Delivering Genomics Through ART

Assisted reproductive technologies help deliver high-quality genetics.

*by **Kasey Brown,** associate editor*

Technology could be the key to quicker generation intervals and increased access to higher-quality genetics. Pablo Ross, assistant professor in the Department of Animal Science at the University of California–Davis, explained that genetic progress stagnates without the use of assisted reproductive technologies (ARTs). He used a flat trend line for winning times at the Kentucky Derby as an example.

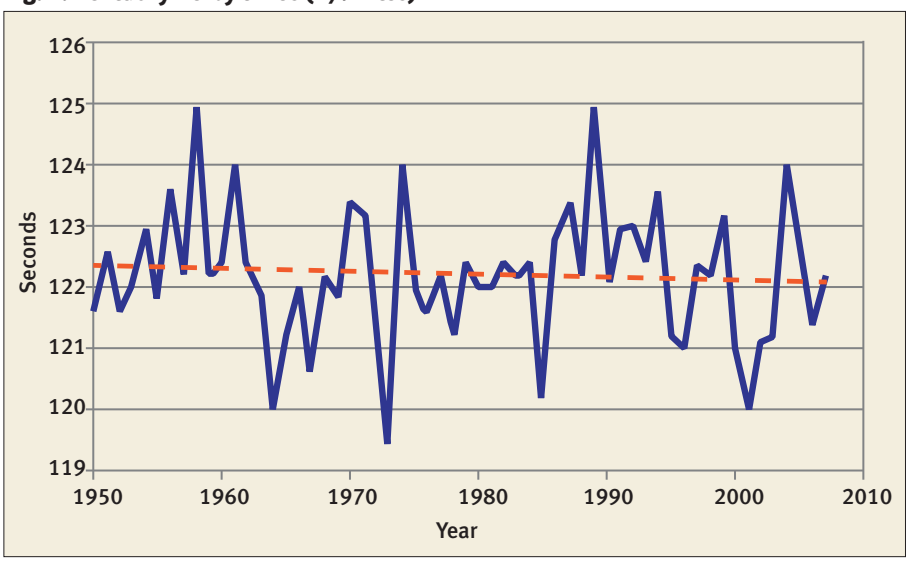
He spoke to attendees of the 2015 Applied Reproductive Strategies in Beef Cattle (ARSBC) symposium in Davis, Calif., this August. Ross said he particularly thought embryo transfer (ET) and *in vitro* embryo production (IVP) could be used to decrease the generation interval dramatically.

For instance, to build a larger high-quality cow herd faster, he highlighted opportunities to use genomics to select top females and using sexed semen to produce replacement females. He said using three sessions of superovulation and ET of heifers beginning at 12 months of age could produce 15 embryos and thus 11 female calves. Breeding the heifer via artificial insemination (AI) at 15 months of age would produce another female calf. Then, six sessions of ovum pickup and *in vitro* fertilization (IVF) during gestation could produce 18 embryos and, say, 10 female calves. In this scenario, one heifer could produce about 20 replacement females, potentially from different high-quality sires.

"This allows for selection of the top 5% of the herd to contribute to the next generation," Ross said.

IVP, which includes procedures to retrieve oocytes and sperm from animals, fertilize them in a laboratory and culture the embryo to a certain stage of development, was another option to produce calves more quickly. IVP can be used in gamete/embryo cryopreservation, preimplantation genomic selection, cloning by somatic cell nuclear transfer, and gene editing and transgenics.

Fig. 2: Kentucky Derby times (1¼ miles)



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►Pablo Ross, assistant professor in the Department of Animal Science at the University of California–Davis, said genetic progress stagnates without the use of assisted reproductive technologies, or ARTs.

While some of these sound like science fiction, Ross said IVF maximizes genetic improvement by optimizing the use of top sexed semen and higher embryo donor flexibility. IVF increases and standardizes embryo production, he said, adding that AI produces about six calves in a cow's lifetime, multiple ovulation and embryo transfer (MOET) produces about 40 calves and OPU/IVF produces more than 80 calves.

IVF also allows for more flexibility in embryo donors, and can produce up to 120 calves from one straw of semen, he said.

He concluded saying that the future of ART could include *in vitro* breeding, which could potentially decrease generation interval to three to four months, and precision breeding.

Ross spoke during Tuesday's final ARSBC session. For more information, visit the Newsroom at *www.appliedreprostrategies.com* to view his PowerPoint, read the proceedings or listen to the presentation.

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Fig. 1: Formula for genetic progress

$$\text{Genetic Progress} = \frac{\text{selection accuracy} \times \text{genetic variation} \times \text{selection intensity}}{\text{generational interval}}$$

Editor's Note: *Comprehensive coverage of the symposium is available online at* www.appliedreprostrategies.com. *Compiled by the* Angus Journal *editorial team, the site is made possible through sponsorship by the Beef Reproduction Task Force.*