Community Breeding Practice and the Challenges in Dairy Cattle Management in North Gondar, Ethiopia

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Abstract— *Dairy product is an important feed supplementation. However, rearing dairy cattle is became a challenge especially at smallholder level due to lack of indigenous dairy cattle breeds. As a result, the country has established cross breeding program since 1990`s. Nevertheless, it is not uniform and does not consider smallholder farmers. Therefore, this research initiated to identify the breeding practice and the main challenges of smallholder farmers in rearing dairy cattle. For this purpose, first systematic field survey was conducted to generate preliminary information and breed judgment. Then two study areas were selected purposively based on milk production potential and dairy breed characteristics. Two focus group discussions per study area were conducted. Then, randomly 200 respondents per study area were selected. Finally, individual interview and field observation were employed to generate the needed data. Even though there is no established breeding scheme, the smallholder farmers practiced breed improvement by either cross breeding or straight breeding. They implemented Cross breeding to improve milk productivity using 50-100% exotic blood sire/semen. Pure exotic semens were preferred for AI (Artificial insemination). The smallholder framers do not select indigenous caw for cross breeding practice. However, they selected indigenous caw/heifer for replacement based on pedigree history, body stature, and udder vein. Regarding mating system, more than 50% of the respondent exercise control-mating system in their herd. Mostly this was done by pertaining the sire and dam together for a single day. In addition to this partiality in preference of sire, less productive individual cattle culled from the herd by castration, sell and slaughtering. The management system, early castration and lack of accurate estrus detection were the major challenges in dairy cattle development. As the result of this survey in the two study areas, indiscriminate cross breeding without consideration of the production system, body size and blood levels were predominant. Therefore, successive training for smallholder farmers on breeding system is highly recommended.*

Keywords— Milk, Breeding scheme, Cross breeding, Straight breeding.

I. INTRODUCTION

Beyond 80% of Ethiopia human population has been engaged in agricultural. This contributes 52% of the gross domestic product (GDP), 90% of the foreign exchange (MoA 2000), and 40% of the annual agricultural output (FAO 2005). The country has the largest cattle population in Africa with 49.33 million heads of cattle (CSA 2008). Cattle provides 1.5 million tonnes of milk and 0.331 million tonnes of meat annually. Which can plays an important role in the economies of farmers, pastoralists and the country at large. In addition, 14 million tonnes of manure is used annually primarily for fuel, and six million oxen provide the draught power required for the cultivation of cropland in the crop–livestock mixed production system (Azage and Alemu 1997).

Although the livestock sector has a significant contribution to the national economy, production per animal is extremely low. Under optimum management, the average milk production per lactation of indigenous cow ranges from 494–850 kg (EARO 1999; Aynalem et al. 2009). This is very low when compared with crosses of Ethiopian Horro with Holstein Friesian (2333.63 Lit./lactation) (Belay et al. 2012).

With an annual human population growth rate of 2.4%, the present 77.4 million Ethiopia's human population will increase to about 149.3 million by the year 2040 (FAO 2005). The rural to urban ratio will also continue to change and is expected to increase in favour of urban population in the coming 25 years. Thus, the demand for animal products is expected to increase substantially (FAO 2005). In Ethiopia, to meet the ever-increasing demand for milk, and milk products and thus contribute to economic growth, genetic improvement of the indigenous cattle has been proposed as one of the options.

Genetic improvement of the indigenous cattle focuses on crossbreeding by importing exotic breeds in the form of live animals, semen, or embryos are less successful in adaptability and productivity. Rather this indiscriminate crossbreeding of exotic breeds with the local populations causes for genetic erosion of the adapted indigenous cattle populations. Because in most cases, it is done without sufficient pretesting of the appropriateness (suitability and adaptability) of the breeds and their

resulting crosses to local production systems or conditions (Aynalem et al. 2014). There is no systematic and organized selection scheme for cattle genetic improvement in Ethiopia. Therefore, this study was initiated with the main objective of assessing community breeding practice and the challenges in dairy cattle management.

II. MATERIAL AND METHOD

2.1 Description of study area

The study was carried out in Dembia and Wegera districts which are located in the North Gondar zone of the Amhara National Regional Government of the Federal Democratic Republic of Ethiopia (Fig. 1).

2.2 Dembia district

The Dembia district bordered by Yelay Armacheho district in the North, Lake Tana in the South, Gondar town and Gondar zuria districts toward the East, and Chilga and Takusa districts in the west. The capital of the district Koladiba is located 35 km away from Gondar town and about 765 km away from Addis Ababa. The district is comprised of highlands at an altitude of 2080 to 1740 meters, covers a total area of 127,000 sq. km. This district has an estimated population of about 334,519. Among these 169,274 are males and 165,245 females.

2.3 Wegera district

The capital of Wegera district, Amba-Giworgis, is located 778 km from Addis Ababa and 40 km from its zonal capital city of Gondar. The total area coverage of the district is 1821 km2. Its human population is 232,000. The altitude of the district ranges from 1600 to 3000 masl. The average annual rainfall is 500 mm. The temperature varies from 10^{o}c to 28^{0}c (BSA. 2009).

The farming system of the study areas are largely characterized by crop-livestock production system, which in turn grossly divides into two: the crop-livestock production system in the lowland and crop-livestock production system in the highland. In both cases livestock husbandry and cropping are practiced in association. So, the term mixed crop-livestock farming is preferred to denote farming system. The average herd size varies greatly, and it ranges from 2.11 to 7.15 animals (high and mid altitudes) (DOA. 1999).

FIG.1. MAP OF THE STUDY AREA

2.4 Description of study cattle population

2.4.1 Dembia cattle

These are cattle types of having variable colour. Docile in temper and the majority have patchy coat pattern mixed from black, brown, white and red. The males have long sheath, short to medium horn length and relatively small ear size. Females do have moderate size naval length. Hump is well developed and small to medium in size with the majority having thoracically positioned (85%). The rest do have cervico-thoracic hump. Horn shape is either straight or curved where the majorities have obliquely upward, or lateral and few individuals with curved forward orientation. Teat and udder size in females ranges from small (60%) to medium. Tail is medium to long in its length. The hair is predominately coarse. Facile profile is totally flat or straight. Rump slope mostly is sloppy with few exceptions having droopy type. Dewlap is well

developed and moderate in size. Main attributes are traction, milk and meat. The above characteristic features indicate that this cattle type stands as an intermediate type between Semein and Fogera cattle. The average milk productivities are 515.00 litters at first lactation (Zewdu 2004).

2.4.2 Wegera cattle

These are medium in body size and are compact. Their coat colour pattern is plain and patchy having a dominant coat colour of plain black, red and black patchy and red patchy with a very small proportion of fawn and grey colour. Their facial profile is predominately flat and some have slightly concave (6%) or convex (12%) profile, which further strengthens the presence of some Sanga blood. Majority have well developed hump in thoracic position but still a considerable number (26%) do have cervico-thoracic humps. Tail length varies but the majorities have medium tail. Horn shape is variable ranging from polled to spiral horns. The most common horn orientations observed are drooping, closed together, obliquely upward and lateral.

Hump and horns are relatively large in males with moderate ear length and sheath. In females, horn and hump are still large but the naval length is small. Teat and udder are also small with few exceptions that have medium size. Rump slope is mostly sloppy with few exceptions having droopy type. They are mostly docile. Main attributes include traction, milk and meat. The average milk productivities are 327.28 litters at first lactation (Zewdu 2004).

2.4.3 Sampling framework and data collection

Primarily systematic rapid field survey was conducted to assess major dairy cattle production system, breeding practices and breed characteristics. Then two districts were selected purposively based on dairy breed judgment and milk production potential. Participants for focus group discussion were selected from society (10-12) (based on their breeding experience, herd size) and from agricultural extension staff (2-3) (based on breeding experience). Two focus group discussions per district (12-15 participants) were arranged. The study population were selected from the total population based farming system (cattle rearing) and cattle population (more than three). Of these, 200 respondents per district were selected randomly from study population for interview.

2.4.4 Data collection

- **Observation:** we collected dairy cattle production system, breeding practice, mate controlling practice, housing and feeding practice via observation.
- **Focus group discussion (FGD):** FGD employed to fill information gap during individual interview and to get general information on the breeding know how, breeding practice, challenges.
- **Individual/family interview:** The general information on selection, culling, breeding method, bull source, and challenges were collected during individual/family interview.

III. STATISTICAL ANALYSIS

Data collected form focus group discussion was summarized and synthesized. Data collected during individual or family interview was checked its completeness and imported to SAS 2002 for simple descriptive statistics (frequency).

IV. RESULTS AND DISCUSSION

4.1 Respondents' profile

The average household size in our study areas was 6.54 which is lower than 7.55 in Gondar Zuria and Lay Armacho districts (Marta et al. 2012). The household comprehends male, female, literate, and illiterate. Of these, erudite man's up to grade six were dominate (56.5%) (Fig. 1). Males above 25 years old were actively participated in dairy cattle management. Females and young folks also partially participated in pen cleaning. A similar result was reported in Gondar Zuria and Lay Armacho districts, in which the number of family members actively working on farm is lower than the household size (Marta et al. 2012).

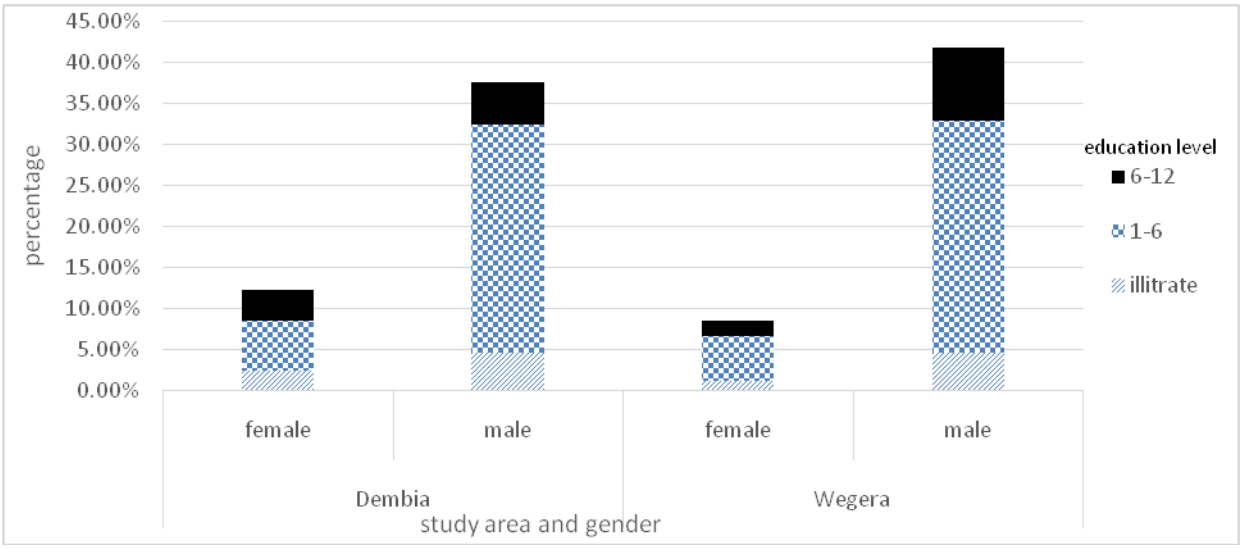

FIGURE 1. RESPONDENTS' SEX AND EDUCATION LEVEL COMPOSITION AND STRUCTURE IN BOTH STUDY AREAS

4.2 Herd size and composition

The overall average of herd size in the study area was 5.84 (Table 1). Which is nearly similar to the value reported in Debark district (5.85) (Marta et al. 2012). The herd comprises ox, cow, heifer, and calf. In some respondents, the composition also included bull. Calves (35.79%) followed by heifers (21.58%) were dominantly found inside the herd. Bulls had less proportion in both study areas (9.27%). In contrast of our result, local oxen comprise a higher proportion of the herd in Gondar Zuria and Lay Armacho (Marta et al. 2012).

TABLE 1
THE AVERAGE HERD SIZE AND COMPOSITION IN BOTH STUDY AREAS

Attributes	Districts		
	Dembia	Wegera	Total
Cow	1.10	1.14	1.12
Ox	0.95	0.71	0.83
Heifer	1.40	1.13	1.26
Bull	0.56	0.51	0.54
Calf	2.03	2.15	2.09
Sub total	6.04	5.64	5.84

4.3 Production system

All respondents maintained their cattle in unpartitioned fence-off pen during nighttime. Regarding feeding system, Free grazing with little supplementation of leftovers including hey during evening or/and morning were dominated. This result disagree with the a report of Gondar Zuria and Lay Armacho in which they supplement improved feed to their cattle (Marta et al. 2012). This might be due to the ILDP (Integrated Livestock Development Project) program, which might provide additive feeds and trainings to the farmers on management system and feed preparation.

4.4 Breeding experience and strategy

There is no structured breeding program at farmer level. However, about 43.0% of respondents have dairy cattle improvement strategy. Of these, 6.34%, 4.23% and 3.52% of respondents preferred straight breeding for milk test, milk fat, milk by product (especially butter) respectively. The reset 85.91% of the respondents exercised crossbreeding strategy to increase the amount of milk production per head of cattle. More than half of respondent (57.89%) in Dembia district preferred 50% blood level semen for cross breeding. However, most of the respondents in Wegera district (65.15%) give priority for 100% blood level semen for AI. There is significant difference in preference of exotic blood level between the two districts (Table 2). In agreement with this, Marta et al. (2012) reported that majority of the respondent in Gondar Zuria

and Lay Armacho prefers more than 50% of exotic blood level for cross breeding. In contradiction, Artificial insemination is not used in Sheko (Bayou et al. 2014). It is unclear why this is the case, it may result from uneven distribution of technology and/or the lack of availability of the artificial inseminations packages in the study areas.

TABLE 2
BREEDING PRACTICE AND STRATEGIES IN TWO STUDY AREAS

Attributes	Districts		
	Dembia n (%)	Wegera n (%)	Total n (%)
Breeding practice			
Yes	80 (40.00)	92 (46.00)	172 (43.00)
No	120 (60.00)	108 (54.00)	228 (57.00)
Breeding strategies			
Cross breeding	76 (95.00)	66 (71.70)	142(82.50)
Straight breeding	4 (5.00)	26 (28.30)	30 (17.50)
If cross breeding? Preferred blood level			
100%	13 (17.11)	43 (65.15)	56 (39.43)
75%	19(25.00)	3 (4.50)	22(15.50)
50%	44(57.89)	20(30.35)	64 (45.07)
reason for performing cross breeding			
Milk amount	65(85.50)	57(86.36)	122(85.91)
Milk test	5(6.60)	4(6.06)	9(6.34)
Fat content	4(5.30)	2(3.03)	6 (4.23)
Butter	2(2.60)	3(4.55)	5(3.52)

4.5 Selection principles and criteria

Almost all respondents had a means of maintaining best productive female for replacement stock. Replacement females inside the herd were selected based on pedigree history, reporductivity and productivity performance, and stature. Of these, pedigree history was exploited widely in both study areas. Moreover, they also select dams during marketing based on stature, udder size, body conformation, pedigree history, and mammalian gland vein. Of these, udder and body conformation were used widely in both study areas. Similarly, Syrstad and Ruane (1998) and Mason and Buvanendran (1982) stated that a selection program should be based on pedigree information. They further confirmed that further progeny testing which should be conducted for bulls selection.

However, only nine percent of respondents select and maintain the best males for breeding and replacement. Which were selected inside the herd by pedigree history, relative performance, body conformation, and growth rate. However, majority of respondents castrated the best males to conserve energy for farming activity. Furthermore, the respondents had selected a bull from neighbours for a single or multiple mate based on stature, pedigree history, super sister productivity, and by others

recommendation. A comparable result were reported in Gondar Zuria, Lay Armacho, and Debark districts in which 13% of the respondent perform cross breeding based their mating decision on recommendations from other farmers.

TABLE 3
SELECTION PRINCIPLES AND CRITERIA IN THE TWO STUDY AREAS

Selection principles	Districts					
	Dembia n (%)		Wegera n (%)		Total n (%)	
Selection of dams	Inside*	Outside**	Inside*	Outside**	Inside	outside
Always	61(31.5)	68 (34)	79 (39.5)	92 (46)	140(35.0)	160(40.0)
Seldom	19 (9.5)	12(5.5)	13 (6.5)	0 (0)	32 (8.0)	12(2.7)
Never	120 (60)	121 (60.5)	108 (54)	108 (54)	228(57.0)	229(57.3)
Selection criteria of dams Pedigree history	30(37.5)	28(35)	35(40.2)	19 (20.7)	65(37.8)	47(27.3)
Body appearance	15(18.7)	13(16.25)	18(19.6)	32(34.8)	33(19.2)	45(26.2)
Udder conformation	18(22.5)	19(23.75)	18(19.6)	22(23.9)	36(20.9)	41(23.8)
Recommended by others	8(10)	16(20)	8(8.7)	14(15.2)	16(9.3)	30(17.4)
Supper sister productivity	9 (11.3)	4(5.0)	11(11.8)	5(5.4)	20(11.6)	9(5.2)
Selection of sires	**Inside***	**Outside*****	**Inside***	**Outside*****	**Inside**	**outside**
Always	61(31.5)	68 (34)	79 (39.5)	92 (46)	140(35.0)	160(40.0)
Seldom	19 (9.5)	11(5.5)	13 (6.5)	0 (0)	32 (8.0)	11(2.7)
Never	120 (60)	121 (60.5)	108 (54)	108 (54)	228(57.0)	229(57.3)
Selection criteria of sires Pedigree history	39(48.8)	13(16.2)	42(45.6)	18(19.6)	81(19.2)	31(26.2)
Body appearance	28(35)	22(27.5)	31(33.7)	26(28.2)	59(20.9)	48(23.8)
Relative productivity	4(5.0)	14(17.5)	8(8.7)	16(17.4)	12(9.3)	30(17.4)
Recommended by others	9 (11.2)	31(38.8)	11(12.0)	32(34.8)	20(11.6)	63(5.2)

Inside*= inside the herd; outside**= during marketing; outside= at neighbours***

4.6 Mate control and culling practice

Mate controlling was done by preventing unwanted male intercourse with heated female. Indeed 65.4% of respondents were control the mating of their herd. Of these, 76% preferred crossbreeding with exotic blood semen by AI (artificial insemination). Likewise, farmers in Gondar zuria and lay Armacho preferred crossbreeding. AI is dominate in low market area of Ethiopia (Bitew et al., 2011).The remaining 6.5% and 17.5% of respondents perform a natural mating with known exotic or indigenous bull in the community respectively. Mostly this was done by pertaining the sire and dam together for the whole day. The others, control by giving priority mating (1-3 intercourse) for the preferred bull of the community or by culling less productive cattle. Less productive cattle were deprived via castration, selling and slaughtering (Table 4).

TABLE 4
MATING CONTROL AND CULLING PRACTICE IN THE TWO STUDY AREAS

Attributes	Districts		
	Dembia n (%)	Wegera n (%)	Total n (%)
Mating control			
Yes	80 (40)	92 (46.0)	172 (43.0)
No	120 (60)	108 (54.0)	228 (57.0)
Strategies			
preventing unwanted sires	16 (20.0)	44 (47.8)	60(34.9)
retaining together	43(53.8)	39(42.4)	82(47.6)
culling less productive from the herd	21(26.2)	9 (9.8)	30(17.5)
If preventing unwanted sires, For how long?			
The whole day	51(63.8)	43(46.7)	94(54.6)
Three intercourse	16(20.0)	32(34.8)	48(28.0)
One intercourse	13(16.2)	17(18.5)	30(17.4)
Culling practice			
castration	29(36.2)	18(19.6)	47(27.3)
sell	21(26.0)	34(37.0)	55(32.0)
tailing alone	30(37.8)	40(43.3)	70(40.7)

4.7 Challenges and opportunities

4.7.1 Management system

Not all respondents had a separate house for the herds by age and sex category except milking calf. Such unpartitioned housing system could be the source of random mating. Because mostly heating has been occurred early morning; so, the available bull in the herd might mate the hated dam. Similarly, Bayou et al. (2014) reported that only calves were normally managed separately from the dams to prevent suckling during the lactation period of the cows. This housing system has negative impact of selective breeding. Therefore, since land is not constraints in most rural area, they have to partition the house with local materials by sex and age.

Dairy cattle needs more feed source for milk production and maintenance. However, in this survey, no respondents have sufficient year round feeds. The limited resources are preferentially given to oxen during farming seasons. Similarly, Mekonnen et al. (2010) states that poor feeding and management of dairy cows/heifers could affect the efficiency of breed improvement. Adequate feed is a prerequisite for improving livestock productivity (Marta et al. 2012). Therefore, the farmers should prepare improved feed (pasture and fodder) during wet (autumn) season.

4.7.2 Non-technical problems

In present survey more than 90% of the respondents castrate male calves those shows good growth rate. Because they believed that castration has fastening the growth rate and conserve energy for ploughing activity. This figure is higher than that 31.2% of respondents in Sheko castrate their bull to improve draft power and docility, temperament and fetch better market price (Bayou et al. 2014). Such kind of practice negates breed improvement by depriving the best individual cattle from generation and by narrowing bull resource. Though early castration was important, considering replacement male shouldn`t neglect.

Furthermore, the majority of respondent faced a problem of accuracy of estrus detection for both AI and natural mating. Because of that some of AI users were costed for about three successive inseminations per estrus due to lack of technical skill in heat detection. In otherwise, the owner of dam could control and give emphasis only for the first mate during natural mating. However, per day the dam would mate with different bulls. As a result it might lead for unwanted consequence. Similarly, Mekonnen et al. (2010) states poor heat detection skills would affect efficiency AI. Moreover, Mwatawala and Kifaro (2009) stated that poor heat detection skills of farmers and improper timing of AI service were the problems of genetics improvement.

V. CONCLUSION AND RECOMMENDATION

Most of the respondents have breeding practice to improve amount of milk produced by head of cattle. Of these, 85.91% of respondents used cross breeding with 50-100% exotic blooded sire/semen. For crossbreeding, about 43% of respondent select replacement female stock. These replacement female stocks were selected by body stature, pedigree history and udder vein. However, majority of the respondents couldn't maintain replacement bull.

Nearly half of the respondents select the best male and female couples by miserly less productive cattle. Besides to partiality in mating, undesirable cattle were also culled from the herd by slaughtering, sell or castration. Early castration especially that is done for the sake of energy conservation negates genetic improvement. Therefore, training should be given to the society.

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