MADDA WALABU UNIVERSITY

MSc THESIS

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ASSESSMENT OF STATUS, PRACTICES AND CONSTRAINTS ASSOSSIATED WITH ARTIFICIAL INSEMINATION SERVICE DAIRY COWS IN GADAB ASASA DISTRICT OF WEST ARSI ZONE, ETHIOPIA

M.Sc. THESIS

A Thesis Submitted to the College of Agriculture and Natural Resources Department of Animal and Range Sciences, School of Graduate Studies

In Partial Fulfillment of the Requirement for the Degree of Master of Science in Agriculture (Animal production)

BY:-

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BALE ROBE, ETHIOPIA

Advisors approval sheet

This thesis has been submitted for examination with my approval as university advisor/s

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DECLARATION

I, the undersigned declare that, the thesis entitled to" assessment of status, practices and constraints associated with artificial insemination AI service in Gedeb Hassasa district, Oromia regional state, Ethiopia" is my original work and it has not been submitted to any institution elsewhere for the award of any degree or like, where other sources of information that have been used, they have been acknowledged.

MADDA WALABU UNIVERSITY

COLLEGE OF AGRICULTURE AND NATURAL RESUORCES

DEPARTMENT OF ANIMAL AND RANGE SCIENCES

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I, first declare and confirm that this thesis is my own work and that all sources of material used for this thesis have been properly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for MSc. degree at the Madda Walabu University and is deposited at the University library to be made available to borrowers under rules of the library. I solemnly declare that this thesis isn't submitted to the other institution anywhere for the award of any degree, diploma, or certificate.

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BIOGRAPHY

I, the author of this work was born in Gedeb Hasassa District of Arsi Zone in March 1986. I attended primary education at Ardayita primary school and Hasassa high school. After completion of high school I joined the Madda Walabu University and graduated by Degree in Animal and Range Since in 2009. Soon after graduation, I was employed in Madda Walabu University in the position of Assistants Lecture at the Department of Animal and Range Sciences where I served for one (1) year.

Secondly, I joined Madda Walabu University, for MSc program study in Animal Production in the Department of Animal and Range Sciences in 2018. Sadiya has married and a mother of two daughters and one son.

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TABLE OF CONTENTS PAGE

LIST OF ABBREVIATIONS AND ACCRONOMIES

A I	Artificial Insemination
AIT	Artificial Insemination Technician
ART	Assisted Reproduction Technologies
CSA	Central Statistical Agency
FAISETD	Field AI service Extension and Training Department
FAO	Food Agriculture Organization
GDP	Growth Domestic Product
IPMS	Improving Productivity and Market Success
MOA	Minister of Agriculture
MOET	Multiple Ovulation and Embryo Transfer
NAIC	National Artificial Insemination Center
NGO	Non-Governmental Organization
NLDP	National Livestock Development project
NM	Natural Mating
SPSS	Statistical Package for Social Sciences
USA	United State of America

LIST OF TABLE PAGE

LIST OF FIGURES

ABSTRACT

Although artificial insemination, the most commonly used and valuable biotechnological tool which has been in operation in Ethiopia for over 30 years, the efficiency and impact of the operation have not been well-documented. This study was undertaken in Gedab Hasasa district with objectives of assessing status of artificial insemination service in Gedab Hasasa district, identifying artificial insemination practices of dairy cattle in the study area and identifying the major constraints associated with AI in study area. For this study across sectional survey study was used. From the total kebels found in the district (33 kebeles) about six(6) kebeles were selected purposively based on accessibility, cost of sample collection and availability of dairy cows. Then, about 180 households were selected using simple random sampling method from sample frame of population for survey part. Data were collected using semi structured questionnaire; focus group discussion and record of artificial insemination record book (retrospective data). The questionnaires were pre-tested and translated into local language (Afan Oromo) and administered to respondents. The data were analysis using statistical analysis system. *Data was summarized using descriptive statistics (means, standard deviation, proportion s, minimum and maximum values).Chi-square test was used to test significance difference between categorical variables and a p-value < 0.05 was considered to look this significance level. Livestock production in the area had an increasing, decreasing, and stable trend with the percentage 9.44%, 75% and 15.56% are respectively trends of livestock production. There was no significant difference between Keble's (p>0.05). Artificial insemination services in the study area 91.67% respondents of dairy owner while 8.33% dairy owner reported that the not available. There was no significant difference between Kebles (p>0.05) The major constraints associated with artificial insemination service in the study area were lack of AITs, lack of awareness about heat detection and delayed time of insemination with an index value 0.265, 0.232 and 0.117, respectively. It recommended that awareness should be created for farmers focusing on heat detection, time of insemination and the linkage between federal, regional, zonal and district institution should be strong enough to encourage the AIT. Therefore, artificial insemination services require urgent measures to improve service delivery mechanism.*

Key Words: *Artificial Insemination service, Constraints, Practice, Status,*

1. INTRODUCTION

1.1. Background of study

Agriculture (mainly crop and livestock production) is the mainstay of the Ethiopian economy employing approximately 85% of the total population (CSA, 2011). Livestock production accounts for approximately 35% to 45% of the total agricultural GDP and 16% to 17% of national foreign currency earnings (Fitaweke Metaferia, 2011). The total cattle population for the rural sedentary areas of Ethiopia is estimated at 55.03 million, of which 55.38% are females (CSA, 2013). Out of the total female cattle population, only151, 344 (0.35%) and 19,263 (0.04%) heads are hybrid and exotic breeds, respectively. Local cows with an average lactation length of 6 months and an average daily milk production of 1.67 liters per cow, the total milk produced during the year 2015/16 was recorded to be 3.06 billion liters (CSA, 2016).The total number of both exotic and hybrid female cattle produced through the crossbreeding program for more than four decades in the country is quite insignificant indicating unsuccessful crossbreeding through artificial insemination (AI) (CSA, 2016).

Artificial insemination has been widely used for breeding female dairy cattle with high genetic merit of breeding bull (Webb, 2003). In Ethiopia AI service for cattle has been introduced at the farm level in the country over 35 years ago as, a tool for genetic improvement (Zewdie, 2006). The present National Artificial Insemination Center (NAIC) was established in 1984 to coordinate the overall AI operation at national level (GebreMedhin, 2005). The efficiency of the service in the country, however, has remained at a very low level due to infrastructure, managerial, and financial constraints, as well as poor heat detection, improper timing of insemination and embryonic death (Shiferaw, 2003).

Reproductive problems related to crossbred dairy cows under farmers' conditions are immense. It was widely believed that the AI service in the country has not been successful to improve reproductive performance of dairy industry (Sinishaw, 2005). Some research finding indicates that AI service is weak and even declining due to inconsistent service in the smallholder livestock production systems of the Ethiopian highlands (Dekeba, 2006). 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 (Gebremedhin, 2005).

Assisted reproductive technologies particularly artificial insemination and estrus synchronization have been operated to enhance genetic improvement of cattle. Even though, some authors (Bainesagn, 2015; Tadesse, 2015; Tessema and Atnaf, 2015) have evaluated the efficiency of assisted reproductive technologies in different production systems of Ethiopia, well thought-out information is not available

1.2 Statement of the Problem

Cattle breeding was mostly uncontrolled in Ethiopia making genetic improvement difficult and an appropriate bull selection criterion has not yet been established, applied and controlled (Tegegn, 2016). Although artificial insemination, is the most commonly used and valuable biotechnology (Webb, 2003) has been in operation in Ethiopia for over 30 years, the efficiency and impact of the operation has not been well-documented (Himanen and Tegegn, 2016). The major problems associated with the artificial insemination service were shortage of input, distance to AI service and inefficiency to generate information for the better application of AIT, lack of accurate, timely and reliable information on dairy sector accounted for inefficient service of AI centers (Tegegn2016). Some dairy records are available in Ethiopia, but they are limited to research institutions. Crossbreeding with exotic breeds without keeping records clearly is a major factor contributing to the erosion of locally adapted AnGR (Köhler-Rollefson, 2004).

The other reasons for inefficient AI service are poor infrastructure, managerial and financial constraints (Shiferaw, 2012), poor semen quality, poor semen handling practices and poor insemination practices (Negussie, 2010; Bekana, 2005). Heat detection mainly reported to AIT by dairy cattle owners when observing sign of heat like mounting on other animals, vulva discharge, bellowing, swelling, redness and mucus discharge of the vulva, restlessness and nervousness (Nuraddis, 2014). (Hamid, 2012) reported that, observation of the estrus signs and bringing the animals for AI solely rests on dairy cattle owners. However, (Woldu, 2011) indicated that small holder farmers are engaged in various farm activities and is quite difficult for them to detect proper time of heat. The dairy owners could detect the heat time but it might not match with appropriate time of insemination. Furthermore (Desalegne, 2009) and (Alemayehu, 2010) revealed that, since AITs are unable to get facilities and services like motor bicycles and fuel, farmers trek their cows for long distances to fetch for AI service. In some area, (Tegegne, 2016) indicated that, cows which show heat are reported to the AI technicians by the owners and the technicians reach the farm to inseminate the cow. In general, identifying the right time of heat for insemination for success rate

Although past researches have been done in other parts of Ethiopia, no study has been conducted so far in Hasasa district; hence there is paucity of information regarding constraints of AI in the district. Therefore, the present study was conducted with the aim of assessing status, practices and constraints associated with artificial insemination service in Gadab Hasasa district of West Arsi Zone.

1.3. Significance of the Study

There is no up to date information in study area on the current status, practice and constraint associated with AI services in district. This study thrives to achieve its aim through conducting household interview and field survey. The finding of this study has a potential contribution to all stakeholders, governmental and non-governmental organization to undertake appropriate measures towards policy formulation and planning of development interventions in livestock production.

1.4. Objective

The study was initiated based on the following objectives.

1.4.1. General objective

- To assess status, practices and constraints associated with AI service in Gedeb Hassasa district, oromia regional state, Ethiopia.

1.4.2. Specific objectives

- To assess status of artificial insemination service in Gedeb Hasasa district.
- To identify artificial insemination practices of dairy cattle in the study area.
- To identify the major constraints associated with AI in study area.

2. LITRETURE REVIEW

2.1 History of Artificial Insemination (AI)

Old Arabian documents dated around 1322 A.D. indicate that an Arab chieftain wanted to mate his prize mare to an outstanding stallion owned by an enemy. He introduced a wand of cotton into the mare's reproductive tract, and then used it to sexually excite the stallion causing him to ejaculate. The semen was introduced into the mare resulting in conception.

Anthony van Leeuwenhook, inventor of the microscope, first observed human spermatozoa under magnification. This finding led to further research. Spallanzani is usually considered the inventor of AI his scientific reports of 1780 indicate successful use of AI in dogs.

In 1899, Ivan off of Russia pioneered AI research in birds, horses, cattle and sheep. He was apparently the first to successfully inseminate cattle artificially. Mass breeding of cows via AI was first accomplished in Russia, where 19,800 cows were bred in 1931. Denmark was first to establish an AI cooperative association in 1936. E.J. Perry of New Jersey visited the AI facilities in Denmark and established the first United States AI cooperative in 1938 at the New Jersey State College of Agriculture.

The AI industry has grown tremendously in the United States since its beginning. In 1970, USDA reported that 7,344,420 dairy females were bred artificially, 46% of the female dairy cattle population

2.2. Importance of Artificial Insemination

The fundamental systems of animal breeding exercise such as random mating, in-breeding, line breeding and out breeding, artificial insemination has proved to be the best and efficient method (Rozeboom, 2007). AI is a vital tool for the rapid improvement of livestock allowing for maximum use of best sires on numerous dams and that it is one of the animal production techniques which can augment production and returns from livestock at a faster rate through cross-breeding programmer (Butswat and Choji, 2009),.

For example, studies of estrus detection and ovulation control which evolved out of a need to correct timely inseminations, led to the development of embryo-transfer Compared with natural mating, AI has been used for genetic improvement by utilizing proven sires, decreasing risk of venereal disease transmission, maintaining accurate breeding records necessary for good herd management, economic service, culling unwanted males on the farm, avoiding injury during mating, avoiding utilizing semen of incapacitated bulls (Roberts, 2006; and Rodring,2010). Furthermore, AI is helpful in lessening the need of farms to maintain breeding males and minimizing the cost of introducing improved genes. All in all, even though there are some drawbacks, they have been overweighed by the advantages (Roberts, 2006).

2.2.1 Reducing transmission of diseases through sexual contact

Exposure of sires to infectious genital diseases is prevented by use of AI which reduces the danger of spreading such diseases (Webb, 2003). In other way, if only males known to be free from disease are selected for semen collection, artificial insemination can play an important part in controlling diseases spread through sexual contact. Some sexually transmitted disease are granular vaginitis, trichomoniasis, navel ill, dourine, brucellosis and coital exanthema. Despite the role of artificial insemination in preventing the spread of a disease from one female to another through the male or from the female to the male during natural mating, it may however be the means of spreading diseases if improperly practiced. Most cooperatives obtain the services of a veterinarian for this work, which requires not only knowledge of the symptoms of diseases but recognition of the necessity for cleanliness, sanitation, and the proper disinfection of utensils before and after use (Webb, 2003).

During natural mating, diseases may be transmitted from the male to the female either mechanically, by carrying the infective organisms from one female to another during mating, or as a result of infection in the reproductive organs and this is overcome by using AI. However, semen samples collected from the male in the artificial vagina are subject to contamination with germs or bacteria.

Bacteria in semen may come either from the reproductive organs of the male or from the apparatus used for collection (Webb, 2010).

2.2.2 Improving animals' productivity

AI plays an important role in enhancing animal productivity, especially milk yields, in developing countries that have a well-defined breeding strategy and a sound technical base to absorb and adapt the technology to meet their needs (BBC, 2015).

For countries to increase their dairy cow productivity, they have to maintain successful AI systems with: an effective technology transfer mechanism, effectively integrated international assistance into their national germ plasma improvement programmers, building and maintaining infrastructure, complement with improvements in animal nutrition and veterinary services and adequate economic incentives to market dairy products. However, many developing countries lack one or more of these requirements (Heifer International, 2014).

2.2.3 Harvesting of individual sires with traits of superior quality

The greatest advantage of AI is that it makes possible maximum use of superior sires (Webb, 2003) in which desirable characteristics of a bull or other male livestock animal can be passed on more quickly and produce more progeny than if that animal is mated with females in a natural mating. Natural service would probably limit the use of one bull to less than 100 mattings per year. In 1968, AI usage enabled one dairy sire to produce semen for more than 60,000 services (Webb, 2003).

In another record, progress in semen collection and dilution and cryopreservation techniques enabled a single bull to be used simultaneously in several countries for up to 100,000 inseminations a year (Gibson and Smith, 2005). This implies that a very small number of top bulls can be used to serve a large female cattle population. In addition, each bull is able to produce a large number of daughters in a given time, thus, enhancing the efficiency of progeny testing of bulls. The high intensity and accuracy of selection arising from AI can lead to a four-fold increase in the rate of genetic improvement in dairy cattle relative to that from natural mating (Kebede, 2011). So, AI has become one of the most important and successful reproductive biotechnology ever devised for the genetic improvement of farm animals. It has been most widely used for breeding dairy cattle and has made bulls of high genetic merit available to all (Webb, 2003).

2.3 Status of AI in Developing Countries

No other technology in agriculture, except hybrid seed and fertilizer use, has been so widely adopted globally as AI (Gibson and Smith, 2005). In developing countries, AI is the most common technology used as compared to other biotechnological tools probably due to that it has the most favorable cost-benefit ratio of the reproductive technology and also requires comparatively less technical skill and equipment. There is no quantitative information on the current status of use of animal biotechnologies in developing countries except the use of some assisted reproductive biotechnologies such as AI, ET and molecular markers (Gibson and Smith, 2005).

The generation of the quantitative information on these biotechnologies was possible due to a painstaking and well organized study conducted by FAO, in which information on a country's capacity in the management of animal genetic resources for food and agriculture was gathered. Reports were received from 169 countries, submitted to FAO between 2002 and 2005 and presented in the State of the World's Animal Genetic Resources published in 2007 (FAO International Technical Conference, 2010). According to FAO (2007), the following conclusions could be drawn about AI in respect of Africa, Asia, Latin America and the Caribbean.

Artificial insemination is mostly used for cattle production systems, especially in the dairy sector. In Africa and Asia, its use is concentrated in peri-urban areas. Other species for which AI is used in all three regions are sheep, goats, horses and pigs, with use more common for sheep and pigs than goats and horses. In addition to these species, in Asia, AI is used for chickens, camels, buffaloes and ducks, and in Latin America and Caribbean regions, for rabbits, buffalo, donkeys, alpacas and turkeys. For the most part, semen for AI is from exotic breeds and used in the expectation of increasing the production of local livestock populations. To a lesser extent, semen from local breeds is also used for this purpose. In Côte d'Ivoire, semen from trypanotolerant cattle has been used and exotic semen has also been used for crossbreeding with

naturally trypanotolerant cattle. Most of the AI services are provided by the public sector but the contribution of the private sector, breeding organizations and NGOs is also substantia. Concerns have been raised regarding the loss of biodiversity due to inappropriate and poorly planned use of AI to inseminate locally-adapted cattle with imported semen for increased production. Most developing countries in Africa and Latin America do not have clear breeding policy in place.
A number of public and private sector organizations in Africa, Asia and Latin America and the Caribbean regions providing artificial insemination services (FAO, 2007).

2.4 Status of AI in Ethiopia

Ethiopia owns, the largest livestock population in Africa (Lemma and Kebede, 2011) but its contribution to the overall agricultural production has shown low as compared to the potential (Kumar, 2005). The dairy industry in particular not developed like other East African countries (Lemma and Kebede, 2011). This may be due to their low genetic potential for specific product or enough knowledge is not available on the indigenous breeds (Kumar, 2005). But, even with very few crossbreds (0.5%) and pure exotics breeds (0.1%), dairy production has been becoming an essential component of the agricultural sector contributing to the alleviation of malnourishment through the production of milk and milk by-products in Ethiopia (Azage,2000; Lobago,2006).

An achievement in increasing milk and meat production by improving the genetic merit of indigenous cattle has been one of the primary livestock development objectives of Ethiopia (Heinonen, 2002). Improvement in livestock resources have been achieved through the implementation of an efficient and reliable AI service, in parallel with proper feeding, health care, and management of livestock (Meles and Heinonen,2002). The country has made great effort to improve the productivity of local breeds through crossing with improved exotic dairy breeds. Nevertheless, the success of such AI for crossbreeding programs has not been satisfactory due to numerous factors, including substandard nutrition, poor husbandry practice, fail to keep records and infrastructure status. Thus, dairy producers have challenging complaint about a poor reproductive performance in animals using AI (Lemma and Kebede,2011). As a result, dairy production is at its lowest stage compared to other countries (Azage, 2000; Lobago, 2006).

Historically, Artificial insemination (AI) as one option to improve the genetic potential of the indigenous breeds of cattle has been introduced to Ethiopia in the early 1930's, but it was interrupted by World War II (Brannang,2004) and restarted in 1952 (Yemane,2000). It was again discontinued due to unaffordable expenses of importing semen, liquid nitrogen and other related inputs requirement (Zewdie,2006). However, it was introduced at a wider scope in the late 1960's (Brannang,2004) and cross breeding through AI was considered as the most suitable economical and time tested breeding technique to generate genetically superior and productive animals (Naokes,2001). In 1984, National Artificial Insemination Center (NAIC) has been established to coordinate the overall AI operation throughout the country (NAIC, 1995; GebreMedhin, 2005). As a result of this, urban dairying was flourishing in many small towns and big cities with different level of intensification from less than 1% to over 40% growth (Kelay, 2002). Even though it is the most commonly used and valuable biotechnology that has been in operation in Ethiopia for over 30 years with different levels of intensification , the efficiency and impact of the operation has not been well-documented (Webb, 2010).

Furthermore, it is widely believed that the AI service in the country has not been successful to improve reproductive performance of dairy industry (Sinishaw, 2005). From the previous little study, AI service is weak and even declining due to inconsistent service in the small holder livestock production system of the Ethiopian highlands (Gebremedhin, 2005).Because of inefficiency in AI services and consequently reproductive inefficiency, there has been a wide belief among dairy producers that dairy animals perform better with natural mating using bulls than AI (Kebede,2011).

Moreover, there is a challenging complaint about a poor reproductive performance in cows using AI than natural service (NS) (Zewdie,2006). This, contrary to the dairy development plan, is hampering the use of AI to upgrade the production and dairy producers are becoming increasingly skeptic of the use of AI (Binici, 2006).

2.5 Practice of Artificial Insemination

The National Artificial Insemination Service since its establishment in 1984 would have been the choice of best breeding practices in providing reliable, efficient and effective insemination services up to mid-1990 after decentralization (Lemma,2011) The mandates and responsibilities of the institution were in recruiting bulls of high pedigree records for locally semen production; importing semen and bulls of high pedigree records, collecting, processing, preserving and distribution of semen, producing and dispatching liquid nitrogen (LN_2,) training of AI technicians and farmers, monitoring and evaluation of the overall AI service, among others . With eight sub centers in selected regions and the AI field service run by Regional Agriculture and Rural Development offices and district Agriculture and Rural Development Office with 791 technicians trained to provide the service the expectations were high (Lemma,2011).

To date, though strengthened with assistance from FINNIDA and financial support from NLDP, services provided are considered to be not satisfactory due to low number of inseminations provided, low conception rate (1.88 number of services per conception by (Desalegn, 2009) and 1.7-2.7 reported by (Smith, 2005). AI service at national and regional levels is constrained by, and lack of clearly defined share of responsibilities among stakeholders in artificial insemination poor coordination (Desalegn, 2009) and 1.7-2.7 reported by (Smith, 2005).

2.6 Constraints of artificial insemination (AI)

2.6.1 Interrupted AI Service Delivery

The most smallholder dairy farmers in many places of Ethiopia expressed no/low satisfaction for AI services delivery system (Atnaf, 2015.) The most important reason for this was smallholder dairy farmers had not got the service regularly (without interruption) due to unavailability of AITs, discontinuation of the service on weekends and holidays and lack of inputs (Nuraddis, 2014;). In addition, absence of incentives and rewards to motivate AI technicians had contributed to a very high turnover of AI technicians all over the country. Hence, the government should notice the problem and design strategies to make the service available in off-working days. In addition, incentives and rewards should be facilitated based on the output of the inseminator (number of pregnant cow after insemination/inseminator) (Azage, 2012).

2.6.2 Discrepancy between Time of Heat Detection and Appropriate Time of Insemination

In Ethiopia heat detection has been performed and reported to AITs by dairy cattle owners during observing sign of heat like mounting on other animals, vulva discharge, bellowing, swelling, redness and mucus discharge of the vulva, restlessness and nervousness (Nuraddis 2014). Hamid (2012) reported that, observation of the estrus signs and bringing the animals for AI solely rests on dairy cattle owners.

However the small holder farmers are engaged in various farm activities and are quite difficult for them to detect proper time of heat. The dairy owners could detect the heat time but it might not match with appropriate time of insemination. This leads to missed out heat period of the cows and heifers and cause failure of conception, (Woldu, 2011).

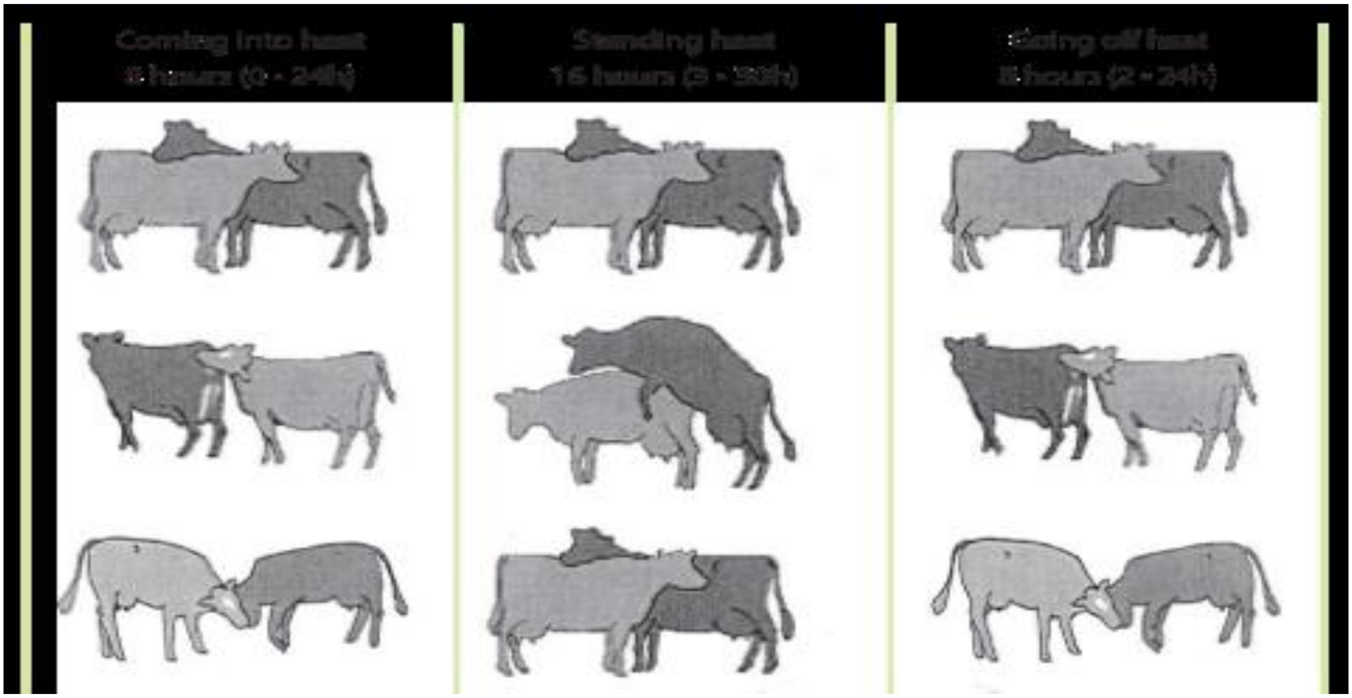
Furthermore, **(**Desalegne,2009) and (Alemayehu,2010) revealed that, since AITs are unable to get facilities and services like motor bicycles and fuel, farmers trek their cows for long distances (more than 28km round trip) to get AI service. In contrast, in same places (Tegegne, 2016) indicated that, cows which shown heat are reported to the AI technicians by the owners and the technicians usually visit the farm to inseminate the cow. In general, identifying the right time of heat for insemination and on time provision of the AI service for the beneficiaries need strong collaboration between stakeholders Intensive training of sufficient AITs, adequate provision of inputs and allocation of them at farmer's premises like developmental agents could reduce the failure due to inappropriate time of insemination.

Table 1 Summary of heat detection in dairy cow/herd

The early heat	The standing heat	The after heat
Duration 3 – 8 hours	Duration 6 – 18 hours	Duration 3 – 12 hours
-Nervous, restless , - Stands alone - Mowing - Sniffing	- Mounting other animals - Refused to eat - Mowing - Sniffing	- Mounting other animals - Symptoms of cool - Less sniffing
- Curious - Mounting other animals -Doesn't stand when mounted	- Tail bent away from vulva - Stands still when mounted by other animals	Runs away when mounted
- Vulva is slightly swollen	- Vulva is swollen - Flow of clear mucus from the vulva	-Some bleeding from the vulva -Less flow or clear mucus from the vulva
-Sometimes decline in milk production	- Often decline in milk production	

Sources: Chebel R.C (2010)

Time to inseminate



	0	6	12	18	24 hours
Artificial Insemination	Too early	Good	Best	Good	Too Late
Natural Service	Too early		Best		Too late

Figure 1Timing of insemination for natural and AI method

Source: Chebel R.C (2010)

2.6.3 Shortage of AITs and Low Output from the Available Technicians

In Ethiopia, AI was undertaken by one or two AI technicians at district level. They are mainly providing services for dairy cows in urban and/or per-urban areas. Little or no AI services are available in rural areas (Tegegne, 2016). More than half of the AI technicians reported that they have good (not excellent and very good) technical know-how about the technology. This is due to absence of on job trainings and other incentives. Given the shortage of AI technicians and the low output of the available technicians, the impact of AI on the number of genetically improved dairy animals for fluid milk in and around urban areas is limited and genetic improvement of dairy animals in rural areas is almost negligible (Desalegne, 2009).

2.6.4 Lack of Appropriate Collaborations between the NAIC and Stakeholders

Absence of collaboration and regular communication between NAIC and stakeholders have greatly contributed for insignificant success of AI service (Desalegne, 2009). Absence of collaboration and regular communication between dairy owner and AI technicians, of technicians through giving proper trainings particularly lack of breeding policy and herd recording system, for those who were under the category of the poor inadequate resource in terms of inputs and facilities and technical expertise These findings are in agreement with absence of incentives and rewards to motivate AI the suggestions (FAO, 2017).

2.6.5 Semen evaluation and Absence of Herd Recording System

Well-designed crossbreeding programs is lead to exploit desirable characteristics of the breeds or strains involved, and to take advantage of heterosis for traits of economic relevance AnGr (Köhler-Rollefson, 2004). In addition, lack of accurate, timely and reliable information on dairy sector accounted for inefficient service of AI centers. Some dairy records are available in Ethiopia, but they are limited to research institutions. Crossbreeding with exotic breeds without keeping records is a major factor contributing to the erosion of locally adapted AnGr (Köhler-Rollefson, 2004). The other reasons for inefficient AI service are poor infrastructure, managerial and financial constraints (Shiferaw, 2012), poor semen quality, poor semen handling practices and poor insemination practices (Negussie, 2010; Bekana, 2005).

2.6.6 Cost of AI compared to natural service

Despite the well-known advantages of artificial insemination, a large number of dairy farmers all over the world still use natural service using bulls to breed their cows. The main arguments allegedly justifying their choice are higher AI costs compared to those of keeping herd bulls and additional costs resulting from extended calving intervals because of low heat detection rates when AI is used. AI costs include; labor, equipment, liquid nitrogen, semen and three ratios of "services per conception" (Valergakis*et,* 2007). The availability of economically priced liquid nitrogen for the cryopreservation of semen is also a particular constraint to utilize AI as a whole (FAO International Technical Conference, 2010).

2.6.7 Impact of AI in genetic diversity

Even though AI is highly effective in improving animals' productivity, there is also a concern that its inappropriate or unplanned use can lead to increased rates of genetic erosion and breed extinction when record keeping is not available (Pilling *et al*.2007).

2.6.8 Difficulty of heat detection

Among different factors that can affect conception rate per AI service, accuracy of heat (estrus) detection is the major one that determines success of program since ova remains viable for only about 12-18 hours after ovulation (Bekana, 2005). A successful AI program must include efficient and accurate heat detection and timely AI relative to ovulation. The failure to detect heat is the most common and costly problem of AI programs and the major limiting factor of reproductive performance on many dairies (Dalton, 2011). The physiological relationship linking ovulation to the onset of standing activity underscores the importance of accurate heat detection as there is a limited window of opportunity in which to maximize conception to AI.

Many biological events occur within the limited window of opportunity of transport time required for viable sperm from the site of deposition to the site of fertilization, the functional viable lifespan of sperm and ova and the timing of ovulation in relation to AI (Dalton, 2011)

2.6.9 Major factors affecting efficiency of AI in Ethiopia

The efficiency of AI in the country has remained at a very low level due to many constraints including; infrastructural, managerial and financial constraints and also due to technical problems such as; poor heat detection, improper timing of insemination and embryonic death. The artificial insemination program in rural bovines is greatly influenced by the status of the farmers' i.e. large marginal, small, and land less farmers (Kumar, 2005).

In addition, conception rate per AI service is affected by; cow related factors including cow fertility, body condition, environmental stresses, nutrition health bull fertility/ quality of semen, efficiency of AI techniques, skills of the inseminators, care of the semen collected, processed and stored (Rogers, 2001).The risk of all these factors vary as the type of production system, level of the dairy business and even with agro ecology. The problem is more aggravated by wrong selection and management of AI bulls along with poor motivation and skills of inseminators (Gebremedhin, 2005).Unlike farms using AI, farms using (NS) natural services have a better chance of detecting estrus and getting heifers or cows pregnant at the first opportunity. Farms using AI have to go through the difficulties of estrus detection required for proper insemination which are both the number one problems in the success of AI in Ethiopia.

Moreover, a number of previous works confirmed that management factor especially nutrition determines pre pubertal growth rates and reproductive development have their own impact on AI. The better managed and well-fed heifers grew faster, get served earlier and result in more economic benefit in terms of sales of pregnant heifers and/or more milk and calves during the life time of the animal (Lobago,2006; Masama,2003).

Even though, smaller farms often rely on AI service because of the cost or difficulty of keeping a breeding bull for natural insemination (Lemma and Kebede, 2011; Rocha, 2001; Kelay, 2002), several factors associated with the success of AI particularly detection of heat, efficiency of inseminator, communication and transport problems and quality of the semen have contradictory effect (Rocha, 2001; Kelay, 2002). Problems with estrous detection as one of constraints become more important in affecting the reproductive performance of dairy cows as herd size increases (Smith, 2004). As also reported in a study (Kelay, 2002), accessing an AI service has many technical and logistic hurdles contributing to the failure of the timely service of estrous cows hence results in poor reproductive performance. So, many dairy farmers use NS to overcome problems associated with estrous detection (Risco, 2000).

3. MATERIALS AND METHODS

3.1. Description of the Study Areas

3.1.1 Location and physical feature

The study was conducted from November 2019 to June 2020 in Gedeb Hasasa district of West Arsi zone of Oromia regional state. It is located at a distance of 275 kms south east of Addis Ababa. Gedeb Hasasa district situated at $(16^{\circ}5' - 8^{\circ}9')$N and $(38^{\circ}5' - 8^{\circ}9')$E longitude in south east of Ethiopia. Gedeb Hasasa district is bordered with Bokoji and Honkolo Wabee district in the east, Dodola district in the southeast, Koree district in the north, Kofale district in South west.

3.1.2 Topography

Gedeb Hasasa district has (55%), highland area and (45%) mid attitude. The altitude of the area ranges from $2300 - 3200 masl$ and characterized by mid sub-tropical temperature range from $03℃ - 28℃$. The annual average rainfall is 1100mm the area covered 22.500 squares Km and the average annually temperature in the district is 26.5℃.

3.1.3 Climate

There are three locally defined seasons comprising two main predictable rainy seasons (long rains "*ganna"*, and short rains "*hagayya*") and dry seasons ("*bona"*). *Ganna* (the main rainy season, from March to April) and *Hagayya* (small rainy season, from May to September) are the two important rainy seasons, more than half of the rainfall is received in *Ganna* (Tadesse, 2015).

3.1.4 **Livestock population**

Gedeb Hasasa district is characterized by mixed (crop and livestock production system

Table 2 Livestock population Gadab Hassasa district

livestock Species	Total Number
Cattle	65,842
Goat	2273
Sheep	30,082
Horse	2260
Donkey	1500
Poultry	16,267
Traditional Beehives	407
Total	**118,631**

Source: Gadab Hasasa Livestock and Fishery Resources Development Office (2012)

3.2 Study Design

Descriptive and cross-sectional studies were applied with the aid questionnaire surveys, focus group discussions, key informant interviews, personal observation and document/record analysis (retrospective data) on the status, practices and constraints associated with AI delivery in the gedeb Hassasa districts. Data were collected from dairy owners/ dairy farmers, AI technicians (AITs), veterinarians, animal health and production experts, and recorded secondary document in the study area.

3.3 Sample Size Determination

Sample size was determined based on the formula recommended by Arsham (2007) for survey studies:

$N = 0.25/SE^2$,

Where N = sample size,

SE = standard error (Assume that SE is 3.73%),

Considering confidence level of 95% at $\alpha = 0.05$.

Based on this formula the total numbers of smallholder dairy farmers selected for questionnaire purpose were about180 dairy cattle owners.

3.5 Sampling Procedures

Sampling was performed using purposive and simple random sampling methods. The study district contains 33 kebeles. From the total kebeles, six kebeles were selected purposively based on feasibility to sample collection, accessibility to road and number of dairy cows. Prior to commencement of sample collection, number dairy cows in each kebeles were obtained from Gadab Asasa Livestock and Fishery Resources Development Office. Then, those households possessing dairy cows were identified by the help of development agents. Then,180 households/dairy farmers were randomly selected from the study sites.

3.4. Type and Sources of Data

Both qualitative and quantitative data types were used for this study. Data for this study was obtained both from primary and secondary sources. Primary data was collected from questionnaire survey while secondary sources were obtained from records, published and unpublished documents, journals articles, project reports.

3.5. Methods of Data Collection

3.5.1. Questionnaire survey

The survey questionnaire was developed and pre-tested for its applicability. A questionnaire was developed, pretested and translated to local language (Afan Oromo) for data collection. Semi-structured questionnaires (open– and close- ended) were used to collect data from dairy farmers with main focus on the status, practices and constraints associated with AI delivery in the study area.

3.5.2. Focus group discussion (FGD)

To complement the survey, FGD was conduct with subject groups by collection of basic descriptive information at the survey sites. This is to acquire useful and detailed information, which was difficult to collect through the questionnaire survey, and to cross-check and to triangulate the data collected from multiple sources as well as to overcome the limitations and biases that steam from using single method and thereby increasing the reliability of the finding. Thus, totally 6 FGD from the six selected kebeles (each consists of 12 members) with 72 participants were formed based on their proximity to each other. FGD checklist was prepared to guide topics for open-ended discussion with group members.

3.5.3. Key informant interviews

Key informant interviews (KII) with 36 key informants (6 knowledgeable informants from each selected kebeles) were interviewed to probe further and to validate the findings of the study. Knowledgeable informants were selected who have experiences with AI practices and cattle production such as artificial insemination technicians, veterinarians, animal health and production experts, animal health extension workers/development agents, elders and model farmers were interviewed to probe further and to validate the findings of the study. Key informant guides (check lists) were designed to collect data

3.5.4. Retrospective data collection

Data of record keeping regarding artificial insemination from year of 2009 to 2012(number of cows inseminated, number of cows pregnant, number of cows born and conception rate) for four consecutive years were recorded and analysed. All d inseminate dairy cows in study area were selected for analysis from record book.

3.6. Statistical Analysis

All data were coded and recorded on Microsoft excel spreadsheet for data analysis. Then, the analysis was done using statistical analysis system (SAS) software version 9.2 (2008). Data was summarized using descriptive statistics (means, standard deviation, proportions, minim um and maximum values).

Indices were used for ranking purpose of keeping cattle and constraint of artificial insemination in the study area as: Index = sum of (3 for rank 1+ 2 for rank 2 +1 for rank3) given for an individual category divided by the sum of (3 for rank 1 + 2 for rank 2+1 for rank 3) for overall category or parameters. Qualitative data from individual observation were analyzed following the frequency procedures of SAS version 9.2 (2008). Chi-square test was used to test significance difference between categorical variables and a p-value < 0.05 was considered to look this significance level.

Regarding retrospective data(artificial insemination record book) were analyzed using the following formula:

$$\text{Conception rate} = \frac{\text{number of cows pregnant}}{\text{number of cows inseminated}} * 100$$

$$\text{Calving rate} = \frac{number\ of\ b\ orn}{number\ of\ cows\ pregnant} * 1\ 00$$

4. RESULT AND DISCUSSION

4.1 General household Characteristics

The general characteristics of the respondents in study area were presented in (Table 3). The ages of respondents were fall at a range of 41-50 years (34.44%) followed by 31-40 years (21.67%). There was no significant difference ($p>0.05$) between the age of the households between kebele. the present finding is in agreement with the report of Tekalign (2021) where about 34.36% of respondents in Essera Woreda were at age range of 45-50 years.

Majority of respondents in study area were male headed (71.11%) followed by female headed (28.89%). There was no significant difference between the sex of household head ($p>0.05$). The present finding is in agreement with the report of Tekalign (2021) where he reported about (62.5%) of respondsents were male headed in Essera Woreda.

Regarding marital status of respondents, about (87.22%) respondents were married, 7 (3.89%) were single and the rest 16 (8.89%) were divorced (Table 3). There was no significant difference regarding marital status of respondents in study area ($p>0.05$). It is in agreement with the report of Tekalign (2021) where he reported about (71.86%) were married in Essera Woreda.

Educational level of respondents in study area is presentedin (Table 3). There was significant difference regarding educational level of respondents in study area ($p<0.05$). Majority of the respondents in study area were attended elementary school (46.67%) followed by of the respondents can read (18.33%). This indicates that respondents who participated in this study were from different levels of education which related with levels of acceptance of artificial insemination technologies and artificial insemination practices. The present finding was agreement with the report of Tekalign (2021) where he reported about (51.42%) were get learn elementary schools in Essera Woreda.

Table 3 Demographic Characteristics of Respondents in the study area

Parameter	Kebele						Overall
Age group	Hanto	Madabatu	Huruba	Bucho	Wokachel	Ella	
20-30	4(13.33)	4(13.33)	6(20.00)	6(20.00	6(20.00)	7(23.33)	33(18.33
31-40	3(10.00)	4(13.33)	9(30.00)	7(23.33	12(40.00)	4(13.33)	39(21.67
41-50	13(43.33	13(43.33)	9(30.00)	8(26.67	5(16.67)	14(46.67	62(34.44
51-60	6(20.00)	5(16.67)	6(20.00)	8(26.67	7(23.33)	4(13.33)	36(20.00
Above 61 year	4(13.33)	4(13.33)	0(0.00)	1(3.33)	0(0.00)	1(3.33)	10(5.56)
Ch-square value							29.0209^{Ns}
Sex of household head							
Male	25(83.33)	24(80.00)	20(66.67)	20(66.67)	21(70.00	18(60.00)	128(71.11)
Female	5(16.67)	6(20.00)	10(33.33	10(33.33)	9(30.00)	12(40.00)	52(28.89)
Ch-square value							5.7332^{Ns}
Marital status							
Married	25(83.33)	26(86.67)	27(90.00)	28(93.33)	27(90.00)	24(80.00)	157(87.22)
Single	0(0.00)	2(6.67)	1(3.33)	0(0.00)	2(6.67)	2(6.67)	7(3.89)
Divorced	5(16.67)	2(6.67)	2(6.67)	2(6.67)	1(3.33)	4(13.33)	16(8.89)
Ch-square value							12.2322^{Ns}
Education level							
Spiritual learning	2(6.67)	2(6.67)	7(23.33)	11(36.67)	6 (20.00)	0(0.00)	28(15.56)
Reading& writing	6(20.00)	6(20.00)	0 (0.00)	2(6.67)	2 (6.67)	17(56.67)	33(18.33)
Elementary school	19(63.33	19(63.33)	14(46.67)	8(26.67)	22(73.33)	2(6.67)	84(46.67)
Secondary school	1(3.33)	1(3.33)	6(20.00)	7(23.33)	0(0.00)	9(30.00)	24(13.33)
Tertiary shool	2(6.67)	2(6.67)	3(10.00)	2(6.67)	0(0.00)	2 (6.67)	11(6.11)
Ch-square value							93.5844^{*}

Mean of family size per household is depicted in (Table 4). The overall mean of male in the family size was 3.19 whereas 3.96 female individuals. There was significant difference between the female and male family size in the study site/kebele ($p<0.05$) where large number of male individual in Hanto kebele while large number of female individuals in Ella kebele.The present finding is agreement with the report of (Sharew, 2018) where he reported about 2.16, 2.13 and 1.85 male individuals in Basona worena, Siyadebrnawayu and Angolelanaterad district, respectively.

Table 4 Family size of respondents in study area

	KEBELE						
Family size	Hanto (Mean±SD)	Madabatu (Mean±SD)	Huruba (Mean±SD)	Bucho (Mean±SD)	Wokachela (Mean±SD)	Ella (Mean±SD	Overall Mean
Male	3.90 ± 2.16^{a}	3.03 ± 1.62^{bc}	2.47 ± 1.17^{c}	3.00 ± 1.05^{bc}	3.07 ± 1.39^{abc}	3.70 ± 1.70^{ab}	3.19
Female	3.93 ± 2.29^{ab}	3.63 ± 1.50^{b}	3.93 ± 1.74^{ab}	3.53 ± 1.83^{b}	3.97 ± 1.43^{ab}	4.77 ± 1.81^{a}	3.96

a-b-c means with the different superscripts under the same row for the same parameter is significantly different at $p<0.05$, SD-standard deviation family size of respondents.

4.2.1 Livestock Number and Composition in study area

Types of livestock and average livestock per household are shown in (Table 5). Overall average numbers of livestock in the study district were 7.80 cattle, 3.99 sheep, 0.52 goat, 1.10 donkey, 0.91 horse, 3.25 chicken and 0.08 beehive respectively. In this study area cattle is the dominant livestock species. But, the discussion made with focus group discussion indicated the numbers of livestock per household were decline due to land allocated for pasture or grazing is either small or degraded with low biomass production, which cannot meet the nutritional requirements of animals. The present finding was disagreed with the report of (Diribi, 2017) cattle are the dominant livestock species in and around Assosa town.

Table 5 Herd composition and average livestock per household in study area

Type of livestock	Hanto Mean±SD	Madabatu Mean±SD	Huruba Mean±SD	Bucho Mean±SD	Wokachel Mean±SD	Ella Mean±SD	Overall mean
Cattle	7.50 ± 5.47^{ab}	6.60 ± 3.62^{bc}	9.50 ± 5.68^{a}	$6.07 \pm 4.\ 31^{c}$	$7.97 \pm 4.\ 51^{abc}$	$9.17 \pm 5.\ 61^{ab}$	7.80
Sheep	$2.67 \pm 3.\ 65^{c}$	$3.9 \pm 3.\ 74^{ab}$	$4.90 \pm 4.\ 14^{ab}$	$5.6 \pm 4.\ 01^{a}$	$2.97 \pm 3.\ 5^{bc}$	$3.83 \pm 3.\ 86^{bc}$	3.99
Goat	$0.5 \pm 1.\ 01^{a}$	$0.53 \pm 1.\ 66^{a}$	$0.57 \pm 1.\ 22^{a}$	$0.67 \pm 2.\ 26^{a}$	$0.43 \pm 153^{a}.$	$0.4 \pm 1.\ 54^{a}$	0.52
Donkey	$0.73 \pm 0.\ 58^{c}$	$0.9 \pm 0.\ 88^{bc}$	$1.4 \pm 0.\ 93^{3}$	$1.1 \pm 0.\ 61^{ab}$	1.3 ± 0.89^{ab}	$1.4 \pm 1.\ 01^{ab}$	1.10
Horse	$0.5 \pm 0.\ 57^{a}$	$1. \pm 1.\ \ 2^{bc}$	$1.2 \pm 1.1\ \ 19^{a}$	$0.7 \pm 0.\ 64^{ab}$	$0.8 \pm 0.\ 91^{ab}$	$1.2 \pm 1.\ 18^{a}$	0.91
Chicken	$4.5 \pm 5.\ 30^{b}$	$3.4 \pm 3.\ 98^{bc}$	$2.6 \pm 1.\ 92^{a}$	$2.5 \pm 2.\ 37^{ab}$	$4. \pm 2.\ 69^{ab}$	$2.5 \pm 2.\ 46^{a}$	3.25
Hive	$0.1 \pm 0.\ 37^{a}$	0	$0.2 \pm 0.\ 82^{a}$	0	$0.1 \pm 0.\ 25^{a}$	$0.13 \pm 0.\ 43^{a}$	0.08

a-b-c means with the different superscripts under the same row for the same parameter is significantly different at $p<0.05$, SD-standard deviation, herd composition livestock per household.

4.1.4 Purpose of cattle production the in study area

The main purposes of cattle rearing in the study area by respondents are depicted in (Table 6). Farmers were use criteria of cattle selection like milk yield, meat yield/carcass, and draft purpose, breeding and income generation. Farmers reared cattle primary for milk production with index value of 0.39 followed by draft purpose with index value of 0.25. Milk is mentioned as one of the most important functions of the local cattle and one of the primary reasons for keeping indigenous cattle. An increase in milk yield will bring additional income from the sale of milk butter. More milk production also means better feed calves that will have better survival rates. The present finding was in agreement with a report by Bekele (2016) where he reported that about 0.36 index value of dairy cow production is milk production in and around Assosa town.

Table 6 Purpose of cattle rearing in the district

Purpose of cattle production	Rank			Index	Overall rank
	R1	R2	R3		
Milk	119	17	24	0.39	1
Meat	15	25	18	0.10	4
Income	24	21	114	0.21	3
Draft	16	107	10	0.25	2
Breeding	6	10	14	0.05	5

R=Rank, Index = sum of (3 for rank 1+ 2 for rank 2 +1 for rank3) given for an individual category divided by the sum of (3 for rank 1 + 2 for rank 2+1 for rank 3) for overall category or parameters.

4.1.5 Cattle breed types and herd structure

Average cattle number by breed types and herd composition per household is listed in (Table7). The overall mean number of crossbred cows, local cows, crossbred heifers and local heifers per household were 1, 0.3, 0.11 and 0.56 respectively. This indicates that crossbred are higher in number of milking than local cattle breed type due to their high milk yield and large in size. The present finding was in disagreement with the report of (Diribi, 2017) where he reported there is higher number of local cattle breed than cross breed in and Around Assosa Town.

Table 7 Cattle type and composition in study area

Cattle type	Hanto (Mean±SD)	Madabatu (Mean±SD)	Huruba (Mean±SD)	Bucho (Mean±SD)	Wokachela (Mean±S)	Ella Mean±SD	Overall Mean
Cross							
Milking Cow	$0.63±0.61^{a}$	$0.5768^{a}±0.$	$0.7358^{a}±0.$	$0.53±0.6^{a}$	$0.63±0.6^{a}$	$0.6±0.6^{a}$	1.32
Pregnant cow	0.10a±0.31	0.10a±0.30	0.23a±0.43	0.07a±0.2	0.20a±0.4	$0.2±0.4^{a}$	0.62
Dry cow	$0.1±0.3^{ab}$	0.00	$0.1±0.3^{a}$	0.00	0.00	$0.1±0.34^{a}$	1.02
Calf	$0.6±0.6^{a}$	$0.5±0.7^{a}$	$0.7±0.5^{a}$	$0.5±0.5^{a}$	$0.6±0.6^{a}$	$0.6±0.56^{a}$	1.21
Heifer	$0.23±0.\ 5^{a}$	$0.3±0.46^{a}$	$0.1±0.3^{ab}$	0.00	0.00	$0.032^{b}±0.$	0.11
Local							
Milking Cow	$1.2±1.2^{a}$	$1.1±0.9^{ab}$	$1.7±1.26^{a}$	$0.9±0.9^{b}$	$1.5±1^{ab}$	$1.5±1.2^{ab}$	0.62
Pregnant cow	$0.77±0.8^{abc}$	$0.4±0.5^{c}$	$0.8±0.9^{ab}$	$0.4±0.5^{bc}$	$0.4±0.\ 5^{bc}$	$0.9±0.88^{a}$	0.14
Dry cow	$1.1±1.12^{a}$	$0.8±0.96^{a}$	$1.13±11^{a}.$	$0.9±1.1^{a}$	$0.9±0.92^{a}$	$1.3±111^{a}.$	0.06
Local calf	$1.1±0.9^{abc}$	$1.1±0.8^{ab}$	$1.5±0.93^{a}$	$0.9±0.92^{b}$	$1.33±0.8^{ab}$	$1.4±0.9^{a}$	0.58
heifer	$0.6±0.67^{a}$	$0.5±0.63^{a}$	$0.5±0.56^{a}$	$0.6±0.73^{a}$	$0.4±0.57^{a}$	$0.7±0.61^{a}$	0.56

a-b-c means with the different superscripts under the same row for the same parameter is significantly different at p<0.05, SD-standard deviation, breed types cross and local cattle composition.

4.2 Production systems and livestock status in study area

Production systems and livestock trendswere presented in (Table 8). The result of survey indicated that majority of the farmers were practiced crop production (58.89%) followed by mixed crop livestock production system (36%). There was no significant difference between livestock and crop production farming activity (p>0.05). Contrary to present finding (Teweldemedhn, 2020) reported about (79.6%) mixed crop livestock production system in Western zone of Tigray Region, Ethiopia. This is because all agro-ecologies could not have similar production systems; the challenges depend on the existing conditions.

Regarding trends of livestock number about 9.44% of the respondants reported increasing trends while 75% of them indicated decreasing trends. However 15.56% reported neither increasing nor decreasing trend. There was no significant difference between trends of livestock production trends (p> 0.05). The decreased trends of livestock production might be due to increasing land degradation, erosion of animal genetic resources, livestock mediated environmental pollution, severe water shortages and the threat of emerging infectious diseases pose several new challenges to sustainable animal production and food security, particularly in developing countries. The present finding was in agreement with the report by (Sharew 2018) found that about 70.1% of respondents agreed that degreaser in livestock number at Basonaworena (67.8%) Siyadebrnawayu (80%) and Angolelanatera (62.2%) district

Table 8 Types of production system and status of livestock at Hasasas district

Parameter	Hanto	Madabat	Huruba	Bucho	Wokache	Ella	OVERALL
Production system							
Livestock production	1(3.33)	1(3.33)	2(6.67)	2(6.67)	1(3.33)	2(6.67)	9(5.00)
Crop production	18(60.0	19(63.33)	16(53.33)	20(66.67)	18(60.00)	15(50.00)	106(58.89)
Mixed production	11(36.6	10(33.33	12(40.00)	8(26.67	11(36.67)	13(43.33)	65(36.11)
Chi-square value							3.3504Ns
Trends of livestock							
Increasing	1(3.33	2.(6.67)	1(3.33)	5(16.67)	2(6.67)	6(20.00)	17(9.44)
Decreasing	26(86.6)	25(83.3	24(80.00	22(73.33)	22(73.33)	16(53.33	135(75.00)
No change	3(10.00)	3(10.00	5(16.67)	3(10.00)	6(20.00	8(26.67)	28(15.56)
Ch-square value							15.4525Ns

4.2.1 Artificial Insemination (AI) Practices in the study area.

The result showed that from the total dairy owners about 68.33% didn’t get the artificial insemination services while the remaining 31.67% had access to artificial insemination services. There was no significant difference between communities who didn’t get artificial insemination services and who had access to artificial insemination services ($p>0.05$). The present finding was in agreement with the report (Ephrem Takele 2019) where he reported about (98.7%) of the responds dot get consistent and regular AI service in the in respective selected Districts of Wolaita Zone, Ethiopia.

Table 9 Artificial Insemination (AI) services and practices of in the study area

			Kebele				
Parameter	Hanto	Madabatu	Huruba	Bucho	Wokache	Ella	Total
Practice AI							
No	21(70.00)	21(70.00)	21(70.00)	17(56.67)	20(66.67)	23(76.67)	123(68.33)
Yes	9(30.00)	9(30.00)	9(30.00)	13(43.33)	10(33.33)	7(23.33)	57(31.67)
Ch-square value						3.0039Ns	

4.2.2 Mating practices and cattle in the study area

The results of mating system and in the study area are given in (Table 10). The main mating system in study area was use natural mating with unselected bull (79.44%) followed by use of artificial insemination techniques (15%). Less number of respondents practices use of natural mating with selected bull (5.56%). The present finding was in agreement with the report of Bekele (2016) where about (70.6%) of respondents practice natural mating with unselected bull in and around Assosa town.

Table 10 Mating practices in the study area

		Kebele					
Mating system	Hanto	Madabat	Huruba	Bucho	Wokac	Ella	Total
Natural mating with SB	4(13.33)	0(0.00)	0(0.00)	2(6.67)	1(3.33)	3(13.3)	10(5.56)
Natural mating with USB	20(66.67)	23(76.6)	27(90)	25(83)	24(80)	24(80)	143(79.44)
Artificial Insemination	6(20.00)	7(23.33)	3(10)	3(10)	5(16.67	3(10.00	27(15)
Ch-square value							20.6017Ns

SB= selected bull, USB=unselected bull

4.2.3 Awareness about AI and heat detection

Awareness about AI service is shown in (Table 11). There was no significant difference between aware and unaware (p>0.05). Majority of (72%) respondents did not have awareness about artificial insemination while about 28.67% of respondents had awareness about artificial insemination practices. The maximum perception of the respondents toward did not have awareness of heat detection was recorded in Hanto (83.33%) followed by Madabatu (73.33%) and the least recorded (56.33%) in Bcho Keble. The present finding was in agreement with the report of (Ephrem, 2019) where he reported about (91.1%) of the dairy farmers in the study area do not have awareness of heat detection in selected Districts of Wolaita Zone, Ethiopia.

When a cow comes into a standing heat in the morning (82%) of the respondents inseminate their cow in the afternoon of the same day. The maximum perception of the respondents toward did not have awareness of heat detection was recorded in Hanto (90%), in Madabatu (90%), in Huruba (90%) followed by Wokachela (83.33%) and the least recorded in Ela (60%).The present study was dis agreement with the report of Alazar(2015) that about 42.1% of the farmers inseminated their cows in the afternoon of the same day animal show heat in Debretobor town.

Regarding cows show heat sign in afternoon the (68.33%) of dairy farmers reported as heat sign is seen on it while about (31.67%) farmers inseminate on the next day morning. There was no significant difference between cow show heat sign in afternoon and on the next day morning (p>0.05). The present finding was agreement with the report of Tamene (2017) where he reported about 75% of dairy farmer their cows show heat sign is seen on it in and Around Ejere District. It is very important for farmers to clearly follow their animals for heat detection and should have inseminated their animals at appropriate time.

Table 11 Awareness of AI beneficiaries on time of insemination in the study site

Parameter	Kebele						
	Hanto	Madabat	Huruba	Bucho	Wokachel	Ella	Total
Aware of heat detection							
Yes	5(16.67	8(67.67)	9(30.00)	13(43.33)	10(33.33	11(36.67	51(28.33)
No	25(83.33)	22(73.33)	21(70.00)	17(56.67)	20(66.67	20(66.67	129(71.67
Ch-square value							3.5294Ns
Cow came in heat in morning							
As heat sign is seen on it	27(90.00)	27(90.00)	27(90.00)	24(80.00)	25(83.33	18(60)	148(82.2)
On the same day afternoon	3(10.00)	3(10.00)	3(10.00)	6(20.00)	5(16.67)	12(40.0	32(17.78)
Ch-square value							13.9865Ns
Cow came in heat in afternoon							
As heat sign is seen on it	26(86.67	19(63.33)	21(70.00)	17(56.67)	20(66.67	20(66.6	123(68.3)
On the next day morning	4(13.33	11(36.67)	9(30.00)	13(43.33)	10(33.3)	10(33.3)	57(31.67)
Ch-square value							7.0090Ns

4.3 Constraint Associated with Artificial Insemination in study area

In study area farmers face different constraints associated with artificial insemination. This includes repeated heat, regular unavailability of AI service, absence of AI services on weekend and holidays, interruption of AI services and communication problems between AI technician and farmers. The detailed constraints were discussed below.

4.3.1. Repeated insemination

Repeated heat is one of the series problems in success of artificial insemination. Majority of the respondents (83.33%) were replied that they face problem of repeated breeding whereas the rest did not face this problem. There no significant difference between study kebeles regarding problem face farmers for repeated breeding ($p>0.05$). This finding was agreement with the report of Teganu and Feyera (2016) who reported that (65.5%) respondents face problem of repeated breeding in Tiyo and Sagure district. The success AI is low due to poor heat detection, improper timing of AI technician and embryonic death, poor semen quality/ poor semen handling practices and poor insemination practices. Discussion made during focus group discussion showed that emphasis given to animal health and breeding in the study site is very low which result in conception failure and reputed breeding causing poor reproduction and production problem. There is also less nitrogen , lack of attention and incentives to AITs, limitation of inputs and facilities, shortage of AITs and poor collaboration of government bodies with NGO's communicate and other concerned bodies are the major problem associated with AI in the country in general

Table 12 Constraint associated with repeated insemination

Parameter	Kebele						
	Hanto	Madabat	Huruba	Bucho	Wokachela	Ella	overall
Do you face repeated breeding problem?							
Yes	25(83.33	25(83.33)	25(83.33)	27(90.0)	24(80.00)	24(80.00	150(83.33)
No	5(16.67	5(16.67)	5(16.67)	3(10.00)	6(20.00)	6(20.00	30(16.67)
Ch-square value							1.4400Ns

4.3.2. Unavailable AI services in study area

Out the total respondants (80%) of them suggested that AI service was not available while about (18%) of respondents were get artificial insemination service. There was no significant between private artificial insemination and government artificial insemination service. The present finding was in agreement with the work of (Ephrem, 2019) where he reported (98.7%) dairy farmer were not get artificial insemination service regularly in selected Districts of Wolaita Zone, Ethiopia.

About (90.56%) dairy farmers traveled with their cow for distance to get AI service whereas (9.44%) dairy farmer could access the service in the short distance. The present finding was agreement with the report (Teganu 2019) where he reported about (57.1%) dairy farmer reported travelled long distance to get artificial insemination service in sagure district.

Close to (77.78%) of dairy farmer respondents is shortage of AITs in the while (22.22%) of dairy farmers reported adequate number of AITs. The present finding was in agreement with the report of Ephrem (2019) where he reported shortage of AIT (91.7%) in selected Districts of Wolaita Zone, Ethiopia.

Table 13 Reason of service of artificial insemination no get regularly without interruption

	Kebele						
Parameter	Hanto	Madabat	Huruba	Bucho	Wokach	Ella	Overall
AI service							
private	5(16.67)	0(0.00)	2(6.67)	3(10.00)	0(0.00)	0(0.00)	10(18.00)
Government	25(83.3)	(100.0)	28(93.3)	(90.0)	30(100)	30(100)	170(82.00)
Ch-square value							13.552Ns
Long distances to get service?							
Yes	16(53.33)	27(90.00)	30(100)	30(100)	30(100)	30(100)	163(90.5)
No	14(46.67)	3(10.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	17(9.44)
Ch-square value							61.125*
Is their shortage of AITs in the kebles							
No	4(13.33)	11(36.67)	0(0.00)	3(10)	12(40)	10(33.33)	40(22.22)
Yes	26(86.67)	19(63.33)	30(100)	27(90)	18(60)	20(66.67)	140(77.78)
Ch-square value							23.785Ns

4.3.3. Availability of AI services on weekend and holiday

Service regarding artificial insemination on weakened and holiday are presented (Table). Majority of dairy farmer (91.11%) indicated that artificial insemination service was available weakened and holiday. The present finding was in agreement with the report (Ephrem, 2019) where he reported about (93%) dairy farmers did not get artificial insemination service on weekend and holydays in selected Districts of Wolaita Zone, Ethiopia.

Majority of dairy farmers (61.67%) missed time of insemination while (38.33%) dairy farmer used natural mating. The present finding was in agreement with the report of (Teganu and feyera, 2016) where he reported about (55.7%) of dairy owner missed time of insemination Sagure and Tiyo district.

According to the result of key informant interviews for artificial insemination, AI technician provide services on the weekend and holyday on personal agreement while same ATs didn't give services because of no interest to do.

Table 14 un availability of AI services on weekend and holy day

Parameters	Kebale						
	Hanto	Madabat	Huruba	Bucho	Wokache	Ella	Overall
Is AI services on week end and holy day?							
Yes	4(13.33)	8(26.67	4(13.33)	0(0.00)	0(0.00)	0(0.00)	16(8.89)
No	26(86.67)	22(73.33	26(86.67)	30(100.0	30(100)	30(100)	164(91.11
Ch-square value							21.9512Ns
If no what do you do?							
Pass the date withoutbreeding the cow	19(73.08)	15(65.22)	15(57.69)	22(73.33)	20(66.67)	20(66.67)	111(61.67)
Use natural mating	11(42.31)	15(57.69)	15(57.69	8(26.67)	10(33.33)	10(33.33	69(38.33)
Ch-square value							2.0364Ns

4.3.4. AI services delivery

Majority of respondent (80.56%) raised that AI services was not regularly only (19.44%) get regularly service (Table 15). The present finding was in agreement with the report of Tekalegn(2021) that 75% of dairy farmers get AI service irregularly in Essera woreda. There was no significance difference between regularly irregularly.

The irregularly AI services was due to shortage of AI technician (7.22%), shortage of inputs (7%). The present finding was in agreement with the report of Yohanis and Tilahun (2018) where about (53%) dairy farmer didn't get AI regularly by different reasons in and around Adama Town.

Table 15 Artificial Insemination services delivery in the study district

Parameter	Kebele						
	Hanto	Madabat	Huruba	Bucho	Wokache	Ella	Total
The AI service regularly?							
Yes	4(13.33	3(10.00)	8(26.67)	9(30.00)	6(20.00)	5(16.67)	35(19.44)
No	26(86.67)	27(90.00)	22(73.33	21(70.00)	24(80.00)	25(83.33)	145(80.56)
Chi square value							5.7103Ns
Reason for Unavailable AI?							
Un availability of AI	24(92.31)	20(74.07)	19(86.36	17(80.95)	20(83.33)	22(80.00)	122(67.78)
shortage of AITs	20(74.07)	5(18.52)	5(18.52)	5(18.52)	5(18.52)	5(18.52)	45(25.00)
shortage of inputs	2(7.69)	2(7.41)	2(9.09)	3(14.29)	2(8.33)	2(8.00)	13(7.00)
Ch-square value							9.2081Ns

4.3.5. Linkage between AI technician and dairy farmers

Communication system between AI technician and dairy farmers is shown in (Table 16). About 57.78% of dairy farmers travels there cows to the area where AI technician is available. But 42.32% made a telephone call to the AITs where a cow comes into heat. There was no significance difference between travels there cows to the area and made a telephone call to the AITs (p>0.05). The present finding was in agreement with the report of (Teganu, 2016)where he reported about (55.8%) and (65.8%) of respondents in Tiyo and Sagure district respectively.

Table 16 showing the way which farmer communicate with AI technician

				Kebele			
Parameter	Hanto	Madabat	Bucho	Huruba	Wokachel	Ela	Total
Communication with AITs							
Took cow to station	17(56.67	18(60.00)	19(63.33)	15(50.00)	19(63.33	26(86.67)	104(57.78)
We call AITs	13(43.33	12(40.00)	11(36.67)	15(50.00)	11(36.67)	4(13.33)	76(42.32)
Chi-square							3.9479Ns

4.3.6. Rank of AI services constraints in study area

The main constraint which negatively influenced the efficiency of AI service in Gedeb Hassasa district are listed in (Table 17). Accordingly the major constraints were lack of AITs, lack of awareness heat detection and delayed time of insemination with index value of 0.44, 0.29 and 0.15, respectively. This finding was agreement with the report of (Teweldemedhn, 2020) where he reported lack of Artificial insemination technicians Western zone of Tigray Region, Ethiopia with index value of 0.206. Ephrem (2019) reported that lack of regular and consistent AI service (99%), lack of weekend AI service (93%), inadequacy of AITs (92%) and lack of awareness (92%) were the major constraints in AI service in selected Districts of Wolaita Zone, Ethiopia.

Table 17 major constraints affecting AI services in the district

Problem	R1	R2	R3	Index	R
lack of AITs	120	50	12	0.44	1
lack of awareness heat detection	33	78	54	0.29	2
delayed time of insemination	8	30	79	0.15	3
Long distance travel to get AI service	12	6	12	0.06	4
Poor infrastructure, managerial and financial	5	11	13	0.05	5
lack of weekend AI service	2	4	7	0.02	6
High cost of AI service	0	1	3	0.001	7

R=Rank, Index = sum of (3 for rank 1+ 2 for rank 2 +1 for rank3) given for an individual category divided by the sum of (3 for rank 1 + 2 for rank 2+1 for rank 3) for overall category or parameters.

4.4. Retrospective results of inseminated cows

The number of cows inseminated (at first and second time of insemination), number of cows pregnant, number of cows give birth and sex of calves presented in (Table 18). Retrospective data obtained from AITs recording book from the year 2009 to 2012 were used for analyzing percentage of Artificial user, conception rate and survival rate of calf in study area for 4(four) consecutive years about 6054 cows were inseminated. From the total cows inseminated 699(11.55%) failed to conceive in the first insemination and second insemination. From the total cows inseminated in four years about 4594(75.88%) of cows were pregnant and 3424 (74.53%) numbers of cows give birth. From these 1895(55.34%) are male calve and 1524(44.66%) are female calve. The presented finding was agreement by report of (Teganu and feyera, 2016) where they reported from the total cows inseminated (9426 number cows) 1055 female calve, 1021 male calve and from 8493 cows inseminated, 2516 female callve, 2512 male calve were born in Tiyo and Sagure districts, respectively.

Table 18 Retrospective results of AI from 2009-202012

Year	Number cows inseminated first	Number cows inseminated second	Number of cows pregnant	Number of cows born	Sex of calf	
					M	F
2009	269(4.44)	31 (11.52)	199 (73.98)	172(86.43)	108(62.79)	64(37.21)
2010	992 (16.39)	149 (15.02)	835(84.17)	695(83.23)	392(56.40)	303(43.60)
2011	2116(39.95)	259 (12.24)	1632(77.13)	1165(71.38)	623(53.48)	537(46.62)
2012	2677(44.22)	260 (9.71)	1928(72.02)	1392(72.20)	772(51.87)	620(48.13)
Total	6054	699(11.55)	4594(75.88)	3424(74.53)	1895(55.34)	1524(44.66)

5. SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.1. Summary and Conclusion

According to the result of the study on assessments of status, practice and constraints associated with artificial insemination service in Gedeb Hassasa district, AI service has been given low emphasis from concerned body. The major farming activities in the study area are livestock production, crop production and mixed type of production. Purposes of keeping were cattle for milk, meat, draft, income, and breeding/replacement herd and trends of livestock number is decreasing in the area. The types of mating system used in the district are natural mating with selected bull, natural mating with unselected bull and artificial insemination (AI) services.

AI success rate of artificial insemination in the study area were challenged by few number of technicians, lack of private service, shortage of input, absence of weekend and holyday, and heat detection problems. Smallholder dairy farmers in study area also faces problem of un available AI service regularly without interruption and the repeat breeding is a major problem.

Constraints associated with AI service in the study area include poor awareness creation for dairy farmers about AI services, lack of AITs , long distance, high cost of service when the a service is given at home. Poor community, insufficiency of concerned body support, loss structural linkage between AI center and service giving unit, absence of collaboration and regular communication between , zonal, district and other stakeholder, , inadequate resource interms of inputs and facilities and absence of incentives and rewards to motivate AI technicians. It can be concluded that AI service in the area is not satisfactory unless corrective measures are taken by concerned and responsible bodies in the study site

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5.2. Recommendation

Based on output of this study the following recommended:

- Awareness should be created by providing training for dairy owners focusing on heat detection, time of insemination and herd management to enhance their knowledge about artificial insemination service;
- Expand and fulfilled the existing AI centers.
- Artificial insemination/ duration of heat stay is function of time, governments and concerned body should have to adjust transportation mechanism for AI experts like motorbikes to provide fast and satisfactory services for the community.
- Regular training should be given for AI technicians about technical and organizational facilities for AI to increase their skills.
- Improvement on the environmental aspect and strengthening input supply systems for cross-breeding programs.

6. REFERENCES

Alazar D (2015). Livestock Input Supply and Service Provision in Ethiopia: Challenges and Opportunities for Market Oriented Development. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 20 ILRI (*International Livestock Research Institute), Nairobi, Kenya.*

Alemayehu Lemma (2010). Factors Affecting the Effective Delivery of Artificial Insemination and Veterinary Services in Ethiopia: Ada'a Case. Presentation by Alemayehu Lemma (Addis Ababa University) to the Ethiopian Fodder Roundtable on Effective Delivery of Input Services to Livestock Development Addis Ababa, 22 June 2010.

Kohler Rollefson ((2004).Status of Artificial Insemination in "Constraints and Acceptability under Field Condition". *Journal of Dairy, Veterinary & Animal Research* 3(3).

Azage Tegegne (2012). Technological Options and Approaches to Improve Smallholder Access to Desirable Animal Genetic Material for Dairy Development: IPMS (Improving Productivity and Market Success) Experience with Hormonal Oestrus Synchronization and Mass Insemination in Ethiopia. "Resilience of agricultural systems against crises" Göttingen

Bainesagn Worku (2015).Assessment of Breeding Practices and Evaluation of Estrus Synchronization and Mass Insemination Technique in Dairy Cattle in West Shoa Zone MSc thesis, Haramaya University, Haramaya, Ethiopia.

Bekele Hailu (2016) . Breeding Practices of Dairy Cattle in and around Assosa Town, Dasash Kassa and Abdi Abdulahi, Assosa University

Bekana M (2005) Reproductive Performance of Fogera Heifers Treated with Prostaglandin F2a for Synchronization of Estrus. *Tropical Animal Health and Production* 37, 373-379.

Bekana M. (2009): Farm animal obstetrics, Monograph, Faculty of veterinary medicine, Addis Ababa University. 1-12pp.

Binici, T, Abate G (2006): Assessing production efficiency of dairy farms in Burdur province, Turkey. *J Agriculture and Rural Development Trop. and Subtropics*, 107: 1-10pp.

Butswat, I. S. and Choji, G. F. (1995): Constraints to the adoption of Artificial Insemination techniques in livestock production in Bauchi L.G.A. of Bauchi State. *Nigerian Journal of Animal production*, 5 (4): 93-188pp.

Central Statistical Authority (CSA), (2011). Sample enumeration report on livestock and farm implement IV, Addis Ababa, Ethiopia, pp.: 26-136pp.

Central Statistics Agency (CSA) (2013). Agricultural Sample Survey 2006/07, volume II, Report on livestock and livestock characteristics. Statistical Bulletin 388 Addis Ababa, Ethiopia, 9-10:25-27pp.

Central Statistics Agency (CSA) (2016) Federal Democratic Republic of Ethiopia, Central Statistical Agency (CSA) Agricultural Sample Survey, Volume II, Report On Livestock And Livestock Characteristics (Private Peasant Holdings).Statistical bulletin, 583, June 2016, Addis Ababa, Ethiopia.

Dalton, J., C. (2011): WCDS Advances in Dairy Technology, 23: 215-229.

Dekeba, A (2006) Performance of the Abernossa Ranch in the production of Ethiopian Boran x Holstein cross bred dairy heifers in Ethiopia Ethiop *J. Anim. Prod.*, 6, 33-53pp.

Desalegn G (2009) Status of Artificial Insemination Service in Ethiopia. A paper presented at the 17th Annual Conference of the Ethiopian Society of Animal Production (ESAP), held at the Head Quarters of the Ethiopian Institute of Agricultural Research (EIAR), Addis Ababa, Ethiopia, pp. 87-104pp.

Diribi Mijena, Mulisa Faji, Kedija Ahmed and Wendimu Bireda 2017. Status of Artificial Insemination Delivering in and Around Assosa Town.

FAISETD (Field AI service Extension and Training Department) (2007). Millennium Report National AI Center, Addis Ababa.

FAISETD (Field AI service Extension and Training Department) (2016). Semen Production and Distribution Report National AI Center, Addis Ababa.

FAO (2006). Livestock's Long Shadow: Environmental Issues and Options, edited by H., Steinfeld, P., Gerber, T., Wassenaar, V., Castel, M., Rosales & C., de Haan.

FAO (2007). The State of the World's Animal Genetic Resources for Food and Agriculture, edited by: B., Risch

FAO (2010). Agricultural biotechnologies in developing countries: Options and opportunities in crops, forestry, livestock, fisheries and agro-industry to face the challenges of food insecurity and climate change (ABDC-10): Guadalajara, Mexico, 1 – 4 March 2010. Current Status and Options for Livestock Biotechnologies in Developing Countries 4-13pp.

Gebremedhin, D., (2005): All in one: A practical guide to dairy farming. Agri-service Ethiopia printing unit, Addis Ababa, 15-21pp.

Hafez, E., S., E. (1993): Reproduction in Farm Animals. 6th ed. Lea and Febiger Philadelphia, 465-468pp.

Hamid Jemal (2012). Study on Factors Affecting the Success of Artificial Insemination Program in Cattle, Siltie Zone. An M.Sc. Thesis, Addis Ababa University. DebreZeit, Ethiopia

Heinonen, M. (2002): Artificial insemination of cattle in Ethiopia. Ministry of Agriculture compiled report. Addis Ababa, Ethiopia, 71-103pp.

Herman,T (2004) Assessment of Breeding Practices and Evaluation of Mass Estrus Synchronization of Dairy Cattle in Sidama Zone, Southern Ethiopia MSc thesis, department of animal and range science, Hawassa college of Agricuture, school of graduate studies, Hawassa University, Hawassa, Ethiopia.

Kelay, B. (2002): Analyses of Dairy Cattle Breeding Practices in Selected Areas of Ethiopia. PhD Thesis, Humboldt University of Berlin, Faculty of Agriculture and Horticulture, 175pp.

Köhler-Rollefson I. (2004) Farm Animal Genetic Resources Safeguarding National Assets for Food Security and Trade Arsi Region, Ethiopia ILCA Research Report No. 11, ILCA, Addis Ababa, Pp. 58.

Kumar, S. (2005): Reproduction in rural bovines, divisions of animal reproduction, IVRI, Izatnagar, 200-243pp

Lemma, A., and Kebede, S. (2011): The effect- of mating system and herd size on reproductive performance of dairy cows in market oriented urban dairy farms in and around Addis Ababa, 11: 526-530pp.

Lobago, F. (2006): Reproductive performance of dairy cow in small holder production system in Selalle, central Ethiopia. Trop. Anim. Health Prod., 38: 333-342pp.

López-Villalobos N. (1998). Effects of Crossbreeding and Selection on the Productivity and Profitability of the New Zealand Dairy Industry PhD Thesis, Massey University, Palmerston North, New Zealand.

Maignel, L. (1996): Genetic variability of French dairy breeds estimated from pedigree information. Int. Bull. Eval. Serv. Bullno., 14: 49-54pp.

Masama, E. (2003): Reproduction and lactation performance in a small holder diary system in Zimbabwe. Trop. Anim. Health Prod., 35, 117-129pp.

Meles, G., M. and Heinonen, K. (2002): Artificial insemination results in Tegulatina Bulga Awraja, Institute of Agricultural Research, and Addis Ababa. Bulletin, 97-99pp.

Metaferia F, Cherenet T, Gelan A, Abnet F, Tesfay A, Ali JA, Gulilat W. A. 2011. Review to Improve Estimation of Livestock Contribution to the National GDP. Ministry of Finance and Economic Development and Ministry of Agriculture Ethiopia: Addis Ababa.

NAIC (1995): NAIC at Glance, Ministry of Agriculture, national artificial insemination center, Addis Ababa, Ethiopia. A monograph,1-30pp.

Naokes, D (2001): Arthur’s Veterinary Reproduction and Obstetrics, 8 ed. Elsevier Ltd., Pp. 75-753pp.

Negussie E. (2010). Reproductive Performance of Local and Crossbred Dairy Cattle at Assela Livestock Farm. Arsi, Ethiopia. MSc Thesis, Alemaya University of Agriculture, Ethiopia

Nuraddis Ibrahim, (2014) Assessment of Problems Associated with Artificial Insemination Service in Selected Districts of Jimma Zone. *Journal of Reproduction and Infertility 5* (2): 37-44pp.

Pilling, D. (2007): The use of reproductive and molecular biotechnology in Animal Genetic Resources management: a global overview Animal Production and Health Division, FAO, V. ledelle Terme di Caracalla 1, 00100 Rome, Italy, 40: 1-13pp.

Risco C.A. (2000): Management and economics of natural service sires on dairy herds. In: Topics in bull fertility Chenoweth PJ Ed, Internal Veterinary Information Service Ithaca, NY, 145-167pp.

Rocha, A. (2001): Reproductive parameters and efficiency of inseminators in dairy farms in Portugal. Reprod. Domestic Anim., 36: 319-324pp.

Rodriguez-Martinez, H. (2000): Evaluation of frozen semen: Traditional and new approaches: In the topic of bull fertility. Traditional and new, Chenoweth (Ed.) Topics in bull fertility: *International veterinary information; International veterinary information service*, Pp. 1.

Rogers, P. (2001): Bovine fertility and control of herd infertility. Grange Research Centre, Dunsany, Co. Meath, Ireland, http://homepage.eircom.net/~progers/infertil.htm.

Rozeboom, K., J. (2007): The Benefits and Constraints to Widespread use of Reproductive Technology in the Future. North Carolina State University, 56-63pp.

Sharew mekonnen. (2018): Assessment of breeding practice, statues of estrus synchronization and mass insemination of dairy cattle in the north shewa zone, Ethiopia.

Shiferaw Y (2003). Reproductive Performance of Crossbred Dairy Cows in Different Production Systems in the Central Highlands of Ethiopia. Tropical Animal Health and Production 25, 551-561pp.

Shiferaw (2012). Assessment of Breeding Practices and Evaluation of Estrus Synchronization and Mass Artificial Insemination Techniques in Dairy Cattle in West Gojjam Zone MSc thesis Bahirdar University College of agriculture and environmental sciences, graduate program, Ethiopia.

Sinishaw, W., (2005): Study on semen quality and field efficiency of artificial insemination bulls kept at the national AI center. MSc. Thesis, Addis Ababa University, Faculty of Veterinary Medicine, DebreZeit, Ethiopia.

Smith, R., D. (2012): Factors affecting conception rate. Proceedings of national invitational dairy cattle production workshop, Cornel University, 1-8pp.

Smith, W. Gilson, W. (2005): Effects of artificial insemination versus natural service breeding on production and reproduction parameters in dairy herds. Profess. Anim. Sci., 20: 185–190pp.

Tadesse Gugssa (2015) Effects of Prostaglandin Administration Frequency, Artificial Insemination Timing and Breed on Fertility of Dairy Cows and Heifers in Eastern Zone, Of Tigray Region, Ethiopia MSc thesis, Mekelle University.

Tegegne, A. (2016). History and Experiences of Hormonal Oestrus Synchronization and Mass Insemination of Cattle for Improved Genetics in Ethiopia: From science to developmental impact. LIVES Working Paper 16. Nairobi, Kenya*: International Livestock Research Institute (ILRI).*

Teganu Gizawu , Feyera Dima (2016). Asssessment of problems and constraints associated with artificial insemination service in two selected district of arsi zone.

Tessema Reta and Atnaf Alebie (2015) Assessment of Problems Associated with Artificial Insemination Services in and Around Gondar Town, North West Ethiopia. Journal of Reproduction and Infertility 6 (2): 22-26pp.

Teweldemedhn Mekonnen* and Leul Berhe (2020). Assessment on artificial insemination service delivery system, challenges and opportunities of artificial insemination services in cattle production in Western zone of Tigray Region, Ethiopia.

Thibier, M., Humbolt, P.& Guerin, B. (2004): Role of reproductive biotechnologies: global perspective, current methods and success rates, In G. Simm, B. Villanueva, K.D. Sinclair & S. Townsend (Eds), Farm Animal Genetic Resources. British Society for Animal Science, Publication 30, Nottingham University Press, Nottingham, United Kingdom,171-189pp.

Valergakis, G. (2007): Comparative study of artificial insemination and natural Service: cost effectiveness in dairy cattle. Mar, 1(2): 293-300pp.

Valergakis, G. Banos, E Arsenos, G. (2007): Comparative study of artificial insemination and natural Service: cost effectiveness in dairy cattle. Mar, 1(2): 293-300pp.

Webb D, (2003).Artificial insemination in dairy cattle series of Animal science department, Florida cooperative extension service.

Webb D,(2010).Artificial insemination in dairy cattle: Available at: http edis.ifas.ufl.edu/pdffilels//ds (08900)

Woldu, T. (2011).Factors Affecting Conception Rate in Artificially Inseminated Cattle under Farmer's Condition in Ethiopia: *Journal of Cell and Animal Biology Vol.* 5 (16), 334-338pp

Yemane, B. (2002): Improved Cattle Breeding National Artificial Insemination Centre. Addis Ababa, Ethiopia, 15pp.

Yohanis Kebebew and Tilahun Bekele(2018). Assessment of Efficiency and Major Constraint of Artificial Insemination Service in Small Holder Dairy Farmers in and around Adama Town. *Int. J. Adv. Res. Biol. Sci.*5(7): 88-99pp.

Zewde, E. (2006).Artificial Insemination Implementation Ethiopian Society of Animal 2003 Reproductive performance of crossbreed dairy Production (ESAP. Addis Ababa, Ethiopia, pp. 7-14.Cows in different production systems in the central.

Zewdie E. (2005): Improving artificial insemination services for dairy cattle in Ethiopia. In: Improving the reproductive management of smallholder dairy cattle and the effectiveness of artificial insemination services in Africa using an integrated approach. *International Atomic Energy Agency (IAEA),* 17-19pp.

Appendix

Questioner survey used to collected information from dairy farmer

Madda walabu University

College of agriculture and natural resource

Department of animal and range sciences

Questionnaire to be filled by dairy farmer

General direction

I would like to express my appreciate for you time and cooperation, in advance to fill this questionnaire. The purpose of this questionnaire is collect information regarding on status and constraint associated with artificial insemination services in Gadab Hasasa worada. This study purely academic.so you're genuine, frank and timely response are quite vital to determine the success of this study. There for I kindly request your cooperation in filling the questioner honesty and responsibly.

- No need of writing name
- The information you give will be kept confidential and used only for this study
- There is nothing "right" or "wrong" answer here and rather what is required is to show the level of your personal opinion to each item.
- If no need or write, the data collectors to fulfill your response
- Please, either tick in the appropriate boxes by using X or√

Part I personal information

The item 1_5 in this section request personal information

1. Name of your kebeles ____
2. Age; - 1. 20 –30 2. 31—40 3. 41—50 4. 51—60 5. Above 61
3. Sex of house hold head 1. Male 2. Female
4. Marital status of the households head 1.Married 2. Single 3. Divorced 4. widowed

5. Education level of house hold head

A. Illiterate
B. Spiritual learning
C. Reading and writing
D. Elementary school
E. Junior school
F. Secondary school
G. Above secondary school

6. Family size __________

Part II l livestock composition and farming

1. What is your major farming activity?

   1. Livestock production 2.Crop production. 3. Mixed type of production

2. Purpose of cattle production(rank)

   1. Milk 2. Meat 3. Draft 4. Income 4. Breeding/replacement 5. Other(specify__)

3. Trends of your livestock

   1. Increasing 2. Decreasing 3. Stable

4. Livestock number and composition

Cattle type	Number
Cattle	
Sheep	
Goat	
Donkey	
Horse	
Chicken	
Hive	

5. Number of cattle by type

Cattle type	Breed type	
	Local	Cross
Milking Caw		
Pregnant cow		
Calf		
Bull		
Heifer		

Part III. ARTIFICIAL INSEMINATION RELATED

1. Which types of mating system you used for your cattle?

   1. Natural mating with selected bull 2.Natural mating with unselected bull 3. AI 4, all types

2. Do you have AI service in your area? 1. Yes 2. No
3. If you're responded to Q2. Is yes, when you start AI using? ____________
4. Are you willing to use AI in animal breeding? 1. Yes 2. No
5. Have you ever crossbred your local cattle? 1. Yes 2. No
6. If yes, which breed did you use? _________________
7. If yes why you prefer cross breeding? __________
8. Have you accessed any breeding services in the last one year? 1Yes 2.No
9. If yes, how many cows you served? ______ And how many cows pregnant and born?___
10. If yes, specify the service below

Types of breeding system used in the farm 1=Bull scheme 2=AI services 3= both types	Organization that is offering the scheme 1=Gov't 2=NGOs 3=Private Practitioner 4=1 &3	you have to pay for the service 1=No 2=yes	If yes, How much did you pay per animal	the service was administered by 1.Government AI technician 2 private AI technician 3.Private practitioner (farmer) 4. all

11. How do you get the first information about AI service -----------?

    1. Extension agent. 2. .AI technician 3.Project agent 4. Neighbors 5. from other area 6=other (specify)

12. As a user of AI does you we get the services regularly without interruption?

    A. Yes 2. No

13. If no what is/are the reason for this?

    1. The service is not available on weekends & holidays 2. There is shortage of AITs
    3. There is shortage of inputs

14. How do you evaluate AI in giving services in the study area?

    1. Highly satisfied 2. Satisfied 3. Less satisfied 4. Non satisfied

2. How do you communicate with AI technician?
   A. We take our caw to AI station 2. We call AI technician when we need them 3. AITs visit us daily
3. Do you have any problem in using AI serves? 1. Yes 2. No
4. If yes what types of problems (rank)

No	problem	Rank
1		
2		
3		
4		

5. Do you have problem repeatedly breeding to get AI services? 1. Yes 2. No
6. If yes list the problem and rank

No	problem repeatedly breeding	Rank
1		
2		
3		
4		
5		

7. Have you faced failure of insemination? 1, Yes 2. No

8. If yes what do think the reason for the failure? (rank)

Factors	Rank
Heat detection problem	
AI technician efficiency	
Distance of AI center	
Absence of AI technician	
Disease problem	
Other	

9. If your cow do not conceive with repeated insemination then what do you do?
    1. Use AI again and again   2. Use natural mating   3. Other(specify)__________
10. Are you aware of heat detection? 1. Yes 2. No
11. If yes what are sign of heat detection/heat identification mechanism? ________
12. When should your cow, which came in heat in morning, be inseminated?

A. As heat sign is seen on it 2. On the same day afternoon 3. As technician order

13. When should your cow, which came in heat in afternoon, be inseminated?

A. As heat sign is seen on it 2. On next day morning 3. As technician order

14. Is there the give the services of AI in private center? 1. Yes 2. No
15. Do you get the services at your around the kebels /Mobile center/ 1. Yes 2. No
16. Do you get AI services on week end and holy day? 1. Yes 2.No
17. If no what do you do?

1. Pass the date without breeding the cow 2. Use Natural mating (NM)

18. Can you travel long distances to get the AI services? 1. Yes 2. No
19. What is the distance from your site of AI? ___________
20. Is there the shortage of artificial insemination technical /AITs/ in the services center?

A. Yes 2. No

21. Would you mind rising the services charge? 1. Yes 2. No

I if you're say No for the above equation why? ____

II If your say yes for the above equation why? __________________________________

PART IV Constraints of AI

No	CONSTRAINTS	RANK
1	Long distance travel	
2	Shortage of AITs	
3	High cost of AI services	
4	lack of mobile AI service	
5	lack of weekend AI service	
6	absence of private AI service	
7	lack of awareness heat detection	