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Assessment of Dairy Cattle Breeding Practices in West Shoa Zone

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***Abstract*—** *This study was conducted to assess the breeding practices of dairy cattle in Adea Berga, Ejerie and Metarobi districts. The study was undertaken using questionnaire-based survey and a participatory group discussion method. A total of 180 households were participated in the interview. A Structured questionnaire was used to describe qualitative and quantitative traits. Descriptive statistics, analysis of variance (ANOVA) and Frequency distribution procedures were used for statistical analysis of survey. Result from the survey indicated that the mean herd size of cattle per household was 6.42 ± 0.50, 8.10 ± 0.69 and 9.04 ± 0.76 in Adea Berga, Ejerie and Metarobi districts respectively. All of the respondents owned dairy cow and about 40%, 61.70% and 10% of the households had 1.92 (ranging 1-10), 2.41 (ranging1-10) and 3.28 (ranging 1-16) crossed cows in Adea Berga, Ejerie and Metarobi districts respectively. About 48.30%, 56.70% and 40.70% of the respondent practiced AI services in Ada Berga, Ejerie and Metarobi respectively, while 3.30% of the respondents practiced synchronization in Ada Berga and Ejerie. On the contrary, about 26.70%, 21.70% and 53.30% of household were practiced uncontrolled natural mating in Ada Berga, Ejerie and Metarobi respectively. Milk production was the primary objective of keeping livestock whereas Metarobi farmers keep their livestock for drought and milk purpose. Finally, the information on breeding practice assessment in these districts may serve as a basis for improvement of dairy cows and may help for designing appropriate breeding strategies of dairy cattle*.

***Keywords*—** *Breeding objective; Herd size; Mating type*.

I. INTRODUCTION

Ethiopia has one of the largest livestock resources in Africa with estimated national herd of 59 .49 million cattle, 30.70 million sheep, 30. 20 million goats and 12.22 million pack animals [1]. In addition, livestock support and sustain livelihoods for 80% of the rural community and female cattle constitute about 55.5% of the national herd [2]. [3] showed that dairy genotypes in the tropics are at the same level of indigenous genes inheritance, while crosses of different exotic breeds differed in their performance indicating that no one breed, crossbreed or crossbreeding strategy will have superior aggregate performance in all production environments. Therefore, farmer's knowledge and preferences about the genotypes should be an integral part of breed improvement efforts because farmers adopt and adapt genotypes to their needs and circumstances [4]. Farm-ers might tend to upgrade to higher exotic grades and/or Friesian based on cross breeding for higher milk yields even though the overall productivity-ty, on the account of repro-duction and production, may be low. In addition, large dairy breeds are associated with high milk yields and are likely to be more popular than smaller breeds in pro-duction systems [5].

Though the breed improvement activities were implemented, the breeding practice, im-portance of farmers' breeding objectives, preferences for different traits, and mating system as breed improvement strategy under low-input systems have not been documented for smallholder dairying in western Shoa, Oromia, which necessitates undertaking this study. Therefore, this study was conducted to study the dairy cattle breeding activities of farmers in central highlands of Ethiopia and identify trait preference of farmers for dairy cattle in the study area.

II. MATERIALS AND METHODS

2.1. Description of Study Area

This study was conducted in three potential districts of Addis Ababa milk shed of West Shewa Zone, Oromia, Ethiopia. The zone has 21 districts and total cattle population 2,015,696 [6]. Selected districts were Adea Berga, Ejerie and Metarobi with 70 km from Addis Ababa.

Adea Berga is found in North of the zone and located at 70 km South west of the capital Addis Ababa. It is also situated at 35km north west of Holleta at 9°12' 0"N to 9°36'0" N latitude and 38°18'0"E to 38°33'0" E longitude. Based on the report of Central Statistical Agency [7] Ada Berga has an estimated total human population of 120654 of which 60366 were males and 60, 288 were females.

Ejerie district is located 70 km in the north of Ambo, the capital town of west shoa zone and 42 km south of Addis Ababa at 8°50'0" E to 9°14'0"N latitude and 38°15'0"E to 38°29'0"E longitude. It is a typical Highland and mid-land area with an elevation of 2060 to 3085 masl. It receives an annual average rainfall of 1200 mm and it's an annual temperature range between 9 ℃ - 28℃. Based on the report of Central Statistical Agency Ejerie has an estimated total human population of 86934 of which 44222 were males and 42712 were females.

Metarobi is located at about 100 km north-west of Addis Ababa. The district lies in a hilly landscape at elevations ranging from 1,200 to 2,900 masl and located at 9°13'0" N to 9°42'0"N latitude and 38°8'0"E to 38°22'0" E longitude. It is bordered by Ejerie in the south, by Jeldu in southwest, by GindeBeret in the northwest, by the Mugger River (which separates it from the Semien Shewa Zone) in the north and by

Adea Berga in the east [8]. The total human population of the district is 166,472 (male = 82,482 and female = 83,990).

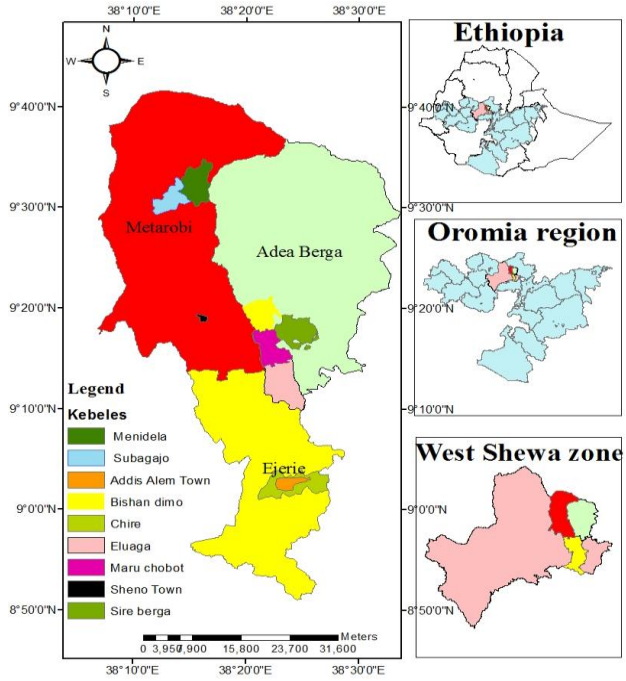

Figure 1. Map of the Study Area Sampling Methods and Data Collection

2.2. Sampling and Methods

The preliminary information of the study area and farmers were taken from the report of zonal consultation meeting and rapid assessment of the selected sites which was held by LIVES (Live-stock and Irrigation Value chain for Ethiopians Smallholder) Project [9]. Secondary information from districts and Zonal Agricultural and Rural Development offices was also utilized to assist in the selection of kebeles from representative districts

To conduct questionnaire-based survey, three districts and three kebeles from each district were purposively selected from west shoa zone of Oromia region based on their dairy cattle availability and milk production potential. Simple random sampling technique was used for farmer selection in kebeles. A total of 180 households (60 from each district) were randomly selected from the dairy holding households for the interview from the selected kebeles. Total sample size was determined using [10],

Total sample (N) = Zα2 x p (1-p) /d2

Where:

N=required sample size

P (expected proportion) = 0.135(by assuming the population is homogenous)

d (desired absolute precision) = 0.05

Zα = 1.96(is the abscissa of a normal curve that cuts of an area at the tails (1-α equals to the de-sired confidence level, for 95%=1.96), for the survey the required sample size of the respondent with 95% confidence level was calculated as, N=Zα2×p, (1-p)/d2= [(1.96)2×0.135(1-0.135)]/ (0.05×0.05) = 3.8416×0.1168/0.0025=180 farmers

Questionnaire Administration

Data was collected from primary sources. A semi-structured Questionnaire was prepared and pre-tested before administration. Some re-arrangement, refinement and correction was done in accordance with respondent perception. A pertinent questionnaire was administered to the respective selected smallholder households in the study area. The questionnaire was filled by trained enumerators recruited for this purpose with close supervision by the researcher. During the inter-view process, every respondent included in the study was briefed about the objective of the study before starting the actual questions.

The information collected included issues related to socio-economic characteristics of the farmers and breeding practice. Among the major breeding practices mating system, trait preference, and routine husbandry practices were assessed during survey. Focus group and key informant's discussion were also conducted to strengthen the data obtained from structured and semi-structured questionnaire. The focused group was formed with 10 people and composed of youngsters, women, village leaders and socially respected individuals who are known to have better knowledge on the present and past social and economic status of the area.

2.3. Methods of Data Analysis

All data obtained from survey were fed to MS-Excel 2007. Qualitative survey data was analyzed for descriptive statistics using frequency procedure of SPSS version 20. The analysis of variance (ANOVA) procedure for quantitative data was obtained from the recall survey using SPSS Version 20 to evaluate the effect of location, breed and livestock holding of farmers. In trait preference ranking method, index was computed using weighed averages and indexes were ranked using auto ranking with MS-Excel 2007.The following formula was used to compute index as employed by [11]

Index = Rn × C1 + Rn-1 × C2 ... + R1 × Cn/Σ (Rn × C1 + Rn-1× C2 + ... + R1 × Cn)

Where, Rn = the last rank (example if the last rank is 8th, then Rn = 8, Rn-1 = 7, R1 = 1).

Cn = percent of respondents in the last rank, C1 = percent of respondents ranked first.

III. Result and Discussion

3.1. Household Characteristics

The major household characteristics of the respondents are presented in Table 1. The study reveals that 90% of the total respondents were male headed households and 10% were female headed households. Male headed household were higher in proportion as compared to female headed household heads in all study areas. This is consistent with the result of [12]. Female headed households was higher in Adea Berga than in the other two districts. This result is relatively similar with the report of Zewdie [13] and [14] which was reported as 86.70% male headed, 13.30% female headed in central highlands and 84.40% male, 16.60% female in north shoa respectively. The current result is different from the report of [15] who reported 33% female headed house-holds and 67% male headed household livestock keepers in Addis Ababa and

also lower than the report of [16] in Hawassa city which is 70% male headed and 30% female headed. The difference might be due to the level of urbanization of the study areas.

TABLE 1. Demographic Structure of the study area

Variables	Adea Berga (N=60)	Ejerie (N=60)	Metarobi (N=60)	Overall (N=180)
Sex				
Male (%)	80.00	93.30	96.70	90.00
Female (%)	20.00	6.70	3.30	10.00
Total (%)	100	100	100	100
Family size*	6.82 (2-13)	5.71 (2-11)	7.75 (2-15)	6.75 (2-15)
Age of household				
Average age *	47.17(24-80)	41.72 (18-73)	46.50 (24-75)	45.00 (18-80)
Below 25yr (%)	-	1.70	-	0.60
25yr to 35yr (%)	26.20	20.30	20.00	22.20
36yr to 45yr (%)	18.00	28.80	31.70	26.10
46yr to 65yr (%)	41.00	42.40	38.30	40.60
Over 66yr (%)	14.80	6.80	10.00	10.60
Total (%)	100	100	100	100
*The figures in bracket of family size and age show that the minimum and the maximum number of respective variables				

The overall average age of the respondents was 45 years and ranged from 18–80 years. There was significant difference in average ages of the respondents in the Ejerie district than Adea Berga. The total average family size of the responding households in the study areas was 7.50 persons and ranged from 2-15 persons.

The educational level of the respondents was extended from illiterate to those who joined higher education. About 46.10% of the respondents were illiterate and 53.90 % had attended different levels of formal education (Table 2). About 73.50% of AI service users and 60% of bull scheme practitioners in Ejerie attended formal education. In addition, 53.80% of uncontrolled bull scheme user respondents were illiterate in Ejerie.

As it was indicated in table 2, about 58.30% of AI users and 75% of the controlled bull service practitioners attended formal education in Metarobi. Meanwhile, 65.60% of the uncontrolled bull service practitioner's respondents attended formal education in Metarobi. On the other hand, about 60.10% of AI service users and 69.20% controlled bull service practitioners' respondents were illiterate in Adea Berga. Besides the above 68.80% of uncontrolled bull service practitioners were illiterate in Adea Berga.

From formally educated AI users Ejerie had the higher proportions of respondents than Metarobi and Adea Berga whereas Metarobi had higher formally educated uncontrolled bull service practitioners than Adea Berga and Ejerie. This might be due to the land scarcity for dairy cattle production. Based on this research finding the level of education of dairy farmers was an important determining factor for adoption of new technologies and the overall intensification of smallholder dairy production. In general, from the overall AI user respondents, 57.50% and 42.50% of them were formally educated and illiterate respectively.

TABLE 2. The education level of households that practicing different mating types

Type of breeding system	District							
	Adea Berga		Ejerie		Metarobi		Overall	
	Illiterate	Formal Edu.	illiterate	Formal Edu.	illiterate	Formal Edu.	illiterate	Formal Edu.
Controlled bull scheme (%)	69.2	30.8	40	60	25.	75.	54.5	45.5
AI service (%)	60.1	37.9	26.5	73.5	41.7	58.30	42.5	57.5
Synchronization (%)	-	-	66.7	33.3	-	-	66.7	33.3
Bull scheme &synchronization (%)	-	-	50.	50.	-	-	50.	50.
synchronization & AI service (%)	50	50	-	-	-	-	50	50
Uncontrolled Natural mating (%)	68.8	31.2	53.8	46.2	34.4	65.6	47.5	52.5
Total (%)	65.	35.	36.7	63.3	36.7	63.3	46.1	53.9

3.2. Livestock and Dairy Cows Herd Size and Structure

Livestock and dairy cattle composition and structure of households are presented in Table 3. Cattle were the dominant species raised by all of the respondents in all of the study areas. The overall average cattle herd size per household was 7.85 TLU and accounted for about 82.73% of the total livestock herd owned by the households. Average cattle herd sizes per household were significantly higher ($p<0.05$) in Metarobi and Adea Berga districts. This result disagrees with the findings of [17] who reported higher cattle herd size per household in peri-urban crop-livestock farms than in urban dairy production systems of central high land. The variations might be due to differences in production objectives between urban and peri-urban farmers. [18] indicated that the lack of space was the major problem to own large herd size in urban dairy farmers, which are forced to rear dairy under confined places sharing with common compound of family residence. The average cattle herd size per household in Ejerie has been found to 8.10 ±0.69. This figure is similar to the report of [19] in Degem.

Sheep, donkey, horse and chicken were the other important livestock species raised by large pro-portion of households in the study areas. Considerable proportion of households (23.30%) were reared goats in Ejerie districts. About 98.90% of the total respondents were owned dairy cows ranging from 1-16 heads, with an overall average of 3.28 heads per household (Table 3). This was similar with the figures previously reported in Sululta G/Jarso and Ejerie districts [20], but it was also comparable to the recent figures reported in Debre Birhan, Sebeta and Jimma [21].

The average number of cows owned per household was not significantly different among districts. However, 96.60% of the respondents in Adea Berga, 100% of the

respondents in Ejerie, 100% of the respondents in Metarobi, and 98.90% of all the respondents in the three districts were owned 1-16 heads of mature dairy cows. With regard to breed composition, 61.70%, 40% and 10% of the household were owned crossbred cows in Ejerie, Adea Berga, and Metarobi respectively. Moreover, 37.20% and 85.60% of the overall respondents were own crossbred and local cows, respectively.

TABLE 3. Herd composition and size of districts

Variables	Adea Berga		Ejerie		Metarobi			overall	
Livestock size and structure (TLU)	%	Mean ±SE	%	Mean ±SE	%	Mean ±SE	P	%	Mean ±SE
Cattle	100	6.42 ± 0.59^{b}	100	8.10 ±0.69^{ab}	100	9.04 ± 0.76^{a}	0.007	100	7.85 ± 0 .40
Sheep	63.7	0.44 ± 0.076^{b}	55	0.31 ±0.066^{b}	80	1.13 ± 0.35^{a}	0.042	66.00	0.91 ± 0.17
Goats	5	0.36 ± 0.18	23.3	0 .82 ± 0.25	16.7	0.45±0.11	0.52	15.00	0.64 ± 0.14
Donkey	71.7	0.40 ± 0 .05	48.3	0.34 ± 0.06	65	0.46±.06	0.37	61.70	0.65 ± 0.03
Mule	1.7	0.36 ± 0.00	-	-	-	-	-	0.60	0.36 ±0.00
Horse	51.7	0.95 ± 0.08	28.3	1.46 ± 0.22	43.3	1.29 ± 0.22	0.27	41.10	1.21 ± 0 .10
Chicken	63.3	0.03 ± 0.016^{b}	65	0.06 ±0.02^{a}	70	0.03 ± 0.005^{b}	0.16	66.70	0.06 ± 0.01
Total	100	7.77 ±0.65 ^{b}	100	9.41 ± 0.81^{ab}	100	11.30 ± 1.04 ^{a}	0.004	100	9.49± 0.50
Dairy cows herd size and structure(heads)									
Total cows	96.6	2.93 (0-12)	100	3.10 (1-14)	100	3.70 (1-16)	0.39	98.90	3.28 (1-16)
Crossbred cows	40	1.92 (1-10)	61.7	2.41 (1-10)	10	2.00 (1-5)	0.61	37.20	2.19 (1-10)
Local cows	90	2.41 (1-6) ^{b}	68.3	2.37 (1-7) ^{b}	98.3	3.56 (1-16) ^{a}	0.005	85.60	2.84 (1-16)
Total dry cows	68.3	2.02 (1-5)	61.7	1.97 (1-4)	76.7	2.28 (1-10)	0.50	68.90	2.11 (1-10)
crossbred dry cows	23.3	1.43 (1-4)	28.3	1.53 (1-3)	6.7	1.00	0.41	19.40	1.43 (1-4)
Local dry cows	58.3	1.77 (1-4)	53.3	1.81 (1-4)	75	2.24 (1-9)	0.38	58.90	1.98 (1-9)
Total Lactating cows	73.3	2.14 (1-7)	81.7	2.30 (1-10)	90	2.17 (1-9)	0.72	81.70	2.20 (1-10)
Lactating crossbred cows	23.3	1.86 (1-6)	51.70	2.03 (1-5)	6.7	2.00 (1-4)	0.42	27.20	1.10 (1-6)
Lactating local cows	65	1.74 (1-5)	45.00	1.85 (1-6)	85	2.14 (1-9)	0.84	65.00	1.94 (1-9)

*Figures in the brackets indicate the ranges in number of dairy cows owned per household
1 TLU = 1.10 Ox/bull, 0.80 Cow/local, 1.20 Cow/cross, 0.50 Heifer, 0.20 Calve, 0.09 Sheep, 0.09 Goat 0.80 Horse 0.36 Ass/mule 0.01 Chicken
Source: adopted from [22], [23] and [24]

3.3. Breeding Practice

The mating types that reported in the study area are controlled bull scheme, natural AI, uncontrolled natural mating, synchronization and the mix of both the bull scheme and synchronization with natural AI (table 4). Bulls can be used for two main types of natural mating, either random mating in free grazing or controlled mating in tethered dairy cows. Under random mating system, heat detection is carried out by the bull and cows in heat are usually mated several times during each heat period. Whereas in controlled mating systems, heat detection is carried out by the farmer and each cow is mated once or twice during each heat period.

In Ejerie district, 8.30 % of the respondents were practiced controlled bull scheme (natural mating) which can give chance to a farmer for bull's selection and allow to mate cow. About 21.70% and 56.70% of respondents were reported to use uncontrolled natural mating and AI service. On the other hand, 10% respondents were practiced combination of one or two types of mating. The selection of bulls for those controlled mating breeders was carried out based on milk yield of the offspring without any record keeping. In addition, the best young males (dairy) are often sold for beef due to lack of means to identify best animals. Farmers often have a relatively low level of formal education and may have variable knowledge of husbandry to help overcome the problems in managing improved genetic material, as their indigenous knowledge was most applicable to the raising of local breeds. Finally, when farms are far from these urban centers, formal market access, poor transportation, and communication difficulties in many parts of the countries contribute to unprofitable dairying by decreasing the motivation to increase productivity [25].

From the sampled households in Ejerie district about 56.70%, 21.70%, 10%, 8.30% and 3.30% of respondents reported to use AI service, uncontrolled natural mating, synchronization, controlled scheme and the mix of bull scheme and synchronization respectively (Table 4). However, in Metarobi districts about 53.30% of the respondents were practiced uncontrolled natural mating, 40% of respondents was reported as natural heat-based AI and 6.70% of them were used controlled bull scheme in sampled households. On the other hand, in Adea Berga district 48.30 %, 26.70 %, 21.70% and 3.30 % of respondents were reported to be practicing natural heat-based AI, uncontrolled natural mating, natural controlled mating and hormonal synchronization, respectively.

TABLE 4. Type of mating system

	Districts			
Type of breeding system	Adea Berga (N=60)	Ejerie (N=60)	Metarobi (N=60)	Overall (N=180)
Controlled Bull scheme (%)	21.70	8.30	6.70	12.20
AI services (%)	48.30	56.70	40.00	48.30
Synchronization (%)	-	10.00	-	3.30
Bull scheme& synchronization (%)	-	3.30	-	1.10
Synchronization & AI services (%)	3.30	-	-	1.10
Uncontrolled Natural mating (%)	26.70	21.70	53.30	33.90
Total	100	100	100	100

The result of AI service was higher than the report given by [26] in Horro Guduru Wollega zone comparing with Ejerie and Adea Berga whereas, it was relatively similar

with Metarobi which is 36.20%. All of the sampled farmers in all areas of study were reported that they have willing to use AI. In Adea Berga (73.30%), Ejerie (78.30%) and Metarobi (51.70%) have tried to improve their cattle through crossing by using different breeding schemes. In general, magnificent number of respondents in all districts were practiced crossing their dairy cows with AI.

3.3. Breeding Objective

The objective of keeping livestock, in Adea Berga, Ejerie and Metarobi districts were presented in table 5. Both Adea Berga and Ejerie districts were kept their livestock primarily for milk purpose. But in Metarobi the farmers kept their livestock primarily for both milk and draught purpose. Draught power was the second objective of keeping cattle in Adea Berga whereas income was the second objective in Ejerie. The farmers in Adea Berga, Ejerie and Metarobi districts were kept livestock for milk purpose and ranked first. About 73.30 %, 68.30 % and 50.00 % of the respondents in Adea Berga, Ejerie and Metarobi primarily kept their cattle for milk purpose respectively. There was difference in priority setting of objectives to kept their cattle between three districts. This was perhaps because of the level of urbanization and size of land holding.

TABLE 5. Breeding objective of keeping livestock and trait preference

District	Traits	Order of trait preference				Index	Order
		Most important	Very Important	Important	Least Important		
Adea Berga	Milk	2.93	0.80	0	0	0.23	1
	Meat	0	0.75	1	0.3	0.13	4
	draught power	2.8	0.50	0.03	0.03	0.21	2
	Income	0.2	2.30	0.23	0.07	0.18	3
	Asset accumulation	0	0.05	0.37	0.8	0.08	6
	social and culture	0	0	0.23	0.87	0.07	7
	Manure	0.4	0.25	0.5	0.57	0.11	5
Ejerie	Milk	2.73	0.80	0.1	0	0.26	1
	Meat	0.27	0.10	1.27	0.27	0.13	4
	draught power	1.2	0.95	0.1	0.32	0.18	3
	Income	0.27	2.55	0.03	0.07	0.21	2
	asset accumulation	0	0	0.1	0.95	0.07	5
	social and culture	0	0	0.10	0.95	0.07	5
	Manure	0	0	0.10	0.95	0.07	5
Metarobi	Milk	2	1.40	0.03	0.02	0.21	1
	Meat	0.07	0.65	1.40	0.07	0.13	3
	draught power	2.87	0.55	0.13	0.03	0.21	1
	Income	0.07	2.95	0	0	0.18	2
	asset accumulation	0	0.25	1.40	0.22	0.11	4
	social and culture	0	0	0.13	0.933	0.06	6
	Manure	0	0	1.30	0.35	0.1	5

IV. CONCLUSION

Milk production was the primary objective for both Adea Berga and Ejerie. It was equally important with draught power as first priori-ty in Metarobi. Milk yield of the indigenous cows were very low as compared to crossed cows. Because of low milk yield of indigenous cows, the majority of the farmers prefer to have crossed cows with exotic cows. Entire farmer in the study area had willing to practice cross breeding their cows through AI technology. Therefore, majority of the respondents use different mating system to have better milk yield of their cow.

The mating systems in study area were controlled bull scheme, uncontrolled, natural mating natural heat-based AI, and hormonal synchronization and the mix of the above. Except uncontrolled natural mating system, all of the above-mentioned practices had an ultimate goal to get crossed calves which were intending to maximize milk yield. Even though the priority is set for milk yield in Ejerie and Adea Berga, livestock was also important for draught power as second priority in Adea Berga and 3rd in Ejerie. Besides the above in-come was the second priority in Metarobi and Ejerie whereas it was 3rd in Adea Berga.

Milk production is the major source income. Community based breeding program by incorporating indigenous knowledge of farmers is the best option in improving breeding practice of dairy cattle in the study area. Further work on improving smallholder farmers' awareness of the breeding and management of crossbred dairy cattle (using a participatory approach) is imperative.

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