Artificial Insemination in Mithun: Techniques for Estrus Detection and Artificial Insemination

Abuno Thepa[1]*, Kelevikho Neikha[2] and Ingutoli H Zhimo[3]

[1]*Department of Zoology, Multi-Disciplinary Research Centre, Nagaland University, Lumami Campus, Nagaland India- 798627*
[2]*Department of Zoology, Don Bosco College, Kohima-797001*
[3]*Department of Biotechnology, Nagaland University, Meriema Campus, Nagaland India- 797001*

Corresponding Author
Abuno Thepa
Email: Abunzthep@gmail.com

OPEN ACCESS

Keywords

Bos frontalis, Artificial Insemination, genetic improvement, silent estrus animals

How to cite this article:

Thepa, A., Neikha, K. and Zhimo, I. H. 2026. Artificial Insemination in Mithun: Techniques for Estrus Detection and Artificial Insemination. *Vigyan Varta* 7 (06): 1-6.

ABSTRACT

Mithun (*Bos frontalis*), an indigenous bovine species of Northeast India, holds immense socio-economic and cultural importance among tribal communities. In recent years, scientific reproductive management practices such as Artificial Insemination (AI) have gained attention for improving the reproductive efficiency and genetic potential of Mithun populations. However, successful implementation of AI in Mithun is often constrained by the occurrence of silent estrus, where behavioural signs of heat are weak and difficult to identify. This article highlights the major techniques used for estrus detection and artificial insemination in Mithun. Important estrus indicators including mounting behaviour, standing heat, vulval swelling, mucous discharge and uterine tone are discussed in detail. The article also describes various estrus detection methods such as visual observation, use of teaser bulls, fern pattern examination of vaginal mucus and rectal palpation. In addition, the principles, advantages, ideal timing and procedure of artificial insemination in Mithun are elaborated. This review emphasizes the importance of proper estrus detection and AI practices for the genetic improvement and conservation of Mithun in Northeast India.

INTRODUCTION

Mithun, an important bovine species native to the Northeastern hill region of India, plays a vital role in the livelihood, culture and economy of tribal communities. Traditionally, Mithuns are reared under free-range forest systems mainly for meat production, ceremonial purposes and socio-cultural values. However, with the gradual adoption of scientific livestock management practices, emphasis is now being placed on improving the reproductive efficiency and genetic potential of Mithun populations.

Artificial insemination (AI) has emerged as one of the most important assisted reproductive technologies in livestock production. Studies have reported pregnancy rates of approximately 40-60% per insemination under well-managed conditions, with large-scale field data indicating high cumulative conception rates following multiple AI services (Tadesse *et al*., 2022).

The technique involves the collection of semen from genetically superior males and depositing it into the reproductive tract of females at the appropriate time without natural mating. In Mithun, AI offers significant opportunities for rapid genetic improvement, conservation of elite germplasm, prevention of venereal diseases and enhancement of reproductive performance. The implementation of AI in Mithun requires accurate estrus detection because AI implementation depends on detecting female silent heat periods which female animals exhibit. Under field conditions, Mithun cows presents challenges for heat detection because these animals produce only minimal behavioral indicators of estrus which their handlers need to observe. Successful AI programs depend on accurate estrus detection and proper reproductive monitoring.

Mithun cows exhibit rare vocalization patterns during heat compared to traditional cattle because they produce and show reduced vocal sounds. The common signs of mounting and standing to be mounted, restlessness and frequent urination appear less intense. The identification of estrus requires trained personal to observe the animal because it displays subtle signs.

Estrus Behaviour in Mithun

'Estrus' is the period in the reproductive cycle of female animals during which they become sexually receptive and capable of conceiving. It is commonly referred to as "heat." During estrus, hormonal changes lead to ovulation and the female may exhibit behavioural and physiological signs. In Mithun, estrus signs are usually weak or silent,so called as 'silent estrus animals' making heat detection more difficult compared to other cattle species. The estrus cycle in Mithun generally ranges between 18 and 27 days, while the duration of estrus may vary from 36 to 72 hours. Female Mithun attain sexual maturity at approximately 24-32 months of age. One of the major reproductive challenges in Mithun is the occurrence of silent estrus, where behavioural symptoms are poorly expressed.

Unlike conventional cattle, Mithun cows rarely vocalize during heat and show less intense behavioural changes. Common signs such as mounting, standing to be mounted, restlessness and frequent urination are comparatively less prominent. Because of these subtle signs, careful observation by trained personnel becomes essential for proper estrus identification.

Primary Signs of Estrus

- Standing to be mounted by a bull
- Mounting behaviour

- Swollen and moist vulva
- Congestion of vulval mucosa
- Tail raising
- Transparent mucous discharge

Secondary Signs of Estrus

- Mild restlessness
- Reduced feed intake
- Frequent urination
- Increased alertness

Per rectal examination method serves as an effective method for detecting estrus in Mithun. The uterus shows tonic activity in its horns during estrus while the cervix remains relaxed and the mature follicles become accessible for palpation on the ovaries.

Techniques for Estrus Detection in Mithun

1. ***Visual Observation:*** The simplest method for estrus detection which most people use today involves visual monitoring. The best time to observe animals occurs during the early morning and evening hours because animals exhibit their highest sexual activity during these times. The detection efficiency increases when observers watch these animals for 30 minutes during the specified times.

2. ***Use of Teaser Bull:*** The use of a teaser Mithun bull is considered one of the most effective methods for identifying estrus females. The teaser bull roams the herd territory where it detects females who show heat through natural behavioral patterns. Cows in estrus usually allow mounting and exhibit greater attraction toward the teaser bull.

3. ***Fern Pattern of Vaginal Mucus:*** The fern pattern test is a simple and reliable physiological method for estrus detection. The researcher collects a sample of transparent vaginal mucus and spreads it on a clean glass slide. The slide undergoes examination after air drying through two methods which include microscopic inspection and dark background comparison. The heat period confirmation occurs through the mucus crystallization process which creates a distinctive fern-like pattern during estrus.

4. ***Rectal Examination:*** Rectal palpation serves to evaluate the three conditions of uterine tone cervical relaxation and ovarian follicular activity. The method proves most effective when animals display no behavioral signs of estrus or when they experience silent estrus.

Artificial Insemination in Mithun

Artificial insemination serves as an effective reproductive technology which enhances both productivity and genetic quality in Mithun populations. The technique enables the extensive use of semen from elite bulls and minimizes direct contact between animals thereby reducing the spread of reproductive diseases.

Advantages of Artificial Insemination

- The process enables the herd to achieve fast genetic progress.
- The expense of maintaining male breeding animals remains reduced.
- The natural mating process permits bulls to mate with only a certain number of female cows while AI allows the use of collected semen to impregnate multiple hundreds and thousands of cows.
- Conservation and propagation of superior germplasm
- Reduction in venereal disease transmission

- Efficient utilization of elite breeding bulls
- Improvement in reproductive efficiency and productivity
- Lower maintenance cost of breeding males

Ideal Time for Artificial Insemination

The proper timing of insemination establishes a necessity for successful conception which Mithun breeding requires. Animals showing estrus signs in the morning are generally inseminated in the evening while those detected in heat during evening hours are inseminated the following morning. The standard practice for insemination recommends that breeders should wait 24 hours after the first signs of estrus to perform the procedure. The implementation of double insemination at 12-hour intervals will enhance the chances of successful conception.

Procedure of Artificial Insemination in Mithun

The recto-vaginal method is commonly used for AI in Mithun.

Steps Involved in AI

1. **Restraint of Animal:** The female Mithun needs to be restrained in a Travis which provides proper handling.
2. **Preparation of Semen:** The process of thawing frozen semen straws requires a 37°C warm water bath which lasts for one minute before the semen straws are loaded into a sterilized AI gun covered with a plastic sheath.
3. **Cleaning of Vulval Region:** The vulval area needs to be cleaned and disinfected properly to achieve proper hygiene.
4. **Recto-vaginal Insemination:** The inseminator inserts a lubricated gloved hand into the rectum to guide the cervix. The AI gun is then passed through the vagina into the cervix, where semen is carefully deposited.
5. **Post-Insemination Care:** After the semen has been deposited, the AI gun needs to be gently removed while all disposable materials should be discarded through hygienic methods.

Challenges in Artificial Insemination Implementation in Mithun

Although it has its benefits, there are quite a number of problems which may hinder the implementation of AI in Mithun on large scale:

- Silent estrus and poor heat expression
- Lack of trained technicians in remote regions
- Difficult terrain and free-range management system
- Limited availability of quality frozen semen
- Poor awareness among farmers regarding scientific breeding

Addressing these challenges through farmer training, infrastructure development and scientific management practices can greatly improve reproductive performance in Mithun.

Recent Advances in Artificial Insemination

Recent technological advancements have significantly improved the efficiency of artificial insemination and semen evaluation in livestock species. These advancements include sperm sex-sorting technologies and flow cytometry-based sperm assessment, which enable accurate evaluation of sperm quality

and functional integrity in breeding animals (Umirbaeva *et al*., 2024). Computer-assisted sperm analysis (CASA) systems have further improved objective semen evaluation by providing precise assessments of sperm motility, morphology, and kinematic parameters in bovine and small ruminant species (Toker *et al*., 2024). In addition, antioxidant supplementation during semen cryopreservation has been widely adopted to reduce oxidative stress and improve post-thaw sperm viability and fertility (Younus *et al*., 2024). Advanced analytical approaches such as imaging flow cytometry have also enhanced multiparametric functional assessment of spermatozoa in livestock (Umirbaeva et al., 2024).

Integration with other reproductive technologies has further strengthened the role of artificial insemination in modern livestock breeding programs. Artificial insemination serves as the foundation for advanced reproductive technologies such as *in-vitro* fertilization, multiple ovulation and embryo transfer, embryo cryopreservation, and genome editing in farm animals. The success of these technologies largely depends on the availability of high-quality semen, efficient sperm processing methods, and reliable insemination protocols (Mikkola *et al*., 2024). Furthermore, assisted reproductive technologies have accelerated genetic improvement, germplasm conservation, and sustainable livestock production in cattle and other domestic animals (Saini *et al*., 2024).

Future Prospects

Future research is expected to focus on species-specific cryopreservation protocols, identification of molecular and omics-based fertility markers, development of portable semen processing systems, and integration of genomic data into breeding decisions (Peris-Frau *et al*., 2020) Expansion of AI for conservation of indigenous and semi-domesticated species is also anticipated.

CONCLUSION

Artificial insemination has significant potential for improving the reproductive efficiency, genetic quality, and long-term conservation of Mithun (*Bos frontalis*) populations in Northeast India. However, the successful implementation of AI programs largely affected by estrus detection efficiency due to silent estrus and poor visual heat signs. The combined use of visual observation, teaser bulls, fern pattern examination of vaginal mucus, and rectal palpation can substantially improve heat detection efficiency and insemination success. Adoption of scientific reproductive management practices, along with farmer awareness, technician training, and improved semen preservation technologies, will strengthen sustainable Mithun breeding programs. Furthermore, integration of advanced reproductive biotechnologies may play an important role in genetic improvement, germplasm conservation, and future livestock development strategies for this unique indigenous bovine species.

REFERENCES

Mikkola, M., Desmet, K. L. J., Kommisrud, E., & Riegler, M. A. (2024). Recent advancements to increase success in assisted reproductive technologies in cattle. *Animal Reproduction*, 21(3).

Peris-Frau, P., Soler, A. J., Iniesta-Cuerda, M., Martín-Maestro, A., Sánchez-Ajofrín, I., Medina-Chávez, D. A., Fernández-Santos, M. R., García-Álvarez, O., Maroto-Morales, A., Montoro, V., & Garde, J. J. (2020). Sperm cryodamage in ruminants: Understanding the molecular changes induced by the cryopreservation process to optimize

sperm quality. *International Journal of Molecular Sciences*, 21(8), 2781.

Saini, M., Sharma, R., Nachiappan, R. K., & Mohan, N. H. (2024). Assisted reproductive technologies for livestock biobanking. *Journal of Livestock Biodiversity*. ICAR- National Bureau of Animal Genetic Resources.

Tadesse, B., Reda, A. A., Kassaw, N. T., & Tadeg, W. (2022). Success rate of artificial insemination, reproductive performance and economic impact of failure of first service insemination: a retrospective study. *BMC veterinary research*, 18(1), 226.

Toker, M. B., Sabancı, A. Ü., Avcı, G., Aktar, A., Denk, B., Bari, Ö., & Özalp, G. R. (2024). Evaluation of cryopreserved ram sperm with nano-ozone solution and post-thaw life span by flow cytometric analysis. *Biopreservation and Biobanking*, 22(4),312-320.

Umirbaeva, A., Kurenkov, A., Makhanbetova, A., Seisenov, B., Vorobjev, I. A., & Barteneva, N. S. (2024). Systematic review and meta-analysis of cryopreserved bovine sperm assessment: Harnessing imaging flow cytometry for multi-parametric analysis. *Frontiers in Veterinary Science*, 11,1371586.

Younus, A. M., Yamanaka, T., & Shimada, M. (2024). The protective effects of antioxidants against endogenous and exogenous oxidative stress on bull sperm. In Vitro Cellular & Developmental Biology, *Animal*, 60, 969-982.