Repro Tracks

▶ by **Bill Beal,** *beef cattle reproductive physiologist, Virgina Tech*

IVF makes ET 'by appointment only'

Remarkable improvements in the techniques for in-vitro fertilization (IVF) and embryo culture have changed the "game" of producing embryos from valuable donor cows. Today's success with IVF and embryo culture makes those procedures competitive with traditional embryo transfer (ET) techniques. In addition, the transfer of embryos produced by IVF and embryo culture has become so routine that a convenient, regular, weekly schedule can be devised to transfer IVF-derived embryos.

Breeder question No. 1

I want to use IVF to increase the embryo production from five heifers I just purchased. However, I have heard "horror stories" about the birth weights of IVF calves. Are those stories true?

Response: When IVF and embryo culture procedures were first developed for commercial use in the 1990s, there was a significant problem with a condition referred to as "big calf syndrome." Calves derived from IVF and cultured in media containing bovine serum were significantly larger than calves born following artificial insemination (AI) mating or traditional ET. Reports at that time indicated calves could range in weight from 50 to 200 pounds (lb.) at birth with a high incidence of calves weighing well over 100 lb. Larger calves consistently caused dystocia, often followed by death loss.

Ten years ago, researchers at reproductive technology centers and major universities developed a serum-free media for use in the IVF process. Since development of the serum-free media, birth weights of IVF-derived calves have been less variable, with very few large calves born.

One reproductive technology center reported that since the change in media birth weights of IVF calves have consistently ranged from 70 lb. to 120 lb. They indicated that the largest calves born in recent years are more than 40 lb. lighter than the large calves born 13 years ago. Furthermore, dystocia rates for IVF calves have fallen from 40% when the old culture system was in use to 13% today. At the same time, the percentage of live calves born after IVF has risen to 98%.

At the present time there doesn't seem to be any more risk of having large calves born following IVF than following natural mating or conventional ET.

Breeder question No. 2

How often can I have ova collected from a donor for IVF, and should I freeze the embryos or transfer them fresh?

Response: Ova are typically collected from donors via ultrasound-guided transvaginal aspiration. A long, small-gauge needle is passed through the vaginal wall, and oocytes are aspirated with gentle suction from the surface of each ovary. The procedure can be repeated regularly; however, in most commercial settings a once-weekly aspiration schedule is common. Donors are often collected for three weekly sessions followed by a one or two-week break before the aspirations are resumed.

Once oocytes are aspirated, they begin a routine, eight-day process that culminates with the transfer or freezing of the IVF-derived embryos (see Fig. 1). The process begins with a 24-hour maturation period during which oocytes are prepared for fertilization. The mature oocytes are then fertilized in vitro and transferred to a culture medium in which they develop for six days. After six days in culture, the developing embryos are evaluated microscopically and the degenerate embryos are removed.

If embryos are to be shipped to the farm or ranch of the owner of the donor, they are packaged in a temperature-controlled container and shipped overnight by commercial delivery service. Alternatively, embryos could be frozen for use later; however, IVF-derived embryos are less tolerant of freezing and thawing, and most ET centers recommend transferring fresh IVF-derived embryos.

If aspiration of donors is performed

Fig. 1: Routine procedure of ova collection, in-vitro fertilization and embryo culture prior to transfer of IVF-derived embryos

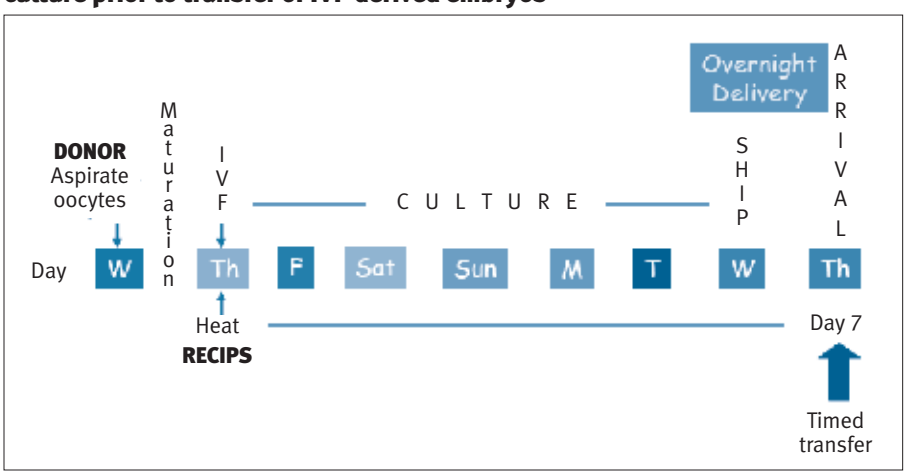

Table 1: Pregnancy rate following the transfer of IVF-derived embryos[1]

	Stage of embryo development at transfer	
	Morula (stage 4)	Blastocyst (stages 5-7)
No. embryos transferred	30	92
No. pregnancies	11	62
Pregnancy rate	37%	67%

[1]Data collected from one Angus farm in spring 2008.

routinely (e.g., each Wednesday as depicted in Fig.1), recipients for IVF-derived embryos can be synchronized to exhibit estrus the day of IVF and embryos can be transferred routinely one week later (e.g., every Thursday as depicted).

Pregnancy rates following the transfer of IVF-derived embryos have improved steadily as the procedure of IVF and embryo culture has been refined. Results from 122 transfers at one farm in the spring of 2008 resulted in an overall pregnancy rate of 60%.

However, when the stage of development of the embryo at the time of transfer was taken into consideration, the pregnancy rate was significantly higher for those embryos that were more developed (blastocyst stage) after seven days of culture than those that were slightly delayed in development (morula stage; see Table 1). Even when the morula-stage embryos were included, the success rate was similar to that following the transfer of embryos by conventional ET techniques. The advantage with IVF was that more embryos were produced per donor and the transfer schedule was turned into a routine, weekly procedure.

Editor's Note: *Bill Beal is a beef cattle reproductive physiologist at Virginia Tech. He conducts research involving estrus synchronization, AI, ET and the use of ultrasound technology. This column is designed to provide answers to questions about reproductive management commonly posed by commercial and purebred breeders. If you have questions or comments related to the reproductive management of cows or bulls, e-mail them to wbeal@vt.edu or mail them to him at the Dept. of Animal & Poultry Sciences, Virginia Tech, Blacksburg, VA 24061-0306.*