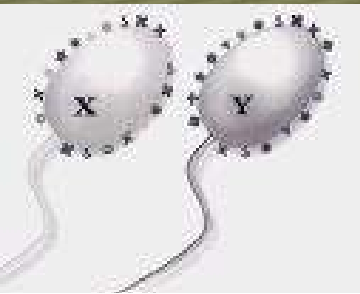




# Economics of Sexed Semen



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# 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-mo 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	



# Results



- **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



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

Reproductive Program (Treatment)	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 %)
<b>Baseline</b>	1	2	2
<b>1) Sexed Semen CR at 85 % of conventional CR</b>	1	2	2
<b>2) Sexed Semen CR at 75 % of conventional CR</b>	None	2	2
<b>3) Sexed Semen to have 95 % heifer Calves</b>	1	2	2
<b>4) Sexed Semen to have 78 % heifer Calves</b>	None	1	1
<b>5) Male calf value at \$0</b>	1	2	2
<b>6) Female calf value at \$700</b>	1	2	2
<b>7) Female calf value at \$280</b>	None	None	1
<b>8) Dystocia cost at \$42.8</b>	1	2	2
<b>9) Dystocia cost at \$14.27</b>	1	2	2
<b>10) Premium paid for sexed-semen at \$40</b>	None	1	2
<b>11) Premium paid for sexed-semen at \$20</b>	1	2	2
<b>1) and 3)</b>	2	2	2
<b>3) and 6)</b>	2	2	2
<b>1) and 6)</b>	2	2	2
<b>1) and 3) and 6)</b>	2	3	2
<b>1) and 3) and 6) and 11)</b>	3	3	2
<b>2) and 4)</b>	None	1	1
<b>4) and 7)</b>	None	None	1
<b>2) and 4) and 7)</b>	None	None	None

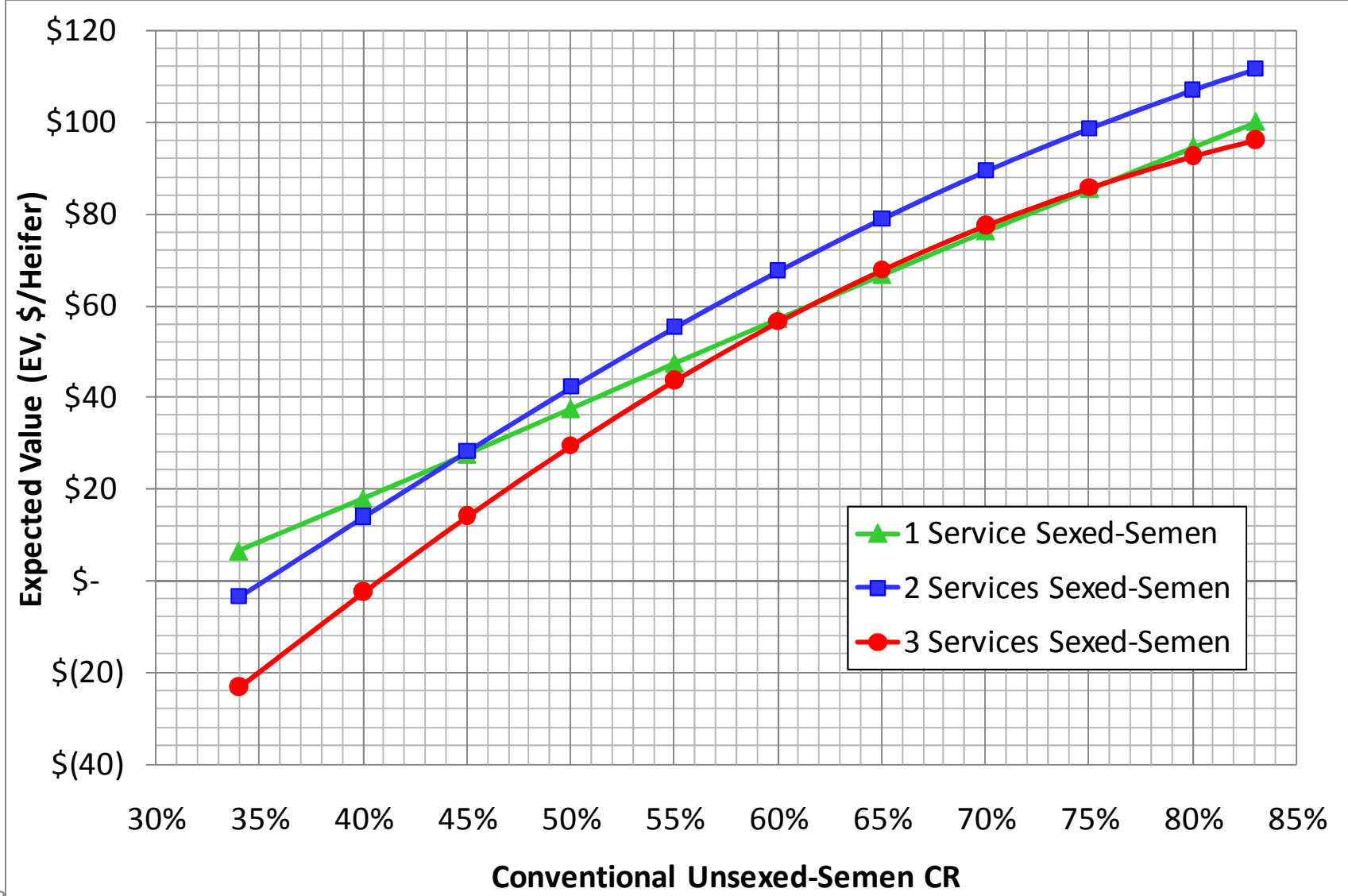
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# Optimal Treatment by CR



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# Impact of Other Variables



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

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# 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



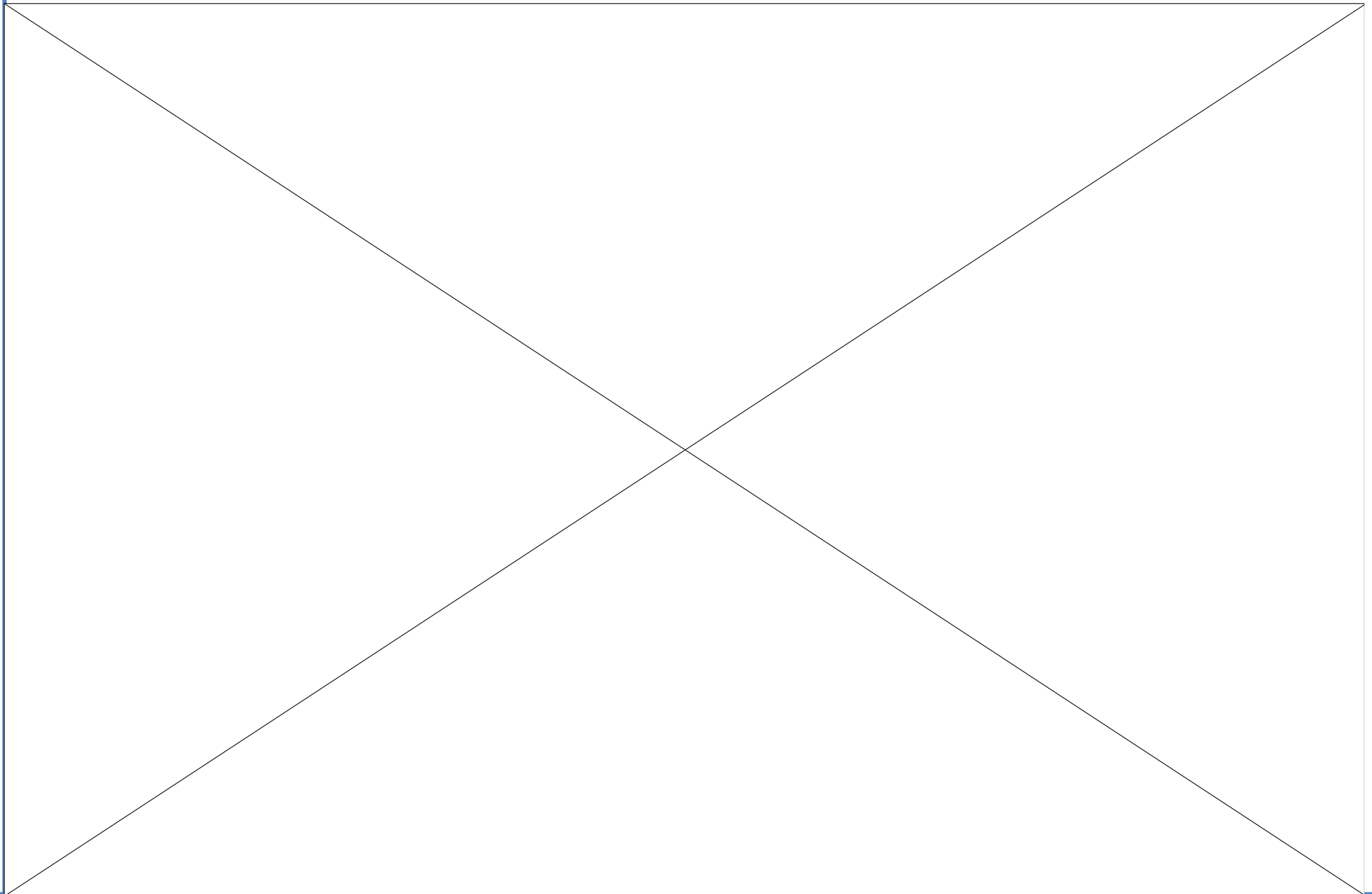
- **Decision support system should be:**
  - **Visually attractive**
  - **Interactive**
  - **Robust**
  - **Preferably online**
  - **Self-contained**
  - **Scenario-driven**
- **Decision support system should have:**
  - **Secured calculations. Users characterize their situation by defining parameters**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



# Decision Support Challenge



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# Thanks



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## Dairy Management

Dairy Management 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. Victor 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 include inter-disciplinary 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 industry.

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