

Sexed Semen Symposium: Applying Sexed Semen in Cattle

887 Current status of sexed semen technology. G. Seidel*, *Colorado State University, Fort Collins.*

For practical purposes, sexed semen first became commercially available in North America in 2006, using the Beltsville method of flow cytometry/cell sorting. No other method has proven effective for sexing semen. Several million doses of sexed semen have been produced to date at the industry standard of ~90% purity. Purity can be adjusted to exceed 95%, but sort rates decrease greatly at >90% purity, and thus achieving such purity becomes very expensive. Sort rates increase at 75–80% purity compared with 90% and decrease costs accordingly. Sort rates at 90% purity can exceed 5,000 live sperm/sec of each sex per sorter nozzle. When considering processing losses and other logistical issues, about 7–8 insemination doses of 2,000,000 sperm of each sex can be produced per sorter nozzle/h under ideal conditions. This sperm dose became the industry standard as the optimal compromise between cost and fertility. Doubling the number of sexed sperm/insemination dose only increases pregnancy rates 2–4% for most bulls. Under good management, proper semen handling, etc., for most bulls in properly controlled experiments, pregnancy rates with sexed semen at 2,000,000 sperm/dose generally fall between 70 and 90% of those of unsexed semen at conventional doses of $\geq 10,000,000$ sperm. Numbers of good embryos recovered when superovulated donors are inseminated with sexed semen of most bulls are approximately half of numbers recovered after using conventional semen AI. ET pregnancy rates per embryo produced with sexed semen are normal. Calves produced via AI of sexed semen do not differ ($P > 0.1$) in any respect from those produced via conventional semen, although there is less dystocia with female than male calves. Procedures for sexing bovine sperm have improved in several small but important ways over the past decade. Further improvements in efficiency resulting in decreased costs are likely. The biggest challenge will be to improve fertility of sexed semen.

Key Words: sexed semen, bovine, fertility

888 The evolution of sex-sorted semen in the US dairy industry. J. M. DeJarnette*, *Select Sires, Inc., Plain City, OH.*

The introduction of sex-sorted semen in the US was accompanied by a deliberate effort not to oversell expectations. Results of early adopters typically met or exceeded expectations and spurred increased demand. High sperm loss limited the genetic caliber of sires offered, however high milk and heifers prices minimized concern for this limited supply product. As market acceptance and sorting experience grew, the genetic quality of sires offered also increased. Notable improvements in sorting efficiency has further facilitated the ability to offer higher levels of sire genetics but remains a limitation to use of the most elite sires. Market dynamics abruptly changed in 2009 when rapidly growing production capacity was met with a ~50% reduction in milk prices. Demand for sexed-semen immediately responded in kind. As the market begins to recover, producer philosophies for application of sexed semen appear to have experienced a more permanent evolution. Greater consideration is now given to semen price and to the genetic potential of both male and female. The economic value, real or perceived, of female calves from genetically superior lactating cows has stimulated greater interest in this application. Use of conventional beef semen in lower genetic value dairy cows has gained in popularity but use of sexed beef semen is unlikely until conception rate issues are resolved. Numerous research efforts have attempted to improve the conception rates of sex sorted semen with only modest evidence of success and little evidence that equality to con-

ventional semen is achievable. Appropriate selection of sires submitted for sorting remains the most reliable method of influencing the fertility potential of sex sorted semen, which in most non-biased trials remains at 70 to 80% of conventional. Reduced purity products increase sorting efficiency and allow for more economical pricing of sexed semen, but with no improvement in conception rates, the economic implications of fewer females must be closely scrutinized. Sex sorting technology appears to have achieved a permanent place in the dairy industry, though efficiencies and applications are likely to continue to evolve.

Key Words: sexed semen, flow cytometry, economics

889 Implications of sex-sorted dairy semen for genetic change. B. G. Cassell*, *Virginia Polytechnic Institute and State University, Blacksburg.*

Sex-sorted semen can increase selection intensity of dams of replacements, but many dairy herds have no genetic evaluations for female selection. Genomic predictions from low density SNP chips may overcome this limitation in the future. Dairy herds that routinely use recently proven bulls in AI sampling programs increase genetic merit of service sires by about \$25 Net Merit \$/per year through genetic trend. Younger animals in such herds are genetically superior to older animals, and increased use of young animals as dams of replacements would improve genetic progress in the absence of genetic evaluations. First parity dams produce about 33% of calves born in typical herds, while second and third or later parity dams produce about 26% and 41% of calves born. With 26, 40, and 67 mo of age at calving and slightly higher frequencies of single female births to first parity dams through fewer twins, average age of dam of single birth heifers is about 45.7 mo with conventional semen. Use of sexed semen for first service only in heifers reduces average age of dam to 44 mo, while single heifer births/100 deliveries increases from 47.1 to 52.2. Genetic merit of dams increases a negligible \$4 in Net Merit \$ over conventional semen. If all heifer matings use sexed semen, age of dam drops to 41.9 mo, but genetic merit only increases by \$8. Significantly more heifer calves result, as single heifer birth rates increase to 60.2/100 deliveries. Herds could eliminate 70% of third and greater parity cows as dams of replacements while maintaining heifer birth rates equal to conventional semen use. A variety of uses of these cows could diversify and improve dairy farm income. Elimination of older cows as dams of replacements reduces age of dam of replacements to 34.9 mo and increases genetic merit of dams by about \$23. This change more than doubles genetic change per year in the dam-daughter path compared with conventional semen, primarily because of shorter generation intervals. However, improvement in this path could be offset by relative small reductions in genetic merit of service sires.

Key Words: sex-sorted, genetic change

890 Economic aspects of the use of sexed semen in dairy heifers and cows considering herd constraints. A. De Vries*, *University of Florida, Gainesville.*

Selective use of sexed semen in heifers and cows may increase genetic progress from the daughter-dam path and allows all calves from low producing cows to be sold because they are not needed to replace culled cows. Economic aspects of the insemination mix in dairy heifers and cows was evaluated with a linear programming model. The model considered 3 semen types (sexed dairy, conventional dairy, conventional

beef), 5 levels of milk production, and 10 parities including heifers. Each parity had 20 voluntary culling opportunities for non-pregnant animals. Heifers were allowed 5 insemination opportunities and cows 10. The model contained 2,425 decision variables. Genetic value of heifer calves was a function of service sire net merit, age of the dam, and level of milk yield of the dam. Heifers were assumed to be genetically equal. Inputs were lactation curves, milk price, feed costs, insemination costs, service rates, conception rates, dystocia costs, involuntary culling risks, and other costs. All bull calves and crossbred calves were sold, as well as excess heifer calves. The optimal decisions resulted in \$335 profit/cow per yr when only conventional semen was allowed without a constraint on the number of heifer calves. Additional choice of sexed semen increased profit/cow per yr to \$339 with sexed semen being used in the

first inseminations in heifers and higher producing first parity cows. Profit/cow per yr increased to \$368 when beef semen was offered as a third choice but fewer dairy heifer calves were born than were needed to replace culled cows. Setting the number of born heifer calves equal to the number needed to replace culled cows, profit/cow per yr was \$321 considering only conventional dairy semen. Sexed semen was not used when offered. When beef semen was also offered, profit/cow per yr increased to \$353 with beef semen used in lower producing cows and conventional semen and some sexed semen in higher producing cows and heifers. The optimal insemination mix often included sexed semen but depended greatly on the relative value of dairy bull calves, dairy heifer calves and crossbred calves.

Key Words: sexed semen, economics