World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Success rate of local and crossbred cow through Artificial Insemination (AI) in Sylhet region of Bangladesh

Fowzia Bahar [1,*], Tanzila Zafrin Tanvi [1], Mahfuza Ferdous [2] and Nazmin Sultana Runa [3]

[1] *Department of Livestock Production and Management, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100.*
[2] *Department of Animal Nutrition, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100.*
[3] *Department of Physiology, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100.*

World Journal of Advanced Research and Reviews, 2024, 21(02), 124–129

Publication history: Received on 28 December 2023; revised on 31 January 2024; accepted on 02 February 2024

Article DOI: https://doi.org/10.30574/wjarr.2024.21.2.0359

Abstract

The study aimed to assess the conception rate as an indicator of the success of Artificial Insemination (AI) of selected AI points of Sylhet district. Three years (2020 -2022) data from Khadim Nagar, Mirza Jungle, and Jaintyapur have been used for this study. Result revealed that Jaintyapur point achieved highest conception rate (98.96%) and lowest found at Khadim Nagar (86.93%). On the other hand, among the total inseminated cattle, 95.6% were a crossbreed. In contrast, 96.2% were local breed. However, while comparing the different semen used for AI, insemination with D×128 attained conception rate 100% at Jaintyapur AI point. Whereas the lowest performance reported SL×788 as 90%. In the case of parity of the cattle, conception rate was 96.5% in first parity, 95.6% in second, 96.7% in third,97.2% in fourth and 65.5% in fifth. Overall, the success of AI in Sylhet district could be considered satisfactory.

Keywords: Artificial Insemination; Cattle; Success rate; Conception rate; Semen

1. Introduction

The Artificial Insemination (AI) technique, widely employed in Bangladesh since the late 1950s and applying in cattle reproduction, it has gained significant popularity (1). Improving reproductive efficiency through AI is considered one of the most effective methods, with considerable potential in male contributions, even if the enhancement in cow population reproductive efficiency is comparable to natural mating. Maximum reproductive efficiency, defined as obtaining the highest number of calves from the parent stock within a specified timeframe, is a key consideration of AI (2).

In addition, achieving earlier calving and shorter calving intervals, influenced by shorter gestation periods and optimal post-partum breeding intervals, is often as achievable through natural mating as with artificial insemination (3). Livestock is a major industry in Bangladesh and contributing a significant factor to the progress of economy. The cattle population in Bangladesh's livestock sector stands at approximately 24.85 million, with their contribution to the Gross Domestic Product (GDP) of the country amounting to 1.85% (BBS, 2023). But compared to other Asian nations, the dairy business is not as established here. The nation has worked hard to increase the production of native breeds by combining better exotic dairy breeds with locally adapted cattle breeds through an artificial insemination (AI) program(4) There are numerous reproductive issues with crossbred dairy cows raised in farmer's circumstances(5) The program's success is limited by reasons such as inferior diet, poor husbandry practices, and inadequate

* Corresponding author: Fowzia Bahar

infrastructure. Dairy farmers are challenging complaints of decreased reproductive performance in animals employing AI.(6).

The main drivers for uptake of the AI are, cost of the semen, the cost of insemination and success of the process. In Bangladesh, AI is generally performed with the technician available at different AI points under the sub-centers in a district. There are 23 AI Centers, 423 Sub-centers, and 554 AI points to cover all 64 districts of the country using frozen semen(7).

Nowadays, some private organizations are also providing service of AI at field level for the sake of continuously increasing demand for commercial dairy farmers. However, farmers are interested in introducing AI for profitable business development that depends on the individual reproductive performance of the cow including both biological and management factors. So, it is inevitable to ensure various factors like heat detection, temperature maintenance, proper nutrition, technician performance, quality of the semen, etc. for the success of the technique. However, frozen semen, a popular element in straws, contains active spermatozoa supplied by the central breeding station that is considered as a unit of storage for insemination at present period of cattle breeding(8). It is easily handled and applied gently to cattle. Additionally, a cow's productive efficiency can be estimated by factors like age at puberty, calving interval, conception rate, and some inseminations (9).

Moreover, the previous study showed that optimum achievement as profit could be possible with a pregnancy rate of 80% after the first insemination(10). Only a few research have been carried out in the Sylhet region to determine the elements of successful AI, although they are not predicated on AI points. Therefore, the purpose of the current study is to find out how three specific places in the Sylhet districts are doing in terms of successful AI with an aim to assess the success rate and evaluate semen breed success at three specific locations in the Sylhet districts.

2. Materials and methods

2.1. Study area

The study was conducted at three AI points namely Khadim nagar, Mirza Jungle, and Jaintyapur in Sylhet region based on three successive years of data.

2.2. Data collection

The data were collected from the record books provided by corresponding authorities at AI points for three consecutive years. For Khadim Nagar and Mirza Jungle, data of the years 2020, 2021, 2022 were collected. For Jaintyapur, data of the years 2019, 2020, 2021 were collected. A direct questionnaire-based survey was also performed to the AI technician to know the different aspects of performance of insemination at field level and major constraints in performance scoring.

2.3. Estimation of Conception Rate:

The conception rate was estimated from confirmation of pregnancy at day 60 rectal examination of post-insemination period among a total number of artificially inseminated cows with frozen semen in a specific period. The results obtained from this manner are generalized to the target population.

$$\textbf{Conception rate (CR)} = \frac{\text{No. of cows or heifer became pregnent}}{\text{No. of cows or heifer inseminated}} \text{ X } 100$$

The report of AI technician performance that provided the services of each point forwarded to the controlling Upazila Livestock Office (ULO). ULO reports service provided to the specific AI-centers. It is the hierarchy of information exchange and storage about for evaluating the success rate of AI for a given period as per the target of achievement set respectively.

2.4. Semen Quality Assurance

Firstly, collection of semen from a known genetic merit, which shows the best performance with the local condition. Then semen is preserved in liquid nitrogen at -196˚C temperature to maintain the quality of semen. After that it is tested for the viability of sperm in some sub-sectors.

2.5. Data analysis

The collected data were tabulated, sorted, and managed on Microsoft© Excel Spreadsheet. The complete analysis was performed by IBM SPSS version 20 statistical software package.

2.6. Delivery method

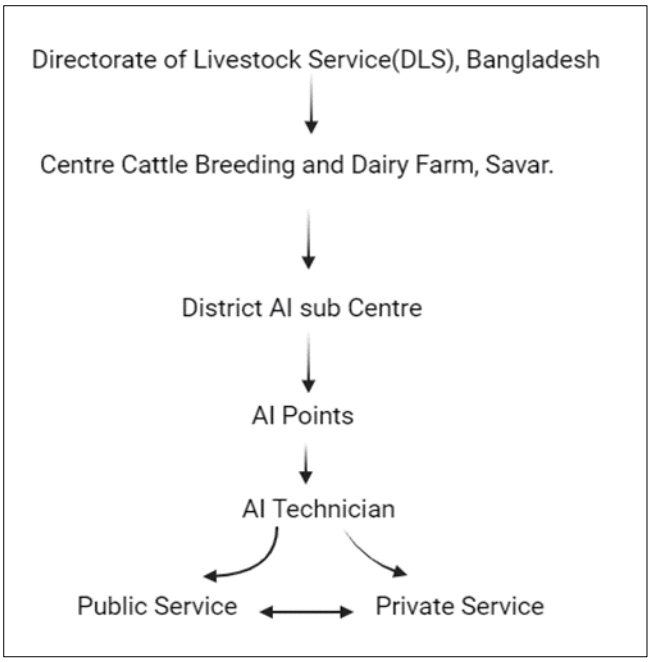

Figure 1 The delivery channel of the Semen for Artificial Insemination is described in figure

3. Results

The obtained results of conception rate are presented in table1. The result indicated that the highest conception rate in average found for three consecutive years (2019-2021) was highest at Jaintyapur point (98.96%) and lowest conception rate (2020-2022) at Khadim Nagar 86.93% on an average. The other point in (2020-2022) at Mirza Jungle point has 92.63% conception rate on average according to their records (Table 1). But the year basis result is slightly different. For Khadim Nagar point, in 2020 conception rate was 80.7% which was upgraded by 92.0% in 2021 and fall in 2022 to 88.1%. However, for Mirza Jungle, in 2020 conception rate was 92.7% which was upgraded by 93.3% in 2021 and fall in 2022 to 91.9%. But, in the case of Jaintyapur, it was higher than the two other points. Such as, in 2019 conception rate was 98.4%. On the other hand, in the year 2020 it was as high as 99.8%, and in 2021, it was little low as 98.7%.

Table 1 Conception rate of three different points in Sylhet region

Points Name	Year	Conception rate %	Average conception rate	Standard Deviation	Standard Error
Khadim Nagar	2020	80.7	86.930	0.171	0.006
	2021	92.0			
	2022	88.1			
Mirza Jungle	2020	92.7	92.630	0.209	0.005
	2021	93.3			
	2022	91.9			
Jaintyapur	2019	98.4	98.960	0.080	0.002
	2020	99.8			
	2021	98.7			

However, on the other hand, the total inseminated cases at three different points for three consecutive years show that, based on cattle breed, the cross population of inseminated cows have 95.6% success rate in conception. Whereas local breeds have 96.2% success rate in AI (**Table 2**). The results depict the scenario of taking AI services in a year-round is almost same proportion according to the breed of cattle population of those areas where AI points are located.

Table 2 Overall, Conception rate at three points based on cattle breed

Breed	**Observation of Artificial Insemination**			**Success Rate %**
	Conceived	Not Conceived	Total	
Cross	3546	162	3708	95.6
Local	1990	78	2068	96.2

Following these, the success rate of three points based on semen used to exhibit that the highest rate is 100% for D×128 semen that used at Jaintyapur point only. However, the lowest performer was SL×788 semen (90.0%). The other kinds of semen that were used in AI are SL×700, L×F×F, and SL×F that have success rate 95.0%, 95.5% and 97.1% respectively.

Table 3 Success rate of AI at three points based on semen type

Semen Breed	**L×F×F**	**SL×F**	**SL×700**	**SL×788**	**D×128**
Success Rate %	95.5	97.1	95.0	90.0	100.0
Crossbreed %	65.0	53.4	86.7	80.0	100.0
Local breed%	35.0	46.6	13.7	20.0	0.0

Table Success rate of AI at three points based on semen type.

The most widely used semen in the field by AI technician is L×F×F. This semen was preferred for serving 65% of the crossbred animal and 35% of local (**Table 3**). SL×F was preferred for 53.4% cross and 46.6% local cattle. Semen type SL X 700, SL X 788 and D X 128 been preferred for crossbred and local breed to 86.7%, 80 %, 100% and 46.6%, 13.7%, 0.0% respectively.

Table 4 Success rate of AI as per parity

Parity	**1st**	**2nd**	**3rd**	**4th**	**5th<**
Conception Rate %	96.5	95.6	96.7	97.2	65.6

Parity of the cattle population shows that success rate was 96.5% in first parity, 95.6% in second parity, 96.7% in third parity and 97.2% in fourth parity. However, the success rate in parity five and over is very low and is 65.6% (Table 4).

4. Discussion

The study was designed to estimate the AI success rate of Sylhet region based on AI points. In most of the breeding applications, whether estrous synchronization is followed or not, semen quality, placement, and timing of AI are critical to a successful pregnancy(11). Every point has a specific target to AI given by specific authorities in a specific year-round. However, the main reason for adopting AI technique in Sylhet region was found in field condition for getting the economic benefit. The simplicity of the technique is also responsible for the usage (12). The highest conception rate estimated (98.96%) in an average for consecutive three years at Jaintyapur point. But, in 2020 it achieved the best results as 99.80%. On the other hand, Khadim Nagar point shows 86.93% in averages which is comparatively lower than the other two points in a sense whereas the most successful year of AI was 2021 with 92.0% achievement, and Mirza Jungle point has 92.63% conception rate that is lower conception rate than Jaintyapur. In 2021, it got 93.3% conception rate at the point which is the best achievement in a year-round. In the records of the AI points, it was found that the time between heat and service was within 15 hours duration for all recorded cattle. That could be effective for a high level of conception rate in that area. Because timing is one of the most important factors for successful AI. Normal

estrous cycle in cows which expressed signs is essential so that insemination can occur at the appropriate time relative to ovulation. A previously conducted study showed that visual observation for standing heat and tail paint to detect estrous reported in individual herd ranging from 25 to 96% (13). However, the environment temperature is moderate of this area that could be another cause of this level of success rate. Other study reveals that during high temperature, the reproductive performance of lactating cows can be reduced whereas heifers do not affect lactating cows(14). But in another study, conception rate of cows markedly reduced when a higher temperature prevails for two days before insemination to 4-6 days after insemination(15). The body condition of the cattle was good enough and nutrient supplements in the ration also followed by a balanced diet that might cause the successful conception for the cattle in study area considered in this study.

The total number of cattle that had taken services from three different AI points during the consecutive periods of collected data was 5776. Among them, 64.19% were cross breed, and 35.80% were local breed. AI is a preferred method for crossbred animals than the local cattle. The overall success rate within the breed variety of cattle was very similar, where 95.6% was successful in the crossbreed and 96.2% for the local breed, respectively. Another study depicts the same results as there is no difference in conception rate between indigenous local and crossbred cows (Gwazdauskas *et al*., 1975). But other studies show that indigenous cows have higher conception rate than other genotypes of cattle breed (16). However, most of the farmers are used to taking natural services for their cattle in the grazing land, and therefore, the number of services in the local breed is almost half than the crossbreed. The system of preservation of semen is similar in all three study points. The liquid nitrogen (N_2) containers with -196˚C temperature are used at those points for cryopreservation of semen. The semen that is usually available in this region was brought into consideration to assess the success rate. The semen type D×128 was found to be 100% successful in Jaintyapur. The poorest success rate is 90% for SL×788. But the success rate is always upper than 90% ranges from 90-100% for all three points that is considered in this study. Thus, five semen types that were considered for AI in three specific points attained significant success rate.

This study also shows that the parity effect in conception rate. The fourth parity got the highest results in this study 97.2% (**Table 3**) which was gradually in the upward mark for every generation that was taken under AI services. The similar result found in another study where conception rate was increased gradually from first parity to fourth parity then decrease in the subsequent parities (17). Although the seasonal impact has not been shown in this study, it plays an important role in AI success rate. The seasonal variations in conception rate of cattle are not only because of seasons alone, but many other factors including the influence of bulls may be involved. Seasonal variation in conception rate might be due to possible changes in nutrition, environmental temperature, and climate and photoperiod as well. Also, success depends on technician performance. The place of insemination is also an essential factor to be mentioned. The success rate may vary from 50-100% due to technician skill of action of AI to the cattle (18). Further, there are too other factors that are related to the success rate which are not included here due to the time limitation of completing the task. Also, the lack of data availability at AI points record books are responsible for conducting this study with few variables. These are the limitations of this study.

5. Conclusion

In summary, the effectiveness of Artificial Insemination (AI) in the Sylhet region appears to be satisfactory. However, it's important to note that the study focused on only three AI point activities and a limited number of variables, requiring cautious interpretation of the results. At the same there are some factors like breed, cow management and AI technicians' expertise are key concerns for the conception rate. A more comprehensive study could provide a deeper understanding of the success rate of AI in the region.

Compliance with ethical standards

Acknowledgments

The author express gratitude to the AI stuff of Sylhet region for providing all necessary information and assistance during the course of study.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] BBS (2023), Bangladesh Bureau of statistics, Livestock Economy at a glance. *Department of Livestock Service, Bangladesh*

[2] Uddin B, Islam M, Nayem RK, Hassan MM. Occurrence of diseases of ruminants admitted at the Santhia upazila veterinary hospital of Pabna, Bangladesh. 2020;8(1).

[3] VanDemark NL. Artificial Insemination of Cattle. Journal of Dairy Science. 1961 Dec 1;44(12):2314–22.

[4] Salisbury GW, VanDemark NL, Lodge JR. Physiology of reproduction and artificial insemination of cattle. WH Freeman and Company.; 1978.

[5] Uddin J. Effect of age, parity and breed on conception rate and number of service per conception in artificially inseminated cows. [cited 2024 Jan 13]; Available from: https://www.academia.edu/14174946/Effect_of_age_parity_and_breed_on_conception_rate_and_number_of_service_per_conception_in_artificially_inseminated_cows

[6] Bekele T. Calf sex ratios in artificially inseminated and natural mated female crossbred dairy herd. In 2005. p. 225–30.

[7] Lemma A, Kebede S. 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. Revue Méd Vét. 2011;162(11):526–30.

[8] Hoque M, Salim H, Debnath G, Rahman M, Saifuddin A. A study to evaluate the artificial insemination (A1) success rate in cattle population based on three years record among different sub-centres of Chittagong and Cox's bazar district of Bangladesh. Pakistan Journal of Biological Sciences (Pakistan). 2003;6(2).

[9] Lyashenko A. Effect of different thawing procedures on the quality and fertility of the bull spermatozoa. Asian Pacific Journal of Reproduction. 2015;4(1):17–21.

[10] Löf E, Gustafsson H, Emanuelson U. Factors influencing the chance of cows being pregnant 30 days after the herd voluntary waiting period. Journal of Dairy Science. 2014;97(4):2071–80.

[11] Morrow D. Analysis of records for reproductive herd health programs. Irish veterinary journal. 1981;

[12] Saacke R. Insemination factors related to timed AI in cattle. Theriogenology. 2008;70(3):479–84.

[13] Vishwanath R. Artificial insemination: the state of the art. Theriogenology. 2003 Jan 15;59(2):571–84.

[14] Walsh S, Williams E, Evans A. A review of the causes of poor fertility in high milk producing dairy cows. Animal reproduction science. 2011;123(3–4):127–38.

[15] Collier R, Dahl G, VanBaale M. Major advances associated with environmental effects on dairy cattle. Journal of dairy science. 2006;89(4):1244–53.

[16] Gwazdauskas F, Wilcox C, Thatcher W. Environmental and managemental factors affecting conception rate in a subtropical climate. Journal of Dairy Science. 1975;58(1):88–92.

[17] Mayne C, Mackey D, Verner M, McCaughey W, Gordon F, McCoy M, et al. Fertility of dairy cows in Northern Ireland. Veterinary Record. 2002;150(23):707–13.

[18] Bhagat R, Gokhale S. Factors affecting conception rate in cows under field condition. Indian Journal of Dairy Science (India). 1999;(5).

[19] McKenna T, Lenz RW, Fenton SE, Ax RL. Nonreturn rates of dairy cattle following uterine body or cornual insemination. Journal of dairy science. 1990;73(7):1779–83.