Cow and Camel Milk Production and Marketing in Agro-pastoral and Mixed Crop- Livestock Systems in Ethiopia

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Introduction

Although Ethiopia holds the largest ruminant livestock population in Africa estimated at about 35 million heads of cattle, 2 million camels, 22.5 million sheep, and 17 million goats (ILRI, 2000; FAO, 2002), productivity has remained low and its contribution to the national economy is limited compared to its potential. Cattle, camel and goats are the main livestock species that supply milk. According to CSA report (2008), total annual milk production from about 10 million milking cows is estimated at about 3.2 billion liters, which is translated into 1.54 liters per cow per day. The contribution of the different indigenous livestock species to the total production is 81.2% from cattle, 6.3% from camels, and 12.5% from goats and sheep. Due to highly perishable nature of milk and mishandling post harvest loses are estimated at 20-35% of the produce (UNDP/MOA, 1993). Per capita consumption of milk in the country is about 16 kg per person per year, which is much lower than the African and World averages of 27 kg/year and 100 kg/year, respectively (Saxena *et al.*, 1997). The overall milk production system in Ethiopia could be broadly classified as pastoral and agro-pastoral, crop-livestock mixed and peri-urban and urban dairy production systems. The highland comprises 40% of the country's land area, holds 88% of the human and 74% of the tropical livestock units (TLU). The main activity is a mixed farming system dominated by crop production and accounts for more than 90 % of the country's economic activity (Constable, et al., 1989). In contrast, the lowland has 78 million hectares land area (60% of total) and 12.2% of the total human population. Ecologically it has arid (64%), semi-arid (21%) and sub-humid (15%) areas dominated by semi nomadic transhumance population whose economy is entirely dependent on livestock production (Solomon, 2000). Milk is the major source of food and income. Cattle dominate the population (55.4% of the TLU) followed by camel (15.3%), goats (13.7%) and sheep (6.4%), (Coppock, 1993), and produce 27% of the total annual milk production (Getachew and Gashaw, 2001). This study was therefore undertaken (1) to characterize the milk production and marketing system, (2) to identify major constraints for the development of market-oriented dairy production, and (3) to formulate recommendations for further interventions.

Materials and Methods

The study was conducted in Mieso district of Oromia Regional State, located 300 km east of Addis Ababa and at about 200 km east of Adama town. The total land area of the district is 196,026 ha. Five rural *Kebeles*, Dire-kalu, Welda-jejeba, Hunde-misoma, Gena, and Huse-mendera with milk production potential were selected using purposive sampling and farmers from each rural *kebeles* were selected using Proportional Probability to Size (PPS) approach and a total of 120 farmers were selected using systematic random sampling methods. Group discussion was undertaken with key informants such as elders and agricultural bureau staff to investigate and have an overview about the overall milk production and marketing system. The information generated in participatory rural appraisal phases was used for the preparation and development of the questionnaire for the formal survey. The questionnaire was pre-tested and modified as necessary. The formal survey was conducted by trained enumerators in 2005/06 using

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120 farmers. To capture gender effects in the overall production system the sample household on each rural *kebeles* was stratified in to female and male headed households. For market study, from the three existing market sites, Mieso and Asebot markets were purposively selected. Milk marketing was monitored during the rainy and dry seasons. To asses the milk marketing data a well-developed questionnaire was used in order to collect information on amount of milk delivered, price and number of the individuals who sale milk. During the monitoring phase, a diagnostic survey was undertaken to identify households that have lactating cows and/or camels in the selected five rural *kebeles*. Lactating cows were stratified into early (1-2 months), mid (3-4 months), and late (5-6 months) lactation stages while camels were stratified into early (1-3 months), mid (4-6 months) and late (7-9 months) lactation stage, depending on their lactation length in order to see the production potential at different stages. About 10 percent of the total lactating cows and camels in each lactation stages for each rural *kebele* were used. Daily cow milk yield (morning and evening) was measured using a calibrated plastic jogs for a period of one week. For camels, daily milk yield was measured three times a day (morning, mid-day and evening).

Results and Discussion

Indigenous breeds of cattle, camels and goats are used for milk production, and natural pasture and crop residues (sorghum and maize stover) are important feed resources. Mineral soil salt (*haya)* is used by about 40% of the respondents. Average cow milk yield per head/day in the wet and the dry seasons was estimated at 3.26±0.07 and 1.63±0.04 liters, respectively, while the respective values for camel were 7.12±0.33 and 3.85±0.20 liters. Average milk produced per household per day in the wet and the dry season was 4.80±0.22 and 2.37±0.11 liters for cows and 13.19±0.95 and 7.63±0.82 liters for camels. Milk and milk product sale is a major sources of income for 96% of the respondents. The amount of cow and camel milk supplied to the market decreases during the dry season by 39% and 28%, respectively. The amount of cow and camel milk sold per day was higher in Mieso (496.6±19.12 liters) than in Asebot market (187.89±19.12 liters). Milk is sold by women organized in traditional milk associations (locally called *Faraqa Annanni)* or on individual basis. Distance to markets and availability of *Faraqa Annanni* were important factors on decision to participate in milk marketing. Feed scarcity, water shortage, security problem, and limited access to veterinary services were the major problems identified by 41%, 30%, 14.5% and 8% of the respondents, respectively. Mortality rate due to diseases was identified as a major cause of loss in cattle (65% of respondents) and camels (67%).

Table 5. Overall species composition of herds in Mieso district

Animal type	Number of households own animals (N=120)	Number of animals	Mean ± SE	% from the total herd composition
Goats	113	723	6.03 ± 0.30	44
Camels	33	220	1.83 ± 0.92	14
Cattle	120	683	5.69 ± 0.35	42

SE= Standard Error of mean. Cv= coefficient of variance

Cattle, camels and goats are used for milk production in the district. All milk animals in the study area are indigenous breeds. All the respondents indicated that cattle, camel and goats are principally fed on natural pasture on non arable lands maintained under rainfed conditions. Crop residues mainly sorghum and maize stover (locally known as, *chinki)* and household waste serve as important feed resources. As an additional feed, mineral soil salt (locally known as *haya)* is used by about 40 % of the respondents during the wet and the dry seasons. Average cow milk yield per head/day in the wet and the dry seasons was

estimated at 3.26±0.07 liters and 1.63±0.04 liters, respectively. Similarly, camel milk yield per head/day in the wet and dry season was 7.12±0.33 liters and 3.85±0.203 liters, respectively. The estimated average cow milk produced per household per day during the wet and the dry season was 4.80±0.22 liters and 2.37±0.11 liters, respectively. Similarly, the estimated average camel milk produced per household per day was higher during the wet (13.19±0.95 liters) than the dry season (7.63±0.82 liters). Milk and milk product sale (96%) and crop sale (95%) are the major sources of income for the farmers/ pastoralists, indicating that both commodities are equally important. The majority of the households sell whole milk (78%) and butter (67%). Whey is sold by only 4.2% of the respondents. About 72% of the respondents indicated that cow milk is sold both during the wet and dry seasons. Some 8.3% of the respondents sell milk only during the wet season. Twenty nine percent of the households indicated that only one fourth of the total household milk production is delivered to the market, and mostly the morning milk is sold and the evening milk is often used for home consumption. The amount of cow and camel milk supply to the market decreases by 39% and 28%, respectively during the dry season. The amount of cow and camel milk sold per day was significantly ($P \leq 0.05$) higher for in the Mieso (496.6±19.12 liters) than in the Asebot market (187.89±19.12 liters). Milk sold per day during the wet season was significantly ($P \leq 0.05$) higher than during the dry season for both cow (551.29±19.2 liters) and camel milk (211.92±19.12 liters). There were generally two types of milk outlets identified in the district. These are traditional milk associations or groups and individual sellers. The traditional milk producer association group is locally called *Faraqa Annanni*. From a total of 94 households that sold milk during the study, only 22 (23%) households were involved in the milk seller groups. The average amount of milk contributed by an individual in group marketing was significantly ($P \leq 0.05$) higher (3.94±0.17 liters/person) than individual sales (1.64±0.06 liters/person). The total amount of milk sold (liter/person/day) at the two market sites differed significantly, being higher in Mieso (3.27±0.17 liters/person) than in Asebot (1.91±0.06 liters/person). Distance of the household from the market was an important variable which significantly ($P \leq 0.05$) affected decision on cow milk sale. Availability of *Faraqa Annanni* in the area had a significantly ($P \leq 0.1$) positive relation in market participation of the household to sale cow milk. Availability of *Faraqa Annanni* in the vicinity increases the opportunity of the household for cow milk sale by 14%.Most of the respondents indicated that milk sale was highly affected by low milk quantity (73%) followed by distance to market, (38%). Cultural taboo on milk marketing was identified by only 7.6% of the respondents, indicating that this issue is not a serious problem in the area. Feed scarcity, water shortage, security problem, and limited access to veterinary services were identified as the major problems by 41%, 30%, 14.5% and 8% of the respondents, respectively. Mortality due to diseases was identified as a major cause of loss in cattle (65% of respondents) and camels (67%).

Conclusion and Outlook

In conclusion, this study has shown that there is a good potential for market-oriented dairy development in the district. However, there is need for interventions to develop infrastructure, enhance input supply system, undertake capacity development and training to enhance the skills of farmers and pastoralists in dairy production, processing and marketing. Attention should also be given to effective conflict management and resolution including the application of customary systems, improved access to veterinary services including training of paravets, improved feed production, conservation and feeding systems, improved marketing system and introduction of improved dairy breeds in some areas where feasible. Experience has also shown that smallholder dairying, producing highly perishable products, can significantly benefit from economies of scale through integration into vertically coordinated dairy value chain. This opportunity seems more feasible in Ethiopian context since the role of large scale dairy farms remains negligible. Thus, organizing dairy producers and integrating them vertically to processors and

input suppliers can reduce marketing and transaction costs; improve productivity and product safety; encourages value addition, and can create employment opportunities along the milk value chain. Regarding the dominant informal milk market, training and certification of milk traders coupled with appropriate incentive has been proved useful to encourage the supply of reasonably safe milk. Besides, creating enabling policy and regulatory environment to encourage investment in the dairy sub-sector by entrepreneurs, processors and input and service providers, public support is needed in different forms such as business development service, improving access to resource and knowledge by private actors and developing market for their products and services. Deliberately encouraging private-public partnership can make substantial contribution to alleviating key challenges for dairy development. Particularly, most of input and service delivery related problems can be substantially ameliorated through enhanced cooperation between milk producers or producer groups, dairy research and private input and supportive service providers.

References

CSA (2008)
(ILRI, 2000;
FAO, 2002);
(MOA, 2000).;
(MOA, 1998);
(UNDP/MOA, 1993);
(Saxena *et al.*, 1997);
(Constable, et al., 1989)
(Ibrahim, 1998)..
(Coppock, 1993).
(Getachew and Gashaw, 2001)..

Because of the erratic rainfall pattern and related reasons resulting in shortage of feed milk production per unit is low and highly seasonal.

Table 6. Major sales of products for household income generation among the rural *kebeles* in Mieso district

	Sources for household income generation (%)							
	Crop sale		Animal sale		Milk and milk products sale		Off-farm activity	
Rural *kebeles*	N	%	N	%	N	%	N	%
D/kalu	13	86.70	9	60.00	5	33.30	7	46.70
Gena	20	95.20	14	66.70	20	95.20	2	9.50
H/mendera	23	67.60	23	67.60	29	85.30	11	32.40

H/misoma	18	66.70	18	66.70	26	96.30	11	40.70
W/jejeba	21	91.30	17	73.90	16	69.60	5	21.70
Overall	95	79.20	81	67.50	96	80.00	36	30.00

N=Sample respondents, D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/misoma= Hunde-misoma,H/mendera=Huse-mendera

Table 10. Milk yield performance of cows in different stages of lactation at different rural *kebeles* in Mieso district

Rural *kebeles*	Daily yield per head (liters)							
	I stage of lactation		II stage of lactation		III stage of lactation		Overall	
	N	Mean ± SE	N	Mean ± SE	N	Mean ± SE	N	Mean ± SE
D/kalu	60	1.41 ± 0.04	40	1.81 ± 0.04	15	0.49 ± 0.03	15	1.28 ± 0.03
Gena	65	1.42 ± 0.06	55	1.81 ± 0.08	35	0.43 ± 0.02	35	1.05 ± 0.04
H /mendera	110	1.38 ± 0.03	215	1.78 ± 0.03	95	0.51 ± 0.02	95	1.23 ± 0.02
H/misoma	40	1.43 ± 0.08	55	2.24 ± 0.09	35	0.49 ± 0.02	35	1.48 ± 0.06
W/jejeba	105	1.28 ± 0.04	25	1.87 ± 0.08	10	0.49 ± 0.05	10	1.24 ± 0.05
Average	380	1.37 ± 0.02	390	1.86 ± 0.03	190	0.49 ± 0.01	190	1.24 ± 0.01
Sig.		0.123		0.00		0.125		0.00

D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/mendera=Huse-mendera, H/misoma= Hunde-misoma, SE= Standard Error of mean, N= Sample milking cows

Table 1. Milk yield performance of camels in different stages of lactation at different rural *kebeles* in Mieso district

Rural *kebeles*	Daily yield per head (liter)							
	I stage of lactation		II stage of lactation		III stage of lactation		Overall	
	N	Mean ± SE	N	Mean ± SE	N	Mean ± SE	N	Mean ± SE
D/kalu	40	2.58 ± 0.09	25	3.31 ± 0.17	10	1.47 ± 0.10	75	2.68 ± 0.10
Gena	5	1.50 ± 0.11	5	3.68 ± 0.29	10	1.55 ± 0.04	20	2.07 ± 0.23

H/mender	15	2.71 ± 0.17	20	3.57 ± 0.17	4	1.44 ± 0.12	39	3.02 ± 0.15
H/misoma	14	1.85 ± 0.08	45	2.72 ± 0.09	21	1.36 ± 0.09	80	2.21 ± 0.09
W/jejeba	11	2.44 ± 0.19	6	3.29 ± 0.62	35	1.29 ± 0.040	52	1.76 ± 0.12
Average	85	2.41 ± 0.07	101	3.11 ± 0.08	80	1.37 ± 0.03	266	2.36 ± 0.06
Sig.		0.00		0.00		0.139		0.00

D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/misoma= Hunde-misoma, H/mendera=Huse-mendera, SE= Standard Error of mean. Sig.= Significant value, N= Sample milking camels

Table 12. Overall reported lactation length of cows and camels in different rural *kebeles* in the Mieso district

Animal species	N	Lactation length (months)		
		Mean ± SE	Min.	Max.
Cow	119	7.29 ± 0.17	5	12
Camel	32	11.25 ± 0.56	7	24

SE= Standard Error of mean, Min. = minimum, Max. = maximum, (N) = Total number of respondents, N= Sample respondents

Table 2. Pre-weaning and post-weaning mortality (%) of dairy animals based on owners response in Mieso district

Animal type	Average mortality rate				Overall mean
	Pre-weaning		Post-weaning		
	N	Mean ± SE	N	Mean ± SE	
Goat	10	41.70 ± 8.00	14	27.60 ± 6.60	30.00
Cattle	27	61.70 ± 5.20	41	32.60 ± 4.40	43.70
Camel	2	66.70 ± 14.70	10	23.50 ± 0.83	35.30

SE= Standard Error, N= sample households who encountered loss in dairy animals due to diseases

Table 3. Quantity of milk sold per day and price of cows' and camels' milk in Asebot and Mieso market places

Dependent Variable	Market place	Milk type	Mean ± SE (liter)	95% Confidence Interval	
				Lower	Upper

				Bound	Bound
Amount of milk sold	Asebot	Cow	343.34 ± 19.22	304.70	382.00
		Camel	193.28 ±19.22	154.60	231.90
	Mieso	Cow	496.57 ± 19.12	458.10	535.00
		Camel	187.89 ± 19.12	149.40	226.40
Price	Asebot	Cow	2.54 ± 0.104	2.30	2.74
		Camel	2.19 ± 0.104	1.98	2.39
	Mieso	Cow	2.71 ± 0.103	2.51	2.92
		Camel	2.43 ± 0.103	2.22	2.64

SE= Standard Error of means

Table 4. Quantity of milk sold per day and price of cow and camel milk based on season in Mieso district

Dependent Variable	Milk type	Season of milk sale	Mean ± SE (liter)	95 % Confidence Interval	
				Lower Bound	Upper Bound
Amount of milk sold	Cow	Wet season	551.29 ± 19.22	512.6	589.9
		Dry season	288.62 ± 19.12	250.1	327.08
	Camel	Wet season	211.92 ± 19.22	173.2	250.50
		Dry season	169.25 ± 19.12	130.8	207.70
Price	Cow	Wet season	1.88 ± 0.10	1.67	2.09
		Dry season	3.38 ± 0.10	3.16	3.58
	Camel	Wet season	1.63 ± 0.10	1.42	1.85
		Dry season	2.98 ± 0.10	2.77	3.19

SE=Standard Error of means

Table 20. Quantity of milk sold and price of cow and camel milk based on season in Mieso and Asebot market places

Variables	Market place	Milk type	Seasonal milk sale	Mean ± SE	95% Confidence Interval

					Lower Bound	Upper Bound
Amount of milk sold	Asebot	Cow	Wet season	473.30 ± 27.336	418.310	528.297
			Dry season	213.38 ± 27.044	158.972	267.782
		Camel	Wet season	243.13 ± 27.336	188.132	298.119
			Dry season	143.43 ± 27.044	89.023	197.834
	Mieso	Cow	Wet season	629.29 ± 27.044	574.880	683.691
			Dry season	363.86 ± 27.044	309.452	418.262
		Camel	Wet season	180.71 ± 27.044	126.309	235.120
			Dry season	195.07 ± 27.044	140.666	249.477
Price	Asebot	Cow	Wet season	1.94 ± 0.147	1.643	2.236
			Dry season	3.14 ± 0.146	2.850	3.436
		Camel	Wet season	1.42 ± 0.147	1.122	1.714
			Dry season	2.96 ±0.146	2.671	3.257
	Mieso	Cow	Wet season	1.82 ± 0.146	1.528	2.114
			Dry season	3.61 ± 0.146	3.314	3.900
		Camel	Wet season	1.86 ± 0.146	1.564	2.150
			Dry season	3.00 ± 0.146	2.707	3.293

SE=Standard Error of means

Table 5. Distribution of *Faraqa Annanni* and number of participants in the *Faraqa Annanni*

	Availability of *Faraqa Annanni* in the area		Individuals participating in the *Faraqa Annanni*	
	N	%	N	%
Rural *kebeles*				
D/kalu	0	0.00	0	0.00
Gena	15	71.00	3	16.00
H/mender	20	58.80	9	33.00
H/misoma	18	66.60	10	38.00
W/jejeba	0	0.00	0	0.00

Household head sex				
Female	10	47.60	4	15.00
Male	43	58.90	18	19.00
Total	53	44.00	22	23.00

D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/mendera= Huse-mendera, H/misoma= Hunde-misoma, N= Sample respondents

Table 6. Reasons for non participation in milk marketing based on the response of producers in different rural *kebeles* in Mieso district

	Small milk quantity		Distance to market		Cultural taboo		High cost of transport		Spoilage		X^2 P-value
Rural *kebeles*	N	%	N	%	N	%	N	%	N	%	
D/kalu	4	40	8	80.00	2	20.00	1	6.70	2	13.00	
Gena	2	100	0	0.00	0	0.00	0	0.00	0	0.00	
H\Mendera	7	100	0	0.00	0	0.00	2	5.90	1	2.90	0.003
H\misoma	1	100	0	0.00	0	0.00	0	0.00	0	0.00	
W\jejeba	5	71	2	29.00	0	0.00	0	0.00	2	28.60	
HH sex											
Female	4	67	3	50.00	2	33.00	2	33.00	3	50.00	0.09
Male	15	75	7	35.00	0	0.00	1	5.00	2	10.00	
Total	19	73	10	38.00	2	7.60	3	11.50	5	19.00	

D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/misoma=Hunde-misoma, H/mendera= Huse-mendera, HH sex=Household Head sex, N= sampled respondents

Table 7. Problems encountered in dairy animal production in Mieso district

Problems	Total HH(N)	Priority of problems in dairy animal production							
		1st		2nd		3rd		4th	
		N	%	N	%	N	%	N	%
Forage and pasture shortage	120	51	41.00	40	32.00	17	14.00	7	6.00
Water shortage	120	37	30.00	40	32.00	10	8.00	9	7.00

Security problem	120	18	15.00	11	9.00	29	23.00	29	23.00
No enough access to vet. services	120	10	8.00	12	10.00	39	31.50	37	30.00
Lack of transport	120	4	3.00	4	3.20	14	11.30	19	15.00
Lack of improved dairy breeds	120	0	0.00	13	11.00	11	8.90	12	10.00
Absecne of credit service	120	0	0.00	0	0.00	0	0.00	1	0.80
Poor extension service	120	0	0.00	0	0.00	0	0.00	4	3.00
X^2 P-value					0.032				

HH=Household, (N)= Total number of respondents, N= Sample respondents

Table 8. Reasons for feed shortage in different rural *kebeles* in the Mieso district as reported by the respondents

	Reasons for feed shortage										
	Poor feed conservation practices		Lack of forage seed		Expansion of crop land		Lack of rain		Security problem		X^2 P-value
Rural *kebeles*	N	%	N	%	N	%	N	%	N	%	
D/kalu	0	0.00	2	13.00	5	33.00	15	100.00	15	100.00	
Gena	15	71.40	1	4.80	20	95.00	21	100.00	18	85.70	
H/Mendera	11	32.00	0	0.00	29	85.00	34	100.00	32	94.00	0.034
H/misoma	16	59.00	0	0.00	25	92.50	27	100.00	20	74.00	
W/jejeba	10	43.50	1	4.30	19	82.60	23	100.00	23	100.00	
Total	52	43.00	4	3.30	98	81.60	120	100.00	108	90.00	

D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/misoma =Hunde-misoma, H/mendera= Huse-mendera, N= Sample respondents

Table 9. Variation in copping mechanism for drought and feed shortage among rural *kebeles* in Mieso districts

	Measures for feed shortage							
	Raised crop-	Give feed in	Purchase crop	Use of grass	Sell animal	Mobility	Use cut and	X^2

Rural *kebeles*	residue		small quantity		residue		root (*burana)*				carry				P-valu e
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
D/kalu	6	40	4	27	0	0.0	4	27	1	7	15	100	0	0.0	0.00
Gena	15	71	10	48	6	29	6	29	0	0.0	16	76	0	0	
H/Mendera	31	91	25	74	4	12	20	59	2	6	24	71	1	3	
H/misoma	26	96	25	93	4	15	16	59	1	3	24	89	1	4	
W/jejeba	20	87	14	61	0	0.0	7	30	0	0.0	21	91	1	4	
Total	98	82	78	65	14	12	53	44	4	3	100	83	3	3	

D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/mendera=Huse-mendera, H/misoma= Hunde-misoma, N= Sample respondents

Table 10. Distance traveled in search of feed by households in the different rural *kebeles* and by gender of household heads in Mieso district

	Distance travel in search of feed (Km)				Sig.
Rural *kebeles*	N	Mean ± SE	Min.	Max.	
D/kalu	15	5.7 ± 0.74	4.00	15.00	
Gena	20	3.8 ± 0.33	2.00	7.00	
H/Mendera	33	9.3 ± 1.27	1.50	40.00	
H/misoma	26	6.6 ± 1.29	0.50	20.00	0.008
W/jejeba	22	6.4 ± 0.73	2.00	16.00	
HH sex					
Female	25	6.2 ± 1.45	0.50	40.00	0.607
Male	91	6.9 ± 0.53	1.00	20.00	
Total	116	6.7 ± 0.51	0.50	40.00	

Sig.= Significant value; HH sex = Household Head sex, D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/misoma= Hunde-misoma, SE= Standard Error of mean, Min.= minimum, Max.= maximum, N= Sample respondents

Table 11. Crop residue feeding calendar among rural *kebeles* in the Mieso district based on farmers response

Feeding calendar	Rural *kebeles*										Total	
	D/kalu		Gena		H/mendera		H/misoma		W/jejeba			
	N	%	N	%	N	%	N	%	N	%	N	%
All year	0	0.00	5	23.80	3	8.80	1	3.70	0	0.00	9	7.50
Sept-Oct	1	6.70	1	4.80	2	7.40	1	4.30	6	5.00	11	9.20
Nov-Jan	13	86.70	21	100.00	34	100.00	27	100.00	23	100.00	118	98.10
Feb-May	1	6.70	8	38.00	9	26.50	3	11.10	7	30.40	28	23.30
Jun-Aug	7	46.70	8	38.10	13	38.20	15	55.60	14	60.90	57	47.50
Nov-May	0	0.00	5	23.80	1	2.94	0	0.00	0	0.00	6	5.00
X^2P-value	0.01											

Sep=September, Oct=October, Nov=November, Jan=January, Feb=February, Jun=June, Aug=August, N=Sample respondents

Table 30. *Burana* (grass root) feeding calendar among rural *kebeles* in the Mieso district based on farmers' response

Feeding calendar	Rural *kebeles*										Total	
	D/kalu		Gena		H/mendera		H/misoma		W/jejeba			
	N	%	N	%	N	%	N	%	N	%	N	%
All year	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Dec-Feb	1	6.70	3	14.00	1	2.90	2	7.40	0	0.00	7	5.80
Mar-Apr	15	100.00	21	100.00	34	100.00	27	100.00	23	100.00	120	100.00
May-Jun	2	13.00	9	42.80	4	11.80	2	7.40	1	4.00	18	15.00
X^2P-value	0.04											

Dec=December, Feb=February, Mar=March, Apr=April, Jun= June, N= Sample respondents

Table 12. Farmers' response on C*hinki* feeding calendar in rural *kebeles* of Mieso district

Feeding calendar	Rural *kebeles*										Total	
	D/kalu		Gena		H/mendera		H/misoma		W/jejeba			
	N	%	N	%	N	%	N	%	N	%	N	%
All year	0	0.00	0	0.0	0	0.00	0	0.00	0	0.00	0	0.00
Sep-Oct	1	6.70	3	0.14	2	0.06	0	0.00	0	0.00	6	5.00

Apr-Jun	3	20.0	21	100	23	0.68	22	0.81	20	0.87	89	74.00
Jul-Sept	15	100.00	21	100	34	100.00	20	0.74	21	0.91	111	92.50
X^2P-value						0.618						

Sep=September, Oct=October, Apr=April, Jun= June, Jul= July, N= Sample respondents, D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/mendera=Huse-mendera, H/misoma= Hunde-misoma

Table 13. Water sources used by the households in different rural *kebeles* in Mieso district

Type of water sources for livestock	N	Percent
River	94	78.00
Well	22	18.00
Lake	9	7.50
Spring water	78	65.00
Pond	43	35.80
Pipe line water	6	5.00

Table 14. Watering frequency of animals in different seasons in Mieso district

Watering frequency	Wet season				Dry season			
	Cattle		Camel		Cattle		Camel	
	N	%	N	%	N	%	N	%
Every day	120	100.00	0	0.00	8	6.70	0	0.00
Once in two day	0	0.00	0	0.00	95	79.00	2	6.00
Once in three day	0	0.00	1	3.00	12	10.00	7	21.00
Once in a week	0	0.00	1	3.00	0	0.00	10	30.00
Once on two week	0	0.00	4	2.50	0	0.00	3	9.00
Once a month	0	0.00	9	27.00	0	0.00	0	0.00
Not watered	0	0.00	6	18	0	0.00	0	0.00

N= Sample respondents

Table 15. Distance moved for searching water among rural *kebeles* and by household heads in Mieso district

Rural *kebeles*	Distance moved for water searching (Km/day)				Sig.
	N	Mean ± SE	Min.	Max.	
D/kalu	15	7.2 ± 0.74	4	10	
Gena	21	3.1 ± 0.33	1	8	
H/Mendera	33	7.3 ± 1.27	2	30	
H/misoma	26	7.3 ± 1.29	2	30	0.004
W/jejeba	22	7.9 ± 0.73	3	20	
Average	117	6.6 ± 0.52	1	30	

Sig.= Significant value; D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/mendera=Huse-mendera, H/misoma= Hunde-misoma, SE= Standard Error of mean, Min.= Minimum, Max.= Maximum, N= Sample respondents

Table 16. Reasons for poor access to veterinary services in rural *kebeles* of Mieso district

Rural *kebeles*	Problem related to access to veterinary service								X^2 P-value
	Financial problem (for medicine and service)		No regular visit by veterinarian		Long distanceof to vet service		Shortage of experts		
	N	%	N	%	N	%	N	%	
1 D/kalu	66.60	10	66.70	13	86.70	4	26.70	0.00	
5 Gena	23.80	21	100.00	10	47.60	12	57.00		
H/Mendera	2	5.90	32	94.00	20	58.80	21	61.70	
H/misoma	15	55.60	25	92.60	17	62.90	18	66.70	
W/jejeba	2	8.60	22	95.60	18	78.00	15	65.00	
HH sex									

	5				18.50			23	85.00		19		70.00		15	55.6	0.18			
Female																0	6			
Male			20		21.50		87		93.5	0	59		63.0	0	55		59.00			
Total	25	20.80	11	91.	7	65.0	70	58.0												
			0	7	8	0		0												

HH sex = Household Head sex, D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/misoma= Hunde-misoma, N= Sample respondents

Table 17. Farmers' response on major diseases that affect cattle in Mieso district

Diseases type	Rural HHs (N)		Overall		D/kalu		Gena		H/mendera		H/misoma		W/jejeba	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Anthrax	3	20	4	19	6	17.6	7	25.9	7	30	25	20.8		
Pasturolosis	4	27	3	14	4	11.7	5	18.5	2	8.6	18	15		
Blackleg	2	13	2	9.5	1	2.9	3	11	1	4.3	9	7.5		

FMD	2	13	1	4.7	2	5.8	0	0.0	1	4.3	6	5
Mastitis	3	20	11	52	20	58.8	12	44	14	60.9	55	45.8
Diarrhea	2	13	5	23.8	2	5.9	0	0.0	2	8.6	11	9
Ticks infestation	4	26.6	2	9.5	9	26	5	18.5	4	17	2	1.7
X^2 P-value												0.016

HH = household, D/kalu= Dire-kalu, W/jejeba= Welda-jejeba, H/mendera=Huse-mendera, H/misoma= Hunde-misoma, FMD=Foot and Mouth Diseases, N= Sample respondents

4. Conclusions and Recommendations

The major technical constraints to dairy production in Mieso district were feed scarcity, water shortage, poor veterinary service and limited access to markets. Contribution of milk production and marketing depends largely on assured supply of accompanying inputs such as feed, veterinary drugs and improved milk marketing facilities. This study showed that there is a large potential for dairy development in the Woreda. However, the following areas need attention if dairy production is to develop into a market-oriented business operation in the district.

- Improve the available natural pasture and introduce hay making; develop and implement rangeland management systems.

- Introduce and develop improved forages as sole crops or integrated with cereal crop production (sorghum or maize system).
- Improved sorghum and maize stover conservation and enhance utilization by chopping, and treating with urea molasses.
- Consider breed improvement with multipurpose utility of local breeds
- Consider the possibility of selection and crossbreeding for dairy production in locations where it is feasible with improved feeding and proper management systems.
- Improve animal health services including paravet training and drug supply system with close monitoring and supervision.
- Strengthen community diseases surveillance and reporting system.
- Establish milk collecting and processing unit through encouraging the already existing self organized group '*Faraqa Annanni'*.
- Introduce technologies for the processing of goats and camel milk.
- Develop market linkage between the producer and consumer of milk products.
- Examine the possibility of credit provision for improved dairy production, processing, and marketing.
- Train district staff, development agents and farmers (mainly women) on dairy production, processing and marketing
- Seriously consider way of dealing with conflicts over resources in the district.