

DAIRY

Affordability a key aim for innovative cattle IVF project

In-vitro fertilisation (IVF) could soon be commercially viable and affordable for mainstream livestock owners.

Stuart Mullan, from Paragon ET, says IVF promises to accelerate the advancement of cattle performance by enabling multiple calves to be bred from genetically elite mothers, without the hormone injections required by the multiple ovulation and embryo transfer (MOET) technique.

The development of IVF in cattle is being led by Mr Mullan and colleagues at Paragon ET's base in Newbiggin, near Penrith. The initiative is a five-year grant-

aided project with the Technology Strategy Board, whose goal is 'to accelerate economic growth by stimulating and supporting business-led innovation'. Paragon Veterinary Group is the lead organisation for the project, supported by three consortium members: University of Nottingham, Cogent Breeding and XLVets UK.

Technique

Mr Mullan explains the IVF technique involves extraction of eggs directly from a cow's ovaries by keyhole aspiration, called ovum pick-up (OPU). This is followed by in-vitro 'test tube' fertilisation, then culture of the

embryos for one week, before transfer into recipient heifers or cows as surrogate mothers for a normal pregnancy and birth.

OPU collections can be performed weekly and eggs collected from juvenile heifers, non-pregnant cows and pregnant donors during the first trimester (three months). Typically, this produces many more potential embryos than the MOET process. This means IVF can offer a very effective choice if MOET has not been successful, or is not appropriate.

The IVF programme's inception came about as a way to continue breeding from elite cows which would not conceive normally or respond to the MOET techniques which the Paragon ET team has been performing for 30 years.

In particular, Stuart Mullan says ovum pick-up was initially developed so high genetic merit 'not hoper' cows could be brought back into their owners' herd breeding programmes. He explains it soon became clear this technique could quickly become a mainstream component in the cattle breeder's toolbox.

"One early success story involved the donor cow Applevue Rudy Mattia which stopped producing fertile embryos at the age of 12. Using the IVF process performed by Paragon ET's partner OPU team in Cheshire, Peter May and Mark Nutsford, she is producing pregnancies again at the remarkable age of 15. These calves are carried during pregnancy by recipient cows, whose breeding cycles are synchronised precisely with the timing of egg extraction and fertilisation," says Mr Mullan.

"This part of the IVF process



In-vitro fertilisation could soon be commercially viable and affordable for mainstream livestock owners.

is the same as for MOET recipients and is consequently well proven and understood by specialist cattle vets. At Paragon ET, it revolves around treating recipient females with a controlled intra-vaginal drug release device. This releases progesterone at a precise rate, which then passes through the vaginal wall into the blood stream. Progesterone suppresses the release of other reproductive hormones, thereby suspending the oestrous cycle temporarily."

Preparation

After the prescribed number of days, removal of the device causes a sharp drop in blood levels of progesterone. This triggers resumption of the oestrous cycle, in preparation for transfer of IVF embryos into recipients at the optimum time. Compared with other devices for the same purpose, Mr Mullan says T-shaped design offers better cow comfort and optimal alignment of oestrus synchrony.

Currently he reports acceptable pregnancy rates in the transfer of fresh IVF embryos to recipients. The main focus of the research team's work is now to concentrate on freezing embryos and to continue improving sub-

“**These calves are carried during pregnancy by recipient cows, whose breeding cycles are synchronised precisely**”
STUART MULLAN

sequent pregnancy rates. Another key focus is to create viable IVF embryos using sexed semen to produce exclusively heifer calves.

Typically, he says each OPU egg collection yields six to eight viable eggs. Extracted eggs require a 24-hour period of maturation in a culture medium before fertilisation. Resulting embryos are cultured for six days in a nutrient medium and then ready for implantation in recipient females which have been synchronised in parallel. He thinks about 35 per cent of

extracted eggs are likely to make viable transferable embryos.

The project is now entering year two of its five-year Technology Strategy Board programme, and the main goal is to make a commercial cattle IVF service available to owners of dairy and beef herds seeking accelerated advancement in cattle genetic merit.

Just like all business propositions examined in the *Dragons' Den* chamber, Stuart Mullan says this one needs to be 'scalable and replicable' to be a success. So in addition to the core scientific research and development work, investment is also planned for developing facilities and equipment, staffing and training, and ultimately sales and marketing.

He says the vision is to have five OPU/IVF teams around the UK within five years, with an associated network of XLVets practices implanting embryos into recipients. Mr Mullan also suggests IVF could largely replace MOET as first choice technique in accelerated genetic progress in cattle, and is resolute the UK can become a global leader in this technology among a number of rival programmes in other countries.



Stuart Mullan is leading the development of IVF in cattle.