

Embryo Technology (Production, Freezing and Transfer) in Cattle

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Artificial Insemination and Embryo transfer are two main reproductive technologies for disseminating the great genetic potentials of the bull and the cow, respectively. Worldwide, more than one and a half million embryo transfers are being conducted each year. In this context, the production of embryos in cattle has relied on two main approaches: MOET (Multiple Ovulation and Embryo Transfer) and IVEP (In-Vitro Embryo Production). In MOET, the donor cow, with the high genetic merit, experiences superovulation to produce several ovarian follicles. Then the superovulated cow is inseminated and the zygote establishes within the oviduct. Several days following fertilization, when the egg reaches the uterus, the embryos are recovered and assessed following uterine flushing. The good quality embryos are transferred to the recipient heifers synchronized with donor in advance. This approach is non-invasive without any particular risks for the donor and could be repeated every six weeks. The donor heifer or cow can return to normal reproduction cycle and becomes pregnant afterward.

During IVEP, the ovarian follicles are visualized by transvaginal ultrasound and perforated by needle to pick up oocyte from individual follicles (Ultrasound Guided Ovum Pick-Up; OPU). This process could be repeated every week or every second week. This technique is invasive and its repeated use could result in the adhesion of ovary to the surrounding tissues subsequent with infertility. In high genetic merit Holstein cows with low ovarian reserve, OPU may not be recommended due to the low recovery rate of oocyte and the high risk of infertility. Therefore, it is recommended to use MOET for valuable females to get reasonable number of embryos with low risk of infertility. In contrast, in those countries like Brazil that access to the high population of beef *Bos indicus* cows with great ovarian reserve, IVEP is highly recommended instead of MOET. It seems that the production of embryos for dairy cattle industry in Iran using MOET approach is simpler, cheaper, more efficient with low risk and more importantly less dependence to abroad for materials and equipment.

The application of embryo technology in a dairy herd, for a period of 3-5 years, could enhance milk production significantly. This could be achieved by collecting embryos from heifer donors belong to the top 10 percent genetics of the herd and transferring them to the heifer recipients belong to the bottom 10 percent genetic of the herd. Moreover, embryo technology enables us to preserve the genetic potential of the herd for a long time insuring the high genetic merit females from unwanted events. Lastly, this technology could provide the possibility to sell the best genetics inside and outside the country.

Our embryo transfer team has 25 years of research on embryo production and transfer in different species like cattle, camel and sheep. We have served dairy cattle industry in Iran since 2020. We have served four dairy cattle farms with great genetic merit. Our results are demonstrated in Tables 1 and 2. The average of our embryo recovery, freezing and transfers stand within the result of the best practitioners in the globe. Our embryo freezing system based on vitrification protocol is very simple, innovative, efficient with high repeatability. More recently we have incorporated single injection of FSH into our superovulation protocol. In other words, we replaced eight injections of FSH with single injection of FSH which is very simple and cost effective.

Table 1. Our embryo transfer results (fresh and frozen) in four dairy farms since 2020 in IRAN

Farm	Owner	Date	Transfer	Pregnant (%)	Calved (%)	Healthy calves
World Elite Heifer	Mr. Saffari	2020-2022	373 (Fresh)	219 (58.7)	147 (39.4)	155
Mahsham	Dr. Baheri	2022-2024	275 (Fresh)	146 (53.1)		
Mahsham	Dr. Baheri	2022-2024	70 (Frozen)	40 (57.1)		
Khorramdarreh Agro-Industrial	Bonyad Mostazafan	2023-2024	58 (Fresh)	45 (77.6)	41 (70.7)	41
Mehr Mandegar Golestan	Mr. Ghalandari	2024	12 (Frozen)	10 (83.3)		

Table 2. Our embryo recovery rates in four dairy farms since 2020 in IRAN

Farm	Owner	Date	Donor	Total Ova/embryo	Transferable embryo
World Elite Heifer	Mr. Saffari	2020-2022	30	9.6±1.26	5.5±0.75
Mahsham	Dr. Baheri	2022-2024	84	8.2±0.61	5.5±0.48
Khorramdarreh Agro-Industrial	Bonyad Mostazafan	2023-2024	11	5.5±0.48	5.9±1.26