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Status of artificial insemination in tigray regional state, "constraints and acceptability under field condition"

Abstract

The study was conducted in Tigray Regional State, Northern Ethiopia; from September 2010 to August 2011.Tigray regional state is located in the northern part of Ethiopia. Eastern and the South-eastern zone of Tigray is purposively selected because it is believed that these areas are the one in which AI service is widely exercised. Retrospective study, employing questionnaire survey to evaluate the status of AI service of dairy cattle was conducted in the region. In the retrospective study, data were collected from records of IA service covering the period from 1992 to 2002EC. Artificial insemination records were obtained from AI certificates, from inseminator's record books & regional Artificial insemination center. Out of the 51032 animals inseminated 28972 animals were pregnant (56%) and the calves born were 18852 (37%). Structured questionnaires were prepared to interview a total of 423 farmers, attendants, managers, veterinarians and AI technicians to collect data on the status of AI services and constraints associated with the service. This survey indicated constraints that hinder the success of AI, heat detection problem (28%), lack of awareness (18%), lack of infrastructures (16%), management problem (14%), low experience of AIT, disease problems, lack of incentive to the technicians and owners are the major limitations among others. As per the respondents from all the PAs of the study area most of the cow and heifers did not come in heat during the dry season of the year. Based on the records of the AIT and the questioner collected the conception rate for total insemination in the dray, rainy and harvest time is 23.92, 35.63 and 55.51% respectively. Conception rate in artificial insemination is affected by the skill of inseminator. The records collected from the farmers (n=380) shows that majority of them (52.89%) came in heat during evening hours followed by those (32.37%) in morning hours. A low number of cows (14.74%) commenced heat during noon/afternoon hours and the rest respondents are not knowing the exact time of the commencement of heat of their animals. The artificial insemination programme in the study areas is greatly influenced by the status of the farmers cows presented for AI belonged to small (51%), marginal (29.57%) and large farmers (19.89%) and this is because farms posses their own bull. Semen samples were evaluated for their motility and livability, 10 straws from each center were used for the evaluation of progressive motility and their livability. Although the lab facilities in same whereas were limited the results of percent progressive motile spermatozoa and percent live spermatozoa obtained are in consistent with the normal ranges of the frozen thawed bull semen.

Keywords: artificial insemination, status, constraints, questioner

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Introduction

Cross breeding through artificial insemination is the most suitable economical and time tested breeding technique for generating higher genetically potential and productive animals. Cattle breeding are mostly uncontrolled in Ethiopia making genetic improvement difficult and an appropriate bull selection criteria have not yet been established, applied and controlled. Although artificial insemination, the most commonly used and valuable biotechnology,[1] has been in operation in Ethiopia for over 35years, the efficiency and impact of the operation has not been well-documented. Reproductive problems related to crossbreed dairy cows under farmers' conditions are immense.[2] It is widely believed that the AI service in the country has not been successful to improve reproductive performance of dairy industry.[3] From the previous, little study AI service is weak and even declining due to inconsistent service in the small holder livestock production systems of the Ethiopian highlands.

In Tigray region AI service provision was started 19years back in the capital - Mekelle & Adigrat, now the service is given by 70 AI Ts in 33 Werdas & the capital city, at 52 breeding units and one farm (TDA farm). Liquid nitrogen and other consumables are distributed to these breeding units every month from a sub centre established in 2001G.C. The sub centre has two liquid nitrogen producing plants each with a production capacity of 10liters per hour. The breeds used for cross breeding in the region at present are pure HF, Jersey, Begait X HF cross (50%) and pure Begait. Despite the fact that AI use in the region smallholder dairy sector has been minimal or non-existent, its potential to improve smallholder dairy productivity cannot be overemphasized. Improvement in service provision, such as AI centers within the vicinity of progressive dairy communities, development of market structures and promotion of "value adding" to products such as fresh or fermented milk products and packaging can ensure a consistent flow of income to dairy farmer's households.

The latter is obligatory in view of findings that excess milk during the rainy season and fasting was discarded in the area of study due to a lack of sufficient facilities to accommodate excess-presented milk. This created a disincentive to continue, let alone attract new farmers to engage in dairying. In this paper an attempt has been made to discuss status of artificial insemination under field conditions in Tigray.[4]

Materials and methods

Description of study area

The study was conducted in Tigray Regional State, Northern Ethiopia, particularly the eastern and south-eastern zone of the region including Mekelle city from September 2010 to August 2011. Tigray regional state is located in the northern part of Ethiopia. Eastern and the south-eastern zone of Tigray is purposively selected because it is believed that these areas are the one in which AI service is widely exercised and constituted wide range of agro ecology. The back ground information of the study area (Eastern and South- Eastern zone of Tigray) is most drought affected area of the region with diversified agro ecological area this is varies in altitude from 1200masl in the low lands to over 3000masl in the high lands. Most parts of Atsbi-womberta and Ganta-afeshum district have rolling to hilly high plateaus.Mekelle, the capital city of Tigray regional state, is located 783km north of Addis Ababa, the capital of Ethiopia.

The mean minimum and maximum annual rain fall is 300mm and 927mm respectively. Rain fall of the study area have bimodal season the long rain season starts from end of June to beginning of September and short rain season stays from January to march. Agro climatically the study areas are divided in to two, high lands (dega) which accounts for 85% and mid high land (Weyna dega) which covers 15% of the area. Mixed crop and livestock farming system is the mode of agriculture in the area. The major crops that are grown in the area include sorghum, maize, wheat, teff, pea and bean. Livestock are main components as main factors for the livelihood of the community to undertake agricultural activities. Cattle are the major live stock kept in the area. In the study area crop vegetation is dependent on livestock. The population density in the area is relatively high and small units of land are extensively cultivated by subsistence farmers. The small undulating mountains in the high lands and surrounding the low land part of the area are very steep and with low vegetation coverage.

Study population

AI personnel in the zone Artificial insemination center, AI technicians, cattle owners and their dairy cattle in the zone and animal production professionals in the region, zone and district agriculture and rural development offices represent the study population. The study populations were cattle owners (n=380) their animals (n=2056), artificial insemination technicians (n=16) and other animal health and production professionals (n=27). Cattle owners were interviewed using structured questionnaire format which was translated in Tigrigna language and artificial inseminator technicians, animal production and health professionals were also interviewed using structured questionnaire.

Study design

In the retrospective study data were collected from the ten year service provision of the region, records of AIC covering the period from 1992 to 2002EC. Artificial insemination records were obtained from AI certificates and from inseminators' record book. Data on the date of first service, number of services delivered, animals examined for pregnancy, pregnancy rate, sex of calf born and subsequent services of cow/heifers and the time of insemination were collected and analyzed. The questionnaire format was prepared for interview and discussion on selected districts (PAs) of the zone, and within the district on selected kushets and then from these selected kushets 15-20 livestock owners by simple random sampling method were interviewed.

Semen samples were evaluated for their motility and livability, 10 straws from each center were used for the evaluation of progressive motility and their livability Immediately following thawing of the straws in water bath (35-37oC) and examined microscopically (for individual motility and live/dead count of the spermatozoa) following the recommended procedures[5,6] by staining with Eosin and Nigrosin stain and Individual motility by putting one drop of frozen thawed semen and covering with cover slip and examining under low power microscope (x10 and x40).

Questionnaire survey

Retrospective study, employing questionnaire survey to evaluate the status of AI service of dairy cattle was conducted in the eastern zone of Tigray (Atsbi wenberta , Hawzen, Saesie tsaeda emba, Ganta-afeshum & wukro, kilte-awlaelo district) and South-East zone (Samre seharti, Adigudom Enderta, including mekelle city). Structured questionnaires were prepared to interview a total of 423 farmers, attendants, managers, veterinarians and AI technicians to collect data on the status of AI services and constraints associated with the service.[7] The details of the questionnaire formats were prepared for farmers, AI technicians and attendants. During the interview process every respondent included in the study was briefed about the objective of the study before starting presenting the actual questions. Then the questions were presented to the respondents some of the information collected through interview was supported by observation. In the survey information on the developed questionnaires included address of the owner's breed of animal's category of animals, technique of service, time of commencement of heat, conception rate in different seasons of the year and failure to conceive and constraints of AI service. Employing questionnaire survey regarding the importance of AI for herd owners related to genetic improvement, milk production and information about general status of the AI practices in the area were also assessed. The questionnaire was designed to identify the major constraints in the success of AI service in the study area.[8]

Data analysis

The data collected from the respondents was analyzed using appropriate statistically package for the social science. All data were entered in to ms- excel after the completion of data collection work from the study areas. The data was summarized using descriptive statics (frequency & percentages).

Results

Artificial insemination programme in the region

Crossbreeding was taken up in the region under the RAIC at different times since 1985 and AI with frozen semen contributed significantly to the cross breeding and upgrading of local cattle. A satisfactory method of insemination is essential for obtaining optimum conception rates (CR). In almost all AI centers, the inseminators differ in their ability to obtain and maintain satisfactory conception rates, the difference in CR due to inseminations often range 5-10%.[9] Imperfection in semen handling, thawing and inseminating techniques

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have been shown to be negatively correlated with the results of AI. The most important primary requisite to obtain high conception rate is inseminating cows and heifers at the appropriate time.[10]

In the retrospective study, data were collected from records of AI service covering the period from 1992 to 2002 EC (Table 1). Artificial insemination records were obtained from AI certificates and from inseminator's record books & regional Artificial insemination center. However, they have not full record book. Data on the date of first service, pregnancy diagnosis, number of calves born and subsequent service were collected and analyzed.

Table 1 Ten Years service provision of the regional AI center (1992-2002EC)

Activities	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total
Production ofLN2 (Lt.)	3240	4239	2191	6676	10534	13001	8452	7457	6979	7072	23442	93283
Semen doses	3216	2579	3346	5826	8897	11400	8340	9251	9400	9402	12228	83885
AI service	1618	2193	2304	2773	4176	6514	4348	4801	4180	7779	10346	51032
PD +V	675	845	811	1173	1684	2994	1965	2963	2784	5001	8077	28972
Calf's born	552	604	637	725	1260	1860	1471	1903	1854	3424	4562	18852
No of AIC	0	0	0	0	0	0	0	0	40	50	60	60
No of AI T	0	0	0	0	0	0	0	0	65	65	76	76
Training	0	0	0	0	0	0	0	0	65	65	86	86

LN2, liquid nitrogen; AIT, artificial insemination technicians; AIC, ai centers, PD +V, pregnancy diagnosis positive; source, regional board (RAI center 2011)

The details of the AI programme of the region and the influence of various factors which affect this programme have been presented and discussed below. Out of the 51032 animals inseminated 28972 animals were pregnant which around 56% is and the calves born were 18852 (37%). Since the efficiency of AI is measured by not how many animals are inseminated and pregnant but by how many calves are born through this technology the efficiency of AI in the region seems satisfactory.

The results of questionnaire survey in the present study indicated that there are many constraints in the success of artificial insemination in the study area (Table 2). As the result of the questionnaire survey indicated major constraints that hinder the success of AI are heat detection problem (28%), lack of awareness (18%), lack of infrastructures (16%), management problem (14%), low experience of AIT, disease problems, lack of incentive to the technicians and owners are the major limitations among others.

25% of the cattle owners (small holders) who participated in the questionnaire survey indicated that, they don't get enough AI service and 60% of them explained the reasons for that as absence of service on weekends and holiday. The study has clearly confirmed that 27.6% of small holders participated in the study areas showed dissatisfaction with the overall AI service Table 3. From the questioners and observations at field level only 16.15% of heifers were brought by the farmers for Artificial insemination, most of the farmers prefer to inseminate cow artificially but for their heifers they prefer natural service the reason is heifers bred artificially are not conceived or have less conception rate than the cow.

Table 2 Response of the owners about the major constraints of AI

Constraints	Frequency	Percent(%)
Lack of infrastructure	62	16.32
Heat detection problem	105	27.63
Management problem	54	14.21
Disease problem	27	7.1
Lack of AIT experience	24	6.31
Lack of awareness	68	17.89
Lack of incentive	40	10.53

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Table 3 Number of respondents and distribution of AI in the studied AI centers by animal category

Name of the AIC	Category of animals			No. of farmers	No. of AIT	No. of other professionals
	Cow	Heifer	Total			
Adigrat	308	53	361	58	2	3
Edagahamus	109	22	131	25	1	1
Frewainy	73	13	86	20	1	2
Hawzen	131	21	152	28	1	2
Wukro	213	38	251	50	2	3
Atsbi-endaselassie	129	29	158	32	1	3
Haykmes'hal	104	8	112	18	1	0
Mekelle	373	79	452	60	3	6
Queha	107	26	133	32	1	2
Samre seharti	51	11	62	22	1	2
Adigudom	73	25	98	20	1	3
Hiwane	53	7	60	15	1	0
Total	1724	332	2056	380	16	27

Cow=83.85%; Heifer=16.15%

Farmers status vs artificial insemination

Majority of cows crossbreed (over 80%) and local breeds (less than 20%) in the urban and per urban areas belonged to different farmers category (Table 4) presented for AI belonged to small (51%), marginal (29.57%) and large farmers (19.89%). The low pattern for less number of inseminations in cows (heifers) belonging to the large farmers shows that this category of farmers possess their own bulls and they allow their animals to be naturally served instead of taking a chance to send their animals at a distant place for artificial insemination. Such a practice may impose stress on cows/heifers, resulting in low conception rates.

Table 4 Farmers status and distribution of AI in the study area

Farmers status	Category of animals		
	Cow	heifer	averall
Small farmers	828(48.03%)	211(63.55%)	1039(51%)
Marginal farmers	510(29.58%)	98(29.52%)	608(29.57%)
Large farmers	386(22.39%)	23(6.93%)	409(19.89%)
Total	1724	332	2056

As per the respondents from all the PAs of the study area most of the cow and heifers did not come in heat during the dry season of the year. The limited grazing land and the non-availability of good quality feeds influence the reproductive performance of bovines. Majority of cows remain anestrous during the long period of the year "bega". A few may come in heat but this is of mainly silent heat which become difficult to detect. Based on the records of the AIT and the questioner collected the conception rate for total insemination in the dray, rainy and harvest time is 23.92, 35.63 and 55.51% respectively. Conception rate in artificial insemination is affected by the skill of inseminator (Table 5).

Table 5 Conception rate in different season of the year 2002-2003 (from the AIT record book and receipts)

Season of insemination	%CR for first insemination	%CR for total insemination
Dray season ("Bega")	17.64	23.92
Rainy season ("Kiremt")	30.12	35.63
Harvest time (Autumn)	48.47	55.51
Total	32.08	38.35

Time of commencement of heat in rural bovine

The time of commencement of heat is a very important factor determining the fate of the estrus for artificial insemination. The records collected from the farmers (n=380) shows that majority of them (52.89%) came in heat during evening hours followed by those (32.37%) in morning hours. A low number of cows (14.74%) commenced heat during noon/afternoon hours and the rest respondents are not knowing the exact time of the commencement of heat of their animals. Lowered environmental temperature (during morning and evening hours) which had a stimulatory effect on pituitary hormone for estrus cycle initiation might be the cause for more number of animals showing estrus in this period Table 6.

Table 6 The time of commencement of heat from 380 respondents

Seasons	Number of respondents	Percentage
Morning	123	32.37
Noon/afternoon	56	14.74
Evening	201	52.89
Night (10pm to 4am)	0	0
Total	380	100

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Physic-morphological characteristics of frozen thawed semen

A total of 130 frozen thawed semen straws 10 from the RAIC and 120 straws from the weredas AI centers were evaluated for their individual motility and livability before and after dispatching to the centers. Although the lab facilities in same weredas were limited the results obtained are in consistent with the normal ranges of the frozen thawed bull semen (Table 7).

Table 7 Physic morphological characteristics of frozen thawed semen

Semen characteristics	NAIC	RAIC	WAIC
%Motile spermatozoa	50-80(65.89%)	60.78%	54.75%
%Live spermatozoa	50-90(72.55%)	71.56%	63.65%

NAIC, national ai center; RAIC, regional ai center; WAIC, wereda ai center

Discussion

The artificial insemination programme in the study areas is greatly influenced by the status of the farmers in relation to heat detection, their awareness, AIT skill and willingness and availability of transportation and infrastructures. The inadequacies' of the system such as use of poor genetic quality bulls, interrupted liquid nitrogen supply, poor delivery of AI services, lack of professionalism in providing services and absence of co-ordination and control over the operations, lead to substandard semen quality, poor coverage and poor conception rates. Although the AI practice has been accepted by fairly a good proportion of livestock owners, certain factors greatly influence acceptance of this practice by others. These factors are infrastructural facilities, farmer's awareness about AI and its merits, lack of farmer's interest, lack of communication and also lack of incentives to farmers and persons engaged in AI work at rural centers. Attempts to improve the efficiency of AI should be based up on the understanding of most important causes for failure. According the respondents' i.e the AI technicians the present survey indicates that the most common factors responsible for the failure of AI are: lack of infrastructure, lack of awareness regarding to AI, reduced conception and use of their own bull were the main constraints encountered during service delivery. In most of the cases the constraints of using AI service were described to have resulted from lack of awareness , having own bull , lack of infrastructure and low conception rate in the proportions of (33.3%), (17.3%) , (30.6%) and (18.6%) respectively. The study confirmed that significant number of small holders participated in the study areas showed dissatisfaction with the overall AI service and this is because of the AI service is not regular in weekends and holidays it is closed and the AI technicians are not responding for the calls from the farmers and farms. The AITs are also having their reason for this ignorance because they are not gating any incentive. Livestock owners do not allow their animals to be served naturally or artificially even though these animals come in heat after a short period of calving with the misconception that there will be drop of milk production if the animal conceives during their milking period. These actions result in increase in the length of calving interval and reduce the number of calves from animals. Knowledge and awareness of proper animal husbandry practices and traditional misconceptions could play an important role in improving the reproductive efficiency of the cows. The owners are not much aware as to when their animals should reach puberty, and the growing animals do not have proper attention and are raised on dry fodder and grazing. Thus the age at puberty which should have been attained at 2 to 2.5years of age is attained as late as 4, 5 or 6years. In this way livestock owners miss at least one or two calf crops.

Recommendations

i. Livestock owners should get educated and trained in modern profitable animal husbandry practices, especially feeding, management and care of growing calves and heifers.

ii. AIT should get regular training not only about AI techniques but also the cow, heifer and calf management practices.

iii. AI center should be open throughout the day time and on weekends as well.

iv. Carrier structures should be established for the AITs.

v. Hardship and overtime allowances should be considered, this may be helpful to reduce the high turnover of AIT.

vi. No heat should be missed and insemination should be given timely to achieve optimum pregnancy results.

vii. As part of a long-term program farmers should breed their dairy cattle by AI through the provision of these services by their colleagues (qualified personnel and localized AI services) to enhance productivity (DIY).

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Conflict of interest

Author declares that there is no conflict of interest.

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