STUDIES ON CATTLE MILK AND MEAT PRODUCTION IN FOGERA WOREDA: PRODUCTION SYSTEMS, CONSTRAINTS AND OPPORTUNITIES FOR DEVELOPMENT

M.Sc.THESIS

BELETE ANTENEH TARIKU

DEBUB UNIVERSITY, AWASSA, ETHIOPIA

APRIL 15, 2006

STUDIES ON CATTLE MILK AND MEAT PRODUCTION IN FOGERA WOREDA: PRODUCTION SYSTEMS, CONSTRAINTS AND OPPORTUNITIES FOR DEVELOPMENT

BELETE ANTENEH TARIKU

A THESIS SUBMITTED TO THE DEPARTMENT OF ANIMAL AND RANGE SCIENCES, AWASSA COLLEGE OF AGRICULTURE, SCHOOL OF GRADUATE STUDIES

DEBUB UNIVERSITY

AWASSA, ETHIOPIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

ANIMAL AND RANGE SCIENCES
(SPECIALIZATION: DAIRY SCIENCES)

APRIL 15, 2006

APPROVAL SHEET 1

This is to certify that the thesis entitled "Studies on Cattle Milk and Meat Production in Fogera Woreda: Production Systems, Constraints and Opportunities for Development" submitted in partial fulfillment of the requirements for the degree of Master of Science in Animal and Range sciences with a Specialization of Dairy Science of the Graduate Program of the Department of Animal and Range sciences, Awassa College of Agriculture, and is a record of original research carried out by Belete Anteheh Tariku I.D.No AWR/2268/96,under my supervision, and no part of the thesis has been submitted for any other degree or diploma.

The assistance and the help received during the course of this investigation has been duly acknowledged. Therefore, I recommended that it will be accepted as fulfilling the thesis requirements.

_____	_____	_____
Name of main advisor	signature	Date
_____	_____	_____
Name of main Co-advisor	signature	Date

MSc Thesis Evaluation Sheet

We, the undersigned, members on the Board of Examiners of _____have read and evaluated_____ and examined the candidate. This is therefore to certify that the thesis has been for the degree_____

_____

_____	_____	_____
Name of Chair Person	Date	Signature
_____	_____	_____
Name of Main Advisor	Date	Signature
_____	_____	_____
Name of Internal Examiner	Date	Signature
_____	_____	_____
Name of External Examiner	Date	Signature

ACKNOWLEDGEMENT

First of all, I would like to pass my great indebtedness to those individuals and institution that were involved directly or indirectly in this work so that my study came to success.

My first earnest appreciation goes to my research advisors, Dr. Fekadu Beyene, Dr. Azage Tegegne and Dr.Birhanu Gebremedihin for spending their precious time to give genuine and regular advice, and to correct this manuscript from the very beginning to very end. I am also grateful for ILRI's information center in the searching and the provision of the requested publications and reference materials during the preparation of this thesis that enabled me to complete the write up timely.

I would like to extend my thanks to ILRI-IPMS (Improving Productivity and Market Success) Project for financing my study through the IPMS-Fogera Pilot Learning Site (PLS), without which this work would not have been possible. My thanks to IPMS Fogera staff Ato Yirgalem Assegid and Teshome Derso in timely adjusting my financial requests and arranging the vehicle and the computer for my study works. I am especially thankful to Muluhiwot Getachew in her immediate facilitations to my financial requests and transferring the working budgets on the right time. I also thank all the staff members of the Fogera woreda agricultural and rural office in a day-to-day encouragement during my study. I especially thank the enumerators and data collectors

and the staff members Ashage Abate, Melese Damite, Solomo Hagos, Ayenew Guadie and Habte W/Silassie who were giving me transport services to the surveyed kebeles.

I am also thankful to Dr. Eshte Dejene in finding and creating links with the sponsor NGO for my study. I am thankful to Ato Abebaw Getachew and Zemen Ayalew for their kind cooperation starting from shaping up of the data to data analysis by taking their precious time.

My deepest gratitude to goes to all my elder and younger brothers and sisters and all my colleagues who offered me comprehensive moral support and treatment that enabled me succeed though out my academic life. I owe them more than a mere expression of thanks

Above all, I praise the Almighty God for giving me the courage and strength in my life.

DEDICATION

To my wife W/zo Desta Zeleke Hibistu for her strength and kindness and my lovely daughter Kidist Belete

ABBREVIATIONS

AI = Artificial Insemination

BOFED = Bureau of Finance and Economic Development

CBPP = Contagious Bovine PleuroPneumonia

CI = Confidence Interval

CL =Crop land

CSA = Central Statistics Authority

DA = Development Agent

DDE =Dairy Development Enterprise

E.C. =Ethiopian Calendar

EARO =Ethiopian Agricultural Research Organization

EB =Ethiopian Birr

EOCCFA =Ethiopian Orthodox Church Children Care and Family Affairs

ESAP =Ethiopian Society of Animal Production

FAO = Food and Agricultural Organization

FAOSTAT = Food and Agricultural Organization Statistics

FLDP =Fourth Livestock Development Project

FMD =Foot and Mouth Disease

FWARDO =Fogera Woreda Agricultural and Rural Development Office

GDP =Gross Domestic Product

GIT =Gastro Intestinal Tract

HH =Household hold

IAR =Institute of Agricultural Research

IDRC =International Development Research Center

ILRI =International Livestock Research Institute

Kg =kilogram

KM =Kilometer

MOA =Ministry of Agriculture

MODP =Market Oriented Dairy Production

NAIC =National Artificial Insemination Center

NGO =Non Governmetal Organization

PA =Peasant Association

PL =Pasture land

RGDP =Regional Gross Domestic Product

SAERP =Sustainable Agricultural and Environmental Rehabilitation Program

SDDP =Smallholder Dairy Development Project

S.E. =Standard Error

SPSS =Statistical Package for Social Sciences

TLU =Tropical Livestock Unit

TMP =Total milk produced

TMC =Total milk consumed

TMPRC =Total milk processed

TMS =Total milk sold

TVET =Technical, Vocational and Education Training Center

USD =United States Dollar

R^2 = Co-efficient of determination

% = Percentage

C^o =Degree Celicius

TABLE OF CONTENTS

LIST OF TABLES IN THE TEXT

LIST OF FIGURES IN THE TEXT

LIST OF TABLES IN THE APPENDEX

LIST OF FIGURES IN THE APPENDEX

Studies on Cattle Milk and Meat Production in Fogera Woreda: Production Systems, Constraints and Opportunities for Development

By Belete Anteneh (Debub University)

Main-advisor: Fekadu Beyene (Ph.D.), Debub University

Co-advisor: Azage Tegegne (Ph.D.), ILRI, P.O.box.5689, Addis Ababa, Ethiopia

Abstract

The study was conducted in Fogera woreda which is one of the districts found in Northwestern of the Amharan region with the aim of Characterization of cattle milk and meat production systems of the woreda, to provide the basis for cattle development interventions. Even though the known indigenous Fogera breed is also found in this woreda little attention has been given to characterize the milk and meat production systems, to assess the production inputs, to identify the dairy products and beef market chain participants and to identify the main constraints and outline the interventions, it is due to this understanding that the present study was initiated. Twelve sample peasant associations were randomly selected (five from Fogera plain and seven outside of the plain) based on the potentiality of milk and meat production. 480 respondents participated of the study. Different survey techniques; namely focus group discussion, data collection by developing formats, persosnel observations and administration of semi-structured questionnaires on milk and meat production practices were employed. Findings of focus group discussions revealed that the types of cattle husbandry practices of the respective study sites (PAs) were different between rural and urban areas. Findings from the semi-structured interviews revealed that 98.75 % of cattle milk and meat productions were undertaken by indigenous cattle breeds. The type of husbandry practice was traditional. Furthermore, the respondents were very much interested to improve their local breeds by artificial insemination and natural mating by crossbred bulls to upgrade the milk productivity of the breeds. The number of cattle per household was significantly different among the village ($P< 0001$). And also the average number of milking cows per household ranges from 1.18 to 2.08. The holding of milking cows per household was 1.59 $\pm$ 0.04 where as holding of private pastureland was 0.18 $\pm$ 0.09, thus the lower production of milk per household may be due to insufficient pasturelands and feed scarcity. Milk produced per household was highly correlated ($P<0.01$) with the number of cows owned by the household and less correlated ($P<0.05$) with area of pasture owned by the household. The average lactation length for local breeds was 7.5 months and the average daily milk yield was 1.5 liters. Age at first calving was 3-5 years and perhaps due to malnutrition. The reported critical constraints of traditional cattle production were seasonal feed shortage, high disease prevalence challenges, lack of crossbreeds, lack

of working capital and lower demand for dairy and beef products due to long fasting periods and lower purchasing power of the consumers.

1. INTRODUCTION

The agricultural sector account for 46% of the gross domestic product (GDP) and livestock contributes 30% to the agricultural GDP and 19% to the export earning (Azage and Alemu, 1998). According to Befekadu and Birhanu (2000), livestock in Ethiopia contributes about 30-35% of agricultural gross domestic product (GDP) and more than 85% of farm cash income. The livestock sub sector also contributes about 13-16 % of total GDP. As Sansoucy et al, (1995) put it, livestock are closely linked to the social and cultural lives of million of resource-poor farmers for whom animal ownership ensures varying degrees of sustainable farming and economic stability.

Ethiopia has the largest livestock population in Africa estimated at about 35million tropical livestock units. Although the country has the largest livestock population in Africa performance in the production of the major food commodities of livestock origin has been poor compared with other African countries, including Kenya (Befekadu and Birhanu, 2000). Most local cattle are zebus; recognized breeds, including Boran, Fogera, Horro, Sheko (Gimira), Abigat (Adal), are indigenous to and synonymous with particular regions. The Fogera and Horro are known as milk producers, the first being reared round Lake Tana in Amhara State and the second in Eastern Wolega in the west of Oromiya State. The Boran, renowned as a beef breed well beyond the boundaries of Ethiopia (Alemayehu, 2002).

The estimated number of Milking cows in Ethiopia are about 9 million and are in the hands of small holders farmers and pastoralists under traditional management system (Azage *et al.*, 2000). The milk production potential of the zebu breed in the highlands mixed crop-livestock system of Ethiopia can not exceed 400-500 kilograms of milk per lactation per cow. Milk production potential of indigenous cattle of Boran, Horro, Barca, Arsi and Fogera is low, ranging from 494 to 809 kg per lactation. It has also been well documented that, in breeding schemes, the raise in milk production through selection is about 1% per year or 3-4 kgs per lactation (EARO, 1999, Zelalem, 2000).

The annual national-demand supply variance for fluid milk alone, calculated on the basis of per capita consumption in Sub-Saharan Africa, is estimated at 500 million kg. Based on this calculation, there will be a minimum annual demand for one billion 14 million kg of milk to satisfy the projected urban population of 39 million people by the year 2020(Azage and Alemu, 1998).

In Ethiopia, the per caput consumption of milk is 19 kg/year; this value is lower than African and world per capita averages, which are 27 kg/year and 100 kg/year (Saxena *et al*. 1997), respectively. According to MOA 1997 and Alemayehu 1998a the per capita consumption of milk is estimated at 19 liters per year, while meat consumption is about 13.9 kg a year. Accordingly, about 495 thousand tones and 5 million tones of milk is required annually to feed the Ethiopian population as per the African and world averages, respectively. This indicates the probability of a wide gap between the current supply of and the demand for milk in Ethiopia.

Dairy products are traditional consumption items with strong demand, and the temperate climate of the Ethiopian highlands allows the crossbreeding of local cows with European dairy breeds to increase productivity (Holloway et al, 2000). The highlands of Ethiopia, which are very well suited for dairying, represent almost 50% (Winrock International 1992) of the total highland regions of sub-Saharan Africa.

Milk plays a very important role in feeding the rural and urban population of Ethiopia and has high nutrition value. Milk is daily produced, sold for cash or readily processed. It is a cash crop in the milk-shed areas that enables families to buy other foodstuffs and significantly contributing to the household food security. Given the long tradition of using milk and milk products by the Ethiopian society, there is no doubt that increasing smallholder dairy production and productivity would bring about a conspicuous impact on improving the welfare of women, children and the nation's population at large (MOA, 1998).

According to a recent livestock report prepared by the FAO (2003), milk constitutes a significant proportion of the value of all livestock food products in Ethiopia (about 56%), while livestock food products also constitute an important proportion of the value of total food products in the country (CSA, 2003; FAO, 2003).

The annual contribution of ruminants to meat production in Ethiopia is estimated at over 3.2 million tones, representing over 72% of the total meat production. Cattle meat

accounts for over 70% of the total red meat production and over 50% of the total meat output in Sub-Saharan Africa (EARO 1999).

According to FAO 1998, the total quantity of meat consumed worldwide rose by 45 million metric tons between 1983 and 1993. Total milk consumption rose by 57 million metric tons in liquid milk equivalents. In 1983 developing countries consumed 36 per cent of all meat and 34 percent of all milk-consumed worldwide. By 1993 those percentages had risen to 48 per cent and 41 percent, respectively.

Between 1977 and 1989, level of dependency increased from 4.1 to 12.8% as a result of food aid, a World Food Programme (WFP) milk powder, and a level of dairy production development that has lagged behind the demand. These factors have eroded the contribution of milk production to food security (Staal and Shapiro 1996). Furthermore, imported milk powder, equivalent to about 11,213 liters of liquid milk per day, has a market share of 23% in Addis Ababa (Belachew *et al*. 1994). Since 1989, importation of WFP milk powder has decreased and nowadays it is not imported; however, importation of other processed dairy products, which are marketed in supermarkets, is increasing. And due to foreign exchange constraints it cannot afford to continue importing dairy products so that developing domestic dairy sector and the expansion of the small-scale fattening are very crucial.

As cattle population has not kept up with the rate of population growth, there is a strong unsatisfied demand, in the majority of tropical countries, for milk and meat.

However, the actual consumption is seriously restricted by the low purchasing power of the majority of the consumers, for whom retail prices are already too high. At the other extreme, the producer is in a difficult position and the course taken, notably for beef, does not allow to envisage the introduction of more intensive techniques, the only ones which would enable an increase in production when the limits of expansion of the pasture area are reached (Reagbot, 1992).

Fogera cattle breed type which has a better milk and meat production potential is found in this woreda in which the production and productivity has been severely declined due to production constraints such as lack of production inputs and lack of information on dairy and beef production and marketing and also the dairy and beef market are localized. Therefore, improvements of dairy and meat productions in Fogera might have a great role in sustaining food security of the study area. So, It is with this view and understanding that the present study is initiated with in the following specific objectives.

-To characterize the cattle milk and meat production systems of the Fogera woreda.

-To indicate the production inputs/services that enable to increase the milk and meat production.

-To assess dairy products and beef marketing-outlets and also to characterize the market chain Participants of cattle products such as dairy products and beef in the woreda.

-To assess the production constraints of milk and meat of the woreda and to indicate the interventions for the indicated production constraints.

2. LITERATURE REVIEW

2.1. Origin and Current Classification of African Cattle

Of the approximately 80 breeds of Zebu cattle in Africa, about 45 are considered native to East Africa and five to southern Africa. Eastern Africa has only five breeds/strains; West Africa has about four more recently developed Sanga breeds (Rege et al.1994). Most Africa taurine cattle (both long horns and short horns) are native to West Africa. The seven Zenga (Zebu x Sanga) cattle breeds documented in Africa (Horro, Fogera, Arado, Jiddu, Alur, Nganda and Sukuma) all are found in Eastern Africa; indeed, they are restricted to Ethiopia, Eritrea, Uganda and Tanzania. Africa is also home to four composite cattle breeds, the Bonsmara of South Africa, the Rana and Renitelo of Madagascar and the Mpwapwa of Tanzania, all developed from cross breeding indigenous breeds with specialized exotic breeds (Rege, 1998).

2.2. General classification of the East Africa Zebu cattle

It is probable that the long horn and short horn type cattle were first introduced in to East Africa from the Sudan and/ or Ethiopia and that the majority of their ancestors originated from the central Saharan region, through same ancestral stock may have been derived from the red sea littoral. Faunal evidence of domestic ovicaprids and cattle, dated 4500-4000 BP, has been found at a number of sites in the northeastern area of the Lake Turkana basin in Kenya (Barthelme, 1984).

After the initial cattle plague (Rinder pest) epidemic and dissemination of the dominant Sanga population. Zebu cattle were introduced from Asia in to Africa at various points on the east coast of the continent and interbreeding with senga remnants resulted in several Zebu-Sanga and Sanga-zebu admixture population. The breeds that emerged from these crosses have been classified in a separate group “Zenga” cattle. Naturally, the Zenga are localized in eastern Africa (Rege and Tawah, 1999).

Table 1: The Abyssinian Zebu breeds

Group	Breed/strain	Areas within the country
Abyssinian short horned zebu (Ethiopian highland zebu)	Jem-Jem (black highland cattle)	Northern part of Sidamo, Bale highlands and areas surrounding Bale, including Yirgalem in Sidamo
	Jijiga	Jijiga area of Somali region
	Arsi	Highlands of Arsi, Bale, Hararge, Shoa and Sidamo
	Harar	Eastern and western Hararge plateau
	Bale	High plateau of Bale zone, in areas adjacent to the habitat.
	Smada	South Gondar, North western Ethiopia between the bend of the Abay river to the south and mount Guna to the north
	Adwa	Adwa in the central zone of Tigray region
	Hammar	Hammer and South Omo
	Mursi	South Omo in the Mursi area.
	Goffa (Goffa dwarf)	Goffa area around Sawla
	Gurage	Gurage and Hadiya area

	Ambo	Western shoa around Ambo,Dandi,Addis Alem and Holetta
	Ogaden	Ethiopia:Ogaden area of Somalia region and bordering eastern Hararge
	Jem-Jem	North Sidamo Bale highlands
	Arado/1/	Northern Shire,Adwa and part of Agame
	Horro/1/	Wollega(Horro Gudru),Keffa,Western Shoa,Illubabor
	Kuri/2/	Djicao,Gambella Gimmira region
	Sheko/2/	Shakico, Shewa Gimmira western SNNP
Boran	Ethiopian Boran (Borena)	Ethiopian: Oran plateau from the Liban plateau to the extreme south
	Somali Boran (Avai)	Somali: Western and Jubaland of the southern part

Sources: Epstein (1971); Payne and Hodges (1997); Rege, 1999a, Rege and Tawah (1999), Hedge, 2002.

2.3. Cattle Production Systems in Sub-Saharan Africa

In many parts of the developed and developing world cattle production systems have intensified this century. Average herd sizes have increases by process of amalgamation of small units and an increase in purchased feed use. Cattle were an easy way of using land inhabited by native peoples and animals for the production of milk, meat and other goods needed by settlers during the period of colonization in the last millennium. The future will bring greater control of cattle production, preserving these systems that benefit society and outlawing those that have detrimental effects on the region in which they are practiced (Philips, 2001).

The total cattle population of Ethiopia is estimated to be 41,527,142. Out of this population, the female cattle constitute about 56.2% (23,336,163) and the remaining 43.8% (18,190,980) are the male cattle. The majority (97.9%) of the cattle population is found in rural areas while very small proportion is accounted for urban areas (2.1%)(CSA, 2003).

According to Ibrahim (2000) the livestock production systems in Sub-Saharan Africa can be divided in to two broad types in Sub-Sahara Africa:

2.3.1. Traditional production systems

2.3.2. Improved production system.

2.3.1. Traditional production systems

Traditionally resource-based animal production systems in which remote pastures, grasses indigestible by humans and backyard refuse are converted in to high value animal products are being substituted by input intensive, science-based animal production systems. These systems have the potential to raise growth rates of out put and cash incomes, improve food security, and reduce environmental degradation (Tangka *et.al*, 2002).

In the pastoral system, relatively large herds of cattle are grazed on communal and public land. Due to seasonal scarcity of feed and water cattle trek over long distances. In this system, cattle owners acquire minimal land holdings at the home base. In West Africa the home base is where family stays. In this system a wet herd for milk is kept at the home base and it is the responsibility of women to market the milk and to use the money to purchase family needs. The women also grow cereal crops for domestic consumption and use the crop residues to feed the wet herd. The dry herd travels long distances sometimes up to 400 km. Pastoralists are unable to settle and take advantage of available production technology. It is estimated that up to 70-80% of Africa's cattle population is within this system.

Agro pastoralists own sizable pieces of land and practice integrated cop-livestock production. In this system crop residues are utilized when feed is scarce but nutritional inadequacies remain. Transfer of technology is not easy and in spite of this in a few countries farmers in this system adapted improved technologies. For example addition of urea to crop residues was adapted in West Africa. Productivity nevertheless is below

potential because animals are fed below the optimum level. Agro pastoralists and pastoralists production systems produce about 70% of the milk and meat in sub-Saharan Africa. The agro pastoral system is a considerable improvement over the pastoralists' production systems.

2.3.2. Improved production system

Production systems in this category are characterized by high inputs. The production systems are market-oriented and farmers adopted improved technology to optimize productivity. These systems are increasingly popular in eastern and southern Africa. Producers usually own less than 10 cows and about 2-4 ha of land with intensive crop - livestock production. In these systems farmers adapt/or adapt available production technology. Large-scale livestock keeping in peri-urban areas is highly commercialized: it is oriented to the demand of urban consumers and depends on high level of purchased feeds, including by-products from agro processing industries. In contrast, small- scale livestock keeping by poorer urban dwellers offers a supplementary source of income, as well as source of animal protein which the families could other wise not afford to buy. Peri-urban and Urban livestock-keeping systems have a potentially important role to play in disposing of organic waste, which other wise could endanger human health, and converting in to useful products.

In peri-urban production systems herds are located within a 40-60 km radius of major cities. The system is located near highly populated urban centers where the producers

have adequate resource and have access to credit to acquire inputs such as feed supplements, veterinary inputs and improved genotypes. In many cases marketing in organized around co-operative societies. Urban livestock are also fed crop residues brought in from surrounding areas, and the manure is transported to gardens inside the city and crop land further way. Some animals kept in cities may wander freely to seek their own forage. If the owners are prepared to invest more in labor, the animals may be herded from grazing patch to grazing patch or tethered in a patch, e.g. tied to a signpost at the road side (Wolfgang Bayer and Waters-Bayer, 1998).

2.4. Economic importance of livestock in Ethiopia

Livestock have diverse functions for the livelihood of farmers in the mixed crop-livestock systems in the high lands of east Africa. Livestock provide food in the form of meat and milk, and non-food items such as draft power, manure and transport services as inputs into food crop production, and fuel for cooking. Livestock are also a source of cash income through sales of the above items, animal hides and skins. Furthermore, they act as a store of wealth and determine social status within the community. Due to this important function, livestock play an important role in improving food security and alleviating puberty (Ethui *et al*., 1998).

The contribution of livestock and livestock products to the agricultural economy is significant, accounting for 40% excluding the value of draft power, fuel, manure and transportation. They are a source of income, which can be used by rural populations to purchase basic needs and agricultural inputs. Livestock comes second to coffee in

foreign exchange earnings. Its contribution can equally well be expressed at household level by its role in enhancing income, food security and social status (Winrock International 1992).

In the rural areas of many developing countries, financial services such as credit, banking and insurance are virtually non-existent. In these areas, livestock play an important role as a means of saving and capital investment, and they often provide a substantially higher return than alternative investments. A combination of small and large livestock that can be sold to meet petty-cash requirements to cover seasonal consumption deficits or to finance large expenditure represents a valuable asset for the farmer (Sansoucy, 1994).

Food production is the primary objective, but the role of animals clearly surpasses this function. Within the integrated systems, animals play a particular vital role, the extent of which is dependent on the type of production system, animal species and scale of the operation. Dairy production is becoming an increasingly important integrated system in many countries, in which this component generates significant, and more importantly, daily cash income, as well as contributing to the improvement of the livelihoods of very poor people and the stability of farm households. It is for these reasons that dairying in the developing countries is considered to be an important instrument of social and economic change, and is identified with rural development (Kurien, 1987).

In the mixed crop-livestock systems of the Ethiopian highlands, livestock are subordinate but economically complementary to crop production in providing draft power, the main agricultural activity. In this ecological zone, livestock, especially cattle, provide traction, which is a vital contribution to the overall farm labor requirement. Livestock also provide meat, milk, cash income and manure, and serve as a capital asset against risk. In the semi-arid low lands, cattle are the most important species because they supply milk for the subsistence of the pastoral families. In the more arid areas, however, goats and camels are the dominant species reared. The former provide milk, meat and cash income, while the nomadic pastoral population for milk, transport and, to a limited extent, meat, keeps the latter (Asfaw, 1997).

Cattle are kept for multipurpose. However, purposes vary with production system. Traction (males) ranked highest, followed by milk (females) and reproduction/breeding (males and females) in both crop-livestock and agro pastoral systems. Manure production also considered important by most crop/livestock and agro pastoralist farmers, but as secondary rather than a primary purpose. In contrast, reproduction/breeding requirements received higher ranks in pastoralist systems and, for female, requirements for breeding outranked the importance of milk production (Workneh, 2004).

In Ethiopia, 45% of livestock owners are women and 33% of livestock keepers households are headed by women in Addis Ababa city. Women are usually responsible for feeding large animals, cleaning the barns, milking dairy cattle, processing milk and

marketing livestock products, but they receive assistance of men, female children and/or other relatives, young children, especially girls between the ages of 7 and 15, are mostly responsible for managing calves, chicken and small ruminants and older boys are responsible for treating sick animals, constructing shelter, cutting grass and grazing of cattle and small ruminants. The role of women managing animals that are confined during most of the year is substantial and they are critically involved in removing and managing manure, which is made in to cakes and used or sold as fuel (Azage, 2004).

In North-western Ethiopia, the small holders rear cattle, primarily for the supply of oxen power for crop production. Dairy, food, cash source, manure, fuel and fuel security are secondary. Cattle and equine provide smallholder farmers with vital for crop cultivation and transportation (Alemu, 1998).

Livestock products, especially dairy, can make unique contribution to human nutrition of the poor in developing countries by providing micronutrients in bio-available form such as vitamin A, in addition to carbohydrates, protein and calcium. Thus, dairy producers by making more milk available for human consumption (Ahmed *et al*, 2003).

In Ethiopia in 1991/93 and 1994, 595 million and 577 million tones of meat, respectively, have been produced. In addition to this due to the export of the 3,790 bovine live cattle in three years (1990-1992) a total value of 1,493 million US $

foreign currency has been gained. In these years the country imported 8 tones of concentrated milk so as to satisfy the milk demand of the population (ILRI, 2000).

According to BOFED's report (2004), the agricultural sector in the Amaharan region contributed nearly 64% to the regional GDP between the period 1994 to 2001.The crop sector takes the lion's share (61%) followed by the livestock (27%) and forest covering 12% of the total 3.2 million hectares cultivated area. The area under irrigation and improved seeds was 1.77 and 2.72 % respectively while the area applied with fertilizer was 33 %(CSA, 2003).

The value of output from livestock in Ethiopia was estimated at around birr 12 billion in 2000 and accounted for about 45% of the value of all agricultural out put excluding the contribution of animal draft power. It is also noted that, at constant prices (1995 US$) value of out put from livestock grew nearly by 22% in the two decades between 1980 and 2000,the increase (1.1% pa) compares well with the growth of the value of agricultural output (FAO, 2003).

Macroeconomics studies carried at regional level (BOFED, 2003) estimate the regional GDP or RGDP to be around close to Birr 13.3 billion, of which agriculture accounted for birr 7.9 billion, or 60% of the RGDP. Likewise, in 2002,the livestock sub sector contributed an estimated birr 2.2 billion, accounting for about 28% of Regional agricultural GDP or 17% of the total RGDP.

Table 2: Ethiopian Livestock and livestock products exports by quantity and value (1999-2002)

No	Product	Quantity (tons)	Value '000 USD
1	Livestock	8,909	7,841
	1.1.Bovine	1,754	1,764
	1.2.Sheep and goat	5,456	5,550
	1.3.Others	1,699	527
2.	Meat and milk products	11,360	19,743
3.	Hides and skin	79,958	401,998
	Hides	22,379	49,149
	Skins	55,831	334,259
	Leather products	1,748	18,590
4.	Dairy products	21	89
5.	Natural honey	22	75
6.	Bee wax	3,178	7,859
7.	Civet	5	2,064
	Total	103,462	439,669

Source: computed from export promotion Agencies raw data (cited by pastoral forum Ethiopia)

2.5. Dairy Production in sub-Saharan Africa

The dairy industry is the sector with the highest degree of protection due to the economically vulnerable position of small milk producers. The dairy industry has a

number of specific features which distinguish it from other sectors of agriculture on a number of respects. The dairy industry is a special case in world agriculture. The specifics of the dairy industry are due to four, partly integrated factors. The first factor is to be found in the specific properties of milk as a raw material. On top of that milk is highly perishable and also potentially subject to adulteration (Falvey et al 1999).

Milk accounts for 16% of the total value of all food products produced from livestock in sub-Saharan Africa, estimated at US$18.3 billion in 1986(FAO, 1986). Despite milk's contribution to gross domestic product and its value as food, Sub-Saharan Africa has failed to attain self-sufficiency in dairy production. This region has, therefore, depended on dairy imports to satisfy rising domestic demand. Because of foreign exchange constraints, however, many countries in the region can not afford to continue importing dairy products and are instead attempting to develop domestic dairy sectors through up grading their local herds, the use of artificial insemination and improvements in dairy marketing systems (Mbogoh, 1984).

2.6. Dairy Production Systems in Ethiopia

In the highland areas agricultural production system is predominantly smallholder mixed farming, with crop and livestock husbandry typically practiced with in same management unit. In this farming system all the feed requirement is derived from native pasture and a balance comes from crop residues and sub grazing (Tedla *et al*, 1989).

The main source of milk production in Ethiopia is from cow but small quantities of milk are also obtained from goat and camel in some regions particularly in pastoral areas.

The dairy industry is the sector with the highest degree of protection due to the economically vulnerable position of small milk producers. Milk- also known as white gold-can be used to make an enormous variety of high quality products. The high cost of milk as a raw material has necessitated a high-tech processing industry. The special nature of milk (perishable and bulky) leads to the necessity of strict and comprehensive quality regulation and to a high transport cost (Falvey, 1999).

Dairy production is a biologically efficient system that converts large quantities of roughage, the most abundant feed in the tropics, to milk the most nutritious food known to man. As Walshe *et al* (1991) pointed out, where there is access to market; dairying is preferred to meat production since it makes more efficient use of feed resources and provides a regular income to the producer. It is almost labor intensive and supports substantial employment in production, processing and marketing. Higher level of production than those achieved in traditional tropical systems, whether from buffalo, cattle, camels or small ruminants, often require the introduction of specialized dairy breeds and increased level of inputs (nutrition and health care) and good linkages to market both for milk sales and input acquisition. Thus, the intensification of small livestock systems through the adoption of dairy production is generally concentrated in areas with good infrastructure close to major markets, although less intensive production may occur in other, more distant areas (Walshe *et al*, 1991). These market

factors, therefore, play a major part in determining the type of dairy production systems found in the tropics, and they are particularly important influences on smallholder dairy development (Falvey *et al*., 1999).

The majority of milking cows are indigenous animal which have low production performance with the average age at first calving is 53 month and average calving interval is 25 months. Cows had three to four calves before leaving the herd at 11-13 years of age; the average cow lactation yield is 524 liters for 239 days of which 238 liters off take for human use while 286 liters is suckled by the calf. But also a very small number of crossbred are milked to provide the family with fresh milk, butter and cheese. Surpluses are sold, usually by women, who use the regular cash income to buy hold necessities or to save for festival occasions (Mugerewa). Both pastoralist and smallholder farmers produce 98% of the country milk production (MOA, 1985 E.C.).

Dairy production is a critical issue in Ethiopia-a livestock-based society where livestock and its products are more important sources of food and income, and dairying has not been fully exploited and promoted. The greatest potential for new technologies in dairying is expected in the highlands of Ethiopia and other sub-Saharan Africa and Asian countries, due to low disease pressure and good agro-climatic conditions for the cultivation of feed. High population densities and animal stocking rates, as well as easy access to markets, make it attractive to invest in market-oriented dairy production technologies in peri-urban areas in these regions (Tangka *et.al*, 2002).

Table 3: Milk yield performance of the Northwestern Ethiopian indigenous breeds

	First lactation (liters)				Second lactation (liters)			
Site	N	Minimum	Max.	Mean	N	Minimum	Max.	Mean
Dembia	18	225.00	1050	515	17	240.00	720.00	469.7
Fogera	14	315.00	1320	635.35	14	360.00	1680.00	760.71
Metema	12	225.00	570	395	12	300.00	495.00	379.16
Semen	12	97.50	190	121.12	12	135.00	210.00	191.66
Wegera	35	150.00	750	327.28	35	225.00	630.00	393.57
Overall	91	97.50	393.57	393.57	90	135.00	1680.00	436.22

Source: Zewdu, 2004

The daily milk yield of this breed has been recorded by Zewdu's study, in which one Fogera cow gives 1.39 liters minimum and 4.63 liters maximum in a day. And the lactation period for this breed is on the average 9.14 months.

All small-holder in the urban areas and the mixed small scale dairy production systems are labor oriented, where milking is done by hand, and often done twice a day. Production on most smallholder farms relies heavily on family labor. The milk production levels also vary between different dairy breeds. On average, cross breed cows produces 8 liters per day per cow and the indigenous one produces 2 liters per day per cow. A number of production constraints are seriously affecting small-holder dairy production. In addition to already highlighted problem of lack of capital to acquire the cross breeds, many farmers face difficulties in getting full information on the breeds they

are going to buy. Other factor hampering milk production include an inadequate feed base, high cost of bought-in feeds, shortage of cash to buy concentrate feeds.

Urban livestock are also fed crop residues brought in from surrounding areas, and the manure is transported to gardens inside the city and crop land further way. Some animals kept in cities wander freely to seek their own forage. If the owners are prepared to invest more in labor, the animals may be herded or tethered in a patch, e.g. tied to a signpost at the roadside. The peri-urban system is sedentary on minimum land where producers' cut-and-carry feed for animals. Peri-urban production systems are popular in the eastern African highlands and in West Africa. Usually cattle are crossbred but producers in West Africa may also use indigenous breeds of zebu cattle selected by owners for high productivity. In peri-urban production systems herds are located within a 40-60 km radius of major cities. The system is located near highly populated urban centers where the producers have adequate resource and have access to credit to acquire inputs such as feed supplements, veterinary inputs and improved genotypes. In many cases marketing in organized around co-operative societies. The system is sedentary on minimum land where producers have adequate resources and have access to credit to acquire inputs and improved genotypes. In many cases marketing in organized around co-operative societies (Wolfgang Bayer and Waters-Bayer, 1998).

Milk production in Ethiopia is low. The indigenous zebu produces about 400-680 kg of milk/cow/lactation compared to grade animals that have the potential to produce 1120-2500 liters over 279-day lactation. With the exception of SDDP, the production and

distribution of cross breed heifers, the provision and distribution of dairy stocks, the provision and strengthening of AI services, and/or bull services were major components of the development projects implemented between 1967 and 1998. Though the effort of these projects, Ethiopia has built up a herd of 120 thousand exotic cattle. So far, only one governmental institution, the National Artificial Insemination Center (NAIC) provides AI services in the country (Ahmed *et al*, 2003).

Improvements in daily milk yield of cows could be considered as one of the strategies to increase the overall milk production in the areas i.e. assuming that persistency and lactation length is improved. This could be achieved through nutritional management interventions during the most critical periods of the lactation period and life cycle. Improvements in nutritional management during the later quarter of pregnancy and during early lactation period could increase peak milk yield, improve persistency and increase lactation length (Azage *et.al*.1994).

There are four major systems of milk productions in Ethiopia. These are pastoralism, the high land small holder, urban and peri-urban and intensive dairy farming. The production system in the country, in respect to marketing situations, can be broadly caragorized in the Urban, Peri-urban and rural milk production system (Azage and Alemu, 1998).

2.6.1. Pastoralism

Even though, information on both absolute numbers and distribution vary, it is estimated that about 30% of the livestock populations are found in the pastoral areas. The pastoralist livestock production system which supports an estimated 10% of the human population covers 50-60% of the total area mostly lying at altitudes ranging from below 1500 m.a.s.l. Pastoralism is the major system of milk production in the low land. However, because of the rainfall pattern and related reasons shortage of feed availability milk production is low and highly seasonally dependent (Ketema, H and Tsehay.R .2004).

Paternalists typically rely on milk for food and also use animals to store generate wealth. Animals are consequently are important in social value systems. Pastoral social systems also commonly emphasize decentralized leadership that promotes flexibility in resource use (Janke, 1982; Coppock *et al*, 1985)

2.6.2. The highland smallholder milk production

The Ethiopian highlands possess a high potential for dairy development. These areas occupying the central part of the Ethiopia, over about 40% of the country (approximately 490,000 km^2) and are the largest of their kind in Sub-Saharan Africa. In the highland areas agricultural production system is predominantly substance smallholder mixed farming, with crop and livestock husbandry typically practiced within the same management unit. In this farming system all the feed requirement is derived from native pasture and a balance comes from crop residues and stub grazing (Tedla *et al*, 1989).

The majority of milking cows are indigenous animals which have low production performance with the average age at first calving is 53 months and average calving intervals is 25 months. Cows had three to four calves before leaving the herd at 11-13 years of age, the average caw lactation yield is 524 liters for 239 days of which 238 liters is off take for human use while 286 liters is suckled by the calf. But also a very small number of crossbred animals are milked to provide the family with fresh milk butter and cheese. Surpluses are sold, usually by women, who use the regular cash income to buy household necessities or to save for festival occasions (Mugerewa). Both the pastoralist and smallholder farmers produce 98% of the country milk production (MOA, 1985 E.C).

Milk is the byproduct of almost every production system: pastoral, agro pastoral, and mixed farming systems (O' Mahoney and Peters, 1987). The trend of the recent past milk consumption show that the production of milk did not keep pace with the growing population as witnessed by the declining figures of the per capita over the years (MOA, 1998).

2.6.3. Urban and Peri-urban milk production

This system is developed in and around major cities and towns which have a high demand for milk. In this system the main feed sources are agro-industrial by products. This system small and medium size farms located mainly in the highlands of Ethiopia. In this system milk is as a means of additional cash income. Most of the improved dairy stock in Ethiopia is used for this type of production. One of the largest sources of milk in Addis Ababa/regional towns is that from intra-urban milk producers. A total of

5167 small- medium- and large-scale dairy farmers exist in and around Addis Ababa (Region 14 Addis Ababa Agricultural Bureau survey report quoted by Azage and Alemu 1998). Total milk production from these dairy farmers amounts to 34.649 million liters/annum. Of this total, 73% is sold, 10% is left for household consumption, 9.4% goes to calves and 7.6% is processed, mainly into butter and *ayib* (Azage and Alemu 1998). The producers deliver milk to consumers or consumers may collect it at the producer's gate. Studies indicate that in terms of volume 71% of intra-urban producers sell milk directly to consumers (Belachew *et al*. 1994).

2.6.4. Intensive Dairy Farming

This is a more specialized dairy farming practiced by state sector and very few individuals on commercial basis. These are concentrated in and around Addis Ababa and are basically based on exotic purebred stock. The urban, peri-urban and intensive dairy farmers are produce 2% of the total milk production of the country.

2.7. Cattle fattening systems in Ethiopia

According to MOA 1996, in Ethiopia there are three types of fattening systems.

2.7.1. Traditional systems

In such type of systems, oxen are usually sold after the plowing season when they are in poor condition. Meat yields are low, the beef is of poor quality and the farmer returns are often inadequate to buy a replacement ox. This is obvious scope to improve this traditional and inefficient system through strategic feeding of good quality forage

to fatten animals before they are sold, or to buy and fatten animals sold by others. In the low lands, where pastoralists do not use cattle for draft, cattle are sometimes fattened on natural pasture in good seasons. In average or poor seasons, low land cattle are rarely fattened and often have to be sold in poor condition at low prices.

2.7.2. By-product-Based fattening

This is a type of fattening in which the agro-industrial by-product such as molasses, cereal milling by-product and oilseed meals are the main sources of feed. In this system grazing land is completely unavailable and crop-residues are only significant roughage source.

2.7.3. The Hararghe fattening system

In this system peasants buy young oxen from the adjacent lowlands pastoral areas, use them for several years, and then fatten and sell them before they become old and emaciated. The system is largely based on cut-and carry feeding of individual tethered animals. Grazing is rare. Few concentrate are used.

2.8. Cattle Disease Prevalence in Ethiopia

Trypanosomiasis in domestic livestock causes a significant negative impact in food production and economic growth in many parts of the world, particularly in Sub-

Saharan Africa (Taylo, 1998) and it has greatly hampered people and animals settlement in a considerable part of the world (Tekle and Abebe, 2001).

Trypanosomiasis that occurs across more than a third of Africa is arguably the most significant disease (ILRAD, 1994) and therefore remains as the major important constraint to livestock production on the continent. The wide occurrence of this disease in people and their livestock retards agricultural and economic development in Africa and 30% of the continent's cattle population, estimated to be 160 million and comparable numbers of small ruminants are at risk from trypanosomiasis.

The disease is a particular constraint to the productivity of recently imported exotic cattle in Africa. Overall several thousands of years, breeds of local cattle, such as N'Dama and West Africa short horn, evolved their own resistance, but these are not as productive as modern European cattle (Phillips, 2001).

In peri-urban production systems herds are located within a 40-60 km radius of major cities. The system is located near highly populated urban centers where the producers have adequate resource and have access to credit to acquire inputs such as feed supplements, veterinary inputs and improved genotypes. In many cases marketing in organized around co-operative societies. n the current Ethiopia, trypanosomiasis is one of the most important diseases which contribute to direct and indirect economic losses on livestock productivity and the extent of the disease and the need to control in tsetse free areas (highlands) of the country is strongly emphasized and it is indicated that no

attempt whatever has no so far been made to address the problem regarding highland (mechanically transmitted) trypanosomiasis (Abebe and Jobre, 1996 as cited by Alekaw, 2004).

2.9. Dairy Marketing in the Tropics

Dairy development in Africa has been hindered by marketing constraints including poor access to markets in rural areas, low availability of products absence of a structural marketing system International development Research center (IDRC), 1984), and unattractive prices to producers where structured marketing does exist. Past efforts aimed at improved dairy production in Africa have focused on the establishment of large scale centralized processing plants in meet the liquid milk demand of urban dwellers (Von Marsow, 1985). Because of inadequate milk collection systems and unattractive prices offered for locally produced fresh milk, these plants rely on imported butter oil and skim milk powder for reconstitution and recombination to meet the market demand. In most African countries direct competition between cheap reconstituted milk and locally produced fresh milk has discouraged smallholder diary. Most countries in Sub-Saharan Africa have formal dairy marketing sub systems that cater primarily for urban milk supplies, and an informal marketing sub system that operated in the rural areas (Mbogot, 1984).

Milk production and consumption levels, the range of products consumed, and consumer habits and attitudes in relation of milk products, vary considerably from country to country even with in a country. To minimize deterioration of quality in the

tropics, milk has to be moved to customer with in two or three hours of milking, or milk products have to be made which will keep with out refrigeration, or preservative added to fresh milk, or it has to be cooled as soon as possible on the farm or at a collection center. Well-organized milk schemes cooled milk from widely scattered suppliers, chill it in the bulk, and transport it to processors with minimal delay (Falvey *et al*, 1999).

In Kenya, informal milk outlets are shown to absorb most of the milk from smallholder farmers accounting for over 80% of the total milk sold. Brokers, traders/hawkers, transporters, co-operatives and farmer groups are identified as the most important participants at the rural markets. The farm gate milk prices in informal markets are 22% higher than in the formal marketing channel. Cooperatives remain the main channel for collecting milk destined to the formal market. Analyses of marketing margins indicate that players in informal market have lower marketing margins as compared to the formal channel. As such, the informal channel out-competes the formal channel by charging prices that are 48% lower per liter of milk. Furthermore, the players in informal markets have devised various methods of assessing milk quality and for screening suppliers. In Kenya, in total, the informal market channel is estimated to control 60% of the total marketed milk. Dairy co-operatives, which used to be an integral part of the formal milk collection and marketing, have been relegated to buyers of last resort. Furthermore, the cooperatives are also marketing a big proportion of their milk directly to urban markets. The 45 licensed milk processors

with an estimated daily intake of 600,000 liters handle the rest of the market share (FAO, 1997).

Milk marketing activities, to a great extent, are determined by technical considerations such as the nature of the product and the relative locations of the producers and consumers, and the distinct income-segmented markets. The relative economic power of buyers and sellers is also crucial in determining the structures of the marketing systems. The nature of milk production as an agricultural activity, and of milk as an agricultural product, is the main reason for the dominant role played by producer-owned co-operatives in milk marketing. The key principles underlying the establishment and operation of marketing co-operatives are to do with bargaining power and economies of scale in activities. Co-operative marketing evolves because on one side of the trade of milk are many small-scale producers with a product which perishable and costly to transport. On the other side of the market in the local area is a single relatively large buyers or a small number of relatively large buyers who assemble, process, distribute and retail milk. These imbalances of market power have led to producers co-operatives being the main stay of dairy marketing throughout the industrialized world (Falvey, *et al.,* 1999).

2.10. Milk Processing and Marketing in Ethiopia

Studies indicate that butter making is an ancient practice that goes back as far as 2000 BC to the time of Egyptian civilization. Butter making may have begun at a similar time in Ethiopia. The traditional Ethiopian practice is to accumulate the milk for two to

three days until it is sour. A clay pot or calabash is then used to churn the sour milk. Butter is used for cash generation, cooking Ethiopian dishes, and medicinal and cosmetic purposes (e.g. application to the braided hair of women). In almost all societies of Ethiopia, women are responsible for butter. In general, husbands or men do not decide what is done with butter produced at home. The contribution of dairy products to the gross value of livestock production is not known but in peri-urban areas about 20% of average income was derived from dairy products (Winrock International 1992).

In the central highlands of Ethiopia (Selale, Debre zeit and Holetta) smallholder milk processing is based on sour milk. The milk for processing can be either from a single milk animal or an accumulation from a large number of animals. The equipment commonly used are clay pots and a stick with three to six figures like projection at one end (called *Mebekia* in Amharic and *Erba* in Oromifa). Some households use only one of the materials while other use them in combination. The types of sour milk processing materials and methods identified in the survey areas could be characterized and grouped in to three types.

Type 1: sour milk is agitated by placing the churn (clay pot) on a mat on the floor and rocking it back and forth. When the churn is filled with milk, usually about half of the volumetric capacity of the churn the opening is sealed by a piece of skin, leather or plastic stretched over the opening of the churn. Then the churn is shaken. The mat can be unprocessed skin or hide, sacks, grass, cereal straws, worn out garments or other similar material. This was common around Holetta and Debre zeit.

Type 2: Sour milk is stirred with Mesbekia by inserting the end with the projections in the sour milk inside the clay pot and using the palms of both hands to rotate the stick. In this case the clay pot is not moved. This was common around Selale.

Type 3**:**First, the sour milk is stirred for some time with *Mesbekia* and agitated by rocking the sour milk in the clay pot back and forth until milk fat is received in the form of butter. This was practiced more around Holetta and Debre zeit (Zelalem et al, 2000).

According to Fekadu and Abrhamsan (1994) milking in three villages of southern Ethiopia is performed one to three times a day. After milking, the milk was transferred in to a smoked clay pot and kept closed at room temperature of about 20-22 C^0 in the house. Milk from the evening milking was added to the morning milk and kept until next morning. The quality of the curd formed was visually evaluated and readiness of the curd for churning was determined by the experienced female member of the household. The churning operation started after stirring the content and transferring to another smoked clay pot. The clay pot was agitated until butter grains started to form. The developed gas was released every 2-3 minutes by opening the top of the churning during the first 10-15 minutes of the churning operation. The churning operation, a back and forth movement was manually performed in a traditional way.

In Borena according to Ephraim and Tarik (1987), after a minimum of one-day fermentation, milk is churned to make the butter. Milk is usually churned in the morning during warm weather, as the Borena appreciate the role of cooler

temperatures in butter production. The *gorfa* (one of the milk containers) is filled to 50-70% capacity with fermented milk and is cradled by a woman who gently rocks it back and forth.

In Ethiopia, in the town areas where there is a good demand for fresh milk the surplus can readily be sold. In the Addis Ababa area there is organized milk collecting system 120 km along the roads leading to the capital. In the rural areas far away from the main roads the possibility of selling fresh milk are more limited. In addition to this, the members of Ethiopian Orthodox Church abstain from consuming milk and animal products about 150 days per year during the fasting periods. The surplus milk has thus to be converted in to butter and cottage cheese (Ayib). These products are usually sold at the markets (Debrah and Birhanu, 1991).

In Ethiopia, fresh milk is distributed through the formal and informal marketing systems. The informal market involves direct delivery of fresh milk by producers to consumers in the immediate neighborhood and sales to itinerate traders or individuals in near by towns. Milk is transported to town on foot, by donkey, by horse or by public transport, and commands a higher price other than when sold in the neighborhood, to cover transport costs (O'Connor *et al* 1990). .

Dairy producers in the Addis Ababa milk shed have available a variety of milk outlets for their production. A substantial amount of the milk marketed by producers, some 75% goes through informal channels; defined here as those channels which avoid

taxation and quality controls. These include direct sale to individuals, sales to institutions, sales to private milk traders, to retail outlets, and to informal dairy processors. But the only formal outlet for liquid milk the Dairy Development Enterprise which operates a system of milk collection and cooling centers along the major roads radiating from the capital (Staal and Shapiro, 1995).

The real consumer prices have continued to increase while producer prices and their share of consumer prices has declined. Estimates also indicate that milk-processing costs are escalating and by 2002 they accounted for about 57% of the price paid per liter by consumers. The cost of packaging material remains one of the major concerns (Andrew M.Karanga, 2003).

The farm-to-house arrangement for milk marketing usually involves a contractual type of arrangement in which individual producers may offer to deliver raw milk directly to the consumers at their homes or at some convenient location. This arrangement is especially common in the case of milk producers who are located in and around large cities, such as Addis Ababa. Rural areas which are distant to big cities have limited or little, if any, markets for liquid milk and milk surplus in such areas will be converted in to butter and/or ghee, and sometimes cheese, and sold in local markets. Such sales in local markets are usually made through established local traders, who may buy directly from producers at farm-gate. Process of butter and ghee, and cheese; vary within and between places, usually depending on season. Hence prices tend to be highest during the dry season (Debrah and Birhanu, 1991).

Raw milk is the source of a regular if not daily income around Holetta and Selale, while butter and cheese are sold at different frequencies in different sites, villages and even households with in the same village. In most cases these differences depend on the amount of milk produced daily, proximity to market and whether the family is fasting or not. The members of Ethiopian Orthodox church abstain from consuming animal products including milk and milk products for about 150 days per year during the fasting period. Farmers far from markets are not selling fresh whole milk, as it is not worth paying to take the small quantity to the market. Instead, they process it the sour milk collected over a few days in to butter and cheese and sell these at the nearest local market (Zelalem *et al*., 2000)

As few grow crops, most food stuffs are purchased milk surplus is shared with neighbors of extended in barter, but is rarely sold except by households living close (< 5 km) to maintain roads and urban centers where there is demand for fresh and fermented milk, and butter. Similar pastoral systems are found in southern Ethiopia working among the Borena, Holden and Coppock (1992) reported that frequency and amounts of dairy products traded depended on herd size and distance to the market butter replacing liquid milk with increasing distance and women from households with large herds trading more often. Butter was sold to lorry drivers and bus passengers' enroute to Addis Ababa, some 500 km away (Coppock D.L., 1994).

Market- oriented dairy production (MODP) technologies involving the introduction of cross bred cows and the utilization of complementary feed and management technologies for increased dairy production, is being undertaken in the of Ethiopian highlands and in many developing countries, particularly in peri-urban areas. In this system, increased milk production is treated as a commercial commodity as milk sales generate regular cash income. Market-oriented dairying has many food security-related benefits for peri-urban smallholder communities (Ahmed *et al*, 2003).

3. MATERIALS AND METHODS

3.1. Description of the study area

The study is conducted in, Fogera woreda, is located in South Gondar Zone of the Amharan National Regional State in northwestern Ethiopia. Fogera woreda is located in north-west of Bahir dar town at a distance of 60 kms, on the main highway leading to Gondar. The total area of Fogera is 117,414 ha out of which 54,471.76 ha is crop land, 9602.36 ha grazing, 2190 ha forest land, 251 ha is covered with perennials, 23,354 ha water bodies (Lake Tana), 7075 ha is used for constructions, 4375 ha wasteland ha and the rest 1698.24 ha swampy areas. The woreda is bounded with Farta woreda in the east, Dera in the south, Lake Tana in the west and Libokemekem woreda in the north (FWARDO, 2006). According to ILRI (2004) the woreda is characterized agro-ecologically as moist Woina Dega and the annual rainfall is monomodal and ranging from 1103 mm to 1336 mm and the temperature ranges from 19-20C^{o}. Topographically, the flat area accounts for 76 %, mountain and hills 11 % and the valley bottom is 13 %. Fogera has 40,958 households in which 40,630 are in rural areas and 328 households are found in the urban areas.

According to the Community Participation and Organization Desk of the woreda (2004), the population size of Fogera is 236,553. Out of this 121,424 are males and 115,129 are females. Among this 208,898 (88.3%) live in the rural areas and the rest 27654 (11.7%) in the towns.

In Fogera woreda there are 157,128 cattle (109989.6 TLU), 7607 sheep (760.1 TLU), 27867 goats (2786.7 TLU), 13,187 asses (6593.5 TLU) and 339 mules (237.3 TLU), 246,496 chicken and 21,883 beehives. Only 2831(1.8%) are found in the urban where as 154, 297 (98.2%) are in the rural areas, (CSA, 2003), only 165 heads of cattle are exotic breeds, and the remaining are indigenous breeds.

The feed resources of Fogera include, green fodder (58.63%), crop residue (7.81%), improved feed (0.06%), hay (7.47%), by-products (0.88%) and other (5.17%), (CSA, 2003).

Livestock diseases of most of economic importance diseases in the study area are Foot and Mouth Disease (FMD), Blackleg, Anthrax, Lumpy skin disease, Contagious Bovine Pleuropnuemonia (CBPP), Trypanosomiasis, Mastitis and Dermatophilosis (Zewdu, 2004).

In deed, the types of diseases reordered by the governmental and private veterinary clinics during the past years were bloat, Trypanosomiasis, Schistosomiasis, Blackleg, Anthrax, Gastrointestinal tract, Lungworms, Ticks, Mastitis, Sore teats, Babesiosis, Pneumonia, Leptospirosis, Pasteurollosis, Heart water, Brucellosis, Black leg, Milk fever, Intestinal worm, Liver fluke, Udder trouble, Faciolasis, Intestinal worm, Diarrhea and Tape worm.

3.2. Selection of peasant associations and participating farmers

The study was undertaken in twelve randomly selected peasant associations (PAs) which all are found in moist woina dega, and 40 heads of the households were randomly selected and interviewed from each PA, therefore, a total of 480 farmers were included in the study.

Field survey was conducted with a random open-ended discussion with the farmers included in the study. In this discussion the agricultural extension staff especially livestock experts and the kebeles development agents were involved in the open-ended discussion. The elders and those farmers who had better experience in cattle raising, especially in cattle milk and beef production participated in the discussion. To estimate the milk off take, milk harvested from milking cows were randomly measured

3.3. On-farm data collection

Data was collected in interviewing the farmers by a semi-structured questionnaire, and personal observations were made on hand milking; milk processing, marketing of dairy products such as raw milk and butter and beef animals, feeding and housing of dairy and beef animals. The health services given by the governmental and private clinics have also been observed during the study. Random measuring of the daily milk off take of the local as well as crossbred milking cows was made. Data on milk production in the peri-urban and urban areas and beef production and marketing in the rural livestock markets were collected using the data collection formats.

3.3.1. Data collection with a semi-structured questionnaire

Information was collected from 480 respondents using a standard questionnaire and data collecting formats developed to collect milk and beef production and marketing informations. Students of TVET colleges on apparent ship programs in the field of animal science were involved in data collection. Orientation was given to the students on how to fill the questionnaire, and interview the farmer in Amharic. The overall purpose of the interview was to understand the production environment; how farmers take various decisions in the cattle milk and beef production system, in order to analyze the constraints and the opportunities of cattle milk and meat production in the study area.

3.3.2. Data collection from the participating farmers through personal observation.

In the interviewed kebeles, observations were made on the following descriptions. The appearance of the animals was observed in order to estimate how they are being fed during the dry and wet seasons. The house was observed for neatness and adequacy in providing enough ventilation and space for the animals (if they are sheltered in closed houses). The amount and cleanness of water, which was used, by the farmers and the accessibility and the type of drinking water were also observed.

There were observations on the procedures of milk production starting from hand milking, smoking of the collecting materials, milk collections, and procedures before the fermented milk was processed. Marketing of products such as milk, butter and beef were also observed to assess the marketing structure , current prices, the amount supplied and market participants of these products. Data was collected on the heart girth measurement and estimation of dressing out percentage of the woreda cattle off take. Observations were made on type of the cattle supplied for slaughtering. The slaughtering service which was given by the municipality abattoir and the backyard slaughtering were observed, slaughtering procedures at the backyard and hygienic practices were also observed.

3.4. Data Analysis

Data collected was managed in such a way that the qualitative as well as quantitative variables were selected. The data so collected by semi-structured questionnaire has been entered in to MS-excel and SPSS (2000) soft wares and also coded for analysis. Descriptive, inferential statistics, regression and correlations were used for data analysis.

The qualitative parameters included among others were gender participation in the dairy farming, the type of the farming systems, the background of the cattle owner, source of information for dairying, reasons for doing dairying, access of training on dairying, dung utilization of the household, type of grazing of the household, reasons for not growing fodder, type of water resources, cattle housing, type of the breeding techniques, sources of the bulls, main constraints for dairy and beef production, market participation and the market chain analysis of the milk, butter and beef of the surveyed kebeles, main production inputs..

The quantitative parameters included were the family size of the households, total cattle number of the households, number of milking cows, area of crop and private pasture land, amount of milk produced, consumed and collected for processing, length of lactation length, weaning age of the calves, milk utilization pattern and beef production. Descriptive statistics such as the frequency, maximum, minimum, mean, standard deviations and the standard error of the quantitative variables were used. The variables milk production, number of milking cows, the area of the pastureland, area

under pasture and family size and their correlation on milk yield were analyzed by correlation analysis.

Statistical Model

$$\text{Model: } Y_{ijklm} = \mu + CL_i + FS_j + MC_k + PL_l + NC_m + \sum_{ijklm}$$

Where Y_{ijklm} = Milk produced per household

μ = Overall mean

CL_i = the effect of i^{th} of area of land under crops (i=0.03,…1)

FS_j = the effect of j^{th} family size (j=1,2,…14)

MC_k = the effect of k^{th} number of milking cows (k=1,2…7)

PL_l = the effect of l^{th} area of crop land (l=0.1…5.75)

NC_m = the effect of m^{th} number of cattle (m=1,2…28)

$\sum_{ijklm}$ = Random error

The determination co-efficient R for milk production in the household was 0.622. The milk produced in the household. An increase in 0.04, 1.81, 0.03, -0.461 and 0.08 for family size, number of milking cows, number of cattle, area under crop area and under pasture, respectively showed a unit increases in milk yield in the household. The increase in the number of milking cows had a significant contribution to the increase in milk production. It might be due to the transformation of the pasturelands in to crop farmlands which further might cause feed scarcity so that the area of crop lands of the household had a negative effect on milk production in respect to feed source available from pasture. In the surveyed kebeles as the size of the family increased the number of cattle in the household also increased. It may be due to this fact that the output of the

analysis showed cattle holding of the household also had a significant effect on milk production. Farmers who had many cattle were allocated plots of land for animal feed there fore area of pastureland had the second significant effect on milk production next to number of milking cows (Appendix 10).

The different activities under taken by the males and females in dairy production was analyzed by a chi-square such as hand milking, milk processing, cattle house cleaning and selling of dairy products test to estimate the frequencies of gender participation in the production systems.

4. RESULTS AND DISCUSSIONS

4.1. Dairy Production Systems in Fogera Woreda

The number of milking and dry cows in the mixed, peri-urban and urban production system is given in Table 4.

In Fogera the dairy production systems are characterized as the rural small scale mixed crop-livestock, the periurban and urban types. Most of the cows held on rural small-scale farms were lactating during the study period, while higher percentages of dry cows were observed on peri urban and urban farms.

In Fogera the dairy production systems are characterized as the rural small scale mixed crop-livestock, the periurban and urban types of dairy production systems.

Table 4: Proportion of milking and dry cows in three production systems in Fogera.

Production system	Cows	
	Milking	Dry cows
Rural small-scale (Mixed subsistence)	23034 (66.8 %)	11418 (33.2%)
Peri-urban	129 (67.2 %)	63 (32.8 %)
Urban	249 (43.8%)	319 (56.2%)

The data of milking as well as dry cows in the urban and peri-urban area was collected from house to house recording

4.1.1. Rural Small-Scale Dairy Production System

This subsistence type of production is the predominant milk production system accounting for over 97 % of total national milk production. In this system, a few far areas where crossbred dairy stocks are distributed, but largely the system is based on low producing indigenous breeds of zebu cattle. Livestock are kept under traditional management conditions and generally obtain most of their feed from native vegetation, aftermath grazing and crop residues (Staal and Shapiro 1996).

Rural small-scale dairy production in Fogera was undertaken by subsistence farmers owning 1-7 local indigenous local cows and cross breeds. The estimated number of the milking cows in this system is 23,034. This production system was constrained by feed, capital, disease mainly trypanosomiasis and internal parasites and genotype problems that are still hindering the milk and meat outputs. The local breeds used for milk production were *Fogera, Simada, Agew, Worie* and *their crosses*.

According to Zewdu (2004) Fogera breed is manly found in the *Wageter, Kiddis hana, Nabega*, *Shina* and *Shaga* kebeles and the other local breeds are the *Simada* and *Agew* found in other peasant associations.

In the surveyed kebeles about 2.8 liters of milk was produced per day per household out of which 0.6 liters was used for consumption, 1.9 liters for processing and 0.4 liters for marketing so that the marketable amount was the smallest portion of the daily

production. The milk suckled by the calf was not recorded so during the study the milk produced in a household did not include the suckled amount. Milk was delivered for market from dairy producers located in *Kuahir abo, Shina, Kiddist hana, Addis betechrstian* and *Wagetera.* The main feed sources in this production system were the uncontrolled communal grazing lands, crop residues and the aftermath. In this system most of the milking processing and selling of dairy products are done by the women. There is no much care for the calves born and the calves are allowed to suckle the dam for 30-40 days after that they were to graze on green forages in the homestead and some of them which did not get the green forage were feeding the calves dissolved barley flour. They call it *Enshurshur*.They were supplementing the calves Enshurshur in the morning especially from 10:00-11:00 a.m.

4.1.2. Peri-urban Dairy Production:

In this study the peri-urban dairy production system was taking place at small town; Alember, which was located 25 kilometers South east of the Woreda's capital and the main raw milk supplier to Woreta and Debre tabor towns. The population size of this town is 8308 out of which 4738 are males and 3570 are females. This town is found 23 kilometers northwestern of Woreta town.

In Alember there were 68 dairy producers out of which 20 of them have crossbreeds. The number of local and crossbred milking cows in the area were 107 (78 %) and 22 (17%), respectively. The amount of milk produced per day from crossbreeds and local

lactating cows is 121 and 367.2 liters, respectively. So a total of 488.2 liters of milk was produced in a day. Out of the milk produced in a day 75 liters (15.4 %) was sold, 79 (16.2 %) liters was consumed and the majority 334.2 liters (68.5%) was collected for processing. The average lactation length for the local and cross breed cows was 8 and 10 months, respectively.

The feed resources in Alember were natural communal and private grazing, hay, oil-seed cake and the crop residues of teff, maize stalk, finger millet. The daily milk off-take on the average from a local and cross breed cow was 2 and 7 liters, respectively. In this system milk producers were facing raw milk marketing problems due to low demand and long fasting days so that they preferred to collect the produced milk for further processing.

4.1.3. Urban Dairy Production:

The urban dairy milk production system is common in Woreta, Woreda's capital. There were 217 smallholder dairy producers in the town. These producers totally owned 249 milking cows out of these 55 (22 %) are the crossbreeds and the rest 194 (78 %) were local cows. The average daily milk off-take from a local and cross breed cow was 2 and 8 liters, respectively. The milk utilization of the town was different from the rural and peri-urban areas. About 828 liters of milk was produced daily and out of which 261.6 liters (31.6 %) liters was sold, 198.8 (24%) liters were consumed and 367.6 (44.4%) liters was collected for processing per day. Due to a better milk

market proximity the share of marketable milk in the urban area was higher that the two systems.

The urban dairy production in Fogera was undertaken by small holders who owned 1-2 crossbreeds and 1-7 local milking cows. The local breeds are Fogera, Agew and Simada types. The cross breeds were produced from the bull services of Abaregay, Yifag bull stations and Ethiopian Orthodox Church Child Care and Family Affairs (EOCCFA) of the Woreta branch. The small dairy producers found in Fogera buy crossbreeds pregnant and lactating cows from Debre tabor.

Unlike the rural and peri-urban dairy producers, the urban producers also were feeding their lactating cows the agro-industrial by-products such as the oil seed cake the wheat bran, hay, by-products of local breweries and natural pasture.. They had also the nearby AI and health services more frequently that the producers of the two systems. The share of the marketable milk was also high. In the surveyed kebeles the grand mean for milk production was 0.426 liters.

4.2. Household Age Structure, Cattle and Land Holding

According to CSA (2003), unpaid family workers constitute the highest proportion (56%) of the population in agricultural households who were engaged in agricultural activities at country level. And about 38 % of the working population was own account workers working in their farms working alone or with the help of family members but without hiring labor. The proportion who hires other in their farm was only about 4%

showing the low capacity of the country's agricultural industry to create employment opportunity for non-holders. The majority (81.9%) of female respondents in agricultural households who were engaged in agricultural activities were unpaid family workers, while self-employment (own account workers) was relatively the common type of employment status (53.1%) among males, showing the dominance of males over females in the tradition/culture of the society. The census result of CSA 2003 showed that about 80.8 % of the population in agricultural households aged 10 years and over was engaged in fully agricultural activities while only 16.6% of the population was engaged in partially agricultural activities. The proportion of population engaged only in non-agricultural activities was very small amounting only to 2.6%.

The interviewed respondents were employed in different activities of which farming ranked first, while pentionists the second. There were also businessmen and civil servants included in the study. Respondents from urban and peri-urban areas were also included in the study.

The total human population in the surveyed kebeles was 3540 out of which 2322 (65.5%) was in the productive age (15-60 years). And the total cattle population in these kebeles was 3492 and out of this the number of milking cows was 764 (21.9%).

The maximum and minimum cattle holding per household was recorded at Addis betechrstian and Wagetera, respectively. Multiple comparisons were made from the statistical out put of the least square differences thus, based on the observed means there was a significant difference ($P<0.05$) in milking cows holding amongst kebeles (Appendix 8).

In the surveyed kebeles, the milk produced and the number of milking cows in a household had highly positively correlated ($R=0.604$, $P<0.01$). And the milk produced in a household and the area under pasture owned by a household had also positive correlation ($R=0.103$, $P<0.05$). But there was no correlation between milk produced and area under crops and family size of the households (Appendix, 5).

Even though the number of milking cows and area of private pastures are significantly correlated in most of the surveyed kebeles insufficient pastures have not much hindered farmers to own milking cows, thus households owned more milking cows than the feed resource they owned on farm. Most of the respondents (60.4%) have one to seven cattle in their household, 34.5% respondents have 8 to 14, 4.1% respondents have 15 to 24 and 0.83% of the respondents have 22 to 28 cattle in their households. In terms of milking cows 57 respondents and most of the respondents (83.6%) have 1 to 3 milking cows, 4.8 % have 4 to 7 cows. In addition to this coverage of the pastures with *amykila,* flooding with is seriously affecting the pastures. Differences in cattle holding was highly significant ($P<0001$) between kebeles. The proportion of the milking cows out of the total cattle herd in the households ranged from 15 to 31.5 %. The maximum percentage

was observed in Wagetera and the minimum in Abuatihua. This may be due to the fact that those farmers found in the periphery of Lake Tana prefer to own more milking cows than others.

The correlation of the amount of milk produced per household and area under crops was significant ($P<0.01$). The mean for consumption per household was 0.57 liters. But there was no correlation between the amounts of milk consumed with area of land under pasture (Appendix 9).

The milk produced in the household and the number of milking cows were also highly correlated ($P<0.01$). The area of private pastureland was also highly correlated ($P <0.01$) with number of milking cows in the household. So that an increased area of private pasture might be important proportionally to the increased number of milking cows so as to increase the milk production in the surveyed households. But the amount of milk produced in the household were less correlated ($P<0.05$) with the area of private pastureland.

According to SAERP (1996) the average cattle holding of the Amharan region is 0.84. The current study revealed that the average cattle holding per household in Fogera woreda was 7.3. The maximum holding (9.73) was recorded at Addis Betechrstian and the minimum (5) at Wagetera. This indicates that Fogera has a big potential for cattle milk and meat production.

In Fogera area cattle holding was significantly different (P<0001) between kebeles. The average holding of milking cows in a household ranged from 1.18 to 2.15. The maximum holding of the milking cows was 28 and was recorded in Addisbetechrstian and the minimum in Abuatihua and Alember. Therefore, the average percentage of milking cows in the study area was 21.9 % out of the total cattle population.

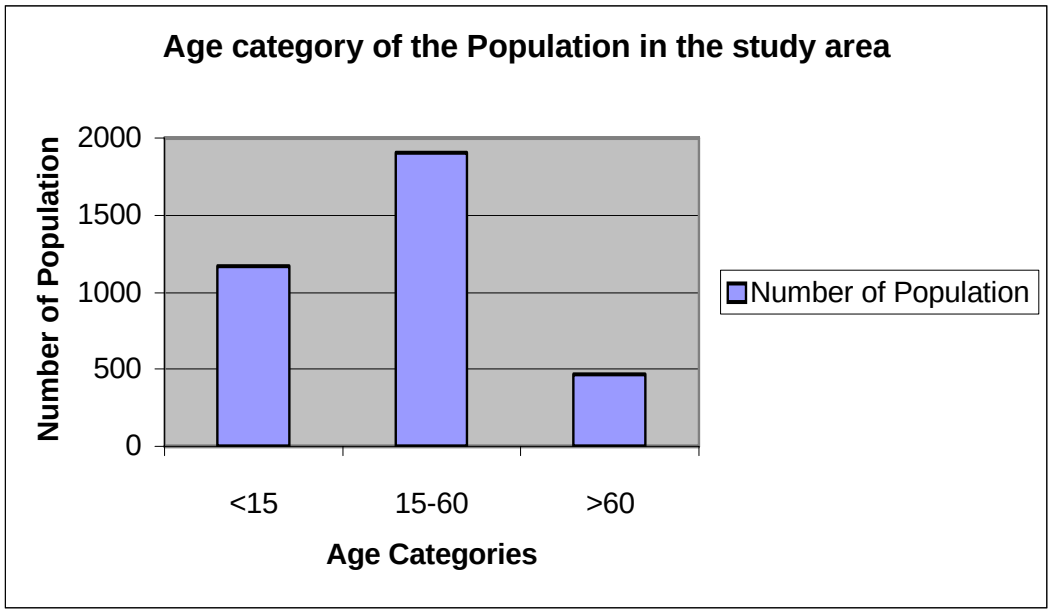


Figure 1:Age categories of the population in the surveyed kebeles

The age structure of the interviewed respondents ranged from 22 to 77 years old and the mean age was 44.26 (Appendix 2). According to CSA 2003 in Ethiopia all age groups who are above ten years old in the rural areas are involved in agricultural activities undertaken in the household so that out of the total population included in the study (3540), 1168 of them were under the age of 15 years old. Therefore, in this category the age groups of the population which were under 15 years old were

involved in livestock keeping activities and feed offering in the study area. As it is indicated in the above graph, the majority of the population were involved in dairy and/or beef production activities. The maximum and minimum land holding under crops was 5.75 and 0 ha, respectively. And the maximum and minimum land holding under pasture was 1 and 0 ha, respectively. The respondents who had better lands were having better pasturelands i.e. they allocate a plot of land in their homestead for animal feeds as well. In the surveyed kebeles most of the farmers owned 1.01 to 2 and 0.1 to 0.5 hectares of crop and pasture lands, respectively. A few respondents had large areas of the croplands (Appendix 7).

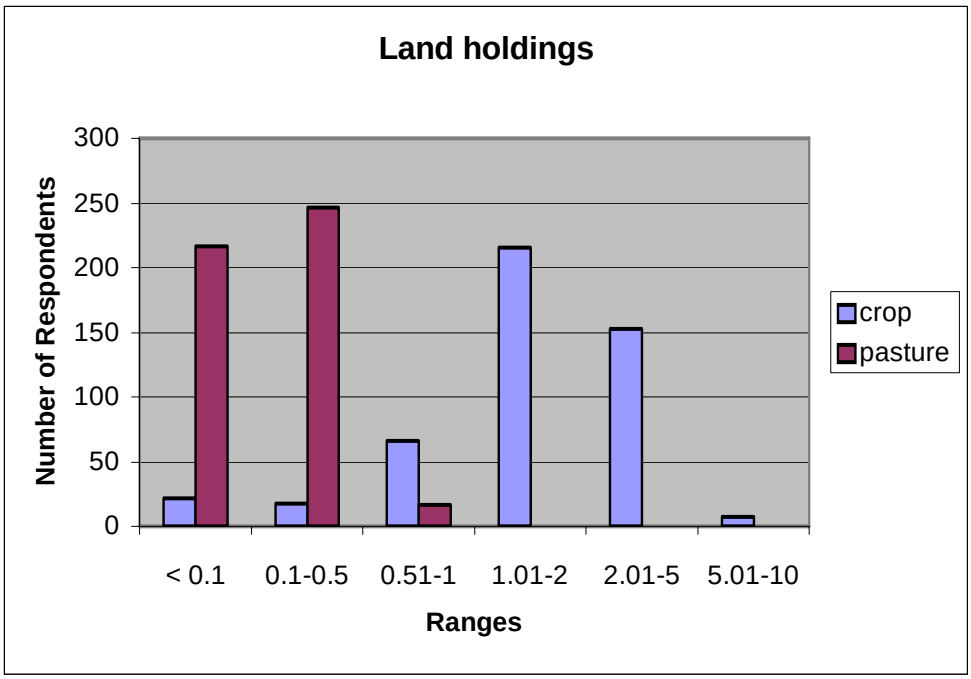


Figure 2: Land holding ranges in the surveyed kebeles

The average cropland holding of the most of the respondents (44.7%) ranged from 1.01 to 2 hectares.

4.3. Gender Role in Dairy Production

Dairy production activities were done by both gender groups. Herd keeping of the cattle mostly was for the children and daughters and other activities such as milking, processing, cleaning and selling of dairy products such as milk and butter was performed by adult males and females.

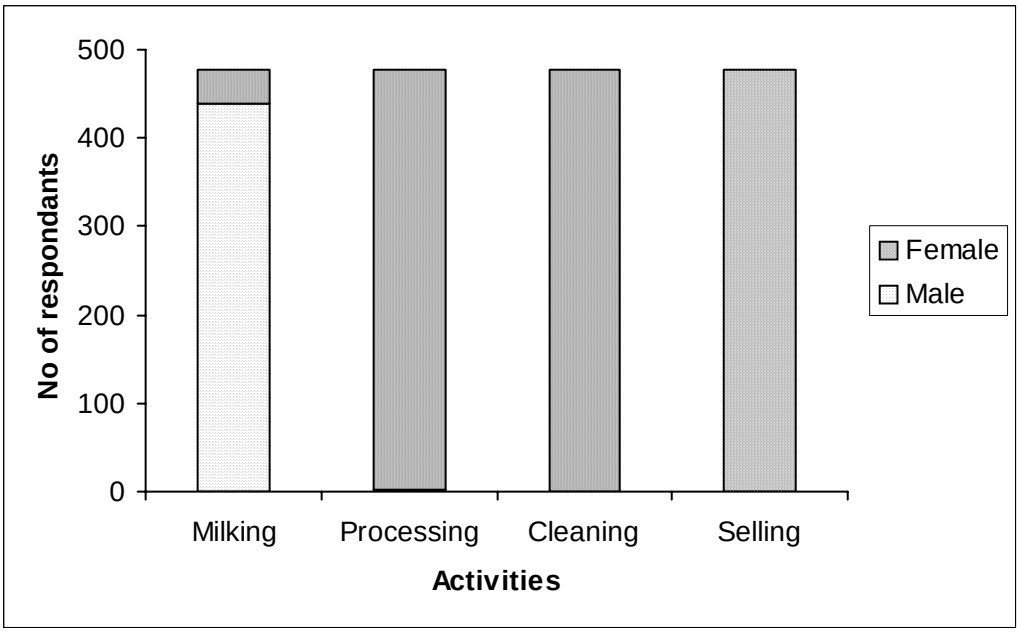


Figure 3: Dairy production activities versus sex group in the Fogera

As it is indicated in above graph the hand milking activity in Fogera is done by males which accounts 97.1 % and the rest 2.9 % by females on the other hand other dairy activities such as milk processing, house cleaning and selling of dairy products in this case butter were performed 99.5 %, 100 % and 100 %, respectively by females. These various activities were analyzed by chi-square test analysis to estimate the role both sex. Thus, there was a high significant difference in involvement between male and female in milking activity (χ^2=175.58, P<0001)(Appendix 2).

Only 12 of them i.e.2.52 % of the respondents were female headed households. This does not mean that the participation of females in dairy and beef marketing was limited rather the reverse holds true in the participation of dairy production activities such as in milk processing, cattle house cleaning and selling of the dairy products. In fact the participation of females in the hand milking activities was minimum due to tradition.

During hand milking activities there was little attention given to harvest the milk in a hygienic way. The milkers wash their hands only in the morning milking times with water but not in evening milking. If the husband is not around, the woman milks the cows. As long as there are sufficient family labor, more family members, the amount of hired labor is kept minimal.

During the raining season the male family members come Woreta town across the flooded plain by swimming the dairy product. The females cannot come the flooded

plain. Even though the females in the households that were processing the fermented milk 93.2 % of the processing activity was done by the mother and the rest 6.8 % by the daughters and employed workers.

Figure 4: Boys and daughter who in between 6 to 12 years of age were involved in livestock keeping activities.

4.4. Butter Production Practice in the Woreda

Milk is fermented either in a gourd or material made from clay. Gurna has a capacity of holding about 10 liters of fermented milk. The milk is churned at around 70% of its holding capacity. Churnable of volume 7-10 liters of milk (2.5 Girera-small gourds)

was needed for single churn. About 600 gm of butter was produced from 10 liters of milk.

In Fogera, butter is made from sour milk (ergo) which was made to sour for 3-5 days. The sour milk was placed in a clay churn or gourd which was smoked to added flavor to the product and to kill the microorganisms. The gourd is on a tripod stands or fixed poles and moved back and forth until the break even point is reached which was checked either by the louder sound (a change in the pitch of louder sound) of the churn or opening the top cover for the clay pot. Formation of the butter grains are checked through the hole made at the neck of the gourd whether they are formed or not by inserting and taking out a thin stick through the hole.

Figure 5: Rural women traditionally processing the sour milk

The time taken and recorded during the study to churn butter using gourd (*gurna*) was 25-60 minutes, which is less than the time taken for the clay pot which is 60-80 minutes. The amount of milk collected for a single churn varies with the number of milking cows and their productivity. The amount of milk collected was ranging from 5-10 liters, and the amount of butter produced per churn ranges from 200-500 gm.

Milk produced every day was collected in the collection clay or gourd smoked with a wood called *Terminalia brownie* or *aballo* in Amharic. The collected milk was made to ferment for three to four days. Fermentation of lactose by bacteria results in lactic acid souring, which is the basis of the manufacture of many dairy products. Under normal storage conditions in the tropics, milk sours in 4-5 hours. The souring has the advantages that it retards the growth of undesirable organisms and makes separation of fat easier. The fermented sour milk is mixed thoroughly by wooden stick called *mesbekia* in Amahric. This fermented milk is transferred to another churning gourd or clay. Finally the mixed fermented milk is churned. The buttermilk is boiled, cooled and made to Ethiopian cheese (Ayib).

4.5. Access of Farmers to Information and Training

The farmers in Fogera get information on doing dairy and/or beef production from different sources as indicated below.

Table 5: Sources of information on improved dairy and beef production

Source	Dairy		Beef	
	Number	%	Number	%
Radio	84	17.5	2	0.4
DA	200	41.7	18	3.8
NGOs	1	0.2	1	0.2
Training	24	5	1	0.2
Parents	144	30	6	1.3
No Information	27	5.6	451	94.2
Total	480	100	479	100

As it is indicated on Table (5) out of 480 respondents 200 of them 41.7 % of them got information about improved dairy production from the kebeles extension agents who were giving extension services around on the contrary most farmers did not get any information about beef production and perhaps that is why involvement of the farmers in beef production in Fogera was very low.

Some farmers also used indigenous knowledge from their parents about the rearing techniques. As it is indicated above table there are few NGOs giving a kind of extension services on dairy and beef production. These are the Ethiopian Orthodox Church for Children and Family Affairs of the Woreta branch focusing on dairying and the Seventh Day Adventist Church on beef production. Farmers were getting informations from a mass media (the radio). About 17.5 % of the farmers indicated that mass media such as radio as a good source of information on improved dairy production.

4.6. Cattle housing and Waste Management

Cattle were tethered either on the communal grazing land or in fences near the homestead during summer months. They tether the cattle in the homestead and nearby farmlands to use the cattles' dung for fertilization purposes. The dung was made to fertilize the communal pasture. It is only the oxen that were housed since they are used mainly for traction purposes in the dry and wet seasons. Most farmers house their cattle in the dry as well as wet seasons, although some of them did not house them in both seasons. Out of 480 respondents interviewed 307 (64 %) of them house their cattle where as the rest 173 (36%) of them did not house cattle. The management of the cattle is poor even in some kebeles there was no cattle housing which really further exposes the cattle to cold stress which directly affects the productivity of the animals. The majority of the respondents (98.1%) use the dung as source of fuel and the rest 1.9 % use it for fertilization this might be due to the fact that the soil in the surveyed kebele was fertile so that fertilization was not much important. Despite of this most of the respondents in the surveyed kebeles were not using artificial fertilizers.

4.7. Feeds and feeding

The feed resources of dairy cattle in Fogera were the privates and uncontrolled communal grazing lands, crop residues, conserved forage such as hay, agro-industrial by-products and the concentrate feeds and the aftermath.

In Fogera, out of 477 respondents 451 (94.5%) of them were producing their own feed either from their own pasture, crop residues and aftermaths and 196(5.5%) respondents purchased feeds especially pasturelands from other farmers either for free grazing and/or cut-and-carry feeding systems. Insufficient land, problem of labor and lack of inputs such as the forage seeds and lack of information were among the reasons given by respondents for not growing their fodder crops.

The area of the communal grazing land is the main and the only feed available for the farmers. The communal grazing land in the Fogera plains accounts for about 9602.36 hectare and were covered by a weed knows to be *Asracantha longifolia* (amykila). This is an annual weed of the swampy or poorly drained areas, often found in black soils. It grows erect to a height of 15-50 cm. It has swampy hairy leaves. Since it does have spines it protects the cattle from free grazing. In fact this weed is not a problem in privately owned pastures because the farmers that have private pastures remove it by hand weeding before flowering stage. Even though a few farmers were removing this weed from their communal grazing land other farmers on the contrary plough the cleared communal grazing for crop production. So due to this problem all the farmers in the surveyed kebeles were not volunteer to remove the weed from the common grazing land. In fact since two years 17,937 hectares of the communal grazing has been transformed in to farmlands. This is one of the main constraints that aggravate the scarcity of feed in Fogera. Dry season feeding is a problem through out the woreda. In addition to this there is no actual and regular feeding regime and during the wet season, the grazing lands were covered with flooded water coming out of the Gumara

and Rib rivers and at this time other grazing lands become very muddy and cattle could not graze. Grazing and/or cut-and carry system of feeding from private paddocks was a common practice for a few farmers. These paddocks usually are either in between the farmlands or in very marginal areas where there is poor sward growth and species composition.

In the Fogera plains even though there are sufficient amount of grazing lands the productivity of these pasture lands was very low due to overgrazing in the wet as well as dry seasons. The cattle herd keepers from the highland kebeles of Dera and Fogera woreda were trekking their cattle to these plains for pasture. There was competition for feed resource during the dry season especially from January to May every year. Such cattle trekking is decreasing due to the high stocking rates of these pasturelands and interbreeding problems.

Table 6: Proportion of the private grazing versus croplands in surveyed Kebeles.

Kebele	Average CL /HH	Average PL/HH	Proportion of pasture (%)
Kuahir Michael	1.97	0.12	5.7
Shaga	1.54	0.12	7.2
Kuahir Abo	1.69	0.15	7.1
Shina	1.65	0.2	9.03
Kidist Hana	1.55	0.16	9
Addisbetechiristian	3.46	0.32	8.4
Woji Arba	2.12	0.16	7.01

Wagetera	1.32	0.05	2.7
Meneguzer	2.16	0.12	5.2
Woreta Zuria	2.34	0.3	11.3
Alember	0.9	0.12	11.7
Abuatihua	2.11	0.31	12.8

The average land holding of the farmers in the Amahara region is 1.7 hectare (SAERP, 1996). Landholding of a household in the surveyed kebeles of Fogera woreda ranged from 1.02 to 3.78 ha. The average land holding in the surveyed kebeles is 2.4 ha which was greater that the average land holding of the region.

As it is indicated in Table(6) the proportion of the private pasture lands were low in areas such as Wagetera where natural communal pasture were more available and the proportion was high in kebeles where the availability of communal natural pasture was low. These were the areas of urban and peri-urban areas.

The farmers used different grazing systems to feed their cows on either on the private or communal pasturelands. Dairy producers using zero grazing were feeding their cattle by the cut-and carry system and are located around peri-urban and urban areas. Those that were using the semi-grazing system were feeding their cattle other feed sources such as the crop residues in the season when these feed sources were more abundant. Besides to these other dairy producers fed their cattle only on uncontrolled communal pastures in this the milk off-take recorded was very low (Table 6).

As it is indicated on table the average area of the cropland was maximum in the Addisbetechrstian Kebele and a better area of private pastureland, too. The average number of cattle per household was also maximum in this Kebele. But the milk produced/HH/day was not proportionally maximum due to lack of improved breeds and traditional management. The importance of crop residues as potential livestock feed varies with type of crop grown-cereals, grain legumes, roots/tubers-and also with the proportion of land under food crops and with the yields of the relevant plant material parts. The output of crop residues tends to rise with rural population density and rules of access. These in turn are influenced by land tenure and the relative importance of livestock in the farming system.

In the Woreda's capital a bulk amount of rice bran was produced from the rice polishers. The Hotel owners and other individuals in Woreta such as the local breweries use bran for cooking purposes. Some dairy producers were offering their cows rice bran ad libitum. However, most of the farmers revealed that they do not use it as cattle feed rather they were handing over the bran after the polishing service for the rice polishers. The traders who were coming from Gondar, Woldya, and Dessie, Nekemt, Dangila were buying this rice bran for the beef producers found in the mentioned areas. These traders were taking 20-200 quintals of rice bran in one trip to such places. At the time of peak rice production the rice polishers were collecting 3400-5420 kg from the farmers in one day and 2400-3400 kg in the slag period. The amount of rice bran produced from the processors increasing from year to year.

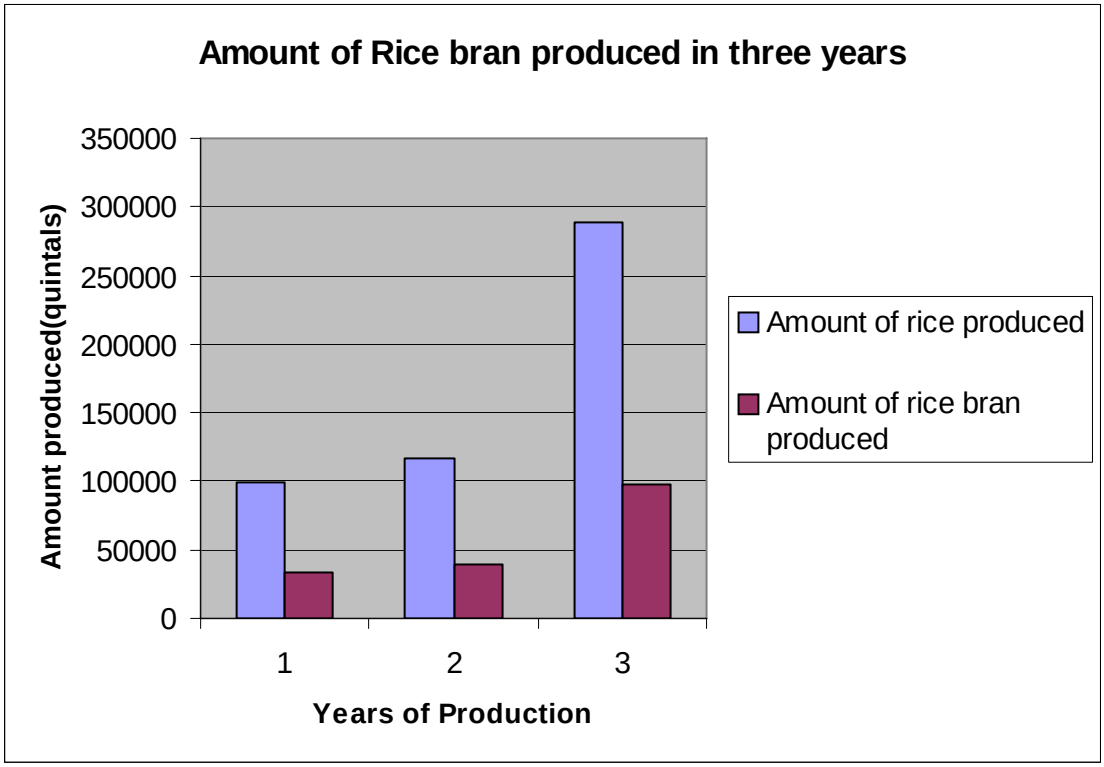


Figure 5: Proportion of rice bran produced in three consecutive years(2003-2005) (key;1 is 2003,2 for 2004 and 3 for 2005)

Rice bran is produced as a by-product from the rice processors. From a quintal of rice 32-36 kilgram of rice bran is produced so that a bulk amount of rice bran is being produced every year. The DM, TDN, CP, CF contents of rice bran are 91,70,13 and 12 %, respectively.

4.8. Drinking Water Resources

The farmers use different water resources for their cattle. Those which were nearer to Lake water for drinking. Out of the total respondents included in the study 48.75% use water for their cattle from ground wells, 47.2 % from rivers, 3 % from Lake Tana, 2.29

% from the ponds and 0.2 % from tap water. During the dry seasons there was a scarcity of drinking water in the kebeles that were using the wells when the water level decreases.

4.9. Cattle breeds and breeding techniques

4.9.1. Breeds

In Ethiopia according to CSA 2003, 99.4 % of the total cattle population in the Country are local breeds and the remaining are the hybrids and the exotic breeds that accounted for about 0.5 % and 0.1 %, respectively. The average lactation period per cow at country level is estimated to be about eight months and the average milk yield/cow/day is about 1.284 liters.

Indigenous cattle have been naturally selected for adaptive rather than for productive traits. Selection takes a long time and requires sustained effort to make substantial genetic progress and impact on productivity. However, due to high genetic variability among those indigenous animals, there is a potential to select for productive traits. There are some individual animals with relatively high milk production. Indigenous cattle are preferred to exotic/introduced animals for their robust adaptive attributes. Subsistence smallholders select particularly female breeding animals for a range of desirable attributes of their animals, but some of them attributes are related to behavior and body form of animals, which are not necessarily direct related to production functions (Bondoc *et al*., 1989, Dereje, 2005).

Genetic improvement for productive traits in livestock, particularly in cattle, has been very slow and insignificant in the country. One of the main reasons for this is lack of well-organized and usable recorded information on the performance of both the indigenous and crossbreeds with exotic genotype to undertake structured selection and breeding programs (Azage, 2000).

According to Zewdu (2004) in Fogera in addition to Fogera cattle breed, there are other breeds such as Simada, Worie and Agew cattle type in Fogera. The Simada is the well-known cattle type preferred because of lower market prices for buyers, as it is small in size. It is known to have good reproductive efficiency. However, this cattle type cannot tolerate the heavy fly burden and the swampy grazing lands of the area. According to farmers, it is its cross with the Fogera that can better adapt to the area.

Alberro and Hailemariam (1982 a; b as cited by Zewdu, 2004) have classified all the cattle population around Lake Tana as Fogera breed type. However, a rapid field survey (Workneh et. al. as cited by Zewdu, 2004) associate with Zewdu's study revealed that the true type Fogera cattle are found only in several villages of the Dera and Fogera districts of south Gondar, on the coastal flanks of Lake Tana. Zewdu's study also reinforced this view, and noted that these cattle are concentrated between Gumara and Rib rivers as well as the main road from Bahir dar to Gondar. According to key informants in the focus group discussions, presently true Fogera cattle are found relatively in large numbers in the following peasant associations: *Kidist hana,*

Wagetera, Shina, Nabega, Shaga and *Avona kotit* from Fogera woreda and *Zera-gigna, Korata and Fisa, Mitseli* from Dera district The Fogera and Horro are known as milk producers, the first being reared round Lake Tana in Amhara State and the second in Eastern Welega in the west of Oromiya State (Alemayehu, 2002, Zewdu, 2004).

The main locations in which the breed found are the Fogera plains around Lake Tana, southern adjoining areas of Gojam. Pied coat of black-and-white or black-and-grey; short, stumpy, pointed horns; hump ranges from thoracic to cervico-thoracic; dewlap is folded and moderate to large in size; docile temperament; used for daught, milk and meat (Rege and Tawah, 1999).

The reproductive performance of the breed was studied at Metekel ranch. The age at first calving for Fogera breed varied significantly in relation to breed type and year of birth, while season of birth has no effect. The age at first calving averaged 47.61 and 40.46 months for Fogera and F_1 heifers, respectively. The average calving interval for Fogera cows was found to be 559 days. The average gestation length of Fogera cows was 281.4 days. The cows mated to pure Fogera bulls carried their calves for 5.4 days longer than those cows artificially inseminated with Fogera semen. The mean body weight of Fogera and F1 calves were 22.45 and 24.92 kg at birth and 114.2 kg and 130.5 kg at weaning, respectively (Addisu and Hegede, 2002).

Until the early 90's, the Fogera cattle from marsh areas used to be trekked to the uplands (out of their territory) during the wet season, from July to October, depending

on the rainfall pattern and distribution. This is mainly due to severe flooding problem that occurs in the wet season. During the dry season cattle from other kebeles of the woreda and other woredas were trekked to these plains that have relatively better grazing lands. This system resulted in growing of grazing pressure on pasturelands of the marsh plain areas. But there was no movement of Fogera cattle to the upland drained areas due to land scarcity in the uplands. In both cases there was a deliberate as well as unintended interbreeding between the Fogera and other cattle types. Last year there were only two herds which were trekked to this plain from Dera woreda for pasture seeking. Since the farmers in the marsh areas were accusing of accommodating such herds due to inbreeding problems and pasture protection the number of herds which were coming to these plains is decreasing from year to year. The farmers revealed that the coat colors such as black and red of the cattle observed which are now becoming common in the grazing pastures were unusual. Peculiar patchy and spotted coat colors of red and white and/or black and white are the distinguishing coat colors for the Fogera breed. During the current study out of the 480 respondents interviewed only six (1.25%) of them owned the cross breeds, and the owners of these cross breeds were found only in the towns.

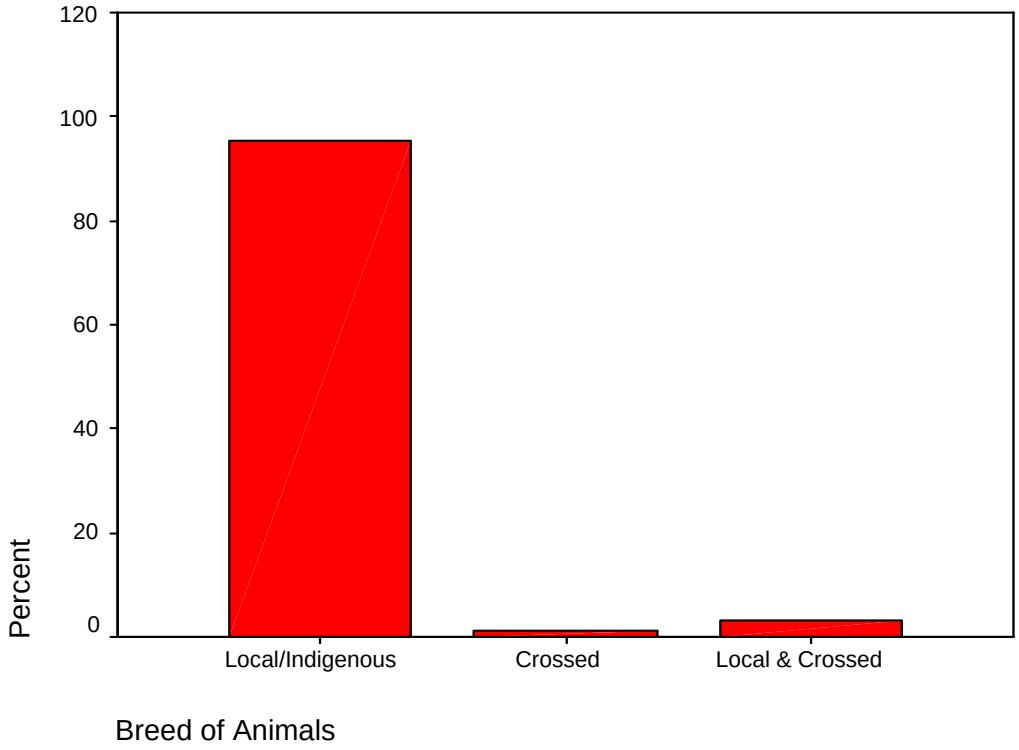


Figure 7: Graphical representation of cattle breed types in the surveyed kebeles

The type of cattle used for dairy production are the indigenous breeds such as *Fogera, Agew, Worrie* and *Simada* breeds and the crossbreeds of these breeds, Crossbreed 50% Fogera-HF heifers which were provided by the MOA from government ranches such as Metekel and Heifers which were produced from the two bull stations found in Debre tabor (Abaregay) and Addis Zemen (Yifag) and sold by the individuals.

Farmers in Fogera did not prefer cattle breeds from Simada and Estie because as they revealed it these breed types do not resist the plain areas and heavy fly burden but those local breed brought from Gojam, Wogera and Dembia were more preferable than those breeds mentioned above because these breeds adapt easily.

Figure 8: A Fogera breed showing docile temperament to a herd keeper

The introduction of crossbred cows and complementary feed and management technologies for increased dairy production results in commercialization of smallholder farms. The milk produced is treated as a cash commodity and integration into the markets occurs. Such intensified, market-oriented dairy production has the potential to make smallholder dairy production the potential to make smallholder farming systems more viable and sustainable. The introduction of these technologies substantially raises milk production and incomes where development driven. The impact of dairy technology on nutrition and health may result from direct increases of households' consumption of milk and dairy products. The impact can also be indirect

through higher household expenditure on food, health and sanitation (Shapiro et al 1998; Tangka et al 2002).

The introduction of crossbred heifers having a 6-month pregnancy to Fogera woreda from the ranches was also increasing the household income of the farmers who were selling raw milk to individuals and caterers. From my observation there were two farmers who were delivering raw milk daily and were gaining a gross income of 425 and 500 EB in a month, respectively. This enabled the rural farmers to take milk as a cash commodity. In fact there were five rural farmers who regularly were delivering the morning milk to the cafeterias and individuals living in Woreta town. All the five farmers owned crossbreed cows. From the milk record of a farmer around Woreta who has got a 50% Fogera-Holstein crossbreed heifer from MOA on August 06/2004 produced 3000 liters of milk from the crossbred cow in the ten months of lactation (October-July, 2004/2005). The farmers were earning 500 EB per month from a raw milk sale.

4.9.2. Breeding techniques

Breeding techniques in Fogera are of two types. They are Natural mating and Artificial Insemination.

4.9.2.1. Natural mating

Bulls can be used for two main types of natural breeding, either free mating in the range or controlled hand mating. In the former system heat detection is carried out by

the bull and cows in heat are usually mated several times during each heat period. One bull can cover 40-50 cows per year, provided there is no market seasonability in the occurrence of heat. In the large herds several bulls may have to be used in rotation, since it is often impossible to introduce two or more bulls at the same time due to aggressive behavior towards one another. In hand-mating systems heat detection and timing of service is carried out by the farmer and each cow is mated once or twice during each heat period. In this situation a bull can be used to mate three to four cows per week or 150-200 cows per year. If a bull is used after a period of sexual rest exceeding two weeks, the first ejaculate is usually poor quality and therefore a repeated mating should always be done after several minutes (Flavey *et. al*.1999).

In the current study during the breeding season some farmers were breeding their cows and heifers by the superior bulls which were owned by themselves or the neighbors. Most of the farmers bred their cows by any bull available in the herd when their cows came to heat. Some farmers who have superior bulls were not also volunteer to give their bulls to their neighbor for breeding service because of the lack of understanding that their bull might loss its genetic superiority due the interbreeding process. Some farmers living around Woreta paid 5 EB for a single crossbreed bull service which was owned by Ethiopian Orthodox Church Children care and Family Affairs of the Woreta branch.

Figure 9: An 87.5 % Crossbred HF bull found in Abaregay bull station (Debre Tabor)

4.9.2.2. Artificial Insemination

Artificial insemination requires semen to be collected from a bull, who is encouraged to mount a dummy cow or sometimes a' *teaser*' cow and his penis is manually directed in to an artificial vagina. This has a heated jacket to maintain the device at the right temperature and to ensure that the conditions in the rubber sheath replicate the conditions of the vagina as closely as possible.

Artificial Insemination may be preferred to insemination by a bull, because the rate of genetic progress can be increased, there is no cost or no danger associated with keeping a bull on the farm and the conception rate may be increased. To achieve genetic progress in a herd, a bull must proven to be of high potential by test-mating it with at least 20 cows. The farmer then has to wait 4-5 years until the performance of the offspring is

known. Even if the bull is proven to have high genetic merit, he can only be used for a maximum of four mating per week, giving him limited reproductive capacity compared with 30,0000 matings per year that are possible when a bull is used for artificial insemination. Providing the necessary resources for artificial insemination is relatively more costly in developing countries, especially if the transport and semen storage costs are high. A second disadvantage of artificial insemination is the potential loss of genetic diversity caused by farmers using a small number of high-value bulls (Phillips, 2001).

The technique involves care and rearing of males from birth to maturity; collecting, grading, preserving and transporting of the semen to females. Development and spread of AI programs has many advantages. The most important one is the use of good sire to produce many daughters in different agro-climatic zone to improve the future generation. With the advent of frozen semen, it is now possible to transport semen too far off places and also use the semen even if the bull is dead. The AI also helps in prevention of spread of reproductive disease through use of disease free bulls (Falvey, 1999).

Artificial insemination is not commonly used in many tropical milk production systems: normal (natural) service using a bull is practiced. If normal service is used and the bull runs with cows, there will be no need for the farmer or stockman to worry about estrus detection. When AI is used, the precise of time of estrus must be detected for the insemination to be carried out at the right time (Mattewman, 1993).

Out of 476 respondents only a few respondents i.e. 45 (9.4 %) bred their cows with Artificial insemination in this case breeding technique 1, 198 (41.5%) and 208 (43.6%) respondents were breeding their cows by their own bulls and bulls owned by their neighbor, respectively in this case breeding technique 2, and the rest 25 (5.2%) respondents were breeding their cows by a crossbred bull owned by the Ethiopian Orthodox Church Child Care and Family Affairs of the Woreta branch, in this case this was a breeding technique 3. As it is indicated on the above graph, even though the demand for the technique was very high the proportion of respondents who were using Artificial Insemination breeding technique was also very minimum which accounts only 9.4 % as compared to the other techniques this is due to that the fact that AI service which was given in the woreda was not sufficient enough. During the current study (2005/2006) there was only one AI technician who could not able to satisfy the increasing demand of the dairy producers. Besides to this there was also road inaccessibility during wet season, In fact there were eight farmers who were trained on AI by MOA unfortunately all of them shifted to other different duties without giving the breeding service so that farmers were using any bull service so as not to miss the critical breeding season.

4.10. Dairy and Beef Cattle Performance

The genotype of tropical breeds is not generally the factor which limits beef production, at least with the modest level of environmental control which still prevails in the majority of tropical countries. The dairy live weight gain obtained in good rearing conditions (correct feeding, rigorous health control, good management)

confirms this point. It is not the same in the case of milk production where cows of local breeds usually respond badly to improvement of the surroundings and rapidly reach their production ceiling (Pagot, 1992).

At IAR stations, the milk yield of Boran, Horro, and Barca cattle was 494, 675 and 559 kg, respectively. Arsi and Fogera have similar production level, which was 872 kg per lactation. However, the milk yield of Fogera did not include the milk suckled by their calves; but the Arsi and Zebu at Asela station were milked without being suckled by their calves. In comparative study at Gondar station the total lactation yield of Fogera and their F_1 and Frisian crosses was 872, 524 and 472 kg, respectively. An increase in annual milk yield by 300% in F_1 crosses as compared to Fogera was observed at Gondar. When the milk suckled by their calves is taken into account by considering growth rate of their calves, the total milk yield of Fogera cows would range between 1174 and 1220 kg. Further analysis of the milk yield of Fogera cows showed that the mean milked – out yield of the best 50 and 25% of the cows was 1156 and 1462 kg, respectively, with the maximum yield of 2817 kg. Accordingly only 5% of the Arsi cows yielded over 800 kg with yield of 1340 kg. Similarly, the best 10% of Horro cows at IAR averaged 1200 kg with the maximum yield of 1528 kg per lactation (EARO, 1999). However, most of on-station findings on the performance of indigenous cattle on milk and other associated traits showed very low figures (Ababu, 2002).

The maximum and minimum amount of milk produced in a household was 40 and 0.25 liters, respectively. Out of the total respondents 234 of them were producing 0.25 to 2.5 liters of milk in the household, 147 households were producing 3 to 5 liters and 48 of them were producing 6 to 40 liters in a household.

The amount of marketable milk to be sold from the kebeles was very low as compared to the amount consumed in the households this is due to the tradition taboo that prevents sale of milk from local cows. There was no a delivery of milk for sale from *Kuahirabo, Shina, Kidisthana, Addis betechrstian* and *Wagetera* kebeles. Long distances of a few kebeles from the Woreda's capital was also one of the reasons not to deliver the raw milk to market. On the average the amount of milk delivered to the market per household was greater from Woretazuria and Alember kebeles which had a better market access for the raw milk. The amount delivered from a household was 2.24 and 1.08 liters, respectively. The marketable amount of milk can be increased by organizing and strengthening the dairy co-operatives to collect and deliver the dairy products to the consumers.

There was a high significant difference ($P<0.001$) between kebeles in delivering the raw milk to the market. Only a few producers from a few kebeles were delivering marketable milk to the towns.

Table 7: Average family size, milking cows, yield/cow, avr.milk produced, maximum consumption per household and amount of milk consumed per household

Kebele	Aver. Fs	Avr.no . Milk cows	Yield/Cow	Avr.milk prod/HH	Max. con/day/HH	Milk con/per

K/Michael	6.8	1.7	0.65	1.11	0.5	0.07
Shaga	6.75	1.2	1.9	2.31	2	0.29
Kuahir Abo	6.55	1.7	2.15	3.65	2	0.3
Shina	4.22	1.73	1.23	2.13	1	0.23
K/Hana	6.9	1.48	1.0	1.53	1	0.14
Addis/Betech iristian	5.9	2.08	1.4	2.96	2	0.33
Wiji Arba	6.35	2.15	2.1	4.54	4	0.6
Wagetera	6.12	1.45	2.4	3.45	2	0.3
Menguzer	5.3	1.45	1.1	1.61	1	0.1
Woreta Zuria	7.6	1.83	2.6	4.72	2	0.2
Alember	6.8	1.18	2.9	3.45	2	0.3
A/Tihua	6.55	1.18	1.7	2.03	1	0.1

In this study the average milk produced from a local cow per day per household ranged from 0.65 liters at Kuahir Michael to 2.9 liters at Alember this difference may be due better management; feeding of milking cows the oilseed cake produced from the oil extractors found in the town and also may be due to better access of the nearby health service deliveries. On the other hand the lower production at Kuahir Michael might be due to sever feed scarcity due to water logged communal pastures observed at the Kebele. And the amount of milk consumed per head per household ranged from 0.07 liters at Kuahir Michael to 0.62 liters at Wojiarbamba.

The dairy products in Fogera are consumed in the household in the form of fermented (sour) milk they call it in Amharic, *Ergo*, raw milk, Ethiopian cheese (*Ayib*), buttermilk they call it in Amharic *Wogemit(Arera)* and the whey obtained after the boiled butter milk they call it in Amharic, *Aguat*.

Fattening enterprises in western countries typically take immature feeder animals and bring them to market weight for sale to slaughter. Cattle in these enterprises normally enter the feedlot at well under one year old and are fattened for six months. Smallholder cattle fattening is also a traditional occupation with in some regions in Ethiopia, e.g. in Harerge Zone of the Oromiya Region where locally named Harar beef is produced. Fat cattle from Harar realize a premium over store condition cattle of up to 50% in the Addis Ababa market (MOA, 1985).

Fattening activity in the Amharan Region, however, differs substantially from the above mentioned western enterprises, in that our smallholder farmers commonly fatten mature and therefore much older animals (5 to 7 years old) for short durations (usually three months). Ordinarily, farmers fatten their draft oxen so that the can fetch better price when brought to market. Some, on the other hand, purchase oxen specifically to fatten and sell them so as to get increased price per weight margins on each fattened animal. In such cases, animals are purchased based on their large skeletal frames and their body conformations. In any case, whether using purchased or own animals, most cattle used for fattening purposes have already reached their full skeletal size. Hence, these fattening more closely resemble fattening of culled cows in western economies (BOA, 2004).

Data was collected on three livestock markets to evaluate the body weight, current price and the performance of beef production of the woreda beef producers. The data

collection was undertaken for 23 days. The maximum weight recorded was 344 kilogram and the minimum was 191 kilogram. The type of cattle supplied, as beef animals were also emaciated and better condition. The cattle supplied as beef were from all age groups and box sex groups. Farmers in Fogera buy oxen for soil tillage from February to March months from Woreta, Debre tabor, Yifag, Alember and Hodgebeya livestock markets. The price of an ox in these months was 650-760 EB. After the farmers finished their tillage they were selling as beef animals after they fed grasses for one to three months with a range of 1100-1800 EB at the cattle markets. Farmers in the open-ended discussions revealed that the trend that they were facing capital and feed problems. Most of the farmers preferred to buy oxen and bulls (2-4 years) to supply to market due to fast body weight gained.

Data was also collected in the Municipality's abattoir to know the proportion of beef animals in grade. Out of 102 cattle only 18(17. %) were in grade 2, 71 cattle (69.6%) were in grade 3 and the rest 13 cattle (12.7%) were very emaciated and were in grade 4. During the study the butcher houses found in Woreta were buying any cattle as beef and which were cheaper. From the live weight and carcass measurements the estimated percentage of dressing in the woreda was 54.5 %.

4.11. Dairy Products and beef marketing

The American Marketing Association has defined marketing as the performance of business activities that direct the flow of goods and services from producer to consumer or final user. In agricultural marketing, the marketing process begins at the

point and continues until a consumer buys the products at the retail counter or until it is purchased as raw material for another production phase. Because consumption is the purpose and end result of production and marketing activities, it is necessary for marketers to focus their activities towards satisfying consumer wants and needs. It is difficult to successfully market something consumers do not desire, even with massive promotional endeavors (Cramer, 1997)

Traditionally, agricultural support programs have focused their investment at the production end of the market chain, at the farmer's level, the aim being to increase production in order to create different levels of surplus to sell at the market place. Increasing production has been achieved through input supply programs supported by production based research, and agronomic assistance, the typical package being a combination of new high yielding varieties, fertilizers and pestcides. This type of intervention leads to increased output, measured in terms of yield per unit area cultivated. For food insecure areas this approach has been highly successful in improving the supply of basic agricultural products and food security is an essential first step in avoiding absolute poverty.

However, getting the balance right between demand and supply in the marketplace takes more than production focus. All too often, markets are unable to absorb rapid increases in production can swiftly oversupply the consumption needs of a community causing a collapse in local prices.

The milk and beef producers in Fogera were facing with marketing problems in the times when the demand for livestock products was low. Milk is a day to day and perishable product which should get a reliable demand unless it is converted to other dairy products. Since most of the consumers of these livestock products are the followers of the Orthodox religion (94.5% of the total population) the producers faced with such marketing problems during the fasting days which abstain from consuming such products so that the producers were selling dairy the products with unattractive prices.

Table 8: Proportion of households faced with dairy product (butter) marketing problems

	Have you Problem in Marketing?		Proportion of respondents faced marketing problems
Kebele	Yes	No	(%)
KuahirMichael	1	39	2.5
Shaga	18	22	45.0
Kuahir Abo	-	40	0.0
Shina	39	1	97.5
Kidist Hana	40	-	100.0
Addis Betechiristian	35	5	87.5
Woji Arba	20	20	50.0
Wagetera	39	1	97.5
Menguzer	40	-	100.0
Woreta Zuria	21	19	52.5

Alember	37	3	92.5
Abuatihua	30	10	75.0
Total	320	160	66.7

As it is indicated in table 9 most of the respondents faced the problem. This is mainly a problem during the fasting days when the Orthodox Church abstain the consumption of livestock products. In Fogera out of the population 94.5% are the followers of this religion.

4.11.1. Milk marketing

The type of milk marketing was informal type of marketing. It was a type of a monthly contractual agreement that means the producer and his client agreed on the amount to be delivered in a day and the price per litter as well and finally the producer received the money at the end of the month. And the producers which were selling the milk in such type of agreement were those producers who owned the crossbreed cows. The other system was that the producer directly sells to the consumer. This type of market was on and off type; it is not sustainable. It existed in the time when there was peak production in wet season.

Because of limited rural road net works and the absence of collection systems and processing facilities, the flow of liquid milk from surplus milk producing milk sheds to urban centers is impended. The participants of milk marketing on Fogera were the producers, the caterers and the Consumers.

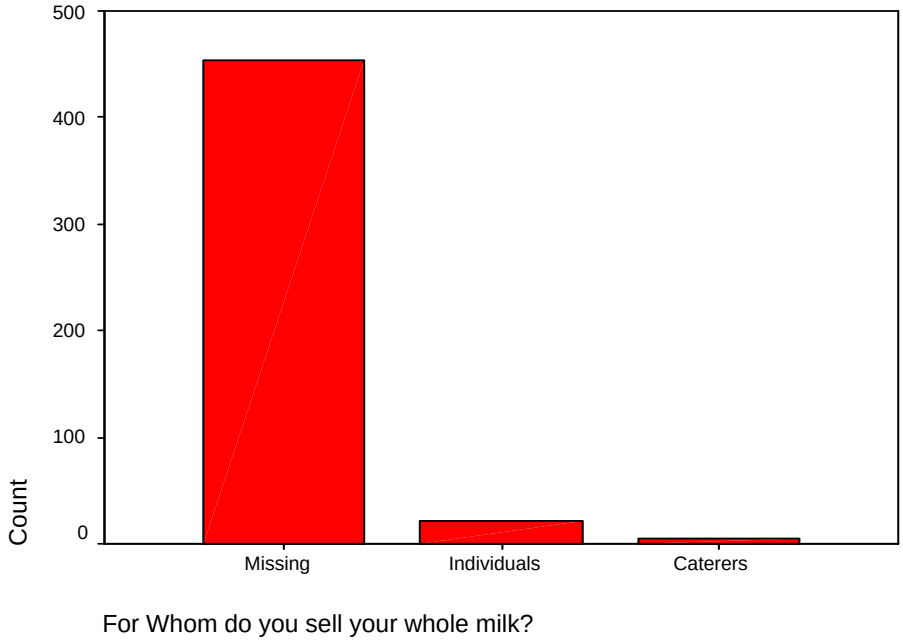


Figure 10: Graphical representations of milk buyers

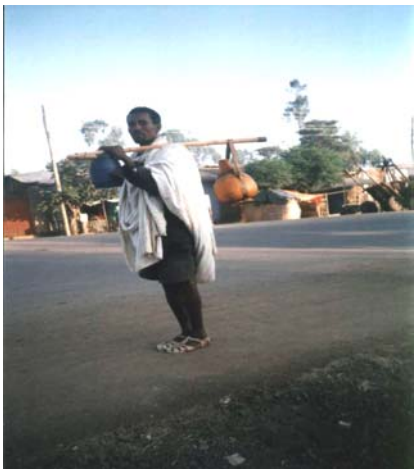
NB: missing values indicate the number of respondents who do not sell raw milk.

In this bar graph the missing value show that the proportion of the producers who do not sell the raw milk. They use the milk for household consumption only.

Producers

As it is indicated below (Figure 8 a) the milk producer delivers the evening milk in form of curd (ergo) and the morning milk in raw for the cafeterias and individual consumers.

The caterers and consumers occasionally reject milk of inferior quality when the producers bring adulterated milk in unsanitized container and/or slightly coagulated milk which is not needed by the buyers. Such producers take back their milk to their house. Farmers use a small to medium sized gourd to deliver their milk. The name of this container in Amharic is *girera* and its holding capacity is 1-4 liters. There were also some milk producers who would like to deliver the raw milk to the market but due to lack of market proximity they do not sell milk. To minimize such losses, the farmers should have effective extension service on how to produce and handle milk. Organizing farmers' cooperatives giving training about production, processing and marketing is a critical step in dairy development in Fogera woreda.



a

b

Figure 11: a, a milk producer delivering milk to market and b, rural woman selling butter to an assembler

Caterers

The caterers were buying the raw milk from all producers. Out of the total caterers five of them had regular clients. They buy the milk if it was produced in a hygienic way. The service providers that made agreement with the producers (regular suppliers) to handover the milk they were sharing the crisis of the producers during the long fasting days. During the study time in one day 247.5 liters of milk were supplied to these service givers found in Woreta and Alember towns.

Consumers

These are the individuals who were either directly buying the raw milk from the producers or consuming from the caterers. A few consumers were giving the comments about the taste of milk they are provided with for the service providers.

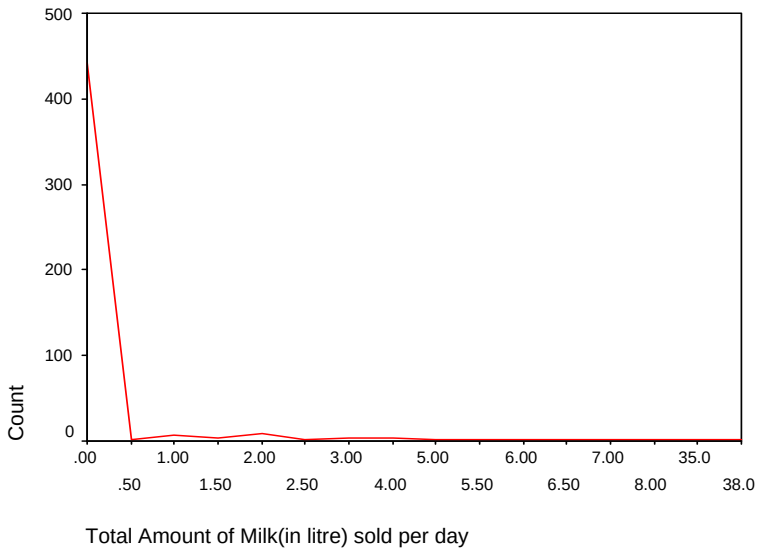


Figure 12: Graphical representation of marketable milk in the surveyed kebeles

4.11.2. Butter Marketing

Butter in Fogera was produced in traditional churning. And it was supplied to the market after the woman collected the butter produced from 3-5 churnings. Some of them also were selling the immediately produced butter to the market. In the rural markets of Fogera, butter prices were fluctuating in the dry and wet seasons which were ranging from EB 20.00 for a kilogram in the wet season to about EB 28.00 for a kilogram in the dry season. Retail prices ranged between EB 22.00 and 30.00, depending on product quality and market demand, the price was higher at Easter and during other feasts and lower during the Fasting periods prescribed by the Orthodox Church.

The participants of butter market chain analysis in Fogera woreda are the Producers, Rural assembler, Wholesaler, the Retailers and the Consumers.

The producers were bringing the butter to the market places in the market days by walking for a few minutes to four hours travel. The market places are *Woreta,* Alember, Woji, Hodgebeya, Robit (Wotemb), Maksegnit, Yifag, Wudo and Hamusit. The producers were selling the butter to the rural assemblers, wholesaler, retailers and/or consumers. The peak production season for butter around Alember was from June to September; in this season the estimated amount of butter supplied in the rural markets during the wet season was 39,360 kg and 11,268 kg in the dry season (October-May).

Table 9: Estimated amount of butter supplied to the markets in the two seasons

Name of market	Amount of butter supplied to the market in the two seasons (kg)		Total butter supplied /yr (kg)	Distance in km
	Dry season	Wet season		
Alember	4320	15040	19360	0
Robit (Wotemb)	1828	6400	8228	15
Woji	2285	8000	10285	10
Kinti	1920	6720	8640	16
Maksegnit	915	3200	4115	15
Hodgebeya	11760	8400	20160	15
Nabega	7879	5628	13507	20
Meneguzer	1105	885	1990	12
Woreta	5686	12222	17908	0

The butter in these was collected by rural assemblers. In each market 40-102 rural assemblers were coming from Alember, Woreta and Debre tabor in the market days.

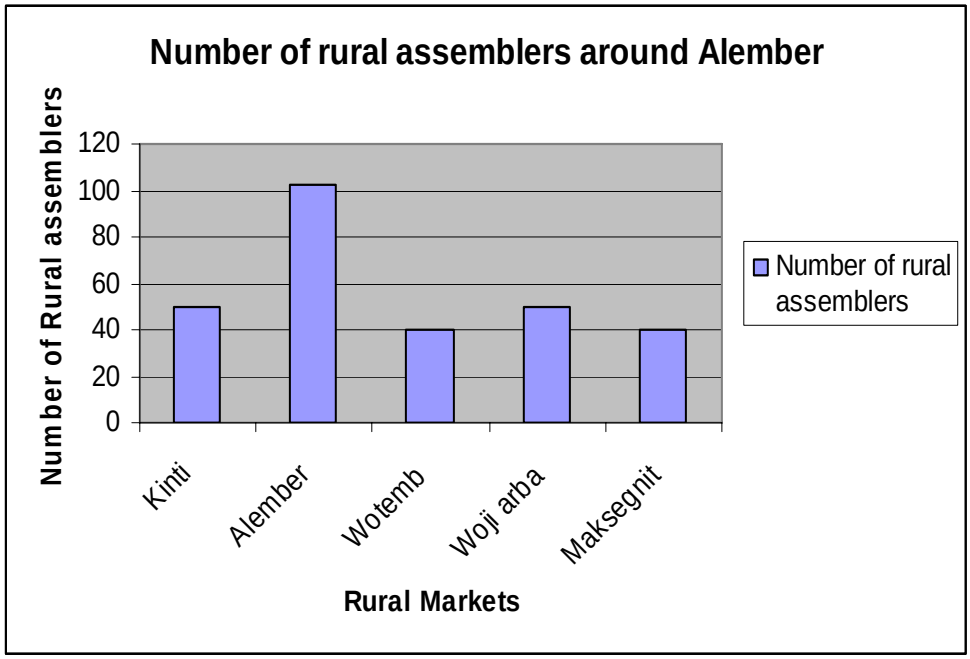


Figure 13: Number of Rural Assembler around Alember

At Alember market, the retailer was not only buying the butter from rural assemblers who were collecting butter from the producers came from different PAs to Alember, Wotemb, Woji, Kinti and Maksegnit markets but also directly from the producers. The retailer had 40-50 regular clients from Zeng, Wotemb, Addis betechrstian and Sinko who were delivering butter in every market days.

During the study at Alember 400-550 kg of butter was provided at one market day especially Saturday. Out of this amount 300 kg (63%) is taken to Debre tabor, 200 kg (42%) to woreta by the retailers and the rest was collected by the retailer in Alember for retailing to passengers and other individuals. The retailers who had better financial

capital were giving money to the other retailers whose financial capital was low. They came from Aringo and Debre tabor and could not able to buy by their own.

The retailer at the Alember market also were taking 400-500 kg of butter to Addis Ababa butter market, about 300 kg to Dessie, Gondar and Bahir dar. Since Alember is crossed by the main high way passing from Woreta to Djibouti he was also selling the butter for heavy tracks drivers driving to Djibouti.

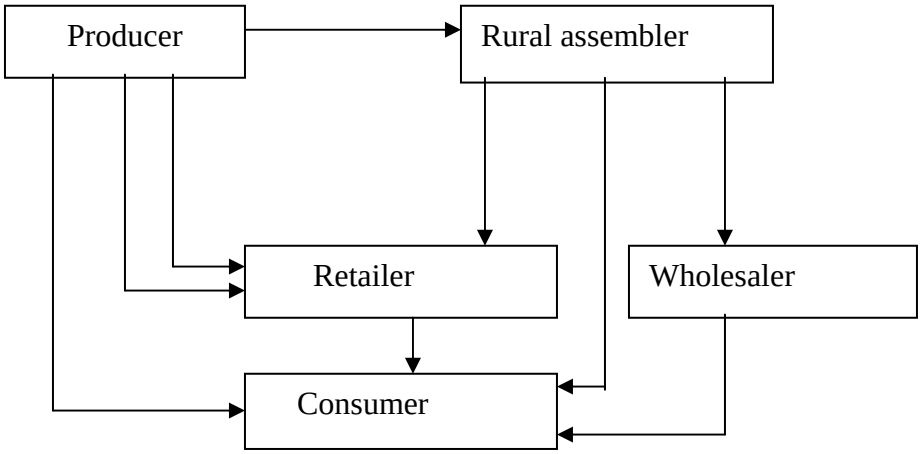


Figure 14: Market chain of butter

The buyers of dairy products in this case butter were the individuals, rural assemble ,retailers and wholesalers

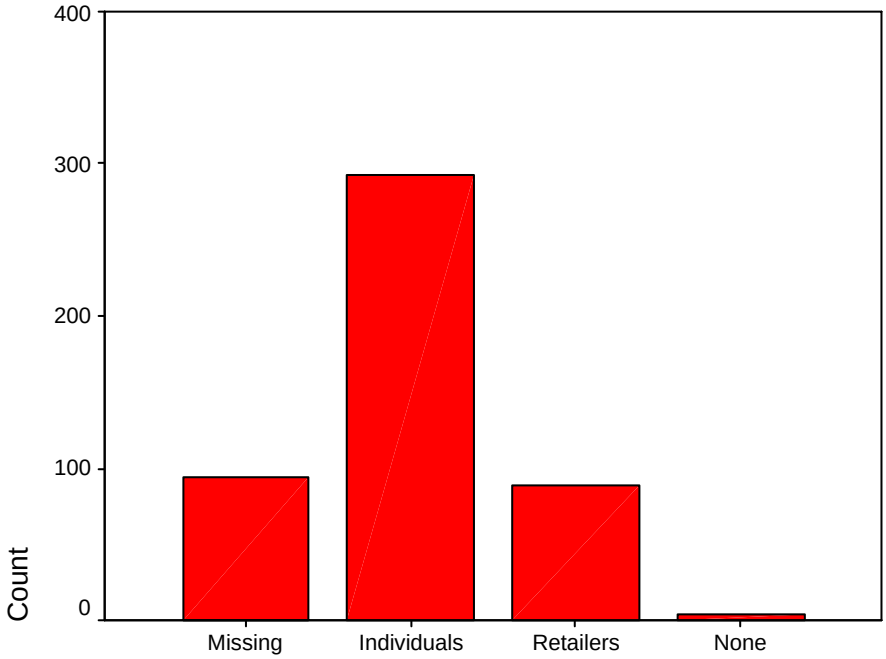


Figure 15: Graph showing the buyers of butter

NB: On the above bar graph, count indicates the number of respondents and the missing values indicate the number of respondents who do not sell butter (home consumption only)

Characterization of the market Participants

Producers

Dairy producers in the Fogera plains travel 5-35 kms to bring their products to Woreta market. During dry seasons women travel on foot from far sites near to Lake Tana to bring the butter to the market but during the rainy season(July-October) they were the men who were selling the butter because of the water flooding problems coming out of

Rib and Gumara rivers which are found in the north and south tip of the woreda. During this time the men could come across the flooded plain by swimming and walking for 1-8 hours.

Dairy Producers outside the Fogera plains come to woreta and other rural markets by walking.

Rural Assemblers

The rural assemblers bring dairy products to rural markets mainly from Debre tabor and Woreta towns. These rural assemblers could be students or other unemployed persons, of which 30 % are the female and 70 % are the male. On the average a rural assembler can buy 7- 10 kg of butter in one market day, and hand over to retailers and wholesaler found in the towns.

On the basis of their capital these rural assemblers are of three types.

1. Those rural assemblers buying and collecting butter using their own money. Each rural assembler may carry had 200-300 birr to collect 7-10 kg of butter from the market.
2. Those rural assemblers who were borrowing half of their capital from retailers and they handed over the butter.
3. Those who took credit in-group from micro finance institutes of Debre tabor.

The rural assemblers collect butter from rural markets and during fasting days. They take and sell the butter to retailers, consumers and the wholesalers in Debre tabor. The rural assemblers buy one kg of butter with 20 birr from the producers during the wet season and sell to retailers and wholesaler with 22-24 birr/kg. Only few rural assemblers collect the butter from the rural market with 22-24 birr/kg from the producers and were selling with 26-27 birr/kg during the dry season. The wholesalers buy a kg of butter with 22-24 birr/kg from the producers and for 25 birr from retailers. They sell with 28-30 birr/kg to the consumers. Whenever there are excess production of butter the wholesaler sells the butter to women butter traders who come from Tigray. Each woman could buy 700-800 kilograms of butter from the wholesaler. The price fluctuation could be due to surplus production owing to the availability of green forage from pasture during dry and wet seasons. The price fluctuation could be due to surplus production owing to the availability of green forage from pastures. During this time there is a better milk production which further increase the butter production. During the wet season the buying price and the retailing prices were 20 and 22-24 EB, respectively. And during the dry season the buying and retailing prices were 23-24 and 28-30 EB, respectively. The butter produced in and around Alember could be marketed in Tigray, Djibouti, Addis Ababa, Gondar, Dessie and Bahir dar towns.

Butter assembling at Woreta town is slightly different from that of the Alember. During summer, the assemblers move out of Woreta town to buy the butter from the producers while coming in to Woreta town. These assemblers collect along the main roadside and buy butter on market days from 8:00 -11:00 a.m. They handed over the

butter to retailers found in town. During dry season they buy butter from the rural markets such as Hodgebeya and Maksegnit. Accessible markets for Woreta town are Hodgebeya, Nabega, Meneguzer, Alember and Woji. Even though there were no wholesalers in Woreta the butter delivered to the market is collected by the rural assemblers. There are four retailers in Woreta out of which one was female and the others were males.

The butter produced in Fogera plains is known as *Toka*. Toka is the unpurified and not well washed, butter and the butter milk also whitish in color. The buttermilk is not well separated from the butter grains. Such butter is supplied from *Nabega, Wagetera, Kiddist hana, Shaga, Wagetera, Shina* and *Kuahr abo*. This type of butter is not preferred by the consumers. The consumers prefer highland butter known as to be *Key Kibe*.

4.11.3. Beef Marketing

Grass fattening is a technique which is economical in material and human resources, but which generally implies a certain loss of energy by the animals when they move from one place to another to change the pasture. On the other hand, selective grazing only allows the exploitation of a fraction of the available grass. Further more daily-live weight gains are often low, which takes on some significance when the forage products have true economic cost and, in particular, when they are cultivated. Finally, this technique is subject to seasonal fluctuations of the forage production and retains a certain expensive character for this reason.

In Fogera, farmers buy oxen during the dry season especially from January to March for traction. After they finished soil tillage they fed either by cut grass from the privately owned pasture two to three times in a season or crop residues such as chick pea straw, lentil straw, rice straw, bean straw, field pea straw and finger millet straw. Beef Producers preferred the period from May to September so as to gain premium prices. Market places for beef animals were Bahir dar and Woreta livestock markets. Beef cattle at Woreta market do not fetch good price because the demand for beef in Woreta is lower than Bahir dar. This is due to low purchasing power of the consumers in Fogera itself.

Around Gondar town the type of fattening was intensive type of fattening in such a way that the beef producers fee their beef cattle the cotton seed cake and the hulls of pea and bean as well as oil seed cake so that the finish the cattle in short period of time and also get premium process from the sale. The time for fattening was time bounded and was adjusted with their regular buyers.

In Ethiopia the existing livestock and their products marketing system is generally under developed. The low level of facilities is not conducive to efficient marketing. Transportation is on-hoof, which leads to considerable weight loss of animals as well as physical injuries and health. Trucking is very limited and used only during holidays and festivals to move finished cattle and small stock to city centers and exportable animals to ports. Poor infrastructure development hampers the flow of trade stock from

pastoral areas to consumption sites. The live cattle from Woreta and Yifag markets were transported on-hoof to Gondar by traveling for about 120 kilometers.

During the study the number of beef supplied to the market per year showed that there was a great variation from Kebele to Kebele. The F-value was 3.68. The variation is highly significant (P<0001) for the surveyed kebeles at 5 %, indicated that there is strong evidence that there is a potential for beef production among surveyed kebeles.

Cattle meat (beef) marketing varied considerably across the woreda. In some markets such as Alember, Hodgebeya and Woreta cattle traders purchase cattle and trek them to Yifag, Gondar and Dembia. The butchers houses also purchase for slaughtering purposes. The demand of beef cattle in Fogera especially in the rural areas was high at *Christmas* and *Ester*. These are the feasts of Ethiopian Orthodox Religion followers when the demand for beef was very high.

The lack of market information reduces the efficiency of the marketing system. Producers do not maximize their returns as they do not get optimum prices. They also do not respond to price changes resulting from supply and demand variations. The lack of market transparency restricts the development of the livestock economy through hampering planning and policy-making. The availability of market information would help producers, traders and exporter to plan production operations and marketing decisions. It would also make a valuable contribution towards better overall government planning and policy-making for the livestock sector (Asfaw 1994).

The rural farmers of Fogera are supplying their beef cattle to the Woreta and rural markets such as Hodgebeya, Woji, Yifag and Alember in the market days. Cattle supplied to markets are from both sexes and all age category including calves, heifers, bulls, oxen, dry and lactating cows.

At Fogera livestock market the beef cattle buyers were the cattle traders, butchers and farmers. Butchers are of two types on the basis of their capital. Some of them could buy good beef where as others buy and slaughter very emaciated animals with low prices. Cattle of good body condition and younger age are preferable on the market. Coat color is not a criterion for selection beef animals. Well-fattened beef animals are supplied to the market from August to October months. The producers who were supplying the beef cattle frequently are from *Shina, Kiddist hana* and *Nabega*.

Figure 16: Traditional and Intensive fattening in Fogera Woreda and Gondar town, respectively.

The price of a beef in Fogera during the study ranged from 700-2000 EB. The maximum price recorded during the dry season is 3400 EB and the lowest was 700 EB, and during the wet season the maximum price is 2600 EB and the lowest is 600EB.

The proportion of male beef animals out of the beef animals supplied to the market in the year was 86 % and the rest 14 % were female.

4.11.4. Characterization of the beef market participants

The beef market participants for beef in Fogera are the producers, service providers, trader and the consumers.

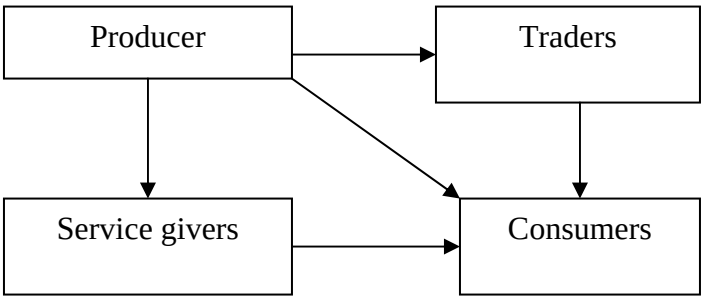


Figure 17: Market Chain of beef

Producers

Basically the main beef producers in Fogera are the rural farmers. The producers also bring cattle to markets from Dera and Farta woredas. The producers of beef were of two types.

1. Producers that were supplying grade 2 beef cattle

During the study there was no a beef animal which was in grade one.

There are farmers who had relatively a long traditional cattle fattening. These producers are feeding on either free grazing or by cut-and carry system in the times when the forage species were available from July to October. During these months a male beef animal in grade 2 could be sold with 1600-1800 EB and female one with 1300-1500 EB. The producers are planning to sell their beef animals during August to October, when the demand for beef animals is high and during the time when there is limited supply of beef animals to the market

2. Producers that supply beef animals in grade 3 and 4

Such producers were not that much concerned on getting good profit. They were supplying the emaciated sterile female, bulls and draft oxen as beef animals so that they were not benefited from the sale.

Table 10: Maximum and minimum price of beef

Price	Grade 1		Grade 2		Grade 3		Grade 4	
	Male	Female	Male	Female	Male	Female	Male	Female
Maximum	NA	NA	1800	1600	1200	900	700	600
Minimum	NA	NA	1600	1550	1100	840	600	480

Traders

The traders coming to the Fogera markets come from Bahir dar, Dembia and Gondar. These traders come to Fogera at any time and buy the beef animals and trek them to Gondar for profit making.

Service providers

The service givers are the butchers' and the Hotels that buy beef animals from the producers.

1. Those buying better beef animals of grade in grade two. These are economically better off can also buy male beef animal with up to 1800 birr and female for 1500 birr.
2. Those which buy better beef animals of grade 3 and 4. These are very emaciated animals and having minimum weight.

Consumers

Consumers are rural farmers and town dwellers who buy beef animals in group during holidays.

Grass fattening is the type of fattening they are on natural pasture in and around the church. Cattle fattening trend of the rural farmers was basically observed in Fogera plains which had better natural pasture than the highland ones. The farmers in the surveyed kebeles either were buying especially the oxen for traction and further which were sold as beef cattle from Woreta and Ambesame markets or they finish the cattle

which they had earlier. The types of feeding systems are of two types. These are grazing freely on preserved private pasture up to the finishing time and cut-and carry system from their pastures known as *Milcha*. Milcha is a mixture of grass and leguminous species, which was cut from their private pasture which further was not for haymaking. The price for a bundle of this forage from July to September (milcha) costs 3-4 EB. During marketing the producers have different criteria while they were selecting their market outlets. Out of the 480 respondents 387 of them (80.6%) of them were selecting price as a criteria, 31 of them (6.5 %) selected distance as a criterion, 17 of them (3.5 %) select reliability as a criterion, 11 (2.3%) long term contract as a criteria this was specially true for milk producers and the rest 7.1 % do not sell at all (home consumption).

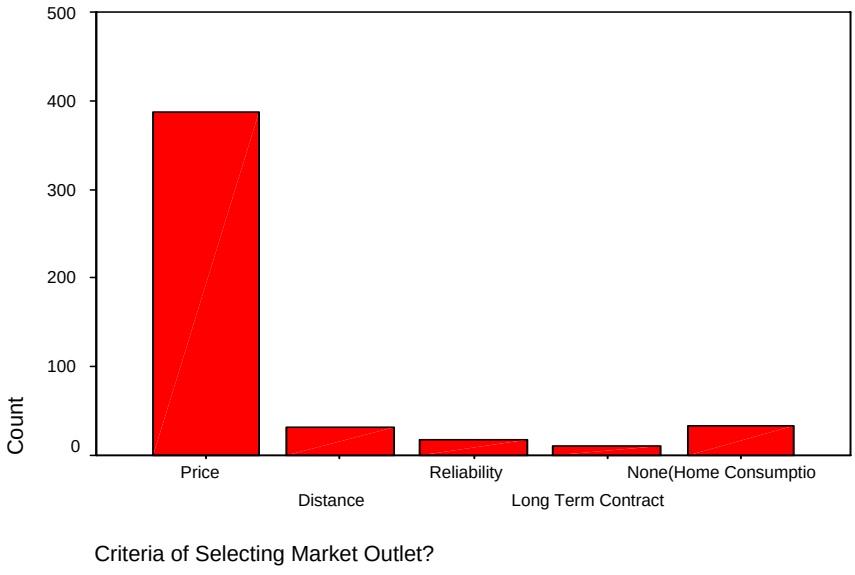


Figure 18: Selection criteria for marketing outlets

NB: On the above graph count on the vertical axis indicates the number of respondent

4.12. Main constraints for cattle milk and meat production in Fogera

4.12.1. Diseases challenges and weak veterinary service deliveries

As per the secondary data collected from private and governmental health clinics; the types of cattle diseases recorded in Fogera were bloat, Trypanosomiasis, Schistosomiasis, Blackleg, Anthrax, Gastrointestinal tract, Lungworms, Ticks, Mastitis, Soreteats, Babesiosis, Pneumonia, Leptospirosis, Pasteurollosis, Heart water, Brucellosis, Black leg, Milk fever, Intestinal worm, Liver fluke, Udder trouble, Facioliasis, Intestinal worm, Diarrhea and Tape worm.

Moreover the most prevalent diseases of Fogera during the study were trypanosomiaisis and internal parasites. The internal parasites that were affecting the cattle population were the Schistosomiasis, Fasciolasis, Gastrointestinal tract and the Lungworm. But the first two were critically affecting the cattle population of the marshy areas. The peak infestation for these diseases is from September to October. The main ectoparasites were the ticks which were causing babesiosis. Mange mites were also the other ectoparasites affecting the cattle production.

Prevention methods employed by farmers varied depending on the type of disease and parasite. In general the routine preventive measures were both government and private veterinary clinics that were giving different treatment and vaccination services. Regarding the occurrence of diseases and parasites as reported by the same farmers,

the majority of diseases were occurred during the dry period from September to May. Trypanosomiasis which was a more prevalent disease in 50% of the surveyed kebeles was seriously affecting the milk and meat productions of the surveyed kebeles. Farmers were also complaining on the expensive prices of the trypanocidal drugs sold by the private drug vendors. According to Alekaw (2004) trypanosomiasis in Fogera is caused by biting flies (Tabanid spp) which becomes a heavy burden to cattle during grazing times in the marsh areas.

During the current study the farmers revealed that the vector was more abundant from October 1st to December last and also relapses during the dry seasons such as April when the body of animals get emaciated.

According the Woreda veterinarians during the study period the infestation of these biting flies as was started in the half of August and was decreasing at the end of October. At times of serious biting by the flies, some farmers were keeping their animals in the house from 9:00-11:00 a.m. in the morning and from 1:00 p.m.-3:p.m.in the afternoon but most of the farmers did not keep the cattle in their house so this fly was severely affecting the grazing times which in turn was affecting the productivity of the cattle by decreasing the time of grazing. During the night there was another also a fly that made the cattle restless. The farmers called this fly in Amharic; *guasha*.

According to Mulualem (1998) from a total 3380 indigenous Zebu (*Bos indicus*) cattle coprologically examined 2808 samples were found positive for liver fluke infection

(fascioliaisis) with an over all prevalence rate of 83.03 %. Prevalence variation exists between the study woredas; the highest being at Fogera (84.21%) followed by Dera (83.04%) and Libikemkem (82.24%).

The veterinary services during the study were given in Fogera by one private and three governmental clinics. The medicines were sold in three drug vendors and the governmental clinics and the vaccines were delivered only by the governmental clinics. Even though the woreda has a great number of livestock population especially cattle the veterinary services were not sufficient enough. The medicines supplied by the MOA were not satisfactory even in the time when the diseases were more prevalent so that the farmers were buying the medicines from the private drug vendors with expensive prices. In addition to this the medicine suppliers such as International drug supplier and Ambasel found in Bahir dar were not efficient enough in supplying different medicines in the time when disease are more prevalent. In the Woreda these were only two clinics having microscopes to do disease diagnosis. The number of skilled manpower in the discipline was not also enough to give the service efficiently. In fact there are eleven veterinarians giving the service in the woreda but the farmers were trekking their cattle 5-10 kilometers to get the health service.

4.12. 2 Feed and feeding systems

The main available feed resources for milk and meat production in Fogera are the communal uncontrolled free and private grazing lands but these feed resources were

managed in a traditional ways that means all the species of the livestock were allocated to graze these grazing lands together which further was causing overgrazing problems. During summer, the pastures become muddy and the animals could not be kept on such pastures especially in the Fogera plains. During the dry season crop residues are also among the main feed resources in the study area. In Fogera the conversion of grazing lands in to crop production seem the main reason for scarcity of feed resources. According to the Woreda Rural and Agricultural Development Office in the last two years (2004-2005) 17,937 hectares of grazing lands were converted to croplands. During summer the farmers found in the Fogera plains faced sever feed scarcity because their pastures in these areas were flooded with water coming from Gumara and Rib rivers.

a **b**

Figure 19: a, cattle browsing on shrubs in dry season, *Asracantha longifolia* (amykila) the very dangerous weed on the pastures of Fogera plain

The urban producers do not have enough grazing lands and the feeds cost are very high. A quintal of oil seed cake increased from 50 EB to 70 EB so that this price was not affordable by the smallholder producers. This creates unfair completion Even there was a competition on the market where small-scale producers with minimal input can supply the market with cheaper dairy products. Even there was a completion of for grazing lands between the rural farmers living at the periphery of Woreta and Alember towns and the urban producers. Even though a bulk amount of rice bran is produced by rice processors most of the rice bran is not used as a feed resource. Use of such resource requires expert advice and extension work.

In the open-ended discussions the farmers revealed that due to sever feed scarcity the heifers do not come heat up to the age of four to five years of age. In the highlands of the Woreda, feed and grazing land were the main limiting factor and need special attention to improve the reproductively and productivity efficiency of the cattle. Many farmers were also selling their cattle during the dry season due to feed scarcity.

Cattle were largely depending on rangeland grazing or crop residues that are of poor nutritive value. In Fogera feed was not supplied uniformly and quality was poor. In addition to this multipurpose cattle that were producing meat and milk were also used for traction were not given adequate feed supplies. Cattle were allowed to graze aftermaths of the rice, teff, finger millet and maize that were high in fiber millet and low in their nutritive value. In spite of this in the natural pastures of *Wagetera, Kiddist*

hana, Shina, Shaga, Aduatihua and Nabega were dominated by weed plant known to be as *Asracanta longifolia* and amykila in Amharic was difficult for the cattle to graze because of its spikes. It almost covers 9602 hectares of the communal grazing lands of the marshy areas. In addition to this these natural pastures were also overgrazed by the cattle which were trekked from PAs of *Wonchit, Ambensamee, Chantebabary, Wanzaye, Geregera* and *Zara Michael* of Dera woreda and *Gura, avona kotit, Sifatra* and *rib Gebriel* of the Fogera woreda itself.

In this study out of 480 respondents interviewed 203 (42.3%) did not have their own private pasture lands thus pasture as the only source of feed for small holders was the main constraint for the small holders.

In Fogera there was no fodder production in the rural as well as urban areas of the district. Insufficient land, insufficient labor, lack of inputs such as forage seeds and lack of informations were among the reasons mentioned by the farmers for not growing fodder/improved forages in their lands.

4.12.3. Lack of genetic improvements activities

During the study out of 480 respondents only six of them (1.25%) had the crossbreed cows. The cows that failed to conceive by artificial insemination due to lack of proper heat detection and inefficient service were bred with a crossbreed bull which was owned by Ethiopian Orthodox Church Children Care and Family Affairs of the Woreta branch. The number of AI services given in ten months (September 2004-June 2005)

was only 192. The rate to be paid for a single bull service was 5 EB. Many farmers were also breeding their cows with any bull available in the herd.

Even though there are two bull stations which are established by MOA in Debre tabor and Addis Zemen towns most of the farmers did not have the access for this breeding technique. The price of a heifer produced from those bull stations and sold by the individuals were also so expensive so that the dairy producers could not able to get them easily. The price of a crossbred heifer produced from these bull stations was in the range of 3000 to 5000 EB.

4.12.4. Lack of frequent extension services

Some respondents (21.5%) did not grow improved forages in the homestead so as to alleviate the feed scarcity of the household. Since feed scarcity was the main problem in Fogera farmers, they should get frequent extension services and trainings on forage production (especially backyard forage production), extension activities should focus on feed resource management such as communal and private grazing land improvements (clearing unpalatable species (eg. Amykila), rotational grazing and fodder conservation system for haymaking, irrigation and over sowing of the improved forage species). Training of farmers on feeding regimes, hygienic milk production starting from hand milking to delivering the raw milk to the market and also marketing information through extension is vital for dairy development of the areas.

4.12.5. Lack of working capital

Intensive hand feeding to fatten cattle is not a traditional practice in Fogera. Forage-based fattening is a common practice in Fogera. The best way to help farmers understand and accept new concepts is to demonstrate them on small scale in their own environment. In the open ended discussions and personal observations most of the farmers revealed that they still did not fatten and sold the beef due to capital and feed problems. Due to lack of capital the farmers are not able to introduce the crossbreeds in to their herds. Farmers found especially in the Fogera plains (*Wagetera, Kiddis hana, Shina, Shaga and Nabega*) which had better pasture lands did not get any credit service from any institution. Farmers' cooperatives are a better strategy to pool resources and to have a better voice in influencing the market, and such options need to be explored in the future

4.13. Opportunities for improvements the cattle milk and meat production of the Fogera.

-Sustainable and planned supply of the medicaments in both wet and dry seasons through the government clinics and drug vendors.

-Strengthening the rural veterinary clinics with skilled man power and veterinary equipments (eg.Solar microscope).

-Establishing community based grazing land management for efficient utilization of the resource including the removal of the pasture weed in the marshy areas.

-Implementing of the nutritive value of improvement of crop residues

-Enhancing the forage production and fodder conservation in the farmers homestead lands.

-Encouraging of the dairy producers to breed their cows with superior Fogera bulls to minimize uncontrolled breeding

-Formal training on AI for selected farmers from Pas having all weather accessible.

-Strengthening the AI service at Woreda level in man power and equipment

-Frequent extension services on improved milk and meat production.

-Creating trade links between the producers and the wholesaler to promote them in milk and beef production.

-Provision of up dated marketing informations to the producers.

-Provision of credit services for the producers (especially for beef) with low interest rate

5. SUMMARY AND CONCLUSION

The study of cattle and meat production: Production systems, constraints and opportunities for development was conducted in Northwestern part of Ethiopia of the Amaharan region, Fogera woreda which is located at 630 km from Addis Ababa. The known indigenous cattle breed type, Fogera is found in this woreda. The villages in which the breed is mainly found are *Sindeye, Tigremender* and *Damote*. In other kebeles where the breed was found there is interbreeding with other indigenous breeds such as Estie and Simada which were trekking to the plain for pasture. Farmers revealed this fact by the changes of the coat colors of the breed which is not yet observed before in their herds. Cattle herd size per households was significantly different among the households. The mean for cattle holding per household was the highest (9.73) in Addisbetechrstian and lowest (4.6) in Wagetera. Cattle were the dominant species in the district followed by goats and sheep. Cattle, goats and sheep account for 81.5 %, 14.5 % and 4 %, respectively. And the number of milking cows per household was also the highest (2.08) in Addisbetechrstian and lowest and lowest (1.18) in Abuatihua. Cattle milk and meat production in this district was employed mainly traditional practices for herding, feeding, watering, housing, milk processing, slaughtering, marketing and most of the activities are labor intensive.

Even though Fogera is dominantly characterized by mixed crop livestock farming system the extent of crop and livestock varies in rural and urban areas.

The feed supplied by crop production was about 58.3 % and the rest 41.7 % was from natural pasture by grazing or fodder conservation. Moreover, the dairy and beef

producers in the town were not dependent on crop production. They supplement their cattle the agro industrial by-products produced in and outside of the Woreda's capital.

Natural pastures, crop residues, grazings of crop stubbles and fallow lands were the major feed resources in the area as well. Grazing of pasturelands contributed 58.33 % for the Fogera plains and 33.33 % out side of the Fogera plains. And the rest proportion 41.67 % for the Fogera plain and 66.67 % outside the plain the feed resources were the crop residues and conserved forage and agro industrial products.

In fact in pastures of Fogera plains there is a dangerous weed called *Asracantha longifolia*, amykila in Amharic. This weed covers 9602 ha of land which affects the grazing land. And the rest proportion 41.67 % for the Fogera plain and 66.67 % outside the plain the feed resources were the crop residues and conserved forage and agro industrial products

Milk production in Fogera is by using the local/indigenous breeds and a few crossbreeds. During the study out of 480 respondents interviewed only six of them had crossbreeds. The milk production systems in Fogera were characterized as Rural, Peri-urban and Urban types of milk production. Rural small scale dairy production was undertaken by subsistence farmers owning 1 to 7 indigenous milking cows with few cross crossbreeds. The distribution of crossbreeds was greater in periurban and urban areas. In the periurban and urban areas the proportion of crossbreed cows out of total milking cows of these areas was 10.6 % and 35.2 %, respectively. The main sources for these crossbreeds are government ranches, butt stations and individuals.

The breeding activities in Fogera are of two types: natural and artificial. In the former technique out of 476 respondents 198 (41.5%) use their own bull, 208 (43.6%) use bulls owned by neighbors and 25 of them (5.2%) use crossbred bulls owned by Ethiopian Orthodox Church Children care and Family Association of the Woreta branch. Even though the there was a high demand for genetic improvement in Artificial insemination only 45 respondents used this technique during the study period. This is due the fact the service which was given only by one technician was not satisfactory. Dairy and beef producers facing marketing problems especially during long fasting periods and due to low purchasing power of the consumers. There was also a price fluctuation of milk, butter and beef in two seasons from 20-25 %, 35-55 % and 27-38 %, respectively.

Most of the hand milking activity was done by the males. About 2.9 liters of milk was produced per day per household out of which 0.6 liters (20.6 %) was consumed, 1.9 liters (65.5 %) as collected processing and 0.4 liters (13.9 %) was delivered to market. In fact there is a traditional taboo that milk produced from local cows is not sold. The marketable amount of raw milk was higher in periurban and urban areas where the demand for the products was higher. A crossbreed and local cow on the average was giving 5.5 and 1.8 liters/day, respectively.

In Fogera, butter is made from fermented milk (ergo), which was made to ferment for 3 to 4 days. The Churning materials are of two types; the clay and the gourd. Women

call the gourd in Amharic as *gourna.* The collecting material (clay) was smoked with a wood species called *Terminalia browni* or abalo in Amharic to add flavor for the product.

To alleviate the feed problems of the study area different feed utilization techniques of the available pastures could be practiced by rotational grazing, cut-and-carry, community based grazing land improvement strategies such as improving the pasture through over sowing of forage species and also training and frequent extension for farmers about forage production and feeding systems should be exercised in the area.

In addition to this, genetic improvement might be also a crucial issue to boost the milk and meat production of the woreda. Even though the capacities of multiplication of pregnant crossbred heifers of the government ranches is limited so as to distribute the such heifers strengthening the artificial insemination service could have a significant effect in upgrading the genotype of the indigenous breeds. During crossbreeding genetic conservation of the Fogera breed should be taken in to consideration so as to maintain the genetic trait of the breed in particular.

Six to seven kebeles of the woreda are marshy and swampy area so that the prevalence trypanosomiasis and internal parasites such as facioliaisis was very high. Thus, strengthening the government veterinary clinics in man power and supplying with sufficient medicines and equipment might help the dairy and beef producers to get the service in low prices and shorter distances.

Facilitation of microfinace credit services in the rural area could be a solution for the farmers who could not able to afford the expensive prices of crossbreed heifers. Due to financial problem farmers were selling the draft oxen as beef animals after they have finished the soil tillage.

6. SCOPE FOR FUTURE WORK

The study area, Fogera, is the native area for the known indigenous cattle breed type, Fogera. In addition to this district near to the regional capital Bahir dar on 60 kilometers distance in north direction. Fogera is also the only district that grows rice in the region so that a bulk amount of rice straw and rice bran from the rice polishers is produced every year. Feed scarcity is the most and the main milk and meat production constraint widely observed in the woreda. In the marshy areas there is a very dangerous weed which fully covers the communal pastures during the time when the pasture vegetation starts to grow for grazing. Fodder production was also negligible due to lack of information on fodder production and feeding systems.

Trypanosomiaisis and the internal parasite such as fascioliaisis and schistosomiaisis were also the main health challenges in the marshy areas of the woreda. The demand for genetic improvement was also high. Most of the subsistence small scale dairy producer produce milk in unhygienic way. Even though there was no surplus production of raw milk these is also a traditional taboo not to sell milk produced from the indigenous cows. Farmers were also complaining on the private expensive medicines which are delivered by the private drug vendors due to the inefficient health service deliveries given by the governmental. On the basis quality butter buyers categorized butter as ***Toka*** and **key**. The price of Toka was cheaper with 20-25 % than the key. Therefore, Toka butter producers were not getting premium price due to the lower preference of the buyers. Despite of this Fogera might have a reliable beef market if there good trade links between the small scale beef producers

and cattle traders found in Gondar which supply a great number of beef cattle to governmental institutions such military camps.

6.1. Research interventions

- Research in the areas of butter and butter fat are recommended and fat analysis of butter Fat needs to be made for the two butter types which have price variations per kg of a product.
- A bulk amount of crop residues such as rice straw and rice bran are produced every year, research could be important to *improve the nutritive value* these feed resources.
- Farmers' in the plain areas do not prefer cattle from Simada (Simada breed) they revealed that they are intolerant for the heavy fly burden than other breeds that come from Gojam and Dembia, that are preferable by the farmers. The cause for the difference in to the resistance to heavy fly burden might be a point of research.
- Research on control of the dangerous weed *Asracantha longifolia* (amykila) may be a research issue since it is almost covering the communal natural pasture and also affecting the grazing efficiency of the cattle population.

6.2. Developmental interventions

- Frequent extension services on improved cattle milk and meat production and provision of updated marketing information.
- Provision of improved forage seeds such as elephant grass,susbania and desmodium.
- Genetic upgrading of the indigenous breeds through AI and crossbred bulls.
- Formal training for the producers on improved dairy and beef production systems

7. REFERENCES

Addisu B., and Prabhakar Hegede. Reproductive and growth performance of Fogera cattle and their F_1 Friesian and crosses at Metekel ranch, Ethiopia. In: ESAP, 2003. Challenges and Opportunities of livestock marketing in Ethiopia. Proceedings 10th annual conference of the Ethiopian Society of Animal Production held in Addis Ababa, Ethiopia, August 22-24.ESAP, Addis Ababa pp 111-117.

Ahmed M.M., Bezabih Emana, Jabbar M.A., Tangka F.and Ethuni S, 2003, Economic and Nutritional Impacts of Market-oriented dairy production in the Ethiopian highlands. Socio-economics and policy Research Working paper 51, ILRI (International Livestock Research Institute), Nairobi, Kenya, 27pp.

Ahmed, Mohamed, S. K. Ehui, and B. Gebremedhin. Forthcoming. 2003, Socio-economic and policy factors affecting the adoption of improved forage: Evidence from the highlands of Ethiopia. Socio- economic and Policy Research Working Paper. 58, Livestock Policy Analysis Program: International Livestock Research Institute (ILRI). Addis Ababa, Ethiopia, 47p.

Alberro M. and Haile Mariam S.1982. The indigenous cattle of Ethiopia. I. World animal Review 41.

Alekaw Sinshaw, 2004, Epidemiology of Animal Trypanosomiasis in three highlands of Ethiopia Bordering Lake Tana, MSc thesis (unpublished), Debre Zeit, Ethiopia.

Alemayehu Mengistu, 2002. Forage Production in Ethiopia: A case study with implications for livestock production, Ethiopian Society of Animal Production (ESAP), Addis Ababa, Ethiopia, 106p

Alemu Gebrewold, 1998, Role of draft oxen power in Ethiopian agriculture. In: First national oxen traction research review and strategy workshop p.9-15, Ethiopian Agricultural Research Organization, Addis Ababa; ILRI, Addis Ababa (Ethiopia): EARO-1 National Oxen Traction Research Review and Strategy Workshop, Debre Zeit (Ethiopia), 3-5 december.1997.

Azage Tegegne, 1998, Cattle breed improvement for sustainable draft power use in Ethiopian agriculture. In: Proceedings of the first national oxen traction research and strategy workshop. P 43-52, Ethiopian Agricultural research organization, Addis Ababa (Ethiopia); ILRI (International Livestock Research Institute), Addis Ababa, Ethiopia: EARO-1 National Oxen Traction Research Review and Strategy Workshop, Debre Zeit (Ethiopia), 3-5 December 1997.

Azage Tegegne, Tsehay Reda, Alemu Gebrewold and Hizkias Ketema, 2000, Milk Recording and Herd Registration in Ethiopia In: Pastoralism and Agro-pastoralism: Which way foreward? Proceedings for the 8th annual conference of the Ethiopian Society of Animal Production. (ESAP) held in Addis Ababa, 24-26 August 2000, Addis Ababa. P 90.

Azage Tegegne and Alemu Gebrewold, 1998. Prospects for Peri-urban Dairy Development in Ethiopia. In: Proceedings of 5th national Conference of Ethiopian Society of Animal Production, 15-17 May 1997, Addis Ababa, Ethiopia, pp 248.

Azage Tegegne, 2004, Urban livestock production and gender in Addis Ababa, Ethiopia. Urban agriculture magazine (The Netherlands), no.12, p.31-32.

Befekadu Degfe and Birhanu Nega, 2000. Annual Report on the Ethiopian Economy: Volume 1,1999/2000. The Ethiopian Economics Association, Addis Ababa, Ethiopia, 429 pp.

Belachew H., Mahmud A., Teferi H.L. and Lemma A. 1994. Dairy products marketing survey in Addis Ababa and the surrounding regions. Dairy Development Enterprise, Addis Ababa, Ethiopia.

Belachew Hurrisa, 2003, Livestock Marketing and Pastoralism; Pastoralist Forum Ethiopia, Proceedings of the 3rd National Conference on Pastoral Development in Ethiopia; Pastoralism and Sustainable Development, December, 23-24, 2003, Addis Ababa.

Benin S.,Ehui S.and Pander J. 2002. Policies for livestock development in Ethiopian Highlands. Socio-economic and Policy Research working paper 41. ILRI (International Livestock Research Institute), Addis Ababa, Ethiopia, 29 pp.

Beyene Seboka and Aberra Deressa (eds), 1998. Agricultural Research and Technology Transfer Attempts and Achievements in Northern Ethiopia. Proceedings of the Fourth Technology Generation, Transfer and Gap Analysis workshop.18-21 march 1997, Bahir dar, Ethiopia, 186-196 pp.

Brokken R.F. and Senait Seyoum (eds). 1992. Dairy marketing in sub-Saharan Africa. Proceedings of a symposium held at ILCA, Addis Ababa, Ethiopia, 26–30 November 1990. ILCA (International Livestock Center for Africa), Addis Ababa, Ethiopia. 392 pp.

Central Statistics Authority, 1995, The 1994 Population and Housing Census of Ethiopia: Results for the Amharan Region, Vol 1: Part 4 Analytical report on housing characteristics, Addis Ababa, Ethiopia.

Central Statistics Authority, 2003, Statistics Report on Farm Management Practices, Livestock and Farm implements. Part II, Addis Ababa, Ethiopia.

Clutton-Brock, J. 1989. Cattle in ancient North Africa. In J. Clutton-Brock, ed. The walking larder, p. 200-214. London, UK, Unwin Hyman.

Coppock DL.1994, The Borana plateau of Southern Ethiopia: Synthesis of pastoral research, development and change, 1980-91, ILCA (International Livestock Center for Africa) Addis Ababa, Ethiopia, 418 pp.

De Leeuw, P.N. and Thorpe, W 1996. Low input Production Systems in Tropical Africa: An analysis of actual and potential cow-calf productivity. In: All African Conference on Annual agricultural conference hand book and volume of Abstracts, South Africa Society of Animal Sciences, 1-4 April, 1996, Pretoria, South Africa.

Debrah S. and Birhan Anteneh, 1991. Dairy marketing in Ethiopia: markets of first sale and producers market patterns, ILCA research report 19, ILCA (International Livestock Center for Africa), Addis Ababa, Ethiopia.

Dereje Yehuala , 2004, On-farm phenotypic characterization of cattle genetic resources and their production systems in South and north Wollo zones of Amharan region, Northwestern Ethiopia, MSc thesis, p.18-19, Alemaya.

EARO, 1999, Livestock research strategy (unpublished), Addis Ababa, Ethiopia.

Ehuni S; Li Pun H. Mares V. and Shapiro B.1998.The Role of Livestock in Food Security and Environmental Protection out look in Agriculture 27(2): 81-87.

Ehuni S; Benin S; Williams T. and Meijer S. 2002, Food Security in Sub-Saharan Africa to 20002, Socio-economics and Policy research working paper 49,ILRI (International Livestock Research Institute), Nairobi, Kenya.60 pp.

Ehui S. and Tsigas M. 1998. Trade and productivity policy options in South and Southeast Asia: Implications for livestock products, Purdue University, West Lafayette, Indiana, USA, 8–10 June 1998. 21 pp.

Epstein, H.E.1971.The origin of domestic animal of Africa, Volume I, Africa publishing corporation, New York, USA, p670.

Epstein H.E. and Mason I.L.1984. Cattle. In: Mason I.L. (ed), *Evolution of* domesticated animals. Longman, London, UK. pp. 6–27

Falvey L. and Chantalakhana, 1999, Smallholder Dairying in the Tropics, ILRI (International Livestock Research Institute), Nairobi, Kenya, 462 pp.

FAO (Food and Agriculture Organization of the United Nations). 1998. Production yearbook, FAO, Rome, Italy. 233 pp.

Fekadu Beyene and Abrhamsan, R.K.1994b. Present situation and Future Aspect of Milk production, Milk handling and Processing of Dairy products in Southern Ethiopia. Farm made milk products in Southern Ethiopia: 1.Chemical and Microbial quality. Ph.D. Thesis. Department of food Science, Agricultural University of Norway.pp1-11.

GebreWold A., M. Alemayehu, S. Demeke, S. Dediye and A. Taddese, 2000, Status of dairy research in Ethiopia. In: The role village dairy co-operatives in the dairy development: Prospects for improving dairy in Ethiopia. Proceedings for workshop, SDDP (Small holder dairy development project), MOA (ministry of agriculture), Addis Ababa, Ethiopia, 73-81pp.

Holloway, G.C., Nicholson, C. Delgado, S. Stall and S.Ethui. 2000. How to a milk market: A case study from the Ethiopian highlands. Socio-economics policy research working paper 28, ILRI (International Livestock Research Institute), Nairobi, Kenya, 28 pp.

Ibrahim H. and Olaloku E. 2000, Improving Cattle for milk, meat and traction. ILRI Manual 4.ILRI (International Livestock Research Institute), Nairobi, Kenya.135pp.

ILRI, 2000. Hand Book of Livestock Statistics for Developing Countries. Socio-Research Institute), Nairobi, Kenya.299.

Jahnke H.E. 1982. Livestock production systems and livestock development in Tropical Africa. Kieler Wissenschaftsverlag Vauk, Kiel, Germany. 253 pp.

Jean Pagot, 1992, Animal Production in the Tropics, Wageningen, Netherlands, 522 PP.

Karungia E.S. 2001, Economic analysis of crossbreeding programs in Sub-Saharan Africa: Conceptional framework and Kenyan case study. Animal genetic resources re search 2.ILRI (International Livestock Research Institute), Nairobi, Kenya, 55 pp.

Ketema, H. and Tsehay, R. 2004. Dairy Production System in Ethiopia, Ministry of Agriculture, Addis Ababa, Ethiopia.

Mbabane, 1997, Livestock Development Policies in Eastern and Southern Africa, Proceedings of a Seminar organized by CTA/IBAR and the Ministry of Agriculture and Co-operatives from 28 July-August 1997, Swaziland.

Mbogoh, 1984, Dairy development and dairy marketing in Sub-Saharan Africa: Some preliminary indicators of policy impacts. ILCA bulletin 19:8-16.ILCA (International Livestock Center for Africa), Addis Ababa, Ethiopia.

MOA (Ministry of Agriculture), Animal and fishery resources development main department, Fattening extension manual, FLDP, 1996, Addis Ababa, Ethiopia, 83 pp.

MOA (Ministry of Agriculture), Animal and Fishery Resource Main Department, 1996, Dairy extension Manual, Addis Ababa, Ethiopia, 97 pp.

MOA (Ministry of Agriculture), 1998. The role of village dairying co-operative in dairy development: Prospects for improving dairy in Ethiopia, Smallholder

Payne W.J.A., 1990, An Introduction to Animal Husbandry in the Tropics, 4th ed, Longman Group UK Limited.

Payne W.J.A., 1997, Tropical Cattle, origin, breeds and breeding policies, Blackwell Science, Oxford, UK.

Phillips, 2001, Principles of Cattle production, CABI, Publication, New York, USA, 282pp.

Rege J.E.O and Lipner ME (eds), 1992, African animal genetic resources: their characterization, conservation and utilization. Proceedings of the research-planning workshop held at ILCA (International Livestock Research Center for Africa), Addis Ababa, Ethiopia, 19-21 February 1992,ILCA, Addis Ababa, Ethiopia, 172 pp.

Rege, J.E.O. and Tawah, L.C. 1999. The state of Africa cattle genetic resource II. Geographical distribution, Characteristics and Uses of present day breeds and strains.

Rege, J.E.O., Abuagye, G.S. and Tawah, L.C.1994a. Short horn Cattle of West and Central Africa I Origin, Distribution, Classification and Population Statistics. World animal review (FAO) 78 (1): 14-21.

Rege, J.E.O, 1998. The contribution of Indigenous livestock to the Economies of Sub-Saharan countries. In: Livestock Development Policies in Eastern and Southern Africa, Proceedings of Regional Seminar, Mbabane, Swaziland, July 28-August, 1997. Pub CTA.

Rege, J.E.O. and Tawah, L.C., 2001, Zebu Cattle for Kenya: Uses, Performance, Farmers Preferences, measures of genetic diversity and options for improved use. Animal genetic resource research 1.ILRI (International Livestock Research Institute), Nairobi, Kenya.

Sansoucy R., Jabbar M., Ehui S. and Fitzhugh H. 1995. The contribution of livestock to food security and sustainable development. In: Wilson R., Ehui S. and Mack S. (eds), Livestock development strategies for low-income countries. Proceedings of the joint FAO/ILRI roundtable on livestock development

strategies for low-income countries, 27 February–2 March 1995. ILRI (International Livestock Research Institute), Addis Ababa, Ethiopia

Staal S. and Shapiro B. 1996. The economic impact of public policy on smallholder peri-urban dairy producers in and around Addis Ababa. ESAP (Ethiopian Society of Animal Production) Publication 2. ESAP, Addis Ababa, Ethiopia.

Staal S.J. and B.I. Shapiro, 1998, Smallholder dairying under transaction costs in east Africa, ILRI-LPA, Brief, no 6, 3p, Nairobi, Kenya: ILRI (International Livestock Research Institute).

Staal S.J. and B.I. Shapiro, 2000, The Economic Impact of Public Policy on Small Holder Peri-Urban Dairy Producers in and around Addis Ababa, ESAP Publication No 2.

Tangka, F.K., Jabbar, M.A. and Shapiro, B.I, 2000, Gender Roles and Child Nutrition in Livestock Production Systems in developing countries: A critical view. Socio-economics and Policy Research Working Paper 27, ILRI (International Livestock Research Institute), Nairobi, Kenya, 64 pp.

Tangka D.K., Emerson R.D. AND Jabbar M.A., 2002, Food Security effects of intensified dairying: Evidence from the Ethiopian highlands. Socio-economics and policy Research working paper 44, ILRI (International Livestock Research Institute), Nairobi, Kenya, 68 pp.

Walshe, M.J., Grindle, J., Nell, A. and Bachmanu, M., 1991. Dairy Development in Sub-Saharan Africa, Washington DC, USA. 94pp.

Winrock. 1992. Assessment of animal agriculture in sub-Saharan Africa. Winrock International Institute for Agricultural Development, Morrilton, Arkansas, USA. 125 pp.

Wolfgang Bayer, 1998, Forage husbandry, Wageningen, Netherlands, 207 pp.

Workneh Ayalew and J.Rowlands, 2004, Design, execution and analysis of the livestock breed survey in Oromiya regional State, Ethiopia.

Zelalem Yilma and Inger, 2000, Milk Production, Processing, Marketing and the Role of Milk and Milk Products on the Small holder Farm's income in the Central Highlands of Ethiopia, Pastoralism and Agropastoralism, Which way foreword? Proceeding of the 8th Annual Conference of ESAP, 24-26 August, Addis Ababa, Ethiopia.

Zewdu Wuletaw, 2004, Indigenous Cattle Genetic Resource, their Husbandry Practices and Breeding Objectives in Northwestern Ethiopia, MSc Thesis (unpublished), Alemaya, Ethiopia.

8. LIST OF APPENDEX

Appendix 1: Conversion for livestock number to Tropical Livestock Unit

Livestock type	TLU
Cattle	0.7
Sheep and goats	0.1
Donkey	0.5
Mule	0.7
Horse	0.8
Camel	1

Source: Janke, 1982

Appendix 2: Age of respondents

Variable	N	Minimum	Maximum	Mean		Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Age of Respondent	476	22	77	44.26	.53	135.310

Appendix 3:Chi-square test for hand milking between male and female sex

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	175.580	2	.000
Likelihood Ratio	47.408	2	.000

Appendix 4: Cropland and pastureland holdings per household

Variable	N	Minimum	Maximum	Mean		Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Area of Land Under Crops	480	.0000	5.7500	1.900869	4.88833E-02	1.147
Area of Pastureland	480	.0000	1.0000	.177240	9.63931E-03	4.460E-02

Appendix 5: Milk utilization pattern of a household

Kebele	TMP/HH	TMC/HH	TMPRC/HH	TMS/HH
	Mean ± S.E.	Mean ± S.E.	Mean ± S.E.	Mean ± S.E.
Kuahir Michael	1.1 ± 0.1	0.29 ± 0.02	0.66 ± 0.11	0.15 ± 0.09
Shaga	2.3 ± 0.4	0.22 ± 0.06	1.6 ± 0.35	0.41 + 0.15
Kuahir Abo	3.6 ±0.3	1.03 ± 0.09	2.6 + 0.19	0
Shina	2.1 ± 0.27	0.37 ± 0.03	1.75 ± 0.25	0
Kidist Hana	1.5 ± 0.12	0.26 ± 0.02	1.25 ± 0.11	0
Addisbetechstian	2.9 ± 0.29	0.73 ± 0.09	2.23 ± 0.22	0
Woji Arba	4.5 ± 0.35	0.95 ± 0.12	3.43 ± 0.28	0.15 ± 0.11
Wagetera	3.4 ± 0.28	0.85 ± 0.08	2.6 ± 0.25	0
Menguzer	1.6 ±0.12	0.5 ± 0.03	1.02 ± 0.09	0.06 ± 0.03
Woreta Zuria	4.7 ±1.26	0.49 ± 0.09	1.99 ± 0.3	2.23 ±1.2
Alember	3.4 ± 0.41	0.83 ± 0.1	1.53 ± 0.24	1.07 ± 0.3
Abuatihua	2.0 ±0.26	0.2 ± 0.05	1.46 ±0.18	0.36 ± 0.2
Total average	2.79 ±0.13	0.56 ± 0.02	1.85 ±0.07	0.37 ± 0.11

Appendix 6: Correlations table for milk production, family size, number of milking cows, area under crops, area under pasture in the surveyed kebeles.

Correlations

Variables		Total Family Size	Number of Milking Cows	Area of Land Under Crops	Area of Pastureland	Total Milk Produced (in litre) per day
Total Family Size	PC	1.000	.121**	.196**	.233**	.085
	2-tailed	.	.008	.000	.000	.064
	N	476	476	476	476	476
Number of Milking Cows	PC	.121**	1.000	.313**	.242**	.604**
	2-tailed	.008	.	.000	.000	.000
	N	476	480	480	480	480
Area of Land Under Crops	PC	.196**	.313**	1.000	.525**	.052
	2-tailed	.000	.000	.	.000	.258
	N	476	480	480	480	480
Area of pastureland	PC	.233**	.242**	.525**	1.000	.103*
	2-tailed	.000	.000	.000	.	.024
	N	476	480	480	480	480
Total Milk Produced (in litre) per day	PC	.085	.604**	.052	.103*	1.000
	2-tailed	.064	.000	.258	.024	.
	N	476	480	480	480	480

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Appendix 7: Frequencies of pastureland holding

Area of pastureland	Number of HH	Percent
.0000	203	42.3
.0100	1	.2
.0125	2	.4
.0300	10	2.1
.0600	1	.2
.1000	8	1.7
.1250	31	6.5
.2000	2	.4
.2400	1	.2
.2500	147	30.6
.3650	1	.2
.3750	2	.4
.5000	54	11.3
.7500	10	2.1
1.0000	7	1.5
Total	480	100.0

Appendix 8: Number of Cattle and milking cows in particular (in TLU)

No	Kebele	Cattle/HH (TLU)	Milking Cows/HH (TLU)	Milking cows/Total Cattle
1	Abua tihua	5.5	0.82	15.0
2	Kuahir Michael	6.3	1.19	19.0
3	Shina	6.2	1.2	19.5
4	Kuahir abo	5.6	1.19	21.3
5	Addisbetechiristian	6.8	1.45	21.4
6	Woreta Zuria	5.9	1.28	21.7
7	Alember	3.8	0.82	21.7
8	Wiji Arba	6.5	1.5	23.2

9	Kiddist hana	6.38	1.03	23.2
10	Shaga	4.5	0.84	24.8
11	Menguzer	3.5	1.01	29.0
12	Wagetera	3.2	1.01	31.5

Appendix 9: Correlation between milk consumed per household versus area of land under crops

Variable		TMC/HH	ALUC
TMC/HH	Pearson Correlation	1.000	.131**
	Sig.(2-tailed)	.	.004
	N	480	480
ALUC	Pearson Correlation	.131**	1.000
	2-tailed	.004	.
	N	480	480

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 10: Regression table for milk yield, area under crop, total family size, and number of milking cows, area of pastureland and number of cattle in the household.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.622	.387	.379	2.1138

a Predictors: (Constant), Surveyed Kebele(Code_W~K), Area of Land Under Crops, Total Family Size, Number of Milking Cows, Area of Pastureland, Number of Cattle of the Household

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1320.302	6	220.050	49.249	.000
	Residual	2095.546	469	4.468		
	Total	3415.848	475			

a Predictors: (Constant), Surveyed Kebele(Code_W~K), Area of Land Under Crops, Total Family Size, Number of Milking Cows, Area of Pastureland, Number of Cattle of the Household

b Dependent Variable: Total Milk Produced(in litre) per day

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% CI for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	Constant	-13.691	3.075		-4.452	.000	-19.734	-7.647
	TFS	4.148E-02	.045	.034	.916	.360	-.047	.130
	NMC	1.810	.140	.670	12.967	.000	1.536	2.085
	NC	-3.246E-02	.039	-.047	-.841	.401	-.108	.043
	AUC	-.461	.111	-.184	-4.150	.000	-.679	-.243
	AUP	8.540E-02	.577	.007	.148	.882	-1.049	1.220
		.135	.029	.174	4.711	.000	.079	.191

a Dependent Variable: Total Milk Produced(in litre) per day

TFS=Total family size,NMC=Number of milking ocws,NC=Number of cattle,AUC=Area under crop. AUP=Area under pasture

Appendix 11: Beef production in surveyed kebeles

ANOVA

Source of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.556	11	0.687	3.688	0.0000
Within Groups	87.175	468	0.186		
Total	94.731	479			

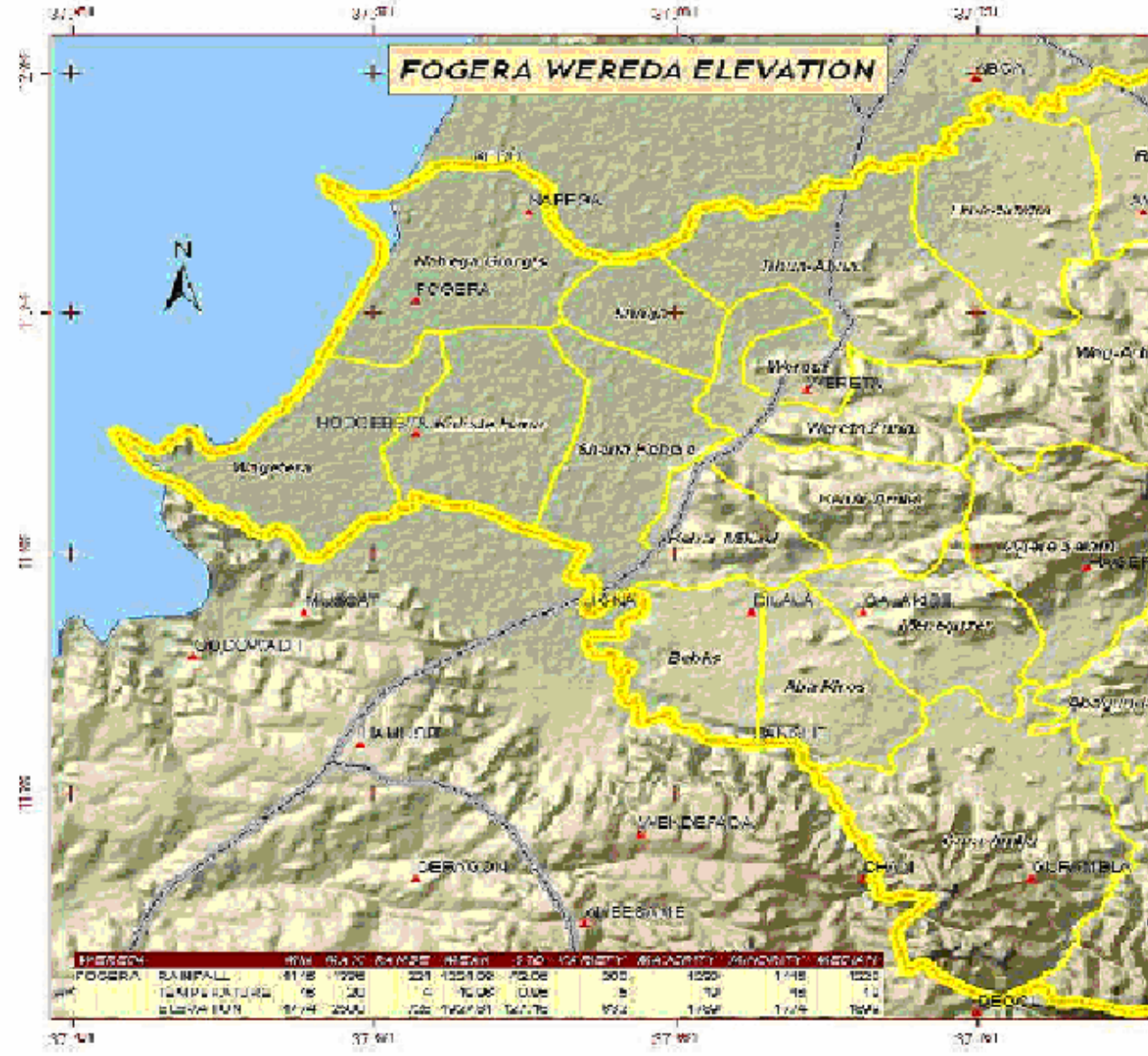


Figure1: Fogera area map

Appendix 9: Survey questionnaire

CASE STUDY QUESTIONNAIRE

Region

Adm.Zone

Study area

Peasant Association

I. Socio-economic Characteristics

1. Sex of Respondents
   1.Male
   2. Female

2. Age of Respondents

3. Family Size

A	Children
B	Females <15
C	Males < 15
D	Adults
E	Females >15
F	Males >15
G	Total

4. Who is the head of the households /family?
   1. Male
   2. Female

5. Age of the head of the household

6. Who participates in the activities in the dairy farming with regards to?

Activities		1.Mother 2.Father 3.Others
A	Milking	
B	Processing	
C	Cleaning	
D	Herding	
E	Sale of dairy products	
F	Sale of animals	

7. Who takes care of fattening animals with regard to?

Activities		1.Mother 2.Father 3. Daughters 4.Sons
A	Selling	
B	Herding	
C	Feeding	
D	Watering	

8. What kind of agricultural activities are you undertaking?
   1. Crop and livestock
   2. Only livestock production
   3. Crop only
9. Which part of your agricultural activity contributes most of the family income?
   1. Crop Production
   2. Live stock Production
10. Is there farmers' association and are you a member?
   1. There is and I am a member
   2. There is but I am not
   3. There is none
11. If you are a member what benefits do you get?
   1. Credit Service
   2. Input Supply
12. Do you receive any help from a government and non-government Organization?
   1. Yes
   2. No
13. Have you ever participated in any development beef production development project?
   1. Yes

2. No

14. Have you ever participated in any development dairy production development project?

1. Yes
2. No

15. What is the background of the owner or the head of the household?

1. Farmer
2. Business person
3. Government employee
4. Retired personnel
5. Other

16. When did you start the dairy farming/beef production?

1. A year ago
2. A month ago
3. A few weeks ago

17. How do you get information on dairying/beef production most of the time?

1. Radio
2. Newspaper
3. From farmer's association
4. From extension agents
5. None

18. What are your reasons for doing dairy farming/beef production?

1.to increase the household income
2.to safeguard the family against risk such as drought
3. to use the animal products as the source of food

19. Did you have any formal training in dairying? /beef production.

1. Yes
2. No

20. If yes, for how long time did you take the training?

1. For a few days
2. For a few weeks
3. For a month

21. Where do you take the training?

1. At the FTCs
2. At Wereda level
3. At the Zone level
4. At region level

II. Herd Structure

22. What type of animal are you keeping?

Type of animals	Amount in number			Total
	Local	Cross	Exotic	
Dairy Cattle				

Oxen
Goats
Sheep
Donkeys
Horses
Poultry

23. Major purpose of keeping animals?
    1. For milk purpose
    2. For meat purpose
    3.For traction
    4.For all above purposes

24. How many of each of the following cattle do you have in your herd?

	Cattle group	1.Local	2.Cross	3.Exotic
A	Milking cows			
B	Dry Cows			
C	In-calf heifers			
D	Young heifers			
E	Calves Males			
F	Females			
G	Steer, Oxen/Sterile Cows			
H	Bulls			

25. How much land do you have under control in hectares?

	Owned	Rented
Area under crops		
Area under pasture		
Perennials (cash crop, fruits)		

III. Housing and waste Management

26. How do you house your animals?
    1. In a house
    2. Tethered in the yard
    3. Not housed at all

27. If the answer to the question 23 is (a), what is the house made from?

		1.Corrugated Iron 2.Grass 3.Wood 4.Concrete 5.Stone 6.Mud
A	Roof	
B	Wall	
C	Floor	

28. When do house them?
    1. All the time
    2. Only at night

29. Do you have any conflict with your neighbors because of your livestock activities?
    1. Yes
    2. No
30. How do you dispose the cattle dung from the barn?
    1. By drainage system
    2. By manual labor
31. How many times are you disposing manure from the barn?
    1. Once per day
    2. Twice per day
    3. Three times per day
    4. More than three times
32. How are you utilizing it most of the time?
    1. I do not use it at all
    2. It is made in to cow dung cake
    3. It is used for soil fertilization
    4. It is used for construction purposes
33. Do you also sell the animals dung cake or decomposed dung?
    1. Yes
    2.No
34. Where do you usually sell your decomposed dung or cake?
    1. At the farm gate
    2. On the near by market
35. What is your labor source in the dairy/or beef cattle production?
    1. Family labor
    2. Hired labor
    3. Both
36. When is your high labor demand?
    1. During the peak of lactation/or during finishing time
    2. During hay harvest
    3. During cow dung preparation

IV. Feeds and feeding

37. What type of grazing system are you using?
    1. Zero grazing
    2. Semi-grazing
    3. Full grazing
38. What is the source of your dairy feed/beef cattle feed?
    1. Own production
    2. Purchased
    3. Both
39. Which crop residue are using for feed?
    1. Teff straw
    2. Barley straw
    3. Rice straw
    4. Maize stalk

40. For what other purpose do you use crop residues?
    1. Use as source of fuel wood
    2. Used for construction purposes
    3. To make household materials
41. Do you grow fodder crops?
    1. Yes
    2. No
42. If yes, which fodder crops?
    1. Grass
    2. Forage legume
    3. Tree legume
43. What are your major reasons for not growing fodder crops?
    1. Insufficient land
    2. Insufficient labor
    3. Insufficient inputs (seed, fertilizer, and cash)
    4. Insufficient draft animal power
    5. Feed for animals is adequate
    6. Insufficient information
44. Do you buy any feed supplements for your animals?
    1. Yes
    2. No
45. Which feed supplements do you buy?
    1. Oil seed cake
    2. Cotton seed cake
    3. Wheat and corn bran and middling
46. Why do you buy these feed supplements most of the time?
    1. For lactating cows
    2. For pregnant cows
    3. For male calves
    4. For female calves

5. For beef cattle

47. What kind of concentrate are you usually using to feed your cows and/or beef cattle?
1. Wheat short and bran
2. Oil seed cakes
3. Formulated ration
4. Bone meal
5. Meat meal

48. From where do you buy your concentrate feeds?
1. From the farmers' association
2. From the ministry
3. From private retailers
4. From the industries

49. How much do you spend on feed per month?
1. 100-200 birr/month
2. 201-300 birr/month
3. >300 birr/month

V. Water Resources and quality

50. What sources of water are you using for your dairy animals and/or beef cattle
1. The city pipeline
2. The near by river
3. Pond
4. Walls

51. Do you usually transport the water or bringing the animals to the rivers or pond?
1. Transport the water
2. Bringing the animals to the river or pond

52. What is your main water related problem?
1. Scarcity
2. Parasites such as leaches
3. Unhygenic/impurity

VI. Breeds and breeding

53. What is the breed of your dairy and/or beef animals?
1.Pure breeds
2.Exotic breeds
3.Local/indigeniuos
4. Cross
5. Mixed

54. Do you know the pedigree of your animals?
1.Yes

2.No

55. If yes, indicate it
    1.From the seller's information
    2.From the Governmental Ranches history card
56. Do you know the exotic blood type, which is present in your herd?
    1.Yes
    2. No
57. If yes, indicate it
    1. Holestien Frisian
    2. Jersey
    3. Gerensey
58. Why do you keep crossbreed animals in your farm?
    1. They produce higher amount of milk.
    2. They produce calves faster
    3. They grow better and faster.
    4. All
59. Do you have different problems with the different breeds of your animals?
    1. Yes
    2. No
60. If yes, which are the problems? (Only one best answer)

		1.Local 2.Cross 3.Exotic
A	Internal parasites	
B	External parasites	
C	Heat Stress	
D	Require more feed	

61. Why do you mainly keep local cows in your herd? (Only one answer)

    1. They produce bull calves for replacement of oxen
    2. They are used to produce crossbred calves
    3. They are easy to manage
    4. They produce milk with better fat content
    5. They are resistant to disease
    6. All
62. From where did you get the cross bred animals originally?
    1. The use of AI from cross breeding from the ministry of agriculture
    2. Purchase of cross breed bull
    3. Purchase of cross breed cow or heifer
    4. The use of cross breed bull from the surrounding

5. Government ranches

63. What kind of breeding technique do you prefer?

1. Artificial insemination
2. Natural mating
3. None

64. How do you get your bull?

1. Own bull
2. Bull owned in common
3. Bull owned by a neighbor
4. From bull station
5. None

65. When you want to dispose your own(s), what criterion do you use in selecting the one(s) to dispose?

1. Old age
2. Sickness
3. Low milk production
4. Infertility

66. Why do you use AI?

1. I do have access to AI service
2. It is simpler than raising a bull
3. It is more economical than a bull service
4. I do not have a bull
5. All

67. Why do you not use AI?

1. I have no access to AI service
2. The efficiency of AI service is not good
3. I do not want to use AI services because of cultural reasons
4. I have a bull, which I can also use for other purposes

VII. Calf rearing practices

68. At what age do you normally wean your calf?

	Breeds	Age
A	Local	
B	Cross breed	
C	Exotic	

69. Which method do you use for pre-weaning milk feeding?

	1.Bucket feeding 2.Partial suckling
A	Local
B	Cross
C	Exotic

70. After weaning, what do you do with male calves?

		1.sell	2.fatten them	3.sell as sire
A	Local			
B	Cross			
C	Exotic			

VIII. Dairy and beef Animals performance

71. How many times do you milk your cows per day?
    1. Morning only
    2. Morning and evening
    3. Morning, mid day and evening

72. How many months of lactation do you normally have?

	1. 1-3 months	2. 4-6 months	3. 7-9 months	4. 9-10
Local				
Cross breed				
Exotic				

73. Do you intend to increase your level of milk production and/or beef production?
    1. Yes
    2. No

74. If yes, indicate
    1. It maintains food production for the household
    2. It is profitable (income generation)

75. If no, indicate
    1. It is not as the crop production
    2. It is not profitable

76. What is the main constraint out of the following constraints for your dairy and /or beef production?
    1. Feed shortage
    2. High feed prices
    3. Disease
    4. High medicament cost
    5. Shortage of land for grazing or forage development
    6. Lack of capital
    7 Inefficient breeding services
    8. Market availability

9. All

77. Could you rank the most important ones?

1. Feed shortage _____
2. Diseases _____
3. Shortage of land _____
4 Capital _____
5. Market _____

IX. Milk and beef production and utilization

78. How much milk is produced per cow per day in your herd on the average, presently?

1. 1-5 liters
2. 6-10 liters
3. >10 liters

79. Who makes decision in the dairy product with regard to: -

1. Consumption
    1. Male
    2. Female
2. Production/processing pattern
    1. Male
    2. Female

80. How is the milk consumed?

1. Alone
2. With meals
3. As an additional

81. How many times do you fatten the animals (cattle) in a year?

1.0nly one time
2. Twice a year
3. Three times

82. Which months in a year do you prefer for selling the beef cattle?

1.September
2.January
3.April
4.Any month

83.How is it utilized?

	Milk Utilization pattern	Amount in liters/day
A	Total Milk produced	
B	For calf feeding	
C	For home consumption	
D	For processing	
E	For sales	
F	For other purposes	

84. Are there seasonal variations in consumption pattern?

1. Yes
2. No

85. If yes, indicate

	Variation	Period (months)	Average yield/day
A	Highest yield		
B	Lowest yield		

86. Do you process your milk?

1. Yes
2. No

87. At what time interval do you process the milk?

1. Every week
2. Every two weeks
3. Every month

88. What materials do you use to process the milk?

1. Clay pot
2. Gourd
4. Other

X. Milk and beef marketing

89. For whom do you sell your dairy products/beef cattle?

		1.To individuals 2.To caterers 3.To retailers 4.To government insti 5.To private Processing 6.To others
A	Beef Cattle	
B	Whole Milk	
C	Fermented Milk	
D	Butter	
E	Butter Milk	

90. What criterion do you mostly use in selecting your beef cattle and/or milk marketing out let?

1. Price
2. Distance
3. Reliability

4. Long term contract

91. Is there any period you have problem of marketing you milk and /or beef?
1. Yes
2. No

92. If yes, which months
1. Fasting months
2. In any month in the year

93. Which method are using for the delivery of your milk and /or beef cattle?
1. I or another family delivers it
2. Collected by consumers or purchasers
3. Taking to the market

94. Which transport means are you using to transport your animals and/or products for sale most of the time?
1. Public transport
2. Traveling on foot
3. Using pack animals

95. Which gender group plays a great role in dairy production?
1. Males
2. Females
3. Both almost equally

96. Which gender group plays a great role in beef production?
1. Male
2. Female
3. Both almost equally

XI. Dairy and beef cattle diseases

97.What is the main disease mainly affects your dairy and/or beef production?
1. Anthrax
2. Blackleg
3. Foot and mouth disease
4. Brucelosis
5. Mastitis
6. Internal parasites

	Animal	Main Disease
A	Lactating cows	
B	Pregnant cows	
C	Calves	
D	Fattening animals	

98. Do you have incidence of human beings infected with any of the diseases?
1. Yes
2. No

99. If yes, which disease

1. Anthrax
2. Blackleg
3. Brucellosis

100. Do you use any traditional or herbal remedies for your cattle?
1. Yes
2. No

101. If yes why?
1. Vet. Services are not available
2. Vet costs are high
3. Vet medicaments are not effective for such disease

102 .Do you use any veterinary services?
1. Yes
2. No

103. From where do you get vet. Services?
1. Government institution
2. Private Vets.
3. NGOs extension services
4. Others

104. How many animals did you lose the last one-year because of diseases?

1. Calves
2. Heifers
3. Milking cows
4. Fattening animals

BIOGRAPHICAL SKETCH

The author, Belete Anteneh, was born in September 1970 in Bichena town, East Gojjam Administrative Zone. He joined Ras Hailu elementary school in September 1977. After completion of his elementary school education, he pursued his secondary school education at Belay Zeleke Senior Secondary School in 1987.Then he joined the Alemaya University of Agriculture in 1988. He graduated with degree of in agriculture (Animal Science) in August 1992.

The author was employed by Ministry of Agriculture in West Gojjam zone as Animal and Fishery Resource development expert in February 1992. Since his employment the Author was working as an expert and team leader for 13 years in different districts of the West Gojjam and Awi Administrative zones of the Amaharan region. In April, 2004 he joined the School of Graduate studies of Debub University to pursue his graduate study in the specialization of Dairy Science.