Practical Estrus Synchronization

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Why reproductive efficiency is so critical

• Estimated that reproductive failure costs the cattle industry (beef and dairy) $2.5 BILLION annually.

• 1% improvement in reproductive performance will generate up to a 3 fold greater return on investment for cow/calf producers than a one percent improvement in production and/or product performance.

<table>
<thead>
<tr>
<th>Calf Crop (%)</th>
<th>Weaning Weight (lb.)</th>
<th>Pounds of calf per cow</th>
<th>Annual costs per cow $350</th>
<th>$400</th>
<th>$450</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>550</td>
<td>495</td>
<td>$0.71</td>
<td>$0.81</td>
<td>$0.91</td>
</tr>
<tr>
<td>90</td>
<td>495</td>
<td>445.5</td>
<td>$0.79</td>
<td>$0.90</td>
<td>$1.01</td>
</tr>
<tr>
<td>90</td>
<td>440</td>
<td>396</td>
<td>$0.88</td>
<td>$1.01</td>
<td>$1.14</td>
</tr>
<tr>
<td>80</td>
<td>550</td>
<td>440</td>
<td>$0.80</td>
<td>$0.91</td>
<td>$1.02</td>
</tr>
<tr>
<td>80</td>
<td>495</td>
<td>396</td>
<td>$0.88</td>
<td>$1.01</td>
<td>$1.14</td>
</tr>
<tr>
<td>80</td>
<td>440</td>
<td>352</td>
<td>$0.99</td>
<td>$1.14</td>
<td>$1.28</td>
</tr>
<tr>
<td>70</td>
<td>550</td>
<td>385</td>
<td>$0.91</td>
<td>$1.04</td>
<td>$1.17</td>
</tr>
<tr>
<td>70</td>
<td>495</td>
<td>346.5</td>
<td>$1.01</td>
<td>$1.15</td>
<td>$1.30</td>
</tr>
<tr>
<td>70</td>
<td>440</td>
<td>308</td>
<td>$1.14</td>
<td>$1.30</td>
<td>$1.46</td>
</tr>
</tbody>
</table>

Break-even calculation: annual cow cost/calf per cow

Adapted from Beverly and Sprott, Texas A & M.
Calving interval
• Goal is that each cow produces a calf every 365 days

Breeding and calving seasons
• Important to have a defined breeding season and calving season
  – The more condensed the better
  • 45 to 60 days
• Increases the uniformity of the calves at weaning
• Assists in ensuring a 365 day calving interval

Calving distribution

<table>
<thead>
<tr>
<th>Day 0</th>
<th>Day 21</th>
<th>Day 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf A (AI) Born</td>
<td>Calf B Born</td>
<td>Calf C (bull) Born</td>
</tr>
<tr>
<td>Calf D Born</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Birth Wt (lbs)</th>
<th>ADG (lbs/day)</th>
<th>Age at Weaning (days)</th>
<th>Weaning Wt (lbs)</th>
<th>Calf Value ($/lbs)</th>
<th>Total Value of Calf ($)</th>
<th>Difference in Value ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>2.1</td>
<td>225</td>
<td>563</td>
<td>1.40</td>
<td>788</td>
<td>-532</td>
</tr>
<tr>
<td>90</td>
<td>2.0</td>
<td>225</td>
<td>540</td>
<td>1.40</td>
<td>756</td>
<td>-556/158</td>
</tr>
<tr>
<td>90</td>
<td>2.0</td>
<td>204</td>
<td>498</td>
<td>1.45</td>
<td>722</td>
<td>-574</td>
</tr>
<tr>
<td>90</td>
<td>2.0</td>
<td>165</td>
<td>420</td>
<td>1.70</td>
<td>714</td>
<td></td>
</tr>
</tbody>
</table>
Cows that calve later in the calving season have a greater probability of not conceiving in the next breeding season due mostly to the proportion of anestrous cows at the start of the breeding season.

Mechanism for Improvement

- Estrous synchronization and AI
  - Numerous protocols available
    - Heat detection
    - Fixed-time AI (TAI)
    - Combination of heat detection and TAI
  - Improved protocols
    - More consistent results and increase pregnancy rates

Goals & Value of Estrous Synchronization

- Improve reproductive performance of the cow herd as measured by average day of conception during the breeding season
  - More cows conceive in first week or day of breeding season
- Similar fertility as spontaneous estrus
  - Improvements in pregnancy rates
- Induce estrous cycles in prepubertal heifers and anestrous cows
  - Progestin-based protocols
- Effective in all cows
  - Heifers vs mature cows; cyclic vs anestrus
- Cost effective and user friendly
Major Points of Discussion

- More cows bred early in breeding season
- Increased uniformity and pounds of calf per cow exposed
- Stimulate estrous cycles in prepubertal and anestrous cows

Hypothetical calving season: AI vs. natural service

![Graph showing more calves born early in the calving season]

Return on Investment Study;
Les Anderson – Univ. Kentucky

- Cost of AI: $29.88 / cow
- Lbs. of calf weaned / cow exposed: calves from synchronized group were 109.5 lbs. heavier
- Added revenue: $99.62 / cow
- Return on investment: $69.74 / cow
  - Does not include savings due to purchasing fewer bulls and lower replacement rates or value of improved genetics in replacements
No Heat = No Breeding

- Prepubertal heifers & anestrous cow do not show heat or ovulate
- Average age of puberty varies by breed and nutritional management
- Average period from calving to 1st estrous cycles in cows with adequate BCS (5+) is ~55 days

Anestrus in Cattle at Start of Synchronization

Progestin-induced resumption of estrous cycles
The Estrous Cycle in Cattle

Hormone Concentration

Days Relative to Estrus

Estrus 5 10 15 Estrus

Available drugs

<table>
<thead>
<tr>
<th>Hormone (Abbreviation)</th>
<th>Function</th>
<th>Commercial Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonadotropin Releasing Hormone (GnRH)</td>
<td>Reset follicle waves, Induce ovulation</td>
<td>Cystorelin®, Factrol®, Fertagyl®, OvuCyst®</td>
</tr>
<tr>
<td>Progesterone (progesterone)</td>
<td>Mimic CL</td>
<td>CIDR®, Intravaginal progesterone-releasing insert, Melengesterol Acetate (MGA)</td>
</tr>
<tr>
<td>Prostaglandin F2α (PGF)</td>
<td>Induce CL regression</td>
<td>Lutalyse®, Estrumate®, ProstaMate®, estroPLAN™, In-Synch™</td>
</tr>
</tbody>
</table>

Cow protocols
Cow protocols

**FIXED-TIME AI (TAI)**

7-day CO-Synch + CIDR®
- Female to be bred on the 7th day. CO-Synch done 3 days before TAI.

5-day CO-Synch + CIDR®
- Female to be bred on the 5th day. CO-Synch done 2 days before TAI.

Heifer protocols

**HEAT DETECTION**

1 Shot PG

* day CIDR®-PG

MGA®-PG

Heifer protocols

**HEAT DETECTION & TIME AI (TAI)**

Select Synch + CIDR® & TAI
- Female to be bred on the 7th day. CO-Synch done 3 days before TAI.

MGA® PG & TAI
- Female to be bred on the 7th day. CO-Synch done 2 days before TAI.

14-day CIDR® PG & TAI
- Female to be bred on the 14th day. CO-Synch done 7 days before TAI.
Recommended Protocols

- Custom selected per operation
- Labor
- Expense
- Facilities
- Experience
- Goals
- Be certain to establish realistic expectations!!

Field Trials Comparing the 5-d vs 7-d CO-Synch + CIDR Protocols

Lactating Beef Cows

<table>
<thead>
<tr>
<th>Timed-Al Pregnancy Rate, % (n)</th>
<th>7 d CIDR</th>
<th>5 d CIDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature Beef Cows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Bridges et al, 2008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005 (1 herd)</td>
<td>66.7 (111)</td>
<td>80.0 (105)*</td>
</tr>
<tr>
<td>2006 (2 herds)</td>
<td>56.2 (201)</td>
<td>65.3 (199)*</td>
</tr>
</tbody>
</table>

* Within year; P < 0.05

Timed-Al pregnancy rates were increased in anestrous and cyclic cows as well as mature and 2-year old cows in the 5 d CIDR compared to the 7 d CIDR protocol.
Virgin Beef Heifers

**Strict Timed-AI**
Pregnancy Rate, % (n)

<table>
<thead>
<tr>
<th>Yearling Beef Heifers</th>
<th>7 d CIDR</th>
<th>5 d CIDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Wilson et al., 2007)</td>
<td>49.0 (204)</td>
<td>59.7 (201)*</td>
</tr>
</tbody>
</table>

*P < 0.05

Virgin Beef Heifers

- “Hybrid” approach that combines a short period of heat detection with timed-AI of heifers not in heat

Overall AI Pregnancy Rate

(Treatment by Location; P > 0.10)

Overall AI Pregnancy Rate:
- 5d = 57%
- 7d = 47%

Breeding Season Pregnancy Rate:
- 5d = 89%
- 7d = 85%

*P < 0.05

Sparks et al., 2010
5-day CO-Synch + CIDR Protocol

Day of Experiment
-5 0 3
GnRH PG PG
CIDR 72 ± 2 hr AI

PG 6-day CIDR
PG
GnRH
CIDR ± 2 hr AI

14-day CIDR-PG

Day of Experiment
-4 ± 2 hr AI 3
CIDR 7am 1pm

Treatment

Pregnant %

<table>
<thead>
<tr>
<th>Treatment</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 day</td>
<td>51%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 day</td>
<td>63%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 day</td>
<td>58%</td>
<td>ab</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P = 0.10

149/257 169/267 149/257

Limitation to the protocol
Cows vs. Heifers?
5-d CO-Synch + CIDR - PGF Delivery
Heifers

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1x PGF</th>
<th>2 x PGF (12 h)</th>
<th>2 x PGF (6 h)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heifers (Rabaglio et al., 2010)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>295</td>
<td>298</td>
<td>298</td>
<td>&lt;0.10</td>
</tr>
<tr>
<td>TAI pregnancy rate</td>
<td>48.8%</td>
<td>50.7%</td>
<td>62.1%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1x PGF</th>
<th>2 x PGF (12 h)</th>
<th>2 x PGF (6 h)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Heifers (Peterson et al., 2011)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>264</td>
<td>298</td>
<td>298</td>
<td></td>
</tr>
<tr>
<td>TAI pregnancy rate</td>
<td>54.2%</td>
<td>50.7%</td>
<td>62.1%</td>
<td></td>
</tr>
</tbody>
</table>

Beef Heifers (M. Day & J. Hall; unpublished)

<table>
<thead>
<tr>
<th>Location</th>
<th>n</th>
<th>2 x Lutalyse</th>
<th>1 x Lutalyse</th>
<th>1 x Cloprostenol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td>225</td>
<td>43.1%</td>
<td>46.8%</td>
<td>57.7%</td>
</tr>
<tr>
<td>Location 2</td>
<td>176</td>
<td>44.0%</td>
<td>65.0%</td>
<td>66.0%</td>
</tr>
<tr>
<td>Location 3</td>
<td>232</td>
<td>53.1%</td>
<td>54.8%</td>
<td>44.9%</td>
</tr>
<tr>
<td>Location 4</td>
<td>232</td>
<td>53.7%</td>
<td>53.8%</td>
<td>51.8%</td>
</tr>
<tr>
<td>Total</td>
<td>1222</td>
<td>(n=482)</td>
<td>(n=267)</td>
<td>(n=267)</td>
</tr>
</tbody>
</table>

5 d CO-Synch + CIDR – Modifying PGF Delivery in Beef Cows

- GnRH
- PGF<sub>20</sub> (8h apart)
- GnRH + AI
- 5-d CIDR
- 72 h
- Co-PG (2-5cc injections) at CIDR removal
- Can we make this more convenient???

5-d CO-Synch + CIDR Protocol
Modifying PGF delivery
Cows, Ages, DPP, and % Cyclic

- 2-year Old Cows
  - n = 525
  - 79 ± 1.0 DPP
  - 39% Cyclic

- Mature Cows
  - n = 1340
  - 64 ± 0.5 DPP
  - 58% Cyclic

5-d CO-Synch + CIDR Protocol
Modifying PGF delivery

Requirements for a successful estrous synchronization program

- Adequate animal handling and working facilities
  - Minimize handling stress
- Proper nutritional management
  - BCS at calving (5-5.5), start of breeding season (min. 5)
- Advanced planning and preparation
- Appropriate expectations
Questions?

• Thank You!