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Assessmentof Breeding Practices and its Major Constraint in Small Holder Dairy Farmers in and Around Hirna Town, Tullo District, West Hararghe, Ethiopia

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Abstract: A cross-sectional study was conducted from November 2017 to June 2018 with the objective of assessing breeding practice and major problems associated with application of artificialinsemination and estruses-synchronization on dairy cattle production at small holder level in five purposively selected peasant associations in and around Hirna town, Tullo district, West Hararghe, Ethiopia. In this survey, A structured questionnaire was used, 400 respondentsinterviewed. Descriptive statistics were used for analysis of the data. According to the study result, 45.75% of the respondents used artificial insemination for breeding their dairy cattle, 34.5% respondent uses natural mating while 19.8% had used estrus synchronization for artificial insemination service. 43.2%, 22.95%, 14.2%, 19.67% of respondents said that most common reason for using artificial insemination instead of a bull was for genetic improvement because it was considered cheaper than using natural service: to avoid getting venereal diseases and no need forbull management. Thus, repeat breeders (not conceived at first service; 49.2%) and distant artificial insemination stations (21.9%) were the major challenges for artificial insemination service.Shortage of inputs (liquid nitrogen and semen), absence ofartificial insemination services on weekends and holydays and absence of sufficient artificial inseminationtechnicians constituted 19.7% , 6.6% and 2.7%, respectively in the study areas. To detect estrus in cow for artificial insemination service, the farmers had used different methods such as observing mucus discharge from cow, mounting to others animals, restlessness and nervousness, swelling and redness of vulva and inappetence. The disadvantages of using a bull for breeding instead of artificial insemination according to the interviewed respondent were poor genetic development (26%), dangerous working environment (5.7%), risk transmittingvenereal disease (1.5%) and (66.7%) not know disadvantage of bull. The major animal disease identified in the area wasbovine Pasteurollosis, mastitis, blackleg and dystocia. To be successful in animal breeding technology awareness for farmer on applications and advantages of artificial insemination and estrus synhronization should be given besides; sufficient artificial insemination professional should be employed for farmers.

Key words: Artificial Insemination · Dairy Cattle · Estrus Synchronization · Hirna Town

INTRODUCTION

Ethiopia is one of the most populated countries in Africa and which has the largest livestock population in Africa, estimated to be 49 million cattle, 45 million sheep and goat, 2.7 million horse, 5 million donkeys and about 1.07 million camels and 42 million chickens. In agricultural mainly crop and livestock production of the Ethiopian economy employing approximately 85% of the total human population.Livestock production accounts for approximately 30% of the total agricultural GDP and 16% of national foreign currency earnings [1].

However, the dairy industry is not developed like other East African countries. Total cattle population for the rural sedentary agricultural areas of Ethiopia is estimated at 43.12 million, of which 55.41% are females. Out of the total female cattle population, only 151, 344 (0.35%) and 19, 263 (0.04%) heads are hybrid and exotic

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breeds with an average lactation length of 6 months and an average daily milk production of 1.44 liters per cow, the total milk produced during the year 2006/07 was recorded to be 2.634 billion liters [2]. Dairy sector development in smallholder farming systems is one of the key strategic important for addressing food security and improved livelihood in developing country in particular in Ethiopia in order to improve the low productivity of dairy cattle, selection of the most promising breeds and cross breeding of these indigenous breeds with highly productive exotic cattle has been considered a practical solution. Thus, the need for clear strategies on the improvement and maintenance of indigenous cattle genetic resources is required along with clear breeding programs for sustainable genetic improvement [3].

Artificial insemination (AI), a process by which sperm is collected from the male, processed, stored and artificially introduced into the female reproductive tract for the purpose of conception [4, 5], has become one of the most important techniques ever devised for the genetic improvement of farm animals. This practice has been widely used for breeding dairy cattle as the most valuable management practice available to the cattle producer and has made bulls of high genetic merit available to all [6].

Synchronization of estrus (heat) is a reproductive management tool which involves manipulating the estrous cycle of females, so that they can be breed at approximately the same time [7]. Estrus synchronization programs improve reproduction efficiency by reducing the length of breeding and calving seasons and increasing calf weaning weights [8]. From the previous studies, it has been found that AI service is weak and even declining due to inconsistent service in the smallholder livestock production systems of the Ethiopian highlands [9]. The problem is more aggravated by lack of recording scheme, wrong selection procedures and poor management of AI bulls associated with poor motivations and skills of inseminators [10].

Therefore, the objectives of this study were to assess the breeding practice of small-holder cows under mixed farming system of selected Hirna town, Tullo districts in West-Hararghe zone and to identify the major problems associated with the application of artificial insemination and estruses-synchronization in the study area.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted from November 2017 to June 2018 on a total of 400 small-holder cows in and around Hirna town, TulloWoreda, Western Hararghe Zone, Oromia Regional State. Western Hararghe Zone is a geographical area located between 7°55' N to 9°33' N latitude and 40°10' E to 41°39' E longitude. The area is characterized by Charcher Highlands having undulating slopes and mountainous in topography. The mean annual rainfall ranges from 850 to 1200 mm per year with minimum and maximum temperatures of 12 and 27°C, respectively.

The major crops grown in the area are sorghum, maize, chat, field beans, potato and teff. Hirna town is located at 371 km from the capital city Addis Ababa towards Eastern direction and 45km from the zonal capital, Chiro. Hirna town and/or 'Tullo'woreda is characterized by two main seasons in a year: the dry season (winter) which extends from January to the end of April and long rainy season (summer) that extends from July to the ends of September. The district has daily mean temperature ranging from 180°c-260°c and mean annually rain fall ranging from 550mm-800mm. The agro-ecological Zone of the TulloWoreda district highland (dega) 40%, mid-highland (weynedega) 57% and kola 3%. The topography of the Tullo*Wored*a moderate highland 1500m, highland 1500m-2500m and very highland >2500m above sea level and relative humidity 21.9% - 65%. The soil types of the district clay include 43%, sand 55% and silt 2% [10]. The livestock populations of the *Woreda* are 125915 cattle, 37, 973 goats, 13, 177 sheep, 171, 499 poultry, 5, 905 donkeys and 338 horses and 274 mules. The total area coverage of the *Woreda* is 45, 679 hectares, of which 30, 275 hectare is cultivated land, 6, 325 hectare is forest land and 253 hectare is bush land and 1000 hectare is miscellaneous land. The *Woreda* have 33 peasant associations and three towns with total human population of 14, 648, of which male 71, 691 and female 74, 798 [11].

Study Design: A cross-sectional type of study using questionnaire survey was carried out from November 2017 to June 2018 in the five purposively selected PA's dairy cattle owners engaged on smallholder dairy farms. The structured questionnaire was prepared and used to collect data from small holder wheninterviewed using commonly spoken local languages Afaan Oromo. Before the starting of the interview, every respondent was briefed explained about the objectives of the study.

Sampling Procedures: In the sampling proceduresfrom thefive districts which are major user of AI service in zone, was purposively selected to conduct the study. Small holder dairy farmers were selected by using simple random sampling. Total of 400 dairy farmers were selected from five distinct.

Study Population: The study population were composeddairy farmers that use AI, dairy farmer that use natural mating and dairy farmer using oestrus synchronizationhad undertaken in five districts, namely Rakatafura, Odabalina, Lubbu-dhaqab, Kirakufis and Tarkanfata within Hirna Town, Tullo*Woreda*. Almost all animals were local (Zebu) breeds kept under mixed farming systems of the study area.

Sample Size Determination: The sample size was determined based on the expected prevalence of 50%. Thus, the sample size was calculated according to Thrusfield formula by using 95% confidence interval and 0.05absolute precision [12] as follow:

N = 1.962 (1- ⓟⓟⓟⓟ)

ⓓⓓ 2

where,
n = Sample size
P = Expected prevalence
d = Desired absolute precision.

As a result, 384 respondents were selected as study population. However, to increase precision sample of 400 respondent was taken.

Data Analysis: The data obtained from the respondents were stored, filtered in Microsoft excel spread sheet and coded and transferred to SPSS software version 20.0 for analysis. The collected data was analyzed by using descriptive statistics and represented in table

RESULTS

From total of 400 dairy cattle owners, the questionnaires survey revealed that 45.75% of house hold used artificial insemination, 34.5% of house hold use natural mating and but 19.8% was used artificial insemination with estrus synchronization in (Table 1).

Most of farmers had tied their cattle besides main house at night 140 (76.5%) and only small number have individual house for his cattle 43 (23.5%). With regard to the farmer started farming dairy cows for >10 years60 (32%), for 10-20 years 90 (49%), above 20 years 33 (19%) (Table 2).

Majority of the farmers were looking for animals mounting other animals 73 (39.7%), nervousness and restlessness 48 (26.2%), Physical heat signs such as mucus discharge 35 (19.4%), swelling and redness of the vulva17 (9.2%) and Inappetance10 (5.5%) (Table 3).

Mostly farmers had start using AI for > 5 years126 (68.85%) and only few owners used AI for < 5 years, 57 (31.14%) indicated (Table 3). The owner was checked heat, one times/day 90 (49.2%), twice/day 60 (32.8), three times/day 33[18] only by using visual observations was used among the interviewed farmers for heat detection and no estrus detection method other than visual observation (Table 4). Most farm owners contacted the AI-technician by take cow to AI-station directly 113 (61.75). Only small number owner uses mobile call 70 (38.3%) (Table 4). According to interviewed respondent heat checked by family 164 (89.6%), stock man, 9 (4.92%) and farm owner himself also checking heat 10 (5.5 %) (Table 4). Most farmers contacted the AI-technician as soon as possible after they had detected heat 141 (35.25%). Small number of owners contact next morning 42 (22.95%) it differed depending on when they detected the heat ((Table 4). The most common reason given for using AI instead of a bull was for genetic improvement 79 (43.2%), because it was considered cheaper than using natural service 42 (22.95%), No need bull management 36 (19.7%), to avoid getting venereal diseases 26 (14.2%; Table 5). The major disadvantage using AI, according to the interviewees, were: repeated breeding 90 (49.2%), AI station was far 40 (21.9%), shortage of input 36 (19.7%), AI service was not available on weekend and holyday 12 (6.6%) and shortage AIT 5 (2.7%; Table 5).

The result revealed that 22.3% of the respondents did not have animal health problems. The result of the survey indicated that regarding disease prevalence, the major animal disease identified in the area was bovine Pasteurollosis (40%), mastitis (22%), black leg (10.4%) and dystocia (5.5; Table 5).

Farmer started farming dairy cows for >10 years 33 (23.9%), for 10-20 years 77 (55.8%), above 20 years 28 (20.3%). Most of farmers had tied their cattle in front of main house at night 98 (71.1%) and only small number have separate house for his cattle 40 (28.98) (Table 6).

The farmers have different source of bull for mating. The households in study area obtained breeding bull from 7neighbors, own farm and village as responded by 59%, 24% and 17% of farmers, respectively (Table 6).

The most common reasons stated by the interviewees why they didn't use AI instead of breeding was because of shortage of AIT 56 (40.6%), shortage of

Table 1: Respondent's used breeding system

Breeding system	Frequence	Percent (%)
AI	183	45.75
Natural mating	138	34.5
AI with synchronization	79	19.8
Total	400	100.0

Table 2: Housing system of dairy owner and the year start farming dairy cows

Factors		No. respondents	Percent (%)
Animal housing system	Individual house	43	23.5
	Beside main house	140	76.5
How many years farming dairy cow	>10 years	60	32
	10-20 years	90	49
	Above 20 years	33	19

Table 3: Assessment of signs of oestrus used in order to report and the year start using AI

Signs of oestrus		Respondents	Percent (%)
Swollen and redness of vulva		17	9.2
Mucus discharge from vulva		35	19.4
Restlessness and nervousness		48	26.2
Mounting other animal		73	39.7
Inappetance		10	5.5
How long you use AI	>5 yaers	126	68.9
	<5 years	57	31.1

Table 4: Number of time estrus detected, a person that detects and means of notifying

Factors		Frequency	Percent (%)
Number of time estrus detected	One time per day	90	49.2
	Two time per day	60	32.8
	Three time per day	33	18
Means of notifying AIT	Take cow to AIT station	113	61.75
	Mobile call	70	38.3
Heat detector	Stock man	9	4.92
	Family	164	89.6
	Owner	10	5.5

Table 5: Common reason given for using AI instead of a bull and AI service and disease problems

Factors		No. of respondent	Percent (%)
Common reason given for using AI	Genetic improvement	79	43.2
	Cost	42	23
	Avoid venereal disease	26	14
	No need bull management	36	20
AI Service Problems	Distant AI station	40	21.9
	shortage of AIT	5	2.7
	AI service was not available on weekend and holyday	12	6.6
	Repeat breeding	90	49.2
	Shortage of input	36	19.7
Common disease	Mastitis	40	22
	Pasteurollosis	73	40
	Blackleg	19	10.4
	Dystocia	10	5.5
	No disease problem	41	22.3

Table 6: Year start farming Dairy cow, housing system and sources of bull for mating

Factors		No. respondents	Percent (%)
How many years farming dairy cow	>10 years	33	24
	10-20 years	77	56
	Above 20 years	28	20
	Total	138	100
Animal housing system	Separate house	40	29
	Beside main house	98	71
	Total	138	100
Use of bull for mating	Own farm	33	24
	Bull come to farm	23	17
	Take Cow to bull	82	59
	Total	138	100

Table 7: Reasons why they didn't use AI instead ofnatural matingand negative about natural mating

Reasons		Frequency	Percent (%)
Why they didn't use AI instead of breeding	Shortage of AIT	56	40.6
	Shortage of input	37	26.8
	No service on weekend and holyday	29	21
	No pregnant result	16	11.5
	Total	138	100
Negative about natural mating	Poor genetic improvement	36	26
	Venereal disease	2	1.5
	Dangerous working environment	8	5.7
	Not know about this	92	66.7
	Total	138	100

Table 8: Problem of disease disturb the herd (natural mating)

Disease disturb the herd	Frequency	Percent (%)
Bovine Pastollosisi	44	31.9
Mastitis	30	21.7
Black leg	21	15
Dystocia	6	4.3
No disease problem	37	26.8
Total	138	100

Table 9: Farmers' participation on synchronization and its problem

Factors		Frequency	Percent (%)
Haveyou participated in synchronization	Yes	79	19.75
	No	321	80.25
	Total	400	100
What is major problem of synchronization	Shortage of input	16	20.3
	Shortage of AIT	33	41.8
	Heat detection problem	30	37.9
	Total	79	100

Table 10: Farmers' satisfied with synchronization and constraints of AI service

Factors		No. respondents	Percent (%)
Have you satisfiedwith synchronization	Yes	15	19
	No	64	81
	Total	79	100
What is major problem ofAI	Heat detection problem	39	49.4
	Shortage of AIT	28	35.4
	Shortage of input	12	15.3
	Total	79	100

input 37 (26.8%), no service on weekend and holyday 29 (21%) and poor pregnancy results 16 (11.5%) (Table 7). The disadvantages of using a bull for breeding instead of AI according to the interviewees were: 92 (66.7%) not know disadvantages of bull, poor genetic development 36 (26%), Dangerous working environment 8 (5.7%), venereal disease 2 (1.5%) (Table 7).

The result revealed that 26.8% of the respondents did not have animal health problems. The result of the survey indicated that regarding disease prevalence, the major animal disease identified in the area was bovine Pasteurollosis (31.9%), mastitis (21.7%), black leg (15%) and dystocia (4.3%; Table 8).

Only few respondents were used estrous synchronization 79 (19.8%) where as with regard to existing AI service problem, Shortage of input 16 (20.3%), shortage of AI technician 33 (41.8%) and heat detection problem 30 (37.9%) are the main persistent AI service problems reported by the respondents (Table 9).

With regarding to farmer satisfaction with estrus synchronization and cause of AI service 15 (19%) was satisfied but 64 respondents (81%) not satisfied with synchronization (Table 10).The main problem of AI service according to synchronization user washeat detection problem 49.4%Shortage ofAIT (35.4%), shortage of input (15%) (Table 10).

DISCUSSION

In the present study, the assessment of breeding practice in and around Hirna town, Tulu district was conducted on 400 respondents supported by questionnaire survey in five different kebeles. The current result showed that 45.75%, 19.8% and 34.5% of interviewed households used artificial insemination, artificial insemination with estrus synchronization and natural mating respectively. This is in agreement with the result of Gebremichael [19] who reported that 42.77%, 22.22% and 35% of interviewed households used artificial insemination, artificial insemination with estrus synchronization and natural mating respectively.

On the other hand, the most common reason using AI instead of a bull according to respondent was for genetic improvement (43.2%), because it was considered cheaper than using natural service (22.95%), to avoid getting venereal diseases (14.2%), no need of bull management (19.67%). Current result line with Tsegay *et al.* [13] reported that artificial insemination has advantage over natural mating because artificial insemination accelerating introduction of new genetics 42%, has low cost in comparison ofbull price 23%, no need of bull management 19% and low disease transmission 16%. Abdinasir [14]. had reported similarly with current result from Bilalo district of Ethiopia about 42 %, 23%, 19% and 16% of respondents have said artificial insemination has advantage over natural mating due to artificial insemination could accelerate introduction of new genetics, has low cost in comparison ofbull price, no need forbull management and low disease transmission, respectively [10]. Also, the advantages of AI include the prevention of reproductive diseases, control of inbreeding, minimizing the cost of keeping bulls for natural service and others.

In similar way, Zumbach and Peters [15] was recommended to use AI because AI has opportunity to choose sires that are proven to transmit desirable traits to the next generation and minimizes the risk of spreading sexually transmitted diseases and genetic defects, increase genetic progress by upgrading the reproductive rate of the male, it is also cost effective.

Among the study kebele the dairy farmers detect estrus in their dairy cows by observing mounting other animals (39.7%), nervousness and restlessness (26.2%), Physical heat signs such as mucus discharge from vulva (19%), swelling and redness of the vulva (9.2) and inappetence (5.5%). Current result is higher than that reported Milkessa [16] with 16.9% for mounting of the cow on other animals, 10% for redness and vulva discharge, 4.6% for bellowing and 3.1% for restlessness and reports of Ibrahim *et al*. [17] with 32.8% by observing mounting of the cow on other animals, redness and mucus discharge of the vulva (9%), restlessness and nervousness (6.6%) and loss of appetite (4.9%). Nuraddis *et al*. [18] reported from Jimma zone districts, Ethiopia in estrus detection about 32.8% of the dairy farmers detect their dairy cows by observing mounting of the cow on other animals, vulva (28.7%), bellowing (16.4%), swelling, redness and mucus discharge of the vulva (9%), restlessness and nervousness (6.6%), both restlessness and loss of appetite (4.9%) and decreased milk production (1.6%). This might be due to good management practice and awareness` of the community about estrous detection system in my study area.

Most farm owners contacted the AI-technician by taking cow to AI-station directly (61.75%). Only small number of owner use mobile call (38.3%). This result disagrees with Gebremichael [19] who report 68.6% of the respondents call with phone when they want to AI technicians for insemination. The difference might be due to lack of communication between dairy owner and AI technicians, lack of vehicles (cars, motorcycles or bicycles) and the condition of the roads.

The major problems of AI, according to the interviewed respondent were: repeated breeding (49.2%), AI station was far (21.9%), shortage of input (19.7%), AI service was not available on weekend and holyday (6.6), shortage of AIT (2.7%). Current result in with Tsegay *et al*. [13] who report from Hydyzone, Southern Ethiopiaartificial insemination constraints by respondents, Repeat heat (not conception at first service) (56%), AI station was far 44%, AI service was not available on weekend and holyday 10%, There was shortage of inputs (liquid nitrogen and semen) 30%, there was no way of communication with AI technician 6%, Delivered sex was male 24%, Management of cattle was poor 4% there was no AI technicians 3%. [8] ranked constraints of AI service from highest to lowest as feed source perception of AI users about AI, poor estrous detection systems, efficiency of AITs, distance from local AI Centre, input for AI activity, price for AI and disease. In similar to current result Nuraddis *et al*. [18] reported from Jimma zone districts, Ethiopia; AI service is challenged due to unavailability of artificial insemination technicians (27%), discontinuation of service along weekends and holidays 30 (24.6%) and lack of inputs 9 (7.4%). Zerihun *et al*. [21] also reported similar result to current study in West Gojjam Zone from 412 cattle owners 285 (69.17%) were not satisfied in different ways in the use of AI service during the time of weekends and holidays, due to shortage of artificial insemination technician, shortage of input, distance from AI service and inefficiency of artificial insemination technician (AIT). Most of farmers had tied their cattle beside main house at night and only small number have separate house for his cattle. Current finding in line with Leggese [22] reported that about 90% of the respondents prefer rearing the cattle within their own dwellings or Main house while 10% of respondent prefer Separate house.

The major animal disease identified in the area was bovine Pasteurollosis, mastitis, black leg and dystocia. These disease conditions was higher than those reported by Gebremichael [19] who reported that 68.3% of the respondents did not have animal health problems and all respondents said that they get veterinary service. These might be due to the lack animal health center and awareness of farmers for treating sick animal.

From present study the most common reasons stated by the interviewees why they didn't use AI instead of breeding was because of unavailability AIT40.5%, shortage of input 26.8% andno service on weekend and holyday 21%, poor pregnancy results 11.5%. The current result in line with Zerihun *et al.* [21] who report that the owner pass without breeding from AI andused natural mating and waiting the next AI service because, there were shortage of input, shortage of AITs and less service were given in weekends and holidays. The result regarding poor pregnancy results similar with findings of Camilla [23] in Uganda.

The farmers have different source of bull for mating. The households in study area obtained breeding bull from neighbors, own farm and village as responded by 59.4%, 23.9% and 16.7% of farmers, respectively. The current result are inagreement with Gabramichael [19] who reporthouseholds in study area obtained breeding bull from neighbors, own farm and village as responded by 61.4%, 21.3% and 17.3% of farmers, respectively.

The disadvantages of using a bull for breeding instead of AI according to the interviewed respondent were: poor genetic development (26%), dangerous working environment (5.7%), venereal disease (1.45%) and (66.7%) not know disadvantage of bull. The result in line with Camilla [23] from Central Uganda reported the disadvantages of using a bull for breeding instead of AI were: poor genetic development, dangerous working environment, problems with inbreeding. Half of the interviewed farmers could not think of any disadvantages at all using a bull.

Major problems respondent mentioned about estrus synchronization were: heat detection problem 37.97%, shortage of AI technician 41.8%, repeats breeding 20.3 %. Current result line with leggese [22] from sidama zone, Southern Ethiopia the major cause of dissatisfaction of synchronization were: poor estrus detection, artificial insemination technician were not available in the AI station at most the time, repeat breeder, poor conception in dairy cattle, long distance to the AI station. The findings regarding shortage of AI technicians are in close accordance with the findings of Tsegaye *et al.* [13].

CONCLUSION AND RECOMMENDATIONS

The most important constraints associated with AI service in the study site include AI station was far, shortage of artificial insemination, repeated breeding, shortage of input, artificial insemination service was not available on weekend and holyday. The repeat breeding situation was a very alarming finding. Generally, AI service in and around Hirna has been given little or no emphasis woreda and kebele level. Therefore, based on the above conclusions the following recommendations are forwarded:

- The zonal body responsible to coordinate and monitor artificial insemination service, herd recording and also livestock breeding programs needs to be established and be very well organized in skilled professionals and material resources
- The private sector should be encouraged to be involved in the artificial insemination service sector but with strict control by an active breeding policy and trainings should be given at federal and/or zonal level to artificial insemination technician to prevent artificial insemination failure.
- Trainings should be given at federal and/or zonal level to prevent artificial insemination failure.
- Sufficient artificial insemination professional should be employed for farmers.
- Awareness should be created for the farmers about the detection of estrus and artificial insemination

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