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Research Article

Dairy Production System in Lowland Area of Gambella, Ethiopia

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ABSTRACT

The average for landholding for pasture lands were higher in pastoral production system (4.31 ± 0.22 ha) than in mixed crop-livestock production system (3.43 ± 0.18 ha). Average cattle herd size per household was higher in the pastoral production systems (12.51 ± 0.32 than in the mixed crop-livestock production system (9.35 ± 0.38). The majority of producers (63.3%) in the pastoral system produced milk for home consumption, while the majority of mixed crop–livestock producers (40.0%) produced milk for selling purpose. All family members had a role in dairy cattle management in both the production systems. In the mixed crop–livestock system, mostly cereal crop based grazing is the major feed resource but these feed resources were managed in a traditional ways. Almost all respondents in the mixed crop-livestock system (96.5%) and pastoral system (100%) did not supplement their lactating cow with additional feeds. More than 400 cattle herds from 2-3 villages graze together between 10 am to 4 pm daily. The main source of water in both the studied areas was river (47.5%). The majority of households (68.3%) in the mixed crop–livestock system kept their cattle separately in barn, while other 8.3% of the households did the same in pastoral areas. The most commonly mentioned diseases of cattle were trypanosomiasis (51.7%), Pastuerllosis (22.5%), CBPP (13.3%), FMD (8.3%) and parasites (4.2%). The overall of the respondents in both systems (53.5%) used traditional medicine to treat their animals. Constraints for dairy development in the area are diseased condition, thieves, lack of veterinary services, lack of credit, feed and feeding and poor extension services. It can be concluded dairy cattle production in the mixed crop-livestock system was economical and based on mixed agriculture (crops plus livestock) with some fishing activity, mining and wild food collection. While in pastoral production the major economic activities are livestock rearing comprising mainly cattle, goats and sheep, respectively.

Keywords: Milk yield; Dairy cattle; Marketing; Gambella; Production systems

INTRODUCTION

Ethiopia holds the largest ruminant livestock population in Africa but productivity is low and its contribution to the national economy is limited as compared to its livestock potential. Demand for milk is increasing day by day due to population explosion. Smallholder farmers and pastoralists are expected to benefit from the rise in demand. Despite huge dairy cattle population in Ethiopia, smallholders are not the beneficiaries of this opportunity owing to constraints like inadequate nutrition, disease, lack of support services such as extension services, inadequate information on improvement, marketing opportunities and other factors.

Itang district is known for its big cattle population in Gambella region. However, the fact that the cattle types are naturally selected for adaptation to disease and harsh climate than for productivity on one hand and predominance of extensive livestock production system on the other deviates the rank with regard to the quantity of the products. This condition calls for both genetic and systemic aspects of dairy cattle improvement. Wider potential to improve the production system exists in the lowland regions of the country wider potential to improve the production system exists in the lowland regions of the country. This is because the low lands have lower density of human and cattle population, and the production system is predominantly pastoralist and mixed crop- livestock. Dairy production in pastoral and mixed crop-livestock area of the region is found in association with traditional production system: communal grazing system and unimproved husbandry system

One of the pre-requisites in deigning dairy production strategy for a country or a region is investigation and assessing of the production systems and the traditional management practices prevailing in the area. There have been a number of such types of researches in the country, which are limited to the highland and mixed crop-livestock farming systems. Little has been done in the lowland areas like Gambella, which are characterized by low rainfall, high

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temperature, prevalence of important diseases and low forage production. There is a need, therefore, to identify and assessing the different types of dairy cattle production systems, management practices, marketing and its constraints that exist in the Itang district so that appropriate recommendations can be tailored to the specific needs of the farmers in each production

MATERIALS AND METHODS

Description of the study area

The study was conducted in Itang special woreda of Gambella National Regional State (GNRS), Ethiopia. Itang is located in the southwest part of Ethiopia, about 825 km from Addis Ababa, which is 48 km far from Gambella the capital city of Gambella [1]. The annual rainfall and annual average temperature are 1247 mm and 34.37°C, respectively [2].

Site selection and sampling techniques

Prior to sampling of the participants very extensive discussions was held with Woreda livestock experts and development agents by preparing short meeting to make clear the purpose of the study and for the establishment of community-based dairy production improvement program.

Individual households having dairy cows of any breed and herd size were identified and listed in selected kebeles. After doing so, a total of 120 households were selected from four kebeles using simple random selection method after identifying the dairy owner from the community using purposive sampling method. Thus 120 households were selected 60 from pastoral system and the remaining 60 from mixed crop- livestock; 30 households owning dairy cattle were randomly selected from each tebele. 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.

Methods of data collection

In each of the study kebele's and PA's discussions were made with agricultural development agents, woreda agricultural officers, and 8 to 15 selected households based on experience on dairy farming activity to know the priority of production performances, marketing aspects, management practices and major constraints for dairy production in the area and Each group was given the chance to identify the different selection criteria for dairy cows.

Data analysis and statistical model

The data collected using different methodologies were analyzed using SPSS statistical package [3]. Descriptive statistics, one way ANOVA, chi-square and ranking were used in data analysis.

- Chi –square
- ANOVA (analysis of variance)
- Ranking

RESULTS AND DISCUSSION

Characteristics of crop and land holding

The overall results from the survey is presented in Table 1 which predicts that majority (46.7%) of the household had crop land which was in the range of 2- 2.5 ha and the rest 35.8 and 17.5% of the house hold of crop land were owning less than 1.5 and 3-4 ha respectively.

Livestock and cattle herd composition

The livestock herd size and composition in the different production systems are shown in Table 2. In the mixed crop-livestock production system, the livestock herd was dominated by poultry (30.33), cattle (29%) followed by goat (23.4%) and sheep (16.6%). The result was not in agreement with the results of IPS (2000) [4], who indicated that the livestock herd in Somali region was dominated by cattle (58.1%) and goats (53.2%). In contrast to our finding in the mixed crop-livestock system, the livestock herd in the present study was dominated by cattle (36%) in pastoral production system followed by goat (27.9%), poultry (25.6%) and sheep (10.5%). These results agree with the results of Daodu et al. [5] which showed that cattle constituted 36 per cent of the herd in Oyo area of Southwest Nigeria.

All the cattle owned by the sampled households were indigenous. The overall cattle herd size and composition in both mixed and pastoral dairy production was dominated by cows and accounts for (43.5%) followed by heifer (16.1%) and bulls (15.4%). Next to dairy cow, heifer and calf comprised a significant proportion of the livestock herd in both mixed crop livestock and pastoral areas. There was no significant ($p>0.05$) difference between bull and steer of livestock holding with the respect to production systems. This is in line with the finding of Kedija [6] who indicated that cows dominated the cattle herd composition at Mieso district. In the pastoral dairy production system, cows contribute the higher proportion that accounted for Cows (46.5%) followed by heifers (17.2%), calves (14.7%), bulls (13.4%) and steers (7%). The present result is in line with the work of Kahsaye [7] he studied in pastoral area of Eritrea and in his report, the household herd structure for the lowlands of Eritrea were female dominated. In mixed crop-livestock producers, cows also contribute the higher proportion that accounted for Cows (39.5%) followed by bulls (18%), calves (14.5%), heifers (14.5%), and steers (12.2%), respectively (Table 3).

Purposes of keeping cattle

Dairy producers in pastoral and mixed crop–livestock production

Table 1: Means and standard errors of crop land of the households in different production systems.

Crop land	Pastoral (N=60)		Mixed crop- livestock (N=60)		Overall (N=120)	
	Frequency	%	Frequency	%	Frequency	%
1- 1.5 ha	31	51.7	12	20	43	35.8
2- 2.5 ha	26	43.3	30	50	56	46.7
3-4 ha	3	5	18	30	21	17.5

N= Number of observations, ha= Hectare

Table 2: Average of livestock herd size and composition in pastoral and mixed crop- livestock production system (Mean ± SE).

Livestock spices	Pastoral		Mixed crop- livestock		Overall	
	Mean ± SE	%	Mean ± SE	%	Mean ± SE	%
Cattle	12.51 ± 0.32	36.0	9.35 ± 0.38	29.0	10.93 ± 0.28	32.50
Goat	9.70 ± 0.49	27.9	7.40 ± 0.38	23.4	8.56 ± 0.32	25.65
Sheep	3.63 ± 0.46	10.5	5.26 ± 0.34	16.6	4.45 ± 0.29	13.55
Poultry	8.90 ± 0.39	25.6	9.58 ± 0.55	31.0	9.23 ± 0.34	28.30
Total	34.98 ± 0.89	100	31.58 ± 0.80	100	33.28 ± 0.61	100

SE= Standard Error

Table 3: Means and standard error of cattle herd size and composition in different production systems.

Cattle types	Pastoral dairy (N=60)		Mixed crop livestock (N=60)		Overall (N=120)	
	Means (SE)	%	Means (SE	%	Means (SE)	%
Cows	5.81 ± 0.26	46.5	3.7 ± 0.21	39.5	4.75 ± 0.19	43.5
Heifers	2.16 ± 0.22	17.2	1.36 ± 0.13	10.4	1.76 ± 0.13	16.1
Bulls	1.68 ± 0.15	13.4	1.68 ± 0.17	18	1.68 ± 0.11	15.4
Calves	1.85 ± 0.11	14.7	1.68 ± 0.17	15.5	1.65 ± 0.07	15.1
Steers	1.00 ± 0.11	7	1.15 ± 0.15	12.2	1.07 ± 0.09	9.8

systems had also different purposes for keeping cows (Table 4). There is a big difference between the mixed crop-livestock and pastoral production system, where the majority of proportion of households (40.0%) in the mixed crop- livestock system produced milk primarily for sale, while the majority of households (63.3%) in the pastoral production system used milk for household consumption.

Milk production and Reproductive Performances

Majority of households in both the mixed crop-livestock and pastoral production indicated as twice milking is a common practice. The present result is in agreement with the result in East Showa, where milking takes place twice a day [8].

In pastoral production system, the means average milk yield/head/day at beginning, middle and end lactation stages was 2.00 ± 0.08 liters, 2.99 ± 0.08 liters and 1.84 ± 0.09 liters, respectively. Unlike pastoral, high milk yield/head/day at beginning, middle and end lactation stages was reported in mixed crop-livestock production system 1.99 ± 0.08 liters, 3.46 ± 0.10 liters and 1.57 ± 0.084 liters, respectively. There were no significant (P>0.05) difference among the studied production systems in the first lactation stage (1-2 months)

According to the household respondent the average amount of milk yield/head/day obtained in this study at beginning, middle and end lactation stages were 2.00 ± 0.06 liters, 3.23 ± 0.07 liters and 1.72 ± 0.06 liters, respectively in both production system. These values were higher than the average of 1.4 liter/day/cow in Oromia regional state as reported by and the average milk yield of local Arsi cows (1.0 liter /head /day) [7]. But the result of this study is lower than the average daily milk yields reported by Abraham [9] (4.06 and 4.47 liters) at western Zone of Tigray (Table 5).

Average daily milk consumption per household was higher in pastoralist's area (1.33 ± 0.09) than mixed crop–livestock (1.12 ± 0.081). Because in mixed crop-livestock production the primary purpose of keeping dairy cattle is for selling rather than household consumption due to market access. There was no significance (P> 0.05) difference daily milk consumption among the production systems (Table 6).

Table 4: Primary purpose for Rearing cattle by dairy farmers in Pastoral and Mixed crop–livestock production systems.

Primary purposes dairy cattle	Frequency (Index)	
	Pastoral system (N = 60)	Mixed crop-livestock (N = 60)
Produce milk for sale	8 (0.22)	24 (0.26)
Produce milk for consumption	38 (0.32)	15 (0.24)
For meat production	3 (0.12)	10 (0.20)
For asset	6 (0.18)	7 (0.17)
Dowry	5 (0.16)	4 (0.13)

N=Sample households

Table 5: The overall milk yields from dairy cows in pastoral and mixed crop- livestock production system.

Lactation stage	Milk yields (Mean ± SE)		
	Pastoral (N=60)	Mixed crop-livestock (N=60)	Overall (N= 120)
Lactation stage I	2.00 ± 0.08	1.99 ± 0.08	2.00 ± 0.06^{NS}
Lactation stage II	2.99 ± 0.08	3.46 ± 0.10	3.23 ± 0.07*
Lactation stage III	1.87 ± 0.09	1.57 ± 0.084	1.72 ± 0.06**

*=Significance difference (P<0.01), **= Significance difference (P<0.05), NS=no significance (P>0.05)

The estimated overall age at first calving for cows was estimated about 49.35 ± 0.22 months. As indicated in the (Table 7) the age at first calving for cows in mixed crop-livestock was higher 48.12 (0.25) months less than that of pastoral production system 50.50 (0.31) months. There was significant (p<0.05) variation

among the studied production systems in age at first calving of cows. As presented, (Table 8) the overall mean calving intervalof cows was found to be 18.61 ± 0.17 months. The results of respondents show that the calving intervals of cows was higher 17.61 ± 0.19 months in mixed crop-livestock and is less than that of pastoral production system 19.65 ± 0.21 months. There were significant (P < 0.05) variations among the production systems in calving intervals of cows. Number of services pre conception in pastoral production was 2.28 ± 0.12 which was higher than that of mixed crop-livestock production system 2.01 ± 0.11. There was no significant (p>0.05) difference among the studied production system in number of services pre conception. From these results the overall means of number of services pre conception was 2.15 ± 0.08in studied production systems.

As presented (Table 9) average lactation length for cows was 8.13 ± 0.13 months. The lactation length of cow in mixed crop-livestock was 8.45 ± 0.17 months which is shorter than that of Pastoral dairy production system 7.81 ± 0.19 months. There were significant (P<0.05) difference among the studied production systems in lactation length.

Milk marketing

Mixed crop-livestock area had relatively better market for fresh milk, surplus products was presented for urban dwellers located in Itang town.

Milk and milk by products prices varies around different seasons and in different locations. A high percentage of respondents 60 percent mixed crop- livestock indicated that amount of milk sale increases during the wet season. This increase in milk yield and supply to the market is mainly due to more cows calving in the wet season and increased feed availability.

The major constraints for milk marketing as identified by the producers in Itang district are low milk quantity (37.5%), long distance to market (31.7%), spoilage (17.5% and cultural limitation (13.3%). Out of the total respondents, majority of pastoral

Table 7: Mean and standard errors of performance parameters of cows in different production systems.

Variables	Performance (Mean ± SE)		
	Pastoral (N=60)	Mixed crop-livestock (N=60)	Overall (N=120)
Age at first calving (months)	50.50 (0.31)	48.21 (0.25)	49.35 (0.22)*
Calving interval (months)	19.65 (0.21)	17.58 (0.19)	18.61 (0.17)*
Number of services per conception	02.28 (0.12)	02.01 (0.11)	02.15 (0.08)^{NS}
Lactation length (months)	07.81 (0.19)	08.45 (0.17)	08.13 (0.13)**

N= Number of observations, SE= Standard Error *= Significant difference (p<0.01), **= Significant difference (p<0.05), NS= Not significant difference (p>0.05)

Table 8: Sales of milk and milk by-product by household, its price (ETB) and consumption during wet and dry in pastoral and mixed crop-livestock production system.

Type of product and its price	Pastoralists (N=60)	Mixed crop-livestock (N=60)	P-value
	Mean ± SE	Mean ± SE	
	Fresh milk sales liter/day/HH		
Wet season	0.76 ± 0.05	1.10 ± 0.05	0.00
Dry season	0.28 ± 0.03	0.32 ± 0.23	0.32
	Butter sale kg/week/HH		
Wet season	0.28 ± 0.026	0.40 ± 0.03	0.04
Dry season	0.11 ± 0.02	0.17 ± 0.023	0.06
	Fresh milk price (Birr/liter)		
Wet season	2.89 ± 0.13	3.85 ± 0.08	0.000
Dry season	8.78 ± 0.10	7.96 ± 0.11	0.000
	Butter price (Birr/kg)		
Wet season	23.38 ± 0.40	27.00 ± 0.48	0.000
Dry season	31.88 ± 0.34	37.75 ± 0.35	0.000

HH: Indicates household

Table 9: Market constraints for marketing of dairy milk in different production systems.

Market constraints	Pastoral system (%)	Mixed crop- livestock (%)	Total (%)
Low milk quantity	15	60	37.5*
long distance to market	48.3	15	31.7*
cultural limitation	15.0	11.7	13.3**
Spoilage	21.7	13.3	17.5**
Total	100	100	100

*= Significant difference (p<0.01), **= Not Significant difference (p>0.05)

production system constraint was long distance to market access (48.3%), spoilage (21.7%), insufficient amount of milk (15%) and cultural limitation (15%). The mean average distance women travel to sell milk in pastoral production system was 24.45 ± 3.23 km and ranges from 20 to 30 km. The long distance to market of households in Dorong kebele decreases their participation in milk marketing.

Dairy cattle husbandry and management practices

Household members participation in various dairy animal management in the studied area and was found to be dependent not only on the sex and age of the family members, but also on the type of the herds possessing. Grandin et al., [10] also noted that allocation of labour to different tasks by different age and sex of the family members is a strategy used to overcome labour shortage and this strict allocation of tasks to various age and sex groups is a typical feature of pastoral system in general.

In the mixed crop–livestock system, mostly cereal crop based grazing is the major feed resource but these feed resources were managed in a traditional ways that means all the species of the livestock were allocated to graze these grazing lands together which further was causing overgrazing problems. Out of all the respondents of mixed crop- livestock 90 percent did not supplement their lactating cows with additional feeds, while only 10 percent used to supplement their dairy cows with additional feeds other than grazing (Figure 1).

The major dairy cattle feed sources available in pastoral production system of the studied area are natural grazing. More than 4000 cattle heads from 2-3 villages graze together between 10 am to 4 pm daily. Productivity of the open savanna is at its peak during April to June when succulent pasture is available; July to September fibrous pasture and October to November standing hay exists. The month of November the rangelands are burnt and for the following 6 months there will be shortage of feed.

The surveyed farmers used different water resources for their cattle in the study areas. The main sources of water identified in the study areas were rivers (47.5%), lakes (30.8%), ponds and wells (20.0%)) and pipe water (1.7%). These results are in agreement with the results of Kedija [6] which showed that rivers as water sources constituted (78%) in Mieso district (Tables 10-12).

The major diseases of dairy cattle identified in the studied areas were Trypanosomiasis (51.7%) which constitute the higher proportion followed by Pastuerllosis (22.5%), CBPP (13.3%), FMD (8.3%) and rest (4.2%) contributed by internal and external parasites as visible in Table 14. Mastitis is also one of the major diseases in the studied areas but farmers are not aware of it because they thought that cannot causes death of animals. All the respondents in mixed crop-livestock and pastoral production system reported that calves are more susceptibility than cows and bulls. Chi-square results indicated that there was highly significant ($p<0.05$) higher variation among the production systems.

Most households (68.3%) in the mixed crop–livestock system kept their cattle separately in barn, while considerable proportions (23.3%) used mixed open barn/shed and rest 8.3% have no houses for their animals. This result is in agreement with the finding of Sintayehu et al., [11] of Shashemene- Dilla area.

The average weaning age of calves in the studied areas was found to be 6.25 ± 0.084 months in mixed crop-livestock system and 6.60 ± 0.095 months in pastoral production system (Table 13). There were no significant ($p>0.05$) variation among the production system in the weaning age of calves The finding of this study is lesser when compared to the result with the report of Tesfaye [12] who found 9.9 ± 0.28 months weaning age in Metema woreda.

According to the farmers ranking, Traypanosomasis was the highest deleterious and prevailing disease followed by Pastuerllosis and Contagious Bovine Pleuro Pneumonia. In addition, Traypanosomasis occurred in all seasons compared to other diseases of the zone (Table 13).

Constraints and opportunities for dairy developments

Production constraints determine the state of dairy cattle production in the study areas. Some of the constraints mentioned by the farmers are feed, health, environmental factors, conflict, management and genotype. The interactions of these factors limit the efficiency at which genetic potential of a given animal species is being utilized. Farmers in all the study areas raised their livestock at subsistence level because of variety of problem in the study areas.

Generally, the major constraints identified by respondents in both pastoral and mixed crop– livestock production system are due to

Figure 1: Cattle grazing at waterlogged areas during dry season around Baro Rivers.

Table 10: Water sources and frequency of watering of dairy cow in different production systems.

Water source	Production system		
	Pastoral (N= 60)	Mixed crop – livestock (N=60)	Over all
1. Rivers	35 (58.3)	22 (36.7)	57 (47.5)**
2. Lakes	18 (30)	19 (31.7)	37 (30.8) NS
3. Ponds and Wells	6 (10)	18 (30)	24 (20)*
4. Pipe Water	1 (1.7)	1 (1.7)	2 (1.7)NG
Watering frequency			
1. Freely at all time	33 (55)	27 (45)	60 (50)NS
2. Twice a day	16 (26.7)	13 (21.7)	29 (24.2) NS
3. Once a day	11 (18.3)	20 (33.3)	31 (25.8) NS

*= Significant difference ($p<0.01$), **= Significant difference ($p<0.05$), NS= Not significant difference ($p>0.05$)

Table 11: The average weaning of calf in pastoral and mixed crop- livestock production system.

Weaning age	Production system		
	Pastoral system	Mixed crop- livestock	Over all
N	60	60	120
Mean	6.25	6.60	6.42
SE	0.084	0.095	0.065

HH: Indicates household, N: Number of students, SE=Standard error (P>0.05)

Table 12: Frequency and percent of major diseases in the pastoral and mixed crop- livestock production system.

Diseases	Pastoral (N=60)		Mixed crop- livestock (N=60)		Total	
	Frequency	%	Frequency	%	Frequency	%
Trypanosomiasis	34	56.7	28	46.7	62	51.7
Pastuerllosis	11	18.3	16	26.7	27	22.5
CBPP	7	11.7	9	15.0	16	13.3
FMD	5	8.3	5	8.3	10	8.3
Internal and external parasites	3	5.0	2	3.3	5	4.2
Total	60	100	60	100	120	100

CBPP= Contagious Bovine Pleuro Pneumonia, FMD= Foot and Mouth Disease, N=Sample respondent

Table 13: Pair wise index and ranking for disease of dairy cows in different production systems.

Diseases	Pastoral		Mixed crop- livestock	
	Index	Rank	Index	Rank
Trypanosomiasis	0.27	1	0.26	1
Pastuerllosis	0.23	2	0.24	2
CBPP	0.19	3	0.22	3
FMD	0.17	4	0.16	4
Internal and external parasites	0.14	5	0.12	5

1= Most importance 5= Least importance

Table 14: Major production constraints in pastoral and mixed crop- livestock production system.

Production constraints	production systems					
	Pastoral (N=60)		Mixed crop- livestock (N=60)		Total (N=120)	
	Frequency	%	Frequency	%	Frequency	%
Diseases	26	43.3	20	33.3	46	38.30
Veterinary services	8	13.3	5	8.3	13	10.80
Water scarcity	1	1.70	2	3.30	3	2.50
Lack veterinary clinics	4	6.70	3	5.00	7	5.80
Feed and feeding	3	5.00	14	23.3	17	14.20
Thieves	15	25.0	9	15.00	26	20.00
Low producing animal	1	1.70	4	6.70	5	4.20
Extension services	2	3.30	3	5.00	5	4.20
Total	60	100	60	100	120	100

diseases contributing 43.3 and 33.3 per cent, respectively. Next to diseases, thieves 25% and absence of veterinary services 13.3 percent for pastoral and feed 23.3% and thieves 15% for mixed crop- livestock, respectively, (Table 14). A chi-square test shows that there were no significant (p>0.05) difference among the production systems.

CONCLUSION AND RECOMMENDATIONS

The milk yield performance of cattle in the studied households was low and age at first calving seems to be extended as it is common for other indigenous cattle in Ethiopia. The calving interval was encouraging but still below the optimal level. The amount of milk production sale and milk price was higher in mixed crop–livestock system than in pastoralists. This is due to better management and marketing access for dairy products and by products located in mixed crop–livestock system than those in pastoralists.

In both production systems feeding of cattle was based on natural feed resources. The selected households depended highly on family

labor in both pastoral and mixed crop-livestock system. In both the production system the animals are seriously infested by diseases such as trypanosomiasis, Pastuerllosis, CBPP, FMD and parasites. Disease, thieves and veterinary services was regarded as the most important for dairy cattle production constraints prioritized by farmers residing in the study areas.

Milk yield is the most important trait preferred by both mixed crop-livestock and pastoral milk producers, but farmers generally depend on informal sources of information and their own morphological markers to select animals for dairy production, obviously due to lack of record keeping practices.

Based on the above conclusions the following points are recommended:

- Production systems and selection based breeding objectives need to be defined in the context of the existing dairy production conditions and interest of local societies in the areas.
- It is recommended that policy makers and donors need to give due attention to improve access to market to assure the well-being of pastoralists, this can be achieved through construction of road, market center, facilitating transportation service, expanding telecommunication service in pastoral areas and linking producers directly with market, thus pastoralists can benefit from the rapidly growing demand for dairy cattle products and by products.
- Transfer of knowledge and technology for integrated farming should be provided.
- Special attention should be given to the diseases mainly trypanosomiasis through conducting research on the epidemiology of the disease, extension and designing appropriates control measures in the areas.
- Development of proper markets and co-operatives societies for collection and marketing of milk in villages.
- Should be given knowledge of pastoral production system of marketing.
- Provide awareness and extension services for preservation of milk and provide necessary information for by products processing.

REFERENCES

1. GPNRS (Gambella Peoples National Regional State). Gambella Regional land-use and Land allotment study. Amended draft final report, Yeshi-Ber Consult (YBC). Addis Ababa, Ethiopia. 2003; 2
2. IAR (Institute of Agricultural Research). Abobo research center progress report 1988-1989. IAR. Addis Ababa, Ethiopia. 1990
3. SPSS (Statistical Procedures for Social Sciences), SPSS (Version 15.00) BI Survey tips. Statistical procedures for social sciences (SPSS) INC. Chicaco, USA. 2006
4. IPS. Resource potential assessment and project identification study of the Somalia Region: Socioeconomics assessment. Investment office of the Somalia regional state. Research report. 2000; 3: 351.
5. Daodu MO, Babayemi OJ. Utilization of some edge-row plants as forage in Nigeria. Pakistan J. Nutr. 2009; 8 (8): 1269-1274
6. Kedija H. Characterization of milk production systems and Opportunity for market orientation: A case study of Mieso District, Oromia Region, Ethiopia.2007; 191.
7. Kahsaye W. The cultural ecology of pastoralism in Eritrea. A geographic Inquiry. Department of Geography and Anthropology. 2002; 8 (3): 345-349
8. Lemma F, Fekadu B, Hegde PB. Rural smallholder milk and dairy production, utilization and marketing systems in East Showa zone of Oromia. Participatory innovation and research: Lesson for livestock development. Proceedings of the 12th Annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa. 2005; 185-192.
9. Abraham A, Abebe H (2018). Ethiopian Indigenous Cattle breed's Diversity, Distribution, Purpose of Keeping, and Their Potential threats. Journal of Biological Innovations 7 (5):70-789.
10. Grandin, BE, De Leeuw PN, De Souza M. Labour and livestock management. An analysis of the livestock production system of Maasai pastoralists in eastern Kajiado district, Kenya ILCA Systems study. International Livestock Center for Africa, Addis Ababa, Ethiopia 1991; 71-82
11. Sintayehu Y, Fekadu B, Azage T, Berhanu G. Dairy production, processing and marketing systems of Shashemene- Dilla area, South Ethiopia. Improving productivity and market success of Ethiopian farmers' project. International livestock research institute, Nairobi, Kenya. 2008; 9: 62.
12. Tesfaye M. Characterization of cattle milk and meat production, processing and marketing system in Metema district, Ethiopia. MSc Thesis, Hawassa University, Awassa, Ethiopia. 2008; 209.