

Embryo Transfer Technology in Cows: A Tool for Rapid Genetic Improvement

Pandiri Keerthana^{1*}, Arya M Narkhede¹, M. S. Bawaskar², D. S. Raghuwanshi², A. P. Gawande² and M. S. Patil²

¹PhD Scholar, Department of ARGO, NVC, Nagpur

²Professor, Department of ARGO, NVC, Nagpur

Department of Animal Reproduction, Gynaecology and Obstetrics, Nagpur Veterinary College,
Maharashtra Animal & Fishery Sciences University-440006, Nagpur

Corresponding Author

Pandiri Keerthana

Email: keerthanapandiri2307@gmail.com



OPEN ACCESS

Keywords

Cattle, Embryo Transfer, Donor Cow, Recipient Cow, Genetic Improvement

How to cite this article:

Keerthana, P., Narkhede, A. M., Bawaskar, M. S., Raghuwanshi, D. S., Gawande, A. P. and. Patil, M. S. 2026. Embryo Transfer Technology in Cows: A Tool for Rapid Genetic Improvement. *Vigyan Varta* 7 (10): 135-138.

ABSTRACT

Embryo transfer (ET) is an important reproductive biotechnology used to multiply genetically superior cattle. A valuable cow normally produces only one calf at a time, limiting the number of offspring that can be obtained from her during her productive life. In ET, embryos produced by a selected donor cow are collected and transferred into suitable recipient cows. The major steps include donor selection, superovulation, artificial insemination, embryo recovery and evaluation, recipient synchronization, embryo transfer, and pregnancy diagnosis. ET helps in faster multiplication of superior female genetics, improvement of herd quality, and conservation of valuable cattle breeds. It can also be combined with technologies such as ovum pick-up, in vitro embryo production, sex-sorted semen, genomic selection, and embryo cryopreservation. With proper donor and recipient management, ET can be a useful tool for improving cattle breeding efficiency.

INTRODUCTION:

Reproductive efficiency plays an important role in cattle improvement. Under natural conditions, even a genetically superior cow can produce only a limited number of calves during her lifetime. Embryo transfer provides a way to increase the reproductive contribution of such valuable females.

The principle of ET is simple. The donor cow provides the embryo, while the recipient cow carries the pregnancy. The embryo receives its genetic material from the donor cow and the selected bull, while the recipient provides the uterine environment required for development (Seidel & Seidel, 1991). Thus, ET allows desirable female genetics to be multiplied more rapidly than through conventional breeding.

Embryo Transfer Procedure in Cows

Selection of Donor Cow

The donor should be healthy, reproductively sound, and genetically superior. Production performance, pedigree, breed characteristics, fertility, and overall health are considered during selection. Genomic information may also be useful in identifying animals with desirable genetic merit.

Superovulation

Normally, a cow ovulates one dominant follicle during an estrous cycle. In ET programmes, hormonal treatment is used to stimulate the development and ovulation of several follicles. FSH is commonly used for superovulation, along with hormones used for estrous-cycle control. The objective is to obtain several fertilized embryos from one donor during a single cycle (Baruselli *et al.*, 2011).

Artificial Insemination

After superovulation, the donor cow is inseminated with semen from a selected bull. Correct timing of insemination is important for successful fertilization. Selection of both donor and sire determines the genetic potential of the resulting embryos.

Embryo Recovery and Evaluation

Embryos are generally recovered from the uterus about seven days after estrus, when they are commonly at the morula or blastocyst stage. In cattle, embryos are usually collected by nonsurgical uterine flushing (Seidel & Seidel, 1991).

The recovered material is examined under a microscope to identify embryos and assess their developmental stage and quality. Suitable embryos may be transferred immediately or preserved by cryopreservation.

Selection of Recipient Cows

Recipient cows should be healthy, reproductively normal, and in suitable body condition. Their estrous cycle is synchronized with the donor so that the uterus is at the appropriate stage for receiving the embryo. A functional corpus luteum is important because progesterone supports the uterine environment during early pregnancy (Baruselli *et al.*, 2011).

Embryo Transfer

The selected embryo is loaded into a transfer straw and introduced through the cervix into the uterus. It is generally deposited in the uterine horn on the same side as the functional corpus luteum. Careful handling and accurate placement are important for successful pregnancy (Roper *et al.*, 2018).

Pregnancy Diagnosis

Recipient cows are examined after transfer to determine whether pregnancy has been established. Ultrasonography is commonly used for early pregnancy diagnosis. Pregnant animals should receive proper nutrition and routine health care throughout gestation.

Importance of Embryo Transfer Technology

Faster Multiplication of Superior Genetics

The major advantage of ET is the ability to obtain more offspring from genetically valuable females. Instead of producing one calf at a time, embryos from a superior donor can be transferred to several recipient cows. This helps multiply desirable female genetics within a shorter period (Hasler, 2020).

Faster Genetic Improvement

ET can accelerate genetic improvement when embryos from selected females are combined with semen from genetically superior bulls. It allows desirable genetic combinations to be used more efficiently in organized breeding programmes.

Improvement of Indigenous Cattle

India has many indigenous cattle breeds with valuable characteristics such as adaptability to local conditions and tolerance to environmental stresses. ET can help multiply genetically superior animals within these breeds and support breed improvement and conservation programmes (Misra *et al.*, 2005).

Conservation of Valuable Germplasm

Embryos can be preserved through cryopreservation and stored for future use. This provides an effective means of conserving valuable genetic material and maintaining desirable cattle genetics for breeding programmes.

Integration with Modern Reproductive Technologies

ET can be combined with modern technologies such as ovum pick-up (OPU), in vitro embryo production, sex-sorted semen, and genomic selection. In vitro embryo production allows oocytes collected from valuable females to be matured, fertilized, and developed into embryos under laboratory conditions. These developments have increased the potential use of embryo technologies in cattle breeding (Hansen, 2023; Hansen, 2024).

CONCLUSION

Embryo transfer is a valuable reproductive technology for increasing the use of genetically superior cattle. By transferring embryos from selected donor cows to suitable recipient cows, more offspring can be obtained from valuable females than through conventional reproduction alone. ET has an important role in genetic improvement, multiplication of superior dairy and indigenous cattle, and conservation of valuable germplasm. Proper selection of donors and recipients, synchronization, embryo handling, and transfer technique are essential for successful results. The combination of ET with OPU, in vitro embryo production, cryopreservation, sex-sorted semen, and genomic selection further increases its usefulness in modern cattle breeding.

REFERENCES

- Baruselli, P. S., Sá Filho, M. F., Ferreira, R. M., et al. (2011). Timed embryo transfer programs for management of donor and recipient cattle. *Theriogenology*, 76(9), 1583–1593.
- Hansen, P. J. (2020). The incompletely fulfilled promise of embryo transfer in cattle—Why aren't pregnancy rates greater and what can we do about it?

- Journal of Animal Science*, 98(11), skaa288.
- Hansen, P. J. (2023). Some challenges and unrealized opportunities toward widespread use of the in vitro-produced embryo in cattle production. *Animal*, 17(Suppl. 1), 100745.
- Hansen, P. J. (2024). Pressing needs and recent advances to enhance production of embryos in vitro in cattle. *Animal Reproduction*, 21(3), e20240036.
- Hasler, J. F. (2020). Forty years of embryo transfer in cattle: A review focusing on the early years. *Theriogenology*, 150, 1–10.
- Krisher, R. L., & Herrick, J. R. (2024). Bovine embryo production in vitro: Evolution of culture media and commercial perspectives. *Animal Reproduction*, 21(3), e20240051.
- Misra, A. K., Kasiraj, R., Mutha Rao, M., et al. (2005). Embryo transfer technology in cattle and buffalo in India: A review. *Indian Journal of Animal Sciences*, 75(7).
- Roper, D. A., Schrick, F. N., Edwards, J. L., & Randel, R. D. (2018). Factors in cattle affecting embryo transfer pregnancies in recipient animals. *Animal Reproduction Science*, 199, 79–83.
- Seidel, G. E., Jr., & Seidel, S. M. (1991). *Training manual for embryo transfer in cattle*. FAO.