

Rationale

- Herd profitability depends on reproductive efficiency, but relationship is highly complex
- Reproductive performance can be measured (e.g., 21-d pregnancy rate)
- Costs of reproductive programs can be calculated (e.g., cost per pregnancy)
- **But**, it is difficult to measure its full economic impact (e.g., profitability)

Profitability of reproduction

- Simulate herd structure in response to a reproductive program
- Calculate the expected net return under different reproductive performances (De Vries et al., 2010; Fricke et al., 2010; Cabrera, 2011)

Dairy Reproductive Economic Analysis

USDA United States Department of Agriculture National Institute of Food and Agriculture
 V.E. Cabrera UW Extension THE UNIVERSITY OF WISCONSIN MADISON

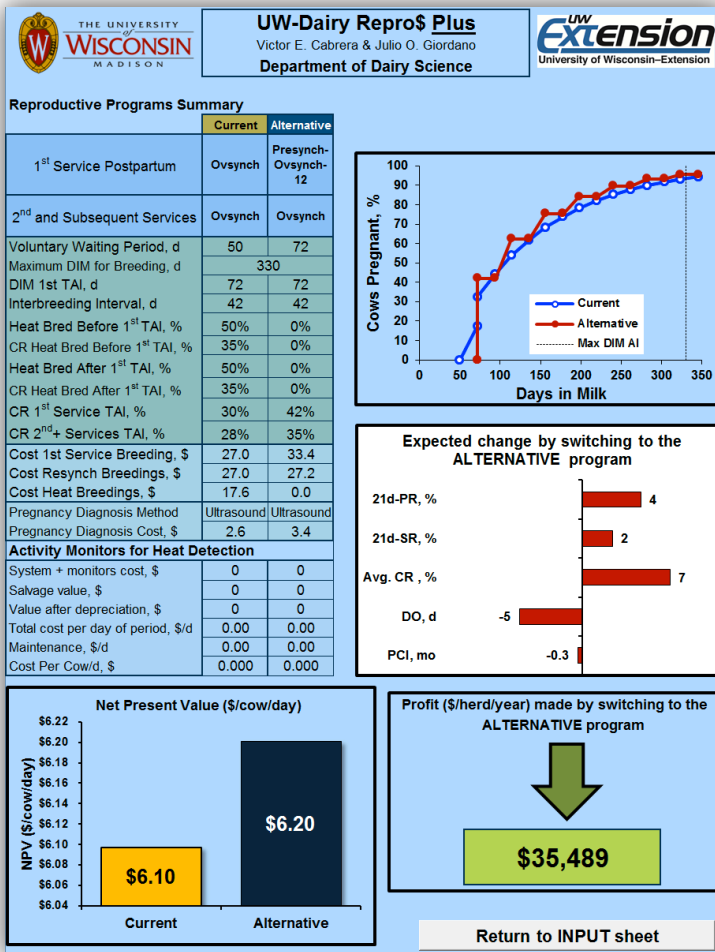
Overview Upload Repro Abort Cull Milk Economics Run Model Results Analyze

Total Number of Cows	100
Iterations Performed	737
Reached Steady State	YES

	Total Revenues & Costs				
	IOFC	Cull	Repro	Calves	Net Return
\$/herd/month	15128.81	-1353.02	-932.8	1048.08	13891.07
\$/herd/day	504.29	-45.1	-31.09	34.94	463.04
\$/cow/year	1840.67	-164.62	-113.49	127.52	1690.08

Month in Milk	Month in Pregnancy									Cull Cows	Revenues & Costs (\$)				
	0	1	2	3	4	5	6	7	8		9	IOFC	Cull	Repro	Calves
	Lactation 1														
1	3.54										0.14	422.47	-69.93	0.00	0.00
2	3.39										0.09	489.30	-45.44	84.80	0.00
3	2.70	0.59									0.06	466.27	-27.96	67.62	0.00
4	2.17	0.48	0.59								0.05	438.04	-24.08	54.34	0.00
5	1.77	0.38	0.47	0.57							0.04	410.78	-20.87	44.17	0.00
6	1.45	0.31	0.38	0.46	0.55						0.04	385.40	-19.18	36.26	0.00
7	1.20	0.26	0.31	0.37	0.44	0.54					0.04	358.39	-18.42	29.94	0.00
8	0.99	0.21	0.25	0.30	0.35	0.43	0.53				0.04	330.60	-17.73	24.73	0.00
9	0.82	0.17	0.21	0.24	0.29	0.35	0.43	0.53			0.04	302.77	-17.76	20.42	0.00
10	0.67	0.14	0.17	0.20	0.24	0.28	0.34	0.42	0.52		0.04	190.20	-18.69	16.84	0.00
11	0.55	0.12	0.14	0.17	0.20	0.23	0.28	0.34	0.42	0.52	0.58	102.51	-20.39	13.84	103.04
12	0.01		0.12	0.14	0.16	0.19	0.23	0.28	0.34	0.41	0.03	29.79	-8.72	0.00	82.79
13	0.01			0.11	0.13	0.16	0.19	0.23	0.27	0.33	0.03	13.03	-6.91	0.00	66.52
14	0.01				0.11	0.13	0.16	0.19	0.22	0.27	0.02	0.47	-5.37	0.00	54.08
15	0.00					0.11	0.13	0.15	0.19	0.22	0.01	-8.44	-4.10	0.00	44.37
16	0.00						0.11	0.13	0.15	0.18	0.01	-14.17	-3.05	0.00	36.57
17	0.00							0.10	0.13	0.15	0.00	-17.51	-2.18	0.00	30.16
18	0.00								0.10	0.12	0.00	-19.11	-1.41	0.00	24.85
19	0.00									0.10	0.00	-8.57	-0.68	0.00	20.41

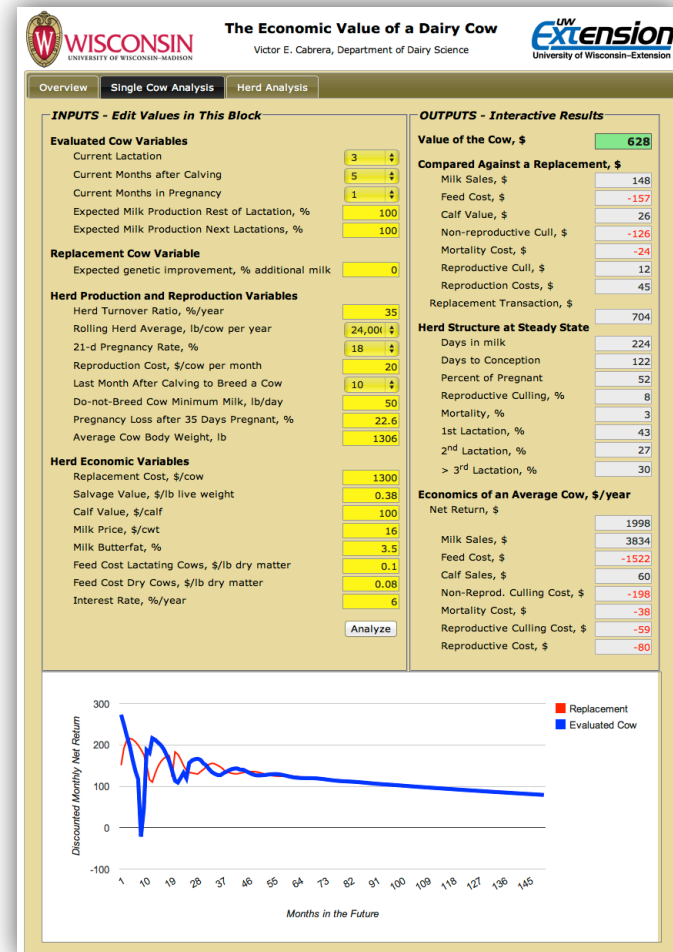
Evaluation of repro programs



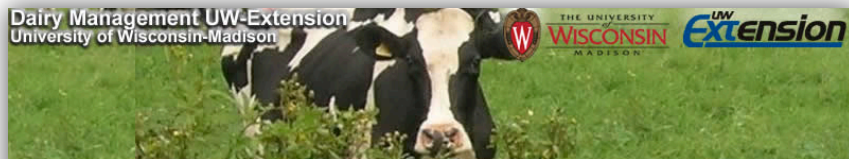
- Analyze specific reproductive programs
- Impact of reproductive management strategies on a farm-by-farm specific basis (Giordano et al., 2011; 2012; 2013; Kalantari and Cabrera, 2012)

Individual cow management

- Not all cows have same reproductive value within a herd
- Opportunities for individual cow decision-making exist (Cabrera, 2012)



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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 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 industry.

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Contact



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- [Optigen® Evaluator](#)
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- [UW-DairyRepro\\$Plus: A Reproductive Analysis Tool that Includes Heat Detection Devices](#)
- [The Economic Value of a Dairy Cow](#)
- [Economic Value of Sired Semen Programs for Dairy Heifers](#)
- [UW-DairyRepro\\$: A Reproductive Economic Analysis Tool](#)
- [Exploring Timing of Pregnancy Impact on Income Over Feed Cost](#)
- [Dairy Reproductive Economic Analysis](#)

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- [The Economic Value of a Dairy Cow](#)
- [Value of a Springer](#)
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- [Herd Structure Simulation](#)

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- [LGM Dairy Feed Equivalent Calculator](#)
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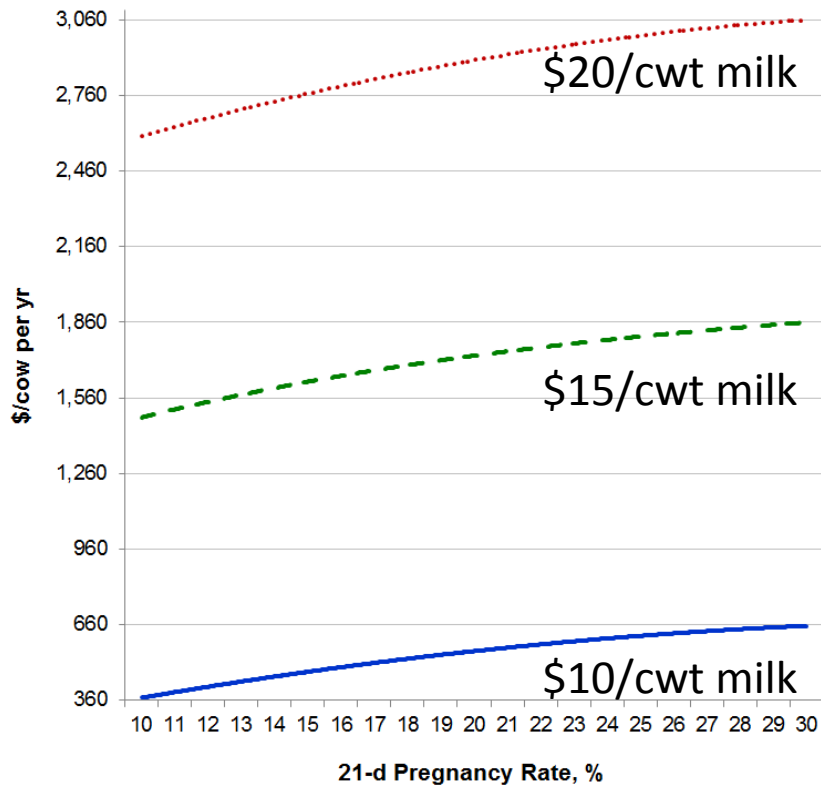
Price Risk

- [LGM Dairy Premium Sensitivity](#)
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Profit of improving pregnancy rate



DairyMGT.info/markov

- Improving reproductive efficiency improves **returns** (Fricke et al., 2010)
- Reproductive efficiency improves **overall profit** (De Vries, 2010; Giordano et al., 2012; Kalantari and Cabrera, 2012)
- Law of **diminishing** marginal net returns

Profit of improving pregnancy rate

- Higher gains are due to improved milk **income over feed cost**
- Other important factors: savings in reproductive costs, return for additional calves, and savings in replacement costs
(Cabrera, 2011)

Expected additional net return (\$/cow per yr)
response to increased 21-d pregnancy rate.

21-d Pregnancy Rate, %	Income over feed cost	Replacement cost	Reproductive cost	Calf return	Overall Net Return
10 to 11	19.42	1.14	6.10	5.25	32
11 to 12	18.28	1.28	5.60	4.84	30
12 to 13	17.18	1.36	5.17	4.48	28
13 to 14	16.13	1.42	4.79	4.16	26
14 to 15	15.12	1.44	4.45	3.87	25
15 to 16	14.17	1.45	4.15	3.60	23
16 to 17	13.26	1.43	3.88	3.36	22
17 to 18	12.41	1.41	3.64	3.15	21
18 to 19	11.62	1.37	3.42	2.95	19
19 to 20	10.87	1.33	3.23	2.77	18
20 to 21	10.17	1.28	3.05	2.60	17
21 to 22	9.52	1.23	2.88	2.44	16
22 to 23	8.91	1.17	2.73	2.30	15
23 to 24	8.34	1.12	2.59	2.17	14
24 to 25	7.82	1.06	2.46	2.05	13
25 to 26	7.33	1.01	2.34	1.94	12
26 to 27	6.87	0.96	2.23	1.84	12
27 to 28	6.45	0.90	2.13	1.74	11
28 to 29	6.06	0.85	2.03	1.65	11
29 to 30	5.70	0.80	1.94	1.57	10

Make your own analyses

“Dairy Reproductive Economic Analysis” online tool

The screenshot shows the web interface for the Dairy Reproductive Economic Analysis tool. At the top, it features logos for USDA, United States Department of Agriculture, National Institute of Food and Agriculture, UW Extension, and The University of Wisconsin-Madison. Below the logos, there is a navigation menu with tabs for Overview, Upload, Repro, Abort, Cull, Milk, Economics, Run Model, Results, and Analyze. The main content area is titled "Find the economic value of improving reproductive performance" and contains a table with input fields for "21-d Preg Risk (%)" and "Repro Cost (\$/cow/mo)" for both "Current Repro Program" and "Goal Repro Program". An "Analyze" button is located at the bottom left of the form.

	21-d Preg Risk (%)	Repro Cost (\$/cow/mo)
Current Repro Program	<input type="text"/>	<input type="text"/>
Goal Repro Program	<input type="text"/>	<input type="text"/>

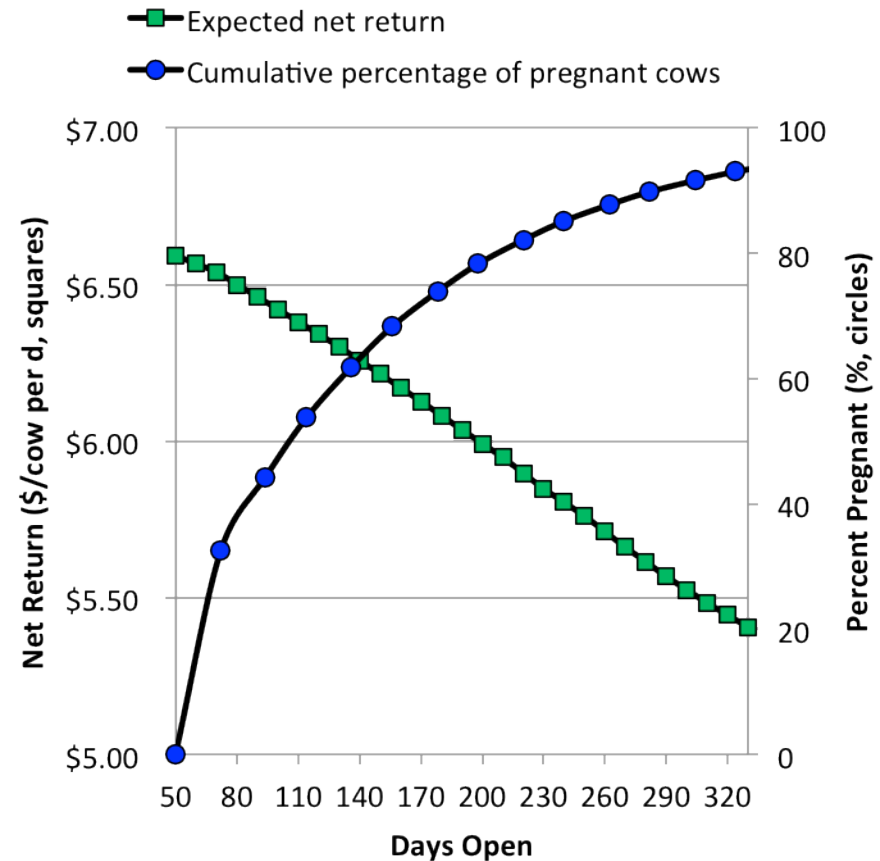
DairyMGT.info/markov

- Enter **farm-specific** information:
 - Milk production
 - Culling rates
 - Abortion rates
 - Prices and costs
- Run model
- Compare scenarios

Farm specific analyses

- Value of a reproductive program assessed by :
 - **Simulating** reproductive performance along with
 - **Estimating** net returns

(Giordano et al., 2011; 2012; 2013; Kalantari and Cabrera, 2012)



[DairyMGT.info: Tools: UW-DairyRepro\\$Plus](http://DairyMGT.info: Tools: UW-DairyRepro$Plus)

Farm specific analyses

- Different herds with different repro programs can have **same** performance
- Same repro program in different herds can have **different** outcomes



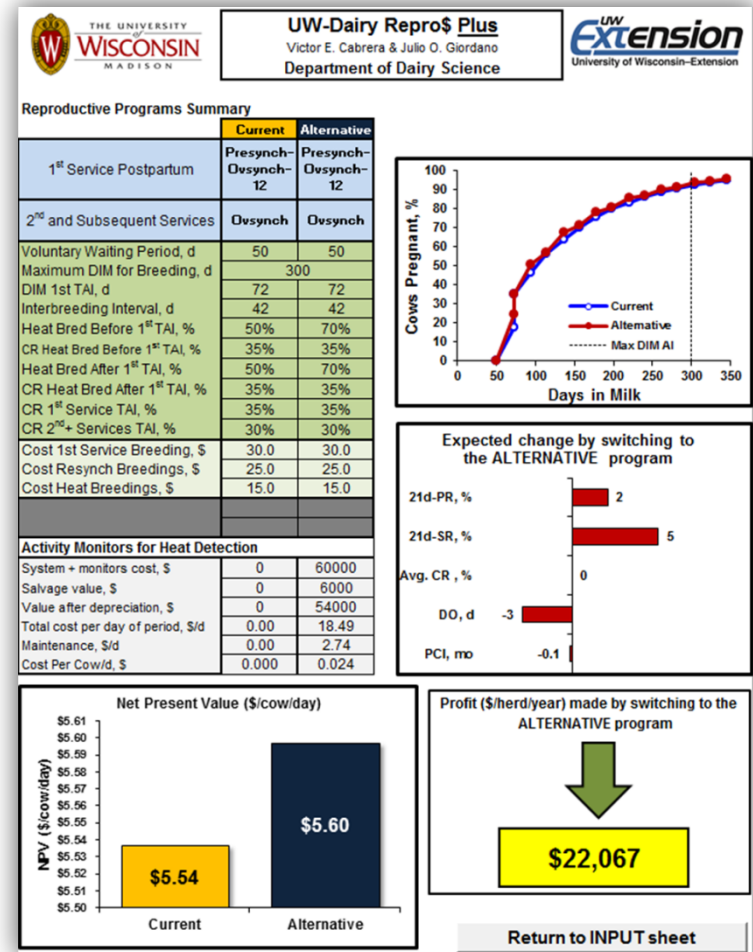
Farm specific decision-making

- Include, exclude, or change level of **TAI** or **HD** (Giordano et al., 2011)
- Manipulate **IBI** for TAI programs (Giordano et al., 2012)
- **Start** re-synchronization before pregnancy diagnosis
- Introduce the use of **chemical** pregnancy test (Giordano et al., 2013)
- Assessing the cost benefit of introducing **HD** devices

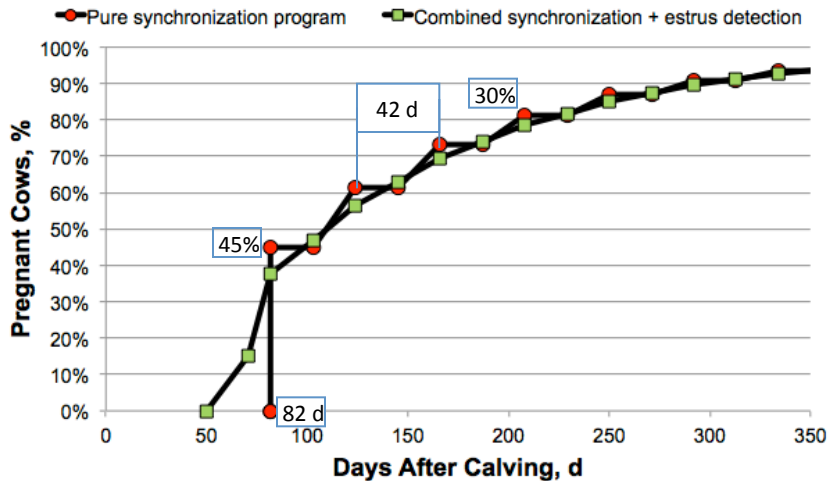


Introducing heat detection devices

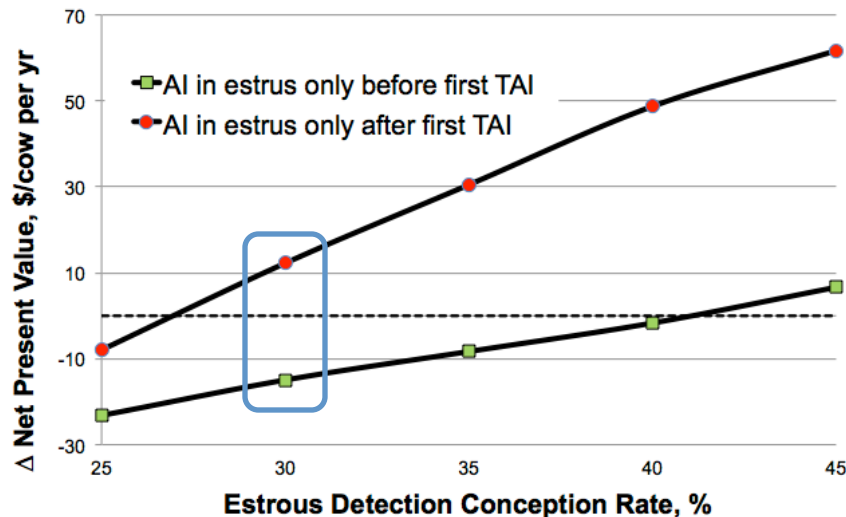
- Increasing the percentage of cows bred in estrus from 50 to 80% increased the 21-d PR by **2%**, and
- Would translate in **\$22,000/year** of additional profit in a 1,000-cow herd



Heat detection between syncs



- Adding 30% CR of 50% ED improves profit?
- **No gain / No loss**

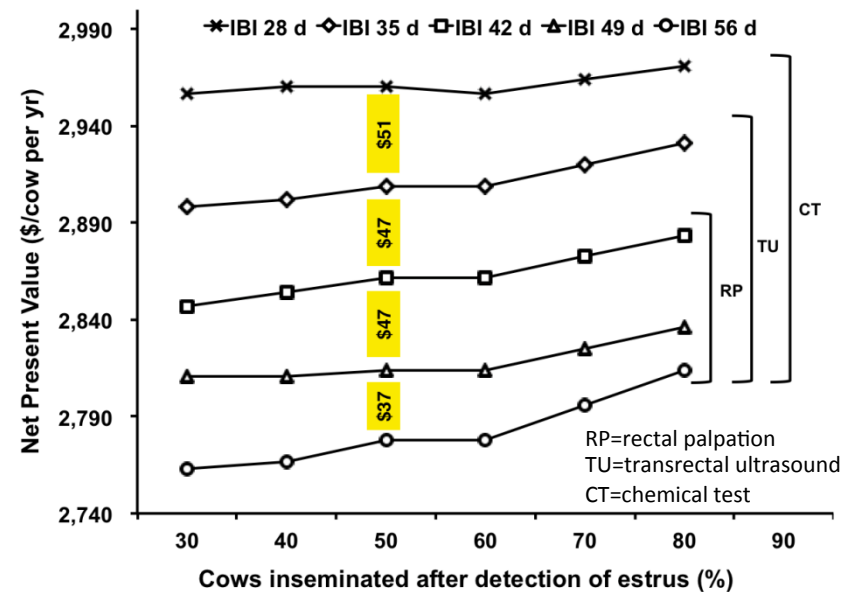


- Only before first TAI: **Loss**
- Only after first TAI: **Gain**

Earlier chemical pregnancy test

- Between **\$40 and \$60** additional profit to 1-week shorter interbreeding interval (between 9 and 4 weeks)
- However, earlier pregnancy tests has **inaccuracies** and is affected by early pregnancy losses

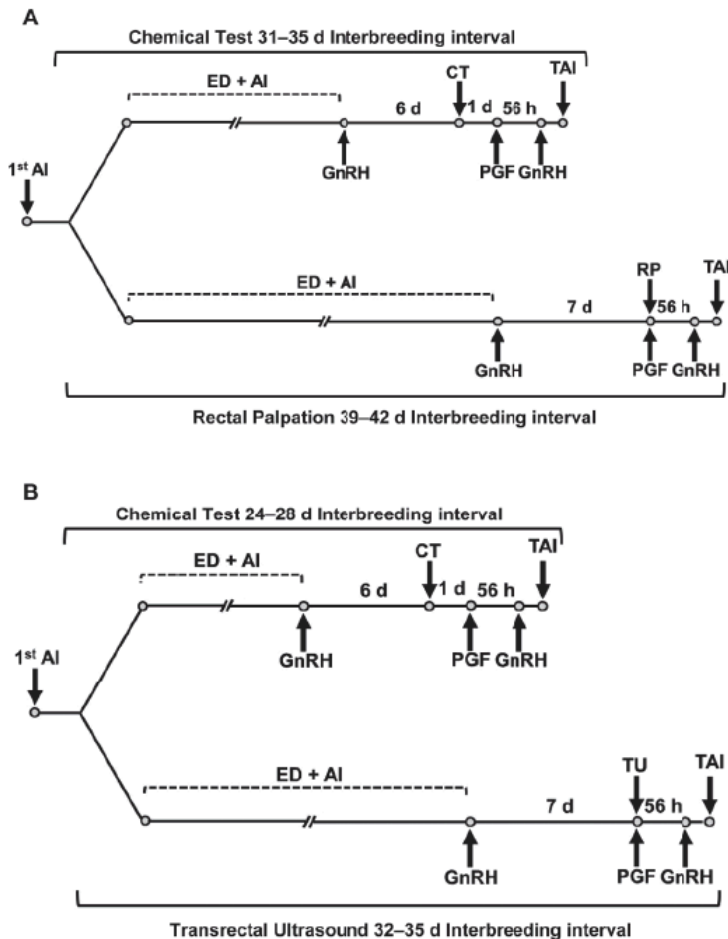
Effect of shorter interbreeding intervals (IBI) when conception rate was 35%



Giordano et al., 2013

[DairyMGT.info: Tools: UW-DairyRepro\\$Plus](http://DairyMGT.info: Tools: UW-DairyRepro$Plus)

Earlier chemical pregnancy test



Value of using chemical test (CT) for earlier pregnancy diagnosis


			\$ per 1% or \$0.1	
	Base	Range	CT31 vs RP39	CT24 vs TU32
% Sensitivity	98/97	94-99	+5.3	+4.5
% Specificity	98/97	94-99	+3.1	+2.5
% Pregnancy loss	6/6.6	0-10	-3.1	-2.5
% Questionable	3.3/8.5	0-10	-0.4	-0.3
% Estrous detection	50	30-80	0.097	-0.220
\$ CT cost	2.4	0.5-5	-0.0175	-0.0192

	Break even	
	CT31 vs RP39	CT24 vs TU32
% Sensitivity	96.4	94.9
% Specificity	95.1	93.2
% Pregnancy loss	8.9	10.5


Giordano et al., 2013

DairyMGT.info: Tools: UW-DairyRepro\$Plus

Make your own analyses



UW-Dairy Repro\$ Plus
 Victor E. Cabrera & Julio O. Giordano
 Department of Dairy Science



Farm Name: Location:

1. Herd Parameters

Lactating Cows, #	934
Parity 1	352
Parity 2	297
Parity ≥ 3	285
Body Weight, lb/cow	
Parity 1	1,350
Parity 2	1,400
Parity ≥ 3	1,450
Involuntary Culling, %/yr	28.5%
Mortality, %/yr	6.0%
Stillbirth, %/yr	10.3%

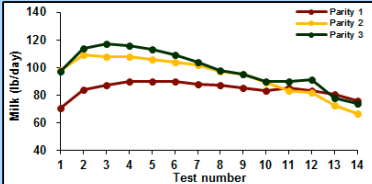
2. Economic Parameters

Milk Price, \$/cwt	15.00
Cost Feed Lactating, \$/lb DM	0.10
Dry Period Fixed Cost, \$/d	2.20
Female Calf Value, \$	125
Male Calf value, \$	50
Heifer Replacement Value, \$	1,250
Cow Salvage Value, \$	650
Labor Cost for Injection, \$/hr	15.00
Heat Detection Cost, \$/hr	15.00
AI Cost, \$/cow	15.00
Interest Rate, %/yr	6.5%

3. Lactation Curves (lb/cow/test)

Own Farm Lactations (Enter/Edit NUMBERS Below)

Test	Parity 1	Parity 2	Parity ≥ 3
1	71	98	97
2	84	109	114
3	87	108	117
4	90	108	116
5	90	106	113
6	90	104	109
7	88	102	104
8	87	97	98
9	85	95	95
10	83	89	90
11	85	83	90
12	83	82	91
13	81	73	78
14	76	67	74



4. Reproductive Program

	Current	Start day	Alternative	Start day
1 st Service postpartum	Ovsynch	Tue	Presynch-Ovsynch-12	Thu
2 nd and subsequent services	Ovsynch	Tue	Ovsynch	Tue
Resynch before preg check	YES		YES	

5. Do you know total breeding costs (semen, hormones, labor for injections, and pregnancy diagnosis)? If "Yes" Check Box

6. Reproductive Program Parameters

	Current	Alternative
Voluntary Waiting Period, d	50	72
Estrus Cycle Duration, d	22	
Maximum DIM for Breeding, d	330	
DIM to 1 st TAI, d	72	72
Interbreeding Interval, d	42	42
Heat Bred Before 1 st TAI, %	50%	0%
CR Heat Bred Before 1 st TAI, %	35%	0%
Heat Bred After 1 st TAI, %	50%	0%
CR Heat Bred After 1 st TAI, %	35%	0%
CR 1 st Service TAI, %	30%	42%
CR 2 nd + Services TAI, %	28%	35%
Cost of 1 st Service TAI, \$	27.3	27.3
Cost of 2 nd + Services TAI, \$	27.3	27.3
Cost of Heat Breeding, \$	20.0	20.0
Cost resynch before preg check, \$	2.00	2.00
Calving Interval, d	13.8	
Dry Period, d	60	

7. Heat Detection Labor Cost

	Current	Alternative
Laborers hr/d	1	0
	3	0

8. Activity Monitors for Heat Detection

	Current	Alternative
System Cost, \$	0	0
Number of monitors	0	0
Cost per monitor, \$	0	0
Maintenance, \$/yr	0	0
Life expectancy, yr	0	0
Salvage value, %	0%	0%

9. Pregnancy Diagnosis Cost


	Current	Alternative
Palpation, \$/hr		
Ultrasound, \$/hr	105	135
Blood Test, \$/cow		

10. Labor Required for Injections and Labor Required for Pregnancy Diagnosis

		Mon	Tue	Wed	Thu	Fri	Sat	Sun
Current	Injections Laborers hr/d		2		1			
	# Cows		50		35			
	Pregnancy hr/d		1.5					
	# Cows		60					
Alternative	Injections Laborers hr/d		2		1			
	# Cows		100		40			
	Pregnancy hr/d		1.5					
	# Cows		60					

11. Hormones Cost

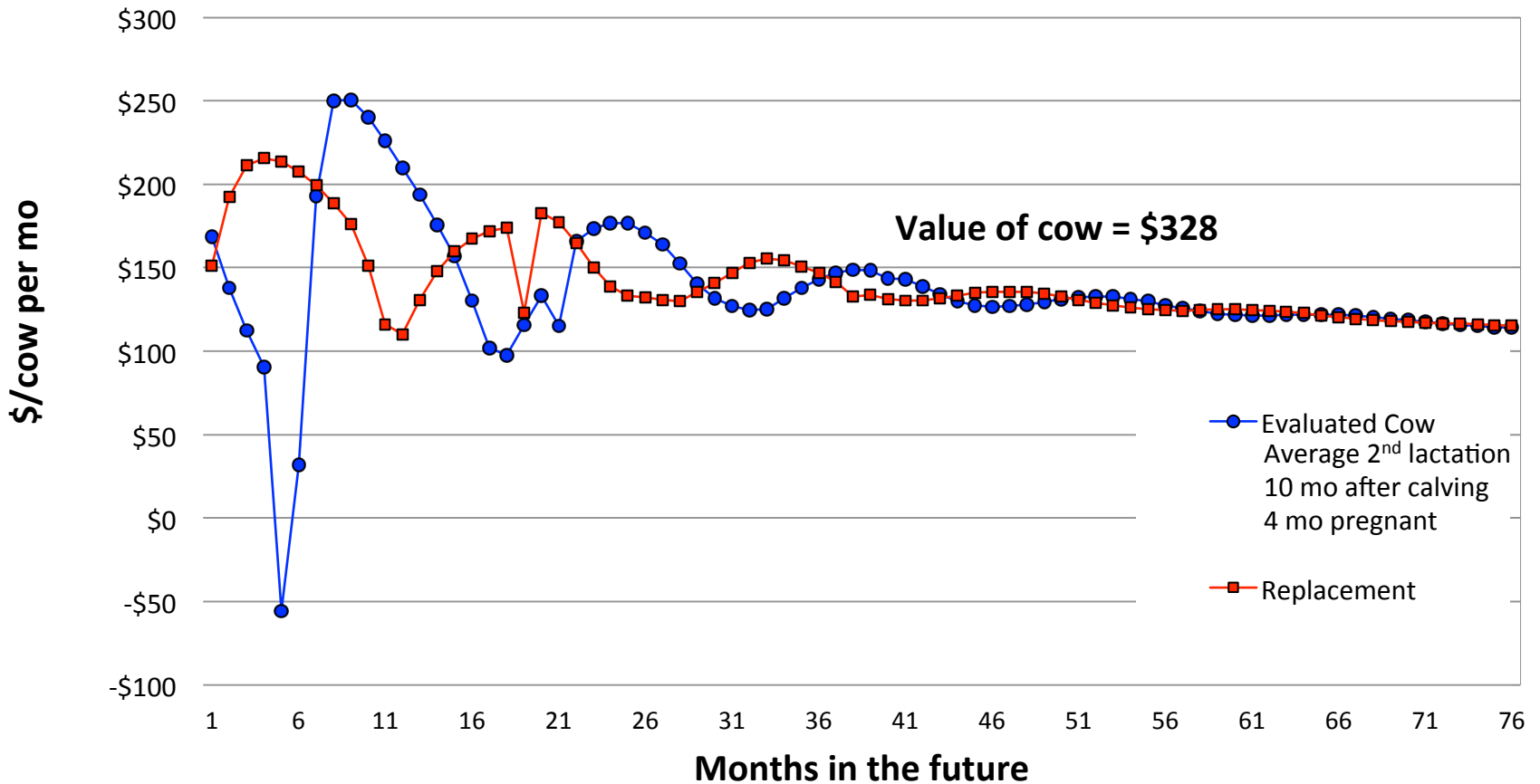
	Vial, \$	# Doses
GnRH	20	10
PGF	25	10
P4 Insert		
hCG		

Parity Group to ANALYZE: 

Individual cow decision-making

- Every cow has a **different** contribution
- After best repro program: **individual cow management**
- **Fine-tune** individual cow reproductive management
- **Critical concepts:**
 - Economic value of a **dairy cow** (Eicker and Fetrow, 2003; Groenendaal et al., 2004)
 - **Retention payoff** (De Vries, 2004; Kalantari et al., 2010)
 - Value ranking of cows
- **Crucial** reproductive decisions:
 - Breeding, VWP, DNB, ...

Determining the value of a cow



Cabrera, 2012. DairyMGT.info/tools/cow_replacement/

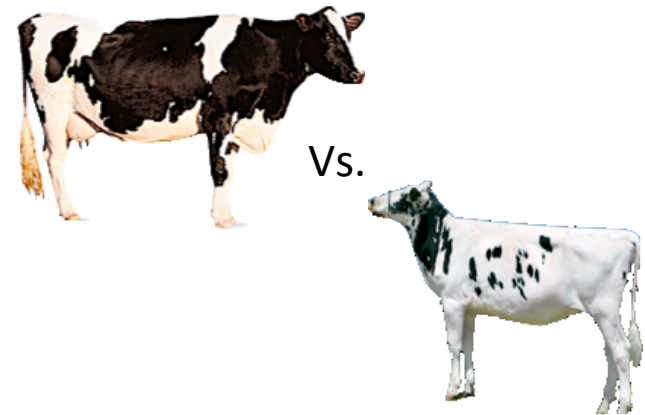
Meaning of value of a cow

- **Positive:**

- Cow provides more profit than potential replacement
- Relative cow value to be used for:
 - Ranking
 - Treating
 - **Better reproductive management**

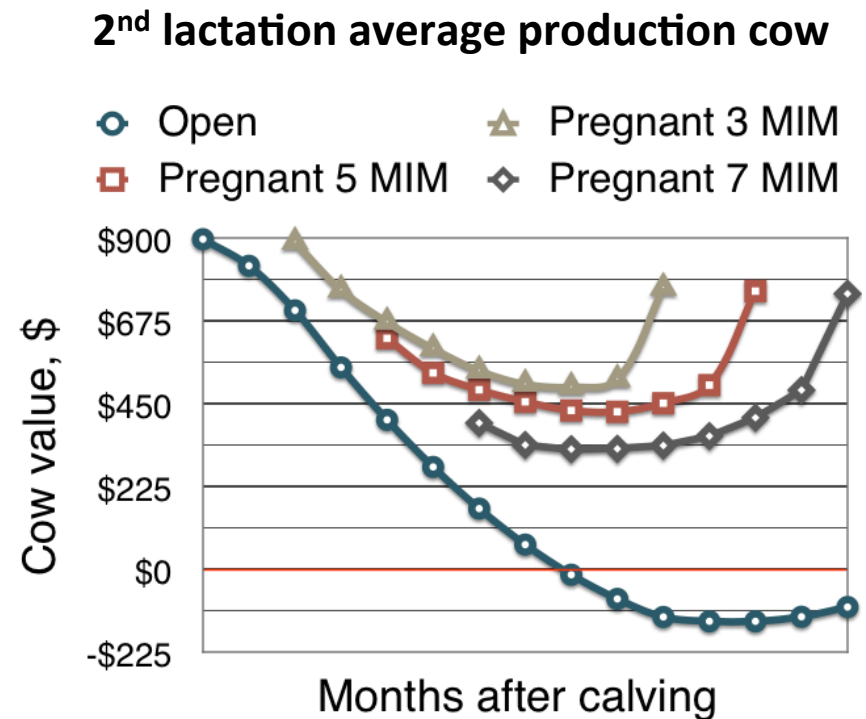
- **Negative:**

- Herd will have higher profit with a replacement



Value of a cow illustration

- **Open cow**
 - Decreases
 - Becomes negative
- **Pregnant cow**
 - Higher than open
 - U-shaped
 - Similar value at calving



DairyMGT.info/tools/cow_replacement/

MIM = month in milk.

The impact of milk productivity

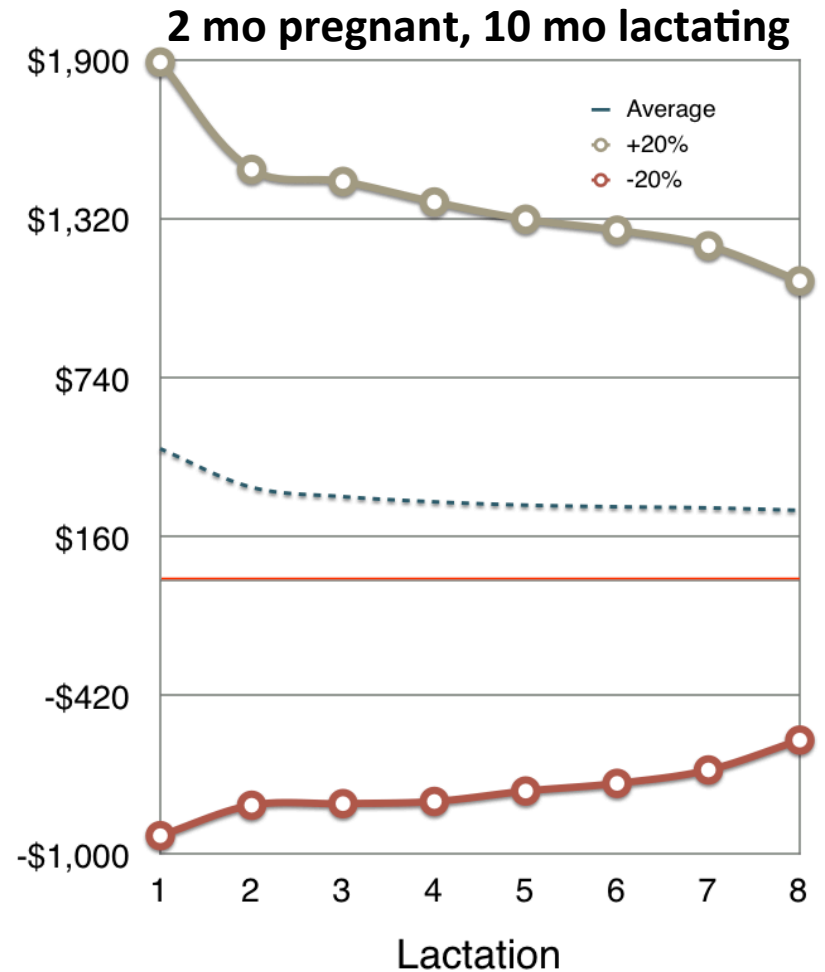
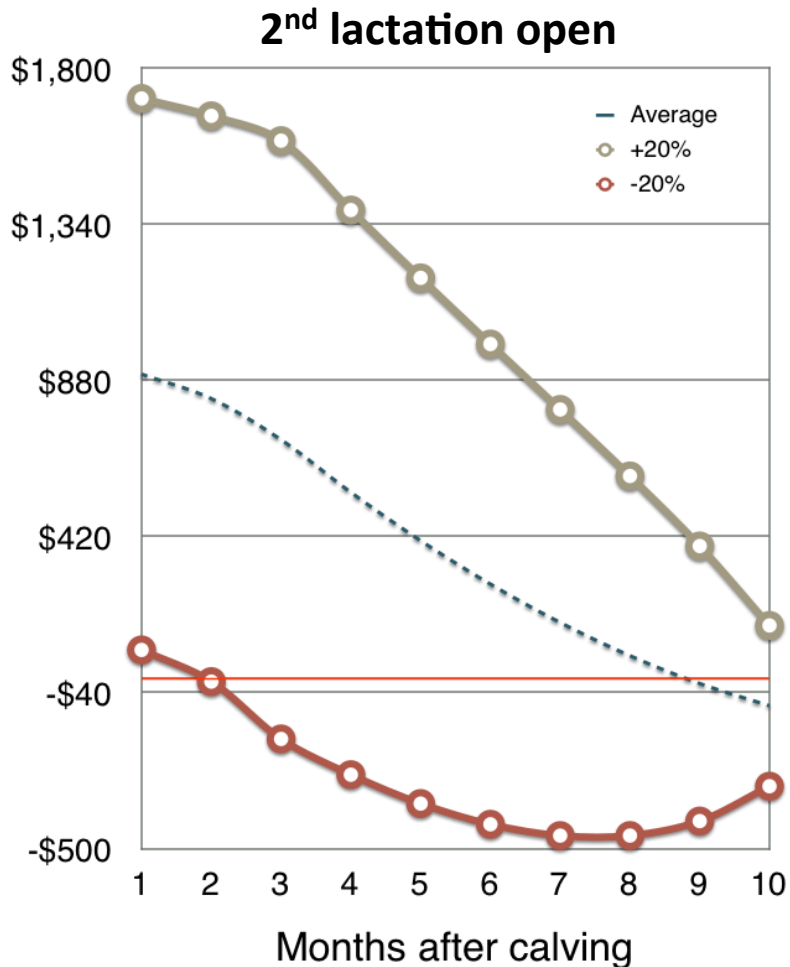




Illustration of possible cow value repro management decisions

Cow Value	MIM	MIP	Manager Possible Reproductive Decision
High	1	0	Consider enlarging voluntary waiting period
Low	1	0	Consider shorten voluntary waiting period
High	9	0	Keep breeding for at least 3 more services
Low	9	0	Label do-not-breed and replace next month
Very High	3	0	Use better quality semen or female sexed semen
Very Low	3	0	Consider embryo transfer or using male sexed semen
Very High	4	1	Consider sooner pregnancy diagnosis confirmation
Very Low	4	1	Consider replacement if negative cow value
Very High	10	5	Consider sooner pregnancy diagnosis re-confirmation
Very Low	10	5	Consider replacement after calving

MIM = month in milk. MIP = month in pregnancy.

Make your own analyses


The Economic Value of a Dairy Cow


 Victor E. Cabrera, Department of Dairy Science

Overview | **Single Cow Analysis** | Herd Analysis

INPUTS - Edit Values in This Block

Evaluated Cow Variables

Current Lactation	3
Current Months after Calving	5
Current Months in Pregnancy	1
Expected Milk Production Rest of Lactation, %	100
Expected Milk Production Next Lactations, %	100

Replacement Cow Variable

Expected genetic improvement, % additional milk	0
---	---

Herd Production and Reproduction Variables

Herd Turnover Ratio, %/year	35
Rolling Herd Average, lb/cow per year	24,000
21-d Pregnancy Rate, %	18
Reproduction Cost, \$/cow per month	20
Last Month After Calving to Breed a Cow	10
Do-not-Breed Cow Minimum Milk, lb/day	50
Pregnancy Loss after 35 Days Pregnant, %	22.6
Average Cow Body Weight, lb	1306

Herd Economic Variables

Replacement Cost, \$/cow	1300
Salvage Value, \$/lb live weight	0.38
Calf Value, \$/calf	100
Milk Price, \$/cwt	16
Milk Butterfat, %	3.5
Feed Cost Lactating Cows, \$/lb dry matter	0.1
Feed Cost Dry Cows, \$/lb dry matter	0.08
Interest Rate, %/year	6

Analyze

OUTPUTS - Interactive Results

Value of the Cow, \$ 628

Compared Against a Replacement, \$

Milk Sales, \$	148
Feed Cost, \$	-157
Calf Value, \$	26
Non-reproductive Cull, \$	-126
Mortality Cost, \$	-24
Reproductive Cull, \$	12
Reproduction Costs, \$	45
Replacement Transaction, \$	704

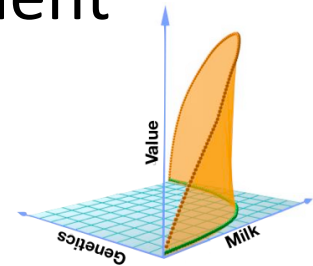
Herd Structure at Steady State

Days in milk	224
Days to Conception	122
Percent of Pregnant	52
Reproductive Culling, %	8
Mortality, %	3
1st Lactation, %	43
2 nd Lactation, %	27
> 3 rd Lactation, %	30

Economics of an Average Cow, \$/year

Net Return, \$	1998
Milk Sales, \$	3834
Feed Cost, \$	-1522
Calf Sales, \$	60
Non-Reprod. Culling Cost, \$	-198
Mortality Cost, \$	-38
Reproductive Culling Cost, \$	-59
Reproductive Cost, \$	-80

- **Critical variables:**
 - Evaluated cow
 - Replacement



- **Important variables**
 - Herd production
 - Herd reproduction
 - Prices and costs

DairyMGT.info/tools/cow_replacement/

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