New success and availability expands use of IVF, ET
Danielle Schlegel for Progressive Cattleman

The growth of in vitro fertilization, combined with embryo transfer, is rooted in several factors related to technical knowledge, accessibility and better herd management.

What was once a cost-prohibitive and unprecedented management practice for beef producers has become more attainable in recent years. Assisted reproductive technologies, specifically in vitro fertilization (IVF) and embryo transfer (ET), have become stronger options to use alongside live cover.

“Although IVF techniques have been available for many years, the high cost, low production and technical limitations associated with IVF have previously hindered its practical use on a large scale,” says Dr. Drew Crisler, veterinarian with ReproLogix. “Therefore, IVF had previously found

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A vet with ReproLogix palpates a cow as he aspirates her for IVF.

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its niche as the last resort to recover valuable genetic material from a donor cow struggling with infertility.”

Shane Morgan, an embryologist with ReproLogix, says technical issues prevented IVF from taking hold on a commercial scale when the technologies were first brought to market. He adds the industry as a whole has made significant progress in both the technology and the resources to execute such procedures. Some points of progress include more qualified technicians and facilities, more focus on expected progeny differences and genomics, improved estrous synchronization protocols, donor and recipient management strategies and software, genetic selection tools and improvement in IVF technologies.

The technology portion of ET has largely stayed the same in the past 30 years. But the improvement in other factors that contributed to a rise in IVF utilization has also led to a rise in success with ET.

“The equipment used for IVF has evolved greatly to include state-of-the-art ultrasound units and aspiration handles that make follicle identification and aspiration easy for skilled technicians,” Morgan notes. “Significant advancements have also been made with the media and techniques used in IVF laboratories, thereby increasing fertilization rates and overall embryo production. Additionally, the use of flow cytometry to sort fresh and reverse-sort frozen semen has made it possible to gender-select from a variety of bulls, even if it is not commercially available as gender-sorted semen.”

**Improved herd management**

Crisler also stresses management protocols on the ranch have improved the utilization and success of such technologies.

“A great deal of emphasis has always been placed on the management of donor cows, and rightly so, as production of a number of viable embryos is the first step in a successful embryo transfer program,” Crisler says. “Producers are becoming more aware of the impact recipient herd management and transportation have on producing and maintaining successful pregnancies.”

“Producers are using higher-quality females and doing a better job of maintaining them in adequate body condition for breeding. Many are having reproductive soundness exams performed on their recipients prior to setting them up for embryo transfer.”

Other factors improving the success of IVF and ET include the use of ultrasonography and software systems designed to track cattle and detect physiological changes such as illnesses or estrus. These technologies have aided producers with their estrous synchronization management by helping reduce human error and increase precision.

For example: “The application of CIDR-containing estrous synchronization protocols in recipient herds facilitates a high degree of synchrony necessary for successful transfer of both in vivo- and in vitro-produced embryos. CIDR-based protocols can also be used to quickly begin superovulation treatments on a donor when a reference heat is not available or a flush is desired in a short timeframe,” Morgan says.

Crisler says ET as a stand-alone practice has not grown as much as IVF due to “few significant advancements having been made in the industry since commercialization of non-surgical embryo collection and transfers in the late 1970s.”

As a result, combining the two technologies has become more prevalent. Crisler says there has been a growth in reproductive centers and technicians that have begun offering both oocyte collection and IVF services.

“Many producers look at ET and IVF with a ‘one-or-the-other’ mindset. Instead of trying to decide whether to use ET or IVF for a donor, why not use both? Cows can be aspirated for IVF in between conventional flushes without hampering flush performance. These two technologies actually work really well together to boost embryo production above what either technology could do on its own.”

Alternatively, Charles R. Looney, president of OvaGenix, also confirms IVF is taking a larger piece of the pie than ET, but he has seen ET grow as conception rates have improved, especially when utilizing IVF and ET in tandem.

“Routinely, the IVF donors are collected every other week, so you can produce a lot more embryos with..."
IVF and with a lot more classes of cattle,” Looney says. “For instance, you can collect from pregnant donors. With IVF embryos, if they collected from pregnant cows, we couldn’t do that with in vivo, so that’s a big advantage. It’s a lot easier to get embryos produced from IVF because you basically take control of all the fertilization, and it’s done outside the cow, so we limit the variability."

Overall, conception rates with both technologies have increased. Looney suggests this, coupled with the growth in available reproduction centers across the U.S., has significantly contributed to the overall utilization of these respective assisted reproductive technologies.

“[When] we first started doing in vitro fertilization, only 12 to 15 percent of the oocytes resulted in an embryo. When we put them in, we’re in 30, 40 percent pregnancy rates with fresh embryos, but at that time, we were culturing the embryos with what we called the entire kitchen sink. We had a lot of serum in the media. We would grow the embryos over a monolayer of fibroblastic cells that grew out of all these different cell types,” Looney recalls."

“[Today] when we flush a cow, we get about 50 percent viability rate with IVF. Even though we’re collecting a lot more oocytes, the average number of total ova from an in vivo collection is about 12 to 15 percent. When we collect from an IVF case, it’d be anywhere from around 20 to 30 percent. Only about four to six would develop into embryos. Then, we’ll transfer them fresh. We’re getting anywhere from 40 to 50 percent pregnancy rates and, if we put them in frozen, they’ll be from 30 to 40 percent. Those numbers aren’t exact, but they’re pretty much what we strive to tell people what to expect when they’re budgeting their ET program,” Looney summarizes. “Still, I think we could improve on that.”

Weighing cost-benefit results

From a cost standpoint, however, IVF and ET are unlikely to ever compete on the same economic and management plane as live cover breeding with the purchase of a bull.

“Embryo transfer and IVF programs typically come with a higher price tag and a considerable investment in time and labor when compared with simply turning bulls out with cows,” Morgan says. “However, the return on investment may be considerably higher for ET and IVF calves depending on the producer’s marketing strategy.”

The primary motivator behind IVF and ET technologies is to proliferate the genetics of superior seedstock at a more rapid pace than what could be achieved with natural mating. A strong secondary motivator is in genetics that travel across international borders.

“The obvious advantages are: It is much easier and more economical to ship a frozen embryo than it is to ship a live calf. There is also far less concern over disease transmission when exporting embryos because in vivo-produced embryos do not transmit infectious diseases – provided they are properly handled post-flush,” Morgan states. “Additionally, conventional ET allows calves to be born in their new environment, thus facilitating their adaptation to the new climate and immunity development to local diseases.”

While IVF or ET may not replace live cover in straight-run commercial cattle, the growing success and feasibility of the technology certainly have earned a seat at the table for producers considering how to pass along specific genetic material.

Danielle Schlegel is a freelance writer based in Whitewood, South Dakota.

Photo courtesy of ReproLogix.

Shane Morgan evaluates a filter containing media and embryos collected during a traditional flush.