Fertility associated economic losses of farms

Victor E. Cabrera
Implications

↑ Reproductive performance
↑ Profitability

Required:
Economic value quantification

Market conditions:
Change constantly

Farm are different:
Farm specific assessments
Large economic impact

Economic net return: Strongly associated to reproductive performance

Reproductive performance:
Most efficient part of lactation curve
Ferguson and Galligan, 1999

Costs replacement and mortality
Galvao et al., 2013

On-farm replacements
Giordano et al., 2012

Relative reproductive costs
Giordano et al., 2012
21-d Pregnancy Rate: Best single index of reproductive performance (not perfect…)
Ferguson and Galligan, 1999

Rate at which eligible cows become pregnant in successive 21-d periods

Integrates many other parameters that indicate reproductive performance

Managers of modern US commercial dairy herds use 21-d PR **adjusted to 50 d VWP**
What happens with the 21-d PR if VWP is arbitrarily changed from 50 d to 70 d?

A. Increases  
B. Decreases  
C. Remains  
D. It depends
Economic impact of reproductive programs: Difficult to assess - integrated

Series of recent simulation studies: Provide interesting clues and further direction

Giordano et al., 2011: Partial budgeting, DSS

Giordano et al., 2012: Daily Markov chains, DSS

Cabrera, 2012: Markov-Chain, DSS

Kalantari and Cabrera, 2012: Markov-Chain, DSS

Giordano et al., 2013: Decision theory

Galvao et al., 2013: Monte Carlo
The economic value of improving reproductive performance

Profit (US$/cow.yr) gain over 10% 21-d PR

Kalantari and Cabrera, 2012
Cabrera, 2012
Galvao et al., 2013
Giordano et al., 2012
Giordano et al., 2011
Herd’s relative milk productivity

21-d PR

Kalantari and Cabrera, 2012

14%TAI+ED

16%TAI+ED

18%TAI+ED

17%TAI

20%TAI+ED

Relative productivity, %

Ranking net return
1=worst, 5=best

TAI=Timed Artificial Insemination
ED=Estrus Detection

TAI+ED

average

76 88 100 112 124
Milk, feed, and IOFC ($/cow.yr)

11,000 kg/cow.yr

13,600 kg/cow.yr

Cabrera, 2012
Calf sales ($/cow.yr)

Return ($/cow.yr) =
- 0.0352 \times (21\text{-d PR})^2
+ 2.8476 \times (21\text{-d PR})
+ 18.93 \quad (R^2=0.996)

♀ Calf value = $100

Between $3 and $1 per 1% increase in 21-d PR

<table>
<thead>
<tr>
<th>Study</th>
<th>♀ Calf value, $</th>
<th>Gain, $/1% 21-d PR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galvao et al., 2013</td>
<td>$140</td>
<td>$1 to $3</td>
</tr>
<tr>
<td>Giordano et al., 2012</td>
<td>$90</td>
<td>$2 to $1</td>
</tr>
</tbody>
</table>

Cabrera, 2012
Replacement supply

↑21-d PR → ↑Selective culling

<table>
<thead>
<tr>
<th>21d-PR, % (reproductive programs)</th>
<th>Replacement balance /1,000 cow Cutoff 300 DIM</th>
<th>NEW cutoff to balance, DIM</th>
<th>Net return change, $/cow.yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>-14</td>
<td>310</td>
<td>-5</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>15</td>
<td>281</td>
<td>+5</td>
</tr>
<tr>
<td>17</td>
<td>20</td>
<td>270</td>
<td>+6</td>
</tr>
<tr>
<td>18</td>
<td>38</td>
<td>240</td>
<td>+7</td>
</tr>
<tr>
<td>19</td>
<td>40</td>
<td>240</td>
<td>+8</td>
</tr>
<tr>
<td>20</td>
<td>48</td>
<td>235</td>
<td>+9</td>
</tr>
</tbody>
</table>

From Giordano et al., 2012
Replacement and mortality costs

Daily hazard for culling (non-pregnant cows)

Mortality = Proportion of culling risk (e.g., 17% of that risk)

Lactations

Lower Costs
$/cow.yr
1% 21-d PR

$4 to $1
Cabrera, 2012

$4 to $3
Giordano et al., 2012

$27 to $4
Galvao et al., 2013

Pregnant = Less risk than non-pregnant (e.g., 75% less risk)
Reproductive costs

- ↑PR (no investment) → ↓Reproductive costs
- ↑PR may require ↑investments
- Depends on investments vs. ↑PR
- Seems to be inconsistent among studies

$/cow.yr  ↑1% 21-d PR

-$4          +$4

Galvao et al., 2013
Giordano et al., 2011; 2012
Oestrus detection, synchronisation, or a combination

Most high yielding USA herds use a combination

78% OD & 87% TAI  Caraviello et al., 2006

Common reproductive practice:

TAI protocol and perform inseminations at detected oestrous in between  Giordano et al., 2012

Recent economic studies:

OD or TAI, but combinations studied  Giordano et al., 2011

Presynch-Ovsynch + Ovsynch with a focus on OD combination  Giordano et al., 2012; Galvao et al., 2013
# Economic effect of TAI with OD

<table>
<thead>
<tr>
<th>Study Programme</th>
<th>First Serv.</th>
<th>Later Serv.</th>
<th>60% OD CR, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giordano et al., 2011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Ovsynch + D32 Ovsynch</td>
<td>45</td>
<td>30</td>
<td>14</td>
</tr>
<tr>
<td>Double Ovsynch + Double Ovsynch</td>
<td>45</td>
<td>39</td>
<td>-12</td>
</tr>
<tr>
<td>Giordano et al., 2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presynch-Ovsynch + Ovsynch</td>
<td>42</td>
<td>30</td>
<td>-17 2 19</td>
</tr>
<tr>
<td>Galvao et al., 2013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presynch-Ovsynch + Ovsynch</td>
<td>33</td>
<td>25</td>
<td>23 57</td>
</tr>
</tbody>
</table>
Interbreeding interval vs. net return

Net return gain by changing interbreeding interval, US$/cow per year

- Presynch-Ovsynch + Ovsynch

<table>
<thead>
<tr>
<th>Change in interbreeding interval (weeks)</th>
<th>Net return gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 to 7</td>
<td>37</td>
</tr>
<tr>
<td>7 to 6</td>
<td>47</td>
</tr>
<tr>
<td>6 to 5</td>
<td>47</td>
</tr>
<tr>
<td>5 to 4</td>
<td>47</td>
</tr>
</tbody>
</table>

Adapted from Giordano et al., 2013
Blood or milk-based pregnancy tests

Potentially effective when used earlier than conventional methods – **Shorten IBI**

**Earlier pregnancy diagnosis with a chemical test** could have some important **drawbacks:**

1. **Lower accuracy**
   a. False negative (issue of sensitivity)
   b. False positive (issue of specificity)
   c. Questionable diagnoses (inconclusive)

2. **Larger proportion of early pregnancy losses**
Accuracy of blood chemical test for early pregnancy diagnosis

Compared to conventional ultrasound or palpation

↓ Sensitivity → 2-3% → Re-synch → Preg. loss

↓ Specificity → 2-3% → Longer IBI → Time loss

↓ Conclusive → 3-9% → Re-test/Longer IBI

↑ Preg. Losses → 6-6.6%/week → ↓ Specificity

Adapted from Giordano et al., 2013
### Chemical vs. Palpation

CT31 vs. RP39; 35 vs. 42 d IBI @ 50% OD

\[ \begin{align*}
= -795 \\
+535 \text{ (sensitivity %)} \\
+305 \text{ (specificity %)} \\
-305 \text{ (pregnancy losses %)} \\
-39 \text{ (questionable diagnoses %)} \\
-1.8 \text{ (cost of test $)}
\end{align*} \]

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity %</th>
<th>Specificity %</th>
<th>Pregnancy losses %</th>
<th>Questionable diagnoses %</th>
<th>Test Cost $</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td>98</td>
<td>98</td>
<td>6.0</td>
<td>3.3</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>Positive</strong></td>
<td>\geq96</td>
<td>\geq95</td>
<td>\leq9.0</td>
<td>\leq27</td>
<td>\leq7.5</td>
</tr>
</tbody>
</table>
d25 Chemical vs. d32 Ultrasound
CT25 vs. TU32; 28 vs. 35 d IBI @ 50% OD

= -638
+450 (sensitivity %)
+253 (specificity %)
-253 (pregnancy losses %)
-34 (questionable diagnoses %)
-1.9 (cost of test $)

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity %</th>
<th>Specificity %</th>
<th>Pregnancy losses %</th>
<th>Questionable diagnoses %</th>
<th>Test Cost $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>97</td>
<td>97</td>
<td>6.6</td>
<td>8.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Positive</td>
<td>≥95</td>
<td>≥94</td>
<td>≤10</td>
<td>≤34</td>
<td>≤7.0</td>
</tr>
</tbody>
</table>
Why profitability increases as reproductive efficiency improves?

A. +Milk
B. -Culling
C. +Replacement
D. All the above
The UWCU Repro$ Tool
Very sophisticated, still highly user-friendly
Video demo
Cows by lactations

Total number of cows in records: 945

- 1st Lact: 43%
- 2nd Lact: 27%
- 3rd Lact: 19%
- 4th Lact: 7%
- 5th Lact: 3.1%
- 6th Lact: 1.3%
- 7th Lact: 0.32%
- 8th Lact: 0.11%
Cows by status

Total number of cows in records: 945

- Lactating: 89%
- Pregnant: 46%
- 21-d PR (50 d): 19%
- Lactating: 89%
- 21-d PR (50 d): 19%
- Pregnant: 46%
## Average BW

**Weighted average**

<table>
<thead>
<tr>
<th></th>
<th>1st Lact</th>
<th>2nd Lact</th>
<th>&gt; 2nd Lact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>43%</td>
<td>27%</td>
<td>30%</td>
</tr>
<tr>
<td>BW</td>
<td>1,200</td>
<td>1,400</td>
<td>1,650</td>
</tr>
</tbody>
</table>

**Conversion:**

- **1,389 lb** = **631 kg**

---

![Cow](image)
### Animal losses

Percentages (%) animals leaving the herd

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involuntary culling</td>
<td>27.4</td>
</tr>
<tr>
<td>Mortality</td>
<td>4.1</td>
</tr>
<tr>
<td>Stillbirth</td>
<td>6.0</td>
</tr>
<tr>
<td>Pregnancy loss</td>
<td>8.7</td>
</tr>
</tbody>
</table>

*Not including reproduction*
### Economic values

Average of a year ending September 2014

<table>
<thead>
<tr>
<th>Description</th>
<th>Milk Price</th>
<th>Feed Cost (lactating)</th>
<th>Feed Cost (dry)</th>
<th>Female Calf Value</th>
<th>Male Calf Value</th>
<th>Heifer Replacement</th>
<th>Salvage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk price</td>
<td>18.5 $/cwt</td>
<td>0.132 $/lb</td>
<td>0.084 $/lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed cost (lactating)</td>
<td>0.41 $/kg</td>
<td>0.291 $/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed cost (dry)</td>
<td></td>
<td></td>
<td>0.185 $/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female calf value</td>
<td></td>
<td></td>
<td></td>
<td>400 $</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male calf value</td>
<td></td>
<td></td>
<td></td>
<td>300 $</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heifer replacement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2,150 $</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salvage value</td>
<td></td>
<td></td>
<td></td>
<td>0.85 $/lb</td>
<td></td>
<td>1.87 $/kg</td>
<td></td>
</tr>
</tbody>
</table>
Lactation curves
Crucial for reproduction evaluation

Days postpartum

lb/cow.d

1st
2nd
3rd+

0 60 120 180 240 300 360
Lactation curves
Smoothing the curves

<table>
<thead>
<tr>
<th>DIM</th>
<th>1st</th>
<th>2nd</th>
<th>3rd+</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>52</td>
<td>82</td>
<td>91</td>
</tr>
<tr>
<td>45</td>
<td>75</td>
<td>105</td>
<td>124</td>
</tr>
<tr>
<td>75</td>
<td>87</td>
<td>112</td>
<td>128</td>
</tr>
<tr>
<td>105</td>
<td>91</td>
<td>112</td>
<td>124</td>
</tr>
<tr>
<td>135</td>
<td>93</td>
<td>109</td>
<td>119</td>
</tr>
<tr>
<td>165</td>
<td>91</td>
<td>104</td>
<td>114</td>
</tr>
<tr>
<td>195</td>
<td>89</td>
<td>99</td>
<td>109</td>
</tr>
<tr>
<td>225</td>
<td>87</td>
<td>94</td>
<td>104</td>
</tr>
<tr>
<td>255</td>
<td>84</td>
<td>90</td>
<td>99</td>
</tr>
<tr>
<td>285</td>
<td>80</td>
<td>85</td>
<td>94</td>
</tr>
<tr>
<td>315</td>
<td>77</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>345</td>
<td>74</td>
<td>76</td>
<td>86</td>
</tr>
<tr>
<td>375</td>
<td>71</td>
<td>72</td>
<td>82</td>
</tr>
<tr>
<td>405</td>
<td>68</td>
<td>68</td>
<td>78</td>
</tr>
</tbody>
</table>

\[ M_{\text{DIM}} = a \left( 1 - e^{\frac{c-\text{DIM}}{b}} \right) e^{-d(\text{DIM})} \]

- \( M \): Milk Yield
- \( \text{DIM} \): Days in milk
- \( a \): Scale (overall capacity to produce milk)
- \( b \): Ramp (slope of milk production rising after calving)
- \( c \): Offset (starting amount of milk yield)
- \( d \): Decay (rate factor of decline in milk yield after peak)

Fig.1: MilkBot's Model

Tool: Milk curve fitter
Herd and economic parameters

**Herd Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd Size (#)</td>
<td>945</td>
</tr>
<tr>
<td>Average Body Weight (lb)</td>
<td>1,389</td>
</tr>
<tr>
<td>Involuntary Culling (%/yr)</td>
<td>27.4</td>
</tr>
<tr>
<td>Mortality Rate (%/yr)</td>
<td>4.1</td>
</tr>
<tr>
<td>Stillbirth (%)</td>
<td>6.0</td>
</tr>
</tbody>
</table>

**Economic Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk Price ($/cwt)</td>
<td>18.50</td>
</tr>
<tr>
<td>Cost Feed Lactating ($/lb DM)</td>
<td>0.13</td>
</tr>
<tr>
<td>Dry Period Fixed Cost ($/lb DM)</td>
<td>0.08</td>
</tr>
<tr>
<td>Female Calf value ($)</td>
<td>400</td>
</tr>
<tr>
<td>Male Calf value ($)</td>
<td>300</td>
</tr>
<tr>
<td>Heifer Replacement Value($)</td>
<td>2,150</td>
</tr>
<tr>
<td>Salvage Value ($/lb)</td>
<td>0.850</td>
</tr>
</tbody>
</table>

**Lactation Curves (lb/cow/test)**

<table>
<thead>
<tr>
<th>DIM</th>
<th>Parity 1</th>
<th>Parity 2</th>
<th>Parity 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>52</td>
<td>82</td>
<td>91</td>
</tr>
<tr>
<td>45</td>
<td>75</td>
<td>105</td>
<td>124</td>
</tr>
<tr>
<td>75</td>
<td>87</td>
<td>112</td>
<td>128</td>
</tr>
<tr>
<td>105</td>
<td>91</td>
<td>112</td>
<td>124</td>
</tr>
<tr>
<td>135</td>
<td>93</td>
<td>109</td>
<td>119</td>
</tr>
<tr>
<td>165</td>
<td>91</td>
<td>104</td>
<td>114</td>
</tr>
<tr>
<td>195</td>
<td>89</td>
<td>99</td>
<td>109</td>
</tr>
<tr>
<td>225</td>
<td>87</td>
<td>94</td>
<td>104</td>
</tr>
<tr>
<td>255</td>
<td>84</td>
<td>90</td>
<td>99</td>
</tr>
<tr>
<td>285</td>
<td>80</td>
<td>85</td>
<td>94</td>
</tr>
<tr>
<td>315</td>
<td>77</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>345</td>
<td>74</td>
<td>76</td>
<td>86</td>
</tr>
<tr>
<td>375</td>
<td>71</td>
<td>72</td>
<td>82</td>
</tr>
<tr>
<td>405</td>
<td>68</td>
<td>68</td>
<td>78</td>
</tr>
</tbody>
</table>

**Graph**

- Parity 1
- Parity 2
- Parity 3
Reproductive program
Description of program

Voluntary waiting period 1\textsuperscript{st} lact, d       40
Voluntary waiting period 2\textsuperscript{nd}+ lact, d    40
Estrous duration, d                                      22
Maximum DIM breeding 1\textsuperscript{st} lact, d       338
Maximum DIM breeding 2\textsuperscript{nd} lact, d       276
Maximum DIM breeding 3\textsuperscript{rd}+ lact, d      236
Reproductive program

Description of program

Do-not-breed minimum milk/d

DIM first TAI injection, d

Resynch before preg check

Interbreeding interval TAI, d

<table>
<thead>
<tr>
<th>lb</th>
<th>kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>36</td>
</tr>
<tr>
<td>36</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>
Reproductive program
Description of program

Heat bred before 1st TAI service, %
AFI detect

CR before 1st TAI service, %

CR 1st TAI service

Heat bred after 1st TAI service, %
AFI detect

CR after 1st HD services, %

CR 2nd+ TAI services
<table>
<thead>
<tr>
<th>Days in gestation</th>
<th>1\textsuperscript{st} preg check, d</th>
<th>2\textsuperscript{nd} preg check, d</th>
<th>3\textsuperscript{rd} preg check, d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34</td>
<td>90</td>
<td>180</td>
</tr>
</tbody>
</table>
Reproductive program
Cost of semen, insemination, & pre check

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semen cost, $/dose</td>
<td>15</td>
</tr>
<tr>
<td>Labor insemination, $/AI</td>
<td>2.5</td>
</tr>
<tr>
<td>Ultrasound, $/hr</td>
<td>30</td>
</tr>
<tr>
<td>Time used in preg check, hr/d</td>
<td>3</td>
</tr>
<tr>
<td>Number of cows checked, #/d</td>
<td>60</td>
</tr>
</tbody>
</table>
Reproductive program
Synchronization labor and hormones

Labor for injections, $/hr

GnRH, $/dose

PGF, $/dose

20

2.4

2.08
Reproductive program
Activity monitors for heat detection (avg)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>System cost, $</td>
<td>40,000</td>
</tr>
<tr>
<td>Monitors, #</td>
<td>990</td>
</tr>
<tr>
<td>Cost per monitor, $</td>
<td>65</td>
</tr>
<tr>
<td>Maintenance cost, $/yr</td>
<td>5,200</td>
</tr>
<tr>
<td>Life expectancy, yr</td>
<td>7</td>
</tr>
<tr>
<td>Salvage value, $</td>
<td>0</td>
</tr>
</tbody>
</table>
# Reproductive program

## Labor for TAI injections

<table>
<thead>
<tr>
<th></th>
<th>Mon</th>
<th>Wed</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laborers, #</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Injections, hr/d</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number cows, #</td>
<td>90</td>
<td>70</td>
<td>130</td>
</tr>
</tbody>
</table>

TAI breedings: Thu
Repro Performance
Reproductive program
UWCU Repro$

Reproductive Programs

Resynch before preg check: NO

Programs Description

VWP (d): 40
Estrous Cycle Duration (d): 22
Maximum DIM for Breeding: 283
Do-not-Breed Minimum Milk (lb/d): 80
DIM first injection for first AI sync program (d): 36
Weekday first injection: Friday
Interbreeding interval for TAI services (d): 70
Heat bred before first TAI service (%): 72
CR heat bred before first TAI service (%): 37
CR first TAI service (%): 25
Heat bred after first TAI service (%): 85
CR heat bred after first TAI service (%): 29
CR second and subsequent TAI services (%): 33
Pregnancy Loss (%): 8.7

% Pregnant

DIM

21-d PR (40 d) 18%
21-d PR (50 d) 19%
Reproductive program
UWCU Repro$

Cows leaving the herd, %

- Non-repro: 23.7%
- Mortality: 3.9%
- Repro: 12.4%

Replacement balance, %

- Supply: 42.2%
- Demand: 40.1%

Pie charts:

- Pregnant: 47%, 53%
- Lactating: 89%, 11%
- Lact=1: 37%, 16%, 12%, 9%
Reproductive program
UWCU Repro$

- Income over feed costs: $3,095.2
- Replacement costs: $242.6
- Reproductive costs: $64.2
- Calf revenue: $152.7
- Cow net value: $2,941.1
What reproductive parameter is **more critical** to be improved in Wisconsin farm?

A. ED

B. TAI CR

C. ED CR

D. Abortion
Management strategy
(In place July 2, 2015)
Reproductive program
Timed Artificial Insemination program

1st TAI service postpartum

2nd+ TAI services

Weekday first injection

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GnRH</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PGF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TAI</td>
<td></td>
</tr>
</tbody>
</table>
Reproductive program

Description of program

Do-not-breed minimum milk/d

DIM first TAI injection, d

Resynch before preg check

Interbreeding interval TAI, d

<table>
<thead>
<tr>
<th>lb</th>
<th>kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>36</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YES</th>
</tr>
</thead>
</table>

| 70 |

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
</table>
Reproductive program

Description of program

Heat bred before 1\textsuperscript{st} TAI service, \% 

\begin{itemize}
  \item AFI detect: 0
  \item CR before 1\textsuperscript{st} TAI service: 0
\end{itemize}

CR 1\textsuperscript{st} TAI service: 47

Heat bred after 1\textsuperscript{st} TAI service, \% 

\begin{itemize}
  \item AFI detect: 23
  \item CR after 1\textsuperscript{st} HD services: 40
\end{itemize}

CR 2\textsuperscript{nd}+ TAI services: 40
Reproductive Performance

Expected change by switching to the Alternative program

- (50dVWP) 21d-PR, % - 10
- DO (d) - 8
- PCI (mo) - 0

Cows Pregnant (%) vs. DIM

Graph shows the comparison between Current and Alternative programs.
10% more pregnant cows

Herd Structure:
Pregnant and open cows

Current

- PG: 46%
- OP: 54%

Alternative

- PG: 56%
- OP: 44%
Herd Structure:
Lactating and Dry cows

Current
- Lact: 89%
- Dry: 11%

Average DIM 179

Alternative
- Lact: 87%
- Dry: 13%

Average DIM 174

2% less lactating cows
11% less 1st lactation cows
### Cows Leaving the Herd

<table>
<thead>
<tr>
<th>Item</th>
<th>Current</th>
<th>Alternative</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Culling (%)</td>
<td>40.3</td>
<td>25.9</td>
<td>-14.4</td>
</tr>
<tr>
<td>Non-Reproductive Culling (%)</td>
<td>23.8</td>
<td>18.8</td>
<td>-5</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>3.9</td>
<td>2.9</td>
<td>-1</td>
</tr>
<tr>
<td>Reproductive Culling (%)</td>
<td>12.6</td>
<td>4.1</td>
<td>-8.5</td>
</tr>
</tbody>
</table>

- 5.0% Non-reproductive culling
- 1.0% Mortality
- 8.5% Reproductive culling
## Heifer Supply and Demand

<table>
<thead>
<tr>
<th>Item</th>
<th>Current</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heifer Supply (% of herd/year)</td>
<td>42.1</td>
<td>41.1</td>
</tr>
<tr>
<td>Heifer Demand (% of herd/year)</td>
<td>40.4</td>
<td>25.9</td>
</tr>
<tr>
<td>Heifer Balance (% of herd/year)</td>
<td>1.7</td>
<td>15.2</td>
</tr>
</tbody>
</table>

⇧ 13.5% EXTRA heifer available
### Economic Results

#### Bar Chart

<table>
<thead>
<tr>
<th>Net Value ($/cow/y)</th>
<th>Current</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$2,960</td>
<td>$3,160</td>
</tr>
</tbody>
</table>

#### Table: Contribution to Net Value

<table>
<thead>
<tr>
<th>Item</th>
<th>Current</th>
<th>Alternative</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Net Value ($/cow/y)</td>
<td>2,960.0</td>
<td>3,160.0</td>
<td>200.0</td>
</tr>
<tr>
<td>IOFC ($/cow/y)</td>
<td>3,132.6</td>
<td>3,202.8</td>
<td>70.2</td>
</tr>
<tr>
<td>Replacement Cost ($/cow/y)</td>
<td>-243.4</td>
<td>-192.4</td>
<td>51.0</td>
</tr>
<tr>
<td>Reproductive Cost ($/cow/y)</td>
<td>-79.6</td>
<td>-46.0</td>
<td>33.6</td>
</tr>
<tr>
<td>Calf Value ($/cow/y)</td>
<td>150.4</td>
<td>195.6</td>
<td>45.2</td>
</tr>
</tbody>
</table>

#### Profit made by switching to the Alternative program

- \$/herd/year: $188,000
- \$/cow/year: $200.0
What was the **single largest** economic parameter improved?

A. IOFC

B. Replacement cost

C. Reproductive cost

D. Calf value
Conclusions

Decision support available
• UW-CU Repro$ Tool
• Open and free

Analysis are farm and market specific
• Farm and market data are required
• Minimum proficiency in dairy reproduction

Case study in Wisconsin
• Improving efficiency of TAI programs and limiting the use of ED to only remaining cows improved substantially the herd reproductive efficiency (~10% 21-d PR) and the herd net return (~$200/cow per yr)
DairyMGT.info
The largest selection of dairy farm decision support tools

Large information
- Projects
- Publications
- Presentations
- Links

Heart of DairyMGT.info
Tools to Support Decision-Making
DairyMGT.info: Tools

>40 Decision Support Tools

Many areas of dairy farm management
- Feed
- Replacements
- Reproduction
- Production
- Replacement
- Environment
- Finances
- Genetics
- Health
- ...

Dairy Nutrient Manager
Grazing-N: Application that Balances Nitrogen in Grazing Systems
Seasonal Prediction of Manure Excretion
Dynamic Dairy Farm Model
Least Cost Optimizer
LGM-Dairy Premium Sensitivity
Return to Labor
Estimate Your Mailbox Price
LGM Dairy Feed Equivalent Calculator
Net Guarantee Income Over Feed Cost for LGM-Dairy
Anatomy of tools
How to explore and use them

Title: The Economic Value of a Dairy Cow
Description: Calculates the projected net return of a cow or the entire herd
Links:
- Online Tool (Open)
- Excel Spreadsheet (Download)
- Presentation (Download)
- Paper (Download)
- Magazine Article (Download)
- Demo (Click to View/Hide the Video)

Supporting Documents:

Video Demo

Other Languages:
- Spanish Version
  - Herramienta (Abrir)
The value of a cow and reproduction

Important relationship for decision-making

Opportunities for cow-level reproductive management. E.g.,

- High value cow → more inseminations
- Low value cow → lower quality semen

Associated economic values could be used to enhance the value of reproductive programs. E.g.,

- The value of a new pregnancy
- The cost of a pregnancy loss
- The cost of an additional day open
The value of a cow

Long-term expected net return of a cow compared with that of an imminent replacement

Critical factors

- Cow’s productivity level in relation to herd mates
- Replacement’s genetic improvement in relation to herd mates
- Cow’s current conditions
  - Lactation
  - Days after calving
  - Pregnancy status
The value of a cow

1. Value of a new pregnancy (e.g., US$ 222 (628-406)
2. Cost of a pregnancy loss (e.g., US$323 (488-165)
3. Cost of a day open (e.g., US$5.2 (704-549)/(120-90)
4. Effect of 10% increased productivity in future lactations

DairyMGT.info
The Economic Value of a Dairy Cow

The tool Economic Value of a Dairy Cow can be used to calculate the cost of a pregnancy loss, value of a new pregnancy, or cost per day open.

Changes to $71 if aborted
So, a loss of $436
How the value of a cow can be used for reproductive decision-making?

A. Breeding opportunities

B. Semen quality selection

C. Calculate the cost of a pregnancy loss

D. All the above
The value of using sexed semen
Producers using it in heifers

Important considerations

• Ratio of females increases greatly
  • E.g., 47% (conventional) to 89% (sexed)
• Conception rate decreases
  • ~ 20% (DeJarnette et al, 2009)
• Sexed semen has a premium cost
  • Double or triple conventional
• Less proportion of male calves reduces the cost of dystocia
Economic considerations of sexed semen

Economic gains of using sexed semen
  • More production of more valuable female calves
  • Reduced cost of treatment of dystocia

Economic costs of using sexed semen
  • More breedings to same level of pregnancy
  • Longer raising time for heifers becoming pregnant later
  • More culling for reproductive failure
  • Extra cost of sexed semen
An example of sexed semen analysis

Best economic value of using sexed semen occurs when it is used in 1st and 2nd heifer breedings.

<table>
<thead>
<tr>
<th>Number of Sexed Semen Services</th>
<th>€ (Benefits - Costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.59</td>
</tr>
<tr>
<td>2</td>
<td>24.59</td>
</tr>
<tr>
<td>3</td>
<td>21.02</td>
</tr>
<tr>
<td>4</td>
<td>13.85</td>
</tr>
<tr>
<td>5</td>
<td>4.86</td>
</tr>
</tbody>
</table>

### Expected Females (%)

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>47</td>
</tr>
<tr>
<td>Sexed</td>
<td>89</td>
</tr>
</tbody>
</table>

### Sexed Semen (% of Conventional CR)

| CR (%) | 80 |

### Conventional Semen Average CR (%)

| CR (%) | 60 |

### Semen Cost ($)

<table>
<thead>
<tr>
<th>Type</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>15</td>
</tr>
<tr>
<td>Sexed</td>
<td>25</td>
</tr>
<tr>
<td>Female Calf</td>
<td>250</td>
</tr>
<tr>
<td>Male Calf</td>
<td>50</td>
</tr>
<tr>
<td>Raising Cost</td>
<td>2</td>
</tr>
<tr>
<td>Salvage Value</td>
<td>81.26</td>
</tr>
<tr>
<td>Dystocia Cost</td>
<td>50</td>
</tr>
<tr>
<td>20-mo Pregnant Heifer</td>
<td>1000</td>
</tr>
</tbody>
</table>
When sexed semen use makes sense economically?

A. Always
B. When the sexed semen cost is low
C. When the CR is high
D. When benefits less costs are positive
Thanks
DairyMGT.info