

## SEXED SEMEN: BIG PROFITS IN WELL MANAGED HEIFERS



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Sexed semen is relatively a new technology that has proven to produce a higher proportion of female calves than conventional semen. Because female calves are much more valuable than male calves in a dairy enterprise, the use of sexed semen is attractive. However, research has also proven that the insemination with sexed semen decreases the conception rate (CR) compared to using conventional semen. Additionally, sexed semen is a substantially more expensive technology than conventional semen. Therefore, the

economic decision of using sexed semen should be based on a careful analysis of the economics between additional investments and potential revenues. Because of the higher cost and reduced CR, sexed semen seems more appropriate for virgin heifers (De Vries, 2009), which have naturally higher CR than adult cows.

### HOW DO YOU CALCULATE THE ECONOMIC VALUE OF SEXED SEMEN?

Partial budgeting is a suitable method to analyze the economic benefits of using sexed

semen on heifers. Partial budgeting tracks the additional revenues, the additional costs, the revenues foregone and the reduced costs when a technological change is introduced. Reproductive programs that include a series of services must include the aggregation of the above factors for each one of the services. Because these occur at different times depending on CR, a fair comparison has to be performed using a discount rate to bring all economic balances to present values in order to calculate and compare net present values (NPV).

The economic value of a sexed semen reproduction protocol would lack of utility if it is not compared with conventional semen reproduction programs. Therefore, the economic value of using sexed semen should be the difference between a sexed semen protocol and the conventional semen: if this value turns to be positive, the sexed semen has an economic advantage over the conventional semen. Assuming that producers will attempt 5 reproductive services on heifers (Kuhn et al., 2006), the analysis should include the economic values when sexed semen is used in 1, 2, 3, 4, or 5 consecutive services. Those services not using sexed semen would then use conventional semen.

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**Table 1. Baseline reproductive and biological parameters of conventional and sexed semen reproductive programs for virgin heifers. (Sources: Seidel, 2003; Silva del Rio et al., 2007; and Cerchiaro et al., 2007)**

REPRODUCTIVE & BIOLOGICAL PARAMETER	CONVENTIONAL SEMEN	SEXED SEMEN
Conception Rate (CR) in 1st Service	40% to 70%	50% to 70% of conventional semen
Low-Low Scenario	40%	20%
Low-High Scenario	40%	30%
High-Low Scenario	70%	35%
High-High Scenario	70%	52.5%
Female Calves Born	46.7%	87.2%

The NPV could be calculated as the aggregation of the discounted monetary values of successive services starting on 14-month old heifers plus the discounted value of the probability of the heifers being culled and replaced if not pregnant after 5 consecutive services. Conditional conception probabilities should determine the overall CR and the probability of pregnant and non-pregnant heifers after each one of the services.

**WHICH ARE THE REPRODUCTIVE AND BIOLOGICAL PARAMETERS?**

Because there is a large variation and uncertainty in the CR of using conventional and sexed semen, it is recommended to perform the analyses between wide ranges (e.g., optimistic and pessimistic scenarios) to obtain results that better portray a complete picture of all potential outcomes. A baseline CR for U.S. Holstein

heifers in 1<sup>st</sup> service can be assumed to vary between 40 and 70% for conventional semen and between 50 and 75% of the conventional semen for sexed semen (Seidel 2003) (Table 1).

It is also needed to assess the expected proportion of female calves born under conventional or sexed semen, for which we could use as a baseline 46.7% when using conventional semen (Silva del Rio et al., 2007) and 87.2% when using sexed semen (Cerchiaro et al., 2007).

It is also known that the CR decreases with each additional service and we could safely assume that the CR may drop an absolute 2.5% for each successive service after the 1<sup>st</sup> service, whether conventional or sexed semen is being used.

**WHICH ARE THE ECONOMIC PARAMETERS?**

Several economic parameters need to be defined according to farm specific characteristics and market conditions. For analysis purposes we can set some baseline parameters. The cost of conventional and sexed semen dose can be set at \$15 and \$45, respectively, which indicates a premium of about \$30 when using sexed semen compared with conventional semen (Olynk and Wolf, 2007).

Other economic parameters that need to be included in the calculations follow. The value of a female calf can be considered to be \$562 whereas the value of a male calf can be considered to be \$48 (Wisconsin USDA Market report, 2008). The average cost of maintenance of non-pregnant heifers between 15 and 20 months of age can be set at \$2.4/d

**Table 2. Baseline economic parameters (\$) of conventional and sexed semen reproductive programs for virgin heifers. (Sources: Olynk and Wolf, 2007; Wisconsin USDA Market Report, 2008; and Zwald et al., 2007)**

ECONOMIC PARAMETER	
Semen Dose	\$15 Conventional/\$45 Sexed
Value of Female Calf	\$562
Value of Male Calf	\$48
Cost of Maintenance Heifer 15-20 Months	\$2.40/day
Salvage Value 20-Month Non-Pregnant Heifer	\$904
Replacement Value 20 Month Pregnant Heifer	\$1,200
Discount Rate	12%/year



**Table 3. Net present value (NPV) of sexed semen programs compared to conventional programs for virgin heifers.**  
 (Source: Wisconsin Dairy Management webpage: <http://www.uwex.edu/ces/dairymgt/> under Management Tools.)

SCENARIO	1 SEXED SERVICE	2 SEXED SERVICES	3 SEXED SERVICES	4 SEXED SERVICES	5 SEXED SERVICES
<b>High Conv./High Sexed</b> 70% Conv./52.5% Sexed	+\$57	+\$64	+\$50	+\$25	-\$5
<b>High Conv./Low Sexed</b> 70% Conv./35% Sexed	\$0	-\$19	-\$51	-\$97	-\$162
<b>Low Conv./High Sexed</b> 40% Conv./30% Sexed	+\$3	-\$11	-\$36	-\$66	-\$101
<b>Low Conv./Low Sexed</b> 40% Conv./20% Sexed	-\$46	-\$102	-\$165	-\$237	-\$316

(Zwald et al., 2007). The average weight of a 20-month non-pregnant heifer is assumed to be 505 kg, the salvage value (cull) assumed to be \$1.79/kg and the replacement value of an equal weight pregnant heifer to be \$1,200 (Wisconsin USDA Market report, 2008). Finally, a discount rate, similar to the minimum interest charged by credit card companies of 12% can be used to calculate the NPV of the studied programs (Table 2).

### SO, WHAT IS THE ECONOMIC VALUE OF USING SEXED SEMEN FOR VIRGIN HEIFERS?

When the CR of conventional and sexed semen are expected to be high (70% and 52.5%, respectively) it would pay to use 1, 2, 3, or 4 sexed semen services. Using sexed semen would bring between \$25 and \$64 of additional income per heifer (Table 3). The maximum NPV of \$64 is observed when 2 sexed services are used. When the CR of conventional and sexed semen are high, the use of 5 sexed services has a NPV of -\$5 indicating that conventional semen would have higher value than using 5 sexed services. When the conventional semen CR is low (40%) and the sexed semen is high, it would still pay to use sexed semen but only in the 1<sup>st</sup> service (\$3).

When the CR of sexed semen is expected to be low (50% of conventional), it would not pay to use sexed semen because the calculated NPV would be 0 or negative.

These values would vary between \$0 and -\$162 when conventional semen CR is expected to be high and between -\$46 and -\$316 when conventional semen CR is expected to be low.

A break-even point where the NPV of using sexed semen equals the NPV of conventional semen would occur for high conventional semen CR when sexed semen CR is 51, 55, 61, 68, and 76% for 1 to 5 services, respectively. This break-even point for low conventional semen CR would occur when sexed semen CR is 74, 78, 83, 88, and 93% for 1 to 5 services, respectively.

Another important factor in the calculation is the price of the semen. Under the assumption that sexed semen dose would decrease its price from \$45 to \$30, the possibilities of using sexed semen would greatly increase. If the sexed semen would

cost \$30 per dose, 1 and 2 sexed semen services would have positive NPV in all cases, except when both conventional and sexed semen CR are low. When both CR are low (40 and 20%, respectively) the NPV of sexed semen will always be

**Figure 1. Screenshot of decision support system to calculate the net present value of using sexed semen programs on virgin heifers. This tool is available at <http://www.uwex.edu/ces/dairymgt/> under Management Tools, then 'Economic Value of Sexed Semen Programs.'**





negative regardless of the price of the sexed semen. Because of the very low CR (conventional and sexed semen), the additional revenue of additional female calves is also very low, which would not justify the use of sexed semen.

**OK NOW... HOW CAN I MAKE THESE ANALYSES WITH MY OWN PARAMETERS?**

Easy. Just visit the Wisconsin Dairy Management webpage: <http://www.uwex.edu/ces/dairymgt/> and then select "Management Tools" on the left side of the webpage. Once there find the tool under the name: "Economic Value of Sexed Semen Programs." This is an online application (Figure 1) that will work directly on your web browser after you

click on the proper link without a need of downloading or installing programs. The opportunity of using sexed semen would greatly depend on particular farm characteristics and market conditions for which specific analysis at the farm level are warranted. Results of using default values as it was done in previous section give a good indication of possibilities and some take-home messages, however these cannot be used to infer and extract particular recommendations. The analysis should be performed on an individual basis and because of that we have created this interactive online tool.

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