

Eggs on ice:

Tom Honadel searches for a better way to freeze cattle embryos

BY JACK HUBLEY

STATE COLLEGE — August is a great month to imagine life without a refrigerator. Without cold storage, summer heat would reduce the shelf life of all those delectable fresh fruits and vegetables, and meats of all kinds could become downright toxic in a matter of hours.

Without the ability to retard bacterial action through freezing, we'd once again be relegated to salting, canning or otherwise mummifying our groceries. Eating undoubtedly is a whole lot more fun than it used to be.

And, with the advent of embryo freezing technology, so is the embryo transplant business.

But even though freezing has added to the success and profitability of the ET business since the mid-1970's, there's still plenty of room for improvement, according to Tom Honadel, a graduate researcher at Penn State's Dairy Breeding Research Center. The present techniques are

not only tedious and time consuming, but the success rate is not what it should be. "Right now only about 30 to 40 percent of all embryos frozen will produce a calf," Honadel estimates. "We've got quite a way to improve."

The procedure goes something like this. After the embryo is collected, glycerol is added as a cryoprotectant to protect the embryo during the freezing process. This is a time-consuming process because the glycerol must be added in steps, since adding all of it at once may rupture the embryo, says Honadel. Normally the glycerol is added in three steps by immersing the embryo in successively stronger concentrations of the cryoprotectant, says Honadel.

When the embryo is ready to be frozen, the temperature is dropped to -7° Centigrade at the rate of 1°C per minute. At -7°, a forceps that has been kept in liquid nitrogen is touched to the straw containing the embryo. This starts the formation

of ice crystals.

The temperature is then dropped to the -37°C. range at the rate of .1 to .3° per minute. At this point, the embryo can be plunged into liquid N at -196° C and stored until needed.

Thawing the embryo begins with a 30-second exposure to a temperature of 35°C, and diluting the cryoprotectant in six steps. With each step requiring 10 minutes, the entire procedure takes an hour. "We don't really know if these steps are all necessary," says Honadel, "but they've been used to reduce stress on the embryo."

Honadel feels that a compound called trehalose, when used in conjunction with glycerol, may streamline the freezing procedure, as well as increase its success rate. As yet untested on bovine embryos, trehalose is a disaccharide sugar found naturally in bakers yeast, as well as in other spores that remain dormant for many years, says Honadel.

One of the problems inherent to the freezing process lies with the formation of crystals that tend to cut the embryo. And though glycerol does help to remove water from the embryo, researchers suspect that the compound may not be withdrawing enough water to minimize the formation of these damaging crystals.

The use of trehalose, Honadel says, may result in drawing still more water out of the embryo. While glycerol penetrates the embryo, trehalose is an extracellular protectant, meaning that it remains outside the embryo, explains the researcher. The water molecules will attempt to restore a balance by moving from an area of higher concentration within the embryo, to the area of lower water concentration outside the embryo that is being occupied by the trehalose.

Though some researchers may claim that removing more water will increase the stress factor, Honadel maintains that benefits may be realized in the form of a reduction in internal damage



Graduate student Tom Honadel hopes to develop a better method of freezing embryos at Penn State's Dairy Breeding Research Center.

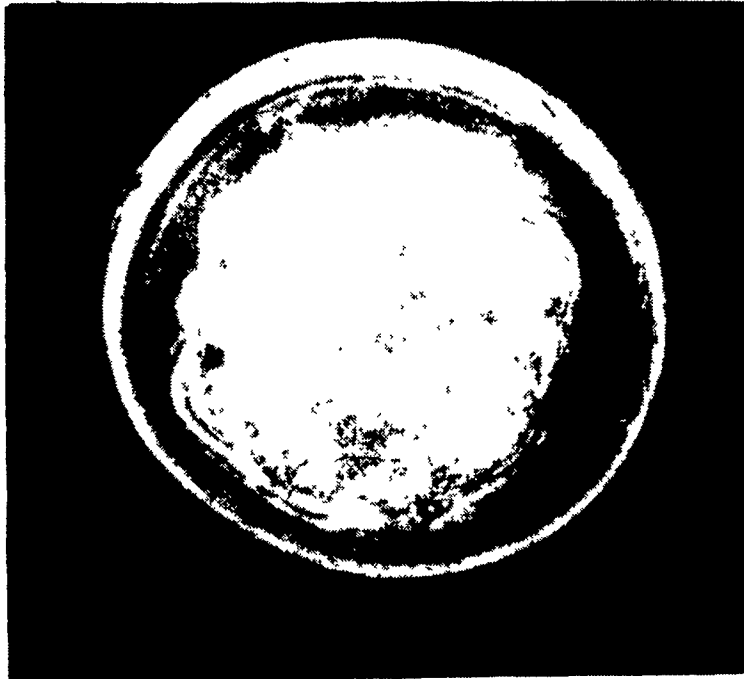
caused by water crystals.

Honadel also believes that, once the optimum level of trehalose has been established, embryos might possibly be plunged directly into the liquid N, eliminating the need for interim steps. "This way we could freeze embryos right on the farm, rather than using a lab," Honadel notes.

Experiments utilizing trehalose on dairy and beef cow embryos are currently underway, notes the researcher. Crossbred embryos are being used throughout the

experiment to eliminate the possibility of only some embryos benefitting from a hybrid vigor component. Embryos will be evaluated visually, and if one treatment level seems to work particularly well, further evaluation will be conducted by transferring these embryos to recipient cows.

And for those interested in learning more about the science of embryo freezing and ET procedures, Tom Honadel will be manning a booth at Ag Progress Days.



Embryos such as this excellent specimen stand to benefit from new freezing technology. At present, only about 30 to 40 percent of all embryos frozen will produce a calf, says researcher Honadel.

Real-Time is real dairy, livestock breakthrough

BY JACK HUBLEY

STATE COLLEGE — It's called a Real-Time Linear Array Ultrasound System. And it has nothing to do with the state-of-the-art stereo/cassette in your new car.

Adapted from equipment used in the medical field of obstetrics, the Real-Time unit can be used for examining any kind of soft animal tissue, says Penn State's Dr. Lester Griel of the Veterinary Science Department.

The department's interest in the machine centers around its use in pregnancy diagnosis. "A uterus full of fluid has a different impedance than one with nothing in it," says Dr. Griel, explaining that different tissue densities change the rate at which sound waves produced by the unit are bounced back.

"Even very early in fetal development, an embryonic vesicle is formed with fluid in it," notes Dr. Griel. "And, by scanning the uterus with a probe, you can detect this fluid. Some people have been doing this as early as 14 days after breeding."

What makes early pregnancy detection so important? Dr. Griel points out that slaughter checks reveal that many fetuses die in very early stages of development. The Real-Time enables research-

ers to diagnose the rate of embryonic loss in live animals during early pregnancy, and may reveal clues as to why the embryos are dying.

The new unit also incorporates a calipers, which permits veterinarians to measure the size of the embryonic vesicle. And since an embryo's chances of surviving can be evaluated based on its size at a given stage, the veterinarian can get a head start on bringing an animal back into heat if the embryo's survival is unlikely.

"From a research point of view, the limits of the machine are our imaginations in determining new ways to use it," concludes the veterinarian.

Extension meat specialist Dr. Bill Henning shares Dr. Griel's enthusiasm for the the Real-Time's potential. Though ultrasonic evaluation of meat animals has been done for the past 25 years, the Real-Time clearly revolutionizes the field of compiling accurate carcass data.

With the Veterinary Science Department absorbing the \$14,000 cost of the unit itself, the Department of Dairy and Animal Science, with help from the Pennsylvania Pork Producers Council, purchased the \$4,500 transducer, or probe, needed for meat evaluation.

According to Dr. Henning, the Real-Time renders a much sharper image of meat and fat composition on its nine-inch monitor than the equipment previously in use. He explains that, unlike older probes that emitted only a single soundwave, the Real-Time sends out 60 integrated soundwaves, providing a much more complete picture of body composition.

With the Real-Time's ability to quickly and accurately evaluate

carcass quality in the packing plant, producers can be paid based on the merit of their product, Dr. Henning points out. And the unit is an excellent tool for selecting breeding stock. "It's a much more objective measure of body composition than the eye," Henning notes.

"And the fact that it's so portable and so accurate really makes it a good educational tool," says the meat scientist. "I'm really

Canadian exhibitors to be at Ag Progress

PHILADELPHIA, Pa. — New and innovative equipment from Canadian farm machinery manufacturers will be on display at Ag Progress Days, Aug. 20-22.

The largest national participation at the show, apart from U.S. representation, will be from Canada—nine companies will be taking part in an exhibition sponsored by Canada's Department of External Affairs.

The Canadian display will feature combination rotary hoe, disc, roller and harrow; pneumatic conveyor; ventilation products; sprayers for all requirements; fifth wheel trailer; chaff spreader and chopper; rockpickers; granular herbicide applicators;

and galvanized steel silos and ancillary equipment.

The Canadian farm machinery industry, composed of more than 200 companies, produces equipment that has been accepted worldwide. After-sales service, high performance standards, quick response to problems, reliability, and wide production scope have given the Canadian industry its excellent reputation.

Visitors to Ag Progress Days will be able to view the products of the following companies:

Airway Division, Holland Equipment Limited, Norwich, Ontario—Rotary hoe, disc, roller and harrow.

Elie Equipment Sales Ltd., Elie,

Manitoba—Grain handling system. Faromor Inc., Waterloo, Ontario—Ventilation products and hog penning.

Hardi Inc., London, Ontario—Sprayers.

Hassa Agra Industries Inc., Landmark, Manitoba—Tote.n.Stak fifth wheel trailer.

Keith Industries Inc., Winnipeg, Manitoba—Straw Storm and Chaff Storm.

Rock-O-Matic Industries, Vonda, Saskatchewan—Rockpickers.

Valmar Airflo Inc., Elie, Manitoba—Granular herbicide applicators.

Ventilateur Victoria Ltee, Victoriaville, Quebec—Galvanized steel silos and ancillary equipment.