

Seeing Double

Cloning could shape a new generation of beef production.

by **Stephanie Veldman**

In February 1997 the world was introduced to somatic-cell cloning through a sheep named Dolly. She wasn't the first animal to be cloned, but she was the first to be cloned using frozen mammary tissue. Previous to that, scientists didn't think it was possible to clone an animal using cells from an adult animal.

Cloning has occurred for thousands of years both in plants and animals. One example of natural cloning is identical twins, which are clones of each other.

For many people, the ability of humans to clone animals seemed to happen overnight, but scientists have been working on this technology for more than 20 years.

"As a graduate student I was working on nuclear-transfer cloning technology. It really got started with splitting embryos," says Steven Stice, professor of animal science at the University of Georgia, Athens. "In 1978 the first embryos were basically cloned by splitting the embryos in half."

Since then, cloning technology has improved. In 1994 scientists began cloning from cell lines, growing embryonic cells in a Petri dish to get donor cells from which to clone. Since Dolly was cloned, the cloning of farm animals has become commercially available to producers.

Scientists and producers are waiting for a decision from the U.S. Food and Drug Administration (FDA) on rules for using cloning in the food production chain. According to Linda Grassie, an FDA representative, the food consumption risk

assessment is currently being written. She says the FDA has tentatively scheduled it to be ready for comment on the FDA Web site at www.fda.gov/cvm by the beginning of June. "The FDA is looking for compositional data from people who are doing this," Grassie says. "There is not much data currently, and it is hard to be certain about risks."

An animal safety analysis is also being written. No date for a comment period has been given yet. The final step in the process will be to write a guidance document. Grassie says the FDA's goal is to have that document ready for comment by the end of the year.

Receiving FDA approval was one of the topics discussed during a September 2002 conference on cloning technology that was sponsored by the Pew Initiative on Food and Biotechnology. Researchers and producers met in Dallas, Texas, to discuss the issues surrounding the entry of animal clones into the food chain. The conference included a summary of achievements to date and where the researchers are headed with the technology in the future.

Somatic-cell cloning

Somatic-cell nuclear-transfer cloning was developed by 1996. Somatic-cell cloning is the transfer of genetic material from the nucleus of the donor cell (the animal you want to clone) into an egg whose nucleus has been removed and replaced with that of the donor cell.

"When we go through and fuse those two cells together we get an embryo that has the genetic material from the cell you want to clone, and then you have the rest of the material coming from the egg," Stice says.

After the egg fuses with the donor nucleus, the embryo starts to develop. It is then transferred into the reproductive tract of a recipient female.

Mark Westhusin, a researcher at Texas A&M University, spoke about the inefficiencies in the cloning process. "In a lot of cases, pregnancy rates for clones may be depicted at a 10% or a 20% rate."

Why clone cattle?

Using somatic-cell cloning in animals provides producers a means by which to preserve genetic lines that would otherwise be extinct after an animal dies. Researchers at the conference on cloning listed several potential benefits to cloning cattle. These include increasing and assuring the supply of semen and embryos, preserving desired genetic traits, creating a bull from a high-performing steer, and eliminating some diseases, such as brucellosis, in cattle.

"We have the ability of cloning diseased cows and bulls and bringing them back without the diseases," says Ron Gillespie, former vice president of marketing for Cyagra. "For example, animals that have died of Johnes disease were cloned and brought back disease-free. We have had a case where bulls a man owned were sterilized by pesticide and cases where cows foundered."

Cyagra, a cloning company based in Worcester, Mass., was founded in 1998. They produced 24 research clones before beginning to produce clones commercially.

"The first commercial clones we produced were the Zeta clones in 2001," Gillespie says. Zeta was a dairy cow who was a poor embryo producer because she had been flushed when she was too young. Her clones are now greatly outproducing Zeta in embryos, Gillespie says.

"Since that point we have produced more than 60 cloned calves, and currently we have 50 in the pipeline," he adds.

Don Coover, veterinarian for SEK Genetics, raised five clones from the Chianina bull Full Flush. He was one of the most popular club calf sires in the United States, and wasn't able to keep up with the semen demand. Coover says that the calves are normal, and are very similar in structure, muscle makeup and personality. Currently, the calves are 18 months old and are ready to be collected; the only thing the owner is waiting for is permission from the FDA to distribute the semen.

Coover says he believes that cloning has

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► Castle Hill Farm, Keswick, Va., had its prize-winning Angus cow, Woodhill Evergreen 120 (below), cloned. Her clone, Castle Hill Evergreen C500 (right), was born in March 2002.



PHOTOS COURTESY OF CYAGRA

the ability to influence genetics on the female side of the industry similarly to how artificial insemination (AI) affected the male side. "You will be able to make large numbers of animals that are genetically identical or closely related."

He adds that current inefficiencies are related to the wide genetic variation found in cattle. "The beauty of somatic-cell nuclear-transfer clones is that we will have the ability, for the first time ever, to preserve and extend

the use of identified and superior proven genetics."

Who's buying?

Gillespie told the group at the cloning conference that it is important to understand who is currently interested in buying clones.

"The commercial producers are not buying clones. Why not? It is too expensive. We are charging \$19,000 for a guaranteed cloned calf. At that rate you would have to

charge \$100 for a hamburger to recover your investment," Gillespie says.

About 90% of Cyagra's business comes from seedstock producers. "These are the people who have, for generations, been selecting and breeding to develop genetically superior livestock. They are striving constantly to derive an optimal level of perfection and production in these animals," he says.

Future of cloning

Stephen Sundlof with the Center for Veterinary Medicine (CVM), FDA, says that farm animal cloning has reached the point where it could be commercially feasible in food production. "Now we find ourselves in a position where we are faced with all the technologies that have gone into this, and we have the ability to make these animals," he says.

He adds that the area the FDA is most worried about is the safety of food derived from clones. Are the animals that are produced as clones disadvantaged or

adversely affected by the technology? "These are questions of interest for the FDA. We decided we need to be very proactive in looking at where our regulatory system is going to be," Sundlof says.

"The public is slowly understanding where this technology is headed," he continues. "They are moving slowly away from the idea of making human clones and now are moving closer to home to the fact that maybe this technology, in some way, will affect their food supply."

"I think the question is not who is buying clones, but how can clones benefit

consumers and producers if and when FDA approves [their use] and when the price is right," Gillespie says. "I think we have to look first at the benefits, which are going to come in terms of safer milk and meat.

"We can reduce [the number of] unwanted animals, such as veal calves," he says. "Fewer livestock will result in fewer environmental problems, and at the end of the day cloning provides us with a means of improving quality over quantity. ... I think that all of the efforts I have heard about are heading us towards a much higher value and more quality animals." 