

Challenges and Opportunities of Artificial Insemination on Dairy Cattle in Ethiopia

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Abstract

Artificial insemination is very important for genetic improvement, especially in dairy cattle breeds. It has problems in meeting the needs of some producers, not its opportunities. The objective of this study was the challenge and opportunity of artificial insemination on dairy cattle in the case of Sayo district, west Wollega Zone, Ethiopia. The problem of not using Artificial insemination is not limited to the region, and there are also dairy farmers in our district who have not practiced the service due to various challenges. In addition, most of the Artificial insemination services reported by the dairy industry have failed, rather than bull services. However, although there are few attempts to quantify opportunities, constraints, and why producers do not use artificial insemination services in other regions, researchers have not disclosed well-documented data on the challenges and opportunities of artificial insemination services in the Sayo region. The Result is Artificial insemination has played an important role in increasing milk production in the study area because the crossbreed that got good traits from exotic breeds gave high milk than local breed.

Keywords

Challenges, Opportunities, Dairy Cattle, Artificial Insemination

1. Introduction

Artificial insemination plays a great role in maximizing the genetic potential of local breeds in combination with good management practice. The success of AI in improving the production and reproduction performance of the local breeds, however, is the combination of the inseminator

efficiency, availability of infrastructures, and the presence of efficient quality semen for the service. Though, AI was very crucial for genetic improvement especially in dairy cattle breed sit has posed problems in satisfying the need of some producers in contrary with its opportunities. The problem of not using AI was not area limited but also there were dairy breed owners in our district who practiced the service and not practiced it due to various challenges. Besides, most of the dairy sectors were seen in reporting failures of AI service than bull service. However, there was no well documented data that revealed by researchers on the challenges and opportunities of artificial insemination service in the Sayo district in spite of few attempts to quantify the opportunities, constraints and why producers were not using artificial insemination service in other districts. Due to this, there was an information gap to the dairy sectors and other producers on the challenges and opportunities of artificial insemination. Therefore, the present study was initiated to fill this information gap. The objective this study was challenge and opportunity of artificial insemination on dairy cattle in case of sayo district west wollega zone, Ethiopia

2. Literature Review

Dairy cattle and livestock have important contributions to agriculture, food, and rural development. They provide products and services such as milk, meat, electric power, and manure for fertilizer and fuel (Mekonen et al., 2012). Dairy farming is seen as one of the few agricultural activities that can provide sufficient income to maintain the economic viability of smallholder farming (Staal et al., 1996), and has the potential to generate income and employment in order to improve farmers' welfare smallholders (Walshe et al., 1991). Small farmers in tropical countries have a broad perspective on milk production and need effective livestock genetic improvement programs to advance their livelihoods. To develop the genetic disposition of animals, selection and breeding methods can be used (Raganitsch et al., 1990; Willam and Simianer, 2011). Breeding methods are distinguished in pure and crossbreeding systems (Willam and Simianer, 2011). In order to develop sustainable genetic improvement programs, it is necessary to know which breeds farmers consider most suitable for their environment, their perceptions of breed attributes, and the factors that influence their breeding decisions (Bebe et al., 2003). In dairy cattle breeding, most of the dairy farmers in the highlands, middle lands, and lowlands in Ethiopia use natural mating using native males (Tesfa, 2009). In addition to natural mating, some farmers in the Sayo district use artificial insemination to produce males with superior genetic quality

Artificial insemination means the entry or delivery of semen into the female genital tract using man-made tools, so it is not natural or a method or technique to insert semen (sperm or semen) that has been thawed and has been pre-processed from male cattle into the female genital tract using a special method and tool called an insemination gun (Toelihere, 1993; Feradis, 2010). In practice, AI procedures involve not only deposition or delivery of semen into the female genital tract but also the selection and rearing of males; storage, assessment, dilution, storage and preservation (cooling and freezing) and transportation of cement; insemination, recording, and determining the results of insemination in female animals; guidance and counseling to farmers.

In 1959 and the following years, the development and application of AI still following in the footsteps of B. Seit, namely the use of liquid semen to improve the genetic quality of dairy cattle. The purpose of Artificial Insemination is to improve the genetic quality of livestock; its implementation does not require superior males to carry to the required places thereby reducing

costs; optimizing the wider use of superior males for a longer period; increase the birth rate rapidly and regularly, and prevent the transmission or spread of sexually transmitted diseases.

Sawadogo et al. (2007) suggests several benefits that can be obtained from the use of AI, namely:

1. Utilizing as much as possible the usability of a male who has superior genetic quality. The usability of a male with superior genetics can be utilized as much as possible. For example: in natural mating, a male can only serve 50 to 70 female cows in one year. With AI, a male can serve 5,000 to 10,000 female cows per year. Some superior males have even produced 100,000 to 200,000 offspring during their lifetime
2. Save on male rearing costs;
3. AI allows increasing the potential for selection as a way to improve the quality of livestock;
4. Prevent disease transmission;
5. Shortening the calving interval and decreasing the number of females that mate repeatedly.

Meanwhile, other benefits are AI allows mating between animals of vastly different sizes without causing injury or harm to females or males; AI can extend the time of use of males who for physical reasons are unable to copulate normally. AI can continue to use old or impotent males; Experimentally, AI can be used to produce hybrids or crosses between animal species that do not mate voluntarily; AI can stimulate higher interest in animal husbandry and better management practices; AI allows mating between animals or livestock that are separated in time and place; AI is very useful for use on females who are in estrus and ovulating but do not want to stand up for the males to ride

3. Methods

This research was designed as correlational descriptive survey research, with quantitative and qualitative approaches. Research used to describe what it is about a variable, symptom, or situation in the field (Akinlua & Haan, 2019). Pathak et al. (2013) explains, qualitative research is research that intends to understand phenomena about what is experienced by research subjects such as behavior, perception, motivation, and action, both in description in the form of words and language, in a specific context that natural and by utilizing various natural methods.

The research location is Sayo district, Ethiopia. This district is one of the centers of dairy cattle in Ethiopia. In addition, there was an information gap between the dairy sectors and other producers on the challenges and opportunities of artificial insemination.

Sayo Regency is a dairy farming area. They use the services of a natural bull for the breeding system. The population in this study were all dairy farmers in Sayo District, totaling 60 farmers. The number of samples was 45 female farmers and 15 male farmers. Primary data collection was carried out by conducting interviews with respondents based on questionnaires that had been prepared and had been tested previously and from other sources. The statistical test used to analyze the data is descriptive analysis.

4. Results

4.1 Household Characteristics

The house of interviewed dairy cattle owners is summarized in Table 1. As presented in the below table most of the respondents were male (75%) whereas female accounted for 25%. The attitude and participation of male towards AI was higher than female, because females believed the exotic breed consumes more feed so they have not power to manage those breeds by harvesting and buying of feeds. So that, females need awareness creation/training/ to use AI by development office. Majority of the education status of respondents in the study areas were primary school (36.67%), secondary school (21.67%) and above secondary school (16.66%). The result showed that small portion of the respondents was illiterate (25%) as compare to literate (sum of primary, secondary and above secondary school). It is believed that literate farmers have better awareness about advantages of AI and improved breed management than illiterate farmers. The below table indicated that 66.67% of the respondents were >35 years old and 23.33% ranged from 25-35 years. This showed that as age increases, the understanding of the farmers towards AI will increase and may easily cope up the challenges and better use the opportunities (Table 1).

Table 1. Household Characteristics

Demography of households	N	%
Sex		
Male	45	75
Female	15	25
Lever of Education		
Illiterate	15	25
Primary school	22	36.67
Secondary school	13	21.67
Above secondary school	10	16.66
Age		
20-25	6	10
25-35	14	23.33
>35	40	66.67

N= number of households %=Percent

4.2 Challenge of Artificial Insemination of Cattle Production System

Production system has influences on AI service and production and reproduction performance of dairy cows. The present result indicated that majority of the households (65%) practiced mixed production system, however, the traditional system accounted for 35%and there was no modern production system. So that this study showed that the type of production system influenced on AI efficiency (productive and reproductive performance) of dairy cattle. The more production system becomes the better the opportunity of AI and the more production and reproduction performance of the dairy cows and the more production system becomes the better decrease the challenges of AI than traditional system (Table 2).

Table 2. Cattle production system

Production system	N	%
Mixed	39	65
Traditional	21	35
Modern	-	-
Total	60	100

N= number of households

% = Percent

Even if AI was practiced continuously in the study area, they faced problems. Among that oestrus detection, management factor, semen quality, in ability AI technician, absence of AI technician was major challenges. According to the respondent majority of heat detection were performed by heard man information (65%) and 35% of heat detection done by regular following during morning and evening. But herdsman might not recognize cows on heat due to lack of ability and carelessness detecting of cows on heat. In addition to this according to the respondent most of the cows come to heat at night, so this is difficult to detect the cows due to lack of light in the house and lack of regular follow of the farmer. Generally, heat detection problem for AI service accounts about 38.33% loss of time of insemination. Insufficient and/or inaccurate oestrus detection leads to delayed insemination, reduced conception rates and thus extended calving intervals (Hammoud et al., 2010). Management factor accounts 15% to the challenge of AI in the study area. Management factor (nutrition, disease and housing system) were determinant factor for the success and challenges of AI in the study area. Among those, nutrition factor was highly affecting the success of AI in the study area. Several factors related to management play roles in successful pregnancy among which nutritional management contribute the largest proportion (Chagas et al., 2007).

According to the respondent the majority of the feed consumed by the cow was hay (43.34%), so it affects the number of service per conception of cows. Animals fed well balanced feed has high rate of conception rate (Anzar et al., 2003). Semen handling and storage is important to achieve threshold or above threshold number of sperms to the ovum necessary to maximize fertilization rate and embryo quality, so poor semen quality is one of the constraints (Saacke 2008). Sayo district semen for insemination (HF and Jersey breed semen) was come from Ethiopian NAIC through Nekemte. The semen used for insemination was thawed at temperature of 34°C. 23.33% of constraint of AI was due to the insemination of abnormal semen. This is due to the inseminator, thawing the semen beyond or below the temperature used (34°C) which affect the motility of semen. Due to this the number of service per conception (low conception rate) of cows was increase and there was lack of sometimes shortage of semen. In ability AI technician were account 5% to the limited factors of AI. This was inappropriate placement of semen in female reproductive tract (out of cervix) due to not gave attention to the cow's behaviour or less palpate the cows. One of the most significant contributions to the successful application of AI in cattle breeding has been made by the highly trained inseminator (López-Gatius, 2011).

Although professional inseminators palpate the reproductive tract of numerous cows every day, most are not trained to examine the uterus and ovaries. This poses a serious practical limitation to the success of AI (López-Gatius, 2011). Absence of AI technician was accounted 6.67 % to the limited factors of AI. In Sayo district there are only two AI technicians, so they may not address the heated cows. Furthermore, AI technicians went to meeting and on the day

Saturday and Sunday they do not found in the AI center (working place). Due to this the cows loss its time of insemination. Even if there is no highly lack of transportation access, distance from AI center had limiting factor (3.34%) in the study area. This is due to low road accessibility especially during night. Lack of awareness also a limiting factor in the study area. It accounts 8.33%. Because peoples believes that the exotic breed consumed high amount of feed, requires high management, high cost and also believes that AI service gives high male to female ratio calves. So it limits expansion of AI (Table 3).

Table 3. Challenge of AI

Parameter	N	%	Rank
AI technician	3	5	6
Semen quality	14	23.33	2
Management Factor	9	15	3
AI technician	4	6.67	5
Shortage			
Lack of awareness	5	8.33	4
Heat detection	23	38.33	1
Distance of AI center	2	3.34	7

N= number of households

%=Percent

4.3 Opportunities of Artificial Insemination

According to the respondents, there lack of improved bull in the study area, so that opportunities were introduced for the utilization AI to improving dairy cow. The main opportunities of AI rose by farmers in the study area were: Artificial insemination have played an important role in increasing milk production in the study area, because the cross breed that got good trait from exotic breed gave high milk than local breed. Artificial insemination has become one of the most important techniques for increase milk production and genetic improvement of farm animals (Armstrong et al., 2003). In the study area one great opportunities was created by motivating the farmer to use AI service were not paid per service provided that they get quality semen and reliable service in order to satisfy the demand for increasing AI users. This quality semen had played an important role in increasing genetic progress by upgrading the reproductive rate of the cow (shorten calving interval and increase lactation length). The growing demands for reliable services and quality semen, in most cases, users of the AI service are willing to pay even higher fees per service provided that they get quality semen and reliable services Chebo & Alemayehu, 2012). The percentage of pregnancies resulting from AI is the product of cows detected in heat and inseminated fertility level of the herd, semen fertility level (Risco 2000).

Artificial insemination also increase the selection potential of farmers, because to use AI farmers select the best cows that have good body condition to hold AI (exotic breed) so as to make good pregnancy without difficulty during birth. Selecting superior breed for crossing of local breed has significant important for AI utilization and breed improvement. AI increases the selection intensity since less bull is needed and it is the basis for selection progress (Zumbach, 2000). The presence of infrastructure in the study area such as water, electricity and communication (telephone and network) in the study area. Furthermore, there are road access and vehicles which were important for AI to apply at the right time. The presence availability of infrastructure like liquid nitrogen, important for keeping of the semen in good condition so as to

improve the fertility rate, insemination material were had an important key role in maximizing the success of AI.

The major challenges raised by the farmer were mainly shortage of technician, poor management, lack of awareness toward AI, heat detection problem, semen quality semen, distance from AI center and inability of AI technician whilst the main opportunity for wide AI use were increasing genetic progress by improving the reproductive rate of the cow such as shorten calving interval, increase lactation length, increase milk production and genetic improvement. Generally, breed type, management and technical skills regarding to determining/known whether the cows were on heat or not were the limiting factors for artificial insemination in the area, besides the presence of equipment's and provision of quality semen from the center were promoting factor for artificial insemination.

5. Conclusion

The major challenges raised by the farmer were mainly shortage of technician, poor management, lack of awareness toward AI, heat detection problem, semen quality semen, distance from AI center and inability of AI technician whilst the main opportunity for wide AI use were increasing genetic progress by improving the reproductive rate of the cow such as shorten calving interval, increase lactation length, increase milk production and genetic improvement. There should be an effort/collaboration activity with the near institution to enhance the opportunities more than the current status

References

- Akinlua, S., & Haan, P. (2019). Comparing and contrasting descriptive designs: Observational studies, correlational research, developmental design and survey research. ResearchGate.
- Anzar, M., Farooq, U., Mirza, M. A., Shahab, M., & Ahmad, N. (2003). Factors affecting the efficiency of artificial insemination in cattle and buffalo in Punjab, Pakistan. *Pakistan Veterinary Journal*, 23(3), 106-113.
- Armstrong, D. G., Gong, J. G., & Webb, R. (2003). Interactions between nutrition and ovarian activity in cattle: physiological, cellular and molecular mechanisms. *Reproduction (Cambridge, England) Supplement*, 61, 403-414. PMID: 14635951.
- Bebe, B. O., Udo, H. M., Rowlands, G. J., & Thorpe, W. (2003). Smallholder dairy systems in the Kenya highlands: breed preferences and breeding practices. *Livestock Production Science*, 82(2-3), 117-127.
- Chagas, L. M., Bass, J. J., Blache, D., Burke, C. R., Kay, J. K., Lindsay, D. R., ... & Webb, R. (2007). Invited review: New perspectives on the roles of nutrition and metabolic priorities in the subfertility of high-producing dairy cows. *Journal of dairy science*, 90(9), 4022-4032.
- Chebo, C., & Alemayehu, K. (2012). Trends of cattle genetic improvement programs in Ethiopia: Challenges and opportunities. *Livestock Research for Rural Development*, 24(7), 1-17.
- Feradis, M. P. (2010). Bioteknologi Reproduksi Pada Ternak. *Alfabeta. Bandung*.
- Hammoud, M. H., El-Zarkouny, S. Z., & Oudah, E. Z. M. (2010). Effect of sire, age at first calving, season and year of calving and parity on reproductive performance of Friesian cows under semiarid conditions in Egypt. *Archiva Zootechnica*, 13(1), 60.

- López-Gatius, F. (2011). Feeling the ovaries prior to insemination. Clinical implications for improving the fertility of the dairy cow. *Theriogenology*, 76(1), 177-183.
- Pathak, V., Jena, B., & Kalra, S. (2013). Qualitative research. *Perspectives in clinical research*, 4(3).
- Raganitsch G., Huber H., Raith F. (1990). Tierzucht und Tierhaltung Landwirtschaftliche Nutztier-Halten, FOTtern, ZOchten. Leopold Stocker Verlag, Graz, Band 1, 67-85.
- Risco, C. A. (2000). Management of the postpartum dairy cow to maximize pregnancy rate. In *XXI World Buiatrics Congress/XXVIII Jornadas Uruguayas de Buiatría*. Centro Médico Veterinario de Paysandú.
- Saacke, R. G. (2008). Sperm morphology: Its relevance to compensable and uncompensable traits in semen. *Theriogenology*, 70(3), 473-478.
- Sawadogo, G. J., Ouedraogo, G. A., Diakhoumpa, M., & Yameogo, N. (2007). Analysis of the cost and benefit of bovine artificial insemination in Senegal. *Application of Radioimmunoassay in Improving the Reproductive Management of Smallholder Dairy Cattle*, 44.
- Staal, S., Delgado, C., & Nicholson, C. (1997). Smallholder dairying under transactions costs in East Africa. *World development*, 25(5), 779-794.
- Tesfa Gebremicheal. (2009). Reproductive performance of indigenous dairy cattle in south Wollo. MSc Thesis, *Mekelle University*, Ethiopia. 65p.
- Walshe, M. J., Grindle, J., Nell, A., & Bachmann, M. (1991). *Dairy development in Sub-Sahara Africa: A study of issues and options* (No. 135).
- Willam A. and Simianer H. (2011). Tierzucht-Grundwissen Bachelor. UTB Verlag, Stuttgart, 41-274.
- Zumbach, B., & Peters, K. J. (2000). Sustainable breeding methods for smallholder dairy production under unfavourable conditions in the tropics. *Deutscher Tropentag. International Agricultural Research, A contribution to Crisis Prevention*, 246-247.