

# Beef on dairy and sexed semen strategies

Mitchell E. Hockett, PhD

STgenetics  
Raleigh, NC 27617

## Abstract

The use of sexed dairy semen and beef semen on dairies as tools to generate genetic progress and expand revenue has evolved tremendously over the past decade to the point these tools have become integrated as part of a finely managed process often referred to as the “sexed and beef” model. Continued improvements in gender-sorting techniques and increased fertility of resulting products have enabled this model to evolve to become standard operating procedure for the bulk of commercial dairies. Planned use of gender-sorted semen allows for controlled and targeted creation of an ideal number of heifers from a specific genetic source. Reproductive programs that improve fertility of these matings in conjunction with gender sorted product that leads to high dairy heifer ratios leads to the opportunity to utilize beef semen to expand revenue potential of crossbred beef x dairy calves above that of a dairy counterpart. This talk will cover programmatic considerations to drive success of “sexed and beef” programs on dairies utilizing these tools to a) accurately calculate and plan to create heifer needs; b) optimize genetic progress and revenue generation; and c) enlarge the value of beef x dairy crossbred sire selection.

**Key words:** beef, crossbred, sexed semen

## Introduction

Implementation of technologies can change over time with changing conditions. Innovation can be defined as developing a solution to a problem while utilizing existing technology in a new way. Artificial insemination has been an integral tool for dairy farms and enabled rapid genetic progress, and multiple innovations based on this tool have occurred including artificial reproductive techniques such as embryo transfer and insemination using gender sorted semen. The latter of these has transformed the dairy industry. Up until the advent of sexed semen, replacement heifers were the product of chance. Artificial insemination using conventional semen was applied to the breeding herd, and regardless of best wishes, heifers could come from the top and bottom end of genetics of the herd with equal likelihood. The invention of sexed semen was first reported in 1989 with demonstration in rabbits.<sup>4</sup> Initial sorting was slow, yet field trials with low doses of sexed frozen semen and fresh semen<sup>3</sup> and larger-scale field trials began demonstrating there was a commercial opportunity.<sup>7</sup> Initially, fertility of sexed semen was low compared to conventional semen.<sup>8</sup> Continued product improvements have closed the fertility gap between gender-sorted semen and conventional semen in field testing.<sup>9</sup> The initial commercial use of sexed semen was largely aimed at increasing the number of heifers created which allowed for internal growth or surplus heifers which could be sold as replacements or beef. Rising feed costs in conjunction with reduced commercial heifer market prices reduced the opportunity for profit<sup>6</sup> for those rearing and selling heifer replacements. However, improvements in the performance of sexed semen have come in parallel to a rise in beef x dairy calf market prices to a level not previously experienced. These factors together have

led to an innovative use of sexed semen and beef semen that has advantages to the dairy of reducing unnecessary feed cost and growing revenue. The “sexed and beef” model, as its name implies, uses sexed semen to achieve the objective of creating a target number of heifers to fulfill the dairy’s replacement and growth needs and beef semen on remaining animals in the breeding herd to increase overall revenue.

## The “sexed and beef” model

The “sexed and beef” model treats every uterus on the farm as a valuable commodity and puts focus on creating the most profitable pregnancy possible in each animal. For high-genetic animals in the herd, the best utilization is to capitalize on their higher relative genetic value to make the highest genetic heifers for the next generation. For lower genetic animals or those with traits that should not be transmitted to future generations, the greatest valuable to the farm is to create a beef x dairy terminal cross and not allow their dairy genetics be perpetuated in the herd. By only creating replacement heifers from the top genetic animals in the herd, genetic progress can be made much more rapidly than previous models using conventional semen that resulted in heifers being born randomly from both high- and low-genetic animals alike. In the more conventional model, genetic improvement on the farm was largely attributed to selection intensity on sires that were utilized. One benefit of the sexed and beef model is that intensity can be placed on both the sires and the dams of future generations to speed genetic progress.

## Heifer inventory management

Precise management of heifer inventory reduces unnecessary cost of raising surplus heifers. The accurate calculation of heifer needs is the first step in a process for dairy managers to build their plan for future heifer creation. Two key metrics that contribute to replacement needs include the cull rate of the herd and desired growth rate for herds wishing to grow internally. Primary reasons for culling have been reported as reproduction, health and mastitis, low production and death.<sup>1</sup> All efforts should be taken to minimize involuntary culling to reduce the number of heifers to be produced annually. In addition to cows leaving the herd, non-completion rate of heifers is a major contributor to heifer production needs. In a survey of farms,<sup>6</sup> stillbirth risk (5.7%), cull risk by 13 mo of age (10.2%), reproductive failure risk (6.8% in breeding heifers), and culling risk in pregnant heifers (6.4%) were reported to be primary reasons for heifers leaving the farm prematurely. Herd health and reproductive programming should focus on reducing non-completion rate to capitalize on investments in genetics and feed to rear heifers. These sources of loss must also be considered in calculating needs, or production of heifers will fall short to sustain the herd.

The second step in heifer inventory management is to determine the number of sexed semen services that are required to yield the calculated heifers needed and to make the right matings. All services with sexed semen do not yield a live heifer calf and, therefore, a host of factors must also be factored to

calculate the number of inseminations that are required. Conception rate of animals being bred, abortion rate, seasonal effects on reproduction, and female ratio of calves resulting from sexed semen must all be considered. For herds that require a steady supply of heifers throughout the year, monthly targets for sexed semen inseminations prevent large swings in heifer production. Regular monthly updates of progress toward goals following reproductive exams allow for regular updates to plan when necessary.

### Selecting dams of future replacements

One major benefit of heifer inventory management is the selection intensity that can be placed on females contributing to the next generation. The goal should be to enhance both generational genetic progress and fertility rates with sexed semen. One approach is to first target the most productive services (1<sup>st</sup> service, 2<sup>nd</sup> service, etc.) of heifers to sex sorted semen, with the underlying assumption that heifers should be the top genetic animals in the herd and the most fertile animals with highest conception rates. These assumptions should be qualified against herd data where available. Additional services should be added in priority rank of youngest to oldest and most to least fertile until the target number of inseminations/month are achieved. Under this plan, older females and less fertile inseminations in younger animals may be targeted to terminal beef sires.

Genomic testing is a tool that can help better identify the true top genetic animals in the herd in replacement of using age as a proxy. When genomic data are available, inferior animals may be culled selectively or targeted for terminal beef cross calf creation. Highest genomic animals, both heifers and cows, can be targeted to boost genetic gain. This approach to heifer creation improves the rate of genetic progress but adds complexity to management of the program. Relative fertility of each service should remain a factor for consideration in high genomic animals (i.e., higher service numbers with lower fertility may best be to terminal beef sires). Genomic testing increases accuracy for determining animals that should be future dams and identifying animals that have negative traits that are not wanted in the herd. Low fertility, mastitis, low livability or productive life and haplotypes that lead to abortions or early death may be identified and eliminated from the herd quickly with targeted use of terminal beef sires.

### What beef sires should be used in sexed and beef programs?

Beef × dairy crossbred calves may have multiple owners in the beef value chain. Perceived value of beef sires may be different to different owners depending on where they are in the chain. For dairy owners, fertility is highly valued due to beef semen being preferentially utilized in older, less fertile cows. Poor fertility increases days open and may result in higher incidence of reproductive culls, thus increasing heifer needs. Fertility of dairy sires on dairy animals is reported by the Center for Dairy Cattle Breeding (CDCB) in the form of SCR (sire conception rate) which predicts expected future differences in conception rates of different sires from the average of A.I. sires of the perspective breed. As of this time, SCR evaluation of beef sires used on dairy breeds has not been reported. While this information would provide great value to producers to avoid low fertility sires, the prevalence of mixed product containing multiple bulls will provide a complication in this analysis as results would be reflective of fertility of an NAAB code for a product rather than of the individual bulls within the straw associated

with that NAAB code. Field research would indicate that, while individual bull variability exists, beef semen from Angus bulls has similar fertility when used on Holstein cows to that of Holstein bulls.<sup>5</sup> Older beef bulls (based on birth date) were associated with having lower field fertility than younger bulls, however, the authors did suggest this observation could be an artifact of older semen that had been in storage longer rather than a direct causal effect of age on semen fertility.

Breed of beef sires has been recognized to impact value of resulting calves. Depending on country and even location within country, different value is placed on the perceived breed of parentage and is related to the intended use and customer demand for final product. In many U.S. markets, Angus genetics are highly valued as calves may qualify for certified angus beef premiums, and U.S. customers have an affinity and perceived value for higher quality grade associated with marbling.

Dairy farm owners who choose to retain ownership of resulting beef × dairy crossbred calves or others who may take ownership of calves downstream from the dairy should focus on traits that combine to impact profit. To maximize the value of beef × dairy programs to the beef supply chain long-term, calves need to perform well and meet the needs of the industry. Traits such as growth, feed efficiency, yield, and carcass quality have moderate- to high-heritabilities and should continue to be areas of emphasis for continuous genetic improvement. There are inherent advantages beef × dairy programs can bring to the beef industry. It has been stated that “A story of quality, sustainability, and traceability in the large and constant supply of beef from crossbred beef × dairy cattle may present profitable branding and marketing opportunities for these products”.<sup>2</sup> It is important to continue to push forward with genetic improvement for dairies to be able to fully capitalize on revenue generation from beef × dairy long term.

### Conclusions

Carefully planned use of gender sorted semen is critical to the overall success of a beef × dairy program to drive profit and genetic progress of the dairy. Accurately calculating the number of sexed semen matings to meet the ideal number of dairy replacements from the top genetic animals in the herd is key. Utilizing sexed semen in animals with top genetics on services of highest fertility will both reduce semen costs and speed genetic progress. Sexed semen products that yield higher female ratio further decrease the number of sexed dairy doses required and expand the opportunity to create additional beef × dairy crossbred calves.

### References

1. Bascom SS and AJ Young. A summary of the reasons why farmers cull cows. *J Dairy Sci* 1998; 81: 2299-2305.
2. Foraker BA, Frink JL, and Woerner DR. Invited review: a carcass and meat perspective of crossbred beef × dairy cattle. *Translational Ani Sci* 2022; 6: 1-7.
3. Garner DL and Seidel GE. History of commercializing sexed semen for cattle. *Theriogenology* 2008; 69: 886-895.
4. Johnson LA, Flook JP and Hawk HW. Sex preselection in rabbits: live births from X and Y sperm separated by DNA and cell sorting. *Bio Reprod* 1989; 41: 199-203

- 
5. McWhorter TM, Hutchinson JL, Norman HD, Cole JB, Fok GC, Lourenco DL, VanRaden PM. Investigating conception rate for beef service sires bred to dairy cows and heifers. *J Dairy Sci* 2002; 103: 10374-10382.
  6. Overton MW, and Dhuyvetter KC. Symposium review: An abundance of replacement heifers: What is the economic impact of raising more than are needed? *J Dairy Sci* 2020; 103: 3828-3837.
  7. Seidel GE. Sexing mammalian sperm where do we go from here? *Rev J Reprod Dev* 2012; 58: 505-509.
  8. Seidel GE and DeJarnette JM. 2022. Applications and worldwide use of sexed semen in cattle. *Anim Repro Sci* 246: 19681
  9. Vishwanath R and Moreno JF. Review: Semen sexing-current state of the art with emphasis on bovine species. *Animal* 2018; 12: s85-s96.

