

Ganga: India's first cloned cow that belongs to indigenous Gir breed

Cows are the mainstay farm animal in India's dairy industry. In 2022–23, India produced 221.06 million tonnes of milk, of which 50% (110.5 million tonnes) was contributed by cows¹. Indigenous cattle breeds such as Gir, Sahiwal, Tharparkar and Red-Sindhi play a significant role in Indian dairy growth. The milk obtained from cattle has enabled India to become the world's largest milk-producing nation. However, the low productivity of indigenous cows (3–4 kg per day) is a major challenge for sustainable milk production. Globally, assisted reproductive technologies have produced quality animals. Among the several reproductive technologies, animal cloning can play a key role in faster multiplying elite animals and the conservation of endangered breeds. In this direction, in 2022, ICAR-

National Dairy Research Institute (NDRI), Karnal initiated cloning of indigenous cows such as Gir, Sahiwal and Red Shindi. It has been a highly challenging task to develop a cattle cloning method for the multiplication and conservation of indigenous cows.

Over the decades, NDRI has been working on the genetic improvement of dairy animals. For the faster multiplication of elite germplasm, NDRI has developed a simple, economical and efficient animal cloning technology called handmade cloning, which has produced over 30 cloned buffaloes in the country². To upgrade the genetic potential of low milk producers and non-descript animals, the Indian government has proposed to increase the coverage of artificial insemination (AI) from the current 30% to

80–90% by the end of 2025 and produce elite germplasm using embryo technologies³. Animal cloning is an advanced technology that offers to make genetic copies of superior animals in the shortest possible time. To produce clones of a cow, oocytes are isolated from live animals using ultrasound-guided needles, and then, matured for 24 h under controlled conditions. The somatic cells of superior cows are used as donor genomes, which are fused with OPU-derived enucleated oocytes (Figure 1). Following chemical activation and *in-vitro* culture, the embryos are developed to the blastocyst stage, which is then transferred to the recipient mothers. After nine months, a cloned calf is born.

A team of scientists worked for over two years to develop the cattle cloning method in India. And recently, a cloned Gir female calf, named Ganga, was born on 16 March 2023 (Figure 2). Gir is a famed Indian dairy cattle breed from Gujarat. Gir cattle are well known for their tolerance to stress and resistance to various tropical diseases. Outside India, Gir cattle are also popular and have been exported to Brazil, the United States, Mexico and Venezuela for the development of zebu cows. This achievement will help us foresee the feasibility of cattle cloning in India. Cattle cloning technology will bring new dimensions to our efforts to produce quality indigenous dairy animals, and the farmers will benefit from this advanced reproductive technology which will lead to future sustainable milk production in the country.

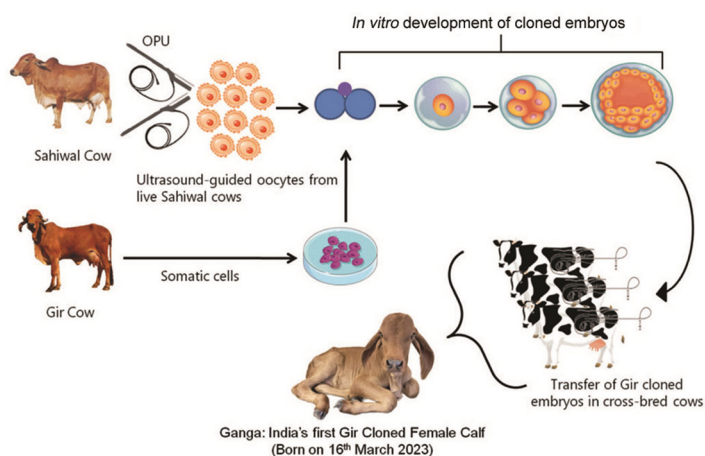


Figure 1. Oocytes were isolated from Sahiwal cows using the ultrasound-guided method and somatic cells of Gir cows were used to develop cloned embryos, which were transferred to cross-bred HF cows. Ganga was born (32 kg) on 16 March 2023.



Figure 2. Ganga (centre) with her genomic donor (left side) and recipient mother (right side).

1. Basic Animal Husbandry Statistics, Department of Animal Husbandry, Dairying and Fisheries (DADF) of India, 2022; <http://dahd.nic.in>
2. Selokar *et al.*, 2018; <https://doi.org/10.1089/cell.2017.0051>.
3. National Dairy Plan, Department of Animal Husbandry, Dairying and Fisheries (DADF) of India; <http://dahd.nic.in>

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