



# When to Use Sexed Semen on Heifers



1 Victor E. Cabrera, 13<sup>th</sup> Annual Arlington Dairy Day, 9 December 2009





# Introduction



- Sexed semen produces higher proportion of female calves
- Female calves are more valuable than male calves
- The use of sexed semen is economically attractive
- Sexed semen also decreases fertility
- Consequently, sex semen would have an increased proportion of females, but with a lower conception rate



# Introduction



- **The decision of when to use should be an economic one based on a careful analysis of additional expenses and potential revenues**
- **Sexed semen is recommended for virgin heifers because higher costs and reduced CR**
- **Wisconsin dairy producers are using it with virgin heifers in first and second services**



# Objectives



- **Present how to calculate the economics of using sexed semen on heifers**
- **Define the biological and economic parameters needed to evaluate the use of sexed semen**
- **Discuss results for baseline conditions and for alternative scenarios**
- **Demonstrate the use of a user-friendly decision support system to evaluate the use of sexed semen on your own conditions**



# Methodology



- **Partial budgeting of different CR with conventional and sexed semen reproductive programs**
- **Partial budgeting = additional revenues, additional costs, revenues foregone, reduced costs**
- **Fair comparison needs to make calculations using a discount rate to compare net present values (NPV)**
- **Expected Value (EV) = Difference between a sexed semen program and a conventional one: if difference is positive, the use of sexed semen is preferred**



# Assumptions and Treatments



- **Assumption 1: Producers will attempt up-to 5 consecutive reproductive services on virgin heifers (Kuhn et al., 2006)**
- **Assumption 2: If the heifer is not pregnant after fifth service, then the heifer is culled and replaced**
- **Assumption 3: The reproductive program starts on 14-month old heifers**
- **Treatments: Sexed semen used in 1, 2, 3, 4, and 5 consecutive services. Services not using sexed-semen, use conventional semen**



# Calculations



- **Overall EV = Average EV of 5 treatments and low, average, and high CR**
- **EV = EV sexed semen – EV conventional semen**
- **Total NPV = Aggregation of discounted monetary values of successive services plus the probability of the heifer being culled and replaced because of reproductive failure**
- **Service NPV = Proportion of pregnant heifers, calf value, Dystocia cost, semen dose, and maintenance cost (DO)**



# Reproductive Variables



- CR for Holstein heifers: 34 to 83% (Avg. 56%) (DeJarnette et al., 2009)
- Sexed semen performance: 80% of conventional semen (Avg. 44.8%) (DeJarnette et al., 2009)
- CR decreases 2.5% for each additional service after first service (Kuhn et al., 2006)
- Conventional semen heifer calf rate: 46.7% (Silva del Rio et al., 2007)
- Sexed semen heifer calf rate: 89% (DeJarnette et al., 2009)





# Economic Variables



- Premium paid for sex-sorted semen dose: \$30 (Olynk and Wolf, 2007)
- Heifer calf value: \$562 (Wisconsin USDA Market Report, 2008)
- Bull calf value: \$48 (Wisconsin USDA Market Report, 2008)
- Dystocia cost: \$28.53 (Dematawewa and Berger, 1997).
- Bull Dystocia cost: 1.57 times greater than female (Martinez et al., 1983)



# Other Economic Variables



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	Conventional and Sexed-Semen	Source
Heifer maintenance 15 to 20 mo old	\$2.4/day	Zwald et al., 2007
Weight of a 20-mo non-pregnant heifer	505 kg	NRC, 2001
Salvage value of 20-mo non-pregnant heifer	\$1.79/kg	Wisc. USDA (2008)
Value of 20-mo pregnant heifer	\$1,200	Wisc. USDA (2008)
Interest rate	12%/year	



# Analyses



- **Calculation EV for baseline conditions**
- **Conventional CR required to find a positive EV**
- **Sensitivity of the main biological and economic parameters**
- **Comparison of scenarios with respect to:**
  - **Overall EV**
  - **Number of sexed semen services with positive EV, and**
  - **Optimal number of sexed semen to maximum EV**



# Baseline Scenario



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- Sexed semen is always be justified for the first service for any level of CR (Overall EV = \$30.10/heifer)

Reproductive Program	Low Conventional CR (34 %)	Average Conventional CR (56 %)	High Conventional CR (83 %)	Required Conventional CR to Justify the Number of Sexed Semen Service(s) %
	EV \$/heifer			
1 service with sexed semen	6.5 (Max)	49.3	100.0	31
2 first services with sexed semen	-3.4	57.8 (Max)	111.6 (Max)	36
3 first services with sexed semen	-23.1	46.4	96.1	41
4 first services with sexed semen	-48.9	24.7	71.7	48
All 5 services with sexed semen	-78.5	-2.7	43.9	58



# Sensitivity Analyses



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Scenario	Overall Expected Value (EV) (\$/heifer)	Conventional CR to Justify 1 Sexed Semen Service (%)	Number of Consecutive Services with Positive Expected Value (EV)		
			Low Conventional CR (34 %)	Average Conventional CR (56 %)	High Conventional CR (83 %)
Baseline	30.10	31	1	4	5
Sexed Semen CR at 85 % of conventional CR	46.40	31	2	5	5
Sexed Semen CR at 75 % of conventional CR	12.50	36	0	4	5
Sexed Semen to have 95 % heifer Calves	52.40	27	2	5	5
Sexed Semen to have 78 % heifer Calves	-10.90	41	0	3	4
Male Calf value at \$0	45.20	28	2	5	5
Female calf value at \$700	69.30	25	3	5	5
Female calf value at \$280	-50.10	59	0	0	2
Premium paid for sexed-semen at \$40	1.1	37	0	3	4
Premium paid for sexed-semen at \$20	59.1	26	3	5	5
Dystocia cost at \$42.8	32.40	30	1	5	5
Dystocia cost at \$14.27	27.70	31	1	4	5



# Optimal Treatment



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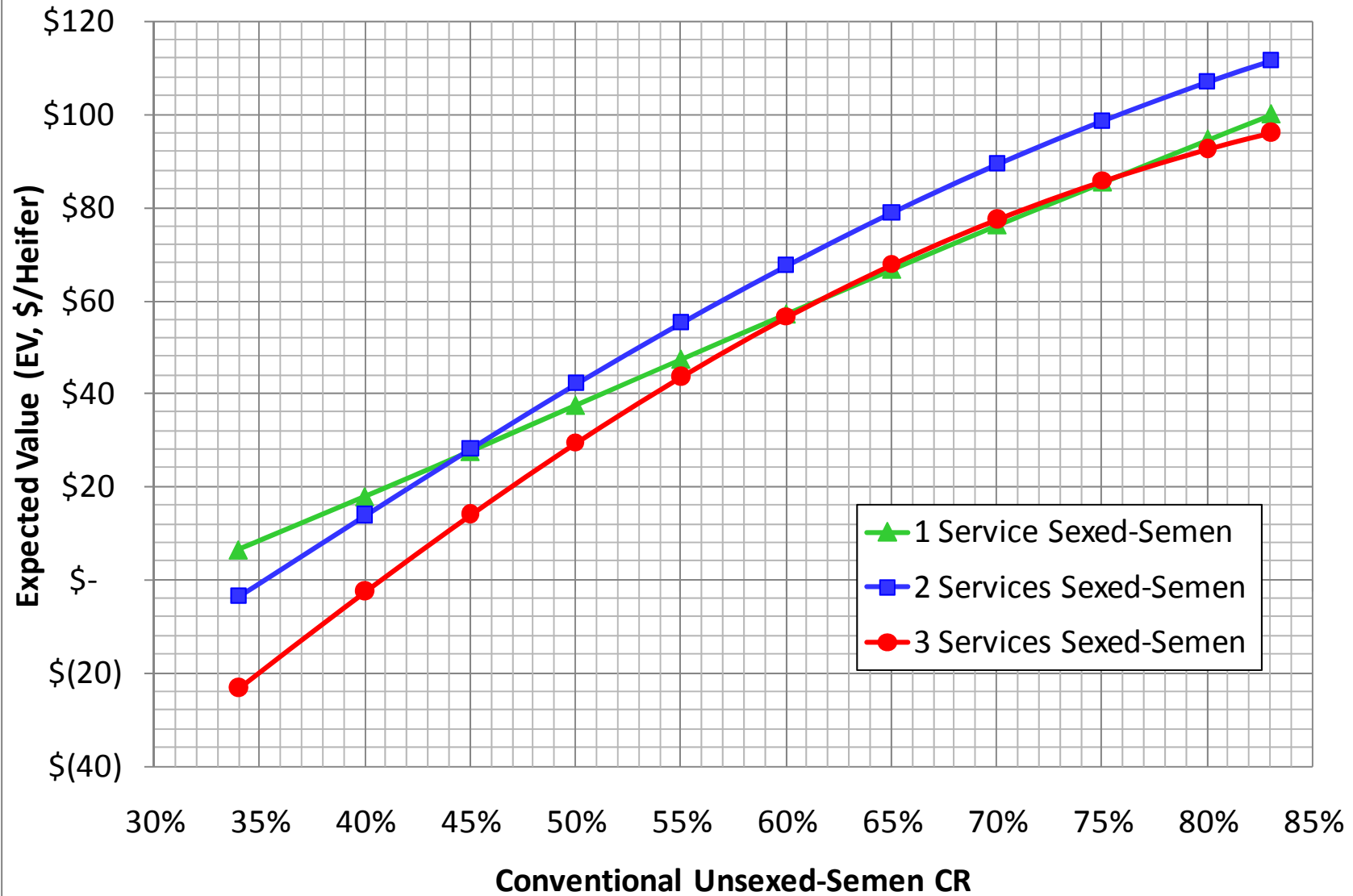
Scenario	Number of Services with Positive and Maximum Expected Value (EV)		
	Low Conventional CR (34 %)	Average Conventional CR (56 %)	High Conventional CR (83 %)
Baseline	1	2	2
1) Sexed Semen CR at 85 % of conventional CR	1	2	2
2) Sexed Semen CR at 75 % of conventional CR	None	2	2
3) Sexed Semen to have 95 % heifer Calves	1	2	2
4) Sexed Semen to have 78 % heifer Calves	None	1	1
5) Male calf value at \$0	1	2	2
6) Female calf value at \$700	1	2	2
7) Female calf value at \$280	None	None	1
8) Dystocia cost at \$42.8	1	2	2
9) Dystocia cost at \$14.27	1	2	2
10) Premium paid for sexed-semen at \$40	None	1	2
11) Premium paid for sexed-semen at \$20	1	2	2
1) and 3)	2	2	2
3) and 6)	2	2	2
1) and 6)	2	2	2
1) and 3) and 6)	2	3	2
1) and 3) and 6) and 11)	3	3	2
2) and 4)	None	1	1
4) and 7)	None	None	1
2) and 4) and 7)	None	None	None



# Optimal Treatment by CR



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# Impact of Other Variables



Variable	Impact
Heifer maintenance cost (\$2.4/d baseline)	<u>-\$1.00 for every +\$0.1</u>
Salvage value (\$1.79/kg baseline)	<u>-\$1.00 for every +\$0.1</u>
Pregnant heifer value (\$1,200/heifer baseline)	<u>-\$2.84 for every +\$100</u>
Dystocia cost (\$28.53/heifer baseline)	<u>+\$1.44 for every +\$10</u>
Premium of sex-sorted semen (\$30 baseline)	<u>-\$14.50 for every +\$5</u>
Discount rate (12% baseline)	<u>-\$0.1 for every +10%</u>





# Conclusions



- Overall, sexed-semen has a higher economic value than conventional semen
- The single most important factor to decide on the use of sex-sorted semen is the current or expected heifer CR:
  - If the CR is between 31 and 44%: optimal use sexed-semen for only FIRST service
  - If the CR is above 44%, the optimal would be to use sexed-semen for the TWO FIRST services
- Other important variables: CR of sexed-sexed semen (+); expected proportion of female calves (+); female calf value (+); premium of sexed-semen (-)
- Other variables will only have limited impact in the decisions



# Conclusions



- **Some considerations that are not included in the economic analysis, but are important to remember in the light of using sexed-semen are:**
  - **Some evidence or suspicion of:**
    - **Greater incidence of stillbirths with sex-sorted semen**
    - **Longer gestation period**
  - **Faster genetic improvement possibilities**
  - **Implications for farm herd expansion**
  - **Decreased bio-security risks**
  - **Implications for US herd expansion**



# Decision Support System



- Results do not apply to all farm and all market conditions
- Every farm is different and we can not always generalize
- Market conditions are also different and change permanently
- Challenge: Provide the same analysis as presented in a decision support system for producers
- Spreadsheets are good and popular, but sometimes could deter users because: the need to download a file, make sure it is compatible with the system to be used (E.g., operational system, Excel version, use of macros, etc.)



# Decision Support Challenge



- **Decision support system should be:**
  - Visually attractive
  - Interactive
  - Robust
  - Preferably online
  - Self-contained
  - Scenario-driven
- **Decision support system should have:**
  - Secured calculations. Users characterize their situation by defining parameters
  - Clear instructions
  - Technical support available



# Decision Support Challenge



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## Economic Value of Sexed Semen Programs for Dairy Heifers

Victor E. Cabrera, [vcabrera@wisc.edu](mailto:vcabrera@wisc.edu), 608-265-8506

<b>1. Conception Rates (CR)</b>		Instructions
<b>1.a. Conventional Semen CR (%)</b>	<b>1.b. Sexed Semen CR (% of Conventional CR)</b>	Manage Scenarios
Low CR <input type="text" value="34"/>	<input type="text" value="80"/>	Print
Average CR <input type="text" value="56"/>		DairyMGT Webpage
High CR <input type="text" value="83"/>		

<b>2. Expected Females (%)</b>	<b>3. Semen Cost (\$)</b>	<b>4. Other Economic Parameters</b>	
Conventional <input type="text" value="46.7"/>	Conventional <input type="text" value="15"/>	Discount (%/yr) <input type="text" value="12"/>	Raising Cost (\$/c) <input type="text" value="2.4"/>
Sexec <input type="text" value="89"/>	Sexec <input type="text" value="45"/>	Female Calf (\$) <input type="text" value="562"/>	Salvage Value (\$/kg) <input type="text" value="1.79"/>
		Male Calf (\$) <input type="text" value="48"/>	Dystocia Cost (\$/heifer) <input type="text" value="28.53"/>
			20-mo Pregnant Heifer (\$) <input type="text" value="1200"/>

Economic Value of Sexed Semen Program (\$)

Conventional CR:	34%	56%	83%
Sexed Semen CR:	27.2%	44.8%	66.4%

Overall EV	30.1
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# Thanks



## UW Extension

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**Welcome to Dairy Management UW-Extension**

This site is designed to support dairy farming decision-making focusing on model-based scientific research. The ultimate goal is to provide user-friendly, computerized decision support systems to help dairy farms improve their economic performance.

Dr. Cabrera focuses on model-based decision support in dairy cattle and in dairy farm production systems. Dr. Cabrera's primary interest is to improve cost-efficiency and profitability along with environmental stewardship in dairy farms by using simulation techniques, artificial intelligence and expert systems. Dr. Cabrera's research and Extension programs involve interdisciplinary and participatory approaches towards the creation of user-friendly decision support systems. As an Extension Specialist, Dr. Cabrera works in close relationships with county-based Extension faculty, dairy producers, consultants, and related industries.

**Some Active Projects**

**Success for Small Beginning Dairy Farmers**  
Strategies of Pasture Supplementation on Organic and Conventional Grazing Systems; Assessment of Economic, Production and Environmental Outcomes

**Assessment of Goats Margin Insurance versus Traditional Price Risk Management Strategies under Alternative Biofuels and Predicted Climatic Conditions: Implications for Wisconsin Dairy Farms**

**Development of a Dairy Economic Decision Support System for Wisconsin**

**Opportunities in Dairy Cattle Management**

- Student, intern, and position positions available

August 21, 2009

**Additional Personal Information about Dr. Cabrera**

University of Wisconsin - Extension  
Dairy Team Bevs  
Read about the latest local herd studies.  
Find out what dairy people are talking about.  
Join in the conversation, and more...

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**Dairy Ration Feed Additive Breakeven Analysis**

Estimates the breakeven milk production needed to pay for a ration ingredient

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Documentation (Download)

**Optigen® Evaluator**

Calculates the economic value of using Optigen® with lactating cows. Optigen® replaces a user-defined source of protein and adds a user-defined source of energy.

HTML Online Tool (Open)

**Cost-Benefit of Accelerated Liquid Feeding Program for Dairy Calves**

Evaluates the use of accelerated heifer feeding programs with respect to conventional feeding programs

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HTML Online Tool (Open)  
Documentation (Download)  
Demonstration (See)

**Economic Analysis of Switching from 2X to 3X Milking**

Estimates the economic benefit (or loss) of a change in the milking frequency from 2 times a day (2X) to 3 times a day (3X) based on user-defined parameters

Flash Online Tool (Play)  
Flash Demonstration (View and Print Information)  
Documentation (Download)

**Economic Value of Sexed Semen Programs for Dairy Heifers**

Estimates the difference of the net present value of various sexed semen reproductive programs and a conventional semen reproductive program

Flash Online Tool (Play)  
Documentation (Download)  
Demonstration (See)

**Income over Feed Supplement Cost**

Maximizes the income over feed supplement cost (IOFSC) for a fixed amount of forage used in the diet and graphs the IOFSC to a substitution of two selected feed supplements

Excel Spreadsheet (Download)

Done

<http://www.uwex.edu/ces/dairymgt/>