

Determining Bull Fertility

A faster test

by Susan McGinley

Fertility in a livestock enterprise is five to ten times more important economically than any other production measure. Detecting high fertility bulls is the key to increasing livestock production and thus profitability.

Cows bred to high-fertility bulls bear more calves earlier in the season, resulting in more beef weaned and marketed per cow, a direct contributor to profit. Bulls with identical semen quality vary in actual fertility. Means to identify bulls on the basis of fertility potential can result in higher pregnancy rates, leading to larger calf crops.

A new test determining bull fertility has been developed through collaborative University of Arizona and industry research. The test is not only accurate, it's also user-friendly, faster than the previous two-day laboratory method, and cost-effective.

More than 20 years of research have gone into the development, testing and marketing of this technology. The rationale behind it is simple: choosing the most fertile bulls for cattle breeding has always held an element of risk. Until you breed a bull and find out his fertility, you don't know if the mating was successful. In multiple-sire herds, which are common in the industry, DNA testing to confirm parentage is necessary to determine fertility of individual bulls.

Roy Ax, a professor in the Department of Animal Sciences at The University of Arizona, has studied each step of the fertilization process. He and his colleagues have focused on a mechanism called "capacitation," where a region called the acrosome, located on the head of the bull's sperm, swells and breaks, releasing enzymes to activate the sperm. This change enables the sperm to fertilize the egg, as long as there are enough binding proteins present.

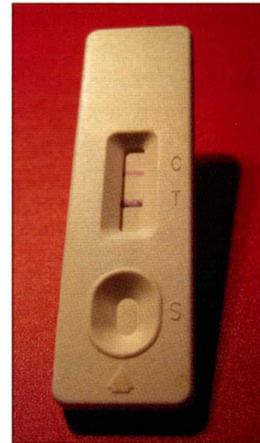
During the 1990s Ax and his colleagues assisted in developing a color-based diagnostic test to identify a protein on bull sperm. An antibody is used to detect presence or absence of that protein, referred to as fertility associated antigen (FAA). Research shows that bulls with FAA on their sperm are 17 percent more fertile than herdmates lacking FAA over a 60-day breeding season. Heifers inseminated once to bulls with sperm-associated FAA had a 16 percent higher pregnancy rate than herdmates inseminated to bulls without FAA on their sperm.

The original diagnostic test, released for commercial use in 1998, was licensed for any rancher or veterinarian in the world to use. Since then it has been adopted by breeders across the U.S., and in at least a dozen countries worldwide, in the Pacific Rim, South America, Canada and Europe.

In January 2004, the next generation of that test, a patented lateral-flow cassette containing reagents to detect FAA, entered the market after University of Arizona scientists conducted extensive research on it.

Housed in a small plastic cassette about the size of a stick of chewing gum, it has a three-year shelf life, requires no special storage, and can be used chute-side. It takes 20 minutes or less to run and works just like a pregnancy test that can

This small plastic cassette, about the size of a stick of chewing gum, shows the purple line indicating the presence of the fertility associated antigen.



Joanne Littlefield

be conducted at home: a purple line in the cassette window indicates the presence of FAA.

Ax advises that the test be included along with the traditional breeding soundness exam (BSE) conducted on bulls. A sample of the semen collected from the bull is mixed with a buffering agent and placed on the cassette window. The test only needs to be performed once in a bull's life. The result indicates the bull's level of fertility. It should be noted that a bull that tests low for FAA antigen has lower fertility but is not completely infertile.

More than 900 bulls from 19 herds were screened with the new test by Ax and other UA Department of Animal Sciences researchers who traveled to six states during spring, 2003. Of the bulls tested, 25 percent were found to be FAA-negative.

The test's economic return is clear, according to Ax. If a few tests are purchased at \$45, at a \$50 profit per calf, and if a bull remains in a herd for four years breeding 25 cows per year, the return on investment is 13-fold per each cow bred. For bulls, a \$45 test yields a net return of \$140 per bull tested. If the kits are ordered in large batches to cut the cost to \$30 per test, using the same inputs stated above, the return on investment becomes 22-fold per cow.

This work was sponsored by a USDA Small Business Innovative Research grant to Reprotec, Inc., the company in Tucson that markets the test. They hold an exclusive license to offer this test worldwide; the UA held a subcontract on the project.

UA scientists are now screening for mutations in the FAA gene that may serve as a DNA-based diagnostic test. TMI Laboratories International, LLC in Tucson is funding the research with the technology licensed to them from the UA's Office of Technology Transfer.

"We've already found 15 mutations in FAA from human prostate," Ax says. Their relation to fertility or cancer will be the subject of future research. This test also has implications for fertility in many species, although so far we only have data on bull fertility. FAA has been detected in dog, ram, boar, goat and human semen." ❀

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Reprotec, Inc.
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