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Male Enhancement

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Bovine male reproductive technologies hold promise for the industry. by Troy Smith



he compilation and marketing of electronic mail address lists must be a lucrative business. How else could so many Internet users become the prey of online salespeople? Anyone who communicates via the Internet is all too familiar with the daily onslaught of advertisements that somehow survive so-called ad-blocking devices and clutter the message inbox.

In a single day, it may be necessary to delete

dozens of solicitations hawking low-interest mortgages, real estate and online pharmaceuticals. And judging solely from the number of product advertisements, there must be strong demand for pills and potions promising "male enhancement." The response from cow country might be better, however, if solicitors offered products for enhancement of



The variation in semen quality among bulls in many beef breeds warrants investigation, says Mel DeJarnette, reproductive specialist with Select Sires Inc.

reproductive performance in the bovine male.

We can't say if technology aimed at the human condition delivers measurable results, but great strides have been made in development of bovine male reproductive technologies. Artificial insemination (AI) is the prime example, according to Mel DeJarnette, reproductive specialist with Select Sires Inc.

After more than 60 years of unprecedented success in the U.S. dairy industry, approximately 70% of its cow population is bred by AI. Yet, DeJarnette adds, AI is applied to less than 10% of the country's 33 million beef cows. It might still be considered a novel male reproductive technology for much of the beef cattle industry, but DeJarnette believes AI and associated "male enhancement" technologies hold promise for beef producers.

"New technologies, in any industry, must demonstrate a return on investment before widespread implementation can be expected," DeJarnette offers. "Technologies that improve production efficiency with increased output per unit of input, or lower production cost while maintaining output quantity and quality, are easy decisions for implementation. Other technologies that may increase production costs and/or lower production efficiency, compared to existing technology, must add value to the product before widespread adaptation can be expected."

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DeJarnette says the AI industry must continue to emphasize quality control programs. The primary objective should be to minimize variation in the

> quality of semen made available to cow-calf producers while optimizing efficiency of semen utilization. Application of new, and some not-so-new, technologies for "male enhancement" could foster increased use of AI among beef producers.

# Sire selection and management

Delarnette sees

opportunity to aid genetic selection by improving the sire sampling process through DNA marker-assisted selection (MAS). DNA marker technology could increase accuracy of selection of young sires worthy of evaluation through progeny testing. The dairy industry routinely uses several DNA markers to screen young AI sires for undesirable traits before going to the expense of progeny sampling. Promising applications to the beef industry include MAS for growth, carcass quality, meat tenderness and disease resistance.

There has been limited genetic selection for male reproductive capacity in beef breeds. Most selection efforts have targeted scrotal circumference, a highly heritable trait associated with semen production capacity. But other technologies to enhance scrotal circumference or semen production capacity are desirable in AI sires, particularly those for which semen demand exceeds supply.

Cloning has potential for increasing the semen supply of high-demand sires and extending the marketing life of aged or deceased sires. Cloning CONTINUED ON PAGE 108





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# Male Enhancement CONTINUED FROM PAGE 107

would have the advantage that it could be selectively applied only to mature, highdemand sires. The primary obstacle to application of this technology is the lack of government approval.

"The AI industry would adopt it, if approved, to produce copies for increased semen production or clones for natural service," DeJarnette says. "Cost efficiency remains a big question, along with FDA (Food and Drug Administration) approval and consumer perception."

The greatest opportunity to boost the fertility potential of a sire is to enhance the quality of neat semen — the natural product undiluted by preservatives or extenders. The heritability of semen quality characteristics is generally considered to be low, but DeJarnette says the variation in semen quality among bulls in many beef breeds warrants investigation. Also worthy of further study is the supplemental feeding of various microminerals, fats and antioxidants that might aid sperm cell production. Currently, it is unclear whether supplementation has merit unless bulls are suffering from specific nutrient deficiencies.

At present, DeJarnette calls the breeding soundness exam, including a thorough semen evaluation, the foundation of sire selection for fertility. In addition to evaluation for minimum standards of scrotal circumference and firmness, ultrasound and infrared thermographic evaluation of the bull's capability for regulating testes temperature may augment selection for reproductive capacity.

# Semen processing and cryopreservation

Even with the best procedures, semen quality is not improved by cryopreservation,

or freezing. However, DeJarnette says new technologies may enhance post-thaw sperm survival and influence threshold numbers of sperm required, per dose, to achieve optimum fertility. Improved post-thaw survival should mean each dose could contain fewer sperm cells without compromising conception rates and allow for more efficient use of genetically valuable semen.

Along with processing methods allowing reduction of sperm dosage, DeJarnette looks for technologies to improve sperm longevity. For example, the pre-freeze addition of cholesterol and antioxidants to semen may allow for sustained time release of sperm.

Sperm sorting for gender preselection (sexed semen) is a research-validated technology that adds value to the semen dose. But the concept is struggling to find its niche in commercial application, DeJarnette admits. The reduced fertility of sexed semen (by up to 30%) and pricey equipment make it a high-input, lowoutput proposition.

"Adoption has been stifled by cost," DeJarnette says. "And high-demand bulls aren't available to this technology, since we're already selling every drop of the popular bulls' semen."

Constraints to commercialization of sexed semen might be alleviated, he says, by improved conception, reduced equipment costs, greater output efficiency or greater price differentials for male vs. female offspring.

### Semen delivery

The final link in the male component of fertility potential is the technician's ability to maintain semen quality until it is deposited in the female reproductive tract. DeJarnette says timely insemination has received tremendous assistance from widespread application of synchronization protocols that allow fixed-time AI. Timing insemination to within a few hours of ovulation has diminished the need for heat detection. While numerous heat detection technologies have been developed, none are without limitations, and the process of heat detection continues to challenge the success of AI for many producers.

"Timed AI probably is the greatest maleoriented technology to be implemented in the last 20 years," DeJarnette says.

Proper timing of insemination may minimize the effects of sperm longevity on conception, thereby minimizing variance in fertility among sires. However, evidence suggests that timed AI utilizing some sires' semen is more successful than with other sires. The differences are not huge, DeJarnette says, but the choice of timed AI protocol may make a difference. Protocols that are less precise in controlling the time of ovulation and that allow insemination at greater intervals prior to the expected time of ovulation may actually magnify the importance of sperm longevity.

### Find the duds

Numerous opportunities exist to enhance reproductive capacity among bovine males, and more can be expected. DeJarnette says technology can and will continue to influence the efficiency of semen utilization. But in a best-case scenario, technology will only maintain the fertility potential of the neat semen sample. Identification of subfertile bulls and semen will continue to be most important.

"It's doubtful that we ever will be able to predict the studs, but we'll have better ways to find the duds," DeJarnette offers.

"The most readily available and economically justifiable male-oriented reproductive technology available to beef producers is the largely underutilized technology of artificial insemination using highly fertile semen obtained from genetically superior sires of known health status," he adds.

"Perhaps the introduction of systematic ovulation control programs will be the technology that encourages greater utilization of AI by the beef industry and, thereby, better positions the average producer to capitalize on other maleoriented reproductive technologies that may be introduced in the future," he says.