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Assessment of Breeding Practice and Statues of Estrus Synchronization and Mass Insemination of Dairy Cattle in North Shewa Zone, Amhara Region, Ethiopia

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Abstract
The general objective of this study was to assess breeding practice, and status of OSMI of dairy cattle. Data were analyzed using SPSS (version.20) and Ms-Excel (2010). Milk yield, breeding ability, body weight, fertility, and udder size are the major traits perceived by farmers. 92.6% of the respondents reared all cattle categories together except higher Holstein Friesian cross breeds and lactating cows. Conception rate (CR) and number of service per conception (NSPC) were affected ($p<0.05$) by year, breed and districts. Majority (67.1%) of the respondents were not satisfied with the results of the estrus synchronization and mass insemination (OSMI) program as the conception rate was low. There was better perception of farmers to OSMI technology in Angolelanatera (50%) compared to the two district. There were better opportunities for the application of OSMI technologies in Angolelanatera and Basonaworena districts due to availability of improved breed and milk receiver union. In conclusion the status of OSMI in the study area was increasing starting 2013-2015as shown in table 26. The main reason for farmers' dissatisfaction on OSMI program was low conception rate of dairy cows.. In addition procurement of the necessary facilities should be in place before implementing an estrus synchronization program.
Keywords: Breeding practice, Estrus synchronization and mass insemination.
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1. INTRODUCTION

Assisted reproductive technologies (ART) such as oestrus synchronization, super ovulation 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 (Webb *et al*., 2003). 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(Rick and Gene, 2013).Oestrus This bio technique also involves regulating the follicular development and thereby provide multiple stimuli thereby inducing oestrus cycle (Rasby and Deutche 2013). Synchronization programs are selected from several predesigned protocols which have been scientifically/clinically proven to regulate the follicular development (IAARD-IJAVS-2015). Oestrus synchronization (under smallholder context) can be used as a tool to effectively use the natural resources when available abundantly to parturate healthy calves and also to evade the period when there is shortages of feed and fodder (Azage*et al*,2016) . Under Ethiopian context parturitions can also be programmed in a way that it coincides with the periods when there is less demand for milk and dairy products(Azage *et al*., 2015).It can also be used as a tool to efficiently use the Artificial insemination (Azage *et al*., 2015). In addition, synchronization of oestrus contributes to optimizing the use of time, labour, and financial resources by shortening the calving season (Kefyalew and Addis, 2015). Thereby increasing the uniformity of the calf crop, exhibit standing oestrus at a predicted time, conceive earlier in the breeding season, and calve earlier in the calving season (Hopkins and Schick,. 2013).

Oestrus Estrous synchronization also enables the farmers to reduce costs involved in the hire of AI technicians and semen import in addition to this concentrated calving and uniform weaning saves time and is cheaper than having individual cows in heat throughout the year (Hopkins and Schrick, 2013). This can be achieved through efficient and accurate detection of oestrus , proper semen handling techniques, and thereby timely AI (Walker *et al*., 1996). Failure of proper oestrus detection is the most common problem in dairy cattle breeding programs (Hansar *et al*., 2014). Thereby resulting in loss of lifetime milk yield, decrease in number of calves born per lifetime, more numbers of days open, and an increase of reproductive culling were reported by (Walker *et al*., 1996). As the accuracy and efficiency of oestrus detection declines, it is important to incorporate oestrus synchronization/induction and timed AI into the breeding management program.

Oestrus synchronization assists in the accomplishment of faster livestock improvement programs such as fixed time artificial insemination (FTAI) and super ovulation of cows, thus minimizing the costs, time and labour required for oestrus detection in cows and does away with buying superior dams and sires. In line with this scenario it was proposed that artificial insemination which follows the oestrus detection can assist in increasing the numbers of crossbreds in Ethiopia (IAARD-IJAVS- 2015).

The history of artificial insemination in Ethiopia goes back to 1938 at the Veterinary institute in Asmara (IAARD-IJVS.2015). The use of AI helps in rapid genetic improvement and also the need to rear bulls (Verma *et al*., 2012). It also provides the opportunity to choice the sires which have proven to transmit desirable traits to the next generation and minimizes the risk of spreading venereal diseases. So far AI using frozen semen has played an important role in enhancing the genetic progress by up grading the subsequent generation. It increases the selection intensity since less bull is needed. (Johnson, 2011). However, there are chances of increase in inbreeding among the herd in absence of proper recording (ICAR, 2000).

However, there are reports which indicate that the AI service in Ethiopia is far from satisfactory (Sinishaw, 2005). The wide application and success of AI and oestruses synchronization across the developed world and its success in Africa and other developed country is still low owing to technical inefficiencies besides managerial and other infrastructure related issues (Azage *et al*., 1995. It has been reported by Dekeba *et al*.(2006) the efficiency of the AI service is declining due to inconsistent service especially among the small holder livestock production system of Ethiopian highlands. This could also be related to controlling of oestrus especially under conditions of small holder management and in many cases they are unable to identify the signs of oestrus (Woldu *et al*., 2011).

The efficiency of AI services in the country is dismally poor because of large areas that each of the AI technicians has to cover and other infrastructures. As AI is a time dependent activity, therefore timely detection of oestrus and also appropriate time of insemination are some of the prerequisites for successful conception (Azage *et al*., 2012 and Lemma, 2010). The qualities of the semen, its storage across different stages of handling besides the skill of the inseminators play important roles in the success of the whole program (Gebremedhin, 2005). This could further influence the efficiency of the oestrus synchronization process especially under the management of smallholder farmers (Woldu *et al*., 2011).

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 (Tsadik *et al*,2008, Jane *et al*., 2009). In many cases, the oestrus occurs during the night hours and therefore difficult to access especially at the late night hours and by the time the inseminators are informed and they respond to the call, the prime time for insemination is long overdue (Aulakh, 2008). Keeping this into account it has been reported that the AI service in Ethiopia was very poor with conception rate to first service being as low as 27.1%, (Desalegn *et al*., 2009).

The reproductive efficiency of the cow can be attributed if the cow parturates regularly. The world strategy is "**One calf per year per cow**", in order to achieve this strategy in the country, the calving interval need to be optimized (Perez *et al*. 2012).In this context, oestrus synchronization as reproductive management tool was initiated in 2013 in North Shewa zone of Amhara region(BoZAR,2015). The synchronization program was started on a pilot scale by the Bureau of Agriculture in North Shewa zone in 2006/2013.Now a day expand in to Siyadebrnawyu, Tarmaber, Angolelanatera, Debre Birehan town and Basona worena districts. The results pertaining to the estrus synchronization program as was initiated in other places where reported from different parts of the country Amhara, Oromia, and SNNPR, Tigray regions in a few districts and zones (Bainesagn, 2015; Debir, 2016; Destalem, 2015). Records till 2017 indicated that in the three districts Siyadebrnawyu, Angolelanatera, and Basona worena districts of North Shewa zone 9097cows were synchronized and 5074 dairy cows inseminated. However, there is lack of detailed comprehensive assessment analysis and there have been very limited studies pertaining to the results and status of the program which addresses North Shewa zone (BoZLFR, 2013-2017).

1.1. General Objective

To assess the overall breeding and management practice, status of estrus synchronization and mass insemination, in dairy cattle in north Shewa zone.

1.2. Specific Objectives

To determine breeding practice of dairy cows in north Shewa zone
To evaluate the constraints of estrus synchronization and mass insemination.
To identify farmer's perception about estrus synchronization and mass insemination

3. MATERIALS AND METHODS

3.1. Description of the Study Areas

A cross sectional study was conducted from, December 2016 to June 2017 in DebreBirhan milk shed area of North Shewa zone. The status of estrus synchronization and mass insemination's data was collected starting 2013-2016. North Shewa Zone is bordering on the south and the west by the Oromia region, on the north by DebubWollo zone and on the east by the Afar Region. Its latitude and longitude are 90º 40' 19.3''N and 390º 31' 45.3'' E, respectively (Google map satellite). The zone has 27 districts and 436 kebeles (ZLFDA, 2013). The average minimum and maximum rain fall is 750 and 1100 mm respectively and its altitude ranges from 937- 3700 m.a.s.l in average 2318.5 m.a.s.l. Its human and cattle population is 2,080,080 and 1,482,346 heads respectively (BOZAR and Ethiopian CSA, 2016/17) respectively. According to (WADR, 2013), its climatic conditions are (32.02% highland,

45.58% midland and 21.95 % lowland).

The selected districts are Siyadebrnawyu, Basonaworena, and Angolelatera. Siyadebrnawyu is found in Northwest of the zone and is located at about 177 km east of the capital Addis Ababa, and 46 km northwest of the zone town of DebrBirehan (CSA 2014). Basonaworena is located at the eastern edge of the Ethiopian highlands in the north Shewa Zone. The town of DebreBirhan is an enclave inside this woreda. Angolelanatera is found in west of DebreBirhan town and is located 120 km east of the capital city of Addis Ababa.

Map indicating the selected districts

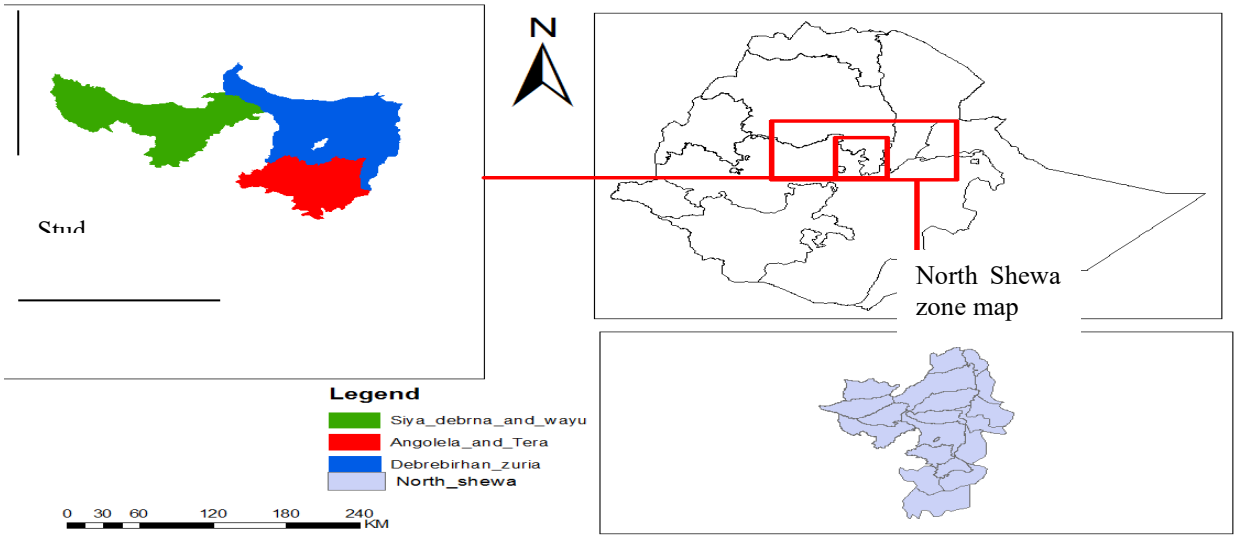

Figure 1. Map of the study areas

3.2. Sampling Procedures

Based on number of synchronized dairy cows, AI practice, attitude of farmers to adopt estrus synchronization and mass insemination technology, their milking shed potentiality, accessibility, and availability of infrastructure, out of 27 districts three districts were selected. Thereafter 9 kebeles from the 3 districts, Gashuamba, Rome and Wolle kebele from Siyadebrnawayu, Bakilo, kormargefiya and Angolela kebele from Basonaworena districts and Chacha town, Cheki and chefanen kebele from Angolelanatera districts were selected using multi-stage stratified purposive sampling followed by random sampling technique. The number of farmers involved in the OSMI was identified from districts record data and from these farmers 270 respondents were selected randomly per districts. In addition, 135 farmers per districts who were not involved in the OSMI were randomly selected. Based on the Yemane (1967) sample formula with 95% confidence level, totally 405 households head were selected for the study to represent the zone.

$$\mathbf{n} = \frac{\mathbf{N}}{\mathbf{1} + (\mathbf{N} * \mathbf{e^2})}$$

Where n=sample size, N=number of population in the three districts, e=0.05 margin error.

3.3. Data Collection method

Data was collected from primary and secondary sources. Primary data was collected using structured questionnaire. For this a structured questionnaire was prepared and pre-tested for its applicability before its administration to the potential respondents and every respondent included in the study was briefed about the objective of the study before starting and presenting the actual questions. Interview was done by the enumerators together with researcher and supervisor. Separate questionnaires were also prepared for the artificial insemination technicians, livestock experts in the districts.

Focus group discussion was also organized in each selected kebeles. Youngsters, women, village leaders, and socially respected individuals who are known to have a better knowledge on the present and past social and economic status of the area were purposely selected. Secondary data was also collected from zonal, districts and kebeles agricultural administrates documents.

3.4. Collected Data

The data that was collected through the survey include household structure, purpose of livestock rearing, and livestock feed types, factor affecting conception rate, disease, mating systems, production and reproduction performance of dairy cows, constraint and opportunities of AI and mass estrus synchronization, perception of the

farmer on mass estrus synchronization and AI.

3.5. Data Analysis

After all the data was collected fed to Ms-Excel (2010) and analyzed by SPSS version 20 and Ms-Excel (2010). Quantitative data obtained from the survey was analyzed by using one way ANOVA. Whereas qualitative data analyzed by chi- square using cross tabulation. Ranking also analyzed by using Ms-Excel (2010). The reproductive performance of the dairy cows as computed the following formula:

$$CR(\%) = \frac{\text{numberof conceivedcows/heifers}}{\text{number of inseminated cows/heifers}} * 100$$

$$NSPC = \frac{\text{numberofconceived cows/heifers}}{\text{number ofinseminated cows/heifers}}$$

The Model used for reproductive and productive performance of dairy cows

Yij=μ+ai+bj+eij

Where yij=response variable (AFS, LL, DO, CI, NSPC)

μ =Overall mean

ai=fixed effect of i^{th} districts (i=3: Angolelanatera, Basonaworena and Siyadebrnawayu)

bj= fixed effect of j^{th} breeds (j=3: Native, HFC, HHFC)

eij= residual error

Index was calculated based on the following formula

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 5^{th} , then Rn = 5, Rn-1 = 4, R1 = 1).

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

4. RESULTS

4.1. Household Demography of the Respondents

The results pertaining to the household demography of the respondents are presented in Table 1. The study shows that most of the respondents were males. Furthermore the respondents in across the study areas viz. Basonaworena (B) , Siyadebrnawyu (S) and Angolelanatera (A) were barely able to read and write, however this included respondents from illiterate to those who were well educated (>12 class). The studies further indicate that most of the family size was between 15-30 years and this too was similar across the study areas.

The results pertaining to the numbers of family members of a particular age category indicates that majority of them belong to 15-30 years category, indicating that they are physically younger age categories the observations were consistent across all the studied location District.

Table 1.Socio-economic and social demography (%) of the respondents in the study areas

	Districts			
Sex (%)	Basonaworena (N=135)	Siyadebrnawayu (N=135)	Angolelanatera (N=135)	Overall (N=405)
Male	89.6	89.6	91.9	90.4
female	10.4	10.4	8.1	9.6
Educational status (%)				
Illiterate	10.4	13.3	11.1	11.6
Read and write	40.7	30.4	37.0	36.0
1-4	11.9	17.0	18.5	15.8
5-8	26.6	20.0	13.4	20.0
9-12	8.9	13.4	13.3	11.9
>12	1.5	5.9	6.7	4.7
Family size per household's (mean±SD)				
1-15 years	2.04±.974	2.38±1.351	2.07±.967	2.16±1.114
15-30 years	2.36±1.358	2.37±1.217	2.17±.98	2.31±1.204
31-60 years	1.78±.472	1.91±.747	1.84±.539	1.85±.595
>60 years	1.50±.535	1.35±.493	1.47±.516	1.43±.501
Aver. Age HH	44.79 (18-72)	43.75 (17-85)	47.07 (30-74)	45.2(17-85)

The numbers in bracket, show that the minimum and the maximum average age of HH per districts and HH= household, SD=standard deviation

4.2. Land Holding and Allocation of the Household in North Shewa Zone

The average land holdings and the usages of the same across the studied areas are presented in Table 2. The study

shows that the grazing land was higher at A while the land owned by the respondents across the studied locations did not vary. The rented out land was lower among the respondents at S while the reverse was true for the communal land.

The amount of cropping land owned and rented out was higher at S while, while the fallow land was higher at B.

The results further indicate that the fallow land was higher at B while the irrigated land was lower at S and A. The study further indicated that the irrigated land (rented out) was higher among the respondents at B and A. The forage land was also higher among the respondents from B. District

Table 2. Land allocation of the household in North shewa zone per districts (Mean±SD) (ha)

	Districts			
Land use pattern	Basonaworena	Siyadebrnawayu	Angolelanatera	Overall
Grazing land overall	0.53	0.54	0.64	0.534
Own	0.61±0.399	0.585±0.30	0.62±0.27	0.61+0.33
Rented out	0.68±0.56	0.49±0.39	0.66±0.26	0.60±0.45
Communal	0.29±0.21	0.58±0.143	---	0.40±0.23
Cropping overall mean	1.12	1.38	1.19	1.23
Own	1.37±0.69	1.56±0.76	1. 2±0.56	1.39±0.69
Rented out	0.87±0.45	1.20±0.86	1.2±0.47	1.06±0.64
Fallow land overall mean	0.47	0.34	0.25	0.35
Own	0.47±0.23	0.25±0.00	0.25±0.00	0.43±0.226
Irrigated overall mean	0.375	0.23	0.4	0.34
Own	0.28±0.19	0.25±0.13	0.31±0.13	.28±0.173
Rented out	0.47±0.33	0.21±0.07	0.50±0.35	0.39±0.276
Forage land overall mean	1.15	0.38	0.23	0.6
Own	2.09±6.6	0.26±0.11	0.23±0.12	0.98±0.18
Rented out	0.21±0.07	0.50±0.25	---	0.35±0.23
Others land overall mean	0.18	0.25	0.5	0.31
Own	0.18±0.13	0.25±0.1	0.50±0.00	0.25±0.137
Over all mean	**2.80±2.4**	**2.62±1.21**	**2.42±0.99**	**2.63±0.173**

4.3. Cattle Herd size and Composition per Household

The findings as presented in Table 3 shows that there were no differences in the her composition of the native cattle across the studied locations, except that of the numbers of oxen numbers of which were higher in A when compared to the other two locations. The overall results also show that the numbers of native cattle were higher ($P<0.05$) at A.

The results further indicate that the numbers of Holstein Friesian crosses (F_1 and 62.5% Holstein Friesian) (HFC) were too varied ($P<0.05$) across the different categories of cattle, with larger ($P<0.05$) numbers of lactating cows being reared at B while the numbers of pregnant cattle were higher ($P<0.05$) at A. The numbers of HFC oxen's too were more in numbers at B and A.

The findings pertaining to the higher Holstein Friesian crosses (≥ 75% Holstein Friesian blood levels) too varied across the studied locations with higher numbers of cattle being reared at A and B. The results pertaining to the numbers of Jersey crosses indicated that the numbers did not vary across the studied locations.

Table 3. Cattle herd size and composition per household by District and breed type in study areas of North shewa (Mean±SD)

	Types of cattle category	Districts			
		Basonaworena (n=135)	Siyadebrnawayu (n=135)	Angolelanatera n=(135)	Overall N=405
Native	calve (M)	1.16±.501	1.16±.437	1.18±.393	1.16±.439
	calve(F)	1.31±.79	1.04±.196	1.23±.439	1.16±.501
	Lactate cow	1.23±.63	1.33±.542	1.21±.631	1.28±.583
	Dry cows	1.08±.28	1.06±.250	1.33±.488	1.16±.370
	Heifer	1.00±.00	1.07±.267	1.25±.500	1.07±.262
	pregnant	1.14±.38	1.12±.431	1.27±.467	1.16±.428
	Bull	1.23±.44	1.11±.323	1.20±.447	1.17±.378
	Oxen	1.66±.92^{a}	1.70±.7^{a}	2.16±.75^{b}	1.78±.804
	Total	3.0±2.1^{a}	3.5±1.9^{ab}	3.83±2.1^{b}	3.43±2.01
HFC	Calve male	1.44±.66	1.36±.58	1.26±.58	1.35±.61
	Calve female	1.45±.616	1.32±.5	1.41±.58	1.40±.57
	Lactating	1.72±1.03^{b}	1.33±.50^{a}	1.5±.72^{ab}	1.55±.82
	Dry	1.26±.51	1.13±.34	1.26±.58	1.24±.52
	Heifer	1.37±1.3	1.12±.38	1.35±.55	1.29±.87
	Pregnant	1.31±.507^{a}	1.21±.49^{b}	1.60±.58^{c}	1.42±.56
	Bull	1.28±.46	1.24±.56	1.11±.32	1.23±.46
	Oxen	1.93±.78^{b}	1.45±.64^{a}	2.02±.9^{b}	1.83±.83
	Total	6.86±3.8^{b}	4.23±2.5^{a}	6.5±2.96^{b}	5.87±3.35
HHFC	Calf (M)	1.00±.00	----	1.00±.00	1.00±.00
	Calf (F)	1.00±.00	1.00	1.22±.44	1.17±.39
	Lactating	1.40±.55	1.00	1.36±.5	1.35±.489
	Dry cow	1.00	1.00	1.00	1.00±.00
	Heifer	1.00±.00	1.00	1.00±.00	1.00±.00
	Pregnant	1.00±.00	---	1.17±.408	1.11±.33
	Total	1.91±.9^{ab}	1.00±.00^{a}	2.47±1.2^{b}	2.09±1.2
	Calve (F)	1.20±.447	1.00	---	1.17±.41
	Lactate	1.25±.463	1.00	---	1.22±.44
	Heifer	1.80±.447	1.00	---	1.67±.52
	Total	4.25±1.36	3.00	---	2.42±0.5

a-b means with the different superscripts under the same row for the same parameter is significantly different at $p<0.05$, SD-standard deviation, JERC= Jersey cross, HFC=Holstein Frisian cross, HHFC, higher Holstein Frisian cross(>75% blood level)

4.5. Assessment of Breeding Practice

4.5.1. Purpose of keeping dairy cows in North Shewa zone

The study pertaining to the purpose of rearing cattle in the studied locations is presented in Table 4. It transpires from the study that cattle in B district are generally reared for income generation followed by breeding and selling of live animals, the results pertaining to that rearing of livestock in S district too indicate that the cattle are raised for breeding and milk consumption while at A district the cattle are primordially reared for generating income followed by those of milk consumption.

Table 4. Purpose of keeping dairy cows in the study areas (%)

Purpose of dairy cow	Districts			
	Basonaworena (n=135)	Siyadebrnawayu (n=135)	Angolelanatera (n=135)	Overall (405)
Generating cash income	34.7	28.3	37.8	33.6
Milk consumption	22.2	30.3	30.3	27.6
Breeding &selling calves	34.8	36.3	17.1	29.4
Replacement	8.3	5.1	14.8	9.4

n= number of respondents per districts

4.5.2. Source of replacement and breed preference of dairy cow

The findings from Table 5 pertain to the source of cattle being used as a replacement in the herd. The findings show that at B District the replacement cattle are generally home bred followed by those which were upgraded. The results further show that at S District the replacement stock was generally get from house while at A District

the replacement was from upgrading using house herd.

Table 5. Source of replacement dairy cows in the three districts (N=405)

	Districts			
Source of replacement	Basonaworena (%)	Siyadebrnawyu (%)	Angolelanatera (%)	Overall
Raised at the home	20	54.1	13.3	29.13
Procured from farm	1.5	---	7.4	2.97
Upgrading	26.7	18.5	40.7	28.63
Buying upgrading	7.4	1.5	11.1	6.67
Home+ Upgrade	44.4	25.9	27.5	32.6

N=total number of respondents in the study areas

4.5.3. Breed preference of the respondents

The results from Table 6 pertain to the preference of the respondents from the three districts towards selection of a particular genotype of cattle. The study indicates that the respondents from B and S districts prefer to rear Holstein Friesian crosses, followed by HHFC and HHFC and HFC. The results from the respondents of A district preferred HHFC followed by HFC and HHFC and HFC being reared together.

Table 6. Ranking of breed preference of dairy cows per districts in the study area of North shewa zone (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
Siyadebrnawayu	HFC	50.8	48.5	0.7	0	0	0.29	1
	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
Angolelanatera	HHFC	48	25.8	16	10.2	0	0.29	1
	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

Index=the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1times 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, JERC= Jersey cross, HFC=Holstein Frisian cross, HHFC, higher Holstein Frisian cross (>75% exotic blood level).

4.5.4. Selection Criteria and trait preference of dairy cattle in the study areas

The findings pertaining to the selection criteria of the cattle based on preferred traits are presented in Table 7,8 and 9 for the three studied districts respectively. The respondents from B district preferred to select cattle based on their milk yield followed by their breeding ability and body weight. The findings also indicate that the respondents from S district preferred selecting cattle based on their breeding ability, followed by bodyweight and milk yield. The study further shows that the respondents from A district indicated that the cattle were selected based on their breeding ability, milk yield and body weight.

Table 7. Ranking of trait preference farmers for dairy cattle in Basonaworena

Traits	1st	2nd	3rd	4th	5^{th}	index	rank
Milk yield	46.66	23.3	13.3	10.04	6.7	0.26	1
Breeding ability	13.3	36.67	16.67	23.33	10.03	0.21	2
Body weight	13.33	16.7	36.67	20	13.3	0.19	3
Fertility	3.3	20.2	33.3	39.9	3.3	0.18	4
Udder size	10.04	23.3	13.3	6.7	46.66	0.16	5

Index=the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1times 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 + 1times fifth order))

Table 8. Ranking of trait preference of farmers for dairy cattle in Siyadebrnawyu districts

Traits	1st	2nd	3rd	4th	5th	Index	Rank
Breeding ability	46.67	26.67	20	6.667	0	0.24	1
Udder size	3.33	40.01	26.67	30	26.7	0.19	4
Milk yield	30	23.3	29.97	13.3	3.3	0.21	2
Fertility	20	3.3	16.67	60.01	0	0.16	5
Body weight	33.33	26.67	16.67	13.3	10	0.20	3

Index=the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1times 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 + 1times fifth order))

Table 9. Ranking of trait preference of farmers for dairy cattle in Angolelanatera

	1st	2nd	3rd	4th	5th	Index	Rank
Breeding ability	73.34	26.67	0	0	0	0.25	1
Udder size	0	23.3	29.97	16.67	30	0.13	5
Fertility	10	23.3	30	30	6.67	0.16	4
Body weight	60	33.3	3.3	3.3	0	0.24	2
Milk yield	46.67	40	13.3	0	0	0.22	3

4.5.5. Breeding objective and rearing system of cattle in the study areas

The results pertaining to the breeding objective of the respondents towards different genotypes of the cattle are presented in Table 10. The findings show that the native cattle are generally reared for milk production and sale of calves followed by sale of oxen. The results also show that the HFC are raised for milk production followed by sale of calves while the higher crosses are raised solely for milk production followed by both milk production and sale of calves.

The study further indicates that cattle of all age categories are reared together; however HHFC and lactating cows are reared separately so that management is better for them.

Table 4. Breeding objective and rearing system of cattle in the study areas of North Shewa zone (%).

Purpose	Districts			Overall
	Basonaworena (n=135)	Siyadebrnawyu (n=135)	Angolelanatera (n=135)	
Native				
sale of oxen and others	15.0	23.7	28.6	22.41
Manure	2.5	1.9	---	1.46
Milk production & sale of calve	68.5	62.2	67.3	66
Milk production, sale of calves &manure	14.0	12.2	4.1	10.13
HFC cattle	***	***	***	***
Milk production	2.5	4.1	7.4	4.7
Sale of oxen	0.8	9.9	2.5	4.4
Manure	0.8	---	---	
Milk production ,sale of calve	67.8	82.7	59.2	69.9
Milk production ,sale of cattle &manure	28.1	3.3	30.9	20.8
HHFC cattle				
Milk production	75.0	100.0	52.6	75.9
Milk production &sale of calve	25.0	---	47.4	24.1
Cattle rearing system	***	***	***	
All categories are reared together except HHFC breeds & 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

* Means with the different superscripts under the same row for the same parameter is significantly different at *** p=0.0001, n=number of respondents

4.5.6. Mating systems

Mating systems in the study areas were presented in (Table 11).The major mating practices revealed that in the study areas were natural (20.7%), AI(33.8%), both (AI+ natural) 31.4%, AI with estrus synchronization (14.1%) of respondents were used (Table 15). The current result was indicated that in Angolelanatera district 55.6% of respondents use AI technology through AI technicians. The remaining two districts are lower as compared to Angolelanatera districts. The application of AI and AI+ estrus synchronization hormone technology was lower in Siyadebrnawayu districts as compared to the two districts. The remaining, 20.7, and 14.1% of respondents were used natural and OSMI + AI, mating system respectively (Table 21). About 4.23% of respondents use bull for the

purpose of back cross.

Table 5. General characteristics of mating practice per districts in North shewa (n=135)

	Districts			
	Basonaworena%	Siyadebrnawayu %	Angolelanatera%	overall
Mating practice				
Natural	13.3	40.7	8.1	20.7
AI	31.8	14.11	55.6	33.8
Both	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
Born calves are good	2	5	3	3.3

Reasons to prefer natural mating (%)								
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Lack of inseminator	9.45[a]	21.62[b]	7. 2[a]	14.4[b]	6.6	16.6	7.75	17.5
High fee of inseminator	2.7[a]	4.05[b]	0[a]	0.9[b]	---	---	0.9	1.65
AITs not come on time	8.1[a]	16.2[b]	7.1[a]	15[b]	10[a]	13.7[b]	8.4	15
Poor conception rate	10.8	10.88	13.6	13.6	6.4	6.7	10.3	10.4
Born calves are male	---	---	---	---	10	10	3.33	3.33
Long distance	5.4	5.4	14.1	14.1	---	---	6.5	6.5
To get back cross)	2.7	2.7	---	---	10	10	4.23	4.23

a-b show that significant at $p<0.05$ between dry and wet seasons within districts ,n=number of respondents per districts

4.5.7. Source of breeding bulls in the study areas

The findings of this study as presented in Table 12 shows the respondents have different source of bulls for mating purpose. On overall percentage 86.38, 5.2 and 5.7% of the respondents obtained bull source from bulls owned by neighbors and friends, home bred bulls, research center and bulls kept by communal respectively with free and fee systems.

Table 6. General characteristics of breeding bulls in North Shewa zone per districts (%).

	Districts									
	Basonaworena			Siyadebrnawayu			Angolelanatera			Overall
Source of bulls	Native	HFC	HHFC	Native	HFC	HHFC	Native	HFC	HHFC	
Home breed bulls	1.5	0.7	---	---	3	---	--	2.96	---	2.72
Neighbors, friend	---	80.7	---	14.8	82.2	---	---	81.44	---	86.38
Bulls reared by communal --		---	---	---	---	---	---	---	15.6	5.2
Using the bull from research center	17.1	---	---	---	---	---	---	---	---	5.7

Selected bull user%				Overall
Users	72.9	63.63	66.7	67.74
None users	27.1	36.36	33.3	32.3

Bull availability	Breed type	Basonaworena	Siyadebrnawayu	Angolelanatera	Overall
Available	HFC, JERC	25.9	7.4	23.4	19
Not available	HFC, JERC	74.1	92.6	76.6	81
Available	HHFC, HJER	10.1	0	8.15	6
Not available	HHFCHJER	89.9	100	91.85	94
Bull service cost (Birr)	HFC, JERC	free	free	Free	free
	HHFC,	15	0	10-50	37.5

HFC=Holstein Friesian cross, JERC= Jersey cross, HHFC=Holstein Frisian cross (>75% exotic blood level), HJERC=higher jersey cross (>75% exotic blood level),

4.5.8. Alternative strategies when breeding bulls are not available

The findings of this study as presented in Table 13 shows that most respondents tried to solve shortage of breeding bulls through different alternative strategies like taking a cow to far kebele's breeding bulls (24.7%), use any available bull (7.6 %), extend for the next estrus, (5.63%), use AI by calling for AITs or take a cow in their station in long distance (21.5%), goes to research center (24%), use their bull (3.2%), use AI (8.17%) and use communal bull (5.2%) of respondents in the study areas (Table 23). About 40% of the respondents in Siyadebrnawayu district take their cows to AI center in long distance this might be one of the mechanism conception failure due to pass of insemination time (Table 17).

Table 7 Alternative strategies of farmers when breeding bulls are not available (%)

	Districts			
Alternative strategy	Basonaworena	Siyadebrnawayu	Angolelanatera	Overall
Take a cow in far kebeles	38.52	14.8	20.74	24.7
Use any available bull	0	22.9	0	7.6
Use AI by calling or take 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 nearest research center	20.1	0	51.85	24
Use AI	7.4	17.1	0	8.17
Use my bull	1.5	3.7	4.4	3.2
Use communal bull	0	0	15.6	5.2

Figure A) privately Figure B). Communal bull donate Figure C) ILCA research center bulls owned bull By ILCA research centerswhich give bull service for the society

Figure 2. Source of breeding bulls in the study areas

4.5.9. Maintaining of mating and pedigree record

The results pertaining to that, Maintaining of mating and pedigree record presented in the Table 14. The overall percentage about 44.5 and 10.34% of respondents in the study areas maintain mating and pedigree records respectively. Among those 30.6 and 13.87 % of respondents maintained mating record through recalling and in notebook recording system respectively and 2.45 and 7.89 % of the respondents in the study areas maintain pedigree record through in notebook and recalling system respectively. On the other hand 89.6 and 95.6, 83.78 % of respondents in Basonaworena, Siyadebrnawayu, and Angolelanatera districts are not maintained pedigree record respectively.

Table 14 . Maintaining of mating and pedigree records in the three 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 to 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 facility		0	6.7	0	0	0	0	0	2.2

N=total number of respondents and n=number of respondents per districts

4.5.10. Respondents awareness on inbreeding

In the study area, most of the respondents have information on the demerits of inbreeding. The current result showed that 76.7, 54.4, and 86.7% of respondents had awareness on the effect of inbreeding in Basonaworena, Siyadebrnawyu, and Angolelanatera districts respectively.

Table 8. Respondent's awareness about the effect of inbreeding in North Shewa zone (%).

Awareness on inbreeding (%)	Districts			Overall
	Basonaworena	Siyadebrnawayu	Angolelanatera	
Yes	76.7	54.4	86.7	72.6
No	23.3	45.6	13.3	27.4

4.5.11. Farmer awareness on estrus detection and time of detection

The awareness of respondents to detecting estrus was indicated in the (Table 16). The data collected from the 405 farmers indicated that (64.7%) respondents said that their cows came in heat during morning time and (20.6 %) in night followed by those (8.5%) at morning + night time (Table26). Regarding to the districts there is significance (p=0.001) difference. As a result 69 % and 29 % of respondents in Angolelanatera were detecting estrus during morning and night time respectively whereas in Basonaworena districts were 48.4 and 19.1% of respondent's detected during morning and night respectively.

Table 16. Farmers' awareness to detect estrus and the time of detecting per districts in the study areas (%)

	Districts			Overall
	Basonaworena	Siyadebrnawyu	Angolelanatera	
Awareness to detect estrus				
Yes	93.3	92.6	99.3	95.1
No	6.7	7.4	0.7	4.9
Time of detect estrus				
Morning	48.4	76.8	69	64.7
Afternoon	4.7	4	0	2.9
Evening	8.7	0.8	0.5	3. 3
Night	19.1	13.6	29	20.6
Morning+ night	19.1	4.8	1.5	8.5

4.6. Reproductive Performance of Dairy Cattle across the Three Districts of North Shewa

4.6.1. Age at first service (AFS)

The age at first service of the native cattle as presented in Table 17 show that the trait varied ($P<0.05$) across the studied locations with higher values reported among the cattle raised in S district. While the AFS of the HFC crosses indicated that the values were higher ($P<0.05$) among the cattle reared in S while there were no differences among the locations when it came to HHFC. Reproductive performance of dairy cattle across the three district and the genotypes are presenting in Table 17 and 18.

4.6.2. Calving interval (CI)

The findings as show in Table indicate that the CI too varied across locations across the genotypes studied. The results show that the CI was higher ($P<0.05$) among the native cattle reared at S while higher ($P<0.05$) values were recorded among the HFC cows raised at A district. The study further reveals that there was no variation across locations for the studied trait when it came to the HHFC cows.

4.6.3. Lactation length (LL)

The findings pertaining to the average lactation length (LL) of the cows of the different genotypes reared across the studied locations. The findings show that among the native cows the values were higher ($P<0.05$) among those reared at S, while there were no differences among the locations in the studied trait across the genotypes studied.

4.6.4. Days open (DO)

The findings pertaining to the day open (DO) indicate variations across the genotypes and also across locations within a particular genotype. The findings show that among the native genotypes the values were higher ($P<0.05$) among those reared at S district while among the HFC the same was observed among the cows reared at A. The

4.6.5. Number of service per conception (NSPC)

The numbers of services per conception results indicated that the values were similar across all the studied areas within a particular genotype.

Table 9.The mean ± standard deviation of reproductive performance of dairy cow per districts with breeds in month

Breeds	Districts	AFS	CI	LL	DO	NSPC
Native*	Basonaworena	45.40±9.1^{ab}	19.5±3.95^{a}	8.50±3.0^{b}	5.80±2.9^{a}	1.36±.48^{a}
	Siyadebrnawyu	46.46±6.75^{b}	21.8±5.59^{b}	9.5±3.13^{b}	7.35±3.35^{b}	1.37±.56^{a}
	Angolelanatera	42.83±5.27^{a}	18.13±3.6^{a}	7.71±2.53^{a}	5.21±3.1^{a}	1.75±1.85^{a}
	Overall	44.8±7.48	19.81±4.9	8.57±3.1	6.12±3.29	1.42±.85
HFC*	Basonaworena	30.1±10.15^{a}	15.85±4.1^{a}	9.10±1.92^{a}	3.89±1.97^{a}	1.38±.49^{a}
	Siyadebrnawyu	35.82±5.7^{b}	16.3±4.22^{a}	9.15±2.1^{a}	5.04±2.76^{b}	1.37±.55^{a}
	Angolelanatera	31.32±6.41^{a}	18.91±4.2^{b}	9.54±1.98^{a}	6.39±3.14^{c}	1.43±.56^{a}
	Overall	**32.20±8.1**	**17.10±4.4**	**9.27±1.97**	**5.13±2.86**	**1.40±.531**
HHFC*	Basonaworena	19.75±7.67^{a}	13.9±4.12^{a}	9.13±2.95^{b}	4.81±.75^{a}	1.14±.38^{a}
	Siyadebrnawyu	18.00±1.17^{a}	12±3.14^{a}	7.00±1.32^{a}	5.00±.00^{a}	1.00±.00^{a}
	Angolelanatera	20.17±2.6^{ba}	15.3±4.14^{b}	9.67±3.26^{b}	7.58±3.18^{b}	1.75±.75^{b}
	Overall	19.90±4.96	16.9±4.9	9.33±3.1	5.12±3.78	1.50±.69

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, LL=lactation length,DO=days open, NSPC=number of service per conception, HFC=Holstein Frisian cross, HHFC, higher Holstein Frisian cross(>75% blood level).

4.8. Productive Performance of Dairy Cow*s*

4.8.1. Milk yield per day per cows in the three Districts

The result of the survey showed that average daily milk yield of local cow in the three, lactation stage was 2.1L in Basonaworena, 1.25L in Siyadebrnawyu and 1.83L Angolelanatera districts per cows with an overall average milk yield of 1.71L (Table 17). Moreover, 6.17, 3.64, and 7.76L per cows in Basonaworena, Siyadebrnawyu, and Angolelanatera respectively with an overall average of milk yield 5.86L for HFC cows. There was significant difference (P<0.01) in between three districts on milk yields of the three lactation stages in HHFC cows. On average milk yield of HHFC cows was 11.73, 5.3 and 13.96 L for Basonaworena, Siyadebrnawyu and Angolelanatera, respectively, with an overall average of 10.32 L per cow per days (Table 18).

Table 10.The mean and standard deviation of milk yield in the three lactation stage of dairy cows in litters per districts /day in North Shewa zone.

		Lactation stages			
	Districts	Early lactation	Mid lactation	late lactation	overall
Native	Basonaworena	3.32±1.10 ^{b}	1.94±.81 ^{b}	0.97±.443 ^{b}	2.1±.78
	Siyadebrnawayu	2.03±0.85 ^{a}	1.10±.41 ^{a}	0.63±.28 ^{a}	1.25±.5
	Angolelanatera	2.95±1.13 ^{b}	1.64±.79 ^{b}	0.90±.35 ^{a}	1.83±.76
	Total	2.57±1.14	1.44±.73	0.77±.38	1.71±.36
HFC	Basonaworena	8.63±3.34 ^{b}	6.1±2.85^{b}	3.67±1.9^{b}	6.17±3.34
	Siyadebrnawayu	5.15±2.97 ^{a}	3.21±2.18^{a}	2.55±1.26^{a}	3.64±2.14
	Angolelanatera	11.31±3.3 ^{c}	7.39±2.77^{c}	4.59±1.92^{c}	7.76±2.7
	Total	8.57±4.1	5.7±3.14	3.37±2.3	5.86±3.2
HHFC	Basonaworena	16.63±4.81^{b}	11.75±4.1^{b}	6.81±3.2^{b}	11.73±4.1
	Siyadebrnawayu	8.00±2.42^{a}	5.00±1.23^{a}	3.00±.072^{a}.	5.3±1.24
	Angolelanatera	18.50±3.39^{b}	13.81±3.1^{b}	9.56±2.42^{c}	13.96±3

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,HFC=Holstein Frisian cross, HHFC, higher Holstein Frisian cross (>75% blood level)

4.10. Factor Affecting Conception Rates and Application of AI in Dairy Cows

In the study, areas factor that affecting conception rates (CR) and application of AI were presented in Table 19. In the present study the overall percentage of respondents agreed that heat detection problem (13.38 %), AI technician efficiency (14.57 %), distance of AI center (11.61%), absence of AIT (7.897 %), disease problem (4.94), service charge (0.99), time of insemination (14.8%), semen quality (11.34%) body condition of the cows (9.873%) and communication 10.6% are the major factors that influence the successful CR and AI application of dairy cows in the study areas (Table 19).

Table 19. Perceived factor affecting conception rates and application of AI in the study areas (n=135)

	Districts			
Factors	Basonaworena%	Siyadebrnawyu%	Angolelanatera %	Overall
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

n=number of respondents per districts

4.11. Major Constraints of AI Service and Ways of Delivering System of the Service

Major constraints of AI service and ways of delivering system in the study areas presented in the Table 20. About 85.9, 88.15 and 75.6% households in Basonaworena, Siyadebrnawyu, and Angolelanatera respectively reported that they had not enough AIT nearby. Therefore, from the total of AI service users about 6.1 % obtained the service any way, 23%, reject, and wait for another 21 days (Table 20). About 31.1, 13.3, and 14.8% respondents reported that there is AIT ability difference on the conception rate. 88.2% of respondents claimed that they did not get AI service during holyday/weekend. The satisfaction of AI service in the present study revealed that 54% respondents were satisfied with the overall AI service. The result indicated that 54, 36.5% during dry and wet seasons respectively of the respondents call with phone when they want to AI technicians for insemination whereas 46 and 63.5% of respondents get the AI technicians for services via take their cows to insemination center during dry and wet seasons respectively.

Table 20. Major Constraints of AI Service and ways of getting service in the study area of North Shewa zone (N=405)

Parameters		Districts						Overall	
		Basonaworena (%)		Siyadebrnaway (%)		Angolelanatera (%)			
Availability of AIT	Yes	14.1		11.85		24.4		16.78	
	No	85.9		88.15		75.6		83.22	
Difference between AIT ability	Yes	31.1		13.3		14.8		19.7	
	No	68.9		86.7		85.2		80.3	
AI service in holyday/weekend	Yes	16.3		14.8		4.4		11.8	
	No	83.7		85.2		95.6		88.2	
Satisfaction with AI	Yes	64.8		28.1		68.9		54	
	No	35.2		71.9		31.1		46	
ways of getting AI service	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	
Call him up over phone	60	23.3	38.9	24.4	62.2	62.2	54	36.5	
Take the cow to station	40	76.7	61.1	75.6	37.8	37.8	46	63.5	
Decision of respondents if AIT come to fail									
Get the service any way		7.4		2.14		8.9		6.1	
Reject & wait for other estrus		23.7		18.52		26.7		23	
Use NM		68.9		79.34		64.4		70.9	
Dominant sex of calves born from AI									
Male		45.60		50.60		60.00		52.1	
Female		21.10		23.00		17.0		20.3	
Do not remember		30.00		18.40		14.10		20.9	
Equal		3.30		8.00		8.90		6.7	

N= Total number of respondents, NM=natural mating

4.12. Trends of OSMI Per, Districts, in the Previous Three Consecutive Years in the Study Areas

The findings as presented in Table 21show that most of the respondents across all the studied locations were not

satisfied with the outcome of the OSMI program. The findings also show that some of the respondents showed that there was a trend in supporting the OSMI program and hence some of the respondents indicated that there was an increase trend in the same.

Table 21.Trends of OSMI per districts, in the previous three consecutive years in the study areas of North Shewa zone (N= 270).

Status of OSMI	Districts			Overall
	Basonaworena %	Siyadebrnawayu%	Angolelanatera%	
Increase	28.9	18.9	37.8	28.5
Decrease	67.8	80	62.2	70
No change	3.3	1.1	0.0	1.5

N=number of respondents of OSMI

4.13. Purpose of Oestrus Synchronization and mass insemination (OSMI)

The perception of the farmers to the OSMI technology as presented in Table 22. The findings show that the respondents from B and S district usually followed the OSMI project was generally initiated so as to initiate the cattle to come in heat and not to wait for another 21 days. While, the respondents from A district were in perception that the OSMI project was basically initiated to shorten the CI.

The results from the farmer's point of view on the OSMI project indicate that the project did not fulfil their aspirations, the results from Table 22 also was indicative that the cattle which were included in the project were done so without any particular criteria for their selection (Table 22).

Table 22. Farmer's awareness about the purpose of OSMI in North Shewa (N=270)

Purpose OSMI	Districts			Overall
	Basona worena%	Siyadebrnawyu wayu%	Angolelanatera tera%	
The cow come in to estrus and it initiate them to the next estrus	72.9	75.5	18.6	37.4
Shorten CI	20.4	20.7	54.3	50.1
Increase milk yield and calve crop	5.1	0.0	11.4	5.50
More calve produce per age of cows	0.0	1.9	5.7	2.5
To avoid feed shortage season and diseases	1.6	1.9	10	4.50

4.14. Perception of Farmers towards the OSMI Technology

The involvement of respondent's with estrus synchronization and mass insemination in the study area was presented in Table 23. The results revealed that 34.4% of respondents agreed that OSMI is not good While 32.3% and 33.3% of respondents agreed that on OSMI are very good and good respectively with positive circumstance (Table 23). On the satisfaction of outcome of OSMI 67.1% not satisfied reported by respondents. On the satisfaction of OSMI in Siyadebrnawyu very low about 22.2% of respondents are satisfied (Table 23).

Table 11. Farmer perception and satisfaction about OSMI in the study areas (N=270)

Perception on OSMI	Districts			overall
	Basonaworena%	Siyadebrnawayu	Angolelanatera%	
Very good	36.7	10.0	50.0	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

* There is significance difference across the districts at*** p=0.0001, N=total numbers of respondents

4.15. Respondents Selection Criteria of Cows and Heifer for OSMI

The result of the present study showed that the main selection criteria of cows and heifers for OSMI application in the study areas are presented in Table 24. About 58.9% of farmers in the study areas had no their own selection criteria of cows for the purpose of OSMI.As a result provide any type of cows and heifers for OSMI whether emaciate or none fertile cows then selected by AITs while 37 % of households provide their cows with animals with optimum body condition for OSMI (Table 24).

Table 24.Respondents Selection criteria of cows and heifer for OSMI (%) N=270

Select criteria	Districts			
	Basonaworena	Siyadebrnawayu	Angolelanatera	Overall
By looking their body size	1.1	5.6	5.6	4.10
Animals with optimum body condition	38.9	35.5	36.6	37.
No criteria	60.0	58.9	57.8	58.9

4.17. Opportunities for the Application of OSMI per Districts

The findings pertaining to the opportunities of OSMI in the studied Districts are presented in Table 25. The results indicate that the according to the respondents from B and A woreda the availability of improved genotypes and presence of milk union in the area. While, the respondents in S district opined that the herds are well managed, feed was available in the area the year around besides the farmers had accepted the OSMI program with open heart.

Table 25. Opportunities for the application of OSMI per districts in the study areas

Opportunity	Districts			
	Basonaworena	Siyadebrnaway	Angolelanatera	Over all
Availability of improved breed	31.1	3.6	35.6	28.1
Availability of milk receiver union	36.7	---	47.8	28.2
%% Availability of good management	14.4	28.9	16.6	19.63
Veterinary service	17.8	28.6	---	11.1
Farmer needs to accept OSMI	---	38.9	---	12.97

4.18. Effect of Years, District and Breeds on CR and NSPC

The findings as indicated in Table 26 show that the conception rate varied across the years with higher conception recorded among the cows inseminated in the year 2015. The findings also show that the numbers of services per conception (NSPC) did not vary across the years. The study also shows that the sex of the calves too were skewed favoring the birth of the bull calves Regarding Districts indicated that the conception too varied across the studied locations with lowest conception recorded among the cattle reared in S district which can be ascribed to high incidences of abortion. The study further indicates that the sex ratio of the calves too favored the birth of bull calves across all the locations The results pertaining to the effects of genotype on the conception and sex of the calves born indicate that it too favored the birth of the bull calves especially among the native cattle while amongst the crossbred there ratio was as expected, i.e. more or less equal numbers of males and females.

Table 26. Effect of Years, districts and breeds on CR and NSPC in the previous three consecutive years, North Shewa(N=270)

		Synchronized (N)	Inseminated (N)	Conceived (N)	Abortion (%)	CR (%)	NSPC (%)	Born calf Male (%)	Born calf female (%)
Year	2013	418	88	5	10.7	25.23	2.8	75	35
	2014	255	171	25	1.59	37.21	2.6	49	51
	2015	347	191	26	3.49	46.6	2.15	56.9	43.1
	Overall mean	340	162	17	5.3	36.34	2.55	60.3	39.7
Districts	Basonaworena	359	181	22	6.9	43.1	2.3	57.7	42.3
	Siyadebrnawyu	280	111	14	19.15	34.2	2.7	63.3	36.7
	Angolelanatera	382	241	26	5.3	41.9	2.3	52.2	47.8
	Overall mean		174	20	10.45	39.7	2.4	57.7	42.3
Breeds	Exotic	736	437	27	29	45	2.22	50.5	49.5
	Native	284	132	18	49	38	2.12	65	35
	Overall mean	510	284.5	22.5	39	41.5	2.17	57.75	510

CR= conception rate, NSPC= number of service per conception, N=number of cows

5. DISCUSSION

5.1. Household Demography

The results as presented in Table 1 indicates that most of the respondents are males which is in close accordance with the findings of Zewdie (2010) who reported that in Highland area of Ethiopia most of the respondents were males. This may be ascribed to the fact that traditionally in the tropics and Ethiopia being no exception the households are traditionally male dominated (Bainesagn, 2015). In many cases will not allow the female members of the house to interact with strangers especially if they are males, the findings to coincide with the observations of (Birhanu *et al*., 2006). The study further indicated that most of the respondents had only basic education and

very few of them have education beyond the secondary schooling, these observations too are in close accordance with those of (Leekim ,2014; Asemu *et al*.,2013; Melku, 2016). However findings have indicated that most of the respondents were illiterate with very few of them who were able to read and write which impairs them from maintaining proper records at their farm (Tsegaye and Tesfaye, 2002). Thus they are mostly dependent on recall method which in most of the cases inaccurate (Destalem, 2015; karume, 2013). The extension agents (in connivance with the University and Research centre staffs) are expected to develop proper extension manuals and recording systems which are user friendly for all sections of the livestock rearers. The results further indicate that most of the respondents were from the age group of 15-30 years and across all the studied areas. This is the most productive age of a person and hence are expected to be physically active (Sintayehu *et al*.,2008), however they lack experience which can be shared with proper livestock extension activities (Birhanu *et al*., 2006).

5.2. Land holding and Status of Grazing Land

The findings as presented in Table 2 show that the land holdings of the respondents across the studied areas are in close accordance with those of (Belay *et al*., 2012). However, higher land holdings have been reported by Melku (2016) and Getachew *et al*.(1993) from high land of Ethiopia. Lower land holdings amount to more land being allotted to agrarian purposes thereby compromising with the ever shrinking grazing lands (Zewudie, 2010). Shrinkage of grazing lands is leading to land degradation and also erosion (Assemu and Shigdaf,2014). Grazing lands have traditionally being the major source of fodder to the livestock in Ethiopia (Seyoum *et al*., 1997; ILRI, 1998). However, increase in agrarian activities will also result in more amounts of crop residues. Thereby enriching the crop residues viz. Urea treatment of straws can help in improving their feeding values (Mahesh and Madhu, 2013). Thus, proper storage of crop residues and also their appropriate handling is necessary to minimize the chances of contamination especially from mycotoxins (project R5181, https://assets.publishing.service.gov.uk/media/R5181b.pd). CAST, 2003 have indicated that mycotoxins pose serious health hazards to consumers of livestock products in many developing countries including Ethiopia.

5.3. Herd size and composition

The findings from Table 3 show that the overall heard size of the native cattle are in close agreement with those of (Adisu *et al*.,2016) from North Gondar. However, the numbers are lower than those reported by (Azage, 2009) from North Gonder. The lower numbers of native cattle as observed may be ascribed to the fact that the respondents prefer the crossbred cattle over the native cattle, the findings are in close agreement with those of (Belay and Geert, 2016). The proportionately higher numbers of crossbred cattle in the study areas may be because the respondents have at their disposal good amount of crop residues which can ensure better nutritional availability the year around. The study further indicates that higher proportion of Holstein Friesian and Jersey crossbreds, which too is in accordance with the observations of (Zewdie 2010; Belay and Geert,2016; LeeKim, 2014). The higher proportion of crossbreds indicates the presence of a good artificial insemination system in the area. The fewer numbers of HHFC i.e higher blood levels of Holstein Friesian crossbreds indicate that either these crossbreds do not perform well in the prevailing agro climate or the farmers are not aware of their management practices , the observations are in close accordance with those of (Million and Tadelle,2013) from Debre Zeit.Studies by (Madalena,1990) have indicated that in the tropical environment the higher blood levels of exotic cattle suffer from tropical degeneration and therefore such cattle rarely perform better than the F_1 crossbreds. These observations are in close consonance with the findings of (Kiwuwa *et al* 1983; Tadesse and Dessie, 2003). The numbers of lactating cows and heifers are more than other classes of cattle the observations too are in close accordance with those of (Debir, 2016) who opined that the numbers of males are usually fewer as the land holdings are shrinking and it is not profitable to rear large numbers of males. Moreover with the AI program being implemented would require fewer numbers of males and therefore the respondents prefer to sell them off at an early age (Verma *et al*., 2012).

5.4. Assessment of Breeding Practice

5.4.1. Purpose of keeping dairy cows in North Shewa zone

The findings as presented in Table 8 shows that generation of income was the primordial reason for rearing cattle, followed by milk consumption and sale of calves, the ranking varied across the locations, the findings are in close accordance with those of (Bebe *et al*.,2003). Rearing of cattle especially of heifers, bulls and calves for income generation are in close accordance with those of (Tsadkan, 2012). Raising cattle for consumption and sale of milk too is in close accordance with the findings of (Destalem 2015).Sale of milk too is an important income generating activities especially in the urban, peri urban areas and also in the rural areas of the country (Alemshet, 2014). However, care has to be taken to establish proper milk collection units, infrastructures (chillers, pasteurizers and milk trucks with thermo stable tanks) too need to be in place for a well-established dairy industry and are one of the most important.

5.4.2. Source of replacement and breed preference of dairy cow

The findings from Table (9) indicate that most of the replacement herd is home born which in most of the cases

are home born. The findings are in close agreement with those of (Alemshet (2014); Zelalem *et al*. (2017), while studies by Zelalem *et al*. (2017) have indicated that in Bahir Dar areas most of the cattle are home born. The replacement of herd by home born cattle while is beneficial at one end, because the respondents are aware of the pedigree of the cattle and that it comes at no cost. It often can lead to high amount of inbreeding in absence of proper recording and management (Lori A. Smith, 1997). This is all the more true when the cattle are inseminated artificially. Thus, a proper recording system has to be put in place a copy of which has to be in hand with the rearers themselves. Proper recording system is usually lacking in the tropical countries and Ethiopia being no exception (ICAR,2000;Philipsson and Rege,2003). The respondents need to be made aware of the same and simple yet effective recording system needs to be put in place.

The results from Table 10 were indicative that most of the respondents preferred Holstein Friesian and Higher Holstein Friesian crosses, these observations too are in close accordance with the findings of (Bebe,2003). However, the respondents need to be made aware of the husbandry practices associated with rearing crossbreds of higher exotic blood levels. This is basically associated with the veterinary care and also the availability of sufficient feeds of proper quality. Studies by Philipssonand Rege(2003) have indicated that under small holder conditions of the tropics Jersey crosses can perform better than Holstein Friesian crosses. This may be because Jersey crosses have low maintenance requirements while the butterfat percentage is quite high (Philipssonand Rege,2003).

5.4.3. Traits preferred in selection of cattle in the studied locations

The results as pertaining to the traits preferred by the respondents across the studied locations are presented in Tables 13 (A district), 12 (S district) and 11(B district). The findings show that the traits preferred are more of less similar across the locations. Milk yield of the cattle are preferred which is in close accordance with those of Bainesaign (2016) from Oromia Region. This is because of established milk processing units in the vicinity except S district. The breeding ability of the cattle are associated with its fertility and the trait as a whole is lowly heritable. Thus, selection of this trait is closely associated with the management of the cattle and the nutrition available. Inclusion of breeding ability as a selection criteria have also been reported by (Godadaw *et al.,* 2014). This trait is closely associated with the lifetime calf crop production which in turn is also associated with the lifetime milk yield of the cattle (Debir, 2016). The inclusion of body weight as a selection criteria as indicated in the study are also correlated with the above two traits. Cattle with optimum body weight usually have a better reproduction ability and also milk yield (Karume,2013). However, higher body weight of cattle is also correlated with high maintenance requirements and there of high feed requirements (karume,2013). Thus, cattle with low maintenance requirements will be those which are favourable under small holder farmers in the Ethiopian scenario (Philipsson and Rege2003).

5.4.4. Breeding objective and rearing system of cattle in the study areas

The findings as presented in Table 14 is indicative that most of the native cattle are raised for milk followed by those of sale of calves and oxen for fattening purposes, the findings are in close agreement with those of (Destalem,2015). The sale of native bull calves as oxen purposes too have been reported by Zewdu, (2004) this is primarily for agrarian purposes and thereafter for beef purposes (CSA, 2016/17). The results pertaining to the objectives for rearing the HFC cattle indicate that they are raised for milk production, sale of calves, the findings too are in close agreement with those of (Destalem, 2015). The HFC crosses are high yielders and therefore preferred by the farmers all over the country (Azage, 1989). The crossbred calves are in high demand by the investors in urban and peri urban locations as the numbers of crossbreds are usually less in the country as a whole (FAO,2010). The findings also show that most of the farmers in Ethiopia depend on organic manure for agrarian purposes (Bainesagn, 2016). The study also shows that most of the higher Holstein Friesian crosses are raised for milk purposes which too is in close agreement with the findings of (Alemshet,2014; Destalem, 2015). However the numbers of HHFC are very few and most of them are females.

5.4.5. Matting Systems

The findings as presented in Table 15 is indicative that the participants use AI and natural mating interchangeably, this is in accordance with the findings of (LeeKim, 2014) from Asela town of Oromia Region and (Getie *et al.* 2015; Destalem 2015). This may be because of the fact that sometimes the AI technicians may not be available which may force the respondents to revert back to natural mating of their cattle (Destalem, 2015). It has also been reported in several studies that at times cattle which do not conceive using several AI do so under natural mating (Destalem,2015). This is ascribed to the fact that many times cattle develop allergy towards the chemicals used in semen preservations especially ethylene glycol and thus impair fertilization and many times the growth of the embryo (Generose *et al.*,1988). The study further indicates that the participants under the project usually select the bulls based on predefined criteria set up by the project officials. It has also been reported that some of the participants also select bulls based on traditional methods which basically comes with experience.

The participants were also aware of the fact that genetic improvement through AI is quite rapid vis-a-vis that of the natural mating. Moreover, many of the respondents were aware of the slow genetic progress ascribed to inbreeding (Alazar *et al*.,2015). The study also shows that many of the respondents were forced to revert back to natural mating of their cattle, primarily based on poor conception and lack of AI technicians, these observations

are in close accordance with those of (Desalegn, 2008; Destalem, 2015). It has been reported in several studies that one of the biggest drawbacks of success of AI in Ethiopian scenario is the lack of proper oestrus detection and consecutively improper timing of insemination (Azage *et al*., 2012). This leads to poor conception rate and thereafter the respondents have no other option but to revert back to natural mating.

5.4.6. Source of breeding bulls in the study areas

The findings from Table 16 indicate that most of the bulls used in the natural mating are reared by the friends and acquaintances these findings are in close accordance with the observations of (karume, 2013; Destalem, 2015; Getie *et al*,.2015; Debir, 2016). Such practices avoid rearing of bulls at every household and consecutively inbreeding within the herd. However, it can lead to spread of venereal diseases as the bull may be serving several cattle at a short period of time (Bahlibi, 2015). It's also possible that conception is poor through natural mating if the bull serves several cows at a short span of time (*Lozano et al., 2009*). This leads to thinning of semen and therefore the sperm count decreases (*Lozano et al., 2009*). Chances of inbreeding within the kebele may also be observed if there are few good bulls within the locality and all the respondents prefer to get their cows covered by the bull (Bebe *et al*., 2003). Therefore, under such condition it is advisable to implement bull rotation program between woredas and no bull has to be reared in the kebeles for more than a year. However, care has to be taken to include only those bulls which are free from commonly occurring venereal diseases and that the bulls are periodically screened for the same.

The findings also show that most of the rearers are well experienced in phenotypic traits associated with a good breeding bull; this may be fallout of their experience in cattle husbandry and also trainings received under the OSMI project.

The results also show that most of the respondents complained that the availability of crossbred bulls are wanting in all the studied locations, which is in close accordance with those of (Gatew *et al*. 2017). It has been reported that in AdisAbeba of Ethiopia that one of the major hindrances in development of dairy industry of the country is lack of crossbred bulls in the country (Yilma et al., 2011). The study further indicates that semen of HFC bulls are available by cost which too is in close accordance with those of (Tadesse, 2010) and (Desalegn, 2008) who reported that the AI is provided by public sector office. Similarly the current study further indicated that the cost of inseminating the cows with the HHFC bulls was expensive which may at times be out of reach from the small holder farmers. It has been reported that the higher crosses need special care and may not be possible for the small holder farmers to manage (Aynalem *et al*., 2009; Guatam *et al*., 2010). Hence, it is advisable to provide the HHFC or higher crosses of Jersey only to farmers who have the resources to manage them. The farmers rearing higher crosses should be so selected who have adequate provisions for feed resources and veterinary care, besides those who are financially capable to provide the emergency necessities for rearing higher blood levels of the crossbreds. This would prevent the cattle from succumbing to tropical degeneration and hence the producing and reproduction capability of the cattle are maintained.

5.4.7 Alternative strategies when breeding bulls are not available

The findings as indicated in Table 17 is indicative of the fact that in absence of the facilities of artificial insemination the respondents search for good bulls in the nearby vicinity and when not available try to get their cattle covered with any bulls available at hand. These observations are in close accordance with those of (Azage *et al*., 2010) who reported that the farmers in Ethiopia have no other choice but to get the cows covered with any bulls at hand. This often leads to negative selection among the herd which is detrimental to the development of cattle husbandry in the region. It has also been reported that the scrub bulls are usually of poor parentage and may be responsible for transmissing many venereal diseases within the herd/s(Thomas,1999). Travelling long distance with cattle in estrus too is not preferred as such cattle usually are stressed (due to the estrus itself and travelling) and many times have poor conception (Fitsum, 2017). It has also been reported that many times the respondents from A district take their cows (in oestrus) to the nearby research centre, these observations are in close accordance with those of (Alemshet, 2014). This is preferred over covering them with the scrub bulls, however the respondents need to plan the same in advance so that the appropriate time of mating is not lapsed and also that records are maintained so that inbreeding can be avoided

5.4.8 Maintaining of records among the herds

The findings from Table 18 and 19 indicate that in spite of the fact that most of the respondents are aware of the ill effects of inbreeding, yet they do not practice maintaining of records among their farm animals. The present findings are in close accordance with the findings of Alazar *et al.* (2015) in Debretabour Town. The findings are also contrary to the observations of Destalem (2015) in central zone of Tigray who reported that most of the respondents are unaware of the ill effects of inbreeding among livestock. The study further indicates that most of the respondents did not maintain any sorts of records which are similar to the observations of (Getie *et al,.*2015; Nibret , 2014). The findings also indicate that a very miniscule section of the respondents had some sought of did so depended on recall methods, which is seldom correct (karume, 2013). Studies by (Solomon *et al*.,2013) have indicated that record keeping is one of the primordial requirements of modern livestock breeding. In absence of proper records the development that has occurred over period of time through implementation of livestock breeding

techniques are seldom accurate (Lori, 1997). Thus awareness creation pertaining to importance of livestock recording needs to be created among the rearers. Simple yet effective record keeping methods need to be developed keeping into account that a large section of the beneficiaries are not literate.

5.4.9. Farmer Awareness to Oestrus Detection, and Time of detection

The results as indicative from Table 20 indicate that the respondents were aware of the importance of oestrus detection in farm animals. Oestrus detection is one of the primordial prerequisites for the success of any artificial insemination program (Reolofs *et al.,* 2010). Proper detection of oestrus and thereafter inseminating the heifer/ cow at the appropriate time ensures that the rate of conception is appropriate (Walker *et al*., 1996). The most popular and time tested method of insemination is the AM/PM and PM/AM method, which indicates that oestrus is best detected twice a day (Hall *et al*., 1959). The study indicates that most of the respondents observe oestrus only once a day which results in high degree of conception failure (Perry, 2005). The respondents need to be made aware of the AM/PM system of oestrus detection and insemination so as to have a fairly high degree of conception (Nebel et al, 1994).

5.5. Reproductive Performance of Dairy Cattle across the Three Districts of North Shewa Zone

The overall estimated average age at first service (AFS) of native dairy cows is presented in Table 21. The AFS of the native cattle too varied across the locations which can be ascribed to both their genotype and the management (Shiferaw *et al.,* 2003; Perera, 1999). It has also been reported that if the management of the cattle are good the heifers mature early. Cattle with low AFS usually have high calf crop production and ultimately higher lifetime lactate yield. The AFS as recorded in this study are in close agreement with those of (Debir, 2016). However, AFS of the native cattle as observed lower than those reported by Mulugeta and Belayneh (2013) from Angolelanatera woreda.

The AFS of the HFC and HHFC cattle too indicated variations across locations, which is may also be ascribed to the management and feed available to the cattle (Shiferaw *et al.,* 2003). The results show that the values are lower at B district it may be ascribed to availability of the feed in the area. The study also show that the AFS of HFC as recorded too are in close accordance with the findings of Nibret, (2012), Desalegn, (2016) while lower AFS was reported in a study by Belay *et al*. (2012) from in Jima Town andZewdie (2010) in the highlands and central rift Valley of Ethiopia.

The calving interval (CI) of the cattle too varied across the studied locations which may be ascribed to the management of the cattle and also their genotype (Shiferaw *et al.,* 2003; Debir, 2016). Cattle with longer CI are unprofitable to rear and are subjected to culling(Graves,2009 ; De Vries, 2005). Longer CI also leads to fewer numbers of calves and lifetime milk yield (suhail *et al*.,2010). The CI of the native cattle as reported in the study area in close accordance with those of Assemu *et al*, (2016) Fogera breed. The study also indicates that CI of the HFC too is in close accordance with those of Emebet and Zeleke (2007) in Dire-Dawa and (Hailemariam *et al*., 1993). The results are however lower than those reported by (Bekele *et al*.,1991) from centeral highland parts of the country . The findings also show that the CI of the HFC as recorded too are higher than those recorded by (Desalegn *et al*., 2016; andYifat *et al*. 2009). The CI of the HHFC is in close agreement with those of Melku, (2016) and Negussie (2006) in Mekelle city which too are higher than those reported by (Kiwuwa *et al*., 1983).

The lactation length (LL) as a trait too has its own economic importance, however cattle with longer LL does not mean that it is profitable (Fikre Lobago *et al.,* 2007). Cattle with lower LL are usually not profitable (Fikre Lobago *et al.,* 2007). It has been reported that the appropriate LL of the cattle are usually around 10 months (Desalegn *et al*., 2016). The LL of the cattle too is influenced by several non-genetic factors especially the feed available and also the diseases prevailing in the area (Perera, 1999). The LL of the native cattle as reported in the study are in close accordance with those of Dejene, 2014, however lower LL of the cattle have been recorded in a study by (CSA, 2016/17;Ouda *et al*. (2001) andTrail*et al*.(1984) from Kenya. The LL of the HFC cattle are in close accordance with the findings of Belay *et al*.(2012); Desalegn *et al*.(2016), the values are higher than those recorded in a study by (Mulugeta, 2005) in yerer milkshed in Addis Abeba. However, the LL of the HFC cattle are lower than those reported by (Mulugeta and Belayneh(2013) from Angolelanatera woreda. The LL of the HHFC as reported in this study area in close accordance with those of (Bainesagn,2016). The values are lower than those reported by (Aynalem *et al*.(2011) and Gabriel *et al*. (1983) from Arsi districts. This may be ascribed to the fact that the HHFC require better management, feed and also veterinary care which is difficult to be provided by the small holder farmers.

The values for days open (DO) is also an economic importance as cattle with longer DO usually have fewer life time calf crop (De Vries, 2006). Longer the DO means that the cattle are prone to longer dry period and lower profitability (De Vries, 2005). It has also been reported that the trait too is influenced by the non-genetic factors viz. feed and the reproductive health of the cattle (Belay *et al.*, 2012). The DO of the native cattle, HFC and HHFC are in close agreement with those of Niraj Kumar *et al*. (2017) and Belay *et al.* (2012) respectively . However, the values are lower than those reported by Addisu *et al*. (2015) from Gondar town and Mulugta and Belayneh,2013 from Angolelanatera woreda for HFC.

The findings also show that the numbers of services per conception (NSPC) in native cow is in close accordance with the values reported by (Belay *et al.*, 2012). Optimum NSPC is correlated with the profitability of the animals (Mukassa-Mugrewa, 1983).More numbers of services are indicative of poor reproductive health (Mukassa-Mugrewa, 1983) . The values are however lower than those reported by Yifat *et al*. (2009), 1.67 as reported frommid Rift valley parts of the country. It has been recorded that HHFC usually require more numbers of services which can be associated with higher productivity Kabir and Kisku, 2013). The NSPC is also influenced by oestrus detection especially of the cattle mated through AI and hence the respondents need to be made aware of the signs associated with oestrus detection. There have also been reported that the HHFC show signs of silent heat especially in the summer months and hence require more numbers of services to conceive (Gebrekidan *et al.,* 2012).

5.6. Milk Production Performance

The results as presented in Table 24 pertain to the milk yield of the cattle of the three genotypes reared across the studied locations. The findings show that the milk yield across all the lactate stages varied across the studied locations, this was recorded across all the genotypes, the findings are in agreement with the observations of (Destalem, 2015). The study also indicates that the milk yield is higher in the first stage of lactation which was in agreement with the findings of (Desalegn *et al*.,2016). The results also show that the milk yield across all the lactate stages varied across the genotypes and that it too varied across the locations which may be ascribed to the management of the cattle (Karume,2013; Swensson *et al*., 1981). The variations also may be accorded in milk yield (within a genotype and lactate stage) across locations also may be ascribed to the parity of the cattle (Adebosin *et al*.,2010). This is because the cattle reared across the locations varied in age and parity and thereby the milk yield (Karume, 2013 ; Migose *et al.,*2006).

5.7. Factor Affecting Conception Rates and Application of AI in Dairy Cows

The results as indicated in Table 27 show the major constraints pertaining to the success of AI program in the study areas. Studies by (Desalegn,2008) have indicated that poor conception is one of the major problems associated with AI in Ethiopia. The factors which were identified by the respondents were pertinent and multifarious, which too accords with the observations of (Desalegn,2008). The respondents indicated that there were problems pertaining to the heat detection especially among the crossbreds, this may correlate with the poor body condition of the animals. Findings of a study by (Harris and Kolver, 2001) have shown that silent heat is commonly observed among the higher crosses especially when they receive improper nutrition. This is also followed by problems associated with the non availability of AI technicians (Mekonnen *et al*., 2010), distance of AI centres from the dwellings of the respondents and consecutively timing of insemination (Azage *et al*.,2012)

5.8. Major Constraints of AI Service and Ways of Delivering System

The findings pertaining to the major constraints associated with the AI services and delivery system as presented in Table 28. The constraints as indicated by the respondents too are apposite, lack of AI technicians especially during the holidays and weekends were the major problems, the observations are in accordance with those of (Alemshet,2014; Desalegne *et al.,* 2009) .This may be overcome by privatization of the services, which in one way can create employment locally but also provide the services regularly. The results also show that most of the respondents call the AI technician (AIT) over phone and those residing nearby take their cattle to the AI centers, these findings are in close accordance with the findings of (Bainesagn,2016). It has also been reported in earlier studies that most of the AIT are unable to keep their words especially when the estrus is spread round the year (Mekonnen *et al*., 2010).This is because of disproportionately fewer numbers of AIT per woredas who are expected to cover long distances within a short span of time (Azage *et al.,* 1995). It has also been reported earlier by the AIT that there are lack of AIT to provide AI service in Ethiopia (Azage and Hoekstra, 2011). Differences in the availability of the AI service across seasons too have been reported in the study areas. It could be ascribed to transportation problems during the wet season. It has also been reported that many times the farmers themselves are busy tilling their fields during the wet season and hence may not be able to inform the AIT on time. While, the converse was true for the dry season. Therefore, culmination of all these factors besides the weather itself may lead to the differences in AI across the two seasons. The findings also indicates that most of the respondents usually go in for NM when they were unable to avail the services, the findings are in close accordance with the findings of (Alemshet,2014; Destalem, 2015) . This may be because they are unsure of the availability of the AI services in the subsequent oestrus . However, many of the respondents prefer waiting for the next round of the cycle. The study also shows that most of the respondents (irrespective of the districts) reported that most of the calves born were males, the observations are in close accordance with the reports of (Frehiwet *et al.,* 2014) from Mekelle. It has been suggested in a study by (Lawson,1980) that many of the sperms bearing X chromosomes usually perish during the freezing and thawing process, thereby skewing the ratio in favour of the Y chromosome bearing sperms.

Adversities due to lack of proper recording system too is evident in recalling the sex of the calves as a large section of the respondents were unable to recall the sex of the calves born at their respective homesteads.

5.9. Trends of OSMI the Previous Four Consecutive Years

The findings from Table 29 was indicative of the fact that most of the respondents were dissatisfied towards the implementation of the OSMI project, this is in close accordance with the observations of (Gatew *et al*,2017) .It maybe because the respondents were not well appraised about the possible outcomes of the project, similar dissatisfaction with OSMI project/s in other parts of the country too have been reported by (Tegegn and Zelalem)from (Bench Maji zone). It is also possible that the respondents were expecting of major paradigm shift in their income after they participated in the project, while the actual outcome was quite lower. Hence, it is always advisable to come out with a clear picture of the project and also appraise the respondents about what they should realistically expect from the project and how can the project can benefit the participants, it's always better to further provide the respondents with the pros and cons of the project.

5.10. Purpose of OSMI

The purpose of participating in OSMI project as have been presented in Table 30.As indicated from the study it is suggested that most of the participants were involved to break the anoestrus condition of their cattle using the PGF2, this is in close accordance with the observations of (Gatew *et al*.(2017) from North Shew zone of Amhara region.However, for the cattle to conceive and complete the full period of gestation requires among others above average body condition and should be provided with a balanced diet. The respondents also indicated that OSMI would have led to lowering the calving interval thereby improving the lifetime lacteal yield of the cattle and also the calf crop, the assumptions of the respondents are in accordance with the observations of (Kefyalew and Addis,2015). However, OSMI is only tool by which oestrus synchronization of cattle in a particular location can be carried out effectively. However, in order to achieve the economic returns from the bio technique the management, nutrition and veterinary care have to be optimized specially for the higher crosses (Azage, 2016; Singh, 2011).Therefore, the respondents need to be trained for optimizing the management and also appraised about the different nutrients which are needed for improving the reproduction and production of the cows

5.11. Perception of Farmers towards the OSMI Technology

The perception of the respondents in the study area pertaining to OSMI as presented in Table 30, show that except for respondents from A district most of the respondents in the other two districts were disappointed from the outcomes of the OSMI program, the findings are in close accordance with those of (Destalem,2015; Ahmed,2017). As indicated ahead the success of the OSMI program is a fallout of several factors and unless the factors are met with there are very less chances that the project will accomplish its goals .Another foremost criteria for the project to meet its goal is to select the cattle with average body condition besides, should be free from any reproductive disorders (Azage *et al*., 2016).

In case of crossbreds the maintenance requirement is high therefore; nutrition has to be provided appropriately otherwise there are chances that there can be adverse effect on the nutrient balance of the cattle. Under such condition the overall benefits from OSMI program may not be achieved, hence the respondents need to be appraised.

5.12. Respondents' Selection Criteria of Cows and Heifer for OSMI

The results as presented in Tables 32 and 33 are indicative of some of the reasons pertaining to the selection of the cattle (32) and constraints thereof (33). The findings show that there were (in most of the cases) no predefined criteria for selecting the representative cattle under the program, the findings are in close agreement with those of (Azage *et al*., 2016). It is imperative that the cattle included in such projects be properly screened for any physical and gynaecological defects, the respondent's be made aware of the pros and cons of the project. The respondents should be also appraised regularly by the experts from the Research station/s and Universities so that the cattle are properly managed and fed on balanced diet (Short *et al*., 1990; Destalem, 2015).Care also has to be taken to ensure that the cattle receive proper veterinary care both during and after pregnancy (Short *et al*., 1990;Miller, 1991).

5.13. Opportunities towards Implementation of OSMI

The possible opportunities associated with the selection of the districts under OSMI program are multifarious. However, the presence of milk union for off take of milk along with presence of crossbreds have been identified by the respondents in B and A districts, while both the factors are favourable but absence of proper feed is again a big challenge in both the areas. Thus, the milk unions can play a big role in augmenting the feed problem in the areas in form of trainings to the farmers in form of fodder conservation techniques. Taking experience from many developing countries, the milk unions can also establish a feed processing plant which can carter to the feed requirements for the cattle reared by the union members. Experience from Anan Milk Union Limited (AMUL)

indicates that establishment of feed manufacturing unit is imperative for success of any milk union and a part of the payment for the farmers is made available in form of feed for their cattle (Nisa, 2016;Dinesh,2011).

Findings also indicate that at S district in spite of having plenty of feed, lack of crossbreds and milk union needs to be addressed so that the advantage pertaining to the feed availability can be properly utilized. Establishment of feed processing unit too need to be set up so that the available feed can be properly carried out throughout the year.

5.14. Effects of Years, Districts and Breeds on CR, NSPC and Sex Ratio of the Calves

The effect of years on the conception rate and secondary sex ratio of the calves born as presented in Table 35 indicate that there were differences across the year's districts and breeds. This may be ascribed to the non genetic factors associated with the same; the findings are in close agreement with those of (Destalem, 2015). This may be ascribed to the availability of feed and fodder. Sex ratio of the calves too varied across the years, Districts and breeds which can further be attributed to the resource allocation theory. But there is no significance difference between districts, years and breed in NSPC.

6. SUMMARY AND CONCLUSION

The present study was initiated due to lack of detailed analysis and lack of inclusive assessment and evaluation of mass synchronized of dairy cattle there have been limited studies pertaining to the results of OSMI, little scientific evidence associated with problem of CR of cows, misunderstandings on oestrus detection, limited information on management practice of dairy cows practiced by farmers. The objectives of the study were; assess the overall breeding practice, and status of oestrus synchronization and mass insemination of dairy cattle in north Shewa zone. The most important preferred traits and selection criteria perceived by farmers were milk yield, breeding ability, body weight, in order of importance. The main objective of dairy cattle breeding was for milk production to generate cash income, while the least was for milk consumption. HFC and HHFC were the major breeds preferred by farmers in the study areas and their major source of replacement stock was through raised at home with upgrading their cattle.

With regard to breeding practice, AI is the major mating system in North Shewa zone. The opportunities for AI and mass synchronization of dairy production in the study area were presence of veterinary service, availability of improved breeds, and availability of milk receiver union, the presence of trained man powers and extension service. Generally, Trends of oestrus synchronization and mass insemination in the last 3 years was on CR increased slightly starting to 2013/14-2015/16 in the study areas.

From the present study, concluded that the status of estrus synchronization and mass insemination technology gradually farmers accept if properly done. The results further indicated that the overall reproductive performance across all the breeds and Districts was sub-optimum.

7. RECOMMENDATIONS

- The policies should be established an appropriate marketing infrastructure, collection, processing, storage, and distribution, to ensure milk productions.
- Creation of farmers' awareness in the study area, on managerial as well as breeding aspects create an opportunity in improving breeding and management practice of dairy cattle and also it avoid misunderstanding of different managerial and breeding aspects which are practiced by farmers traditionally.
- Limited number of AI technician and their efficiency is the major problem in the study area; as a result the number of AITs could be increased per kebele and give training for AITs so as to satisfy farmers demand.
- Participatory and sustainable breading strategy could be undertaken through incorporating indigenous knowledge of farmers and by including trait preference of the dairy owners to improve productivity of dairying.
- In the study areas, insemination was carried out only at the third days after hormone injection. However, some cows come to oestrus after three days and hence farmers have not access to AITs at that time. As a result it is better to AITs to wait until three up to eight days after hormone injection in their kebele.
- To improve efficiency of dairy cattle productivity practicing andestrus synchronization and mass insemination improving oestrus detection method, proper time of insemination, good management practice,proper semen handling, full inseminator equipment, improve AITs efficiency of detected oestrus and follow up after synchronization of the dairy and appropriate animal selection should be considered before implementing oestrus synchronization and AI.

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