

**SMALLHOLDER FARMERS CATTLE HUSBANDRY PRACTICES, MILK
PRODUCTION AND MAJOR CONSTRAINTS IN TELO DISTRICT OF KAFA
ZONE, SNNPR**

BY

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DEDICATION

I dedicate this thesis manuscript to my beloved father G/Michael G/Tsadik who was the way to my success in all directions and exceptional person for me!

BIOGRAPHICAL SKETCH

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LIST OF ABBREVAITIONS

ANOVA	Analysis of variance
CSA	Central Statistical Authority
E.C.	Ethiopian calendar
ESAP	Ethiopia Society of Animal Production
ETB	Ethiopian birr
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
Ha	Hectare
IBC	Institute of Biodiversity Conservation
ILCA	International Livestock Centre for Africa
ILRI	International livestock research institute
LL	Lactation length
LVS	Livestock
M .a .s .l	Meter above sea level
Max	Maximum
Min	Minimum
SD	Standard deviation
SE	Standard error
SNNP	South Nation Nationalities and People
SPSS	Statistical package for social science

ABSTRACT

A cross sectional study on smallholder farmers cattle husbandry practices , milk production and major constraints in Telo district was conducted from September 2011 to March 2012 with aim of assessing cattle husbandry practice, milk production and determining major constraints of milk production from randomly sampled 156 households (33 from urban and 123 from rural). Information was collected using questionnaire survey, farm visit and group discussion and analyzed using SPSS.version 16.0. Sixty two percent of household heads were male. The average family size per household was 6.8 persons. 58% of household heads were illiterate, and most of these were found in rural, the average of cattle herd size was 7.45, which is significantly higher in rural milk production than in urban milk production. 99% of cows were of indigenous breed. Cows (67.3%) and calves (66.9%) were housed sharing in family house. The main source of feed were grazing on natural pasture on the grazing area of individual owned 71.2%, combination of rented and individual owned 10.3% and only rented 18.6%. Seventy nine percent of respondents were producing crops like wheat, barley, teff, maize, but the ones who supplementing their cattle with crop residues were only 13.7%. About 67.3% of smallholders used water from river for their cattle. The reported disease were Anthrax, black leg, parasite, bloating, cough. Most smallholders relay on traditional healers or on their own skill to treat their sick animals. The primary objective of cattle keeping in rural milk production was for traction, while in urban was for milk production. Male calves suckle relatively longer period than female calves. The dung removed from cattle's house was not put in use. The estimated average daily milk yield of local and cross cow was 1.4 and 7.28 litters with an estimated LL of 8.47and 9.92 months, respectively. Total milk produced per lactation was significantly higher in urban. There was no practice of selling fresh milk in rural. Over all percentage of milk sold in study area was 19.2%, the largest volume of milk produced in rural was processed, the major constraints in milk production were shortage of grazing land, disease and low productivity. Crop and livestock sectors were not complementing each other. Therefore, there should be resource control over.

Key words: Cattle, Husbandry, Major constraints, Milk production, Smallholder, Telo

1. INTRODUCTION

Agriculture is the mainstay of the Ethiopian economy, employing approximately 85% of the total population. Livestock production in Ethiopia is mainly of smallholder farming system with an animal having multipurpose use and accounts for approximately 30% of the total agricultural GDP and 16% of national foreign currency earnings (IBC, 2004). Moreover, Ethiopia has diverse animal genetic resources and its relatively large livestock population (approximately 100 million) is well adapted to and distributed among diverse ecological conditions and management systems. Ethiopia has currently the highest cattle population in Africa, estimated to be 50.8 million. Out of these, the female cattle constitute about 54.87 percent and the remaining 45.13 percent are male cattle, from these milking cows number is about 10 million with an estimated annual total milk production of 3.2 billion liters or 1.54 liters per day per cow (CSA, 2010). Majority of these animals are indigenous and owned by smallholder farmers under traditional management (Azage *et al.*, 2000).

In spite of the presence of large and diverse animal genetic resources, the productivity (i.e., meat and milk) of livestock remains low for various reasons, such as inadequate nutrition, poor genetic potential, inadequate animal health services and other management related problems. Besides, farm-data recording systems at the smallholder production level are either totally absent or incomplete, so it is usually difficult to get reliable data with which to evaluate the performance of smallholder dairy cattle (Mekonnen *et al.*, 2006). Moreover, owing to problems associated with logistics, high research costs and other inconveniences, longitudinal observational studies are usually difficult to implement at the smallholder level. Consequently, in the past most research attempts have focused on institutional herds and there has been only very limited efforts to make cross-sectional observations to evaluate the performance of dairy cattle in Ethiopia (Bekele *et al.*, 1991; Mukasa-Mugerwa *et al.*, 1991; Mekonnen *et al.*, 1993; Swensson *et al.*, 1998 and Shiferaw *et al.*, 2003).

Ethiopia's increasing production potential, human population, urbanization trends and household incomes are leading to a substantial increase in the demand for livestock products. In light of prevailing land-resources limitation, expecting the establishment of large scale commercial dairy farms in urban and peri-urban areas is unlikely. Thus, under Ethiopian condition, there is no doubt that the increase in milk supply to urban centers will continue to relay on smallholder dairy for many years to come (Mekonnen *et al.*, 2006).

The mainstay of Kefa population is rain fed subsistence agriculture and majority of these population practices mixed crop-livestock production system under traditional management. Telo District is one of 11 District in Kefa zone and found at distance of 45 km from Bonga or capital of Kefa zone. The main agriculture system in this area are livestock production especially mixed crop-livestock production, coffee production, spices, crops like barley, wheat, maize, teffe, inset, bean, pea and sorghum. Milk production is an integral part of the farming system in this District. According to the "Woreda" agricultural and rural development report of the year 2008, the total cattle population is about 81,993 from these milking cow contributes 13,346. Milk production is mainly from indigenous cows which are kept by smallholder farmers under traditional management system. Even though, the District is believed to have potential for milk production, nothing has been studied on existing husbandry practices, major constraints associated with milk production, resources utilization or recycling between two integrated (livestock and crop) production systems. Therefore, the objectives of this study were:-

- To assess husbandry practices of cattle in the Telo district
- To determine the milk production situation of smallholder farmers and.
- To investigate major constraints for milk production in Telo district

2. LITERATURE REVIEW

2.1. Dairy production systems in Ethiopia

Four major systems of dairy production can be distinguished in Ethiopia. These are lowland pastoral dairy production systems, rural highland smallholder dairy production system, urban and peri-urban small scale dairy production system and large scale dairy production system (Ketema and Tsehay, 1995; Azage et al., 2000).

2.1.1. Lowland pastoralist dairy farming

About 30% of the livestock populations in Ethiopia are found in the pastoral areas. These areas comprise 50% of the total land area of the country and have altitudes below 1500 m.a.s.l. Pastoralism is the major dairy production system in the lowlands. Livestock doesn't provide inputs for crop production but are the very backbone of their owners providing all of the consumable and saleable outputs and regarded as insurance against adversity. Milk production is dependent on season due to the rainfall pattern that influences feed availability (Ketema and Tsehay, 1995).

2.1.2. Rural highland smallholder dairy farming

There are two types of systems in the highlands. The traditional system that is based on indigenous breeds and the market oriented system that is based on crossbred dairy cattle. The average lactation yield for indigenous cows is 524 liters for 239 days and the average age at first calving is 53 months and the average calving interval is 25 months. The average milk yield and lactation length for crossbred dairy cows ranges from 518.8-1448 kg and 110-300 days, respectively, depending on the breed type. The milk produced is mainly consumed by the household in the traditional system while most of the milk is sold to generate income in the market oriented system (Tesfaye, 1995).

2.1.3. Urban and peri-urban small scale dairy farming

This system is developed in and around major cities and towns located mainly in the highlands of Ethiopia. The main feed resources are agro-industrial byproducts and purchased roughage. The system comprises small and medium sized dairy farms that own crossbreed dairy cows. Farmers use all or part of their land for forage production. The primary objective of milk production is generating additional cash income to the household (Ketema and Tsehay, 1995; Azage *et al.*, 2000).

2.1.4. Large scale dairy farming

This system is a specialized market oriented dairy operation practiced by the state sector and very few private commercial farms. Most of these farms are located in and around Addis Ababa and basically keep exotic dairy stock (Azage *et al.*, 2000).

2.2. Husbandry Practices

2.2.1. Purpose of keeping cattle

Knowledge of reasons for keeping animals is prerequisite for deriving operational breeding goals (Rewe *et al.*, 2006). As an integral part of the mixed farming system, livestock production plays a substantial role. It meets urgent financial need, dietary requirements, draft power, transport, loan repayment, dowry and gift, fuel, fertilizer, as a buffer in the case of crop failure and also for social and cultural functions in Mecha and Bahir Dar Zuria districts (Assaminew, 2007). The use of indigenous zebu cattle as multipurpose animals in Ethiopia was also reported by Van Dorland *et al* (2004). He also revealed that the production objectives of farmers in mixed production system include not only marketable products such as milk, generation of income from sale of live animal, butter, hide and meat, but also non-

marketable functions such as draught power, manure, threshing crops and socio-cultural services.

2.2.2. Livestock housing

The traditional livestock husbandry practiced across the Ethiopian highlands is similar. Livestock are kept in a 'kraal' during the night. During the day time, they are herded on communal pasture, private grazing lands or in stubble depending on the season (Getachew *et al.*, 1993). Improved type of housing using barns constructed from locally available and cheap materials is being practiced mainly by urban and peri-urban smallholder dairy farmers owning crossbred dairy cattle. Roofless fenced enclosures were used to keep cattle during night times. Calves, however, were separated from adults and housed in the same shelter with households (Dessaegn, 2009).

2.2.3. Feed resources and feeding practices

The highlands of Ethiopia are characterized by mixed crop-livestock farming systems where the crop and livestock subsystem complement each other (Getachew *et al.*, 1993). They are inhabited by large human and livestock population where smallholder farmers cultivate a variety of crops and rear different livestock species. The area allocated to grazing in the highlands has been progressively declining through time due to expansion of cultivation. As a result, crop residues have become one of the major feed resources for livestock (Daniel, 1987). The major livestock feed resources identified by Mekonnen *et al* (2012) in Western Oromia were natural pasture, crop residue, aftermath grazing, crop thinning, fallow land grazing, household kitchen waste and local beer by-product called "Atela". Natural pasture was the main feed resource that support livestock in the study area during the cropping season, whereas crop residues are the major feed in the dry season in the district as crop production is high in the farming community. Crop residues used for animals feed are maize Stover, barely straw, teff straw, wheat straw, noug straw and pluses straw. Teff straw contributes more for livestock feed when compared to any other crop residues. This is due to

the fact that teff straw is essential for cattle and draught oxen during cultivation in the study area. Barely straw also contributes as cattle feed next to teff straw. There is a high preference for “mosino” (straw of the late planted local barley, which is the equivalent of spring barley) straw as animal feed. Crop fields such as maize, teff and barely are used for stubble grazing after harvesting. The use of improved forage and concentrate feed by the farmers in the Horro district is insignificant. Only 1.8 percent of the respondents were found to conserve and utilize hay during the dry season. 22.9% of the respondents had owned grazing land and utilized individually. The use of both communal and private grazing land is reported by most of the respondent (Mekonnen *et al.*, 2012). Herded and free grazing was practiced on communal natural pastures that constituted almost the only feed resource for all farmers. Crop residues like teff (*Eragrostis teff*) straw, millet straw, maize and sorghum Stover as well as hay from natural pasture were provided for working oxen and in times of feed shortage or dry season (Dessalegn, 2009).

2.2.4. Healthcare

Diseases are important causes of reduced productivity of meat, milk, draft power as well as hide and fuel (Rodostits, 2001). He indicated that the basic structure of health management program includes scheduled herd visit by the dairy veterinarian, but the actual interval for scheduled herd visit is variable and somewhat dependent on herd size, the calving pattern during the year and the number of animals that can be dealt by the farm. Thus, for small herd of less than 60 cows, once every three weeks will be sufficient (Arthur, 2001). Livestock diseases are among the major factors that limit cattle owners' benefits as a result of mortality. Bloating, pasteurellosis, trypanosomosis, anthrax, blackleg, foot and mouth diseases and parasites comprise the major reported animal diseases. Bloating is serious disease that causes livestock death during rainy season resulting from over consumption of fresh clovers (*Trifolium* species). Farmers noted that even though their animals are attacked by disease, they continue to produce under the disease challenge (Mekonnen *et al.*, 2012).

2.2.5. Labour distribution

In West Gojam milking is done mainly (52.6%) by men, while processing and sale of milk products and barn cleaning are mainly the jobs of women followed by female children (Assaminew, 2007). Feeding and milking are primarily undertaken by women Sale of live animals and breeding decisions are undertaken mostly by men (95.4%). This specific study showed that women have no equal participation in the decision making of household affairs i.e. decisions are made solely by men (Kedija, 2008).

2.2.6. Breeding

Cattle breeds of the tropics are known to have low milk production potential compared to the temperate breeds that have been selected for specific production traits, tropical breeds mostly have multipurpose functions; with no or little attention given to milk production (Fikre, 2007).

2.2.7. Calf rearing

Calf rearing practice is one of the most important husbandry practices, which sustain milk herd through supplying replacement stock. However, calf rearing is the most delicate activity in milking, it is a practice often neglected in Ethiopia (SDDP, 1999). Calf suckling resulted in higher milk yield and long lactation length of the dam, higher pre-weaning gain of the calf and higher weaning weight (Gebre Egziabher *et al.*, 2000).

2.2.8. Waste management

The excreta obtained from cattle plays great role for human being as source of household fuel, fertilization and as house decoration. According to Belete (2006), the majority (98.1%) of households use the dung as source of fuel and the rest (1.9%) use it as fertilizer. Cattle

manure provides an important fraction of domestic fuel needs in areas with limited fuel-wood supplies. Manure sales make significant contributions to cash incomes. In some farming systems, such as in North western Province, selected fields are intensively manured by livestock penned overnight in the fields. However, little of the animal manure produced in the country is used intentionally as fertilizer for crop production (Zewdu, 2004).

2.2.9. Culling

Dairy cattle's culling is the act of removing dairy cattle from herd and replacing them with other cows. Dairy cattle can be culled from herd for production or health reasons. The average annual culling rate describes the percentage of cattle that are culled from the herd annually. Determining the optimal culling rate can be difficult for the producers and if the culling rate is too high, farmers fail to earn an adequate return on their cattle investment, if too low the farmer foregoes production and genetic improvement (Hadly, 2003).

2.2.10. Record keeping

An important aid for farm management is keeping of records for all animals and events relating to animals throughout their lives. The main purpose of record keeping is for dairy herd management. Records of insemination, birth date, dam, sire, calving date, vaccination date, health problems, treatment, milk yield and feeding can help farmers to predict future or preventive need for health care. Smallholder farmers do not seem to pay sufficient attention to keeping good records (Aiumlami, 1999).

2.3. Milk production performance

According to Staal *et al* (2008) about 63% of the annual total national milk production is produced by rural smallholders in mixed farming system of the highlands and about 22% of total annual national milk production is from smallholder producers found in urban and peri urban milk production. The highland smallholder milk production is found in the central part

of Ethiopia where milk production dominated by subsistence, smallholder mixed crop and livestock farming (Assaminew, 2007; Belete, 2006; Sintayehu *et al.*, 2008). In this system, all feed requirement is derived from native pasture and a balance comes from crop residues and stubble grazing. Cattle are the main source of milk even though they are kept primarily as draught power source with very little or no consideration given to improving their milk production capabilities (Zegeye, 2003).

The lactation performance of dairy cattle is usually measured by determining the total milk yield per lactation, total milk yield per year, average daily milk yield, lactation length, lactation persistency and milk composition (Fikre, 2007). In most modern dairy farms, a lactation length of 305 days is commonly accepted as a standard. However, such a standard lactation length might not work for smallholder dairy cows in which the lactation length is extended considerably in most cases (Masama *et al.*, 2003; Msangi *et al.*, 2005; Teodoro and Madalena, 2003). Furthermore, such an extended lactation period has practical significance for the smallholder dairy farmer as it provides compensation for the usually extended calving interval (Tanner *et al.*, 1998).

2.4. Milk consumption pattern

Milk and milk products plays an important role as parts of the diet of many Ethiopians. They consume either fresh or fermented forms. About 81.2% of the total milk produced in the country is from cows, whereas the remaining 6.3% and 7.9% is from camels and goats respectively. Indigenous cows' contribution is about 97% to the total milk production from cattle, the rest 3% coming from improved dairy stock (Getachew, 2003). The consumption of milk and milk products varies geographically between the highlands and the lowlands and the level of urbanization (Adebabay, 2009). In the lowlands, all segments of the population consume milk products, while in the highlands the major consumers primarily include children and some vulnerable groups of women. The demand for milk in rural areas is mainly for fresh whole milk and this demand is partially satisfied by home production and or purchased from neighboring producers. The demand for processed milk in the rural areas is

currently nil and expected not to change significantly in the near future. Consumption of milk and milk products in rural is heavily influenced by livestock ownership, but in the urban areas, milk consumption is influenced by levels of income. The growth in demand for dairy products resulted from rapidly growing population, urbanization, changes in life style or consumption behaviors and some increase in incomes (FAO, 2003).

2.5. Major constraints of dairy in smallholder in highlands of Ethiopia

The livestock sector in general and dairy sub-sector in particular does not make a contribution to the national income considering with its size (Ehui, 2000). The reasons for this are numerous and include both technical and non technical constraints.

2.5.1. Non-technical constraints

The non-technical constraints of dairy development generally include a variety of socio-economic and institutional considerations, which are most cases and also common constraints to other agricultural sector in the country.

Human population

The high rate of population increase (2.9-3 % per annual) is reckoned to affect livestock development. The demand for livestock products is directly related with the annual population growth. The livestock production lags behind the rate of growth of cattle population (1.1 %). Moreover, high population growth has forced people to cultivate more and more land. The necessity to extend the cropping areas to support the increasing population in the highlands, the carrying capacity of the land is stretched beyond its limits, which resulted in low production performance of the livestock (Ketema and Tsehay, 1995; Agajie *et al* (2002)).

Livestock population

One of the serious constraints to the livestock development in Ethiopia rest on the importance attached to the economic functions of the livestock found in various agro ecological zones. Overall livestock in Ethiopia are used as input function, asset and security function. Farming methods in Ethiopia have remained unchanged for centuries, cultivation is carried out using oxen drawn by traditional ploughs in the highland. This demands high dependency on animal power (as an input function). High population growth has forced people to plough more land, which in turn demand more ploughing capacity. Therefore, to fulfill this demand more ploughing capacity requires for the presence of a higher cattle herd, which created pressure on grazing land and ultimately poor economies of peasant farm (Ketema and Tsehay, 1995). The other economic benefit of livestock, as a source of additional income consideration as assets and security are also important, and due to low productive indigenous stock these functions requires to maintain large herd and demand additional area of grazing land (Agajie *et al.*, 2002).

2.5.2. Technical constraints

Animal health

Animal health and management in use are also major constraints of dairy development in Ethiopia which cause poor performance across the productive system. Many of the problems resulted from the interaction among the technical and non-technical constraints themselves e.g. poor health care system relies heavily on veterinary measures, poor grazing management systems continue to cause high mortality and morbidity (e.g. internal parasites), many of the disease constraints which affect supply are also a consequence of the non-technical constraints e.g. insufficient money to purchase drugs or vaccines. According to Assaminew and Eyassu (2009), the most prevalent diseases reported in smallholder dairy in Bahir Dar and Mecha Worda are trypanosomiasis, mastitis, dermatophilosis and anthrax.

Feed resource availability

Natural grazing is the most important source of feed in both the highland smallholder and pastoral dairy farming. It is estimated that over 90% of the total animal feed is obtained from unimproved and communal pasture, rangeland and fallow. In the highlands grazing resources have deteriorated as a result of human population pressure and the intensity of cultivation. Crop residues and agro-industrial by-products account for the remaining 7 and 3 percent, respectively (Tilahun, 1995). The urban and peri-urban dairy production systems depend more on agro- industrial by-products. Poor body condition due to shortage and low quality of feed increased the risk of mastitis (Mekonnen and Tesfaye, 2010).

Genetics

The genetic of Ethiopia's livestock have evolved largely as a result of natural selection influenced by environmental factors. About 99% of the cattle population in Ethiopia are indigenous that are adapted to feed and water shortages, disease challenges and harsh climates. The productivity of indigenous livestock is however, believed to be poor even if no practical recording scheme has been used to judge their merit (Tsehay, 1997).

Marketing constraints

Enhancing the ability of poor smallholder farmers to reach markets poses development challenges. Difficult market access restricts opportunities for income generation. Remoteness results in reduced farm gate price, increased input cost and low return to labour and capital (Tsehay, 2002)..

3. MATERIALS AND METHODS

3.1. Description of the Study area

The study was conducted in Telo District, Kefa zone of SNNP Regional State. It is located at 500 km Southwest of Addis Ababa and 45 km from Bonga or capital of Kefa. The total area coverage is 5569.4 hectares and total population of 623,125 people. The altitude ranges from 2436 to 2451 m.a.s.l which represents typical highland environment. The main rainy season is from June to September with a mean annual rainfall of 1278 mm and the average daily temperature varies from 17-25°C. Four “kebeles” namely Oda, Dacha, Wora and Yama were selected as study sites based on potential for dairy. Oda is a small town while the rest three Kebeles are rural areas of mixed crop livestock production system. Thus for the purpose of this study, the milk production system was classified as urban for Oda and rural mixed crop-livestock production systems for the rest three Kebeles.

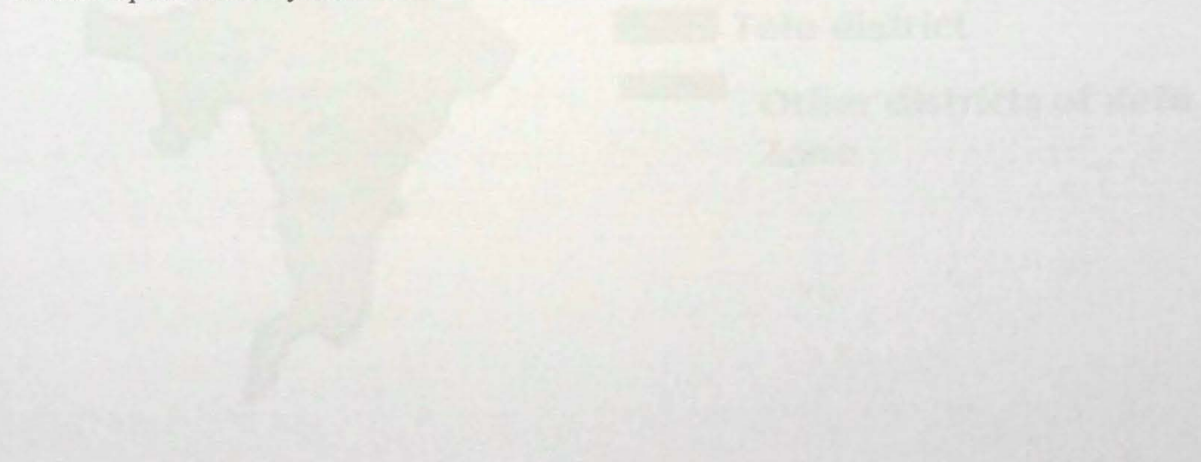
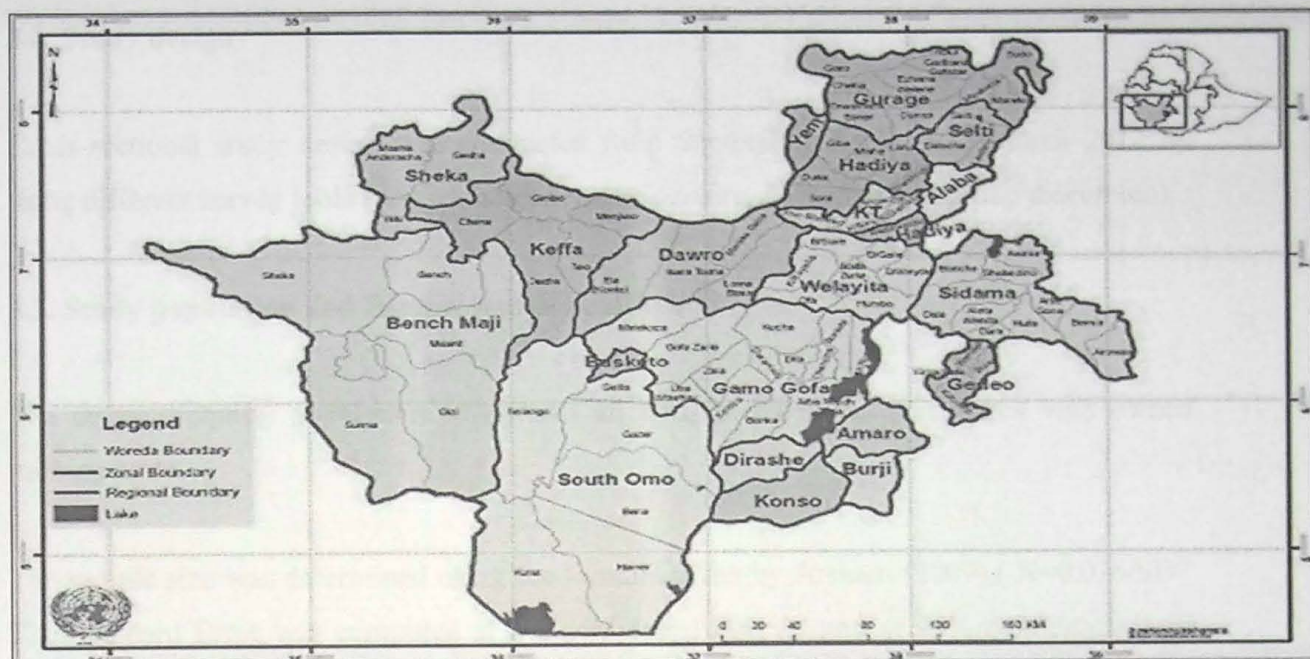


Figure 1. Map of Ethiopia and SNNPR region

Source: District maps of Ethiopia (2000)



Telo district

Other districts of Kefa Zone

Figure 1: Map of Ethiopia and the study area

Source: Federal maps of Ethiopia “Woreda”.

3.2. Study design

Cross-sectional study design was conducted from September 2011 up to March 2012 by using different survey tools (semi-structured questionnaire, farm visit and group discussion).

3.3. Study population and Sample size determination

The target sampling population constituted all households in the study area who owned milking cows.

The sample size was determined using the formula given by Arsham (2007), ($N=0.025/SE^2$). The Standard Error was computed at 8% confidence interval and at 95% confidence level that gave SE value of 0.04. Where, N=sample size and SE= assumed standard error. Thus, the total sampled household was 156 (33 smallholders from urban milk production system and 123 from rural (mixed crop-livestock milk production)).

The study participants' distribution in the four Kebeles (Dacha, Oda, Wora and Yama) was proportionate to the smallholders having milking cows in each Kebele (Table 1). The identification of study participants was done by using random sampling method.

Table 1: Sample size distribution among the four Kebeles of study area

Kebele	Smallholders having milking cow	Sample taken
Dacha	265	40
Oda	218	33
Wora	298	45
Yama	252	38
Total	1033	156

3.4. Data collection

Secondary data

Secondary data from “Woreda” Agriculture and Rural Development Office

Questionnaire survey

A total of 156 smallholders were interviewed using a pre tested and semi-structured questionnaire. The questionnaire contained both open and close ended questions. The overall purpose of the questionnaire was to determine demographic characteristics of household, understand the livestock production situations, socioeconomic background of the smallholders, cattle husbandry aspects, milk production performance of cows, to identify the major constraints that hindering milk production in the study district.

Estimated performances of cows: information were collected on estimated daily milk yield at the early, middle and late of lactation, lactation length, Since the research was based on a one-visit interview, it was not possible to record milk yield at intervals, rather farmers were asked for the quantity of milk they milked from their cows during previous lactation periods at the early (beginning), at the middle and at the late (end) of lactation. Daily milk yield at the early lactation refers to the quantity of milk in liters the farmers milked daily from a cow during the first two to three months of lactation, daily milk yield in the middle of lactation refers to the quantity of milk the farmers milked daily from a cow for the next six months and daily milk yield at the late lactation refers to the quantity of milk the farmers milked daily from a cow during the remaining months. In addition, the values for lactation length were recorded in months since most of the farmers didn't have records and it was difficult for them to recall the lactation length in days.

Group discussion

In addition to individual interviews, focus group discussions were undertaken with key informants (extension workers, elders, animal production and health experts, and community chair person) in order to strength or supplement major information obtained from individual interviewers. The issues included were major feed resources, type of disease and their local name, extension service and major constraints.

Farm inspection:

A onetime farm inspection was done at the same time with the questionnaire interview to observe cattle housing systems, feeding practices, milking and milk handling practices. Barn cleanness was qualified as poor when there is bad smelling, dung accumulation, gutter, holes presence and when the animals flank, udder and belly were soiled, the barn cleanness qualified as fair when there is some smells that is not much sniffing and if the dung or mud was not more than feet of animals. The barn cleanness qualified as good when there was no one of the above mentioned defects was observed. Ventilation was qualified as not adequate when there is bad smell or smell of ammonia or if there is suffocations, if there was no above suffocations then the ventilation qualified as adequate.

3.5. Data entry and analysis:

Microsoft excel computer program was used for data entry and SPSS (Statistical package for social science (2006) software version 16.0 was used for data analysis. Statistical methods like descriptive statistics (mean, standard deviation, percentage, cross tabulation frequency), correlation and ANOVA were used to summarize data. Levels of significance of variations in different measured variables were analyzed using one-way ANOVA and chi-square. Differences was considered significant for $P < 0.05$.

4. RESULTS

4.1. Socio- economic characteristics

Household heads' sex, age and educational statues in the study participants are shown in Table 3. The majority (62.2%) of the household heads were male and 37.8% were female. Female headed farms were more frequent in urban milk production system. The household heads' age was categorized as young (20.6 %), adult (47.8%) and old (31.6%). The average family size per household was 6.8 persons (6.87 persons in rural (mixed-crop livestock) production system and 6.74 in urban milk production). The highest number of children (<15 years of age) per household was found in urban milk production and the highest number of older persons (>55 years of age) was found in rural (mixed crop-livestock) production systems. The highest number of active working group category (15-55 years of age) was also found in rural (mixed crop-livestock) production system (Table 2).

Table 2: Family size and age group distribution of the study participant in study area

Production system	Age groups	<15	15-55	>55
Rural	N	111	116	116
	Mean	2.65	2.69	2.69
	SD	1.248	1.288	1.288
	Minimum	1	1	1
	Maximum	7	8	3
Urban	N	33	33	6
	Mean	2.76	2.48	1.50
	SD	.792	.712	.548
	Minimum	1	2	1
	Maximum	5	5	2
	Overall mean	2.67	2.64	1.53

N=number of smallholders SD=standard deviation

The educational status of household heads was divers. The majority of household heads (58.3%) were illiterate, and most of these were found in rural (mixed crop livestock) production system.

Table 3: Sex, age and educational level of household heads in study area

Variable		Rural		Urban		Overall	
		N	Percent	N	Percent	N	Percent
Sex		123		33		156	
	Male	81	65.9	16	48.5	97	62.2
	Female	42	34.1	17	51.5	59	37.8
Age category		123		33		156	
	Young	25	20.5	7	21.2	32	20.6
	Adult	56	45.9	18	54.5	74	47.7
	Old	41	33.6	8	24.2	49	31.6
Educational level		123		33		156	
	Illiterate	83	67.5	8	24.5	91	58.3
	Read and write	9	7.3	2	6.1	11	7.1
	Elementary	25	20.3	11	33.3	36	23.1
	High school	6	4.9	5	15.5	11	7.1
	Diploma and above	-	-	7	21.1	7	4.5

N=number of respondents, young=20-35 years of age, adult 36-55 years of age and old =greater than 55 years of age

4.1.1. Livestock holding

The livestock species kept in the study areas include cattle, sheep, goat and equine with mean number per household of 7.45, 6.9, 2.2 and 1.94, respectively. Cattle were the dominant livestock type in the study area. Mean milking cows' number was 4.26 of which cross breed cows represent only a very small mean 0.04 (1%) proportion (Table 4).

Table 4: Livestock composition in smallholder farms in study area

LVS	Rural					Urban					Overall				
	N	Mea n	Ma x	M in	SD	N	Mea n	Max	Mi n	SD	N	Mea n	Max	Mi n	SD
Cattle	123	7.97	22	1	4.4	33	5.52	11	2	2.1	156	7.45	22	1	3.9
Equine	72	1.97	8	1	1.3	11	1.73	3	1	.9	83	1.94	8	1	1.2
Sheep	114	6.9	20	1	4.4	-	-	-	-	-	114	6.9	20	1	4.4
Goat	43	2.2	6	1	1.5	-	-	-	-	-	43	2.2	6	1	1.5
CRP	-	-	-	-	-	3	1	1	1	.00	3	.01	1	1	.00
CRL	-	-	-	-	-	5	1	1	1	.00	5	.03	1	1	.00
LOP	71	1.32	3	1	.5	19	1.11	2	1	.3	90	1.28	3	1	.5
LOL	87	1.48	5	1	.76	29	1.76	3	1	.73	116	1.55	5	1	.7
LOD	85	1.41	3	1	.7	7	1.14	2	1	.3	92	1.39	3	1	.6

CRP=Cross pregnant, CRL= Cross lactating, LOP=Local pregnant, LOL=Local lactating, LOD=Local dry, Max=maximum, Min=minimum, SD= Standard deviation, N=number of respondents, LVS=Livestock

4.1.2. Purpose of keeping cattle

The primary purpose of keeping cattle in rural (mixed crop-livestock) production system was to provide oxen for draft power (rank 1) followed by production of milk for family consumption (rank 2), reproduction (rank 3) and social prestige (rank 4). But in urban milk producers, the primary objective was for milk production (for sell), reproduction, meat and social prestige, (Table 5).

Table 5: Purpose of keeping Cattle in urban and mixed-crop livestock system in study area

Objective	Rural			Urban			Overall		
	N	Mean	Rank	N	Mean	Rank	N	Mean	Rank
Meat	123	4.89	5	33	3.18	3	156	4.53	4
Milk	123	2.41	2	33	1.06	1	156	2.13	2
Traction	123	1.29	1	33	4.82	5	156	2.04	1
Social prestige	123	4.67	4	33	4.52	4	156	4.64	5
Ceremonies	123	5.94	6	33	5.94	6	156	5.94	6
Reproduction	123	4.57	3	33	2.33	2	156	4.10	3
Hide	123	6.19	8	33	6.67	7	156	6.29	7
Manure	123	6.09	7	33	7.48	8	156	6.38	8

The lowest mean indicates the most important purpose and the largest mean indicates the least important purpose respectively, Rank 1 = most important purpose, Rank 8 = least important purpose.

4.1.3. Trends in breeding female cattle number

Respondents indicated that the number of breeding female cattle during the past five years, showed an increase (66%), decrease (32.1%) and no change (1.9%). The increase was said to be due to reproduction (62.1%) and purchase (37.9%) while for the smallholders with decreased herd size, death (50%), shortage of grazing land (24%) and financial requirement were mentioned as reasons (Table 6).

Table 6: Trends in breeding female cattle number in the past five years in smallholder farms in study area

Trends in female cattle number		Rural		Urban		Total	
		N	Percent	N	Percent	N	Percent
	Increase	76	61.8	27	81.8	103	66
	Decrease	45	36.6	5	15.2	50	32.1
	No change	2	1.6	1	3.0	3	1.9
Reason of Inc.	Purchased	26	34.3	13	48.1	39	37.9
	Reproduction	50	65.7	14	51.9	64	62.1
Reason of Dec.	Death	23	51.1	2	40	25	50
	Finical requirement	8	17.8	1	20	9	18
	Shortage of grazing land	10	22.2	2	40	12	24
	Shortage of labour	4	8.9	-	-	4	8
	Reproduction	-	-	1	100	1	100

N=number of respondents, Inc. =increase, Dec. =decrease

4.1.4. Off-farm activity

The smallholders were not only involved in livestock and crop production but also in off-farm activities in order to supplement their income. Accordingly 36.4% of the respondents participated in off-farm activity such as civil servant (10.8%), hotel and café (14.8%), religious leader (11.3%), carpenter (12.9%), broker (1.6%), local and cultural beverage “teji,

tela and borde” production (10%) trade (38.6%). From this study, men (65 %) were predominantly involved in off-farm activities followed by women (31.3%), and youth (4.9%). Boutique traders and civil servants were dominantly found in Oda Kebele (urban production system). Rural traders were more of engaged beef cattle and small ruminants marketing.

4.1.5. Land holding

The average land holding per household was 2.12 hectares of which 1.42 hectare (67%) was allotted for crop production (Table 7). The remaining land was used for pasture, coffee and “Inset” production. Land partition for different activities was closely related family size and number of animal the household owned (Figure.2and 3).

Table 7: Land division in study area

Land size		N	Mean(ha)± SD	P- value
Crop	Rural	122	1.43±0.86	0.024
	Urban	2	.03±0.00	
	Total	124	1.41±0.87	
Inset	Rural	110	.280±0.18	0.002
	Urban	18	.125±0.13	
	Total	128	.258±0.18	
Pasture	Rural	98	.294±0.19	0.897
	Urban	33	.299±0.23	
	Total	131	.295±0.20	
Coffee	Rural	42	.178±0.14	0.166
	Urban	3	.062±0.15	
	Total	45	.170±0.13	

N=number of respondents, Max=maximum, Mini =minimum, SD=Standard deviation

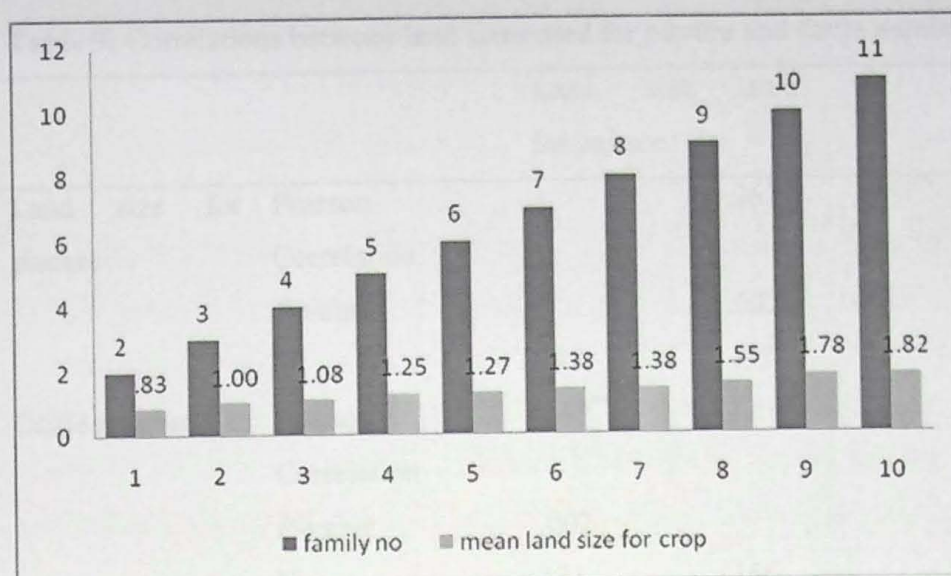


Figure 2: Family number and mean land size used for crop production in ha

Table 8: Correlations between family size and land allotted for crop production

		Family size	land size for crop
Family size	Pearson	1	.198*
	Correlation		
	p-value		.027
	N	156	124
land size for crop	Pearson	.198*	1
	Correlation		
	p-value	.027	
	N	124	124

*. Correlation is significant at the 0.05 level

Table 9: Correlations between land sizes used for pasture and cattle number

		Land size for pasture	Cattle
Land size for pasture	Pearson	1	.267**
	Correlation		
	P-value		.002
Cattle number	N	131	131
	Pearson	.267**	1
	Correlation		
	P-value	.002	
	N	131	156

** . Correlation is significant at the 0.01 level.

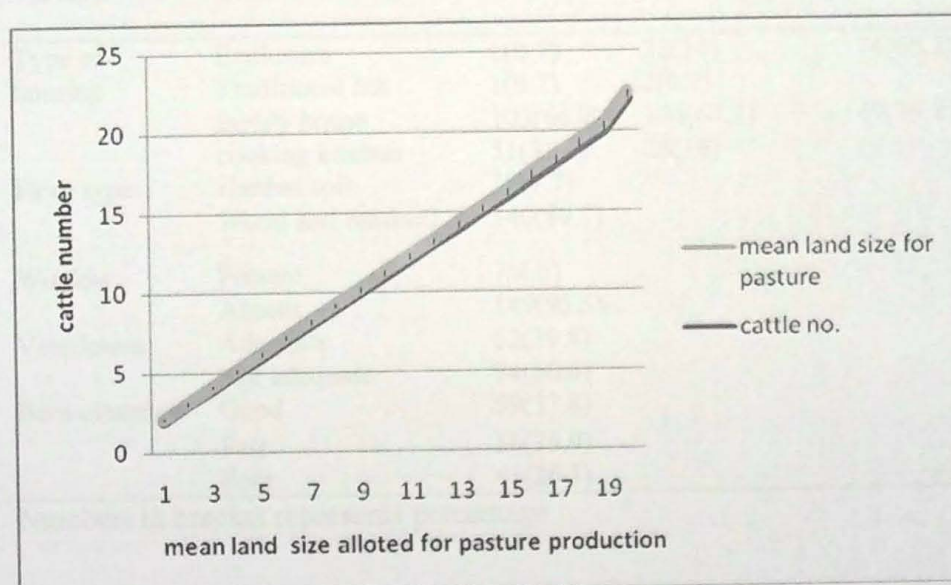


Figure 3: cattle number and mean land size for pasture

4.2. Husbandry practices

4.2.1. Housing practices

The main objective of housing cattle in this study area was to protect them from cold stress, natural enemies (hyena and lion) and theft at night. During day time cattle were/are not housed unless cattle themselves search natural shed. But only pregnant cows were housed during extreme environmental condition of day time. The main housing systems observed were enclosure, traditional hut, sharing family house and in kitchen. Cows and heifers (67.3%) and calves (66.9%) were housed most of the time in family house (Table 10).

Table 10: Housing conditions of cattle in study areas.

Variable		Calves	Cow and heifer	Bull and oxen
Type of housing	Enclosure	1(0.7)	22(14)	74(60.2)
	Traditional hut	1(0.7)	2(0.7)	
	family house	103(66.9)	104(67.3)	49(39.8)
	cooking kitchen	51(31.8)	28(18)	
Floor type	Harden soil	12(7.7)		
	Wood and hardsoil	140(89.7)		
Window	Present	7(4.5)		
	Absent	149(95.5)		
Ventilation	Adequate	62(39.4)		
	Not adequate	94(60.6)		
Barn cleanness	Good	59(37.8)		
	Fair	56(35.9)		
	Poor	41(26.3)		

Numbers in bracket represents percentage

4.2.2. Feeding practices

The smallholder farmers indicated that the common feeding practice was tethered grazing and herded grazing. Grazing lands, in most cases (71.2% of the smallholders) uses area of individual owned. The rest use a combination of individual owned and rented (10.3%) and only rented (18.6%) grazing lands. Farmers reported that more pasture and grazing lands are being cropped leaving unproductive marginal and waterlogged areas for grazing. Cows were

supplemented with potage (“genfo”) prepared from mixture of left over from grain milling and residue of “kocho”, kitchen leftover, by-products of local beverage (‘borde, tella and areke”). Although smallholders produce large volume of crop residues from cereal grain (teffe, wheat, barley, maize and sorghum) production, experience of feeding crop residues to animals in general and to cattle in particular is almost inexistent in the area. From the smallholders who participated in the present study 79% were also producing crops but the ones who supplementing their cattle with crop residues were only 13.7% (Table 11).

Table 11: Smallholders engaged in cereal crop production and their experience in using crop residues for cattle feeding in study area

Variable		N	Percentage
Crop production	Yes	124	79
	No	33	21
Use of crop residue for animal feed	Yes	17	13.7
	No	107	86.3
Reasons for not using crop residue	Lack of awareness	79	74
	Alternative use	2	2
	Refusal of animal	26	24
Use of urea treatment	Yes		
	No	17	100

4.2 3. Watering and source of water

Source of water for cattle were river, dams and pipe water. The majority (67.3%) of smallholders used water from river for their cattle, while 24.4% from dams, 8.3% from pipe. Frequency of watering varied with season (Table 12).

Table 12: Source of water and the practice of watering cattle in study area

Variable		n	Percentage
Source of water	River	105	67.3
	Pipe	13	8.3
	Dams	38	24.4
Frequency of watering in dry season	Once per day	1	0.6
	Twice per day	110	70.5
	Three times per day	42	26.6
	Free access	3	1.9
Frequency of watering in wet season	Once per day	82	52.6
	Twice per day	2	1.3
	Three times per day	1	0.6
	Not watered at all	71	45.5

4.2.4. Health care

Access to modern cattle health services was significantly ($p < 0.05$) different between rural (mixed crop-livestock) and urban smallholders (Table 13). Most smallholders rely on traditional healers or on their own skill to treat their sick cattle. Table 14, illustrates some of the traditional treatment interventions for different disease conditions.

Table 13: Access to modern cattle health services in study area

Variable			Local name	Rural N=123	Urban N=33	Total N=156
Frequently encountered disease	Anthrax	Duficho		27(22)	4(12)	31(19.9)
	Black leg	Googgishoo		27(22)	2(6.1)	29(19.6)
	Ecto parasite	Qaaphoo		10(8.1)	4(12.2)	14(9)
	Cough	Oshiyo		2(1.6)	7(21.2)	9(5.8)
	Bloat	Maacee nafoo		10(8.1)	1(3)	11(7.1)
	Teat problem	Xachi doomo		6(4.9)	5(15.2)	11(7.1)
Other health problems	Emaciation	Daloo		25(20.3)	5(15.2)	30(19.2)
	Diarrhea	Goocibeet biiyo		16(13)	5(15)	21(13.5)
Source of treatment	Animal health clinic			37(30.08)	30(90.9)	67(43)
	Traditional			52(42.3)	1(3.03)	53(34)
	Not treated			36(29.3)	2(6.06)	37(23)

Table 14: Traditional practices of cattle health care in study area

Disease	Traditionally practiced animal health interventions
External parasite lice and mange	Washing by soured whey and residue of 'kocho' (eekko)
Tick	Picking up the tick and smash with ash
Diarrhea	Feeding dried bred prepared from flour of sorghum, grind clay pot and salt
Cough	Provision of forest birds' egg (akkee gabexoo)
Black leg	Opening the infected area
Bloat	Provision of 'areke' and boiled coffee

4.2.5. Breeding practice

The vast majority (99%) of milk cow found in the study district were indigenous zebu breed ; the only few (1%) were crossbred cows and owned by the urban smallholders. Natural mating is the most common means of breeding cows using local bulls (85.3%) and cross bred bull (6.5%). AI service is very limited (8.3%). The source of bull for mating purpose in rural smallholders were 69% from village and 31% from their own farm, while almost all (99%) of urban smallholders were using bull from rural farmers. Most majority (99.5%) of rural smallholders castrate male cattle at an average age of 5.7 years using local techniques (stone), but none of urban smallholders practices castrating male cattle rather they sell at younger age (after weaning).

4.2.6. Calf rearing

Suckling is the most common calf feeding method. In local breeds depending on the sex of neonates, for up to one month and above month period after calving, the cow is not milked and the whole milk is left for calf suckling. While in cross breeds, for up to four days period after calving, the cow is not milked and the whole milk is left for calf suckling and some milked for cat or stripping to the ground when the calf cannot finished. Male calves were allowed to suckle the whole of their dams' milk for a relatively longer period (more than a month) than female calves (less than a month) (Table 15). Bucket feeding is very rare. Respondents indicated that weaning of calf was easier practice, because the dam herself

ignores the calf when she attempts to stop milk production. Thus, weaning is duty of dam rather than deliberate human action

Table 15: Calf rearing methods in study area

Variable		Cross N	Percent	Local N	Percent
Period of calves suckle	Until cow dry off	8	100	156	100
Period grass feeding	After month	3	37.5	129	82.7
	After two month	5	62.5	27	17.3
Frequency of suckling	Once	7	87.5	5	3.2
	Twice	1	12.5	50	32.03
	Three times	-	-	99	63.4
	Not separated	-	-	2	1.3

Table 16: Calf rearing method with respect to sex in study area

Variable			rural	Urban	Total
Period of starting milking when the neonate is male	30 to 40 days	N	92	-	92
		Percent	74.8	.-	59
	15 to 20 days	N	9	31	40
		Percent	7.3	93.9	25.6
	not separated	N	22	2	24
		Percent	17.9	6.1	15.4
Period of starting milking when the neonate is female	30 to 40 days	N	11	2	13
		Percent	8.9	6.1	8.3
	15 to 20 days	N	85	31	116
		Percent	69.1	93.9	74.4
	not separated	N	27	-	27
		Percent	22	-	17.3

N= number of respondents

4.2.7. Waste management

Dung removed from cattle houses were not put in use in most cases. Only 27% of the smallholders reported using of dung as fertilizer and only 3.2% use as energy source by making dung cake. The remaining large majority (96.8%) indicated that they were not using it due to lack of awareness (66.9%) (Table 17).

Table 17: Waste management practice of smallholders in the study area

Variable		N	Percent
Use of dung as source of fuel	Yes	5	3.2
	No	151	96.8
Reason not to use	Lack of awareness	101	66.9
	Alternative use	47	31.1
	no fuel problem	3	2
Use of dung	Fertilizer	41	27.2
	House decoration	6	4
	“Akembalo”	3	2
	Nothing	101	66.9

N =number of respondents

4.2.8. Culling practice

The majority (36.6%) of rural smallholders cull their milk cows due to disease condition and old age (24.4%), while the majority (39.4%) of urban milk producers were cull their milk cows due to low productivity followed by old age (18.2%). Both urban and rural milk producers taken together, disease condition was the first cause of culling (31.4%) followed by old age (23.1%), low productivity (17.3%) (Table 18). The other culling reasons include financial requirement, temperament and feed shortage. About 90% of the smallholders produce replacement stock from their own farm while the rest purchased from open market based on body conformation, presence of lower fore teeth for effective grazing, docile nature while palpating teat and udder and free from any visible injury.

Table 18: Reason of culling milk cow in study area

Reason of culling		Rural N=123	Urban N=33	Total N=156
low productivity	N	14	13	27
	Percent	11.4	39.4	17.3
disease condition	N	45	4	49
	Percent	36.6	12.1	31.4
financial requirement	N	19	5	24
	Percent	15.4	15.2	15.4
Aggressiveness	N	13	2	15
	Percent	10.6	6.1	9.6
feed shortage	N	2	3	5
	Percent	1.6	9.1	3.2
Old age	N	30	6	36
	Percent	24.4	18.2	23.1

N=number of respondents

4.2.9. Labour distribution in cattle husbandry

Barn cleaning, feeding, milking, milk processing and selling of dairy products were activities mostly done by women. Men's jobs were more or less limited to selling and buying of animals and breeding (matting) activities. There were also some differences between urban and rural households in labour distribution among family members. Women of urban household appeared to have relatively less work load than those of the rural households (Table 19).

Table 19: Division of labour among family members in cattle husbandry in the study areas

Activity	Rural (n=123)				Urban (n=33)				Overall (n=156)			
	Men	Women	Son	Daughter	Men	Women	Son	Daughter	Men	Women	Son	Daughter
BAC	6.5	69.1	9	15.4	24.2	36.4	24	15.2	10.3	62.2	12	15.4
SB	65.5	27.6	4.9	2.4	54.5	30.3	15.2	-	62.8	28.2	7	1.9
Feeding	17.1	62.6	13	7.3	24.2	42.4	12.1	21.2	18.6	58.3	13	10.3
Herding	19.5	17.9	55.3	7.3	9.1	21.2	63.6	6.1	17.2	18.6	57	7.1
Watering	18.7	30.1	45.5	5.7	9.1	33.3	48.5	5.7	216.7	30.8	46	6.4
Mating	59.3	1.6	38.2	0.8	45.5	-	54.5	-	56.4	1.3	42	0.6
Milking	4.1	76.4	7.3	12.2	24.2	54.5	6.1	15.2	8.3	71.8	7.1	12.8
Processing	-	64.2	4.9	30.9	-	60	6.7	33.3	-	64.7	3.8	31.5
SDP	1.6	82.1	3.3	13	3	48.5	21.2	27.3	1.9	75	7.1	16

SDP=Sell of dairy products, SB=Selling and buying of cattle, BAC=Barn cleaning,

4.2.10. Extension service on dairy farming

Only 25% of the smallholders said that they had got some advice from extension agents on improved dairy farming. Nearly half of the smallholders (45%) were operating their farms based on their own experiences only, some 5% benefitted from radio transmitted messages and the rest (25%) from parents and other relatives experiences. Only 5.8% the small holders took some sort of training at Woreda level (two days training) on improved dairy farming and milk handling (Table 20).

Table 20: Extension service on improved dairy farming in study area

Variable	N	Percent
Development agent	39	25
Own experience	70	45
Radio	8	5
Family experience	39	25
Training situations		
Trained	9	5.8
Not trained	147	94.2

N= number of respondent

4.3. Milk production

In Telo district cows are the only source of milk for human consumption and milk from small ruminants was not consumed due to cultural taboo. Table 21 illustrates the daily milk yield and lactation length of local and crossbred cows. Ninety nine percent of the total volume of milk produced is obtained from local cows and one percent from cross bred cows (Holstein Fresian x Zebu).

The average milk yield of local cows per day reported by the respondents was 2.08, 1.329 and 0.81 liters for the early, mid and late lactations, respectively with an overall average of 1.4 liters per day. The average daily milk yield of crossbred cows reported was 9.75, 7.88 and 6 liters for the early, mid and late lactations, respectively with an overall average of 7.28 liters per day. Average lactation length of local and cross breed cow in study area was 8.47 and 9.92 months, respectively.

Table 21: Average milk yield and lactation length of cross and local breed cows as reported by smallholders in study area

Variable		Cross cows stage of lactation				Local cows stage of lactation			
		Early	Mid	Late	LL	Early	Mid	Late	LL
Rural	Mean	-	-	-	-	1.96	1.238	0.76	8.37
	N	-	-	-	-	123	123	123	123
	Max	-	-	-	-	3	2	2	24
	Mini	-	-	-	-	1	0.5	0	6
	SE	-	-	-	-	0.45	0.406	0.032	.207
Urban	Mean	9.75	7.88	6	9.75	2.52	1.667	1.02	8.85
	N	8	8	8	8	33	33	33	33
	Max	13	10	8	12	4	3	2	12
	Mini	6	4	2	8	2	0.5	0	4
	SE	0.75	0.71	0.732	0.526	0.103	0.0833	0.067	0.446
Total	Mean	9.75	7.88	6	9.75	2.08	1.329	0.81	8.47
	N	8	8	8	8	156	156	156	156
	Max	13	10	8	12	4	3	2	24
	Mini	6	4	2	8	1	0.5	0	4
	SE	0.75	0.718	0.732	0.526	0.045	0.390	0.030	0.188

Max=maximum, mini =minimum, SE=standard error, n=number of respondents

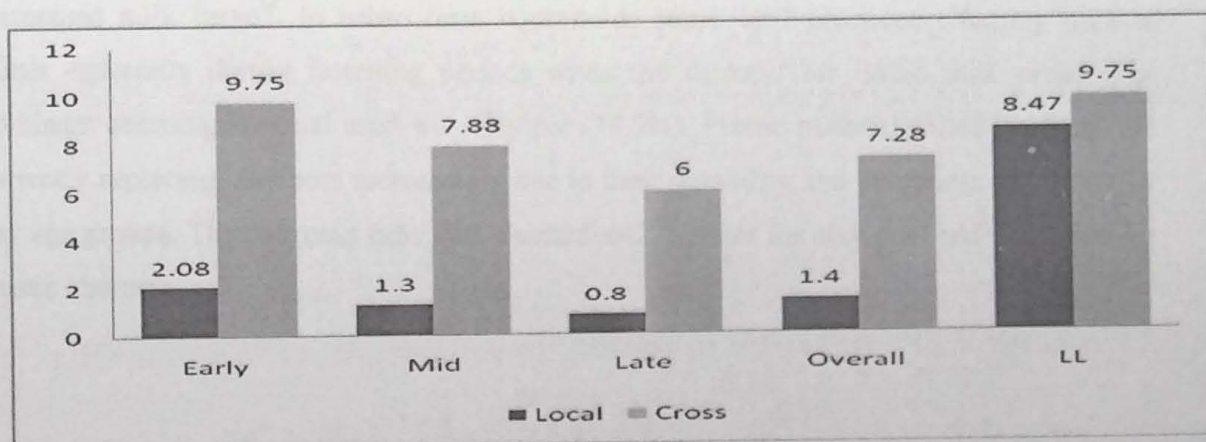


Figure 4: estimated average daily milk yield in liters and lactation length (month) of local and cross breed cow in study area

4.3.1. Milking and milk handling

In both urban and rural (mixed crop-livestock) production system frequency of milking was twice per day (morning and evening). There was no practice of milking in cases of stillbirth or death of calves. Calves were allowed to suckle prior to milking. All milk producers in the study area wash their hand before milking. Some 15% of the urban smallholders even wash udder and teat before milking. The milking utensils, commonly used in both production systems, were plastic materials. Nearly half (45%) of the respondents indicated that they washed milking utensil both before and after milking. The rest washed once per day (32.5%), once in two days (12.5%) or once in three days (10%). The utensils were washed by using boiled plants like basil “besobla”, “koseret” “tejisar” and leaves of “tikur enchet”. The large majority (95.5%) of urban and nearly half (46%) of the rural smallholders filter milk to separate some impurities by using pieces of pores cloths (urban milk producers) and plant fibers “Kancha” (rural milk producers).

4.3.2. Milk processing

The majority (93.7%) of rural (mixed crop-livestock) production system households process milk to butter. Only few (6.3%) households do not convert milk to butter but consume it as fermented milk “ergo”. In urban farm households some 40% practiced churning milk to butter especially during fastening periods when the demand for liquid milk drops. The dominant churning material used was clay pot (78.5%). Plastic material called “jerikan” are currently replacing clay pots increasingly due to their durability and handiness to operate by any age groups. The churning time was claimed as 2-2:30hrs for clay pots and 1-1:30hrs for plastic churners.

4.3.3. Milk use categories and marketing features

Table 22 shows that milk use categories varied between urban and rural milk producers. The overall indicated percentage of milk sold in the current study area was 19.2%. Fresh milk marketing was informal and only practiced in urban milk production system. The milk marketing outlets were mostly (70 %) neighborhoods and rarely (30%) café with modes of payment at monthly bases (locally they call it contract) and pre payed with price per liter ranging from five to ten (5-10) ETB. The rural (mixed crop-livestock) producers don't sell milk due to lack of market access 77 (62.6%), low productivity 17 (13.8%) and cultural taboo 29 (23.6%). The rural milk producers sell butter and cottage cheese twice per week on Thursday and Sunday which are large local marketing days and there was no fixed price for butter and cottage cheese supplied by farmers. But the traders supplying only butter and sells one kg of butter one hundred fifty to two hundred (150-200) ETB. Selling of cheese by measuring was not common in the district. The consumers buy in an agreement.

Table 22: Milk marketing attribute in study area

Variable		Rural N	Percent	Urban N	Percent	Total N	Percent
Selling milk	Yes	-	-	30	90.9	30	19.2
	No	123	100	3	9.1	126	80.8
Buyers of milk	Café	-	-	9	30	9	30
	Neighbor	-	-	21	70	21	70
Price/lit ETB	5-8	-	-	17	56.7	17	56.7
	8-10	-	-	13	43.3	13	43.3
Reason to not Selling milk	Low productivity	17	13.8	3	100	20	15.9
	Lack of market accesses	77	62.6	-	-	77	61.1
	Culture	29	23.6	-	-	29	23

Total milk produced per lactation was significantly ($p < 0.005$) high in urban milk production system than in rural (mixed crop-livestock) production system. The largest proportion (322.6±16.8) of raw milk produced in rural farm households was processed, while in urban farm households the largest (508.4±119) proportion was sold (Table 23).

Table 23: Milk use pattern in study area

Variable		N	Mean± SE	P-value
Total milk produced per LL	Rural	123	387.42±32.072	0.001
	urban	33	999.55±182.728	
	Total	156	516.90±49.998	
consumed at home	Rural	28	159.43±24.016	0.04
	Urban	32	186.34±29.928	
	Total	60	173.78±19.422	
Sold	Rural	-	-	-
	Urban	30	508.43±119.047	
	Total	30	508.43±119.047	
Processed	Rural	123	322.66±16.863	0.23
	Urban	33	359.18±75.410	
	Total	154	330.48±20.774	

LL=lactation length, SE =standard error

4.4. Major constraints of milk production

The major constraints hindering milk production that were cited and ranked by the respondents from rural (mixed-crop livestock) production system in decreasing order of importance were shortage of grazing land, disease, low production performance of indigenous cows and lack of market access. Urban smallholders mentioned more frequently feed related problems that include shortage of grazing land, seasonality in the availability of the traditional brewery by-product “Atela” and lack of agro industrial byproducts. During our survey study we also witnessed that the local beverage especially “tella” was not regularly prepared during summer due to less demand by customers in that period.

4.4.1. Shortage of grazing land

In rural (mixed crop-livestock) production system the available family land is portioned into different agriculture activities that include crop production, coffee, “Inset” (*Ensete ventricosum*) and natural pasture, with the largest proportion of land assigned for crop production. Grazing land (feed) shortage is particularly acute from October-December and

June. Urban milk producers also faced similar problems of grazing land except those rented grazing land from organization owning land in the area.

Table 24: Summary of milk production constraints cited and ranked by smallholders

Constraints	Rural			Urban			Overall		
	N	Mean	Rank	N	Mean	Rank	N	Mean	Rank
Shortage of grazing L.	123	2.33	1	33	1.33	1	156	2.12	1
Health problem	123	2.80	2	33	3.79	4	156	3.01	2
Low productivity	123	2.83	3	33	3.73	3	156	3.02	3
Lack of market access	123	4.45	4	33	5.64	6	156	4.70	4
Water scarcity	123	4.76	5	33	5.82	7	156	4.99	6
Feed shortage	123	5.26	6	33	2.76	2	156	4.75	5
Labour shortage	123	5.60	7	33	5.06	5	156	5.48	7

The lowest mean indicates the most important constraint and the largest mean indicates the least important constraints respectively, L=land, Rank 1 = most important problem, Rank 7 = least important problem, N=number of respondents

4.4.2. Disease outbreak

Infectious and parasitic diseases encountered in the study area as reported by the veterinary technician working in the area were anthrax, black leg, pneumonia, diarrheal diseases, external and internal parasites, babesiosis and bloating. Both rural and urban smallholders ranked health problems as second most important constraint, next to grazing land shortage. The severity of the disease problem was said to be partly associated to shortage of drugs in the Woreda animal health clinic, irregularity of vaccination programs and absence of laboratory equipments and chemical reagent.

4.4.3. Low production performance of indigenous cows

Almost all (99%) cows found in the study area were/are indigenous low producing cows. The problem was indicated by the smallholders as well as animal production and health technicians in the current study area. Due to poor infrastructure development in the area,

farmers were/are not benefiting from dairy technologies like AI that could help to improve productivity. In the extension service of the government also livestock were/are not given equal emphasis as to the crop sector.

4.4.4. Lack of market access

Remoteness to the town and lack of road access to the town or milk demand place was indicated as the bottleneck of rural smallholder milk producers. Thus, rural smallholders have the only chance to convert milk in to butter and cottage cheese in order to sell with non fixed price. Majority (76 %) of rural smallholder milk producers reported as although they have no chance to sell butter and cheese during heavy rain season (July and August) due to land slide and over filling nature of the river what they across to the market.

4.4.5. Feed shortage

Urban smallholder milk producers mentioned feed shortage as their second most important constraint that hinders milk production next to shortage of grazing land. Majority (94%) of urban smallholder milk producers indicated that the seasonality of local beverage especially, “tella“ production and the total absence of agro-industrial by products were the major problem associated with feed shortage. During summer animals only depended on grazing land.

5. DISCUSSIONS

5.1. Socio-economic characteristics of households

The average family size of 6.8 persons per household in the study area is comparable with what was reported by Adebabay (2009) (6.22 person) for Bure district. Slightly lower and higher family sizes were reported by other authors for different areas. Tesfaye (2007) for Mettema area 5.7 persons and Assaminew (2007) 7.7 person for Bahr-Dar zuria and Mecha Woreda. This shows the availability of family labour for cattle (dairy) production in the present study area. In this study, the active working group accounts the highest category of the household heads, thus, this has positive impact to undertake agriculture activities.

The educational level of smallholders with the highest percentage of illiterate in rural (mixed crop-livestock) systems than urban dwellers was most likely due to less accessibility to schooling in rural areas. In this study about 58.3% of the smallholders were illiterate and this might have negative impact on technology adoption for improved dairy farming. The proportion of illiterate respondent is much higher than what was reported by Adebabay (2009) 31.5% for Bure district. The role of education is obvious in affecting household income, adopting technologies, demography, health and as a whole the socio-economic status of the family as well (Kerealem, 2005). The positive correlation obtained in the present study between level of education and ownership of crossbred cattle also supports the notion that education is the key to facilitate the degree of adoption of improved livestock production technologies (annex 2, Table 4). Education is an important entry point for empowerment of rural communities and an instrument to sustain development. In this context, educational level of the farming households may have significant importance in identifying and determining the type of development and extension service approaches.

The average land holding of the respondent in the study area was 2.12 hectare per household with highest (1.4 ha) portion allocated to crop production followed by pasture (0.295 ha) and

the least proportion (0.1785 ha) was allocated to coffee production. This average land holding pattern of household was lower than the national land holding size of 2.5 hectare. This has negative implications on household income and livestock production. This study also revealed that the average land allocated for improved forage production was absent which notifies further works in creating awareness in forage and pasture development in the district. The average land size used as pasture in the study area is much lower than what was reported by Kelay (2002).

The average cattle number per household in the study area was 7.45 with minimum and maximum number of 1 and 22, respectively. The higher numbers of cattle were found in rural (mixed crop-livestock) systems, this might be due to land availability and the need for oxen (for traction) in rural (mixed crop-livestock) production systems. As the result showed land size for crop and family number per household has positive correlation with Pearson correlation coefficient of 0.28 and p -value 0.027, the same result was found for cattle number and land size for pasture or grazing land fig.2 and 3, this implicates that as human population increases crop cultivation also increase and as result, grazing land will be decreased, as cattle number increases there will be competition for grazing land and in over grazing and finally decreases the maintenance and productivity of animals. This result is in line with the findings of Agajie *et al* (2002) who reported the significant and positive correlations between family number and farm size and the requirement of land size for grazing as cattle number increases. Respondents indicated that the primary objective of cattle keeping in rural (mixed crop-livestock production) systems were for traction followed by milk production for home or family consumption. But in urban livestock production, the primary objectives of cattle keeping were for milk production. This result agreed with the reports of Adebabay (2009) for Bure district; Sintayehu *et al* (2008) Awassa, Shashemene and Dilla and Belete (2006) for Fogera district who reported the primary objectives of cattle keeping in highlands of Ethiopia were for production of oxen for traction.

5.2. Husbandry practices

The housing system between urban and rural milk production system was significantly different. Ninety eight percent of urban milk producers housed calves, heifer and cow in cooking kitchen, while majority of rural milk producers housed calves, heifer and cow in family house. This finding is disagreed with the findings of Dessalegn (2009) for Northern Tigray who reported all cattle were housed in roofless fenced enclosure except calves which were housed in family house. Sharing family house for animals without partitioning into different class may be doubtful of animal and human health and needs consideration and attention of zoonotic disease

The source of feed for cattle as well as for cows was not significantly different between rural and urban production systems (Annex 2 Table 6), the main source of feed were grazing on natural pasture and after math grazing with tethered and herded grazing system and very rarely crop residues. This finding is in line with the report of Adebabay (2009), Assaminew (2007) and Seyoum *et al.* (2007) who indicated that the major basal feed resources for cattle in Bure, Bahir Dar and Mecha districts and the highlands of Ethiopia, respectively, are natural pasture, crop residue and stubble grazing. But disagreed with the findings of Daniel (1987); Dessalegn (2009); Mekonnen *et al* (2012) who reported crop residues particularly cereal straws are the major livestock feed resources particularly in the dry seasons, providing 40-50% of the total annual livestock feed in Ethiopian highlands. This might be due to less attention and emphasis given by the extension workers (animal nutrition experts) towards the effective utilization pattern of resources in ones hand and this needs quick action to be taken to cope up the feed shortage problems of farmers in the district.

In this study area, the source of labour for cattle production was only from family member. The labour distribution among family member showed that there was significant difference between urban and rural milk production systems. In urban milk production (24.2%) of men participated in barn cleaning, but in rural milk production only 6.5% of men participated in barn cleaning. In general milking, barn cleaning, processing and feeding supplemental feed

was primarily undertaken by women followed by daughters. This finding is agreed with the finding of Kediya (2008) who found in Meiso district that milking is primarily undertaken by women. But in contrast to the findings of Adebabay (2009) who found that milking is primarily undertaken by men in Bure district. Sale of live (62.5%) cattle and breeding decisions are undertaken mostly by men (men and son). This result showed that women have no equal participation and involvement in the decision making of household affairs i.e. decisions are made solely by male. Therefore, this result indicated, the necessity of gender education in the district so that women can be empowered in every social, economic, cultural and political context.

The calf rearing and husbandry practices observed in the current study area showed that there was great variation among two sex (male and female neonates and between urban and rural milk producers. The rural milk producers allowed their male neonates to suckle relatively longer period than the female neonates, this might be due to the need of male calves to be strong for future traction. But no significant difference between sex of neonates in urban (the majority starts milking before month after calving for both sex).

As this result showed the dung removed from cattle house was not put in use. This finding is disagreed with most of findings so far reported in most highlands of Ethiopia. Some of these are Zewdu (2004) who reported cattle manure provides an important fraction of domestic fuel needs in areas with limited fuel-wood supplies. Manure sales make significant contributions to cash incomes, Belete (2006), who reported the majority (98.1%) of households use the dung as source of fuel and the rest (1.9%) use it as fertilizer this also needs quick attention and action to be taken in order to minimize deforestation and desertification of our green country due to fuel wood necessity in the district.

5.3. Milk production and utilization

In this study, the overall mean daily milk yield of local and cross breed cows were 1.4 and 7.28 liters per days, respectively. This result is lower than the report of Adebabay (2009) for both categories. As per Adebabay report milk yield of local and crossbred cows were 1.82 and 8.25 liter respectively. On the other hand, the report of Assamenew (2007) for Mecha and Bahir Dar Zuria Districts (1.2 liter for local and 5.2 liters for crossbred cows) was lower than our findings. The average milk yield of local cows in rural (mixed crop-livestock production) systems was significantly lower than that of urban local cows. This might be due to feed supplementation to cows in urban milk production systems. The overall mean lactation length of local and cross bred cow in the current study was 8.47 month (254 days) and 9.75 month (292.5 days) respectively. The estimated lactation length of cross bred cow was comparable to the ideal lactation length of 305 days as defined by Foley *et al.* (1972).

Milk use pattern in the study area showed that the majority of milk producers did not consume fresh milk; the primary consumers of fresh milk in the study area were children below two years of age, old men and some vulnerable groups of women. This result is in agreement with the findings of Assaminew (2007) in Bahir Dar zuria and Mecha district, who reported among family members, children (less than one years of age) have the privilege to drink whole milk. The overall percentage of milk sold in the study area was 19.2%. This finding is lower than the total percentage of milk sold for urban 47% by Yitaye, *et al* (2009). The milk marketing system reported in this study district was informal with price differences for two main outlets (neighborhood and café with mode of payment contract and prepaid. This result in line with the findings of Tsehay (2002) who reported that buying and selling prices of milk and milk products have seasonal variations and have no fixed price as such. As this result indicated the peak price of milk (ten) ETB per liter indicated that there is high demand and low supply of milk in the area. The largest proportion of milk produced in rural (mixed crop-livestock) production system was processed, but in urban milk production system the largest proportion was sold. This might be due to the market access (due to lack of

6. CONCLUSION AND RECOMMENDATIONS

Based on data and information collected in this study, it can be concluded that husbandry practices in general and resource utilization or circulation between two (crop and livestock) sectors in particular were under developing (poor). Milk production systems are characterized by subsistence or hand to mouth milk production and interwoven by many constraints. Dairy technologies like improved breeds, health care, improved forage production, access to market, access to extension service (information on husbandry practices), etc., are not available or accessible for smallholders of the district. Based on the above findings the following points are recommended:

- Support and training in fodder production and managing and utilization of available feed resources in farmers hand will have considerable help to improve the dairy sector.
- Smallholders should be provided/supported with production inputs and extension service in modern dairy farming that include health care, improved genetic materials, credit facility and improved husbandry practices.
- Quite large number of smallholders have long years of traditional experience in animal production. Thus, trainings support to smallholders in modern dairy farming will help to improve their productivity and product quality.
- Establishing market access will fill the gap between demand and supply of milk.
- Further studies should assess the nutritional values of various locally available animal feed resources for feeding dairy cows, so that tailored solutions could be provided.

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8. ANNEXES.

Annex 1: SURVEY QUESTIONNAIRE FORMAT

Kebele ----- Name of respondent-----

I. Socio-economic Characteristics of the respondent

Household head sex 1/ Male 2/ Female

Age of Household head -----

Family Size with age group

Age group in years	Number
<15	
15-55	
>55	

Educational backgrounds of respondent 1 illiterate 2 read and write 3 elementary 4/ high schools 5 diploma & above.

Herd structure and composition

	Exotic	Cross	Local	Total number
Pregnant cow				
Lactating cow				
Dry cow not p				
Oxen				
Heifer				
Bull				
Male calves				
Female calves				
Horse				
Donkey				
Sheep				
Goat				
Mule				

Trend in the number of female animals for past five years 1/ Increase 2/ Decrease

3/. No change

Explain the reasons for the livestock number if the number is increase or decrease.

Increase _____

Decrease _____

How much land do you have under control in hectares?

	Owned	Rented	Total
Area under crops			
Area under inset			
Area under pasture			
Area under coffee			
Improved forage			

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

Activity	Husband	Wife	Son	Daughter
Sell of animal				
Cleaning of barn				
Sell of dairy products				
Feeding animal				
Watering animal				
Mating				
Milking				
Processing				

What kind of agricultural activities are you undertaking 1/ Crop and livestock 2/ only livestock production 3/ Only Crop Production?

Which agricultural activity contributes most of family income? 1/crop 2/livestock

Do you learn about new livestock husbandry practice from:-

Publication	1/ Yes	2/No
Talking to neighbors	1/ Yes	2/No
Extension agents	1/ Yes	2/No
Field day (Farmers)	1/ Yes	2/No

The concern of training you trained 1/ managing milk cows 2/ improving milk cow breed 3 / use of improved forage 4 / conservation and treating agricultural crop residues

Did you get information on improved ways dairy farming? 1/ Yes 2/ No

If yes, from where did you get? 1/ Radio 2/ Newspaper 3/ from farmer's association 4/ from extension agents 5/ others (specify) _____

Did you receive any formal training in dairying? 1. Yes 2. No

If yes, duration of the training? 1. for a few days 2. For a few weeks

3. for a month

Where did you take the training? 1. at the FTCs 2. At Woreda level

3/ At the Zone level 4/ at region level 5/ other (specify) _____

II. Milk production performance and utilization

Average daily milk production in litters and lactation length in month

Breed of cow	Early lactation	Mid lactation	Late lactation	lactation length in month
Exotic				
Cross				
Indigenous				

Milk use pattern

Category	Quantity(in litters)
Total milk produced	
consumed at home	
sold	
Processed	

Frequency of milking per day 1/ once 2 twice 3/ three times

Milking of cow upon death of calves 1/ yes 2/no

Milk marketing

Do you sell milk? 1/ yes 2/ no

If yes for whom you sell milk 1/ hotel and restaurant 2/ local market 3/ neighborhood 4/ for cooperatives 5/ others (specify) _____

Price per litter in ETB 1/ 5-8 birr 2/ 8-10 birr 3/ 11-13birr

If you do not sell what is reason? 1/ low productivity 2/ low price 3 /lack of market access or remoteness 4/ cultural taboo 5/ others (specify) _____

III. Husbandry practices

Purpose of keeping cattle (rank them in order of importance)

Purpose	Cattle	Sheep and goats	Equine	Others
Meat				
Milk				
Work power				
Social prestige				
Ceremonies				
Hide				
Manure				
Reproduction				

Rank according to priority 1 to 8, 1 representing highest use and 8 least use

Reason of culling 1 low production 2 disease prevalence 3/financial requirement
4/aggressiveness of cow 5/ feed shortages

Source of replacement stock

Criteria to select replacement stock

Watering

Source of water 1/ river 2/ pipe water 3/dam and wells 4/lake

How many times you water dairy cow per day during dry season? 1/once 2/twice 3/ three times 4/ not watered at all 5/ free accesses

How many times you water your cattle during wet season? 1/once 2/twice 3/ three times 4/ not watered at all 5/ free accesses

Feeding practice

Feeding Practice 1/- Grazing 2/ - Stall-feeding 3/ both grazing and stall feeding

If animals are grazing

The grazing area used is: 1/ Communal, 2/ Owned by individuals or family unit
3/ both 4/rented

Would you feed your animal supplemental feed? 1/ yes 2/ no

If yes, mention types of supplemental feeds

Breeding practices

What is the means you use for cattle reproduction?

1/ AI 2/ Breeding bulls (cross) 3/ Local bull

Source of bull 1/ from own farm 2/ from village 3/ others specify-----

When you castrate male cattle

What kind of crop mainly you cultivate? 1 barley 2 wheat 3 maize 4 sorghum 5 teff 6
others, specify-----

Would you use crop residue as an animal feed? 1 yes 2 no

If your answer is no what is the main reason? 1 lack of awareness 2 lack of accessibility 3
alternative use of crop residues

Calves rearing suckle

When the calves start feeding grass? 1\after month 2/ after two month 3/ after 3 days others
specify

When would you start milking 1\ as soon as cow give birth 2/ after a month 3/ after three days others specify-----

Frequency of calve suckle at a time of milking 1/once 2/ twice 3/ three times

Waste management

Are you using animal excreta as fuel 1 yes 2 no?

If no what is the main reason?1/ lack of awerness2/ alternative use 3/ others specify-----

Then for what purpose you use the excreta? 1/ manure 2/ decoration of house 3/ nothing

Health care

Is there regular vaccination? 1/ yes 2/ no

Where did you get the vaccination for your cows 1/ at kebele station 2/ at woreda clinic

What kind of disease frequently affects your milking cows?

From where did you get treatment? 1/ private clinic 2/ woreda governmental clinic 3/ traditional herbal medicine 4/ no treatment given at all

IV Constraints of livestock production (put in rank 1-8)

Constraints	Cattle	Equines	Small ruminants
Shortages of feed			
Shortages of grazing land			
Health problem			
Low productivity			
Predator			
Water scarcity			
Scarcity of labor			
Other specify			

Annex 2 :ANOVAS TABLE

Table 1: ANOVA table Cattle number in two production systems

		Sum of Squares	Df	Mean Square	F	Sig.
Cattle	Between Groups	156.477	1	156.477	10.844	.001
	Within Groups	2222.112	154	14.429		
	Total	2378.590	155			

Table 2: Analysis of variance(ANOVAs) for average milk yield with respect to stage of lactation length and lactation length

		Sum of Squares	Df	Mean Square	F	Sig.
average milk yield of early lactation	Between Groups	8.038	1	8.038	29.709	.000
	Within Groups	41.664	154	.271		
	Total	49.702	155			
average milk yield of mid lactation	Between Groups	4.786	1	4.786	22.984	.000
	Within Groups	32.065	154	.208		
	Total	36.851	155			
average milk yield of late lactation	Between Groups	1.703	1	1.703	13.300	.000
	Within Groups	19.714	154	.128		
	Total	21.417	155			
lactation length in month	Between Groups	6.061	1	6.061	1.094	.297
	Within Groups	852.779	154	5.538		
	Total	858.840	155			

Table 3 : ANOVA for milk use pattern

		Sum of Squares	Df	Mean Square	F	Sig.
total milk produced	Between Groups	1.170E7	1	1.170E7	48.076	.000
	Within Groups	3.747E7	154	243298.717		
	Total	4.916E7	155			
consumed at home	Between Groups	78564.149	1	78564.149	4.438	.040
	Within Groups	955935.597	54	17702.511		
	Total	1034499.746	55			
Processed	Between Groups	73914.698	1	73914.698	1.412	.237
	Within Groups	8061537.023	154	52347.643		
	Total	8135451.721	155			

Table 4 Correlation between educational level and owning cross breed cow

		educational level	crossbreed
educational level	Pearson Correlation	1	.373**
	Sig. (2-tailed)		.000
	N	156	156
Cross breed	Pearson Correlation	.373**	1
	Sig. (2-tailed)	.000	
	N	156	156

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

Table 5 source of feed (grazing area) cattle in Telo district

		grazing area used		
		individual owned	Individual owned and rented	Only rented
rural mixed crop-livestock production	Count	111	9	3
	Expected Count	87.5	12.6	22.9
	% within production system	90.2%	7.3%	2.4%
	% within grazing area used	100.0%	56.3%	10.3%
	% of Total	71.2%	5.8%	1.9%
Urban	Count	0	7	26
	Expected Count	23.5	3.4	6.1
	% within production system	.0%	21.2%	78.8%
	% within grazing area used	.0%	43.8%	89.7%
	% of Total	.0%	4.5%	16.7%
Total	Count	111	16	29
	Expected Count	111.0	16.0	29.0
	% within production system	71.2%	10.3%	18.6%
	% within grazing area used	100.0%	100.0%	100.0%
	% of Total	71.2%	10.3%	18.6%

Table 6 Pearson chi-square value of feed source or grazing area in Telo district

X^2	Df	<i>p-value</i>
116.266	1	0.000

Annex 3: Figures



Figure1 Herded grazing around homestead



Figure2 Aftermath grazing (tethered)



Fig 3 Daughter churning with clay pot

fig 4 Manure removal



Fig. 5 milking without separating calf

Fig.6 milk filtering using fiber

9. DECLARATION

I under signed, declare that, this thesis is my original work, has not been presented for degree in any other university and that all source of material used for the thesis have been duly acknowledged.

Name: Askale G/Michael G/tsadik

Signature: _____

Place: Addis Abeba University, Debrezeite, Ethiopia.

Date of Submission: -----.

This has been submitted for examination with my approval as University advisor

Dr. Mekonnen H/Mariam -----