.1 | 192 | 678 |
| Total | 2704 | 403 | 14.90 | 3.78 | 100.0 | 1940 | 3468 |

Table 10 C. Number of holders by type of primary working status in the small towns stratum.

| Working status | Estimate | Standard Error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Fully engaged in Agriculture | 1231 | 433 | 35.13 | 12.39 | 35.4 | 390 | 2072 |
| Trade(formal or informal) | 1083 | 256 | 23.59 | 4.77 | 31.1 | 586 | 1580 |
| Governmental and Non gover.employ | 698 | 322 | 46.09 | 10.92 | 20.0 | 72 | 1324 |
| Others | 470 | 316 | 67.2 | 14.99 | 13.5 | 0 | 1084 |
| Total | 3482 | 676 | 19.41 | 10.15 | 100.0 | 2169 | 4795 |

Table 11 A. Number of agricultural holders by type of usage of agricultural production in the zone.

| Usage of agricultural production | Estimate | Standard error | CV% | Deff | % of estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Upper limit | Lower limit |
| Totally for consumption | 4484 | 984 | 21.95 | 51.25 | 72.5 | 2717 | 6251 |
| Totally for sale | 115 | 50 | 43.68 | 1.46 | 1.9 | 20 | 210 |
| partially for sale and consumption | 1588 | 255 | 16.05 | 3.6 | 25.7 | 1114 | 2062 |
| Total | 6187 | 787 | 12.72 | 10.83 | 100.0 | 4723 | 7651 |

Table 11 B. Number of agricultural holders by type of usage of agricultural production in the large towns stratum.

| Usage of agricultural production | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Upper limit | Lower limit |
| Totally for consumption | 2202 | 551 | 25.02 | 13.98 | 81.4 | 1158 | 3246 |
| Totally for sale | 18 | 13 | 71.53 | 0.6 | 0.7 | 0 | 43 |
| partially for sale and consumption | 484 | 95 | 19.64 | 1.32 | 17.9 | 304 | 664 |
| Total | 2704 | 403 | 14.90 | 3.78 | 100.0 | 1940 | 3468 |

Table 11 C. Number of agricultural holders by type of usage of agricultural production in the small towns stratum.

| Usage of agricultural production | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Upper limit | Lower limit |
| Totally for consumption | 2282 | 816 | 35.74 | 30.15 | 65.5 | 697 | 3867 |
| Totally for sale | 97 | 49 | 50.01 | 1.61 | 2.8 | 2 | 192 |
| partially for sale and consumption | 1104 | 237 | 21.43 | 4.03 | 31.7 | 644 | 1564 |
| Total | 3483 | 676 | 19.41 | 10.15 | 100.0 | 2170 | 4796 |

Table 12 A. Annual income and expenditure from agricultural production/ for agricultural activities in birr ( 1$=8.2) in the zone.

| Items | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Total receipts | 931,026 | 305,906 | 32.86 | 1.55 | 100.0 | 389,266 | 1,472,786 |
| Livestock | 358,479 | 121,390 | 33.86 | 1.7 | 38.5 | 142,162 | 574,796 |
| Milk/Butter | 249,963 | 141,384 | 56.56 | 0.94 | 26.8 | 0 | 517,886 |
| Eggs | 32,021 | 10,345 | 32.31 | 1.11 | 3.4 | 13,441 | 50,601 |
| Crops | 175,460 | 82,970 | 47.29 | 5.79 | 18.8 | 14,249 | 336,671 |
| Miscellaneous | 115,103 | 62,370 | 54.19 | 1.03 | 12.4 | 3,086 | 227,120 |
| Total expenditure | 2,561,453 | 548,325 | 21.41 | 3.02 | 100.0 | 1,576,661 | 3,546,245 |
| Livestock | 818,564 | 247,024 | 30.18 | 2.49 | 32.0 | 365,769 | 1,271,359 |
| wage for labour | 440,188 | 126,724 | 28.79 | 1.08 | 17.2 | 207,903 | 672,473 |
| Animal feeding | 584,867 | 97,145 | 16.16 | 3.77 | 22.8 | 411,755 | 757,979 |
| Fertilizer | 392,631 | 110,571 | 28.16 | 5.47 | 15.3 | 196,810 | 588,452 |
| Seed | 110,042 | 43,330 | 39.38 | 4.33 | 4.3 | 33,738 | 186,346 |
| Miscellaneous | 215,161 | 140,292 | 65.2 | 3.97 | 8.4 | 0 | 487,748 |

Table 12 B. Annual income and expenditure from agricultural production/ for agricultural activities in birr ( 1$=8.2) in the large towns stratum.

| Items | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Total receipts | 413,676 | 232,925 | 56.31 | 0.97 | 100.0 | 0 | 855,069 |
| Livestock | 151,015 | 100,515 | 66.56 | 1.29 | 36.5 | 0 | 341,491 |
| Milk/Butter | 193,704 | 139,904 | 72.23 | 0.93 | 46.8 | 0 | 458,822 |
| Eggs | 12,057 | 6,106 | 50.64 | 0.49 | 2.9 | 486 | 23,628 |
| Crops | 19,858 | 8,707 | 43.85 | 0.86 | 4.8 | 3,358 | 36,358 |
| Miscellaneous | 37,042 | 36,290 | 97.97 | 0.7 | 9.0 | 0 | 105,812 |
| Total expenditure | 1,261,408 | 470,460 | 37.3 | 2.46 | 100.0 | 369,886 | 2,152,930 |
| Livestock | 491,643 | 232,136 | 47.22 | 2.43 | 39.0 | 51,745 | 931,541 |
| wage for labour | 258,156 | 116,267 | 45.04 | 0.93 | 20.5 | 37,830 | 478,482 |
| Animal feeding | 344,894 | 80,706 | 23.4 | 3.58 | 27.3 | 191,956 | 497,832 |
| Fertilizer | 115,388 | 75,186 | 65.16 | 8.26 | 9.1 | 0 | 257,865 |
| Seed | 40,889 | 34,749 | 84.98 | 5.33 | 3.2 | 0 | 106,738 |
| Miscellaneous | 10,438 | 6,010 | 57.58 | 1.28 | 0.8 | 0 | 21,827 |

Table 12 C. Annual income and expenditure from agricultural production/ for agricultural activities in birr ( 1$=8.2) in the small towns stratum.

| Items | Estimate | Standard error | CV% | Deff | % of Estimate | 95% confidence interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower limit | Upper limit |
| Total receipts | 517,350 | 198,303 | 38.33 | 6.84 | 100.0 | 132,047 | 902,653 |
| Livestock | 207,464 | 68,061 | 32.81 | 4.64 | 40.1 | 75,221 | 339,707 |
| Milk/Butter | 56,259 | 20,406 | 36.27 | 2.72 | 10.9 | 16,610 | 95,908 |
| Eggs | 19,964 | 8,351 | 41.83 | 3.15 | 3.9 | 3,738 | 36,190 |
| Crops | 155,602 | 82,512 | 53.03 | 6.11 | 30.1 | 0 | 315,923 |
| Miscellaneous | 78,061 | 50,724 | 64.98 | 1.33 | 15.1 | 0 | 176,618 |
| Total expenditure | 1,300,045 | 281,652 | 21.66 | 4.59 | 100.0 | 752,795 | 1,847,295 |
| Livestock | 326,921 | 84,461 | 25.84 | 2.29 | 25.1 | 162,813 | 491,029 |
| wage for labour | 182,032 | 50,409 | 27.69 | 4.48 | 14.0 | 84,087 | 279,977 |
| Animal feeding | 239,973 | 54,071 | 22.53 | 2.73 | 18.5 | 134,913 | 345,033 |
| Fertilizer | 277,243 | 81,075 | 29.24 | 3.83 | 21.3 | 119,714 | 434,772 |
| Seed | 69,153 | 25,883 | 37.43 | 3.04 | 5.3 | 18,862 | 119,444 |
| Miscellaneous | 204,723 | 140,163 | 68.46 | 3.98 | 15.7 | 0 | 477,060 |

# ANNEX II

## LIST OF TOWNS AND SURVEY QUESTIONNAIRES

Name of towns in stratum one

| Name | Number of enumeration areas | Number of agricultural households |
|---|---|---|
| Debre Markos | 48 | 1210 |
| Bichena | 15 | 1235 |
| Dejen | 12 | 271 |
| Mota | 25 | 348 |
| Total | 100 | 3064 |

Name of towns in stratum two

| Name | Number of enumeration areas | Number of agricultural households |
|---|---|---|
| Digotsion | 1 | 259 |
| Weyinwuha | 1 | 9 |
| Keranyo | 2 | 44 |
| Sedie | 2 | 77 |
| Gidwoyin | 6 | 115 |
| Merto Lemariam | 10 | 162 |
| Dibo | 2 | 132 |
| Felegebirhan | 3 | 41 |
| Debrework | 11 | 280 |
| Yetmen | 3 | 121 |
| Kuyi | 3 | 124 |
| Rebugebiya | 3 | 26 |
| Amanuel | 11 | 245 |
| Yejube | 4 | 162 |
| Yebokila | 2 | 69 |
| Chemoga | 1 | 19 |
| Amber | 2 | 141 |
| Liga | 1 | 27 |
| Wejel | 3 | 94 |
| Lumame | 8 | 110 |
| Yeduha | 2 | 55 |
| Elyas | 6 | 194 |
| Total | 86 | 2506 |

# LISTING FORM OF HOUSEHOLDS

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| STRATUM | WEREDA | Name of town | Kefitegna | KEBELE | E.A |
| | | | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

| 7 | | | 8 | 9 | | 10 | 11 | | 12 | 13 | 14 | | | | | | 15 | | | | | | | | | | | | | | 16 | | | | 17 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SERIAL NUMBER OF HOUSEHOLD | | | NAME OF HEAD OF HOUSEHOLD | NO. OF MEMBER OF HOUSE-HOLD | | IS THERE A HOLDER IN THE HH.? YES = 1 NO = 2 | SERIAL NUMBER OF HOLDERS WITHIN THE HOUSEHOLD *(IF CODE 1 IN COLUMN 10)* | | NAME OF THE HOLDER | TYPE OF HOLDING CROP ONLY=1 LIVSTOCK ONLY =2 BOTH=3 | TOTAL CULTIVATED LAND IN HEC. | | | | | TOTAL NUMBER OF LIVESTOCK | | | | | | | | | | | | | | SERIAL NUMBER OF HOUSEHOLDS WITH HOLDERS *with out restriction of size of holding* | | | | ORDER OF SELE-CTION (CSA cut off Value) | |
| | | | | | | | | | | | | | | | | | Cattel | | Sheep | | Goats | | Equines | | Chickens | | Total | | Beehives | | | | | | | |
| 12 | 13 | 14 | | 15 | 16 | | 17 | 18 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |
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# PART -1 IDENTIFICATION, DEMOGRAPHIC CHARACTERISTIC AND OTHERS (form-2)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STRATUM | WEREDA | KEFTEGAN | TOWN | KEBELE | ENUMERATION AREA | HOUSEHOLD ID. NUMBER | HOLDER'S NAME | HOLDER'S ID. NUMBER | SEX MALE =1 FEMALE=2 | AGE | EDU.ATTAINMENT ILLITERATE =1 INFORMAL EDUCA.=2 GRADE 1-6 =3 GRADE 7-12 =4 CERTIFICATE,DIPLOMA , DEGREE OR ABOVE=5 |
| | | | | | | | | | | | |
| 1 | 2 3 | 4 5 | 6 7 | 8 9 | 10 11 | 12 13 14 | | 15 | 16 | 17 18 | 19 |
| | | | | | | | | | | | |

CONTINUED

| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|
| TYPE OF HOLDING CROP ONLY =1 LIVESTOCK ONLY =2 CROP AND LIVESTOCK =3 | TYPE OF THE MAIN WORKING STATUS ENGAGE IN AGRICULTURE =1 ENGAGE IN TRADE(FORMAL OR INFORMAL) =2 ENGAGE IN GOVTAL & NON-GOVTAL=3 OTHERS (SPECIF) =4 | USAGE OF AGRICULTURAL PRODUCTION TOTALLY FOR HOME CONSUMPTION =1 FOR HOME CONSUMPTION AND SALE =2 FOR SALE=3 | WITHIN THE LAST ONE YEAR(JANUARY 10,1999 TO JANUARY 9,2000) IF COLUMN 14 IS CODE 2 OR 3 HOW MUCH DO YOU GET FROM THE FOLLOWING AGRICULTURAL PRODUCTS | | | WITHIN THE LAST ONE YEAR(JANUARY 10,1999 TO JANUARY 9,2000) HOW MUCH IS YOUR EXPENDITURE FOR THE FOLLOWING AGRICULTURAL ACTIVITIES | | |
| 20 | 21 | 22 | TYPE OF RECEIPTS | CODE 23 | BIRR 24 25 26 27 | TYPE OF EXPENDITURE | CODE 28 | BIRR 29 30 31 32 |
| | | | FROM SALE OF LIVESTOCK | 1 | | FOR BUYING LIVESTOCK | 1 | |
| | | | FROM SALE OF MILK/BUTTER | 2 | | FOR WAGES | 2 | |
| | | | FROM SALE OF EGGS | 3 | | FOR ANIMAL FEEDING | 3 | |
| | | | FROM SALE OF CROPS | 4 | | FOR BUYING FERTILIZER | 4 | |
| | | | FROM SALE OF OTHERS (SPECIFY) | 5 | | FOR BUYING SEEDS | 5 | |
| | | | TOTAL | 6 | | FOR BUYING OTHERS(SPECIFY | 6 | |
| | | | | | | TOTAL | 7 | |

## PART-3 NUMBER OF LIVESTOCK BY TYPE AND SEX

FORM-4

| 1 | | 2 | 3 | | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| SR. No. | | TYPE OF LIVESTOCK | CODE | | TOTAL LIVESTOCK TOTAL | | |
| 1 | 2 | | 3 | 4 | 5 | 6 | 7 |
| 0 | 1 | CATTLE | 0 | 1 | | | |
| 0 | 2 | SHEEP | 0 | 2 | | | |
| 0 | 3 | GOATS | 0 | 3 | | | |
| 0 | 4 | ASSES | 0 | 4 | | | |
| 0 | 5 | HORSES | 0 | 5 | | | |
| 0 | 6 | MULES | 0 | 6 | | | |
| 0 | 7 | CHICKENS | 0 | 7 | | | |
| 0 | 8 | CHICKS | 0 | 8 | | | |
| 0 | 9 | BEEHIVES WITH BEES COLONY | 0 | 9 | | | |