New Ways for an Ancient Science

Long before the world knew of science in the modern sense, there was husbandry—the scientific control and management of a specified branch of farming—at least in the production of livestock.

Remains of domesticated cattle dating to 6,500 years B.C. have been found in Turkey, but some experts say domestication of cattle may reach back 100 centuries. And wherever there are domesticated livestock, there is someone who's worrying and thinking and planning to improve those animals' reproduction.

That's because, for the livestock producer, reproduction means payday. Whether the end commodity is meat or milk—or muscle power for the farm—all the hard work and tender care ultimately come to naught if the herd doesn't reproduce.

For a function that animals have long been doing naturally, breeding can be remarkably fraught with difficulties. Big bulls can mean big, strapping calves—but that can also translate to calving difficulty.

And though twin calves would appear to be a double payoff, more than a third of calvings involving twins need human assistance for a successful outcome, compared with only 15 to 20 percent of single-calf births. According to Agricultural Research Service scientists at the U.S. Meat Animal Research Center at Clay Center, Nebraska, cows carrying multiple calves may take longer to rebreed under typical production systems. That's because the fetuses don't leave enough room in the cow's body cavity for a full stomach of the normal low-energy diet needed to attain the physical condition to rebreed quickly.

To improve the livestock breeding odds for agricultural producers, ARS scientists have been pushing the edges of scientific knowledge for years.

One of their most remarkable advances of recent times was development of technology at Beltsville, Maryland, that makes it possible to sort livestock sperm based on their chromosomal content—X versus Y. Y-chromosome sperm result in male offspring, while X-chromosome sperm promote females.

Why would farmers care about gender, as long as their herds get bigger?

For the dairy farmer, milk's the thing—and a cow that delivers a male calf has paid for her year of feed and veterinary care with an animal that's not going to contribute a drop to the dairy's milk output. Beef farmers, on the other hand, are more likely to want male calves because, pound for pound, males grow faster than females on the same amount of feed.

Recently, ARS scientists at Beltsville announced advances in the cryopreservation of pig embryos—a major step forward in making swine with important genetic traits available to breeders worldwide.

The meat industry has been routinely cryopreserving embryos of various livestock species—especially cattle—since the mid-1980s. But conventional freezing methods won't work for pig embryos, which are extremely sensitive to slow cooling below temperatures around 59°F. As they cool, pig embryos undergo physiological and structural changes that leave them incapable of normal development.

So ARS scientists are using a rapid cooling process called vitrification that is thought to outrace the damaging effects of slow cooling. They have increased the cryopreserved pig embryo survival rate to more than 80 percent in the laboratory. [See "Vitrification Keeps Pig Embryos Viable," *Agricultural Research*, March 1998, pp. 19-20.]

Up-to-date information is crucial for helping producers get the best results from their livestock breeding efforts. That's why ARS scientists at Beltsville recently doubled the frequency of their reports evaluating dairy breeding animals. The reports show which have outstanding milk yield, milk composition, and other valuable traits. That's vital news for farmers as well as businesses specializing in artificial insemination and embryo transfer. Thanks to this increased reporting from ARS, dairy farmers can now pinpoint the best bulls and calves 3 months sooner.

At Clay Center, ARS scientists have reported findings from a 4-year study that indicate cattle producers can pay particular attention to birthing ease when selecting breeding animals, without giving up larger calves later on. In the study, calving assistance was required 24 percent less frequently among young cows selected on the basis of ancestral records for calving ease dating back to 1978. One good indicator of calving ease: lower birth weights of calves. But while the average birth weight of calves born to easy-calving 2-year-olds was 6.6 pounds lighter than calves from unselected breeding lines, yearling weight wasn't affected, the scientists report.

As the past year's headlines about Dolly, the cloned Scottish sheep, have proved, advances in reproductive technology are big news. ARS scientists nationwide are working hard to turn their reproductive research advances into "news you can use" for America's livestock producers.

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