

The role of gender-sorted semen in rebuilding the beef herd

Justin Rhinehart for *Progressive Cattleman*

At the time of writing this article, many areas of the U.S. are experiencing a rebuilding phase in the cow-calf sector. There is a great deal of discussion about many aspects of this rebuilding phase, including how long or how rapidly it will continue, where the increase in cow numbers will concentrate geographically and whether the additional numbers will come from an expansion of

conventional cow-calf production from established ranches or if it will come from the addition of new producers using what are considered to be unconventional methods.

In any of those rebuilding scenarios, or even if rebuilding slows to a crawl due to other market and environmental drivers, increased utilization of new technologies should be a focus for improving system-wide

efficiency. Sex-sorted (aka gender-sorted) semen for A.I. is one of those technologies that could enhance the rebuilding effort and then continue to improve production efficiency as the industry experiences other cycles.

The basics

Before discussing the application of a specific technology, it is a good idea to understand the basic

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mechanisms that make it possible. For sex-sorted semen, the ability to shift the gender ratio of a calf crop comes from the fact that gender is determined by the sperm cell that fertilizes the egg. Sperm cells that result in a heifer calf (XX) have more DNA than sperm cells that result in a bull calf (XY).

Of the several attempts to find ways to sort XX and XY sperm cells, the only method proven to be commercially viable is flow cytometry. Before going through the flow cytometer (sorting machine), a fluorescent dye is incorporated into the DNA of the sperm cells. They pass through the sorting machine in drops of liquid containing a single sperm cell per droplet. The machine detects the amount of fluorescence each cell emits; an XX sperm cell will have more fluorescence than an XY. A positive or negative charge is applied to the droplet depending on the type of sperm cell in it. Then, the machine can sort them into different collection tubes, based on the charge on the droplet, as it moves through a magnetic field.

Initially, flow cytometry yielded very low conception rates when sex-sorted semen was used fresh soon after processing. Work in the laboratory and field studies eventually improved the results until sexed semen became commercially available on a large scale in the U.S. in 2004. The sorting method has continually been improved over the last 10 years and yields better fertility than when commercial use began.

Advantages and disadvantages

The advantage of shifting sex ratio has been most obvious for dairy producers, where male calves generally have little value. Beef cattle producers have been able to use both XX- and XY-sorted sperm in different scenarios. Seedstock producers are able to increase the number of bulls they market each year and target specific females to produce replacement heifers. Commercial producers have been able to increase the number of steers, giving them more total weight and usually more valuable weight, to sell. Similar to the purebred scenario, commercial producers can select specific cows to target replacement heifer production. All of these situations have to be evaluated with the disadvantages outlined below in mind. Specifically, the production benefits do not always outweigh the additional input (both increased cost and reduced fertility).

This sorting method is not

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Because it takes longer to process sex-sorted semen, the process yields fewer straws per ejaculate with fewer cells per straw. Staff photo.

perfect, but it does shift the ratio 85 to 95 percent of the desired sex. Very recent improvements are being reported with fertility using sex-sorted semen. However, it continues to be considered lower-fertility than non-sorted frozen semen. It takes much longer to process sex-sorted semen than conventionally processed semen. Therefore, it yields fewer straws per ejaculate with fewer cells per straw and reduced fertility. Additionally, individual bulls inherently have different fertility, and this difference can be exacerbated during the sorting process.

Current breeding strategies and industry trends

Sex-sorted semen is currently reserved for use in herds where whole-herd reproductive efficiency has been optimized through intense reproductive management. Until recently, pregnancy rates to sexed semen have been considered highest in virgin heifers that are bred 12 hours after the beginning of standing heat. But the early data that led to those general recommendations came from the dairy industry, and recent research shows that difference is not as dramatic between beef cows and heifers.

Fixed-time insemination (appointment breeding) with sex-sorted semen does not currently yield consistently adequate fertility. There continues to be a great deal of research to find the right estrous synchronization protocols and timing of insemination to reach pregnancy rates comparable to fixed-time A.I. with conventionally frozen semen. That will continue to be the major limiting factor to widespread use of gender-sorted semen in commercial cow-calf production. With continued improvements being made to the sorting process, finding protocols that yield consistently good results could soon be a reality.

Embryo transfer using sex-sorted semen has followed a similar trend. Results were inconsistent and generally poor for early adopters. More recently, as the process of sorting has been largely improved, results have become more favorable and breeding with sex-sorted semen in multiple ovulation ("super-ovulated") embryo transfer appears to be more widely used. But most producers report breeding more often or using straws prepared with more sperm cells specifically for embryo transfer protocols.

Use of in vitro fertilization (IVF) has dramatically increased in the U.S. over the last three years. However, using frozen sex-sorted semen in this process decreases the number of transferable embryos from a single IVF procedure. Some labs are successfully producing IVF embryos by sorting conventionally frozen semen (reverse-

sorted) just prior to incubating it with harvested oocytes (eggs).

Rebuilding the herd

If the beef industry continues to see market drivers for expansion, gender-sorted semen could play a role in accelerating it. As this technology enters a phase of more rapid improvements in fertility, the timing could work well for the industry. But the fact remains that even conventional A.I. is underutilized (relative to its potential impact) in beef cattle production. Consequently, gender-sorted semen might be more useful as a tool to improve the overall genetic quality of the expanding national herd than it will be for more rapidly increasing the sheer number of heifers available for retention.



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