DAIRY CATTLE PRODUCTION AND MARKETING SYSTEMS IN THREE SELECTED DISTRICTS OF WOLAITA ZONE, SOUTHERN ETHIOPIA.

M.Sc. THESIS

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DAIRY CATTLE PRODUCTION AND MARKETING SYSTEMS IN THREE SELECTED DISTRICTS OF WOLAITA ZONE, SOUTHERN ETHIOPIA.

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As thesis research advisor we hereby certify that we have read and evaluated the thesis prepared, under our guidance, by Abraha Hailu, entitled **"***Dairy cattle production and marketing systems in selected districts of Wolaita Zone, southern Ethiopia*.**"** We recommend that it can be submitted as fulfilling *thesis* requirement.

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As members of *Board of Examiners* of the *M.Sc. thesis open defense examination,* we certify that we have read, evaluated the thesis prepared by Abraha Hailu and examined the candidate. We recommended that the *thesis* could be accepted as fulfilling the thesis requirement for the Degree of *Master of Science* in Animal science (Animal Production).

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DEDICATION

This thesis is dedicated to my beloved father, kesist Hailu Bahta, whom I lost at the time of my child hood on 26 February 1992/2000. May God rest his soul in peace!

STATEMENT OF THE AUTHOR

I declare that this thesis is my original work and all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. degree at Jimma University, College of Agriculture and Veterinary Medicine and put at the University Library to be made available to borrowers under the rules of library.

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BIO GRAPHICAL SKETCH

The author, Abraha.Hailu was born in Gulomekada district, eastern zone of Tigray National Regional state in 1986 G.c., He attended his primary and junior secondary school at Zala, from 1993-2000. The author attended 9^{th} –11^{th} grade at Zala-Anbessa senior secondary school from 2001-2003G.C. He continued and completed his preparatory school at Adigrat, Agazi Compressive High School in 2004. He joined Awassa college of Agriculture in 2005 and completed his B.Sc degree in Animal and Range Sciences in 2007/08 G.C. Then after, he was employed in Damot Sore district (Wolaita Zone in Southern Ethiopia) Bureau of Agriculture in 2008 and working as expert of animal production until he joined Jimma University, School of Graduate Studies for the Degree of Master of Science in Animal Production in 2012.

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LIST OF ABBREVIATIONS

AFC	Age at First Calving
AI	Artificial insemination
ANOVA	Analysis of Variance
BoARD	Bureau of Agriculture and Rural Development
BoFED	Bureau of Finance and Economics Development
CI	Calving Interval
CSA	Central Statistical Agency
DAs	Development agents
DWARD,	Damot Weyde District Office of Agriculture rural development
EARO	Ethiopian Agricultural Research Organization
ETB	Ethiopian birr
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
GDP	Gross Demos tic Product
GLM	General Liner Model
HA	Hectare
HHH	Household head
ILCA	International Livestock Center for Africa
KDARD	Kindo koisha District office of Agriculture and Rural Development
LL&MY	Lactation Length and Milk Yield
LSD	List Significance Difference
MoARD	Ministry of Agriculture and Rural Development
MOFED	Ministry of Finance and Economic Development

ABREVIATIONS (*Continued…*)

KM	Kilometer
N	Number of respondents
NGOs	Non-governmental organizations
OARD	Office of Agriculture and Rural development
PA	Peasant Association
PLC	Personal limited company
PRA	Participatory Rural Appraisal
SNNPRS	South Nations Nationalities and People Regional States
SPSS	Statistical package for Social Sciences
Sq.k	Square Kilometer
TMP	Total Milk Production
USD	United States Dollar
WCBMC	Wolaita Cattle Breeding and Multiplication centre
WFP	World Food Program
WBISPP	Woody Biomass Inventory Strategic Planning Project.

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DAIRY CATTLE PRODUCTION AND MARKETING SYSTEMS IN THREE SELECTED DISTRICTS OF WOLAITA ZONE, SOUTHERN ETHIOPIA

ABSTRACT

The study assessed in three selected districts of Wolaita Zone Southern, Ethiopia during 2012/13.The objectives of the study were to assess dairy cattle production and product marketing and to identify the major constraints and opportunities for dairy cattle production in the study area. A stratified sampling method was employed to select representative districts from three Agra ecological zones. From each agro- ecology one district was selected purposively based on cattle production potential (.i.e. from highland Damot Sore, from midland Damot Woyde and from lowland Kindo Koisha). From each district, two peasant associations (PA) were selected purposively based on cattle potential. The overall family size of the study was 7.47±2.37 (Mean±SE) and not significant difference was observed among the studied districts. Furthermore, for 70% of dairy producers sale of the crop was the main sources of income even if the butter were predominantly marketable though out the year. The average landholdings of the sampled households were 1.21±0.05 (Mean±SE).of which pasture land was 0.32±0.02 (Mean±SE).The average cattle holding in the study area was 8.15±0.47 heads per household. But it varied significantly (P<0.001) among the study districts. From the total cattle herd structure, the average numbers of cows (3.03±0.12) was higher. Of which 2.64±0.12 was local breed cows, 0.15±0.03 Holstein cross and 0.19±0.04 was Jersey cross cows. In the study districts, artificial insemination was used to improve their local breed cattle. However, for most (38.97%) respondents distance to AI station is the main problem. For the majority (42.38%) of respondents' source of cross breed cattle were from markets places. The total mean milk yield/cow/day of Holstein cross, Jersey cross and local breed cows were (5.7±0.21), (2.85±0.12) and (1.79±0.05) litters, respectively. The average lactation length of Holstein cross, Jersey cross and local bred cows were (9.63±0.34), (8.65±0.36) and (8.65±0.36) months, respectively. Average Mean age at first calving of local cow, Holstein cross and Jersey cross was (49.29±1.13), (39.55±1.34), and (35.8±1.43) months, respectively. On the other hand overall mean calving interval of local cow, Holstein cross and Jersey cross-bred cows were (18.48±0.5), (16.17±0.5) and (14.9±0.6) months, respectively. The average volume of milk produced/day/household in the studied districts was 4.05±0.32Littre.Out of total milk produced the largest (65.58%) volume of milk was used for processing. In the study area, 85.1% of the respondents preferred to sell butter than other dairy products. Some of the respondents (40%) used river water for their cattle. Maize stalk (42.2%) and wheat straw (41.7%) were the major crop residues used for cattle feeding. In the study area, farmers widely used crop residues and Enset leave (71.8%), when a feed shortage occurs during the dry season. Anthrax, Tripanosomiasis, Blackleg, Tick and Pneumonia were the major reported cattle diseases .In general the main problems of milk production & marketing in the studied districts were lack of feed, disease outbreak, lack of credit, market access and infrastructures.

Key words: cattle production, feed sources, cattle disease, constraints to cattle production and marketing systems.

1. INTRODUCTION

Ethiopia has the largest cattle population in Africa estimated about 52.13 million heads of cattle (CSA, 2012) and contributes 40% to the annual agricultural output and 15% total gross domestic product. Cattle produce a total of 1.5 million tones of milk and 0.331 million tones of meat annually (FAO, 2005).

According to the 2010 report of the Central Statistical Agency (CSA) the total the indigenous breeds accounted for 99.19 percent, while the hybrids and pure exotic breeds were represented by 0.72 and 0.09 percent, respectively (CSA, 2010). The major species used for milk production in Ethiopia are cattle, camel and goats. Cattle produce 83% of the total milk and 97 % of the cow milk comes from indigenous cattle breeds (MOARD, 2004).

Ethiopia's stricken economy is based on subsistence agriculture accounting for almost half of the gross domestic product (GDP), 60% of exports, and 80% of total employment (Exxun, 2008). Livestock production contributes an estimated 16 percent to the total GDP and over 40 percent to the agricultural GDP (Diao et *al*., 2007), 15% of export earnings and 30% of agricultural employment (Staal *et al*, 2008). Livestock contributes to the livelihoods of 60-70% of the population (Michael, 2004).

Despite its huge number, the livestock sub-sector in Ethiopia is less productive in general, and compared to its potential, the direct contribution to the national economy is limited. The poor genetic potential for productive traits, in combination with the sub-standard feeding, health care and management practices are the main contributors to the low productivity (Zegeye, 2003).

In Ethiopia, the human and animal populations are very much affected by nutritional problems, primarily due to lack of food of high nutritional value. Therefore, to solve this problem and to ameliorate the nutritional status of the population, measures should be taken to improve animal production to ensure better supply of animal protein of high nutritive value (Ashebir, 1992).

The milk production potentials of the zebu cattle breeds in the highlands of Ethiopia cannot exceed 400-500kg 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 (EARO, 1999; Zelalem, 2000).

The national milk production remains among the lowest in the world, even by African standard, approximately produces about 3.2 billion liters of milk from 10 million milking cows, which is translated in 1.54 liters per cow per day (CSA, 2008). Consequently, the national milk production and the overall milk consumption in Ethiopia are very low, even compared with other least developed African countries (Zegeye 2003; Melesse and Beyene 2009).Per capita consumption of milk in the country is as low as 17 kg per head while the average figure for Africa is 26 kg per head (Gebrewold et al 1998). This indicates the existence of a wide gap between potential demands of the growing population of Ethiopia. In order to meet the demand of the growing population of Ethiopia, milk production has to grow at least at a rate of 4 % per annum (Azage, 2003)

To be effective, the efforts to improve the productivity of smallholder dairy production and improve its market orientation needs to be supported and informed by a detailed understanding of the current and dynamic conditions of production, marketing, processing and consumption of milk and dairy products (Asfaw, 2009).

In general, more than 75% of the produce is absorbed locally for consumption (Getachew and Gashaw 2001). However, in the country, milk production, handling, processing, consumption and marketing are traditional and constrained by multiple problems.

SNNPRS is one of the region's second largest milk producing from the country. According to the SNNPRS Basic Socio-Economic and Demographic Information About the region (2007), the livestock population of the region is estimated 9.9 million cattle 3.4 million sheep, 2.4million Goat 0.86 million Sheep and goat, 0.9 million equines 7.6 million poultry. Despite the huge potential in the region, livestock productivity is low. It is estimated that total milk producing of 572 million liters annually from an average daily milk yield per cow of 1.2 litters (CSA, 2008).

Wolaita Zone has high potential for livestock production with greater access to market for quality agricultural products including milk products. In the zone dairy development projects have also been launched. To achieve Wolaita Agricultural Development Unit (WADU)

established the farms in 1971 and 1987 with the financial aid Dairy Rehabilitation and Development Project (DRDP) with an introduction of 90 Jersey breed heifers and 2 Jersey bulls as initial foundation stock for the farm. The Zone has also the accessibility of cattle breeding and multiplication centers and Veterinary Service Center as well as a huge supply of crop-residues science the Zone is two the main cropping seasons.

Although, the aforementioned intervention along the dairy production were implemented in the Zone, there is no any such study has been done, especially in Damot woyde, Damot sore, and kindo koisha districts of Wolaita Zone .So far concerning with the study areas, there was no compiled document on milk production, processing, breeding, housing, feeding, health service and including marketing system of cattle and their products. Therefore, evaluation of the prevailing production system, identification of limitation on production and marketing of cattle was assisted to design appropriate improvement strategies, and suggests appropriate area of intervention for improvement of cattle husbandry. Therefore, the study was mainly conducted with the following objectives

- To asses dairy cattle production system in the study area
- To assess dairy cattle product marketing system in the study area
- To identify constraints and opportunities of milk production and marketing in the Study area

2. LITERATURE REVIEW

2.1. Economic Importance of livestock in Ethiopia

Livestock performs multiple functions in the Ethiopian household economy by providing food, input for crop production and soil fertility management, cash income as well as in promoting savings, fuel, social functions, and employments. The multiple purposes and the emphases on use vary with the production system. Both in crop–livestock and agro-pastoral systems, animal traction ranked first, followed by milk and reproduction. Most crop–livestock farmers and agro-pastoralists farmers also consider manure production as a secondary important by-product. In contrast, in pastoralist systems, reproduction/breeding requirements received higher ranks and for female animals, breeding out ranked the importance of milk production (Workneh and Rowlands, 2004).

Within the integrated crop–livestock production systems, livestock plays a particular role to provide milk, meat, cash income, manure, and serves as capital asset against risk. In 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. In the highlands of Ethiopia, smallholders rear cattle, primarily for the supply of oxen power for crop production. Milk production, cash source, manure and fuel are considered as secondary. Cattle and equine play a vital role in smallholder farms for crop cultivation and transportation (Alemu, 1998)

The value of output from livestock in Ethiopia was estimated at around ETB 12 billion in 2000 and accounted for about 45% of the value of all agricultural output excluding the contribution of animal draught power. It was also noted that, at constant prices (1995 USD), the value of output of livestock grew nearly by 22% between 1980 and 2000 and this increase (1.1% per annum) compares well with the growth of the value of agricultural output (FAO, 2003)

Similarly, the Ethiopian Ministry of Finance and Economic Development (MoFED) estimated the gross value of ruminant livestock production in 2008/09 at Birr 32.64 billion. The estimate includes the values of livestock off-take (Birr 9.653 billion), milk and milk products (Birr 19.471 billion) and other products, e.g. wool, dung and change in stock inventory.

2.2. Milk Production Systems in Ethiopia

In the highland areas, agricultural production system is predominantly smallholder mixed farming, with crop and livestock husbandry typically practiced the same management unit. Among the systems, milk production system is the most biologically efficient systems that convert large quantities of roughage, the most abundant feed in the Ethiopia, to milk, the most nutritious food (Belete, 2006).

Milk production system can be broadly categorized into three based on marketing situations, such as urban, per urban and rural milk production system (Tsehay, 2002). The main source of milk production in Ethiopia is from the cow, but small quantities of milk obtained from goat and camel is also used in some regions particularly in pastoralist areas (IPS, 2000).

Out of the total milk production of the country, rural milk production system contributes to 98%, while the peri-urban and urban dairy farms produce only 2% (Ketema 2000).

2.2.1. Urban dairy production system

The urban dairying, like most urban dairying of Ethiopia and other east African countries is characterized by market orientation and by the types of inputs, particularly feeds (Sintayehu 2008).The main feeds resources are agro-industrial byproducts (Oil Seed Cakes, Bran, etc) and purchased roughage (Ketema and Tsehay,1995; Sintayehu, 2008).Currently, a number of smallholder and commercial dairy farms are emerging mainly in and around the capital Addis Ababa (Felleke and Geda, 2001; Azage, 2004) and most regional cities and towns (Ike, 2002; Nigussie, 2006).

The urban milk production system inside and around Addis Ababa consists of 5167 small, medium and large dairy farms producing about 35 million liters of milk annually (Tsehay ,2002). Out of the total volume of milk produced in and around Addis Ababa, 73%,10%, 9.4%, 7.6%

were marketed, left for household consumption, goes to calves and processed into butter and ayib (Ethiopian cottage cheese), respectively (Azage and Alemu, 1998).

Although some farmers produce good quality milk, hygienic quality and composition of most milk marketed in such production systems is poor (Tsehay, 2002). Moreover, price is high even when quality of milk is low. No standards and quality control mechanisms or dairy policy exists to safeguard consumers.

2.2.2. Peri-urban dairy production system

This system is found in the outskirts of the capital city and regional cities and mostly concentrated within a radius of 100 km around Addis Ababa, which includes dairy farms ranging from smallholder to commercial farmers (Felleke and Geda, 2001). The main feed resources in this system include agro-industrial by-products and purchased roughage. The system comprises small and medium sized dairy farms that own crossbreed dairy cows. Dairy farmers use all or part of their land for forage production. The primary objective of milk production in this system is generating additional income to the household (Hizkias and Tsehay, 1995; Azage *et al*., 2000**).** The most specialized and high-tech system is an intensive milk production system. State sector and very few individuals on commercial basis practice it. These are concentrated in and around Addis Ababa. Urban, peri-urban and intensive systems account 2% of the total milk production of the country (Belete, 2006**).**

2.2.3. Rural milk production system

Rural dairy production system is part of the subsistence farming system which is the first system (pastoralists, agro pastoral and mixed crop–livestock producers) contributes about 98%. The livestock is kept under traditional management conditions and generally obtain most of their feed from native vegetation, aftermath grazing and crop residues (Tsehay, 2002).This sector is largely dependent on low producing indigenous breeds of cattle, which produce about 400-680 kg of milk/cow per lactation period (Gebre-Wold *et al.,* 2000). The household mainly consumes the milk produced in the traditional system. Processing is usually done using traditional technology in to products such as butter, ghee, *ayib* and sour milk. Milk and milk products are usually marketed through the informal market after the households satisfy their needs (Tsehay, 2002).

2.3 .Milk-marketing System in Ethiopia

As common in other African countries (e.g., Kenya and Uganda), dairy products in Ethiopia are channeled to consumers through both formal and informal dairy marketing systems (Mohammed et.al. 2004). However, Ethiopian milk marketing system is not well developed. This can be reflected from the fact that only 5% of milk produced in rural areas are marketed as liquid milk. In fact, the vast majority of milk produced outside urban centers in Ethiopia is processed into products by the farm household and sold to traders or other households in local markets (Holloway *et al*., 2000). This has resulted in difficulties of marketing of fresh milk where infrastructures, especially transportation facilities are extremely limited and market channels have not been developed. In the absence of an organized rural fresh milk market, marketing in any volume is restricted to the urban and peri-urban areas (Getachew, 2003)

Formal marketing system, is usually controlled by the government, includes organized collection, processing and distribution of fresh milk and other dairy products at official, government-controlled prices. The Dairy Development Enterprise of Ethiopia is an example of formal marketing systems in Africa. The formal marketing system, in which the milk from the state farms, private farms and subsistence producers within the radius of 150 km around Addis Ababa, is collected at the roadside (milk collection and chilling centers) and taken to a central processing plant (Bennett, 2001).

In any marketing channels and outlets, various actors participate in marketing of commodities and process of transactions made. These include itinerant /mobile traders, semi-whole sellers, retailers, cooperatives and consumers. Marketing outlet is the final market place to deliver the milk product, where it may pass through various channels. A network (combination) of market channels gives rise to the market chain. A marketing survey in Hawassa, Shashemene and Yergalem depicted that milk producers sold milk through different principal marketing channels (Woldemichael, 2008)

2.4 .Milk Consumption in Ethiopia

Ethiopia produces approximately 3.2 billion liters of milk from 10 million milking cows and average of 1.54 liters per cow per day over a lactation period of 180 days (CSA,2008 quoted by Tefera, 2010).About 83% of the total milk produced is consumed at the household level and only

7% is supplied to the formal and informal markets. The remaining balance is distributed between in-kind wages (0.43%), and used for processing (10.06%) primarily as a means of extending the shelf-life during times of surplus (GOE, 2007). The consumption of milk and milk products varies geographically between the highlands and the lowlands and the level of urbanization (Ahmed *et al.*, 2003).

As compared to other countries, Ethiopia has a low level of milk consumption in the region (Kenya with 90 lt/cap, and Uganda with 50 lt/cap). Even though Ethiopia has the largest inventory of milk producing animals, (cattle, sheep, goats and camels), per capita consumption of milk is low compared to Kenya with fewer livestock and Sudan. The national per capita consumption of milk and milk products is estimated at 17 kg (Ahmed *et al.,* 2003).

2.5 Some of the Productive and Reproductive Performances of Dairy cattle in Ethiopia

The reproductive performance of the breeding females is probably the single most important factor that is prerequisite for sustainable dairy production system and influencing the productivity. Both production traits (like daily milk yield and lactation length) and reproductive traits (such as age at first calving and calving interval) are crucial factors determining the profitability of dairy production (Peters and Ball, 1995; Lobago *et al*., 2007)

The main contributors to poor performance of animals are their genetic merit, feed standard, poor health care and management practices (Zegeye, 2003). According to Lemma *et al*. (2005), average milk off-take of local Arsi cows was about 1.0 liter/head/day. Brokken and Senait (1992) reported that the average daily yield of local cows was about 2 liters, compared with about 6 liters for crossbred cows. As a result, the livestock sector contribution to both the national and household level is below its potential level (Berhanu *et al.*, 2007).

2.5.1. Days open

An increase in the number of days between calving and conception, also known as days open, influences profitability of the dairy industry. This influence is partly attributed to factors such as increased breeding cost, increased risk of culling and replacement costs, and reduced milk production (de Vries and Risco, 2005). Days open affects lifetime production and the generation

interval (Ababu, 2002). Days open should not exceed 80 to 85 days, if a calving interval of 12 months is to be achieved (Peters, 1984; Enyew, 1992).

2.5.2. Lactation Length and Milk Yield (LL&MY)

Indigenous breed of cows are generally considered low milk producers. However, their adaptability and survival under the traditional management system is excellent when compared with the introduced exotic cattle species (Zegeye, 2003) .The total annual milk yield of Ethiopia from about 10 million milking cows is estimated 3.2 billion litters and this translated to an average production of 1.54 liters/cow per day (CSA,2008) Milk production per day per head is very low and this is further affected by relatively short lactation length and extended short lactation length and extended post-partum anoestrus resulting in low production efficiencies (Azage and Alemu, 1998).

Research findings on Ethiopian indigenous cattle types indicated that lactation length is less than 100 days of lactation period under average to good management conditions in the Ethiopian context (Zelalem *et al*., 2006). Lemma (2005) however reported a longer lactation length of 9.5 months for local cows in the East Showa zone of Oromia.

2.5.3. Calving interval (CI)

Calving interval refers to the period between two consecutive calving and is a function of days open and gestation length (Gidey, 2001; Kedja, 2007). The Economic return from milk production is maximized with a calving interval of 12 months, a dry period of approximately 60 days and days open of 85 days. The duration of this period is influenced by nutrition, season, milk yield, parity, suckling and uterine involution. The previous study indicated that calving interval for Ethiopian Zebu ranged from 12 to 24 months, which varies among breeds and animals within a breed (Gifawosen *et al*., 2003). A days open of 248.4, 211.1, 253.0 for Boran, Horro and Barka cattle, respectively, has been reported (Gifawosen *et al*., 2003)

Research conducted in Abernosa Ranch with Boran x Holstein- Friesian F1 crossbred dairy cows showed long calving interval (534.3 days), with average breeding efficiency of 44.6%, average calving rate of 72% and heifer reproduction efficiency of only 38% (Ababu *et al*.,2006)

2.5.4. Age at first calving (AFC)

Age at first calving is the age at which heifers calve for the first time (Gidey, 2001). It is closely related to the rearing intensity, and in a breeding program has an impact on generation Interval and response to selection. Acceptable and optimum performance of age at first calving under the improved smallholder system in the tropics is less than 30 and 36 months, respectively (Perera, 1999). Heritability of Age at first calving is generally low, indicating that this trait is highly influenced by environmental factors such as feed and health (Mukasa-Mugerwa, 1989). For instance, age at first calving of Borana cattle ranged between 45.5-51.1 months (IAR, 1991). But under better management in Kenya, the Borena breed calved remarkably at the early age of 34-36 months. In general, the ages at first calving for local cows in the same area were 52 months and for crossbreed were 31.06 months (Kurtu, 2003).

2.6. Major Constraints of Dairy cattle Production in Ethiopia

The traditional smallholder dairy system makes up the largest characterized mode of milk production, and uses low input feeding, management requirement, and the indigenous genotypes (Jabbar *et al*., 1997). The characteristics of the improved dairy production system vary substantially in terms of intensification, management systems; genotype used, type and method of marketing and processing of milk and dairy products.

2.6.1. Shortage of feed

Availability, quality and quantity of feed vary among varied production systems. Cattle mainly depend on rangeland grazing or crop residues that are of poor nutritive value. Feed is not uniformly supplied and the quality is poor (Ibrahim and Ololaku, 2002)

Improvements of genetic make up only contribute up to 30% to production, while the 70% is dependent on nutrition and management. Unfortunately, indigenous animals are low milk producers because of the shortage of nutrition. Poor nutritive values of feeds lower the production capacity and fertility potential of animals. If fed well, 20-25% more milk could be produced from the same livestock (Sethumadhavan, 2004).

2.6.2. Lack of productive breeds

As compared to breeds originated from temperate areas, cattle breeds originate from the Tropics generally have a limited genetic potential for milk production. The large cattle population of Ethiopia has relatively limited numbers of exotic dairy cattle and their crosses. Less than one percent of the total cattle population is exotic or crossbred dairy cows (Muriuki and Thorpe, 2002).Consequently, milk production in Ethiopia is low. The indigenous zebu breed produces about 400-680 kg of milk/ cow per lactation period, compared to grade animals that have the potential to produce 1,120-2,500 liters over 279-day lactation (Muriuki and Thorpe, 2002). Even under a research center management condition, average milk yield did not exceed 500 liters (Zelalem *et al*., 2006). The other research findings reported that Barca cattle type produced the lowest for both total milk (672 kg) and Annual milk yield (673kg) (Million and Tadelle, 2003)

2.6.3 Animal health care

Animal health care and improved health management is also one of the major constraints of dairy development in Ethiopia, which caused poor performance across the production system. The most serious animal disease constraints to livestock productivity are the parasitic and viral diseases, mainly vector-transmitted that have a wide geographic distribution and who's severities are strongly influenced by the environment (Tedonkenk and Pieper, 2000). For instance a research conducted at Metema area indicated that LSD, Babesiosis, Trypanosomosis, Mastitis, and Entritis were the major cattle diseases, which contributed to decrease the productivity of livestock (Gizachew, 2007).

2.6.4 Shortage of water

Since rainfall rather than livestock, density determines net primary production and vegetation cover, its variability is the most important climatic factors determining the state of the natural resource base. Hence, rainfall variability and net primary productivity of the vegetation correspondingly determines livestock production (Sere *et al*., 1996). One unusual feature of the Borana is the highest degree of water restriction of cattle during the dry seasons such that animals may be watered once every three, two, or four days (Coppock, 1994).

During the dry season, water is available only from wells and some lakes and streams (Ibrahim and Olaloku, 2002). This leads to overgrazing around watering points. Water intake increases as watering frequency is decreased and feed conversion efficiency becomes lower as watering interval increase (Ibrahim and Olaloku, 2002).

2.6.5 Land holding and crop Production

The land size allotted to individual farmers by a Peasant Association (PA) as per the land reform declaration of 1975, depended on family size, fertility of the land, the number of PA members and the total land area available within the PA (Getachew *et al*., 1993). Most farms in Ethiopia are fragmented and smallholder mixed crop–livestock systems are interdependent. Increasing human population coupled with diminishing land resources and increasing urbanization are creating a growing number of landless people who also have to produce their own subsistence (Kebreab *et al*., 2005*).*

In Southern Ethiopia at Alaba district, Yeshitila (2008) reported that the average land size owned by a farmer is about 2.5 ha. The same report indicated that land and livestock holdings have a direct linear relationship, where farmers with large land holdings have higher livestock holdings and when land holdings became smaller there is a trend of keeping more numbers of small ruminants than cattle. According to (CACC 2003) the average land holdings of the small holder farmers in the country and SNNPRS is 2.0 to 5 ha for 32.6% and 16.2% respectively and 1.1 ha in Shashemene-Dilla area (Yigrem et al 2008)

3. MATERIAL AND METHODS

3.1 Description of the Study Area

This study was conducted in Damot weyde, Damot Sore and Kindo Koisha district of the Wolaita Zone of the Southern Nations, Nationalities and People Regional State, South Western Ethiopia. Wolaita Zone is one of the 13 administrative Zones in SNNPR State found at the South- Western part of Ethiopia. The Zone has 438,370 hectares of land. Out of the total land, 9 % is highland (*Dega),* 56% medium land (*Woina dega)* and 35 % is low land (*Kolla*). The elevation of the area ranges from 1200 to 2950 m.a.s.l. and the annual average temperature is 15-20 ^{o}C while average rainfall is 1200 to 1300 mm. The human population of zone is about 1,527,908 million of which 49.3% are male and 51.7% are female (CSA, 2007) Out of these, 11.7% live in towns and the rest 88.3% live in rural areas. The average annual population growth rate of the Zone is 2.3%. It is one of the most densely populated areas in the country with an average of 290 people per km^2.Of the total land area of the zone 54 % is currently cultivated, 11 % employed for grazing and 21 % under bush, shrubs and forest cover (Dessalegn, 2007)

Sodo is the biggest and the capital city of the zone. It is among the 18 growth- pole town selected in the region. It is located at a distance of 350 Km away from Addis Ababa, South-West of Ethiopia. Primary occupation of the Wolaita Zone is farming. Mixed crop-livestock production predominates, but there are some pastoralists in the lowland area. According to (CSA, 2006) the livestock potential of the Zone is 808,211 cattle, 177,702 sheep, 121,849 goats, 1,153 mules, 26,894 donkeys, 643,049 poultry and 20,466 traditional bee hives. Major crops grown in the Zone are Enset, root crops, maze, wheat, fruits and vegetables. Accessibility of Enset (false banana) in the zone is a further factor affecting the severity of seasonal food shortages for human and livestock.

Wolaita zone is subdivided into twelve districts and one administration town. Out of the total districts Damot Sore, Damot Woyde and Kindo Koisha districts were selected based on difference in agro ecology and potential for cattle productions.

Demote Sore district is located at a distance of 336 South -West of Addis Ababa, capital of Ethiopia. The altitude of the district varies from 1900 to 2350 m.a.s.l and the surface area

coverage estimates 400-600 sq km. The area is densely populated with very small farm size (averaging 0.25 ha per farming family). The area receives a mean annual rainfall of 1350 mm and has a mean annual air temperature of 18.5 ºC. Based on the BoARD (2011) the district has a total population of 116,048 of whom 58,011 were men and 58037 women. In the District wide varieties of crops are grown such as cereals (*Teff,* maize, wheat, and barley), pulses (faba bean, field pea, haricot bean) and root and tuber crops such as potato, sweet Potato and enset. The livestock productions are: cattle (44,660) poultry (41,585) sheep (10,004), equines (3,278), and goats (2165) (BoARD, 2011).

Damot Woyde is one of the districts of Wolaita zone located at a distance of 365 Km Southwest of Addis Ababa, capital of Ethiopia. The district is found at in the altitude of 1300 – 2100 m.a.s.l and the area coverage of 783.44 sq km. The annual rainfall ranges from 700–1300 mm. with daily temperature ranges 16^0C – 30^0c. Based on the (CSA, 2005) the district has a total population of 212,341, of whom 107,281 are men and 105,060 are women's. The livestock potential of the district is cattle 109,254, sheep 84,435 goats 9,449 and equines 2,356 (BoARD, 2011). Concerning of dairy products such as milk, cheese and butter are marketing dairy products of the districts. Though marketing of milk and cheese is limited within the district, butter is highly traded outside of the district. Cereals (maize, sorghum, Teff), pulses (haricot bean, chick-pea) root crops such as sweet potato, Irish potato, enset, and coffee and different fruit trees are important as the main crops grown in the districts (BoARD, 2006).

Kindo Kosha district is located at a distance of 392 km South -West of Addis Ababa, capital of Ethiopia. The altitude of the district varies from 700-2280 m.a.s.l with an average annual rainfall ranging from 900–1300 mm. The minimum and maximum daily temperature of the area is 25^0C – 40^0C, respectively. Based on the KWARD (2011), the district has total population of 120,911 of whom 61,700 are women and 59,111 are men. The surface area of the district is 77,641 hectare. The major economic activity of the district is intensive mixed farming, whereby crop production is combined with animal husbandry and off-farm activities. The district is lowland dominated endowed by high livestock population. Having large numbers of cattle ownership in the area believed to be an indicator of wealth. In the district wide variety of crops are grown, such as *ensets,* Maize, Teff, Cotton, Haricot bean, Sweet potato, Irish potato, Taro, Yam, Chick-pea, Ginger, Pumpkin, Coffee and Fruit trees

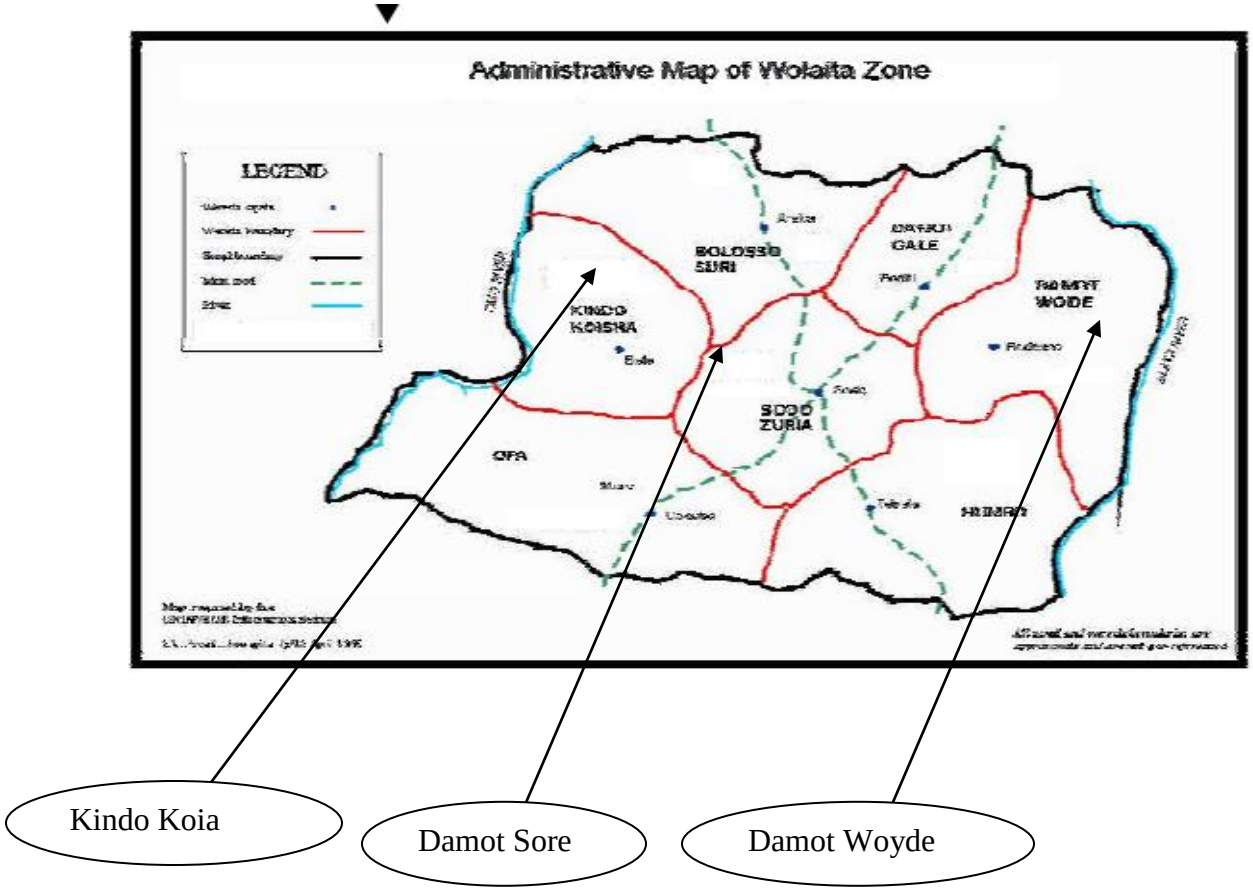


Figure 1: Map of the study districts

3.2 Sampling Techniques and Sample Size

3.2.1 Sampling procedure

Stratified sampling method was used based on the agro-ecological zone (high land, medium land and low land) altitude. The three districts were stratified to farmers association's /*kebeles*/ according to their dairy cattle keeping potential (i.e. Damot Sore from highland, Damot Woyde from midland and Kindo Koisha from lowland). From each district of each agro ecology two PA's were selected purposively based on cattle producing potential and again from each selected PA's 30 households were selected randomly from those farmers who have dairy cattle. Therefore, systematic random sampling method was used for selecting individual household.

3.2.2 Method of data collection

Both primary and secondary data were used to study used to study dairy cattle production and marketing systems in the three selected districts of Wolaita zone Ethiopia collect the data

Primary data

Primary data was collected directly from each selected households in each agro ecology. These primary data include:

Household socio-demographic characteristics: age category, sex, religion cultural taboos, ethnic group, family size, educational background, primary occupation, income sources, and farm information among others.

Dairy cattle production and reproductive performance; Type of cattle breeds (Local, Holstein cross and Jersey cross), productive and reproductive performance (Age at first calving, milk yield, lactation length and weaning age), amount of milk produced, consumed and milk utilization pattern and processing, input utilization (Improved feed and breeding techniques), milk and milk product marketing and main constraints of dairy production.

Participatory rural appraisal (PRA): Based on the information generated through PRA, the questionnaire and record sheets was developed for the formal interview / main survey. The PRA mainly focus Group discussion (FGD) was used with different key informants like; development agents(DAs), livestock experts in the respective districts and representatives of cattle breeding and multiplication centers , elders, dairy cattle owners and youth delegates.

Secondary data

Secondary data sources were used from Office of Agriculture and Rural Developments of each study district (Damot Sore, Damot Woyde and Kindo Koisha), Non-Governmental Organizations (NGOs), PAs and other relevant institutions who played significant role in the dairy development of the district. Cattle population and major constraints of dairy cattle production and marketing of the respective study districts were among the data collected

3.3 Data analysis

Data (both qualitative and quantitative) were cleaned and entered into Microsoft office Excel sheet. All the surveyed data were analyzed using statistical procedures for social science (SPSS) version 16 (SPSS, 2007). Statistical variations in categorical data were tested by means of cross tabs, with significant differences at $P< 0.05$; while the descriptive statistics for the numerical data was subjected to one way analysis of variance (one-way ANOVA) using the general linear model procedure of SPSS and Level of significance was also considered at $P<0.05$.The analyzed data was presented and summarized using tables, percentages and graphs. The following model was used for the quantitative variables

$Yij= \mu + A\ i + eij$ where; Yij= the dependent variable; μ = the overall mean; Ai = the altitude variations effect and eij = the error term.

For parameters required ranking, indices were also calculated to provide a ranking of the major constraints of dairy cattle production and marketing systems in the study areas. The indices were calculated as follows; Index = Sum of (3 * number of HH ranked first + 2 * number of HH ranked second + 1 *number of HH ranked third) given for an individual reason, criteria or preference divided by the sum of (3 * number of HH ranked first + 2* number of HH ranked second + 1 X number of HH ranked third) for overall reasons, criteria or preferences.

4. RESULT AND DISCUSSION

4.1 Socio demographic characteristics of households

4.1.1 Family profile of the studied households

The results for the social, demographic characteristics of dairy producers in the study area are presented in Table (1). The average family size in Damot Sore, Damot Woyde and Kindo Koisha districts were 7.57±0.31, 7.35±33 and 7.5±2.21 persons/household, respectively. Proportionally lowest family size was found in Damot Woyde district than the two study districts. The overall mean family sizes of sampled households in the study areas were 7.47±2.37. This value is higher than 7.26 persons/ household registered so far in Delbo watershed of the *wolaita zone* by Ayantu (2006), However it is much similar to the (7.39) heads per household obtained in the Shashemene–Dilla (Sintayehu, 2007) and (7.5) Dale district of Sidama Zone (Endeshaw, 2007). But it is considerably higher than the average 4.9 persons in rural areas of SNNPRS (CSA, 2007).

Regarding the age distribution of family, majority of them are between16 and 60 years followed by 6 to 15 years. Generally, majorities (49.6%) of the respondents were in the productive age than that of the non productive age groups (1.5%) and this in turn implies that households have a good source of family labor for different farm activities. The average mean age of the household heads in the three studied districts were not significant (P >0.05) different (Table1).The overall mean age of the households in the study areas were 44.91±0.8years. This result was smaller than the average age of 47.6±1.7 in the highland areas of Ethiopia (Zewdie, 2010).

Table 1. Average family size, Sex of family head and age distribution of the family

Variables	*Study Districts*						*Overall*	
	Damot Sore		*Damot Woyde*		*Kindo Koisha*			
	N	%	N	%	N	%	N	%
Sex of HH								
Male	57	95	51	85	54	90	162	90
Female	3	5	9	15	6	10	18	10
Mean age (SE) of HH	44.57±1.49		44.2±1.22		45.95±1.46		44.91±0.8	
Age category								
<6years	47	10.58	79	17.9	80	17.9	216	16.1
6-15 years	137	30.78	158	35.8	146	32.7	441	32.8
16-60years	253	56.85	201	45.6	212	47.7	666	49.6
>60years	8	1.79	3	0.7	9	2	20	1.5
Average family size	7.57±0.31		7.35±0.33		7.5±2.21		7.47±2.37	

HH=household head, N= number of household's, SE=Standard error

The majorities of respondents (70.6%) in the study areas were Protestants followed by Orthodox (27.2%) and Islam (2.2%). Nearly all households in the Kindo Koisha district were protestant followers (93.3%) and the lowest were in Damot Sore (55%) followed by Damot Woyde (63.3%).Respondents (27.2%) followed Orthodox Christian for this study was much smaller than respondents followed Orthodox Christian (98.9%) in the *Bure woreda* (Habtemariam, 2010). Regarding the marital status of the household heads most of (90.6%) were married, whereas the remaining 4.4% and 5% were widowed and divorced respectively.

Table 2. Religion and marital status of the households in the study districts

Variables	Study districts						Over all	
	Damot Sore		Damot Woyde		Kindo Koisha			
	N	%	N	%	N	%	N	%
Religion								
Protestant	33	55	38	63.3	56	93.3	127	70.6
Orthodox	26	43.3	20	33.3	3 [b]	5	49	27.2
Muslim	1	1.7	2	3.3	1	1.7	4	2.2
Marital status								
Married	55	91.7	54	90	54	90	163	90.6
Widow	2	3.3	2	3.3	4	6.7	8	4.4
Divorced	3	5	4	6.7	2	3.3	9	5

N=number of households,

Education is an important entry point for empowerment of their production and productivities of the rural societies. The result of this study (Table, 3) showed that comparatively there was more adult education in Damot Woyde (53.3%) than kindo Koisha (45%) and Damot Sore (38.3%). However, the highest proportion of the household received the primary level of education was in Damot Sore district (40%) followed by Damot Woyde (23.3%) and Kindo Koisha (21.7%).The difference could be attributed better access to schools of Damot Sore starts from an earlier time and more accessible to urban center due to the area is close to the zonal administrative town (Sodo town). This indicates that with higher education levels and near to the urban center, ability to adopt new technologies is observed more rapidly than lower educated farmers. As reported by Kuastros (2007), the uneducated respondents in Alaba distric*t* were (42.5%), which were much higher than the total respondents had not received any education in the current study. In general, the overall adult educational status of the study districts (45.6%) was higher than the regional literacy rate (30%). Of them, 43% were men and 17% were women (http://sepdc.com/Comment.html).

Table 3. Education status of the household head in the study districts

Educational level of HH	*Study Districts*							
	Damot Sore		*Damot Woyde*		*Kindo koisha*		*Over all*	
	N	%	N	%	N	%	N	%
No formal	6	10	9	15	14	23.3	29	16.1
Adult literacy	23	38.3	32	53.3	27	45.0	87	45.6
Primary school	24	40	14	23.3	13	21.7	51	28.3
Secondary school	5	8.3	4	6.7	6	10	15	8.3
Diploma and above	2	3.3	1	1.7	0	0.0	3	1.7

N=number of households, HH=household head,

4.1.2. Land holding

The average private landholding size in the study districts is presented in (Table 4).The highest proportion of the land was used for crop production activity followed to grazing lands than perennial crops. The mean land holding of households in Damot Sore, Damot Woyde and Kindo Koisha were (0.63±0.03), (0.96 ±0.04) and (1.88± 0.09) hectares. The total mean land holdings of the households among the study districts were significantly different ($P<0.001$). This is due to high population density in the highland and midland districts of the zone. As reported by Eyasu (2003), the overall average density of the zone is 360 persons/km^2. This indicated that land is one of the big challenges for the dairy producers. According to the result of this study survey (Table, 4) mean land allocated of annual crops was (0.63±0.04) hectare. There was a significant difference among the three districts in allocating their land for annual crops. This study showed that respondents in Kindo Koisha and Damot Woyde districts had more land size for annual crops than Damot Sore District. In addition, respondents in Kindo Koisha had higher land allocation for perennial crops than the two other (Damot Sore and Damot Woyde) study areas. The total mean land holding size of the respondents in the current study area was (1.21±0.05ha). This study result was similar with the reported 1.223 ha (ranged 0.84-1.52), land holding/household of *Bure* woreda, North-west Amhara (Fisseha, 2009).

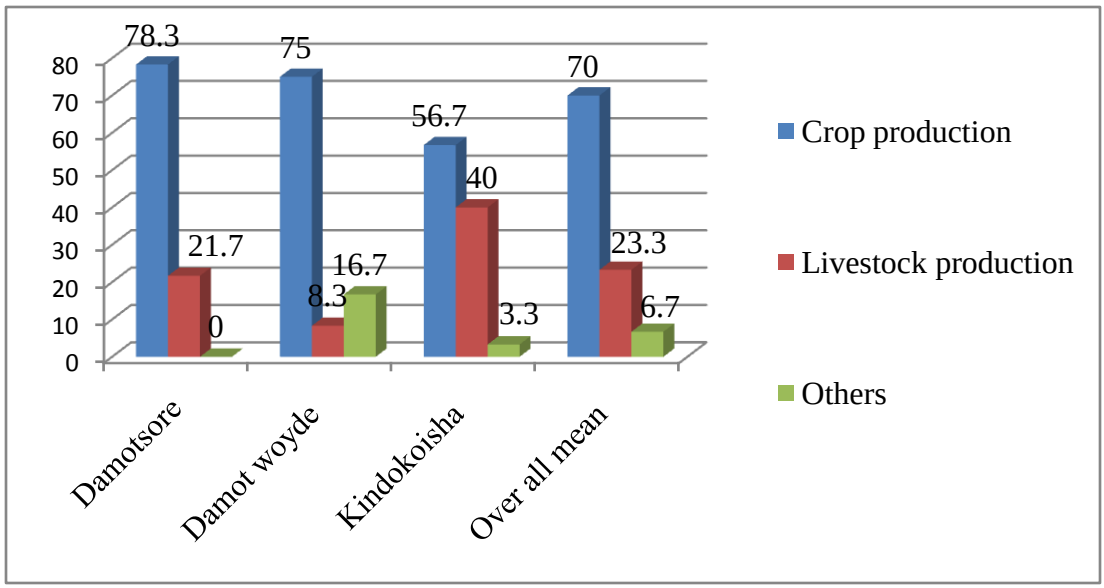
Table 4. Average farm size and land use patterns of respondents in the study districts

	Study districts				
Land holding	***Damot sore***	***Damot woyde***	***Kindo koisha***	***Over all***	***p***
Total land holding (ha)	0.63±0.03[a]	0.96±0.04[b]	1.88±0.09[c]	1.21±0.05	***
Annual crop land (ha)	0.3±0.01[a]	0.46±0.03[b]	1.13±0.08[c]	0.63±0.04	***
Pasture land (ha)	0.129±0.01[a]	0.3±0.02[b]	0.52±0.04[c]	0.32±0.02	***
Perennial crop land (ha)	0.19±0.01	0.19±0.02	0.24±0.19	0.21±0.21	ns

*Means on the same row with different superscripts are significantly different (P<0.05); ha=hectare; ns = not significant; ***P<0.001*

4.1.3. Income source of respondents

Contribution of sale of the crops, animal and animal products were the major income sources of the farmers. The main sources of income in the study area for 70%, 23.3% and 6.7% of farmers were sales of crops, live animal and animal products and others pottery, carpentry and petty trading respectively. The area is a mixed farming production system, but dairying is not the main income source even if the butter were predominantly marketable throughout the year in the study area. Shortage of land and high population density were the main challenges affecting the income of the farmers, especially in the highland and midland of the areas. But the farmers obtain income from sale of crop is higher in Damot sore and Damot woyde than Kindo koisha district. The reason is comparatively farmers produce more than two or more seasons per year by using intercropping in a small plot of land in addition to better soil fertility for crop production in the area. As a result, coffee sales are the biggest source of household income, especially in the highland study area.



Other income =pottery, carpentry and petty trading

Figure 2. Major sources of income of households in the study districts

4.1.4. Major Sources of information for milk production in the study districts

The source of information is a base to increase production and productivity in the small-scale farmers, especially in the rural part of the country. In the study area, implementation of different agricultural technologies has been launched for the development of mechanized agriculture. As a result, the dairy producers have to get better access to different sources of information to enhance dairy production. The Majority (67.8%) of the respondents can access to knowledge on dairy production through development agents (DAs).Higher extension service was getting in Damot Woyde (75%) and Damot Sore (73.3%) than Kindo Koisha (55%). Farmers have got lower extension service in Kindo Koish was probably due to the topography (infrastructure), and Agro ecology of the district makes difficulty to give extension service to dairy producers.

None of the respondents got information from radio in Damot Sore study site, but higher information was getting from farmers association (16.7%) and other sources (8.3%) like visiting research centers, technology exhibition and experience sharing from neighbors and trainings .The reason was that dairy producers in Damot Sore had comparatively better access to farm inputs such as a cross breed animals and commercial feeds. Whereas higher proportion of dairy producers (23.3%) in Kindo koisha study site was obtained information from traditional

knowledge of their parents. This showed that a number of households inadequate capacity of extension service in Kindo Koisha areas .The overall respondents had got access information from extension agents in the study area was higher than Respondents had access to extension services (45.5%) in the *Bure* district (Adebabay, 2009)

Table 5. Major sources of information for milk production in the study districts

Information sources	***Study of the district***							
	Damot Sore		***Damot Weyde***		***Kindo Koisha***		***Over all***	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***
Radio	0	0.0	4	6.7	10	16.7	14	7.8
Farmers association	10	16.7	3	5	3	5	16	8.9
Parents	1	1.7	7	11.7	14	23.3	22	12.2
Extension agents	44	73.3	45	75	33	55	122	67.8
Other sources	5	8.3	1	1.7	0	0.0	6	3.3

N= Number of households

4.1.5. Labor allocation for different dairy cattle activity practices

According to group discussion all members of the family can participate in all types of dairy cattle related activities except milking, processing the milk and selling dairy products but their level of participation varies across the types of activity. The respondents said that cultural taboo was restricted males from involving in milk selling and processing activities. Due to this reason, females (wives) perform milking, processing the milk and selling dairy products alone or in some households with the help of girl children. In the whole study districts wives (86.7%) and the rest by girls (13.3%) mainly performed milking. In contrary Milking was largely performed by husbands (44.7%) in the Amhara Region Metema district (Tesfaye, 2007)

The frequency of cleaning animals' barn varies from area to area and type of production system (Table, 7). According to the respondents in the study area barn cleaning was largely done by

females followed by males .slightly larger proportion of females are involved in barn cleaning in Damot Sore (45%) than Damot Woyde (43.3%) followed by Kindo Koisha (40%) district. Whereas the involvement of boys (10.6 %) and girls (17.8 %) was comparatively less (Table, 6)

Similarly, in all study areas females are the largest shares of responsibilities undertake in the feeding of dairy cattle, which are carried out inside and around homestead. In Damot Woyde, the proportion of responsibility of female (48.3%) was higher. whereas duties of females in Damot woyde (45%) and Kindo koisha (45%) areas were similar proportion. In the other hand boys were higher responsibilities mainly for herding and watering cattle's with the considerable share of males (fathers). Relatively task of boy children in the herding is lower in Kindo Koisha (33.3%) district than the two study districts (Damot Sore and Damot Woyde). In the lowland area (Kindo Koisha) the livestock herding particularly outside of the homestead in the large communal pasture land is done by groups a practice known as *wudea*, where Task of males (fathers) were shared larger responsibilities.

Table 6: Share of responsibilities in the dairy cattle activities among the family members in the study districts

Labor allocation	study district s %												over all			
	Damot Sore				**Damot Woyde**				**Kindo Koisha**							
	Female	Male	Boy	Girl	Female	Male	Boy	Girl	Female	Male	Boy	Girl	Female	Male	Boy	Girl
Milking (%)	90	-	-	10	91.7	-	-	8.3	78.3	-	-	21.7	86.7	-	-	13.3
Selling and Processing (%)	73.3	-	-	26.7	71.7	-	-	28.3	76.7	-	-	23.3	73.9	-	-	26.1
Barn cleaning	45	26.7	10	18.3	43.3	31.7	6.71	18.3	40	28.3	15	16.7	42.8	28.9	10.6	17.8
Herding%	11.7	28.3	43.3	16.7	8.3	25	51.7	15	8.3	40	33.3	18.3	9.4	31.1	42.8	16.7
Feeding Management%	48.3	31.7	11.7	8.3	45	35	11.7	8.3	45	30	18.3	6.7	46.1	32.2	13.9	7.8
Watering %	21. 7	10	46.7	21.7	28.3	21.7	41.7	8.3	16.7	36.7	41.7	5	22.2	22.8	43.3	11.7

4.1.6. Housing and waste management of dairy cattle

The experience of cattle housing in the three districts was presented in (Table, 7). Nearly all the households (93.3%) in the studied districts kept their cattle within the family house except for some (6.7%) of the respondents housed in separated home. Majority of the Respondents keeps their cattle with in family house were due to lack of space to construct separate shelter outside the main family house and fear of theft. Housing of cattle in the three districts was not statistically different (P>0.05). However, relatively used separate house from the main family residence was higher in the Kindo koisha than the other two study districts. Similar housing conditions were also reported by Asrat et al (2012) in Boditti and Bereda et al (2012) in Guraghe area. In contrary, 75.9% of households used isolated pen houses for their animals in *Bure* district reported by (Habtemariam, 2010).

Majority of the farmers (56.1%) used grass, (37.2%) corrugated iron and others (6.7%) such as plastic and plant leaves as a roofing material. In addition, all of the farmers (100%) the floor of the house were compacted soil or earth floor without any kind of pavement this leads to difficulty in effective manure removal in addition to high labor needed to clean the barn.

According to group discussion, farm yard manure was not commonly used as a source of fuel but they were used to fertilize homestead crops mainly for coffee, *enset*, maize, root crops and fruits This condition magnifies the importance of cattle dung in relation to land scarcity of the studied area. Waste management is one of the major routine activities in dairy production. So it is a must to properly clean manure and urines from the dairy house/shelter to assure good and hygienic environments. Majority of the respondents (56.7%) in the study areas were disposing dung from the barn once per day and this result is higher than (43.3%) reported by Teshager (2012)

Table 7: Cattle housing and waste disposal system in the study districts

Factors	*District of the study*							
	Damot Sore		*Damot Woyde*		*Kindo koisha*		*Over all*	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Type of housing								
keep cattle with people home	55	96.7	57	95	53	53	168	93.3
Others	2	3.3	3	5	7	11.7	12	6.7
Roofing material								
Corrugated iron	28	46.7	22	36.7	17	28.3	67	37.2
Grass	29	48.3	36	60	36	60	101	56.1
Others	3	5	2	3.3	7	11.7	12	6.7
Flooring material								
Mud	60	100	60	100	60	100	60	100
Concert	0	0.0	0	0.0	0	0.0	0	0.0
Frequency of disposing dung								
Once per day	44	73.3	38	63.8	20	33.3	102	56.7
Every two day	1	1.7	5	8.3	3	5	9	5
Evert three-day	15	25	22	28.3	17	36.7	54	30
Every four to five day	0	0.0	0	0.0	15	25	15	8.3

N=number of households

4.2. Cattle Type and Herd Composition

The mean cattle holdings with different breeds and herd structures in the three districts are presented in (Table, 8). The average numbers of cattle were higher in Kindo koisha with (12.1 heads/HH) than Damot woyde (6.57 heads/HH) and Damot sore (5.8heads/HH). The mean cattle holding difference is due to the availability of the vast communal grazing area and private landholding in the lowland area may account to higher cattle holdings than highland and midland areas. The overall mean cattle holding per household (8.15heads/ HH) and significantly differ among the three study districts ($P<0.001$).This result is comparable with mean cattle holding of (8.01) reported by Negussie (2006) for Mekelle area and much higher than (3.9) heads per household in Shashemene-Dilla areas reported by Nebiyu (2008)

Out of the mean cattle holding with different breeds (local and cross bred cattle's) per household in the study areas, cows (3.03heads/HH), calves (1.78 heads/HH) and oxen (1.31heads /HH) were found higher than the other herd types. On the other hand, heifers (0.86heads/HH) and breeding bulls (0.98heads/HH) were found in less proportion in the herd structure. When comparison is made, the mean holding of cow in the study area was smaller than (3.55±0.18) heads /HH reported by Teshager (2012) in the Illu Aba Bora Zone.

As indicated in the Table 8, out of the mean holding of different cattle breeds, local cow is the major one in the household herd structure with the value of (2.64±0.12). The result of this finding agrees with that of (Adebabay, 2009) in Bure district, (2.6 head/HH) and higher than 1.89 head/HH reported by Habtemariam, (2010) for *Bure* District, West Gojjam Zone

As survey revealed that, crossbred blood types of cattle (Holstein crosses and Jersey crosses) in the herd composition were fewer than local Zebu cattle in the whole study districts. Among the cross breed (Holstein cross and Jersey cross) cattle herd composition in the area, Jersey cross cows were higher proportion (0.19±0.04) followed by Holstein cross cow (0.15±0.03). However the contribution of Holstein cross cow in Demote sore (0.3) was highest, followed by Damot woyde (0.12) than Kindo koisha (0.03).This difference is probably due to dairy farmer's better access to get improved genotype cattle breeds, better awareness of artificial insemination (AI) and resistance to agro ecology.

The mean of local, Holstein cross and Jersey cross breed cows in the three study districts were 2.64, 0.15 and 0.19 per household, respectively. The result of this finding for local and Holstein cross cow agrees with the finding of Adebabay (2009) in *Bure* district which was reported that mean holding of local and Holstein cross cows were 2.6 and 0.2 per household, respectively. However, the total mean of local cow holding in the Illu Aba Bora Zone was 3.55±0.18 heads per household (Teshager, 2012), which is higher than the current finding.

Table 8.Harmonic mean and standard error of cattle herd size and composition in the studied districts

Herd type	Study districts			Over all	P
	Damot Sore	*Damot Woyde*	*Kindo Koish*		
Total cows	2.12±0.13[a]	2.32±0.15[a]	4.65±0.19[b]	3.03±0.12	***
Local cow	1.62±0.01[a]	2±0.13[a]	4.32±0.19[b]	2.64±0.12	***
Holstein cross cow	0.30±0.07[a]	0.12±0.0[b]	0.03±0.02[b]	0.15±0.03	***
Jersey cross cow	0.22±0.01	0.2±0.06	0.15±0.06	0.19±0.04	ns
Total heifers	0.73±0.09	0.82±0.09	1.02±0.15	0.86±0.07	ns
Local heifer	0.38±0.07[a]	0.57±0.08[a]	0.92±0.13[b]	0.62±0.06	***
Holstein cross heifer	0.23±0.07[a]	0.1±0.04[b]	0.02±0.02[b]	0.12± 0.04	**
Jersey cross heifer	0.12±0.41	0.17±0.06	0.08±0.04	0.12± 0.08	ns
Total local calves	1.28±0.11[a]	1.33±0.11[a]	2.73±0.15[b]	1.78± 0.09	***
Total cross calves	0.27±0.06	0.2±0.06	0.12±0.05	0.19± 0.03	ns
Total oxen	0.72±0.09[a]	0.98±0.11[a]	2.23±0.17[b]	1.31±0.03	***
Local oxen	0.72±0.09[a]	1±0.11[a]	2.23±0.11[b]	1.32±0.09	***
Holstein cross oxen	0.00	0.00	0.00	0.00	- --
Jersey oxen	0.00	0.07	0.00	0.02±0.02	ns
Total bull	0.68±0.09[a]	0.92±0.1[a]	1.35±0.14[b]	0.09±0.07	***
Local bull	0.42±0.07[a]	0.75±0.09[b]	1.27±0.14[c]	0.81±0.07	***
Holstein cross bull	0.12±0.05[a]	0.03±0.02[b]	0.02±0.02[b]	0.06±0.03	**
Jersey cross bull	0.08±0.04	0.13±0.05	0.08±0.04	0.1±0.03	ns
Mean Cattle holding per household	**5.8±0.57[a]**	**6.57±0.62[b]**	**12.1±0.85[c]**	**8.15±0.47**	***

*Means in the same row having different superscript are statistically different (P<0.05), HH=household; ns= not significant;*p<0.05, **p<0.01; ***p<0.001*

4.2.1. Cattle breeds and breeding techniques in the study districts

4.2.1.1 .Type of cattle Breeds kept by the respondent households

Dairy cattle breed improvement program, was launched in different parts of Ethiopia, particularly in the Wolaiyta zone in collaboration with the World Bank to achieve WADU (Hailemariam, 1994). Among the development effort was establishment of cattle breeding and multiplication center, introduction of AI, and distribution of cross breed bulls and heifers to the farmers. Supply of cross breed in Wolaita zone was in two phases: the first phase was in1971 and the second was 1987 by imported 90 Jersey breed heifers and two Jersey breed bulls from Zimbabwe and Kenya, respectively. As a result, the current study showed a number of farmers owned crossbred cattle (Holstein and Jersey cross breeds).Accordingly, out of the sampled respondents (N=180) the predominant cattle breeds in the study areas were local/indigenous breeds (56%), followed by both local and Jersey cross (17.8%), and both local and Holstein cross (15%).

Across all the study districts, majority of the farmers used local breeds, but proportionally higher in Kindo Koisha District (75%) than Damot Woyde (60%) and Damot Sore (35%). On the other hand, higher proportions of households owned a pair of local and Jersey cross breeds around Damot Woyde (20%) but less comparable proportion were found in Damot Sore (16.7%) and Kindo Koisha (16.7%). Households who owned pair of Holstein cross and local bred cattle were significantly higher in Damot Sore (31.7 %) than Damot Woyde (10%) and Kindo Koisha (3.3%) district ($P<0.001$). This might be due to farmers' better use of Artificial insemination (breeding technology), existence of more breeding Holstein cross bulls and better access to get Holstein cross heifers since the district is near to government ranch (Table 8).Among the reasons mentioned by the dairy farmers why they kept Jersey cross bred better than Holstein cross bred cattle were due to easy to manage (do not require lot of feed) and less frequent disease incidences and size of the bred that they have lack of space cattle house. The other reasons explained by respondents were due to better milk fat and short reproductive performance. This agrees with the earlier study reported by Tesfaye (1990) that the choice of the Friesian and Jersey breeds was suggested to be linked to feed availability and the potential market for liquid milk. In

addition the policy recommends Jersey cross for areas where milk had to be processed before reaching the market and where the feed availability is less promising.

Table 9: Type of cattle breed kept by the sampled respondents in the study districts

Variables	***Study districts***							
	Damot Sore		***Damot Woyde***		***Kindo Koisha***		***Over all***	
	N	%	N	%	N	%	N	%
Type of cattle breed								
Local breed	21	35	36	60	45	75	102	56.7
Local and Jersey cross	10	16.7	12	20	10	16.7	32	17.8
Local and Holstein cross	19	31.7	6	10	2	3.3	27	15
Jersey cross	1	1.7	1	1.7	0	0.0	2	1.1
Holstein cross	3	5	0	0.0	0	0.0	3	1.6
Local and both crosses	6	10	5	8.3	3	5	14	7.8

N=number of households head

4.3.1.2 Sources of the Cross breed cattle

The source of cross breed (Holstein and Jersey cross breed) in the studied districts were of the respondents were summarized in Table 10. Out of the total cross breed users majority of the respondents has got from local market/private owners (43%). The use of AI in the study area is higher than 24.1% of reported around Debrezeit milk shad, *Ada* District (Anteneh, 2008) and 25% reported for *Bure Woreda* (Habtemariam, 2010)

Table 10. Means of getting the first crossbreed cattle by the respondents in the study districts

Source of cross breed	*Study districts*							
	Damot sore		*Damot woyde*		*Kindo koisha*		*Over all*	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
From AI	15	37	11	31.4	2	12.5	28	27
From neighbors cross bull	8	19.5	7	20	2	12.5	17	17.3
From WCB&MC	3	7.3	3	8.6	1	6.3	7	7.4
From local market	15	37	12	34.3	9	56.3	36	43
From MOARD	0	0.0	1	1.9	0	0.0	1	0.6
From NGO	0	0.0	1	1.9	2	12.5	3	4.8

AI=Artificial insemination, WCB&MC=Wolaita cattle breeding and multiplication centre, MOARD=Ministry of agriculture and rural development.NGO=none governmental organization

4.3.1.3 Breeding techniques

Different initiative has been made to improve the local dairy cattle particularly in Ethiopia. Out of the different initiatives, established by AI service as early as in the late 1960s was mentioned by assistance of different developmental projects in different part of the country were mentioned. Out of them wolaita Zone is one of the semen distributer sub-centers out of the nine sub centers in Ethiopia. According to the current study in the three districts, the dairy producers used two types of breeding techniques .These are natural breeding and artificial insemination. Out of the sampled respondents (N=180) in the current study (52.8 %) of the households use natural mating. there was significantly higher ($p<0.05$) in the lowland study district than the two study districts in using the natural mating (Table 11). Science breeding technology was implemented in the study area there is better accessibility of breeding technology in all the study districts. However, among the reasons lowland farmers used natural mating was due to farmer's knowledge of AI/lack of awareness, due to the far distance to the AI station from farmers homestead with up and down topography and the other main reason mentioned by respondents were due to the unfavorable environment to the cross breeds. Using of natural mating for the current study is lower than (92.7%) of the respondents use natural mating for the study area in the Bure district (Adebabay, 2009).

Respondents in the study area were used either AI or both breeding techniques. About (12.2%) of the households used AI technique; whereas (35%) of the respondents used either of the two techniques (Table, 12). In the three districts, there is significant variation in using AI service (P<0.05) .The use of only AI in the current study was higher than the study conducted in Fogera *Woreda* (9.4%) by Belete (2006) and *Bure woreda* (1.75%) by (Adebabay, 2009)

Table 11: Types of breeding techniques used by the dairy participants in the study districts

Parameter	***Study districts***							
	Dmot Sore		***Damot Woyde***		***Kindo Koisha***		***Over all***	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***
Breeding mechanism								
natural mating	28 [a]	46.7	27[a]	45	40[b]	66.7	95	52.8
AI	11 [b]	18.3	6 [a]	10	5 [a]	8.3	22	12.2
Both techniques	21	35	27	45	15	25	63	35

N=number of household, Both technique=Natural mating and artificial insemination (AI)

4.3.1.4 Major AI service related problems in the study area

The AI service in the study Districts were solely provided by the Office of Agriculture and Rural Development (OARD). Based on the responses of respondents, personal observations and discussion with *kebele* DAs, the dairy producers were not used AI technique effectively. Among the reasons mentioned by the farmers for not using AI (Table 12) for majorities (39%) of the respondents in the studied area was due to AI station was very far from their residence .This was due to the AI service is provided by one AI technician in the AI station (Woreda town). However, Adebabay (2009) reported that lack of access to AI (77.3%) was the main problem for *Bure* district farmers. But very few (4.3%) farmers replied that distance to AI station was the main problem for access AI service. About (16%) respondents reported that the unwillingness of AI technicians and logistical problems were reasons for not using AI. Some farmers also mentioned other reasons such as lack of information/awareness (13.6%), environment disfavor to management of the cross breed (10.3%) , none effectiveness (7.4%), don't have any interest due to taboo based on cultural values (4.8%) and (7.9%) of the households raised other different

reasons such as fear of Dystocia by the assumption of the small Zebu cow not capable of bearing crossbreed fetus ,lack choice of Holstein Frisian semen and price of AI service were also mentioned by little respondents

Table 12: Major AI service related problems mentioned by the households in the study districts

Factor	***Study districts***							
	Damot sore		***Damot woyde***		***Kindo koisha***		***Over all***	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***
Reasons not using AI								
Distance from AI	14	33.3	15	35.7	23	47.9	52	39
Non effectiveness	4	9.5	1	2.4	5	10.4	10	7.4
Lack of interest	4	9.5	2	4.8	0	0.00	6	4.8
Lack of awareness/information	6	14.3	5	11.9	7	14.6	18	13.6
Environment disfavor them	1	2.4	5	11.9	8	16.7	14	10.3
Unwillingness of AI technician and logistics	8	19	10	20.8	4	8.3	22	16
multiple responses	5	11.9	4	9.5	1	2.4	10	7.9

N=numbere of households, AI=Arteficial insemination,

4.3. Feed Sources in the Study Districts

4.3.1. Feed sources used for cattle in the study areas

Animal feeds represent the major input in any dairy operation. Common feed resources in the studied areas varied between production systems. In the mixed crop/livestock production system, grazing and crop residues are the major feed resource. In addition, about (35.6 %) of respondents use purchased feeds in addition to their own production, while few (10.6 %) proportion of respondents their source of cattle feed were purchased from the market. The overall, majority of respondents use animal feed resources only from their own production (49.97%) in the current study was slightly lower than households use animal feeds from their own crop farm (53.7%) in Shashemene–Dilla area, South Ethiopia Sintayehu, et. al, (2008) .The study survey revealed that about (12.26 %) of the respondents spent more than 300 ETB per month , while others (34.06 %) and (49.97%) spent 201-300 ETB and 100-200 ETB, respectively for the purchase of feed.

Results of the study revealed that about 11 (12.26 %) of the respondents spent more than 300 ETB, while others 29 (34.06 %) and 36 (49.97%) spent 201-300 ETB and 100-200 ETB, respectively for the purchase of feed in the studied districts

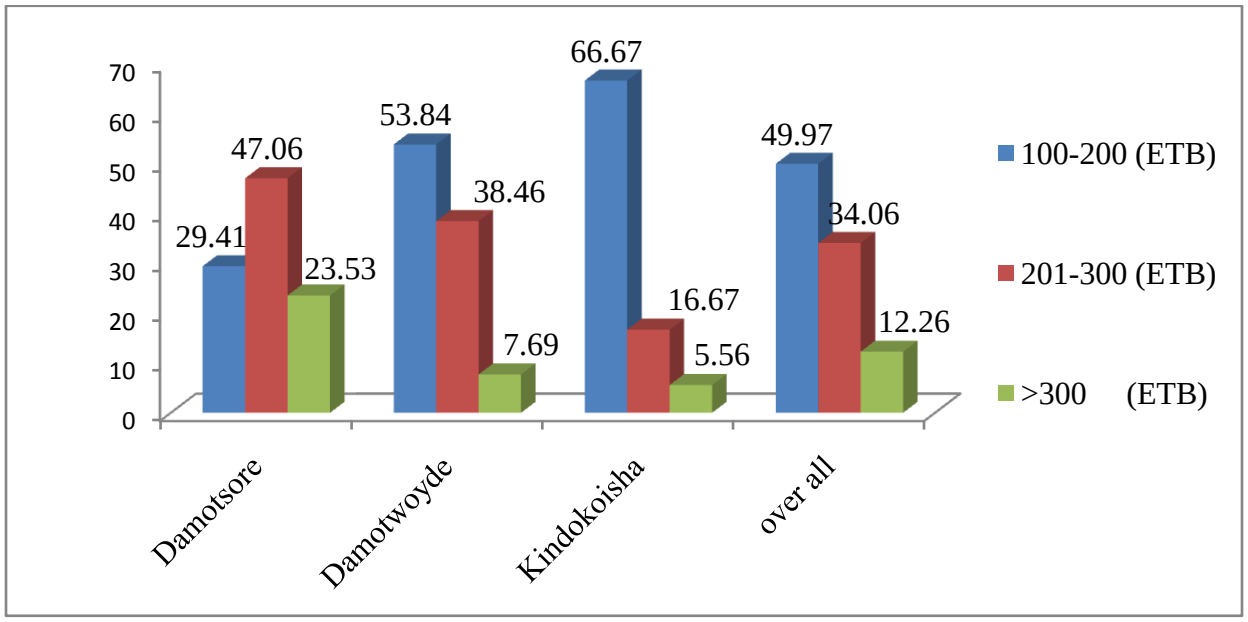


Figure 3. Money spent for feed per month for dairy cattle in the study districts

4.3.2. Types of crop residues and feeding practices

Crop residue was the major feed sources in the present study areas as is the case in most parts of the country as reported by Tolera (2009). In the current study area, annual food crops particularly cereals and root crops are dominant, and crop farming is highly integrated with livestock production, particularly with cattle. However, the availability and importance of each type of crop residue varied among the studied districts due to varied in agro ecologies. Accordingly, higher proportion of maize stalk was used around low land area (63.3%) than in mid altitude (33.3%) and highland area (30%). However, higher proportion of wheat (65%) was used in highland district whereas sorghum has no any contribution to the highland study area, again due to the variation in suitability of altitudes for growing the various crops. Likewise, Teff straw is the main source of crop residue but their importance is very limited in the studied districts. The reason was Teff straw in the area is used for construction of local house by mixed with mud, so it is much cost either to buy or purchase. In general, the majority of the respondents use crop

residues cattle feed specially in the late dry season and early wet season (Table, 13). This is because of low herbage yield obtained from natural pasture

Table 13: Types of crop residues used for cattle feed in the study districts

Variables	***districts of the study***							
	Damot Sore		***Damot Woyde***		***Kindo Koisha***		***Overall***	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***
Type of crop residue								
Teff strew	1	1.7	4	6.7	3	5.0	8	4.4
Sorghum	0	0.0	2	3.3	9	15	11	6.1
Faba bean straw	1	1.7	0	0.0	6	10	7	3.9
Maize stalk	18	30	20	33.3	38	63.3	76	42.2
Wheat straw	39	65	32	53.3	4	6.7	75	41.7
Others	1	1.7	2	3.3	0	0.0	3	1.7

N=number of households,

4.3.3. Improved forage cultivation practice

Improved forages have been introduced so far to wolaita zone through different developmental projects. However, the main reason for forage developments in the study areas were supply of forage seed to the farmers by the respective district Office of agriculture with Safety net project. The seeds were multiplied in demonstration centers and on farmer's road side farms and water harvesting. Farmers make use of the forages and at the same time harvest the seed and sale it to the respective district of agricultural Office. Accordingly, a number of farmers cultivated improved grasses species like Elephant grass, Rhodes grass and Desho grasses. Relatively, numbers of farmers (92.5%) in the highland areas have improved grasses followed by midland (77.5%) and lowland (75%) areas. There were significantly different ($P<0.001$) concerning cultivation of improved forage grass. This is might be due to difference varied in agro ecology and active participation of the farmers in forage development.

Among the improved legumes forages, Desmodium, Lucerne, and Lablab species had better contribution to dairy farmers in the areas. Proportionally, dairy farmers (6.1%) in midland were

cultivated forage legume than highland dairy producers (3.8%), but there was no any respondents replied for legume forage development in lowland area. With regard to tree legumes, comparatively less proportion respondents (3.8%) in highland studied areas have legume trees than the two-study sites (Table, 14).

Generally, majority (81.7%) of the respondents in the study areas had cultivated-improved grass followed by tree forage (15%) and legume forages (3.3%). The result on the proportion of the households experienced on improved grass development for the current study is higher than 61.7 % of the households in Illu Aba Bora Zone by Teshager (2012). In the study area, there are also problems related to improved forage availability. Among the reasons mentioned by the farmers for not growing forages in their lands were due to farmers owned small size of land (49.1%), lack of input (19.2%) and lack of labor (6%), and (25.7%) of respondents gave multiple responses such as drought(poor adaptability), lack of awareness and poor quality seeds.

Table 14: Improved forage cultivation practice and reasons for lack of forage cultivation

Parameters	***Study districts***							
	Damot sore		***Damot woyde***		***Kindo koisha***		***Over all***	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***
Type of forage Grown								
Grass	49	92.5	38	77.5	24	75	111	81.7
Forage legumes	2	3.8	3	6.1	0	0.0	5	3.3
Tree legumes	2	3.8	8	16.3	8	25	18	15
Reasons for not growing								
Insufficient of land	5	71.4	6	54.6	6	21.4	17	49.1
Lack of labor	1	14.3	0	0.0	1	3.6	2	6
Lack of input	0	0.0	2	18.2	11	39.3	13	19.2
Multiple response	1	14.3	3	27.1	10	35.7	14	25.7

N=number of household, Multiple response=such as drought, lack awareness and poor quality seeds

4.3.4 .Types of feed supplements

Supplemental feeding practice of cattle exercised in the area is presented (Table, 15). From the total sampled respondents (N=180) about 42.8% supplemented their cattle's .The most important feed resources used for supplements were wheat bran, corn bran oilseed cake, boiled maize and haricot bean. The overall, majorities (57.2%) of them supplemented wheat bran and corn bran, followed by oil seed cake (28.3%). According to the respondents and personal observation, the reason for the higher proportion of farmer supplied wheat bran and corn bran than Oil seed cake was due to the availability of large flour mills (*Hashshu Flour Mill PLC)* in the administrative town (Sodo town) in addition to wheat bran retail shops in the study district towns.

The order of importance to the different class of cattle's goes with the purpose of cattle in the areas. Among the class of cattle's the largest number of farmers supplied for both lactating and beef animals (81.7%) followed by lactating cows (8.2%) ,while few supplied class of cattle's were beef animals (6.9%), calves(1.9%) and pregnant cows (1.3%). This indicated that the primary aim of supplementing cattle was for better milk production and fattening.

Table 15: Type of feed supplements used for cattle in the study districts

Parameters	*Study districts*							
	Damot Sore		***Damot Woyde***		***Kindo Koisha***		***Over all***	
	N	**%**	***N***	***%***	***N***	***%***	***N***	***%***
Do you provide feed supplements?								
Yes	34	56.7	26	43.3	17	28.3	77	42.8
No	26	43.3	34	56.7	43	71.7	103	57.2
Type of supplements								
Wheat bran and corn bran	26	76.5	17	65.4	5	29.4	48	57.1
Oil seed cake	3	8.8	6	23.1	9	52.9	18	28.3
Boiled maize and haricot bean	5	14.7	3	11.5	3	17.6	11	14.6
Class of cattle fed the supplements								
For lactating cow	5	14.7	1	4	1	5.8	6	8.2
For pregnant cow	0	0.0	1	4	0	0.0	1	1.3
For calves	2	5.8	0	0.0	0	0.0	2	1.9
For beef animals	1	3	0	0.0	3	17.6	4	6.9
For lactating and beef animal	26	76.5	24	92.3	13	76.4	63	81.7

N=number of households

4.4 Water Source

Source of water, water related problem and distance to search water in the study area are presented in (Table, 16). Dairy producers' used different water resources for their animals. Majority of the farmers used river water sources (40%), followed by own well (*Ella*) (27.2%), pond (17.8%), pipe (13.3%) and other sources (1.7%). The total average of households use the river of the current study is similar with (40%) of the households in the Highlands and Central Rift Valley (CRV) of Ethiopia (Zewdie, 2010). However, respondents explained that the biggest problem for their animals, not accessing water, especially from the wells because they required labor to supply or lift water from the ground every time.

With regard to water related problem in the study area, scarcity of water was the major problem (63.3%), unhygienic /impurity (18.3%), lack of water resources (1.7%) and other problems (16.1%) such as parasite problems in addition to scarcity and accessibility due to lack of labor to supply water. Scarcity of water, especially in the lowland study area was a serious problem for peoples and animals. The scarcity, water (63%) under this study was higher than (53%) reported by Tsedeke (2007) for Alaba woreda. As indicating (Table 16), majority (60%) of the respondents travelled less than a kilometer from homestead to search water sources for their animals while 31.7% ,7.2% and 1.1% of the interviewed households indicated that they travelled (1-2 km), (3 -5 Km) and greater than 5 kms in getting the watering point, respectively.

Table 16: Sources of water and water related problems in the study districts

	Study districts							
	Damot Sore		***Damot Woyde***		***Kindo Koisha***		***Over all***	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***
Sources of water								
Pipe	16	26.7	7	11.7	1	1.7	24	13.3
River	21	35	24	40	27	45	72	40
Pond	4	6.7	5	8.3	23	38.3	32	17.8
Own well(Ella)	19	31.7	24	40	6	10	49	27.2
Others (spring water)	0	0.0	0	0.0	3	5	3	1.7
Water related problem								
Scarcity	29	48.3	39	65	46	76.7	114	63.3
Unhygienic /impurity	13	21.7	10	16.7	11	18.3	34	18.9
Lack of water resources	0	0.0	0	0.0	3	5	3	1.7
Other problems	18	30	11	18.3	0	0.0	29	16.1
Animals moved for searching water								
Less than 0.5km	45	75	40	66.7	23	38.3	108	60
From 1to2 km	15	25	17	28.3	25	41.7	57	31.7
From 3 to 5km	0	0.0	3	5	10	16.7	13	7.2
Greater than 5 km	0	0.0	0	0.0	2	3.3	2	1.1

N=number of households

4.5 Productive and reproductive performance of dairy cattle

4.5.1 Milk yield

The average milk yield/day of local cows in Damot Sore (2.11±0.09 liters /cow/day) was higher than Damot Woyde (1.89±0.05 liters/cow/day) and Kindo Koisha (1.38±0.02liters/cow/day) study districts. Similarly the milk yield of Holstein cross cow in Damot Sore was significantly higher (7.79±0.33liters/cow/day) than the two study districts (Table, 17). This relatively higher milk yield observed in the highland area might be due to the difference in the level of management and the farmers get other farm inputs, because the area is closer to zone town. The overall mean milk yield of local cows in the studied area was (1.79±0.05liters/cow/day).Similar result was reported (1.82 litter/cow/day) in *Bure* District (Adebabay, 2009). On the other hand, the milk yield of local cows for the present study was higher than (1.67 Littre/cow/day) in North Shoa zone, Amhara Region (Mulugeta and Belayneh., 2013).But the result is slightly lower than the average milk off take of 1.9±0.045 liter/cow/day in Metema district (Tesfaye, 2007).

The average milk yield obtained from Holstein cross cow in Damot Sore district was (7.79±0.33liters/cow/day).This value was more or less comparable to (7.8kg/day/cow) and (7.6±0.3litres/cow/day) reported for Northwestern highlands of Ethiopia (Yitaye, 2007) and in the highland areas (Debreberhan, Jimma and Sebeta) of Ethiopia by Zewdie (2010) respectively.

In addition the average milk yield of Jersey crossbred cows (4.06±0.19littre/cow/day) in Damot Sore District was significantly ($P<0.05$) higher than Damot Woyde (2.43±0.1litre/cow/day) and Kindo Koisha (2.06±0.07 Liters/cow/day) (Table 17). The higher milk yield produced from Jersey cross cow in Damot sore (4.06±0.19) was comparative with earlier reports with mean milk yield of 3.9 Littre for local Barka x jersey at Bako (Tesfaye, 1991) and 3.8 litter/day/cow for Jersey cross cow at Zimbabwe (Ngongoni *et-al*, 2006).But less than the average milk yield produced from Jersey x local Arsi (4.67 litter/cow/day) (ILCA, 1983).In general the present study showed that, milk production potential of indigenous cattle breeds was very low can temperate breeds .whereas Holstein crosses cows were better milk production than Jersey cross bred cows. The current finding was supported by Kefena et al, (2011) where Frisian crossbred dairy cows produced more milk than Jersey-bred cows.

4.5.2 Lactation length

The Average lactation length of indigenous cow in Damot Sore (9.8±0.38 months) was higher than Damot Woyde (8.64±0.27 months) and Kindo Koisha (7.23±0.13 months) studied areas. The reason for the short lactation length in the midland and lowland areas were might be due to availability of poor nutritional (encroachment feeds), prevalence of diseases and seasonal availability of water. The average lactation length of local cows (9.8±0.38months) in highland studied area was agree with study conducted in *Bure (9.8 months)* reported by (Adebabay, 2009). The overall lactation length of local cows in the studied area was (8.56±0.26 months). This value was closer to the recent study (8.87±0.12month) at the Ilu Aba Bora Zone (Teshager, 2012). However, higher than the value reported by Tesfaye (2007), Kedija (2007) for the indigenous cows at Metema district North Gonder Zone (5.9±0.14 months) and Meiso District (7.29 months), respectively. Similarly, the lactation length of jersey cross cow in the highland area was higher than midland and lowland area with (9.88±0.46 months), (8.71±0.34months) and (7.36±0.27 months) respectively. While the lactation length of Holstein cross cow was (10.8±0.45months), (9.58±0.38months) and (8.5±0.2 months) in highland, midland and lowland study areas respectively.

As indicted (Table 17) the overall mean lactation length of local cow, Jersey cross and Holstein cross cows was (8.56±0.26months), (8.65±0.36months) and (9.63±0.34 months), respectively. The overall lactation length of Jersey cross cow was almost similar but higher than that of local cow but shorter than lactation length of Holstein cross cow. This study is supported by (Kefena et al 2011), which is Jersey crossbred dairy cows have shorter lactation lengths and calving interval than Frisian crossbred dairy cows that reflects better reproduction efficiencies in Jersey crosses.

The overall mean lactation length of Jersey cross cow in the studied area was 8.65±0.36months. This result is less than the report of (EARO, 2001) which indicated that the average lactation length of Jersey crossbred cow was 276 day (9.2 months) .However, this is less than the average lactation length of Jersey cross cow in the highland studied area (9.8±0.46 months (Table 17).while, the overall mean lactation length for Holstein cross cow in the studied areas was (9.63±0.34months) which is higher than study conducted in Jimma town that is 9.13±1.99

months (Belay.*et al*., 2012). In contrary, the result is smaller than 333.9days (11months) of the study in North Showa Zone by (Mulugeta and Belayneh, 2013)

4.5.3 Age at first calving

As indicated in (Table 17) the average AFC for local the cow in Damot Sore, Damot Woyde, and Kindo Koisha study area was (46.54±1.71months), (49.3±1.19months) and (52.03±0.5 months), respectively. Whereas the AFC for Holstein cross was (34±1.42 months), (38.94±1.52months), (45.7±1.07months) in the highland, midland and lowland study areas, respectively. There were significant ($P \leq 0.05$) variations among the breeds within the three study areas AFC of the local cow, Jersey cross, and Holstein cross cows. The overall mean age at first calving of local cow and Holstein cross cow in the studied areas were (49.29±1.13 months) and (39.55±1.34 months) respectively. This result is similar to the mean AFC of (49.37±0.25 months) for local cow reported by Teshager (2012). The finding of the average mean AFC in the present study was slightly higher than (47.16 ± 8.7 months) and (37.95 ± 9.4 months) for local cow and Holstein cross cow in smallholder dairy producer in North showas zone, Amhara, Region (Mulugeta *etal,* 2013). By contrast, higher AFC was reported for Boran x Holstein-Friesian F1 crossbred dairy cows (53.9 months) at the Abernosa Ranch (Ababu *et al*., 2006) and 4.5year (54.4 months) for AFC of local cow in Metema District (Tesfaye, 2007).

In this study, Jersey cross breed cows are younger at AFC than Local and Holstein cross breed cows in the three studied districts. In addition, AFC varied between study areas. The variation in the AFC between breeds and locations is probably due to the difference in genotype, management, feeding systems, occurrence disease and draught especially in the lowland study areas. As indicated in (Table 17) the average AFC of Jersey cross breed cow in Damot Sore , Damot Woyde and Kindo Koisha areas were (29.33±1.37 months) ,(35.68 ±1.40 months) and (42.4±1.53 months), respectively. The average AFC of Jersey cross cow in the Damot Sore area is slightly higher than 28.5 months and the 29.2 months reported for Jersey xArsi and Friesian x Arsi, respectively, at Assela, Ethiopia (Negussie et al 1998). On the other hand, the finding of AFC in the present study was lower than 36.7 and 40.1 months estimated for crossbred dairy heifers in smallholder dairy farms in Malawi (Agyemang and Nkhonjera 1990).

4.5.4 Calving interval

As shown in (Table, 17), the average calving interval of local cows in Damot Sore, Dmot Woyde and Kindo Koisha was (16.92±0.69 months), (17.83±0.53 months) and (20.69±0.27 months) months, respectively .While the mean calving interval for Jersey cross bred cow in Damot sore, Damot Woyde and Kindo Koisha area was (12.59±0.59 months),(15.12±0.59 months) and (17±0.62 months),respectively. Likewise calving interval for Holstein cross were (14.7±0.62 months), (16.46±0.64 months) and (17.35±0.45 months) in Damot Sore, Damot Woyde and Kindo Koisha respectively. There were variations among the breed and within the breeds in the three studied districts. Ingenious cows were generally longer calving interval than exotic blood cattle's. However, Jersey crossbred cow was better and shorter calving interval than Holstein Frisian cross. This variation could be associated with genotype difference, lack of breeding management, agro ecology to particular area, disease prevalence, lack of own bull and improper use of inputs (AI and Feeds)

The overall mean calving interval of local cow, Holstein cross and Jersey crossbred cows were (18.48±0.5), (16.17±0.5) and (14.9±0.6) months, respectively. The value obtained mean calving interval for local cow (18.48±0.5 months) in the present study was almost similar with (18.76±0.23) months for indigenous cow in the Ilu Aba Bora Zone, (Teshager, 2012) and (18.6 month) in Oromia region Workneh and Rowland (2004) and18.6 months (559 days) for Fogera cows at the Metekle Ranch (Addisu and Hegede, 2003). But the average mean calving interval of Holstein cross in this study was slightly higher than (15.4 months) conducted in Selale area Gashaw (1992) and 14.3 months (kiwuwa, et al. 1983). In contrary, the result found in the current finding is smaller than 748.2 days (24.9 months) and 660 days (22 months) of indigenous cow and their cross Holstein Frisians in North Showa Zone (Mulugeta and Belayneh, 2013).The average mean calving interval for Jersey cross in the study area was 14.9±0.6 months. Similar results were reported by Omar (2008) which indicates the calving interval of Jersey x Local were (14.08±0.62 months). In the other hand slightly lower calving interval were reported for Jersey x Local Arsi and Holstein Friesian x Local Arsi which is 411 days (13.7 months) and 456 days (15.2 months) respectively (Gabriel, *et al*.1983).

4.5.5 Weaning age

There was significant variations (Table, 7) among the studied district on weaning age of the local calves at ($P<0.05$). While the weaning age of Holstein cross and jersey cross calves among the studied districts did not significantly different. The total weaning age of local, Holstein cross and Jersey cross calves were(8.34±0.25),(9.1±0.2)and (7.66±0.31) months , respectively .The result of weaning age of local calves in the current study were smaller than (9.9± 0.283) months reported by Tesfaye (2007). The survey revealed that, Holstein cross calves were longer weaning age, followed by local breed calves, while Jersey cross calves were shorter weaning age in the whole study districts. (Table, 17)

Table 17: Productive and Reproductive performance of dairy cattle in the study districts

Variables	*District of the study*			*Overall*	*P*
	Damot Sore	*Damot Woyde*	*Kindo Koisha*		
Daily milk yield (kg)					
Local cow	2.11±0.09[a]	1.89±0.05[a]	1.38±0.02[b]	1.79±0.05	***
Holstein cross	7.79±0.33[a]	6.3±0.25[ab]	3.03±0.07[b]	5.7±0.21	*
Jersey cross	4.06±0.19[a]	2.43±0.1[b]	2.06±0.07[b]	2.85±0.12	*
Lactation length (months)					
Local cow	9.8±0.38[a]	8.64±0.27[a]	7.23±0.13[b]	8.56±0.26	***
Holstein cross	10.8±0.45	9.58±0.38	8.5±0.2	9.63±0.34	ns
Jersey cross	9.88±0.46	8.71±0.34	7.36±0.27	8.65±0.36	ns
Age at first calving (months)					
Local cow	46.54±1.71[a]	49.3±1.19[b]	52.03±0.5[c]	49.29±1.13	***
Holstein cross	34±1.42	38.94±1.52	45.7±1.07	39.55±1.34	ns
Jersey cross	29.33±1.37[a]	35.68±1.40[a]	42.4±1.53[a]	35.8±1.43	ns
Calving interval (months)					
Local cow	16.92±0.69[a]	17.83±0.53[b]	20.69±0.27[c]	18.48±0.5	***
Holstein cross	14.7±0.62	16.46±0.64	17.35±0.45	16.17±0.57	ns
Jersey cross	12.59±0.59[a]	15.12±0.59[a]	17±0.62[a]	14.9±0.6	ns
Weaning age of calves (months)					
Local calves	9.17±0.35[a]	8.21±0.25[a]	7.63±0.14[b]	8.34±0.25	*
Holstein cross	9.6±0.4	8.52±0.34	9.25±0.22	9.1±0.2	ns
Jersey cross	8.3±0.39	7.63±0.3	7.05±0.25	7.66±0.31	ns

*Means in the same row having different superscript are statistically different (P<0.05); ns= not significant;*P<0.05, **P<0.01; ***P<0.001*

4.6. Milking Practice

Calves were allowed to practically suckle their dams prior to milking this is due to producers believe calf suckling for milk let-down. Udder and hand washing prior to milking was unknown. And cows were hand milked after the milk wet their hands with a strip of milk plastic jug was used for milking while clay pot was used for storage and processing. As indicated (Table, 18) the frequencey of milking in the study area was performed two to three times per day. For cows milking twice, a day was during morning (6-7 am) and early evening (4-5 pm) while for the three times milking cows was at morning (6-7 am), midday (12 am-1 pm) and evening (7-8:30 pm). This indicates that they did not bother about the regularity of milking time or there is no fixed time schedule for milking though it affects yield.

Out of the interviewed dairy producers, higher proportions of the respondents (62.2%) were milking their cows thrice a day. The current result for milking frequency thrice a day was almost similar with the result in around Boditi, Southern Ethiopia, where (65%) of the respondents milking their cows was thrice a day (Asrat *et al.*, 2012). In addition Beyene (1994), noted that, in some Enset producing areas of the Wolaita Zone, farmers milk their cows thrice a day. As opposed, this Yigrem (2008) noted that very few farmers (3.3%) in Shashemene and Dilla areas milking their cows thrice day.

Farmers who have experience fermented milk in the study area were used different ways to know whether the fermented milk is ready for churning or not. Among these techniques, 52%, 29.1%, 17.2% and 1.7 % of the total respondents used by physical compactness of the fermented milk , milk volume , others like smell of milk and the color of milk , respectively. Majority of the farmers decided the milk to be ready for churning by the way of physical compactness of the fermented milk. To process fermented milk different local materials was used such as clay pot and others like plastic bottles (*jerikan).* Farmers also used several types of plants/herbs for smoking milking equipments, while commonly four plants were used for smoking purposes Table (18)

Table 18: Milking practices and milk processing in the study districts

Factors	Study districts						Over all	
	Damot Sore		Damot Woyde		Kindo Koisha			
	N	%	N	%	N	%	N	%
Frequency of milking per day								
Morning and evening	14	23.3	20	33.3	34	56.7	68	37.8
Morning ,mid day and evening	46	76.7	40	66.7	26	43.3	112	62.2
Experience of processing milk								
Yes	60	100	58	96.7	46	76.7	164	91.1
No	0	0.0	2	3.3	14	23.3	16	8.9
Indicator for processing								
Volume of FM	26	43.3	18	31	6	13	50	29.1
The color of the FM	0	0.0	0	0.0	3	5.2	3	1.7
Physical compactness of FM	27	45	32	55.2	25	54.3	84	52
Others	7	11.7	8	13.8	12	26.1	27	17.2
Smoking plants								
Gulluwa	30	50	38	63.3	18	30	86	47.8
Guccachchaa	10	16.7	12	20	25	41.7	47	26.1
Kosorotya	14	23.3	2	3.3	16	26.7	32	17.8
Shaashshaa	6	10	8	13.3	1	1.7	15	8.3

N=Number of households, FM=fermented milk

4.7 Milk Utilization Pattern

Source of milk used for regular consumption and processing by households in the study districts were totally from cows unlike many lowland areas where households commonly utilize goat milk. In the Kindo koisha district goat milk is considered to have medicinal values and only given to elders and children. The average volume of milk produced per day/HH in Damot Sore area (4.35±0.43litter) was relatively higher than the average volume of milk produced/day/HH in Kindo koisha (4±0.23Litter) and Damot woyde (3.8±0.3littre) districts .This is might be due to higher number Holstein and Jersey cross milking cows available in Damot Sore and it may happened increased volume of milk produced per day per household than the two studied

districts (Table,19) .The overall milk volume per day per household in the study area was (4.05±0.32littre) .This is higher than (3.0 Litters) reported for East Shoa Zone of Oromia (Lemma *et al.*, 2005) as well as in Shahsemene-Dilla areas (1.97±0.24 liters to 2.84±0.28 liters) (Sintayehu, 2007).

Milk produced in the household was utilized either fresh or after being processed into other products .Out of the total fresh whole milk volume produced per day per household the large proportion of milk (65.6%) was used for processing mainly into butter. About half of the total processed milk (34.6%) was consumed directly as fresh whole milk. while little (2.1%) portion of milk was used for sale. Among the reasons explained by the respondents to the high proportion of milk processed was due to distance and lack of access to market to low price of whole milk prefers processing mainly for butter. The sale of fresh milk was, as a bit higher in Damot Sore (4.82%) than Damot Woyde (1.32%).While none of respondent's completely fresh milk was a sale in the Kindo Koisha district. In general, this survey revealed that in the three study districts a little portion of milk was sold to milk market outlets. This clearly points out that dairy production in the current study area with fresh whole milk is not market oriented. According to group discussing with the key informants it was explained that that sale of fresh milk and consumption was uncommon due to the low quantity of milk produced particularly during the dry season and cultural believes particularly sell of fresh milk.

Table 19: Total volume of milk production per household and utilization pattern in the study districts

Variables	*Study of the district*			Over all	P
	Damot Sore	**Damot Woyde**	**Kindo Koish**		
	Mean (SE)	**Mean (SE)**	**Mean (SE)**	**Mean (SE)**	
TMprd/HH	4.35±0.43	3.8±0.3	4±0.23	4.05±0.32	ns
Milk utilization (%)					
For home consumption	26.9[a]	25.26[a]	49.5[b]	34.6	***
For processing	67.82[a]	78.42[a]	50.5[b]	65.58	*
For sale	4.82	1.32	0.0	2.0	ns

*Means in the same row having different superscript are statistically different (P<0.05); ns=not significant;*P<0.05;***P<0.001, SE= standard errors, HH= Households, TMPrd/HH = Total milk produced per household*

4.8. Marketing of Milk Products at Studied Districts

Experience of selling milk and milk products in three study districts were presented (Table 20). Most of (83.3%) of the Households in the study districts had experience of selling milk and milk products, while fewer (16.1%) proportion of respondents did not sell. Comparatively more inhabitants (98.3%) in the highland study areas were involved in selling milk and milk products than mid land (86%) and low land study areas with (P<0.001).This difference result might be due to farmers in the highland area owned a higher number of high yielding exotic blood cows and access good market opportunities due to the nearness the rural *kebeles* to the market sites this results large number of traders engaged in the area.

According to the survey result (Table, 20), the largest number of respondents (85.1%) was sold butter followed by a local cheese (31.5%). This is may be due to absence of milk collection centers and traditional beliefs. This survey result for sold butter is lower than (95.1%) reported for Ilu Aba Bora Zone by (Teshager, 2012) and more than (90%) of the respondents sold their butter in Metema district, (Tesfaye, 2007) and higher than (56%) Butter was the main product sold in the Central Rift valley (Zewdie, 2010).

Out of (83.9%) experience of selling dairy products in the studied area very few respondents (3.4%) in the highland study area involved in selling raw milk and none of them were sold raw

milk in midland and lowland studied areas .This indicates that the households who participate on the large amount of butter sale in the highland area participate more on milk sale. the reason why not sell the raw milk in mid land and low land is Difficulty in market access (absence of milk collection centers),traditional beliefs, need to process, Remoteness and seasonal variation in milk production .The same result was reported by Lemma *et al. (*2005) indicated that about 96.7% of the respondents in Adami Tulu and Arsi Negelle as well as about 93.3% in Lume districts did not sell fresh milk largely due to cultural taboo and market limitation. in contrary (78%) of the respondents in around Mekele area were sold milk in fresh form,(Negussie, 2006).

As gathered from dairy producers and other marketing agents, the dairy marketing system in the studied areas was entirely informal. The price butter was set through negotiation between producers and buyers and varies considerably depending upon fasting and non-fasting period. The potential buyer of butter in the studied areas were traders (66.8%) followed by urban consumers (27.9%), where as tea houses and hotels (5.9%) had insignificant contribution as a potential buyer of butter in the studied area. This finding is almost similar to the study conducted in Metema District (Tesfaye, 2007).

According to the difference butter-marketing agents and personal observation, butter is highly traded outside of the Zone in *Addis Ababa*, *Shashamane, Hawassa, Yirgalem, Dila,* among other towns. There are traders who are engaged in butter transaction within and out of the Zone. Furthermore, *Wolaita* butter is formally processed and has brand name called *Wolaita Kibe*".The current study is similar with studies conducted in Fogera *woreda* similar marketing structure where butter produced in rural areas is Sold and consumed locally but also sold in external markets (Addis Ababa) through a system of inerrant traders. The other thing is most of (83.3%) of the respondents to deliver milk and milk products to market place was used by traveling on foot, while the rest 16.1% and 0.6% were using pack animals and public transports respectively .

Table 20: Marketing practice of milk and milk products by household in the study district

Type of products	Study districts							
	Damot Sore		Damot Woyde		Kindo Koisha		Over all	
	N	%	N	%	N	%	N	%
Do you sell dairy products?								
Yes	59	98.3	52	86.7	40	66.7	151	83.9
No	1	1.7	8	13.3	20	33.3	20	16.1
Type of dairy product s sold								
Row milk	6	10.17	0	0.0	0	0.0	6	3.36
Fermented milk	2	3.39	0	0.0	0	0.0	2	1.13
Butter milk	4	6.78	0	0.0	4	10	8	5.59
Butter	55	93.22	44	84.62	31	77.5	130	85.11
Cheese	16	27.12	22	42.3	10	25	48	31.47
Others	2	3.39	0	0.0	0	0.0	2	1.13
Who is your butter buyer								
Trader	33	60	32	72.73	21	67.74	86	66.82
Tea house and hotels	5	9	1	2.27	2	6.45	8	5.9
Urban customer	17	30.9	12	27.27	8	25.81	37	27.99
Means of delivery								
Traveling by foot	39	65	52	86.7	59	98.3	150	83.3
Using draft animals	20	33.3	8	13.3	1	1.7	29	16.1
Public transport	1	1.7	0	0.0	0	0.0	1	0.6

N=number of households

Price of butter and distance to market milk and milk products in the study areas are presented in (Table, 21). During the survey period, the minimum and maximum price of butter in Damot Sore area was 90 ETB and 118 ETB per kg, respectively, Which was higher price than the two study areas,($P<0.05$). This is probably due to the area is closely to zone town may higher demand, comfortable environment (availability of infrastructure) and number of external traders engaged in the area and farmers sell their products in the marketplace rather than farm gate . The overall mean price of butter in the study area was between the minimum of 85 ETB per kg and maximum of 98.3 ETB per Kg. This is much expensive than the recent price of butter

(60.99±0.71) ETB in Ilu Aba Bora Zone (Teshager, 2012). In addition the current surveyed price of butter was quite expensive than earlier reported by Ayantu (2006) in around Wolaita area. That was 23.7 ETB in the wet season and 29.7 ETB in dry season.

Average distance to milk and milk product market centers was analyzed as an indicator of access to market (Table 21).Dairy producers at Kindo Koisha were relatively traveled long distance (14.99±0.46 km) to milk and milk product market .while dairy farmers in Damot Sore district had easy access to dairy product market with a average distance of (8.99±0.42 km) followed by dairy farmers in Damot Woyde (12.27±0.52 km) .This indicates that the three districts were differed significantly at ($P<0.05$) in distance travel to milk and milk product market .The overall average distance traveled to market milk and milk products in the study areas were 12.08±0.46 Km, and which ranged from 3.5-21km .

Table 21: Households distance to dairy products market points in the studied districts

Variables	District Of the study	***N***	***Mean ± SE***	***Minimum***	***Maximum***	***p***
Price of butter						***
	Damot Sore	55	100.6±0.6[a]	95	118	
	Damot Woyde	44	85.68±0.33[b]	90	99	
	Kindo Koisha	31	68.34±0.46[c]	70	78	
	Overall mean	130	84.87±0.46	85	98.3	
Distance to market						***
	Damote Sore	60	8.99±0.42[a]	3.5	16	
	Damot Woyde	60	12.27±0.52[b]	5	19	
	Kindo Koisha	60	14.99±0.46[c]	6	21	
	Overall mean	180	12.08±0.46	3.5	21	

N=*Number of households, SE=standard error*

4.9 Major Constraints of Milk production and Marketing in the Study Areas

Dairy production and marketing in the studied area were constrained by different factors. Producers in the studied area identified the major problems and constraints according to their

degree of importance as shown in Table 22, below. These include feed shortage, land shortage, water shortage, shortage of genetically improved dairy animals, poor animal health services, poor extension services (credit) regarding improved dairying.

4.9.1 Feed shortage

Wolaita zone is one of the populated areas in the region. Due to high population density of farmers holding of grazing land is none or very small particularly in the highland and the midland area of the studied districts. In addition, grazing land have been continuously taken to croplands. This has led to overgrazing of pastures and land degradation. For these reasons, feed shortage has become a serious problem for the dairy producer's particularly in the dry season. As indicated in Table 22, about 24.4% of the total respondents in the studied districts were reporting a feed shortage as first for cattle productivity particularly in the dry season. In Bure district by (Adebabay, 2009), 47.5 % of the respondents faced feed a shortage, which is higher than the current study. The availability of feed resources is relatively better during the wet season. On the other hand, there is scarcity of feed during the dry season (i.e. from January to May).

Table 22, Ranks of dairy cattle production and marketing constraints by the household in the study district

	Study districts %											
	Damote Sore			***Damot Woyde***			***Kindo Koisha***			**Over all**		
	R1	***R2***	***R3***	***R1***	***R2***	***R3***	***R1***	***R2***	***R3***	***R1***	***R2***	***R3***
Feed shortage	35	38.3	13.3	38.3	21.6	15	0.0	10	30	24.43	23.3	19.4
Water shortage	0.0	3.3	16.7	18.3	28.3	11.7	30	28.3	18.3	24.15	19.96	15.6
Disease	10	11.7	16.7	6.7	26.7	13.3	43	28.3	5	19.9	22.23	11.7
Shortage of land	43.3	28.3	13.3	26.7	8.3	26.7	8.3	11.7	6.7	26.1	16.1	6.7
Lack of capital	8.3	13.3	8.3	5	5	5	1.7	1.7	3.3	5	6.7	5.5
breed improvement	1.7	3.3	6.7	3.3	1.7	0.0	8.3	10	10	4.43	5	5.6
Market access	1.7	1.7	10	1.7	5	13.3	6.7	16.7	13.3	3.4	7.8	12.2
Other	1.7	1.7	10	0.0	3.3	15	1.7	8.3	13.3	1.1	4.43	12.8
Total	100	100	100	100	100	100	100	100	100	100	100	100

R1, R2and R3 are the first, second and third ranked constraints, respectively

4.9.2. Strategies to cope up feed shortage

Respondents faced feed shortage to their cattle and methods of alleviation are presented in (Figure 4). Out of the total sampled respondents (66.3%) of them faced a feed shortage to their cattle particularly in the dry season. Majority (71.8%) of the farmers used, stored feed (crop residues) and enset leaves to alleviate feed shortage. This study revealed that farmers in midland (86.5%) and highland (71.79%) agro ecologies were highly dependent on crop residues and enset leaves as a means of alleviation feed shortage than the lowland (57.58%) ,studied areas . About (10%) of the respondents in the lowland areas were transferring their animals to neighbors *kebele* near to Omo river which is found at the border of the studied district (Kindo Koisha) and Dawro Zone ,where large communal pasture (stand hay) land is available. On the other hand, out of the total respondents (18.09%) of them used multiple mechanisms such as grow improved forages, provider of soil salt by mixing with left over from human consumptions, some respondents were used sale of animals as a last option during feed scarce period.

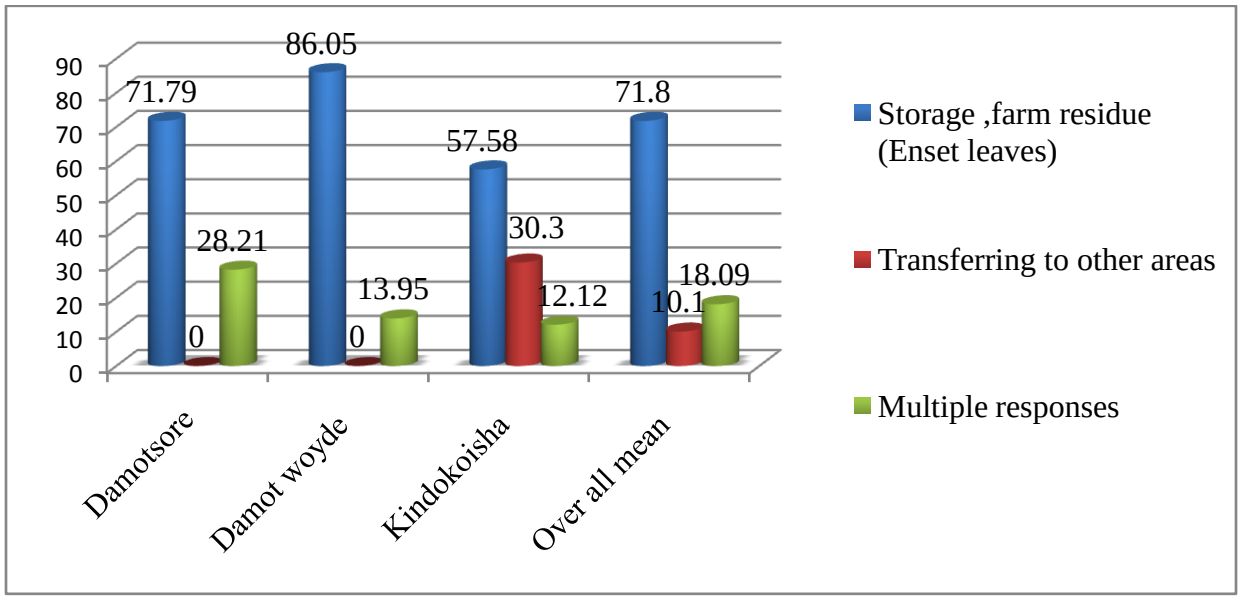


Figure 4: Strategies followed by households to cope up during period of feed scarcity in the study districts

4.9.3 Water shortage

Out of the total respondents (24.15%) of them are ranked the water scarcity in the first major constraints of livestock production (Table 22). According to the survey data water shortage was a serious problem in kindo Koisha compare to the two-studied districts (Damot Sore and Damot Woyde). Due to this reason majority of the respondents in Kindo Koisha area was ranked the second most cattle production constraint followed by disease prevalence.

4.9.4 Major cattle disease types and method of control strategies

As Table 22, showed, about (43.3%) of the respondents in Kindo Koisha, disease was ranked first as a major problem of cattle production in the area. This is higher than the highland (10%) and the midland (6.7%) areas. In the studied districts the intensity and type of disease are different.

The survey data revealed that, the occurrence of different types of animal disease in the three study districts were ranked Based on their relative degree of importance .For instance Black leg (30%) and Pneumonia (26.7%) were ranked as first and second major prevalent diseases in Damot Sore area while Anthrax (26.7%) and Black leg (21.7%) were ranked the major diseases in Damot Woyde district. Similarly, Responses by farmers indicate that Tripanosomosis infection was the third major prevalence diseases' in Damot Woyde (16.7%) and Damot Sore (13.3%). By contrary the Occurrence of this disease was first highly damaging animals in Kindo Koisha (38.3%) followed by Anthrax (25%) and Ticks (23.3%). From this study result, it is possible to conclude that agro-ecology to the variation in the distribution and abundance of the diseases in animals. Respondents were calling the diseases by the local name. Based on the overall data and obtained secondary data from veterinary experts the major health problem of cattle in the study area were Dulo (Antrax), Shihula (Tripanosomosis), Tilikia (Blackleg), Tick and Pneumonia. In addition, other Disease was reported with minor a degree of importantance includes; Mastitis, FMD, Liver fluke, Lungworm and Dystocia. Among the least economically important diseases, mastitis is the major prevalence disease in milking cows that causes decreased milk production (Table, 23)

In order to minimize the economic losses due to diseases, farmers were using different control and prevention measures. The overall result showed that (Table, 23) out of the total respondents (78.3%) were using both modern and traditional veterinary practices, very significant proportion of the farmers (4.4%) were useing modern veterinary service only, and (17.2%) were used only traditional medicine to treat their animals. similar results were reported for Metema district by (Tesfaye, 2007), 17.8% of respondents were used cultural medicine to treat sick animals

As gathered from key informants, traditional treatment mostly involves plant extracts administered differently depending on the type of disease. For instance Pneumonia was treated by orally given extracted herbs (like *godareuta, dachi marachia, chaltia, bosha* and *mimia*) with temusha.This kind of treatment measure was practiced in the whole studied areas. However mostly practiced in the highland studied District .Because pneumonia was a serious problem in the highland studied district (Table, 23). In the other hand, respondents were treated as external parasites of cattle by practicing mixture of Butter and naphtha (Disel) while Trypanosomiasis was treated by crushing the leaves of *Tenadam, bud of Bisana* and *pepper* mixed with water and give orally to the animal. AS explained by the respondents Anthrax has no any traditional treatment and it is transmitted from animals to humans by eating infected animal meat. Respondents said that when animal death is infected with Anthrax, the only option was burning /disposal/ of the carcass.

In addition, in whole study districts the farmers were made effort to control and treat the diseases by vaccination and treatments in governmental and other institutions. The major reported sources of veterinary services were government (73.9%), private (16.3%), both government and private clinics (9.3%) and very significant proportion of farmers (0.62%) were obtained veterinary service from NGO specially to minimize the risk of Trypanosomiasis infection in lowland study district. Relatively, respondents that used animal health services from private clinics were higher in the lowland study district (42.59%) than midland (3%) and none in highland district.

According to the respondents and district animal health experts reported, the main animal health problem were lack of enough medicine for all diseased animals, less frequent animal health

service, remoteness of animal health centers, lack of skilled animal health technicians. In addition, lack of budget Perdium and chemicals were also mentioned as limiting factors affect animal health in the whole study districts. On the average Largest number of farmers (53.3%) travel about 1to 1.5 Kms, (27.8%) of them were travel 1.6 to 3km km, (15%) of them travelled 3.1 to 5 and (3.9%) of the respondents were travelling more than 5 Kms to get an animal health center.

Table 23: Rank of common cattle disease by the household in the study districts

Type of Disease	***Study districts***															
	Damot Sore				***Demot Woyde***				***Kindo Koisha***			**Over all**				
	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Iindex
FMD	0.0	1	9	0.031	3	3	8	0.069	2	5	5	0.064	1.7	3	7.3	0.054
Liver fluke	0.0	3	11	0.047	3	5	10	0.087	0	1	10	0.031	1	3	10.3	0.055
Lung worms	3.33	0	9	0.042	1	0	3	0.018	0	0	6	0.017	1	0	6	0.026
Black leg	30	12	3	0.225	13	18	7	0.209	5	14	9	0.146	12	14.7	6.3	0.193
Anthrax	20	17	2	0.2	16	0	5	0.161	15	15	5	0.224	14.3	16.3	4	0.581
Pneumonia	26.7	3	1	0.152	5	3	0	0.063	0	1	0	0.005	7	2.3	0.3	0.073
Tick	3.33	2	12	0.061	7	10	2	0.161	14	12	3	0.193	7.6	8	5.7	0.138
Dystocia	0.0	2	1	0.014	1	3	1	0.030	0	2	6	0.028	0.33	2.3	3	0.024
Mastitis	3.33	7	10	0.083	1	3	4	0.039	0	3	2	0.022	4.3	4.3	5	0.048
Tripanosomiasis	13.3	13	2	0.144	10	15	10	0.212	23	7	12	0.266	13.7	11.7	8	0.207

Index = *[3 for rank 1) + (2 for rank 2) + (1 for rank 3)] for each of the factor divided by sum of all of the factors*

4.10 Major Opportunities for Milk Production (dairy development in the Study districts

- According to the key informants , the major opportunities for dairy cattle production in the study areas include availability of good agro ecological zone, water sources, emphasis for infrastructure by government, availability of cattle breeding and multiplication center, presence of research centers, higher educational institutes, training availability, the presence of governmental and non- governmental organizations who are involved partially in dairy cattle improvement are good opportunity for dairy producers to access information for milk production and use of the farm inputs. As the result, majorities of dairy producers are accessing knowledge on dairy production improvement from other dairy producers.
- Presence of regional veterinary laboratory in the zone is also important to develop strategic diseases control scheme especially to commonly occurring infectious diseases like anthrax, black leg and tripanosomiasis as well as to maximize health service coverage of the area.
- The area is very densely populated in addition to rapidly growing urbanization from time to time. This makes the dairy producers more profitable as a result of high market demand for animal products and ever increasing the price in general the income level of households will increase by success of market-led dairy development

- Farmers in the study area were found to have two to three main cropping seasons per year and good habit of cropping by intercropping different crops. This is the best opportunity to supplement their cattle's by crop residues. In addition, implementations of forage development practice have been started so far by the dairy development projects, and then farmers are easily accessed to supplement their cattle's.

- Availability of greater land holding and firing for the encroachment feeds to improve the range land pasture in the large communal grazing lands, particularly in the lowland area good opportunity for efficient utilization of the resource and favorable for livestock production.
- Importation of different improved genotype breeds (Holstein and Jersey) to the area of government is suitable to use preferable breed of cattle by the farmers and to make them profitable.

- In general due to different implementations of change made in the area the farmers have important opportunities for dairy improvement. such implementations were provided for technical knowledge through capacity building and knowledge management, supply of inputs (especially crossbred cows, veterinary medicines and equipments and fodder seed), delivery of extension service: AI service, fodder development and animal health related services and availability of credit services.

5. SUMMARY AND CONCLUSION

The study was assessed in Damot Sore, Damot Woyde and Kindo Koisha districts. In these study areas, two peasant associations (PAs) were selected from each district of each Agro ecology based on cattle potential and again from each selected PAs 30 households were selected and a total of 180 households were used for data collection and analysis.

The overall mean family sizes of the sampled households in the study areas was 7.47±2.37, with no differ significantly (P>0.05) in the studied districts. The average mean land holding was 1.21±0.05ha.Out of which 0.32±0.02 was allocated for grazing lands. The Area is mixed farming production system, but dairying is not the main income source even if the butter were predominantly marketable throughout the year. Accordingly, as reported by the majority (70%) of dairy producers, source of incomes was from sale of crop.

The average cattle holding in the study area was 8.15±0.47 heads/HH. Snice the cattle herd structure total numbers of cows (3.03±0.12) were higher most of which was a local breed cow (2.64±0.12).Total numbers of oxen (1.31±0.09) in the studied districts were higher in the cattle herd. This showed that reflection of the importance of cropping in the areas. Whereas total number of bulls (0.98±0.07) and heifers (0.86±0.07) were considerable proportion in the cattle herd.

In the study area majority (56.7%) of the dairy producers were using local breed cattle followed by pair of local and Jersey cross (17.8%) and a pair of Local and Holstein cross (15%). Whereas few respondents (1.7%), (1.1%) and 7.8% were owned only Holstein cross, Jersey cross and pair Local and both crosses (Holstein cross and jersey cross) respectively. There were significantly different (P<0.05) in farmers holding breed of cattle types in the study area. Large numbers of Farmers (75%) in Kindo Koisha districts were kept only local breed cattle. Farmers owned pair Local and jersey cross breed (20%) in Damot Woyde districts was higher. While farmers inhabitant in Damot Sore and Kindo Koisha districts were owned comparable proportion (16.7%), However farmers found in Damot Sore district were mainly kept pair of Holstein and local breed cattle (31.7%). None of respondents were kept only Holstein cross and jersey cross in Kindo Koisha. Inanition no farmers also kept only Holstein cross in Damot Woyde.

Dairy producers were used two types of breeding techniques. Most of the farmers (52.8%) were used natural mating and only (12%) bred their cows with artificial insemination. The remaining (35%) of them respondents were use both artificial insemination and natural mating. There were also artificial insemination related problems in the area. For (38.9%) of the farmers in the study area were due to the artificial insemination station is very far from their homestead followed by Unwillingness of technicians and logistic problems(16.1%)and lack of information (13.6%).Likewise about (10.3%),(7.4%),(4.8%),(7.6%) of the farmers were not used AI due to environment disfavor to management, none effectiveness, Lack of interest (cultural believes) and Multiple responses(lack of prefer Holstein Frisian semen, price of the service and the small size zebu cows not bearing cross breed fetus).

The overall mean milk yield of Local, Holstein cross and Jersey cross bred cows in the study area was 1.79±0.05 liters/day/cow), (5.7±0.21 liters) and (2.85±0.12litter/day/cow), respectively. Average milk yield of local cow in Damot Sore district was (2.11±0.09 liters/cow/day). It was significantly ($P<0.05$) higher than Damot Woyde (1.89±0.05 liters/cow/day) and Kindo Koisha (1.38±0.02liters/cow/day) areas .Similarly average milk yield of Holstein cross cow was higher in Damot sore (7.79±0.33 litters/cow/day) than Damot Woyde (6.3±0.25littere/day/cow) and Kindo Koisha 3.03±0.0 litters/cow/day).Inanition the average milk yield of Jersey cross cow was (4.06±0.19 litters/cow/day), (2.43±0.1 litters/cow/day) and (2.06±0.07 litters/cow/day) in Damot Sore, Damot Woyde, and Kindo Koisha study districts, respectively.

Among the studied dairy cattle breeds types in the area, the longest lactation length was Holstein cross with the overall mean of (9.63±0.34 months).in the other hand the overall lactation length of Jersey cross cow was (8.65±0.36 months).This was shorter than the overall mean of Holstein cross cow but it was slightly longer than lactation length of local cow (8.56±0.26 months). From the overall data Jersey cross breed cow was the better reproductive performance that is shorter age at first calving (35.8±1.43 months) Followed by Holstein cross (39.55±1.34months).Were as Local cow was longer (49.29±1.13months) age at first calving. Mean calving interval of Jersey cross cow was (14.9±0.6 months).This was shorter than the average mean calving interval of Holstein cross (16.17±0.57months) followed by Local breed cow (18.48±0.5 months) .With regard to weaning age of the calves, Holstein cross calves were longer weaning age (9.1±0.2

months) followed by Local calves (8.34±0.25 months) while Jersey cross calves (7.66±0.31 months) were shortage weaning age.

The total volume of milk production / Day /HH in the study area was (4.05±0.32littres). From the total volume of milk produced/day/HH the largest volume of milk was (65.6%) used for processing followed by consumed directly as fresh whole milk (34.6%), while little (2.1%) portion of milk was used for sale. About 83.9% of the respondents in the study areas had experience of selling milk and milk products. Among the salable dairy products, butter (85.1%) takes first and followed by cheese (31.47%) and buttermilk (5.59%)

Farmers in the study areas used river, own well (*Ella*), Ponds, Pipe and spring water as major sources of water. In the study area, (40%), of the respondents use the river as the sources of water for cattle, though the availability drastically declines during the dry season. Nearly all the households (93.3%) in the studied districts was kept their cattle within the family house except for some (6.7%) of the respondents housed in separated home .This was due to lack of space to construct separate shelter outside the main family house and fear of theft

Different types of Crop residues were used as a source of cattle feed. However, the availability and importance of each type of crop residue varied among the studied districts .From the total majority of the dairy producers were used a maize stalk (42.2%) and wheat straw (41.7%) . while few proportion of respondents was used sorghum (6.1%),Teff straw (4.4%) and faba bean straw (3.9%) .In addition to crop residue farmers were cultivated improved forage. From the overall data most (61.7%) of the farmers were growing improved grass followed by tree legumes' (10%) and forage legumes (2.8%). There were also problems for growing the improved forage in the study area such small size of land (49.1%), lack of input (19.2%) and lack of labor (4.9%), and multiple responses (24.7%) such poor adaptability, lack of awareness and poor quality seeds.

In general dairy producers in the studied areas were identified the major problems and constraints of milk production and marketing according to their degree of importance .These includes a shortage of land, availability feeds, water shortage, shortage of genetically improved dairy animals poor animal health services, poor extension services (credit) regarding improved dairy ,infrastructure and market access .

6. RECOMMENDATION

Based on the findings of this research the following recommendations are pointed out

- Provide capacity building of AI technicians and employee, additional trained AI technicians, allocation of credit for farmers are the key to provide the service at the *kebele* level.
- Farmers in the area should get Jersey semen in addition to Holstein cross semen
- Strengthen of government ranches (Wolaita cattle breeding and multiplication center) important to sustainable supply/distribute / exotic blood breeds to the farmers

- Since shortage of land is the big challenge in the dairy producers Cultivation of improved forage crops suitable for the different agro-ecological zones and farming systems with accompany technologies should be encouraged. Such forages that are nutritionally superior and yield more biomass per unit area

- Dairy cattle owners must receive basic training regarding animal disease prevention and modern cattle management systems

- Promotion of efficient use of alternative feed sources such as silage, hay, crop and vegetable by-products and local beverage by-products is also essential.

- The dairy producers should be organized to form cooperative/or union so that they can sell their milk and milk product at the right place and time for optimum benefit in addition to
- There need to be milked processing plant in the study areas so that the producers and processors get optimal benefit from these areas

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8. APPENDICES

8.1. Appendix I. Analysis of variance (ANOVA) and other tables

Appendix Table 1.ANOVA test on family size per household between the study districts

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	1.478	2	.739	.131	ns
Error	1001.383	177	5.658		
Total	1002.861	179			

SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value, ns=non significance

**p<0.05; **p<0.01; ***p<0.001*

Appendix Table 2: ANOVA test type of breed cows in the cattle herd structure in the study districts

Parameters	Source of variation	SS	DF	MS	F	Sig
Total cow	Agro ecology	238.044	2	119.022	73.451	***
	Error	286.817	177	1.620		
	Total	524.861	179			
Local cow	Agro ecology	256.078	2	128.039	97.196	***
	Error	233.167	177	1.317		
	Total	489.244	179			
Holstein cross cow	Agro ecology	2.233	2	1.117	7.398	***
	Error	26.717	177	.151		
	Total	28.950	179			
Jersey cross cow	Agro ecology	.144	2	.072	.281	ns

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; ns=non significance; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 3: ANOVA test on landholdings of households in the study district

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	50.787	2	25.393	127.935	***
Error	35.132	177	.198		
Total	85.919	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 4: ANOVA test type of breeding bull herd in the study districts

Parameters	Source of variation	SS	DF	MS	F	Sig
Total bull	Agro ecology	13.733	2	6.867	8.858	***
	Error	137.217	177	.775		
	Total	150.950	179			
Local bull	Agro ecology	22.011	2	11.006	16.292	***
	Error	119.567	177	.676		
	Total	141.578	179			
Holstein cross bull	Agro ecology	.811	2	.406	5.418	**
	Error	13.250	177	.075		
	Total	14.061	179			
Jersey cross bull	Agro ecology	.100	2	.050	.440	ns
	Error	20.100	177	.114		
	Total	20.200	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; ns=non significance; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 5 .ANOVA test type of cattle Breeds kept by the respondent households

	study districts						Total		P-value
	Damot sore		***Damot woyde***		***Kindo koisha***				
Variables	N	P	N	P	N	P	N	P	
Type of cattle breed in HH									***
Local breed	21	35 [a]	36	60 [b]	45	75 [b]	102	56.7	
Local and jersey cross	10	16.7	12	20	10	16.7	32	17.8	
Local and Holstein cross	19[a]	31.7	6[b]	10	2[b]	3.3	27[b]	15	
Jersey cross	1	1.7	1	1.7	0	0.0	2	1.1	
Holstein cross	3	5	0	0.0	0	0.0	3	1.7	
Local and both crosses	6	10	5	8.3	3	5	14	7.8	

*N= number of household, P=percent. = Significant value at *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 6: ANOVA test on landholdings of the study districts

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	50.787	2	25.393	127.935	***
Error	35.132	177	.198		
Total	85.919	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 7: ANOVA test type of breeding techniques of households in the study districts

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	5.544	2	2.772	3.343	*
Error	146.767	177	.829		
Total	152.311	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 8: ANOVA test major AI service related problems in the study districts

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	4.844	2	2.422	.423	ns
Error	1014.733	177	5.733		
Total	1019.578	179			

SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; ns=non significance

Appendix Table 9: ANOVA test total milk production per day per household in the study districts

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	8.829	2	4.415	.675	ns
Error	1157.107	177	6.537		
Total	1165.936	179			

SS= Sum of Squares, Ms= Mean Squared; Sig. = Significant value, ns=non significance

Appendix Table 10: ANOVA test on Productive and Reproductive (daily milk yield, lactation length, age at first calving, calving interval and weaning age) performances of the local cow in the study districts.

Parameters	Source of variation	Sum of Squares	df	Mean Square	F	Sig.
DMY	Agro ecology	10.202	2	5.101	25.581	***.
	Error	35.295	177	.199		
	Total	45.497	179			
LL	Agro ecology	94.786	2	47.393	9.948	***
	Error	843.225	177	4.764		
	Total	938.011	179			
AFC	Agro ecology	2640.667	2	1320.333	14.344	***
	Error	16292.863	177	92.050		
	Total	18933.530	179			
CI	Agro ecology	835.260	2	417.630	25.485	***
	Error	2900.560	177	16.387		
	Total	3735.819	179			
WA	Agro ecology	32.875	2	16.437	4.017	*
	Error	724.251	177	4.092		
	Total	757.125	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 11: ANOVA test on Productive and Reproductive (daily milk yield, lactation length, age at first calving, calving interval and) performance of the Holstein cross cow in the study districts.

Parameters	Source of variation	Sum of Squares	df	Mean Square	F	Sig.
DMY	Agro ecology	20.150	2	10.075	2.876	*
	Error	620.001	177	3.503		
	Total	640.151	179			
LL	Agro ecology	30.014	2	15.007	1.940	ns
	Error	1369.099	177	7.735		
	Total	1399.113	179			
AFC	Agro ecology	231.920	2	115.960	1.058	ns
	Error	19396.001	177	109.582		
	Total	19627.921	179			
CI	Agro ecology	44.852	2	22.426	1.137	ns
	Error	3490.856	177	19.722		
	Total	3535.708	179			
WA	Agro ecology	20.520	2	10.260	1.591	ns
	Error	1141.552	177	6.449		
	Total	1162.072	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; ns=non significance; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 12: ANOVA test on reproductive performances (lactation length, age at first calving, calving interval and milk produced per cow per day) of the Jersey cross cow in the study districts

Parameters	Source of variation	Sum of Squares	df	Mean Square	F	Sig.
DMY	Agro ecology	6.619	2	3.309	3.216	*
	Error	182.150	177	1.029		
	Total	188.769	179			
LL	Agro ecology	23.869	2	11.934	1.498	ns
	Error	1410.091	177	7.967		
	Total	1433.959	179			
AFC	Agro ecology	28.880	2	14.440	.117	ns
	Error	21881.723	177	123.626		
	Total	21910.603	179			
CI	Agro ecology	7.490	2	3.745	.175	ns
	Error	3793.195	177	21.430		
	Total	3800.685	179			
WA	Agro ecology	14.067	2	7.034	1.150	ns
	Error	1082.251	177	6.114		
	Total	1096.318	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; ns=non significance; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 13: ANOVA milk utilization pattern among the study districts

Parameters	Source of variation	SS	DF	MS	F	Sig.
Volume of milk use for home consumption	Agro ecology	40.324	2	20.162	6.988	***
	Error	510.676	177	2.885		
	Total	551.000	179			
Volume of milk use for processing	Agro ecology	35.029	2	17.515	3.748	*
	Error	827.204	177	4.673		
	Total	862.233	179			
Volume of milk use for sale	Agro ecology	1.454	2	.727	.919	ns
	Error	140.046	177	.791		
	Total	141.500	179			

*SS= Sum of Squares, Ms= Mean Square, ns=non significance *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 14: ANOVA test on average distance travelled to search water in Km in the study areas.

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	11.911	2	5.956	14.830	***
Error	71.083	177	.402		
Total	82.994	179			

*SS= Sum of Squares, Ms= Mean Square, Sig. = Significant value; *p<0.05; **p<0.01; ***p<0.001*

Appendix Table 15: ANOVA test on average distance to health clinic in Km in the study areas

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	47.244	2	23.622	48.087	***
Error	86.950	177	.491		
Total	134.194	179			

*SS=Sum of Squares, Ms=Mean Square, Sig. = Significant value,*p<0.05;**p<0.01;***p<0.001*

Appendix Table 16: ANOVA test animal health service used by the HHs in the study areas

Source of variation	SS	DF	MS	F	Sig.
Agro ecology	2.344	2	1.172	2.026	ns
Error	102.433	177	.579		
Total	104.778	179			

SS=Sum of squared, DF=degree of freedom, MS = mean square, Sig=significance value, ns=non significance

QUESTIONNAIRE –DAIRY CATTLE PRODUCTION AND MARKETING SYSTEMS IN SELECTED DISTRICTS OF WOLAITA ZONE, SOUTHERN NATIONS, NATIONALITIES, AND PEOPLES REGIONAL, STATE ETHIOPIA.

Enumerator's name _____ Respondent name _____

Respondent name number _____Region _____

District _____ Keble _____

Date interviewed _____Time of interview started _____ Time of interview end____

I. House hold characteristics

1) Respondent's Status in family: 1. Head 2. Wife 3. Son 4. Daughter 5. Others_____

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

3) Age of head of household _____ Years

4) Education of the head of household:

1. No formal 2 .Adult literacy 3. Primary 4. Secondary 5. Beyond secondary

5) Religion of head of the household: 1 .Orthodox 2. Muslim 3. Catholic 5.protistant 4. Other

6) Ethnic group of head of the household: _____

7). Family Size

Age group(years)	No of members in the household		
	Male	**Female**	**Total**
>60			
16-60			
6-15			
<6			

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

Activities	**1.Father** **2.Mother** **3.Daughter** **4.Son**
Milking and processing	
Milk and product marketing	
Herding	
Feed collection	
Watering	

9). what kind of agricultural activities are you undertaking?

1. Crop and livestock 2. Only livestock production 3. Crop only

10) Which part of your agricultural activity contributes most of the family income?

1. Crop Production 2. Live stock production 3. If others specify_____

11. 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

12. If you are a member what benefits do you get? 1. Credit Service 2. Input Supply 3. If others

13. Did u have access to credit for dairy production purpose? 1. Yes 2. No

14. If yes, from where did you get the credit? (Multiple responses is possible)

1. Omo microfinance 2. Individuals 3. NGOs 4. Credit

5. Cooperatives and saving association 6. Other (specify)

15. In what way does credit help in developing the dairy sector?

16. 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

17. When did you start the dairy farming? 1. A year ago, 2. A month ago, 3. A few weeks ago

18. How do you get information on dairying most of the time?

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

19. What are your reasons for doing dairy 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

II. Herd Structure

20) Major purpose of keeping animals?

1. for milk purpose 2. For meat purpose 3. For traction 4. For all above purposes

21) How many of each of the following cattle do you have in your herd?

No	Cattle group		Type of breed			
			Local	Holstein cross	Jersey cross	Exotic
1	Milking cow s					
2	Dry cows					
3	Heifer					
4	Calves	M				
		F				
5	Oxen/sterile					
6	Cow					
7	Bull					
8	Others					

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

NO	**Descriptions**	**Owned**	**Rented**	**Total**
1	Area under crops			
2	Area under pasture			
3	Perennials			
4	Others			

III. Housing

23) Do you have an experience of housing your dairy animals? 1. Yes 2. No

24) If yes, what type of housing system?

1. Simply crashes 2. Open with roof on the top only 3. I keep the animals with the people residence 4. I tethered at the yard 5. Others please specify _____

25) If no, why you don't use house for the dairy animals?

1. They are great in number 2. We don't have stationary place 3. If they acclimatize the outside environment, they became strong enough4. If others please specify _____

26) Do you have a selection of species for housing? 1. Yes 2. No

25) If yes, what are the species privileged (Advantage) for housing? 1. Cattle 2. Sheep 3. Goat 4.Equines 5. If others specify Rank them with priority: 1.__ 2. ___3.__ 4._ 5._____

27) Do you have an experience of age of cattle selecting in housing? 1. Yes 2. No

28) If yes, for what age group you give priority?

1. Small calf 2. Milking cows 3. Oxen 4. Dry Cows 5. Fattened animals 6. Heifers

Rank them with the priority given: 1____ 2.____3. ____4. ____ 5.___6_____

29) What are the materials which the house made from?

No	Types of the materials	Roof	Wall	Floor
1	Corrugated Iron			
2	Grass			
3	Wood			
4	Wood			
5	Mud			
6	If Others			

30) When do house them? 1. All the time2. Only at night 3.If others please specify

31) Do you have any conflict with your neighbor's because of your livestock activities?

1. Yes 2. No 3. Sometimes but it is not usual

32) How do you dispose the cattle dung from the barn?

1. By drainage system 2. By manual labor 3. If others please specify

33) How many times you are disposing manure from the barn?

1. Once per day 2. Twice per day 3. Three times per day 4. More than three times

34) How you are 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 5. If others please specify

35) Do you also sell the animals dung cake or decomposed dung? 1. Yes 2.No

36) Where do you usually sell your decomposed dung or cake?

1. at the farm gate 2. On the nearby market 3.others

37) What is your labor source in the dairy production?

1. Family labor 2. Hired (employ) labor 3. Both 4.if other specify

38). When is your high labor demand? 1. During the peak of lactation 2. During hay harvest

3. during cow dung preparation 4. If others please specify

IV. Feed and feeding

39) What type of grazing system are you using?

1. Zero grazing 2. Semi-grazing 3. Full grazing 4. 1nad 2_____

40) What is the source of your cattle feed? 1. Own production 2. Purchased 3. Both

41). what are the sources of feed? 1. Natural grazing land 2. Crop residue 3. Crop after math 4. Concentrate 5. Brewery product (atela) 6. Hay 7. Others

Rank them: 1_____2._____3.____ 4.____5.____6._____7_____8___

42). what are your major feed resources for your animals? Rank them in order of importance

43). which crop residues being used for feed?

1. Teff straw 2. Barley straw 3. Rice straw 4. Maize stalk 5. Others

44) Do you have an experience of making hay? 1. Yes 2. No

45) If yes, from which land?

1 .Individual Pasture land, 2. Crop land (after math), 3.Cultivated grass 4. Roadside grass

5. Community pasture land 6. Other (specify) _____

46) If no, what was your major reason? 1. We did not know about its importance.

2. We don't have any feed shortage 3. We can let our animals simply to the dried grass.

4. Since we do have large number of cattle, we cannot accommodate all. 5. It has no importance.

47. Do you grow forage crops? 1. Yes 2. No

48. If yes, which forage crops? 1. Grass 2. Forage legume 3. Tree legume

49) If No, what are your major reasons for not growing fodder crops?

1. Insufficient land 2. Insufficient labor 3. Insufficient inputs (seed, fertilizer, and cash)

4. Lack of rain 5. Feed for animals is adequate 6. Insufficient information 7. Others

50) Do you buy any feed supplements for your animals? 1. Yes 2. No

51) Which feed supplements (concentrate) do you buy? 1. Oil seed cake 2. Cotton seed cake

3. Wheat and corn bran and middling 4. If others specify

52) From where do you buy the supplementary feeds?

1. from the farmers' association 2. From the Ministry of Agriculture (ARDO)

3. from private retailers 4. From the industries 5. From others please specify

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

54) Did you come across shortage of animal feed? 1. Yes 2. No

55) If yes, Can you mention at what months feed shortages exist? 1._____2._____3_____

56) If yes, what was your solution to alleviate your problem? 1. Conserve crop residues 2. Use Of small amount of feed 3. Purchase crop residues 4. Sell animals 5.use other mechanism

V. Water Resources and Quality

57) What sources of water are you using for your dairy animals and/or beef cattle?

1. The city pipeline 2. The nearby river 3. Pond 4. Walls 5. If others please specify

58) 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 3. Others_____

59. What is the frequency of watering your animals?

No	Breed type	Frequency	
		Wet season	Dry season
1	Local		
2	Holstein cross		
3	Jersey cross		
4	Exotic		

Codes: Frequency: 1 = Once in a day 2 = Twice in a day 3 = Three times in a day 4 = other

60) What is your main water related problem?

1. Scarcity 2. Parasites such as leaches 3. Unhygienic/impurity 4. Others _____

VI. Breeds and breeding

61) What is the breed of your dairy and/or beef animals? 1 Local/indigenous. 3. Cross 4.Exotic breeds 5. Mixed (specify)

62) Do you know the pedigree of your animals? 1. Yes 2. No.

63). If yes, indicate it 1. From the seller's information 2. From the Governmental Ranches history card 3. If other specify

64. Do you know the exotic blood type, which is present in your herd? 1. Yes 2. No

65) If yes, indicate it. 1. Holstein Frisian 2. Jersey 3. Guernsey 4.if other specify

66) What is your breeding system? 1. Natural breeding 2. Artificial breeding 3. Both

67) 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

68. 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

69. 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

70. 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

71) If your breeding system is natural, what are its mechanisms?

1. We select the best type of bull and we inseminate our cattle

2. We don't have any selection activity; simply we used uncontrolled breeding

3. Others _____.

72) Do you have an experience of selection the best cattle type for breeding purpose?

1. Yes 2 No.

73) If yes what are your parameters used to select the best cattle for breeding purpose?

1. Color coat 2. Behavior of the animals 3. Body conformation 4. Milk production potential

5. Drought power potential 6. If others specify

74. 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 from Tigray credit crevice 4. The use of cross breed bull from the surrounding 5. Government ranches 6.if other (Specify)

71) When you start having cross bred cows? 1. One years ago, 2. Two years ago 3. Six Months ago, 4. Three years ago 5.if others specify

72) Why do you keep crossbreed animals in your farm?

1. Better milk production 2. Higher growth rate 3. Higher weaning weight

4. Better body conformation 5.All 6.If others please specify

73) Why you only stick with Local cows?

1. Better disease resistance quality 2. Better resistance on heat stress.

3. Better fat content 4. I don't get cross breed cows/heifers 5.others

5. Better body conformation 6. They can fit for Drought purpose

7. I don't know other means

74) Do you have an experience of using AI? 1. Yes 2. No

75) If no, why did not use it? 1. We did not know its advantages 2. We did not have any option To get AI service 3. We did not have interest for Crossbreeding 4. Environment will disfavor Them. 5. If other specify

76) If you are only sticking on local animals, what was the source of your bull?

1. Own source 2. From neighbors 3. From everywhere source 4. Others_____

77) What type of a local bull you prefer?

1. begait(barka) type 2. Horro type 3. I used the unknown 5.Others_____

78) Do you have any major reason for your preference?

1. Body conformation 2. Milk production 3. Better milk quality 4. Better traction power

5. Others Rank the reasons: 1. ----- 2. ------ 3. ------- 4. -------- 5. -------

79) What are the major problems in managing crossbred dairy cows? 1. Feed problem 2. Disease problem 3. Lack of labor 4. Lack of water 5. Lack of money 6 other

80) Why did you want cross breeding services? 1 .To gets more milk 2. To get more drought power. 3. Other

VII. Calf rearing practices

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

	Breed type	**Age of calf weaning**
A	Local	
B	Holstein cross breed	
C	Jersey cross	
D	Exotic	

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

No	**Breed**	**Feeding system**		
		Bucket Feeding	**If bucket feeding how much L/Day**	**Partial feeding**
A	Local			
B	Holstein Cross			
C	Jersey cross			
D	Exotic			

82) After weaning, what do you do with male calves?

No	**Breeds**	**1.Sell**	**2.Fatten Them**	**3.Sell as sire**
A	Local			
B	Cross			
C	Exotic			

VIII. Health condition

83) Do you have any animal health problems? 1 .Yes 2. No

84) If yes, what are the major animal health problems? Please rank in order of importance.

1. Foot and Mouth 5. Anthrax 8. Diarrhea

2. Liver Fluke 6. Pneumonia 9. Dystocia

3. Lung Worm 7. Ticks 10. Mastitis

4. Black Leg 11. Tripanosomiosis and others _____

Rank: 1 ____ 2 ___ 3 ___ 4 ____ 5 ___ 6 ____ 7 ___ 8 _____

85. Do you have any chance of having health clinic in nearby your residence? 1. No 2.Yes

86. If yes, how many km you will go to get this health clinic? --------- Kms

87. Do you have incidence of human beings infected with any of the diseases?

1. Yes 2. No

88. If yes, which disease indicate it_____

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

90. If yes, what are the local plants used for medication to livestock?_____

91. If yes, why you use these traditional medicines?

1. Veterinary services are not available 2. Veterinary costs are high

3. Veterinary medicaments are not effective for such disease

4. No regular visit by veterinarians 5. Long distance to animal health stations

92. Do you use a combination of veterinary services and traditional medicines? 1. No 2.Yes

93. From where do you get veterinary Services?

1. Government institution 2. Private Veterinary services 3. NGOs extension services 4. 1 and 2

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

1. Calves____2. Heifers___3. Milking cows____4. Steer___ 5. Oxen

VIII. Dairy Animals performance

95) How many times do you milk your cows per day?

1. Morning only 2. Morning and evening 3. Morning, mid day and evening

96) How many months of lactation do you normally have? Just put a tick sign (√).

No	Breeds	Period of lactation (months)				
		1-3	4-6	7-9	9-10	11-12
A	Local					
B	Holstein cross breed					
C	Jersey cross breed					
D	Exotic					

97. How much the daily milk yield per head (liter)

NO	Breed	Dry season	Wet season
1	Local		
2	Holstein cross		
3	Jersey cross		
4	exotic		

99) Do you intend to increase your level of milk production? 1. Yes 2. No

100) If yes, indicate, 1. It maintains food production for the household) 2. It is profitable (income generation 3 if other specify _____

101) if no indicate 1. It is not as the crop production 2. It is not profitable 3. If other specify____

102) what are the main constraints for your dairy 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 10. Others _____

103) could you rank the most important ones from those constraints?

1. Feed shortage____2. Diseases ___3. Shortage of land____4 .Capital___ 5. Market__

104. Productive and reproductive performance.

parameter	**Breed cattle's type**			
	Local	**Holstein cross**	**Jersey cross**	**Exotic**
Age at first calving(months)				
Lactation length(months)				
Calving interval (months)				
Daily milk yield/cow(litter)				
Average lactation yield(litter)				
Weaning age (months)				

IX. Milk production and utilization

105. How much produced per household?

	Volume produced	Unit	**Dry season**	**Wet season**
	Milk/day			
	Butter/week			
	Cheese/week			
	Fermented milk			

106. Who makes decision in the dairy product with regard?

1).to consumption? 1. Male 2. Female

2.) Regard to production/processing pattern 1. Male 2. Female

107. How is the milk consumed? 1. Alone 2. With meals 3. As an additional

108. How is it utilized from the total amount of milk produced proportion in percent?

No		**Milk utilization**	**Proportion in percent**	
	Total milk production/HH		**Dry season**	**Wet season**
		Calf feeding		
		Home consumption		
		Processing		
		Selling		
		Other purpose		

109. Are there seasonal variations in consumption pattern? 1. Yes 2. No

110. If yes, indicate_____

XII. Milk Processing

111) Do you have an experience of processing the dairy products? 1. Yes 2. No

112) If yes, what are the processed products?

1. Butter 2. Butter milk 3. Chees 4. Fermented milk 5.Ghee 6. Others

113) Do you know the purpose of fermenting milk for a certain period of time? 1. Yes 2. NO

114) If yes, what was the reason? 1. It gives us good flavor and taste. 2. It helps for churning of Fermented milk. 3. It is a means of preservation. 4. Other reasons _____

Rank them with priority: 1._____ 2._____ 3._____ 4_____

115) How long does the milk will be stored for fermentation before it is processed in to butter?

No	Length of time (days)	Dry season	Wet season
	Minimum day		
	Maximum day		
	Average day		

116) what materials do you use to process the milk? 1. Clay pot 2. Other_____

117) do you have an experience of smoking your milking cans and other related

Materials? 1. Yes 2. No

118) If yes, what are its advantages? 1. for good and pleasant flavor and taste 2 .For good shelf life of the products 3. For killing microorganisms. 4. Others._____

Rank them; 1._____ 2._____ 3._____ 4._____

119) what are the plants or the materials used for smoking your milking equipments?

1_____2_____ 3_____4_____

120) what matters whether the processing is ready or not? 1. Milk volume 2. The color of the

Fermented milk 3. Physical compactness of the fermented milk 4.if other (specify)

121. How many hours does it take to churn fermented milk into butter?

122) what are the materials used for churning of milk in the process of butter making? 1.___2__

123) give the volume of fermented milk churned to produce 1 kg butter?

No	Total amount(local unit)	Dry season	Wet season
1	Minimum amount		
2	Maximum amount		
3	Average amount		

124) what about the frequency of churning of fermented milk into butter during wet season?

1. Every two weeks 3. Every 24 hours 5. Within the four days interval

2. Once in a week 4. Within three days interval 6 .specify if others

125) what about the frequency of churning of fermented milk into butter during dry season?

1. Every two weeks 2. Once in a week 3. Every three weeks

4. Within the three days interval 5.within four days interval 6. Specify _____

126) for how long do you store butter before selling (months)? Minimum ____ Maxim_____

127) If, you store your butter for a certain period, do you have an experience of adding

Something in it? 1. Yes 2. No

128) If yes, what are the materials added? 1. Salt 2. Spices 3. Only cook with heat 4. Other

129) what are its advantages? 1. for coloring 2. For taste 3.Others _____

130) Do you process butter milk into cheese? 1. Yes 2. No

131). If yes, what matters the time of cooking?

1. The amount of butter milk 2. The type of material used for cooking 3. The amount of heat

Is given 4 if .others specifies _____

132) If yes, how much butter milk is required to produce 1 kg cheese? _____ Liters

133) If no, what should be your reason?

1. It will be consumed by the family 2. There is no cheese market

3. We don't want to produce cheese 4.It will be consumed by the calves 5. If others specify

134) Do you process butter in to other product? 1. Yes 2. No

135) If yes, what are the products? 1. Cooked butter 2.spiced butter 3.salted product

136) If yes, what are the materials used to process butter? 1_____2_____3._____4_____

137) what is the importance of processing butter? 1. For preservation 2. For long period of storage 3. for good flavor and taste 4.for good market value 5. If others _____

Rank them: 1_____2._____ 3._____4_____

IVX. Dairy product marketing

138) Do you have an experience of selling raw milk? 1. Yes 2. No

139) if yes, what are the dairy products you are going to sell? 1. Raw milk 2. Fermented milk (*Ergo*) 3. Butter 4. Butter milk 5. Cheese 6. Whey milk

Rank them in the order priority given: 1._____ 2.____3. ___4.___5.____ 6._____

140) If no, what was your reason?

1. Milk is forbidden to sell due to traditional problem 2. There is no excess milk for selling.

3. No market access 4. Market place is too far. 5. If others please specify_____

141) Sales of the dairy Products and Prices:

142) How much is sale a liter of milk in your village _____ Birr/Litter?

143) How much is a liter of milk in your nearby town _____Birr/litter?

144) who from the household delivers the milk to the buyers? 1. Husband 2. Wife 3. Adult male children 4. Adult female children 5. Child 6. All members of the HH 7. Hired labor 8.others
Rank them: 1_____2. _____3._____ 4_____ 5._____ 6.__

145) has any of your milk intended for sale been rejected 1. Yes 2. No

146) If yes, what percent of the time?

1) 75 % of the time 2) 50 % of the time 3)25 % of the time 4 .Specify (other) _____

147) which milking is mostly rejected? 1. Morning 2. Evening

148) what should be the main reason? 1. It will be sour 2. Others (specify)

149) what is the main reason for being sour?

1 .Non availability of buyers. 2. Because of the distance to the delivery point

3 .Because of preservation problem 4. 2 and 3 5. Specify (other) _____

150) How much do you get from sale of the following product/year?

No	**Commodity type**	**Maximum Birr**	**Minimum birr**
	Raw milk		
	Butter		
	cheese		

Appendix II: Focal group discussion checklist

Part I. Production aspect

1. Major dairy cattle production system of the area?

2. Major dairy cattle production constraints and mechanisms to allivate the problems

3. The overall Trends of dairy development in the last ten years?

4. Available cattle feed resources and way of feeding system

5. Main source of water and water related problems during different seasons

6. Types extension services in dairy cattle production

Part II. Market aspect

1. Dairy product marketing system of the area in general.

2. Sources of marketing information. Is the source available, reliable, recent and accurate?

3. What are the main Problems/constraints in relation to dairy product marketing (price, buyer's problem, accessibility, market structures etc.)?

Part III. Health aspect

10. The most common dairy cattle diseases and measures taken?

2. Known disease outbreaks emerging frequently. Losses due to the out breaks

3. Indigenous knowledge in coping different diseases

4. Problems related with health input and service provision

Part IV .Credit service

1. Is credit crevice available? Is it profitable, is it beneficial?
2. What are the major Problems associated with credit and opportunities