The current and future assisted reproductive technologies for the livestock animals

Mphaphathi M.L [A, B], Seshoka M.M [E], Thandavhathu M.R [A], Raphalalani Z.C [A], Maqhashu A [A], Ramukhithi F.V [A,C], Raito M.B [B], Kanuya N.L [D] and Nedambale T.L [C]

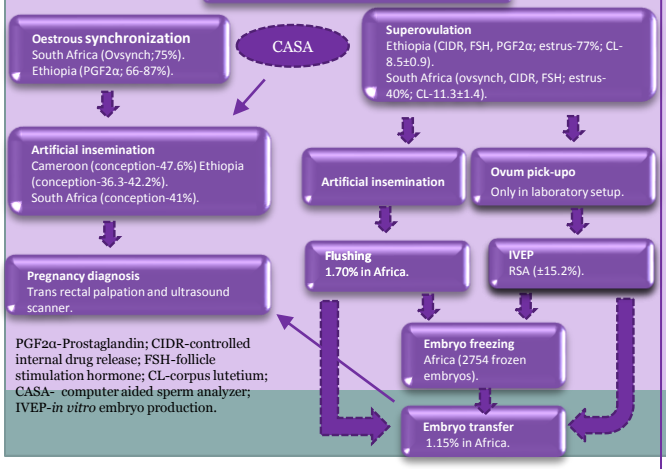
[A] Agricultural Research Council, Animal Production Institute, Germplasm Conservation & Reproductive Biotechnologies, Private Bag X 2, Irene, 0062, RSA.
[B] University of the Free State, Department of Animal, Wildlife and Grassland Sciences, P.O. Box 339, Bloemfontein, 9300, RSA.
[C] Tshwane University of Technology, Faculty of Science, Department of Animal Sciences, Private Bag X 680, Pretoria, 0001 RSA.
[D] Sokoine University of Agriculture, Faculty of Veterinary Medicine, Department of Veterinary Surgery and Theriogenology, P.O. Box 3020, Morogoro, Tanzania.
[E] Department of Agriculture, Land Reform & Development, Vaalharts Research Station, Private Bag X 9, Jan Kempdorp,8550, RSA.

INTRODUCTION

Successful reproductive technologies such as artificial insemination (AI), superovualation, ovum pick up and embryo transfer need to be applied on a large scale in future. Other emerging animal biotechnologies such as multiple ovulation & embryo transfer (MOET), *in vitro* embryo production and cloning provides powerful tool for rapidly changing the animal populations, genetically. The focus will be more on technologies that manipulate the female gamete. Synchronization of cows oestrus is one of the ways to regulate the estrus signs detection and it reduces time and labour cost. The AI is the oldest animal biotechnology and it is still a vital technology for improvement of livestock. Improvements in methods to cryopreserve/freeze and store semen have made AI accessible to more livestock farmers. The MOET is a crucial tool for the implementation of genetic improvements and conservation programs of endangered livestock, it is the method of choice for germplasm control.

However, its utilization is limited due to the variability that exists in predicting the quality and quantity of transferable embryos that will be recovered following administrating of FSH and flushing. The technology for *in vitro* oocytes maturation, fertilization and culturing requires suitable mediums and skills so that viable embryos can be produced. Thereforeproduced embryo *in vitro* or *in vivo* may then be transplanted into the recepients of cryopreserved/frozen for future use. The principles of cloning happens quite frequently naturally. This means the cloned animal is an exact duplicate in every way of its parent, it has the same exact DNA. Therefore, animal biotechnology is crucial to other interventions in the reproductive process such as, control of seasonal breeding, hormonal regulation of ovulation, estrous and pregnancy establishment etc. This advanced reproduction technologies will definitely play an important role in the future perspective and visions for efficient reproductive performance in livestock industry/ agricultural biotechnology.

MATERIALS & METHODS



PGF2α-Prostaglandin; CIDR-controlled internal drug release; FSH-follicle stimulation hormone; CL-corpus lutetium; CASA- computer aided sperm analyzer; IVEP-*in vitro* embryo production.

DISCUSSION

The preservation of female gametes is currently done through means of oocyte and embryo cryopreservation/freezing. The field of Cryobiology has seen much progress during its four decades history, progress driven predominantly by research in humans, cows and mice. The two basic cryopreservation techniques (slow freezing and vitrification) rule the field, the first to be developed and the vitrification, which, in recent years, has gained a foothold (Saragusty & Arav, 2011).

In vitro-produced (IVP) cattle embryos are more sensitive to cryopreservation than their *in vivo* counterparts due to their higher lipid concentrations, whereas *Bos indicus* IVP embryos are even more sensitive than *Bos taurus* IVP embryos (Sanches *et al*., 2013).

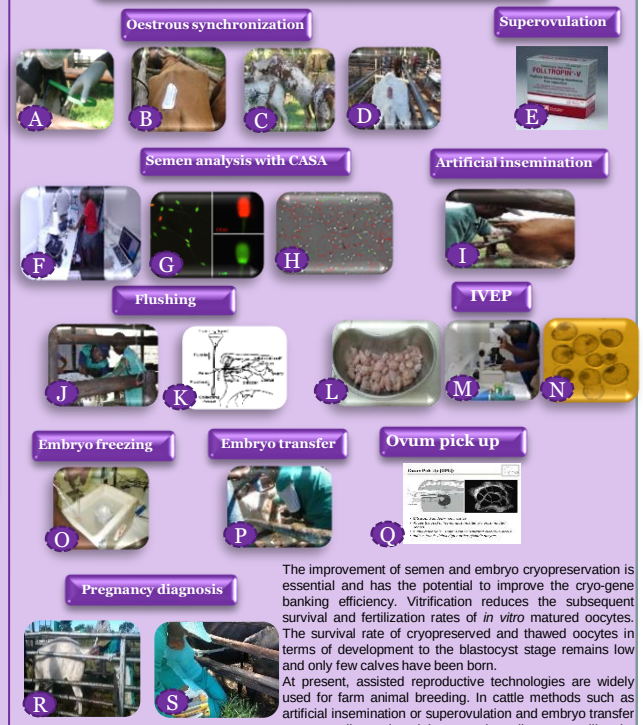
It is challenging to superovulate Nguni heifers and successful recover quality embryos following flushing. Moreover, it has an impact on conserving Nguni genetic materials such as embryos and oocytes. Superovulation has a potential of helping in rapid genetic improvement and conservation of breeds with reduced biodiversity such as Nguni cattle breed. Information on the superovulatory response of Nguni cattle is crucial in programs of *in situ* and *ex situ* conservation of this indigenous breed. OPU has been greatly spread over the years due to the increased number of transferable embryos, mainly due to the improvements of the *in vitro* embryo production technologies (Boni, 2012).

CONCLUSIONS AND RECOMMENCATIONS

The improvement of semen and embryo cryopreservation is essential and has the potential to improve the cryo-gene banking efficiency. Vitrification reduces the subsequent survival and fertilization rates of *in vitro* matured oocytes. The survival rate of cryopreserved and thawed oocytes in terms of development to the blastocyst stage remains low and only few calves have been born.

At present, assisted reproductive technologies are widely used for farm animal breeding. In cattle methods such as artificial insemination or superovulation and embryo transfer are generally employed, because they allow us to utilize the genetic potential of male and female animals more effectively.

VISUALS EXAMPLES OF ASSISTED REPRODUCTIVE TECHNOLOGIES



The improvement of semen and embryo cryopreservation is essential and has the potential to improve the cryo-gene banking efficiency. Vitrification reduces the subsequent survival and fertilization rates of *in vitro* matured oocytes. The survival rate of cryopreserved and thawed oocytes in terms of development to the blastocyst stage remains low and only few calves have been born.
At present, assisted reproductive technologies are widely used for farm animal breeding. In cattle methods such as artificial insemination or superovulation and embryo transfer are generally employed, because they allow us to utilize the genetic potential of male and female animals more effectively.