

# Sexed Semen Nearing Reality

We've heard for years that a commercially feasible way to sex semen was just around the corner. It appears we've finally turned the right corner.

BY TROY SMITH

**F**rom the time artificial insemination (AI) became a practical reproduction-management tool, researchers have been haunted by the notion of developing sexed bovine semen so the gender of AI-produced calves could be predicted.

Since it is the bull's contribution that determines the offspring's gender, scientists sought a means of separating sperm bearing the X (female) chromosome from sperm bearing the Y (male) chromosome. They've wrestled with the concept for nearly 30 years, periodically hinting that availability of the technology was just around the corner.

The industry seems to be peeking around the right corner at last. During the recent Range Beef Cow Symposium in Greeley, Colo., John Schenk told a producer audience that commercialization of sex-specific sperm is imminent.

Schenk represents XY Inc., a Fort Collins, Colo., company that has researched application of sperm-sorting technology in cooperation with Colorado State University (CSU).

"Sex-specific sperm soon will be available to the cattle industry for use in high-profile, genetically elite herds, with widespread availability to commercial herds following within two years," said Schenk.

## ■ The sorting gate

Schenk's brief refresher course in reproductive physiology reminded producers that bovine sperm contain 30 chromosomes, one of which is the sex chromosome. If a sperm cell bearing an X chromosome fertilizes the egg, the result is a female calf, while fertilization by a Y-bearing sperm cell results in a bull calf.

The only reliably proven difference between X- and Y-bearing sperm is their respective content of deoxyribonucleic acid (DNA). In mammals, 3.8% more DNA is contained within the X chromosome, and that difference is detectable through a process known as cytometric analysis.

Sorting is possible because sperm cells capable of

producing females have a certain "glow" — at least they do when sperm are stained with a dye that binds specifically with DNA. Since X-chromosome-bearing sperm contain more DNA, they glow brighter when illuminated by an ultraviolet laser light beam.

In layman's lingo, this highly sophisticated sperm sorter discriminates between the brightness differences of the X- and Y-bearing sperm and separates them accordingly. In addition, only live, membrane-intact sperm are sorted, with dead sperm removed during the process. For routine production, says Schenk, sorting is accomplished at 90% purity for a specific sex.

## ■ Study results

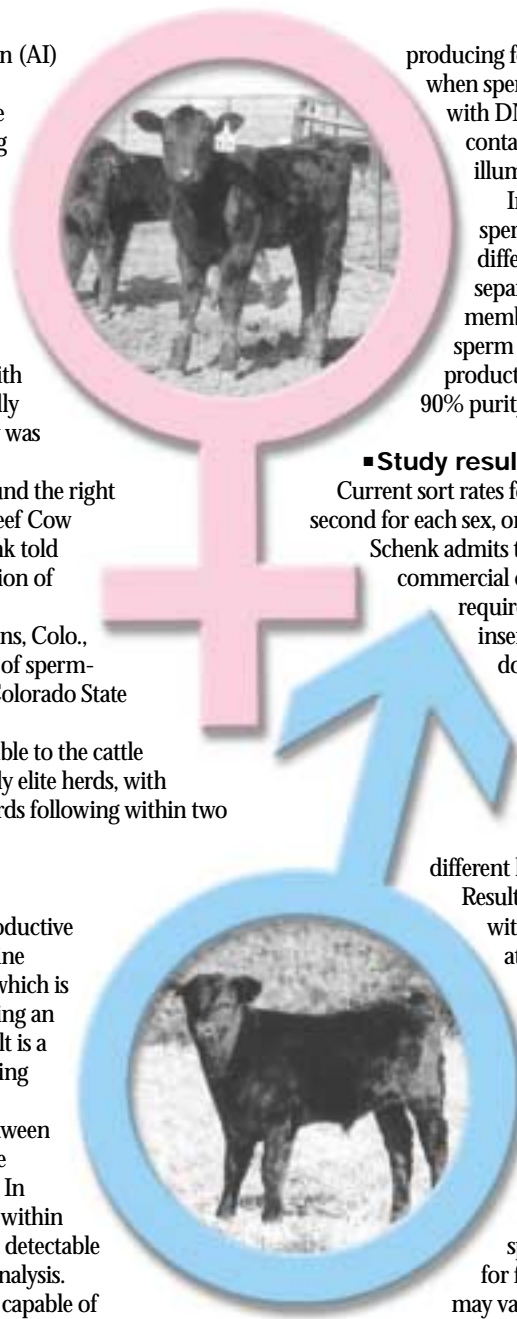
Current sort rates for bull sperm exceed 2,000 live sperm per second for each sex, or approximately 8 million sperm per hour.

Schenk admits that is too slow for practical application to commercial cattle production, since an hour of sorting is required to accumulate an amount sufficient to inseminate one cow according to conventional AI dosages.

Therefore, XY Inc. and researchers at CSU have focused on refining the sorting technology, but they also have explored insemination methods using fewer sperm. Schenk said 11 field trials have been completed, involving heifers in several different herds under different management practices.

Resulting pregnancy rates among those inseminated with reduced dosages of sex-specific sperm were at least 85% of the pregnancy rates of the control group inseminated with unsexed semen containing seven to 20 times more sperm.

"However, in marginally managed herds, or with lower-fertility bulls, sexed sperm resulted in fewer pregnancies compared to controls," said Schenk. "Maximum fertility for sorted sperm at lower dosages may only be achieved with high-fertility sires. Just as sperm from some bulls have higher tolerances for freezing and thawing, tolerances for sorting may vary among sires."





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“Fertilizing potential of sorted sperm from average-fertility bulls may approach maximum levels if increasing sperm dosage can compensate for lower fertility, but low-dose insemination of sorted sperm from low-fertility bulls likely will result in unacceptably low pregnancy rates.”

Schenk said limited data involving lactating beef and dairy cows with sexed sperm revealed pregnancy rates lower than those achieved with virgin heifers. Too few data are available for valid conclusions, but lower pregnancy rates in cows may be due in part to uterine involution, lactation and higher nutritional needs, which occur during the time cows are inseminated. More bull-to-bull variation also may exist in pregnancy rate with sexed sperm in cows than in heifers.

#### ■ Is it practical?

As a reproductive physiologist at the University of Nebraska West Central Research Center in North Platte, Neb., Gene Deutscher has been looking hard at commercial application of sex-specific sperm. He says the technology looks good and promises to get better as the sperm-sorting process is hastened. Relative success of insemination with reduced-sperm dosage also looks promising.

“Sexed semen is already being marketed to dairy herds in

England,” says Deutscher, “and dairy producers will likely be first to use it when it becomes available in the [United States] — maybe as soon as next year. They’ll want it to reduce numbers of unwanted bull calves and for faster genetic advancement in breeding for heifer calves.”

For use in beef herds, Deutscher expects interest among seedstock breeders seeking to breed for replacement females with superior maternal traits and, in some cases, to significantly increase production of bull calves. Early on, cost will likely be a limiting factor. Some industry experts anticipate the cost of sexed semen could be at least double that of non-sex-sorted semen. Considering the potential variability in sorting tolerance, access to popular and particularly fertile sires may command a significant premium.

“I do believe the heifer-development industry will be very interested in this technology. Breeding replacement heifers to have lighter heifer babies should result in less calving difficulty, and getting a live calf is a priority with first-calf heifers,” he added. “Eventually, commercial cattlemen may use sexed semen to enhance their crossbreeding programs by breeding their best cows to maternal sires (to raise replacement females) and raising steers out of their other cows bred to terminal sires.”

