RESEARCH ARTICLE

Breeding practice, status of estrus synchronization and mass insemination of conception rate of dairy cattle in North Shewa Zone, Ethiopia

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Background: Since 2004 up to this time there was many efforts were apply to improve local breed genetics through crossing with exotic breed using oestrus synchronization followed by mass insemination methods; however the status of Oestrus Synchronization and Mass Insemination (OSMI) conception rate related to breeding practice were not identified. So this study aimed to assess breeding practice and status of OSMI conception rate of dairy cattle.

Methods: Out of 27 districts, three districts and 405 respondents were selected purposive followed by random sampling techniques per each district.

Result: Most respondents used AI+natural mating system for the purpose of rapid genetic improvement moreover reproductive performance of dairy cattle per district and breeds was statistically significant. About 87% of respondents have not maintained mating and pedigree records. Heat detection problem, lack awareness about selection criteria of cows for OSMI program and AIT efficiency were the major factors of OSMI Conception Rate (CR). In conclusion the status of CR and number of service per conception per district, breed and year were vary ($p<0.05$) and finally the status of OSMI CR moderated from year to year.

Keyword: Breeding practice; Conception rate; Breed type; Oestrus synchronization

INTRODUCTION

Oestrus Synchronization and Mass Insemination (OSMI) and Artificial Insemination (AI) are some of the important bio techniques for improving the reproductive and thereafter the lifetime productivity of the cattle thereby enhancing the overall profit from cattle farming [1]. Oestrus synchronization involves manipulating the oestrus cycle of females, so they can be bred at approximately the same time, thereby saving both time and logistics [2]. This bio technique also involves regulating the follicular development in that way inducing the oestrus cycle [3]. Synchronization programs are selected from several predesigned protocols which have been scientifically/clinically proven to regulate follicular development [4]. OSMI under smallholder context can be used as a tool to effectively use the natural resources when available abundantly to parturition healthy calves and also to evade the period when shortages of feed and fodder [5]. However, the wide application and success of OSMI across the developed world and its success in Africa and other developed countries is still low owing to technical inefficiencies besides managerial and other infrastructure-related issues.

The qualities of the semen, its storage across different stages of handling beside the skill of the inseminators play important roles in the success of the whole program [6]. This could further influence the efficiency of the OSMI conception rate especially under the management of smallholder farmers [7]. Detection of oestrus is usually faulty as many of the farmers are not aware of its signs and also there are cases of silent oestrus in the zebu cattle [8]. The estimated overall mean calving interval of dairy cows in Ethiopia is 12.2 to 26 but in ideal world strategy of calving interval is "One calf per year per cow", to achieve this strategy in the country, the calving interval needs to be optimized [9]. As a result, to solve those problems OSMI technology is the key point. On this program, different studies were performed in different parts of Ethiopia, in Amhara region, Oromia region, and SNNP Region, and Tigray regions with the conception rate of 59.6%, 59.16%, 42.2% and 36.12%, respectively. In this context, OSMI as a reproductive management tool was initiated in 2013 in North Shewa zone of Amhara region as a pilot-scale by the Bureau of Agriculture in Siyadebrnawayu, Tarmaber, Angolelanatera, DebreBirhan town, and Basona worena districts.

Records till 2017 and 2018 indicated that in those districts 9097 cows were synchronized and 5074 dairy cows were inseminated by the bureau of agriculture. However, they did not study the status of OSMI Conception Rate (CR) relation to breeding practice by detailed comprehensive assessment analysis [10]. As a result, the present study was initiated to perform a detailed comprehensive assessment of the overall breeding practice in related to status of OSMI CR, in dairy cattle with the following specific objectives

- To determine the breeding practice of dairy cows.
- To evaluate the constraints of oestrus synchronization and mass insemination conception rate.
- To identify farmer's perception about oestrus synchronization and mass insemination conception rate.
- To determine the status of oestrus synchronization and mass insemination conception rate in the study area.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Debrebrihan milk shed area of North Shewa zone. Its latitude and longitude are 90° 40' 19.3''N and 390° 31' 45.3'' E, respectively (Google map satellite).

Sampling procedures

Based on the number of synchronized dairy cows, AI practice, the attitude of farmers to adopt OSMI technology and accessibility of infrastructure, out of 27 districts, three districts (Siyadebrnawayu, Basonaworena, and Angolelatera) were selected. Thereafter, 9 kebeles (Deneba 01, Gashuamba and wollie from Siyadebrnawayu, Cheki, Chacha and Seritie from Angolelantera finally Chefanen, Debrebrihan zuria and Bakilo kebele from

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Basonaworena district) were selected using multi-stage stratified purposive sampling followed by a random sampling technique. The number of farmers involved in the OSMI were identified from districts record data and, based on the Yemane sample formula with a 95% confidence level, totally of 405 respondents were selected for this study.

Data collection method

Data were collected from primary and secondary sources. Primary data were collected using a structured questionnaire, interview and focus group discussion on each selected kebele. Secondary data was collected from zone, districts and kebele agricultural administrative record documents and for cross-checking use farmers.

Data analysis

After all the data were collected fed to Ms-Excel (2010) and analyzed by SPSS version 20. The ranking was also analyzed.

The reproductive performance of dairy cows as computed the following formula:

CR (%)=(Number of conceived cows/heifers)/(Number of inseminated cows/heifers) × 100

NSC=(Number of conceived cows/heifers)/(Number of inseminated cows/heifers)

Where CR: Conception Rate, NSC: Number of Services per Conception rate

Index=The sum of (5 times first order+4 times second order+3 times third order+2 times fourth order+1 times fifth order) for individual variables divided by the sum of (5 times first order+4 times second order+3 times third order+2 times fourth order+1 times fifth order) for all variables.

RESULTS AND DISCUSSION

Breeding practice

Breeding objective and rearing system of cattle in the study areas: In Table 1, show that respondents reared their cattle for milk production after that sale of calves and oxen. On the other side all age of cattle categories were reared together except HHFC breed and lactating cows. This finding is in close agreement with those of CSA, 2016/17.

Ranking of breed preference of respondents

TABLE 1

Breeding objective and rearing system of cattle in the study areas (%)

Parameters	Districts			Overall
	Basonaworena (n=135)	Siyadebrnawayu (n=135)	Angolelanatera (n=135)	
Overall purpose	***	***	***	***
Milk production	2.5	4.1	7.4	4.7
Sale of oxen	1.6	9.9	2.5	4.4
Milk production, sale of calves and oxen	67.8	82.7	59.2	69.9
Milk production and manure	28.1	3.3	30.9	20.8
Cattle rearing system	***	***	***	
All categories are reared together except HHFC breeds and dairy cows	96.3	95.56	85.9	92.6
Cows reared separately from bulls	1.5	---	7.4	2.97
All categories are reared separately	2.2	4.44	6.7	4.45

Table 2 the results from the respondents of A (Angolelanatera) district preferred higher Holstein Friesian Crosses (HHFC) which have above 75% of exotic blood level and followed by Holstein-Friesian Cross (HFC) 50-75% of exotic blood level due to the high demand of crossbred calves by the investors in urban and peri-urban locations as the numbers of crossbreds are usually less in the country as a whole [11]. In addition to this most of the HHFC are raised for milk a purpose which is in close agreement with the findings of [12].

TABLE 2

Ranking of breed preference of respondents per district (N=405)

Districts	Breed type	1st	2nd	3rd	4th	5th	Index	Rank
Basonaworena	HFC	41.9	47	11.1	0	0	0.28	1
	HHFC	48	21.8	23.7	3.5	3	0.26	2
	HHFC+HFC	39	14.5	10.6	35.9	0	0.23	3
	JERC	0.7	5.9	47.4	33.3	12.7	0.16	4
	Local	0	3.52	1.48	0	95	0.07	5
	HFC	50.8	48.5	0.7	0	0	0.29	1
Siyadebrnawayu	HHFC+HFC	44	54.7	1.48	0	0	0.28	2

	HHFC	0.7	33	11.9	47	7.4	0.17	3
	Local	3	0.48	63	26.52	7	0.17	4
	JERC	3.7	2.3	0	23	71	0.09	5
	HHFC	48	25.8	16	10.2	0	0.29	1
Angolelanatera	HFC	10.5	42	47.5	0	0	0.26	2
	HHFC+HFC	0	43.7	36.3	20	0	0.23	3
	JERC	0	0	6.7	93.3	0	0.15	4
	Local	0	0.48	0	3.52	96	0.07	5

Note: JERC: Jersey Cross; HFC: Holstein Frisian Cross; HHFC: Higher Holstein Frisian Cross (>75% exotic blood level).

Mating systems, availability of breeding bulls per breed and alternative strategies: The major mating practiced by respondents was both (AI +natural) (33.8%), which are they use AI and natural mating interchangeably this is in accordance with the findings [13]. This might be because sometimes AI technicians were not available which may force the respondents to revert to the natural mating of their cattle and vise-versa. It has also been reported in several studies that at times cattle that do not conceive using several AI do so under natural mating and it is contradicted with the report [14]. The overall percentage (94%) of respondents did not get HHFC and HJERC (Table 3) which is most of the respondents complained on the shortage of above 75% exotic blood level bulls in all the studied locations, which is in agreement. It has been also reported that the progenies carrying higher percent of exotic (HF) germplasm may not be possible for the smallholder farmers [15].

TABLE 3

General characteristics of mating practice and bull availability per district (n=405)

		Districts			Overall
		Basonaworena %	Siyadebrnawayu %	Angolelanatera %	
Mating practice					
Natural		13.3	40.7	8.1	20.7
Both		31.8	14.11	55.6	33.8
AI		39.29	40.79	14.1	31.4
AI+OSMI		15.61	4.4	22.2	14.1
Reason to prefer AI		%	%	%	%
No need rearing bulls		0	0	3	1.1
Safe without any hassle		8	4	4	5.3
Rapid genetic improvement		90	91	90	90.3
Bull availability	Breed type				
	HFC, JERC	25.9	7.4	23.4	19
	HFC, JERC	74.1	92.6	76.6	81
	HHFC, HJER	10.1	0	8.15	6
	HHFC HJER	89.9	100	91.85	94
Alternative strategies when bull not available near by					
Take a cow in other kebeles		38.52	14.8	20.74	24.7
Use any available bull		0	22.9	0	7.6
Use AI by calling or taking a cow in their station in long distance		17.8	40	6.71	21.5
Extend for the next estrus		14.68	1.5	0.7	5.63
Goes to the nearest research center		20.1	0	51.85	24
Use AI		7.4	17.1	0	8.17

Note: HFC: Holstein Friesian Cross; JERC: Jersey Cross; HHFC: Higher Holstein Frisian cross (>75% exotic blood level); HJERC: Higher Jersey Cross (>75% exotic blood level)

Maintaining of mating and pedigree record: Among the total percentage, 30.6% and 2.45% of the respondents were maintained mating and pedigree records through recapitulating system respectively. This is in line with the findings this report indicate that a very little section of the respondents had some sought of did so depending on recall methods, which is seldom correct. From Table 4 most of respondents did not maintain any sorts of record which is in agreement with the observation [16].

TABLE 4

Maintaining of mating and pedigree records per districts

Maintaining of mating and pedigree record (%)		Basonaworena (n=135)		Siyadebrnawayu (n=135)		Angolelanatera (n=135)		Overall (N=405)	
		Mating	Pedigree	Mating	Pedigree	Mating	Pedigree	Mating	Pedigree
Yes	In a note book	19.3	8.9	6.7	4.4	15.6	10.37	13.9	7.89
	Recalling	34.1	1.5	17.7	0	40	5.85	30.6	2.45
No		46.6	89.6	75.6	95.6	44.4	83.78	55.5	89.66
Why not do so									
Lack of awareness		85.8	85	94.12	100	98.3	100	92.7	95
Lack of education		7.9	8.3	4.9	0	1.7	0	4.8	2.8
Busy to record		6.3	0	0.98	0	0	0	2.5	0
Lack of facilities		0	6.7	0	0	0	0	0	2.2

Reproductive performance of dairy cattle per district

Age at First Service (AFS): The better values (42.83 ± 5.27) month reported among the native cattle reared in a district as compared to the rest districts (Table 5). The AFS of HFC was better 30.1 ± 10.15 and (31.32 ± 6.41) month in B and A districts respectively compared to S district. This difference might be due to management conditions and lack of awareness on manages the cross-breed cows in the S district. Cattle with low AFS usually have high calf crop production and ultimately higher lifetime lactate yield. The study also shows that AFS of HFC as recorded too are in close accordance with the findings of Desalegn et al., while lower AFS was reported in a studied by Belay et al.

Calving Interval (CI): The CI of native breed as reported in the study area is in close accordance with those of Assemu et al. About 18.91 ± 4.2 months recorded among HFC cows reared at a district. This result is higher than reported [17]. This might be due to the management of the cattle and also their genotype. The CI of the HHFC is in close agreement with those of Melku, and contradicted with the study.

Number of Services per Conception (NSC): The overall mean plus standard deviation of NSC native, HFC, and HHFC breed was 1.42 ± .85, 1.40 ± .531 and 1.50 ± .69 month in that order. The findings also pertaining that the NSC in native cows is in line with the values reported. The value is lower than those reported by Yifat et al. It has been recorded that above 75% of exotic blood level breed cows usually requires more numbers of services which can be associated with higher productivity [18]. The value of NSC of HFC cow is similar with the study.

TABLE 5

Mean ± standard deviation of reproductive performance of dairy cow per district in month

Breeds	Districts	AFS	CI	NSC
Native	Basonaworena	45.40 ± 9.1^{ab}	19.5 ± 3.95^{a}	1.36 ± .48^{a}
	Siyadebrnawayu	46.46 ± 6.75^{b}	21.8 ± 5.59^{b}	1.37 ± .56^{a}
	Angolelanatera	42.83 ± 5.27^{a}	18.13 ± 3.6^{a}	1.75 ± 1.85^{a}
	Overall	44.8 ± 7.48	19.81 ± 4.9	1.42 ± .85
HFC	Basonaworena	30.1 ± 10.15^{a}	15.85 ± 4.1^{a}	1.38 ± .49^{a}
	Siyadebrnawayu	35.82 ± 5.7^{b}	16.3 ± 4.22^{a}	1.37 ± .55^{a}
	Angolelanatera	31.32 ± 6.41^{a}	18.91 ± 4.2^{b}	1.43 ± .56^{a}
	Overall	32.20 ± 8.1	17.10 ± 4.4	1.40 ± .531
HHFC	Basonaworena	19.75 ± 7.67^{a}	13.9 ± 4.12^{a}	1.14 ± .38^{a}
	Siyadebrnawyu	18.00 ± 1.17^{a}	12 ± 3.14^{a}	1.00 ± .00^{a}
	Angolelanatera	20.17 ± 2.6^{ba}	15.3 ± 4.14^{b}	1.75 ± .75^{b}
	Overall	19.90 ± 4.96	16.9 ± 4.9	1.50 ± .69

Note: a-b means with the different superscripts under the same column for the same parameter is significantly different at p<0.05
SD: Standard Deviation; AFS: Age at First Service; CI: Calving Interval; NSC: Number of Service per Conception; HFC: Holstein Frisian Cross; HHFC: Higher Holstein Frisian Cross (>=75% HF germplasm inheritance)

Factor affecting conception rates of osmic in dairy cows

In Table 6, the overall percentage of respondents agreed that heat detection problem (13.38 %), AI technician efficiency (14.57%), distance of AI center (11.61%), time of insemination (14.8%), semen quality (11.34%) and communication barrier 10.6% are the major factors that influence the successful CR of OSMI. The respondents indicated that there were problems of heat detection especially among the crossbreds; this may correlate with the poor body condition of the animals and HHFC shows signs of silent heat especially in the summer months and hence require more numbers of services to conceive. This is also related to problems with the non-availability of AI technicians, the distance of AI centers from the dwellings of the respondents, and consecutively timing of insemination.

Table 6: Factor affecting conception rates of OSMI in the study areas (n=135)

Factors of OSMI	Districts			Overall
	Basonaworena %	Siyadebrnawayu %	Angolelanatera %	
Heat detection problem	11.1	11.9	17.13	13.38
AI technician efficiency	17.8	11.1	14.8	14.57
Distance of AI center	12.6	17.8	4.44	11.61
Absence of AIT	5.19	14.8	3.7	7.897
Disease problem	5.93	5.19	3.7	4.94
Service charge	2.22	0.74	0	0.99
Timing of insemination	12.6	17	14.8	14.8
Semen quality	17	5.93	11.1	11.34
Body condition of the cows	8.89	11.1	9.63	9.873
Communication	6.67	4.44	20.7	10.6

Note: N: Number of respondents per district; CR: Conception Rate

Perception and satisfaction of farmers towards the OSMI CR

The results revealed that 32.3% and 33.3% of respondents agreed that OSMI of respondents agreed that very good and good respectively with positive circumstances (Table 7). On the satisfaction of outcome of OSMI CR 67.1% not satisfied. The perceptions of most respondents were disappointed with the outcomes of OSMI CR. This is in close accordance with those.

TABLE 7

Farmer perception and satisfaction about OSMI in the study areas (N=270)

Perception of the farmer on OSMI	Districts			Overall
	Basonaworena %	Siyadebrnawayu	Angolelanatera %	
Very good	36.7	10	50	32.3.
Good	23.3	35.6	41.1	33.3
Not good	40	54.4	8.9	34.4
Satisfaction of OSMI result	***	***	***	
Yes	32.2	22.2	44.4	32.9
No	67.8	77.8	55.6	67.1

Status of OSMI CR and NSC per years, district, breeds

The conception rate varied across the years with higher conception recorded among the inseminated cows. This vacation is farmer management practice especially for high graded animal and this program held once times per year per districts. Regarding districts indicated that the conception too varied across the studied locations with lowest conception rate was recorded among the cattle reared in S district. The status of OSMI CR was in somewhat increased per year (Table 8). The conception rate per breed, in crossbred it was higher as compared to native breed. This may be ascribed to the non-genetic factors associated with the same; the findings are in close agreement with those.

TABLE 8

Status of OSMI per years, districts, breeds in CR and NSC (N=405)

		Synchronized (N)	Inseminated (N)	Conceived (N)	CR (%)	NSC (mean)
Year	2013/14	418	98	15	15.3	2.8
	2014/15	255	171	35	20.46	2.6
	2015/16	347	191	46	24.08	2.15
	Overall mean	340	153.3	32	19.95	2.55
Districts	Basonaworena	359	181	42	23.2	2.3
	Siyadebrnawayu	280	121	22	18.18	2.7
	Angolelanatera	381	158	32	20.25	2.3
	Overall mean	340	150	20.67	20.54	2.4
Breeds	Exotic	736	318	83	26.1	2.22
	Native	284	142	13	9.15	2.12

Note: CR: Conception Rate; NSC: Number of Service per Conception; N: Number of cows

CONCLUSION

Milk yield is most important preferred traits perceived by farmers as trait then, growth rate is another trait perceived by the respondents, in order of importance. But they did not considered on body condition score, size of uterus; ovary, reproductive health, hormonal level, and overall health were not considered for oestrus synchronization. The main objective of dairy cattle breeding was for milk production to generate cash income. As a general higher percent of exotic (HF) germplasm animal were the major breeds preferred by farmers in the study areas. Generally, a trend of OSMI of CR was fluctuated year to year. This study concluded that the status of OSMI of CR was varied across breed and year. The results further indicated that the overall reproductive performance across breed and district was sub-optimum so in order to increase the conception rate, creating awareness for farmers on selection criteria of cows for OSMI program and perform capacity building of AIT apply proper management for improved breed are mandatory.

REFERENCES

1. Abebe K, Demissie T. Assessment on milk yield and reproductive performances of crossbred dairy cattle in selected dairy production systems of central highlands of Ethiopia. Asian J Dairy Food Res. 2021;40(3):290-294.
2. Seid A, Aliy M, Ibrahim N, et al. Perception Of dairy cattle owners on ooestrus synchronization and mass artificial insemination services in Jimma Zone. South Western Ethiopia. 2017;7:137-144.
3. Tesfa A, Mekuriaw S. The effect of land degradation on farm size dynamics and crop-livestock farming system in Ethiopia: A review. Open J Soil Sci. 2014;4(1).
4. Haile A, Joshi BK, Ayalew W, et al. Genetic evaluation of Ethiopian Boran cattle and their crosses with Holstein Friesian in central Ethiopia: Milk production traits. Animal. 2009;3(4):486-493.
5. Duguma B, Kechero Y, Janssens GP. Productive and reproductive performance of Zebu X Holstein-Friesian crossbred dairy cows in Jimma town, Oromia, Ethiopia. Glob Vet. 2012;8(1):67-72.
6. Birhanemeskel AL, Mekasha YO, Kide WE. Evaluation of the reproductive performance of crossbred (HF x Zebu) dairy cows in urban and peri-urban dairy system in Adigrat, Northern Ethiopia. Life Sci Int Res. 2016;3:42-46.
7. Chanyalew Y, Zewde T, Gatew H, et al. Evaluation of two estrus synchronization protocols in dairy cattle at North Shoa zone Ethiopia. Anim Prod. 2018;19(2):93-100.
8. Genzebu D, Tamir B, Berhane G. Study of productive and reproductive performance of cross breed dairy cattle under smallholder's management system in Bishoftu and Akaki Towns. Int J Agric Sci. 2016;6(2):912-913.
9. Gebremichael D, Belay B, Tegegne A. Assessment of breeding practice of dairy cattle in central zone of tigray, Northern Ethiopia. J Biol. 2015;5(23).
10. Gebrekidan TW, Zeleke MZ, Gangwar SK. Reproductive and productive performance of dairy Cattle in central zone of Tigray, Northern Ethiopia. Int J Adv Biol Biomed Res. 2012;58:63.
11. Kabir F, Kisku JJ. Reproductive performance of different crossbred cows of Bangladesh. Afri J Agri Res. 2013;8:723-6.
12. Alemayehu K, Getu A. The Status of Estrus Synchronization and Conception Rate in Ethiopian Cattle Breed. Int J Agric Vet Sci. 2015;1(1):19-26.
13. Perez-Cabal MA, Garcia C, Gonzalez-Recio O, et al. Genetic and phenotypic relationships among locomotion type traits, profit, production, longevity, and fertility in Spanish dairy cows. J Dairy Sci. 2006;89(5):1776-1783.
14. Tadesse M, Getahun K, Hunde D, et al. Analysis of the non-genetic factors influencing the performance of high-grade and inter se mated crossbred dairy cows at holetta dairy research farm, Ethiopia. Asian J Dairy Food Res. 2022;41(1):38-42.
15. Tewari H, Kumar S, Rath R, et al. Existing housing and breeding management practices adopted by dairy farmers in Tarai region of Uttarakhand, India. Indian J Anim Res. 2018;52(3):449-453.
16. Woldu T, Giorgis YT, Haile A. Factors affecting conception rate in artificially inseminated cattle under farmers' condition in Ethiopia. J Cell Anim Biol. 2011;5(16):334-338.
17. Yadav SP, Paswan VK, Sawant P, et al. Breeding and calf rearing management practices followed in Varanasi district of Uttar Pradesh, India. Indian J Anim Res. 2016;50(5):799-803.
18. Yifat D, Kelay B, Bekana M, et al. Study on reproductive performance of crossbred dairy cattle under smallholder conditions in and around Zeway, Ethiopia. Parity. 2012;277(0.23).