



When to Use Sexed Semen on Heifers



1 Victor E. Cabrera, 13th 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



| | 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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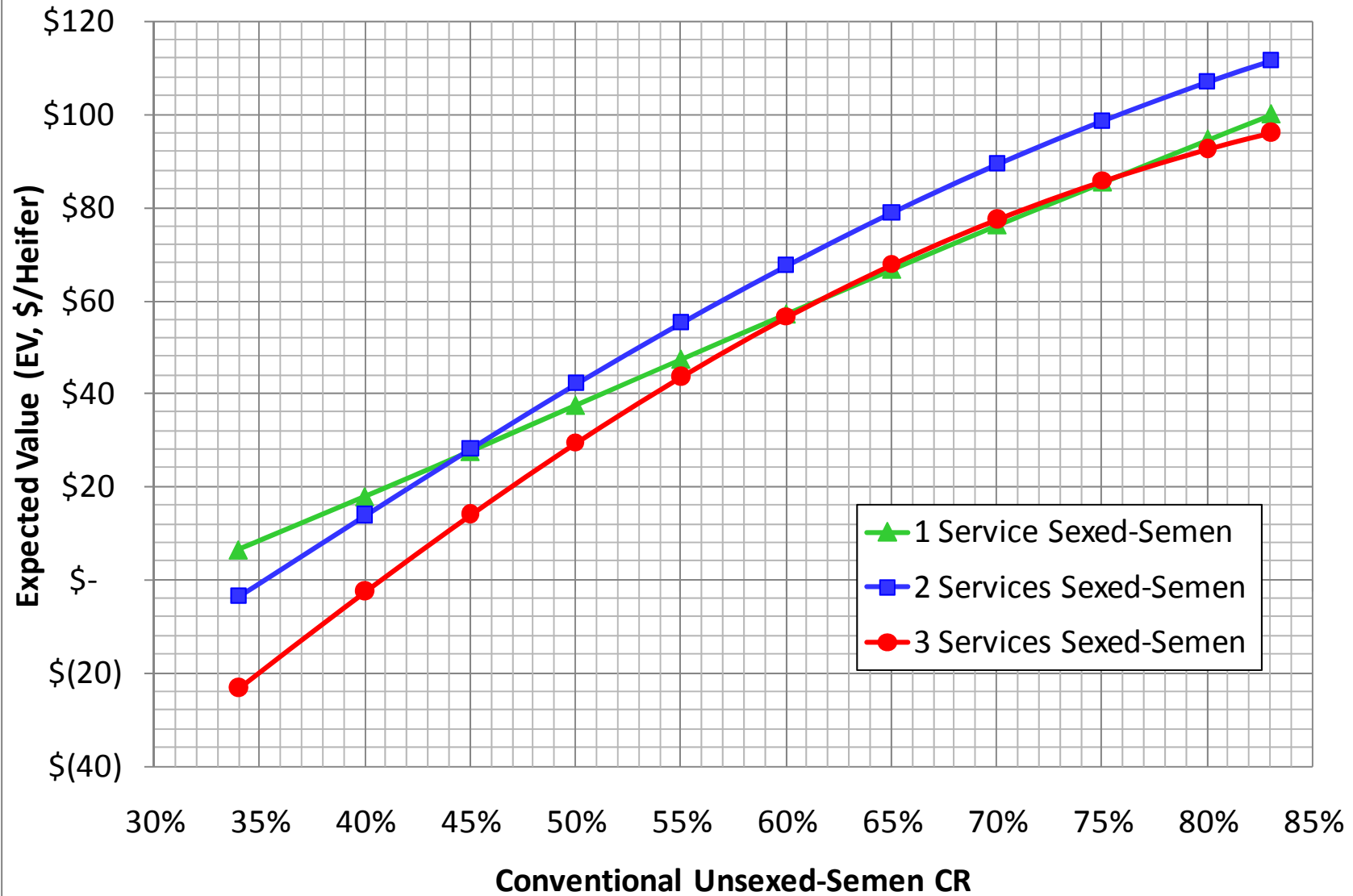
| Scenario | Number of Services with Positive and Maximum Expected Value (EV) | | |
|--|--|--------------------------------|-----------------------------|
| | Low Conventional CR (34 %) | Average Conventional CR (56 %) | High Conventional CR (83 %) |
| Baseline | 1 | 2 | 2 |
| 1) Sexed Semen CR at 85 % 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, 608-265-8506

| | | |
|--|--|---|
| 1. Conception Rates (CR) | | Instructions Manage Scenarios Print DairyMGT Webpage |
| 1.a. Conventional Semen CR (%) Low CR: 34 Average CF: 56 High CR: 83 | 1.b. Sexed Semen CR (% of Conventional CR) 80 | |
| 2. Expected Females (%) Conventional: 46.7 Sexec: 89 | 3. Semen Cost (\$) Conventional: 15 Sexec: 45 | 4. Other Economic Parameters Discount (%/yr): 12 Female Calf (\$): 562 Male Calf (\$): 48 Raising Cost (\$/c): 2.4 Salvage Value (\$/kg): 1.79 Dystocia Cost (\$/heifer): 28.53 20-mo Pregnant Heifer (:): 1200 |

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

| | |
|------------|------|
| Overall EV | 30.1 |
|------------|------|



Thanks



UW Extension

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