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**Aishee Rauthan**  
School of Agricultural Sciences,  
Shri Guru Ram Rai University,  
Patel Nagar, Dehradun,  
Uttarakhand, India

**Ankur Negi**  
School of Agricultural Sciences,  
Shri Guru Ram Rai University,  
Patel Nagar, Dehradun,  
Uttarakhand, India

## Artificial insemination in cattle

**Aishee Rauthan and Ankur Negi**

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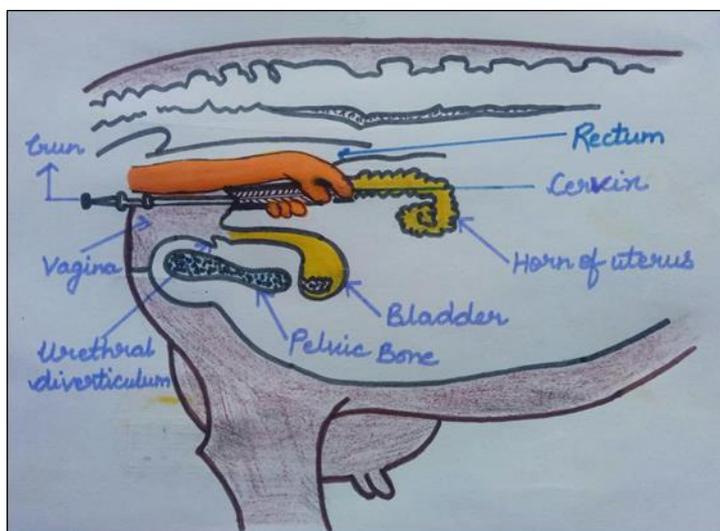
### Abstract

Artificial Insemination technology is one of the greatest technology developed in the field of Animal Husbandry, which solves a lot of problems associated with the sexual mating of cattle. Artificial Insemination is the technique of fertilizing the female cow artificially *i.e.*, without physical mating of the cow and bull. It is performed by injecting the semen of a bull directly into the ractovagina of the cow. This technique not only prevents Sexually transmitted diseases but also at the same time provides maximum chances of fertilization with superior offspring. Although, the success rate of this technique is low in our country due to a lack of skilled personnel and improper handling. Therefore, in this paper, we have briefed about the need for Artificial Insemination in our country along with its adequate procedure, equipment used, and methods.

**Keywords:** Animal husbandry, artificial insemination

### Introduction

The fertilization process in cattle has always been the most difficult part of Animal husbandry or can say in the dairy industry. The natural process of sexual mating had a low conception rate as well as the chances of getting Sexually transmitted diseases were also higher. Therefore, this technique of Artificial Insemination was developed by a Russian researcher, Llya Lvanovich Lvanov in 1922 (Ombelet & Robays., 2015) <sup>[1]</sup>. Artificial Insemination is a method in which the Ova of a cow has fertilized artificially by inserting the semen of a bull using a syringe. In this method, the cattle are not allowed for sexual mating and thus it prevents sexually transmitted diseases as the semen is directly injected into the cervix part of the ractovagina of the cow thus, it increases the rate of conception along with genetically superior offspring in them (Patel *et al.*, 2017) <sup>[2]</sup>.



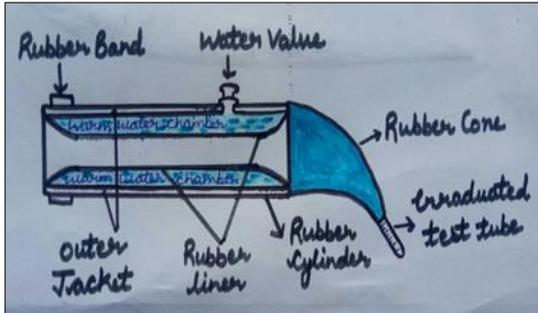
**Fig 1:** Artificial Insemination of Cow

**Corresponding Author:**  
**Aishee Rauthan**  
School of Agricultural Sciences,  
Shri Guru Ram Rai University,  
Patel Nagar, Dehradun,  
Uttarakhand, India

**Procedure of Artificial Insemination**

• **Equipment needed for Artificial Insemination**

a. **Artificial Vagina:** Artificial vagina is the most important part of Artificial Insemination as this is used to collect the semen of a bull artificially. It is made up of a rubber barrel both externally and internally in which hot water of up to 60 °C temperature is poured in a way that the temperature of the inner lining of the rubber remains 40-45 °C (FAO joint., 2005) [3]. For smooth insertion of the penis and better penile erection, the inner lining of the AV is lubricated properly and is placed firmly around the male genitalia of the bull (Brinsko *et al.*, 2011) [4]. The artificial vagina is attached properly to the semen collection vial through rubber bands and is covered by a jacket-like material to avoid leakage of semen ejaculated by Bull.



**Fig 2:** Artificial Vagina

b. **Extender:** Extenders are the nutritive materials like Milk, Egg yolk, Glycerin and some antibiotics, etc. which not only dilutes the semen but also provides nourishment to the stored sperms and maintains their viability (Rehman *et al.*, 2013) [5].

c. **Straws:** The collected and processed semen are transferred in straws in an amount sufficiently needed to fertilize a female Cow (Diskin. 2018) [6].



**Fig 3:** Semen Containing Straw

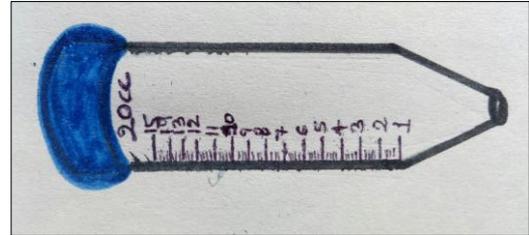
d. **AI Rods/Catheter:** This is basically a syringe-like equipment that draws the semen out from the semen containing straws and once it reaches the site of insemination *i.e.*, into the cervix of the ractovagina of a cow, it deposits the semen into the cervix for fertilization process (Mike O'Connor., 2012) [7].



**Fig 4:** AI Rod

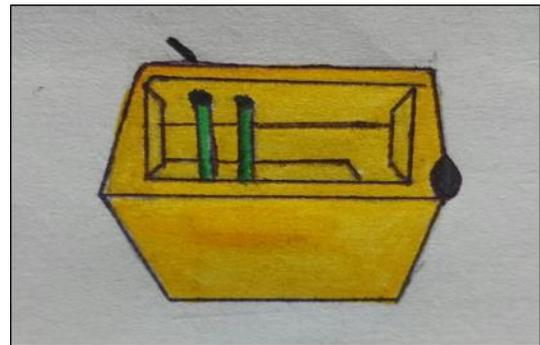
e. **Straw Cutter:** These are used to cut the ends of the straws containing semen without harming the sperms so that the straw could easily get attached to the AI Rod.

f. **Collection Vial:** A semen collection vial is a glass tube with a pre-marked scale for determining the quantity of collected semen and is attached to the artificial vagina via a rubber band at the time of semen collection (Knoop & Pouden., 1943) [8].



**Fig 5:** Collection Vial

g. **Thaw bath:** As the Semen is stored at freezing temperature to protect it from getting denatured, it is very important to defrost the semen before injecting it into the vagina of the cow thus, a Thaw bath of about 40 seconds in warm water at 35 to 38 °C are given to the Straw containing semen without harming the sperms (Patel *et al.*, 2017) [2].



**Fig 6:** Thaw Bath

h. **Paper Towels:** As we know that the sperm in the semen denatures at high temperatures in order to avoid the denaturing of sperm in the semen and to avoid contaminations, the ends of AI Rods are wrapped in a paper towel before inserting them into the Vagina of the Cow. The paper towel also absorbs the excess moisture of the vulva.



**Fig 7:** AI Rod wrapped in a paper towel

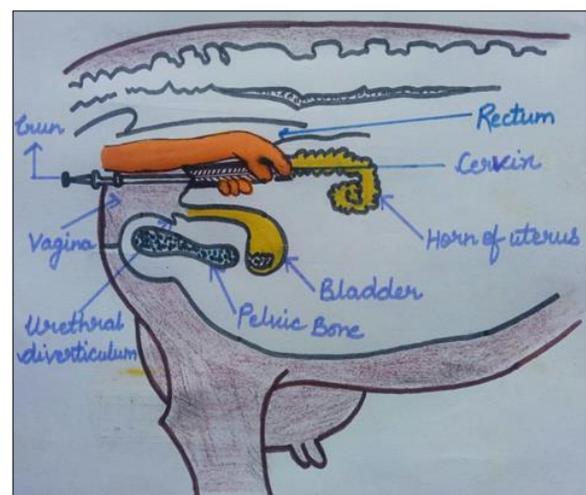
i. **Lubricants:** These are the aqueous substances like Vaseline etc., used to lubricate the inner lining of the artificial vagina while semen collection for smooth insertion of the male genitalia of the bull (FAO Joint. 2005) [3].

j. **Plastic Sheath:** A protective sheath is kept over the AI rod once it gets attached to the semen-containing straws and are locked with the help of a plunger during insemination.

- **Methods of Semen Collection:** For performing the artificial insemination of cattle, the collection of viable semen from a healthy bull is mandatory. The semen can be collected via any of the three methods given below:-
  - a. **Rectal Massage:** This method is the most common method of collecting semen from the bull in which the semen collecting personnel uses his fingertips to massage the ampullae near the prostate gland of the rectum softly along with rhythmic strokes, in order to excite the Penis for semen ejaculation into the semen collecting vial (Perry *et al.*, 2021) <sup>[9]</sup>.
  - b. **Electro-ejaculation:** Palmer *et al.*, 2005 <sup>[10]</sup> studied that Electro-ejaculators equipped with a rectal probe having three electrodes can be used for semen collection mechanically.
  - c. **Artificial Vagina:** Artificial vagina is a device used for semen collection. These are fitted with outer rubber jackets in which warm water are filled in a way to maintain the internal temperature up to 44 to 48 °C and are then fixed around the penis of the bull after lubrication, in order to provide favorable condition for Penile erection and semen ejaculation by the bull (Brinsko *et al.*, 2011) <sup>[4]</sup>.
- **Semen Evaluation:** Tanga *et al.*, 2021 <sup>[11]</sup> in his paper described that, once the semen from a healthy and viable bull is collected, it went through an evaluation procedure in which the semen is evaluated to analyse whether it can fertilize the ova of a cow or not along with their viability, motility and their tolerance to freezing and thawing procedures.
- **Processing of Semen:** Cseh *et al.*, 2012 <sup>[12]</sup> studied that the semen after collection should be stored carefully as the sperm can get destroyed at higher temperatures, and thus just after collection of semen, they are processed by adding extenders such as milk, glycerine, egg yolks, etc. to dilute the semen as well as to provide nourishment to the sperms during storage.
- **Storage of Semen:** As sperms are highly temperature sensitive and cannot tolerate high temperatures, thus it becomes important to store them carefully. Therefore, the straw containing the semen is stored in liquid nitrogen tanks and is frosted at a constant rate of temperature till the temperature reaches 320 °F.
- **Symptoms of Heat in Cow:** The procedure of Artificial Insemination is carried out only when the cow is on heat (estrous) *i.e.*, when the ova matures and is about to get released into the genitalia for fertilization which lasts for about 36 to 72 hours but the period of conception ranges only between 12 to 18 hours (Khan *et al.*, 2020) <sup>[13]</sup>. Therefore, it becomes crucial to identify the heat duration in the Cow for better breeding procedures, and thus following are the symptoms of heat in the cow:-
  - The vulva of a cow swells up during heat and the vulva lips upon opening can be seen red in colour with mucous layering.
  - Recurrent urination is also observed at the onset of the estrous cycle.
  - During estrous, a cow can be seen raising their tail again and again.
  - Generally, during standing heat duration, the cow allows mounting of other animals on her.
  - The onset of heat is marked by the thin and transparent mucous discharge, which becomes thick and rubbery after the completion of the estrous cycle (O'Conner. 2016) <sup>[14]</sup>.

## • Steps of Artificial Insemination

When the Cow is on heat *i.e.*, when her ova matures for the fertilization process, the procedure of artificial insemination should carry out (Mike O' Connor. 2012) <sup>[7]</sup>. First of all, the straw containing the semen is given a thaw bath for 40 seconds to stabilize the temperature of the semen as they are stored at freezing temperature (Patel *et al.*, 2017) <sup>[2]</sup>. The semen-containing straw is then attached to the AI rod and is fixed carefully with a protective sheath and plunger and the part of the AI rod having semen is then wrapped with a paper towel to maintain the temperature of semen (Selk., 2017) <sup>[15]</sup>. The AI rod loaded with semen is then carried to the cervix of the Racto vagina of the cow and once it crosses three layered rings of the cervix, the sperms are injected to fertilize the Ova in the uterus of a cow. After the incorporation of the semen into the cervix, the AI rod is removed out carefully and the reproductive tract of cow is given a slight massage to distribute the semen into the uterus as an assurance of fertilization whether the ova is released from the left or right ovary.



**Fig 8:** Artificial insemination of a cow

## Conclusion

Artificial insemination is an artificial process of fertilizing female cattle by depositing the semen of a viable bull directly into the cervix of a ractovagina of cow to increase the conception rate in females Cattle. This technology is not only helping the dairy industry to emerge with higher production but is also helping dairy farmers to have high Milk yielding cows to uplift their earnings from them.

## References

1. Ombelet W, Robays VJ. Artificial Insemination history: hurdles and milestones. Facts, views & vision in ObGyn. 2015;7(2):137-43.
2. Patel Gaurang, Haque Nilufar, Madhavatar MP, Chaudhari Ashvin, Bhalakiya Nikita, Jamnesha Natvarbhai, *et al.*, Artificial insemination: A tool to improve livestock productivity. J Pharmacogn Phytochem. 2017;6(6S):307-313.
3. FAO Joint. Improving artificial breeding of cattle and buffalo in Asia Guidelines and Recommendations, 2005. ISBN 92-0-112005-2 ISSN 1011-4289.
4. Brinsko SP, Blanchard TL, Varner DD, Schumacher J, Love CC, Hinrichs K, *et al.* Semen Collection and Artificial Insemination with Fresh Semen. Manual of Equine Reproduction, 2011, 160-175. doi:10.1016/b978-0-323-06482-8.00021-1

5. Rehman Fawad, Zhao Chunqiu, Shah Muhammad, Qureshi Muhammad, Wang XD. Semen Extenders and Artificial Insemination in Ruminants. *Veterinaria*. 2013;1(1):1-8.
6. Diskin MG. Review: Semen handling, time of insemination and insemination technique in cattle. *Animal*. 2018;12(s1):s75-s84. doi:10.1017/S1751731118000952
7. Mike O'Connor. Reviewing Artificial Insemination Technique. College of agricultural sciences. Agricultural research and cooperative extension. The Pennsylvania State University. PennState Extension. c2012.
8. Knoop CE, Pounden VD. Artificial Insemination of dairy cattle. Ohio agricultural experiment station Wooster, Ohio. c1943.
9. Perry Viv, Phillips Nick, Fordyce Geoffrey, Gardiner B, Entwistle K, Chenoweth Peter, *et al.*, Semen collection and evaluation. c2002.
10. Palmer CW, Brito LFC, Arteaga AA, Söderquist L, Persson Y, Barth AD. Comparison of electro ejaculation and transrectal massage for semen collection in range and yearling feedlot beef bulls. *Animal Reproduction Science*. 2005;87(1-2):25-31.
11. Tanga BM, Qamar AY, Raza S, *et al.* Semen evaluation: methodological advancements in sperm quality-specific fertility assessment: A review *Anim Biosci*. 2021;34(8):1253-1270. doi:10.5713/ab.21.0072.
12. Cseh S, Faigl V, Amiridis GS. Semen processing and artificial insemination in health management of small ruminants. *Animal Reproduction Science*. 2012;130(3-4):187-192. doi:10.1016/j.anireprosci.2012.01.
13. Khan MH, Vikram R, Hanah SS, Khate K, Joshi V, Devi S, *et al.* Estrus (Heat) Detection & Artificial Insemination (Ai) In Mithun. Director, ICAR-NRC on Mithun, Medziphema, Nagaland. ICAR-National Research Centre on Mithun (An ISO 9001: 2015 Quality Management System) Medziphema, Nagaland, 2020, 797106.
14. O'Conner ML. Heat Detection and Timing of Insemination for Cattle. The Pennsylvania State University. PennState Extension. c2016.
15. Selk G. Artificial Insemination for Beef Cattle. Oklahoma State University. c2017.