Sexed semen – the economic facts

by Thomas R. Overton, College of Veterinary Medicine, University of Georgia, Athens, GA 30602-7385, USA.

Traditionally, cows are bred to initiate a new lactation and create female dairy calves for replacements. National herd replacement rates are limited by the supply of heifers. About 33-37% of the US herd is replaced yearly. Since national herd size in the US is fairly constant, the replacement rate is driven by the number of heifers entering the national herd yearly. The supply of heifers is determined by reproductive efficiency, death loss, and proportion of calvings that result in live females.

With 'sexed semen' or gender enhanced semen (GES), it is possible to increase the proportion of live female calves born yearly. However more pregnancies are needed to return cows to the next lactation than are needed to produce the necessary herd replacements. Producing more heifers than are needed by the dairy industry is not desirable.

Sexing semen

The concept of sexing semen has been around for years. A variety of methods have been tried including gender specific antibodies, centrifugation, free flow electrophoresis and flow cytometry. The only method with a proven track record is flow cytometry.

Semen can be sexed because the X chromosome is larger than the Y chromosome and X-bearing sperm have 3.85% more DNA than Y-bearing sperm.

A fluorescent dye that binds to DNA is used to measure DNA content. Fluorescence in response to laser light is then used to determine gender.

Currently, one US company has GES on the market, but other companies seem likely to offer this product, too.

Potential sources of value

Using sexed semen can help ensure an adequate number of replacement heifers. Because genetic selection can occur on both the cow and bull side, rate of genetic improvement can be increased.

An abundant supply of heifers increases the opportunity to cull those with poor health or below average growth rates.

Theoretically, there is a potential for reduced risk of dystocia with more heifer calves being born. There is also a reduced risk of freemartins since more twin pairs will be heifers rather than bull-heifer co-twins. Early adopters may be able to capitalise on high heifer prices.

However, there are downsides to this technology as well. Every cow should not produce a heifer calf; only the best cows should be producing daughters for maximal genetic gain.

There is an extra cost for sexed semen, as well as problems with reduced fertility with the current technology. Heifers produced in excess of industry needs will have less value. Use of sexed semen is risky if the producer is only trying to capture value from high heifer prices.

Currently, a pregnancy in a dairy cow results in one of three outcomes. These are heifer calf, bull calf or freemartin heifers. All heifer calves are generally raised as future herd replacements.

Because of the high demand for replacements and relatively poor reproductive efficiency in dairy cows, little or no selective pressure is applied to the heifer herd.

Bull calves and freemartin co-twins generally enter the dairy beef markets. Using GES

or sexed semen will not change these outcomes, but it will change the ratios.

Currently, GES breedings result in around 85% females. However, there is variability around this ratio just as for traditional AI breeding.

Producers should expect to experience periods where fewer females calves are born than were expected.

Based on random chance, percent of female births resulting from GES pregnancies could be as low as 55% or as high as 90%. Producers need to be prepared to experience a 55% heifer rate even when they were expecting 85% heifer calves.

Another potential drawback with GES breedings is a reduction in fertility. Conception rates experienced with current GES products are greatly reduced compared to traditional AI.

In 541 breedings at a single dairy, GES resulted in a 36% reduction (21 percentage units) in conception rate. A multi-farm test in New York, USA, suggested that about a 30% drop in conception rate should be expected when changing to GES.

Which animals to target

In mature animals, the expected decrease in conception rates would reduce pregnancy rates enough to more than offset extra value of the heifer calves. Because of their higher fertility, virgin heifers are presently a more economically sensible target for GES breedings.

Producers might be tempted to start breeding virgin heifers at a younger age to offset the lowered conception rates with GES. However, this can lead to other problems such as increased risk for dystocia, more stillbirths, and premature culling of fresh heifers.

A practical alternative is to use GES for the first breeding and then switch to normal AI technology for subsequent services. This can prevent age at first pregnancy from getting too high.

Another problem experienced with GES is a higher risk of stillbirths. Some of these stillbirths may be due to breeding heifers earlier than normal. However, the limited availability of sires and lack of calving ease GES sires may also play a part in the problem.

What is the value of GES?

The value of GES can be estimated using three different approaches. The first merely considers the price difference between newborn bull and heifer calves.

The price differential becomes the value. In the other two approaches, newborn bull calves are sold immediately and the heifer calves are raised either for sale or as herd replacements.

In these cases, the value becomes the difference between price received for a newborn bull calf and expected profit following either the sale of a springing heifer or the entry of a first lactation cow into the herd. In all cases, critical data includes increased cost of GES units and the value of the resulting offspring.

In the third option, where the resulting heifer enters the milking herd, there is additional value to be derived from selecting only the best heifers. This can result in enhanced genetic gain for the herd.

If fertility problems with GES can be alleviated, more opportunities will develop. Using GES with multiparous cows could become economically feasible. This would allow producers to use only their best cows to produce replacement heifers.

The better the herd genetics, the more valuable additional heifers resulting from GES will be. Herds with good information about the genetics of their cows and growing heifers will also be better able to profit from the additional heifers produced by GES.

Herds that want to assure full production of replacements should consider GES, although traditional approaches to reduce mortality in both the calf rearing and transition periods may be more profitable.

Expanding herds may gain some biosecurity advantages by using GES. However practical considerations during expansion, such as filling rates for barns and pens, mean that many expanding herds will still need to buy cows.

Herds considering GES need to plan for the extra heifers that will enter the operation. Is there enough capacity for the increase in heifer numbers?

Hutches, pens, labour, capital, feed supplies, and storage facilities are some of the many areas that can become overwhelmed if heifer numbers increase by 70% (from a 50% heifer ratio to an 85% ratio).

Concluding thoughts

GES may turn out to be a major new tool for the dairy industry. There is a potential to dramatically re-evaluate the way cows are bred if the current fertility problems can be solved. At present, GES allows producers to improve both the quality and availability of heifers. However, the very real risks associated with the current GES technology should be weighed against the potential rewards. Costs of GES are all upfront, while the pay-off occurs in the future.

In estimating expected returns, use conservative heifer values. Heifer prices may decrease if availability increases. It is also critical to factor in the costs of lower fertility and increased dystocia/stillbirth. ■

www.milkproduction.com