Economics of Sexed Semen

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

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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**

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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**

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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)**

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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	

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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

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Sensitivity Analyses

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

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

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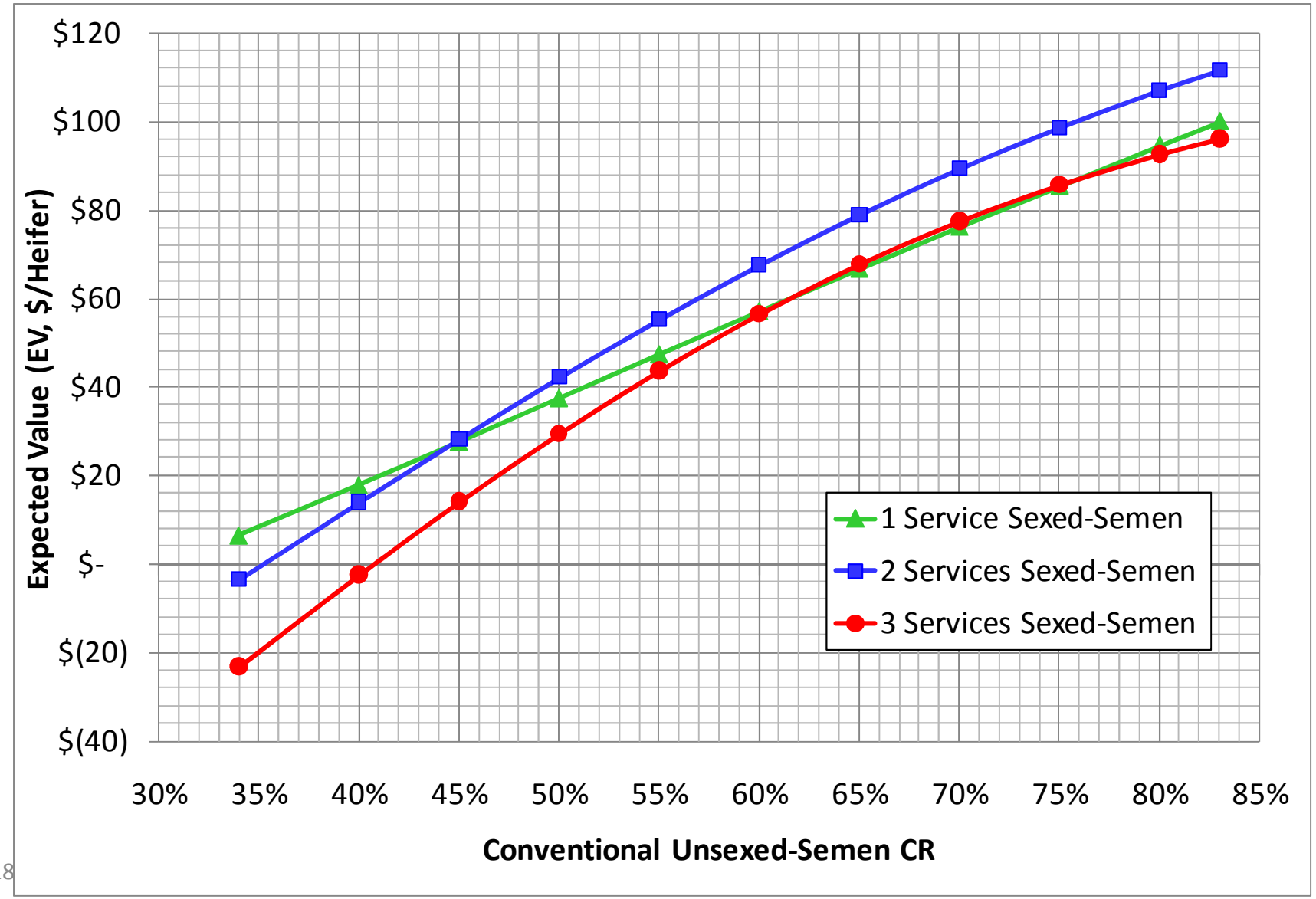
Optimal Treatment by CR



Impact of Other Variables

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

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.)**

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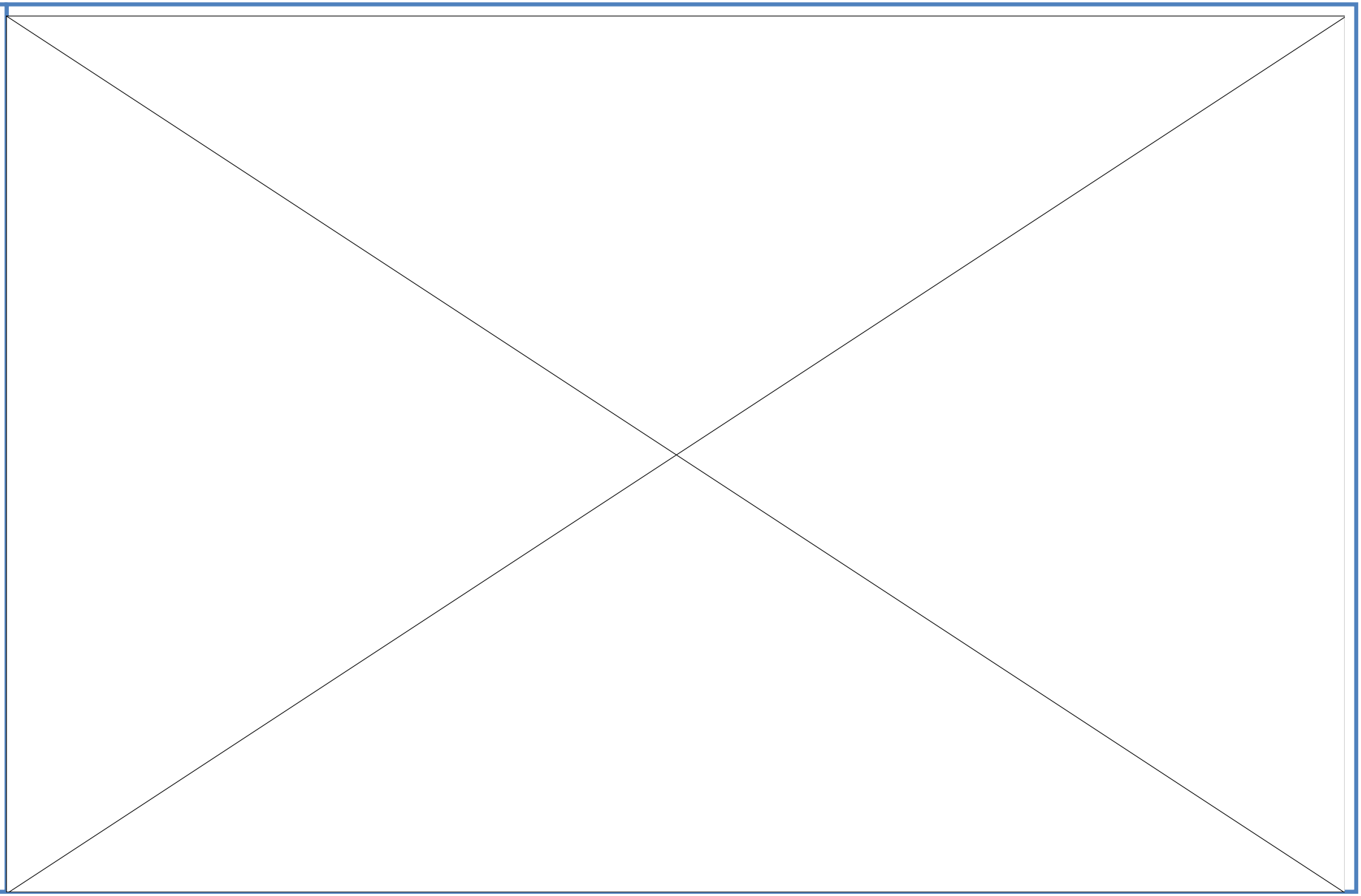
Decision Support Challenge

- 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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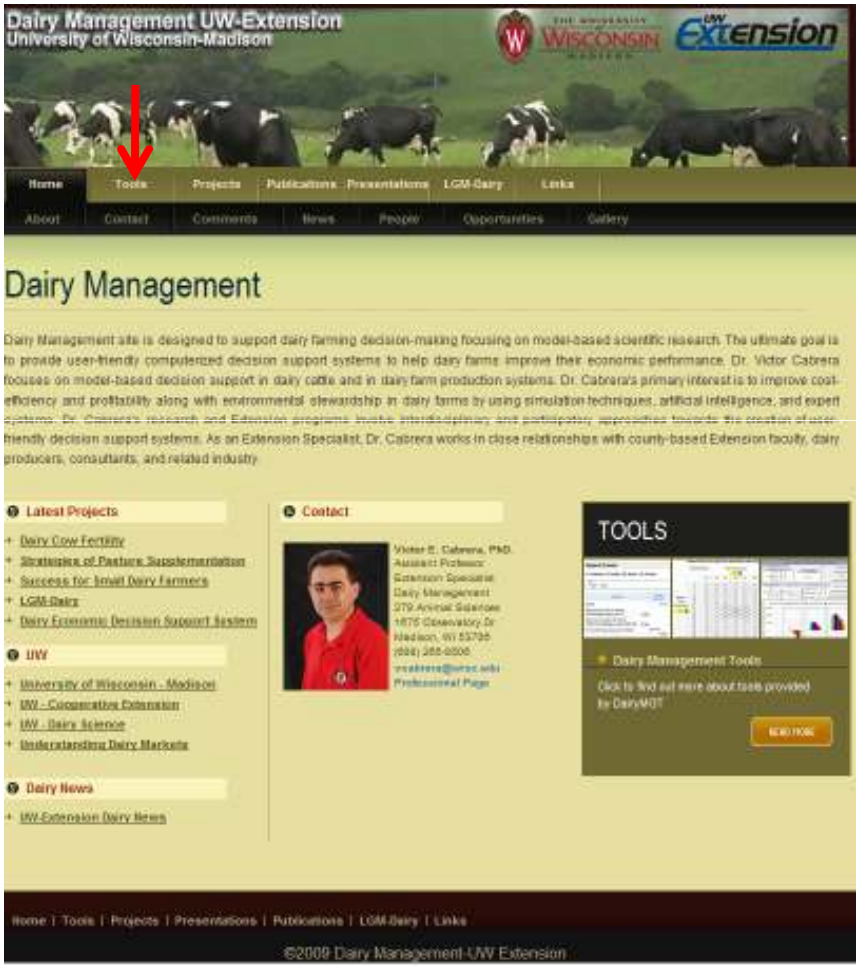

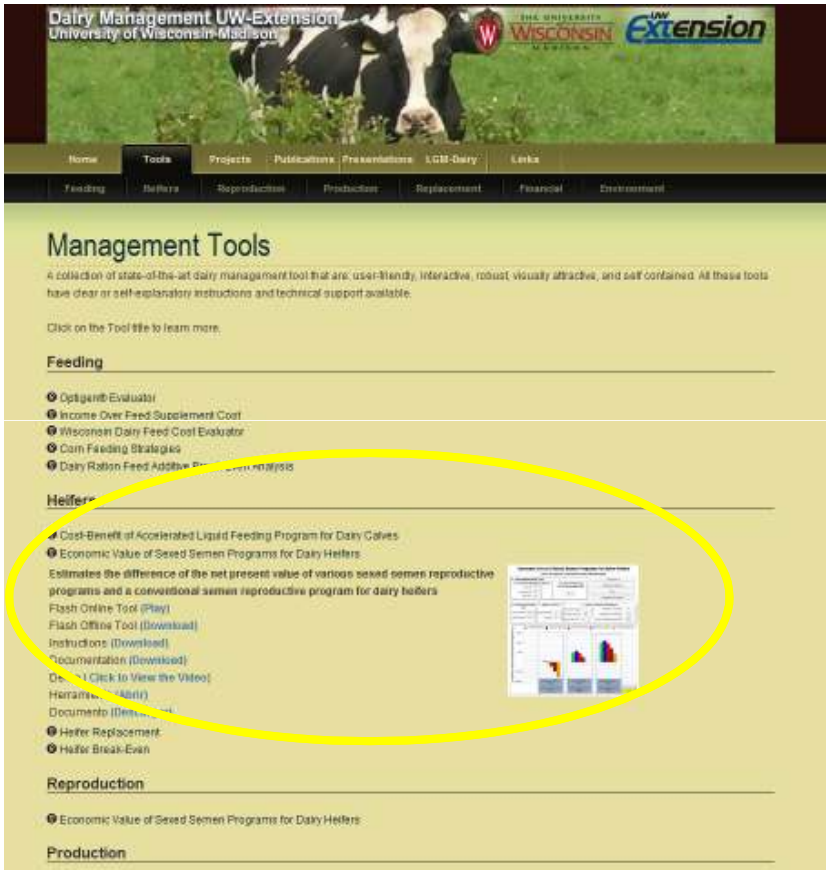

http://dairymgt.uwex.edu/ or http://dairymgt.info