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Popular Article

Embryo Transfer Technology in Cattle: An Overview

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Introduction

Through the widespread and effective use of frozen semen, artificial insemination has made it possible to accomplish genetic advancement in cattle very swiftly over the past 70 years. Since cows can actually only have one calf a year, until thirty years ago, the male side of genetic contribution via artificial intelligence (A.I.) accounted for the majority of the rapid genetic progress. Thanks to advancements in embryo transfer methods, cows can now give birth to twenty-five or more children a year. A successful Al programme can achieve faster genetic gain by adding ET technology than it could with Al alone.

The first step in the transfer of cattle embryos is to choose a well-fed, genetically exceptional, non-pregnant embryo donor (cow or heifer). Eight to twelve non-pregnant females are recognised at the same time. The embryos might be transferred right away as fresh embryos or frozen for later use after they have been gathered and identified.

Numerous embryos are transferred and a continuously high recipient pregnancy rate are the results of a successful embryo transfer programme. Several protocols, timetables, strategies, and materials are used during the entire process. For an embryo transfer programme to be successful, every detail must be considered.

Advantages:

- It enhances genetic potential.
- There is an increase in productivity.

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- It amplifies the financial gain.
- It makes people more resistant to illness
- It raises the number of calves in a lifetime.
- It shortens the time between generation
- It intensifies the process of choosing
- The process of import and export is simplified by the use of embryos, which offer lower costs, easier transportation, and more genetic diversity.

Disadvantages:

- Decreased genetic diversity
- Low success rate
- Expense and upkeep of recipient females
- Need for specialized tools and personnel with training

Steps involved in ETT approach are as follows:

1) Selection of donors

Generally, animals with a history of no more than two breeding per conception, good genetic superiority, disease-free status, and no ovarian adhesions are chosen as donors. Because it gauges a knack to transmit genetic information, a high cow index value is the strongest predictor of good genetic potential for dairy cows.

2) Induction of superovulation

The release of several oocytes in a single oestrus episode is referred to as superovulation. Getting the most fertilised and transferred embryos possible is the aim of superovulation therapy. Follicle stimulating hormone (FSH) and mare's serum gonadotropin PMSG, also known as equine chorionic gonadotropin (eCG), are among the preparations used to promote superovulation. The main idea behind all superovulation procedures is to use hormone preparations that are administered subcutaneously or intramuscularly to encourage substantial follicular growth. Gonadotropin therapy is started during the midluteal phase of the oestrus cycle for the best results. Approximately 85% of all normal fertile donors will respond to superovulation treatment with an average of five transferable embryos

3) Insemination

A high percentage of normal, motile cells in high-quality semen is an essential stage because the oviducts of the super-ovulated females require a larger number of viable sperm cells to reach them. On the other hand, several inseminations are required at the commencement of standing oestrus (12, 24, and 36 hours).

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4) Recovery of embryos

Two methods are used to recover the embryos. They are:

a. Non-surgical method

This is a relatively straightforward procedure that doesn't damage the donor; it's carried out under spinal anaesthesia. Determine how many corpora lutea there are by palpating the ovary per-rectally. The donor cow's cervix is punctured with a tiny synthetic Foley catheter, and to collect the embryos, a unique medium is pushed into and out of the uterus.

a. Surgical method

This technique is applicable to all species in which anaesthesia is administered during a laparotomy to expose the reproductive tract. To make the uterus turgid, culture medium is injected through the oviduct or through a puncture at the utero-tubal junction. After that, a blunt needle fitted with a flexible catheter is used to penetrate the uterus. The medium will rush through the catheter due to the pressure, creating enough turbulence to transfer the embryos into a collection tube.

5) Evaluation of embryo

Shape, colour, quantity, compactness of cells, size of perivitelline space, quantity and size of vesicles, and zona pellucida status are among the factors considered in the evaluation of embryos. To view the developmental stages, morphological evaluation is carried out at different microscopical magnifications. An assessment of the quality of the morphological appearance is completed.

Quality evaluation

Sr. No.	Quality	Appearance of the embryo
1.	Excellent	symmetrical, spherical, and composed of uniformly sized, coloured, and textural cells
2.	Good	Few extruded blastomeres, irregular shape and a few vesicles.
3.	Fair	Extruded blastomeres, vesiculation, and a few degenerated cells
4.	Poor	Numerous extruded blastomeres, degenerated cells, cells of varying sizes, l numerous vesicles. Not preferred for embryo transfer.

6) Embryo storage

Donor embryos can be transferred immediately into recipients, or they can be subjected to Short-term storage for 24 to 72 hours at 4°C in PBS/medium 199

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supplemented with 50% FBS. For long term storage, embryos are stored in liquid nitrogen (-196°C).

7) Selection of recipient females

Proper recipient selection is critical to embryo transfer success. The data on Cows that are reproductively sound, free from diseases, calving ease with mothering ability are selected as recipients.

8) Synchronization of the recipients

To maximize embryo survival in the recipient female following transfer, conditions in the recipient reproductive tract should closely resemble those in the donor. Therefore, oestrus of donors and recipients should be synchronised within 24 hours which increases the conception rates. The Synchronization of the recipients and donor is done with same procedure under same time.

9) Embryo transfer

The embryo to be transferred is taken into a 0.25 ml straw and then placed into the AI gun. The insemination gun is carefully passed through the cervix and into the uterus corresponding to the ovary that has a corpus luteum. The embryo should be disposed as deep into the uterine horn as feasible without using force.

Conclusion

The process of embryo transfer, which is employed in animal breeding, is essential for increasing the population's effect over improved genotype. Nonetheless, broader and more skillful application of the existing strategies is required to maximize their benefits. The majority of assisted reproductive technologies can be built upon the successful history of embryo transfer technology. The dairy industry is currently using embryo transfer to improve genetics. The quickest approach to increase genetic efficiency on ruminant farms, big or small, is to do this. Consequently, ETT will alter animal breeding going forward. More focus should be made on enhancing infrastructure and providing scientific training along with the necessary hygienic practices in order to increase success in ETT.

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