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REPRODUCTIVE BIOTECHNOLOGY IN SHEEP BREEDING

MIHAELA TOH[1], ANA-GINA ARMAȘ[1], LOREDANA VĂDUVA[2], DANIELA VĂLUȘESCU[1], IOAN PETROMAN[1*]

[1] *Development Research Station for Raising Sheep and Goats, S.C.D.C.O.C. Caransebeș*

[2] *University of Life Sciences "King Mihai I", Faculty of Management and Rural Tourism, Timisoara*

[3] *University of Life Sciences "King Mihai I", Faculty of Food Engineering, Timisoara*

*Corresponding author's e-mail: ***i_petroman@yahoo.com***

Abstract: *This paper examines the main reproductive biotechnologies applied in sheep breeding between 1998 and 2025, highlighting their performance, practical relevance, and principles. Artificial insemination and oestrus synchronization emerge as the most widely used techniques, ensuring efficient herd management and rapid genetic dissemination. Cryopreservation, embryo transfer, and in vitro fertilization support the conservation and multiplication of valuable genetic resources. Advanced methods, though primarily used in research, offer strategic potential for genetic improvement and specialized production. The analysis emphasizes species specific constraints, including the anatomical and physiological particularities of sheep reproduction. Comparative data show variable success rates depending on hormonal protocols, management quality, and technical expertise. In Romania, reproductive biotechnologies are increasingly integrated into breeding programs, supported by national conservation initiatives. These technologies clearly enhance productivity, genetic progress, and sanitary veterinary control in modern sheep husbandry.*

• Introduction

Reproductive biotechnology in domestic animals is the set of modern methods, procedures, and techniques by which animal reproduction is controlled, intensified, or optimized using biological, hormonal and technological tools. Its essence is the directed intervention on reproductive processes in order to increase economic efficiency, fertility, genetic quality, and prolificacy of the herd. It includes all techniques that allow the manipulation of embryos, gametes, and hormonal processes to obtain controlled and efficient reproduction, more offspring from genetically valuable animals, prevention of diseases transmitted through mating, rapid genetic improvement, and superior zootechnical production. The main reproductive biotechnologies are: artificial insemination, i.e. the collection, evaluation, dilution and preservation, and inoculation of semen, allowing the use of elite breeders on a large scale; cloning and nuclear transfer / transplantation, i.e. obtaining genetically identical individuals, a technique used for high-value or research animals; embryo sexing, i.e. determining sex before implantation, a technique useful for breeding programs or specialized production; embryo transfer, i.e. the induction of polyovulation in donor females, harvesting, evaluating and preserving embryos, and transfer to synchronized recipient females, rapidly increasing the number of offspring from valuable genetic lines; Reproductive biotechnologies – whose benefits are highlighted in the literature dedicated to reproductive biotechnologies – are important because they accelerate genetic improvement, i.e. rapid multiplication of superior animals; allow adaptation to market requirements, i.e. embryo sexing, specialized productions; allow advanced research, i.e. cloning, in vitro fertilization, and transgenesis; allow sanitary-veterinary control, i.e. the reduction of transmissible diseases; increase prolificacy, i.e. more offspring/female; and result in economic efficiency, i.e. higher production of meat, milk, and wool. Reproductive biotechnology is a complex field that combines biology, genetics, technology, and veterinary medicine to control and optimize the reproduction of domestic animals.

• Material and method

The material used in this paper consists in articles published on the reproductive biotechnologies in sheep breeding during the period 1998-2025. The research method is the bibliographic one and it aims at identifying the specifics of these biotechnologies at both international level and in Romania.

• Results and discussion

The articles investigated show the following reproductive technologies in sheep breeding (for a comparative synthesis, with special focus on Romania, see Table 1 below):

- Artificial insemination – peculiarities: higher success with laparoscopic artificial insemination (standard in Australia, New Zealand, UK); semen often frozen (cryopreservation), but with lower fertilization rates than in cattle; very tortuous cervix → difficult transcervical artificial insemination; practical applications: breeding programs for prolificacy, wool quality, meat traits; control of diseases transmitted through mating (Brucella ovis, epididymitis); rapid dissemination of elite rams; typical performances: laparoscopic artificial insemination with frozen semen: 50-65% fecundity; transcervical artificial insemination with fresh semen: 40–50%

In Romania, they use the following reproductive biotechnologies in sheep: artificial insemination and oestrus synchronization (the most widely used technologies), followed by embryo transfer (increasing in meat breeds – Suffolk, Texel – and endangered / number-limited / rare native breeds), and cryopreservation (essential for the indigenous / local breed conservation programs).

Table 1. Comparative synthesis of reproductive biotechnologies in sheep breeding

Reproductive biotechnology	Use level	Advantages	Limitations
Artificial insemination	**high**	**rapid genetic diffusion**	**moderate fecundity, sinuous cervix**
Cloning / transgenesis	research	biomedical models	costs, ethics
Cryopreservation	**high**	**breed conservation, export**	**variable quality post-defrosting**
Embryo transfer	**medium**	**valuable female multiplication**	**costs, variable response**
In vitro fertilisation	low	oocyte recovery, research	technically difficult
Oestrus synchronisation	**very high**	**efficient artificial insemination, grouped farrowing**	**needs strict management**
Sexing	low	optimised herd structure	costs

• Conclusions

Reproductive biotechnology has become an essential pillar of modern sheep breeding, enabling precise control and optimization of reproductive processes. The bibliographic analysis above confirms that artificial insemination and oestrus synchronization remain the most widely applied and economically impactful technologies in both global practice and Romania.