The Estrous Cycle and Estrus Synchronization

Katie Pfeiffer
UW-Extension
2013 Cow/Calf Meetings
Estrus Synchronization

• Controlling the estrous cycle so that a group of females express estrus at approximately the same time.
  – Most often used as part of an AI/ET program to reduce labor.
  – Can also be used to advance breeding date of late calving cows and manipulate marketing scenarios.
Estrus synchronization – Why?

• Opportunity to establish pregnancy in all females on the 1\textsuperscript{st} day of the breeding season.
• Increase the number of opportunities to inseminate.
  *63 d breeding season = 4 chances
• Advances the calving season and increases days postpartum at the next breeding.
• Uniform calf crop
• Facilitate AI
Ovarian Cycle

- Estrogen
- Progesterone
Estrous Cycle
Estrous Cycle

Ovulation
(release of the egg)

Day of the Estrous Cycle

0  2  4  6  8  10  12  14  16  18  20  0

Estrus

Estrus
Corpus Luteum (CL)

Growth and Regression of the CL

Day of the Estrous Cycle

Estrus

0 2 4 6 8 10 12 14 16 18 20 0
Corpus Luteum (CL)

Progesterone
(needed for establishment of pregnancy)
Corpus Luteum (CL) Regression

Prostaglandin F2α (PG)
(destroys the CL)

Day of the Estrous Cycle

Estrus
Follicle Development

Follicle Stimulating Hormone (FSH)

Recruitment

Next Recruitment

FSH precedes recruitment of follicles
Follicle Development

Luteinizing Hormone (LH)

Dominance

Growth

Selection

LH promotes follicular growth
Follicle Development

Luteinizing Hormone (LH)

Selection → Growth → Dominance → Estrus → LH Surge → Surge release of LH induces ovulation → Ovulation
Follicle Development

3 Follicular Waves

Day of the Estrous Cycle

Estrus
Follicle Development

Estrogen
(induces estrous behavior)

Follicular Phase

Day of the Estrous Cycle

Estrus

0 2 4 6 8 10 12 14 16 18 20 0
Endocrinology of the Estrous Cycle

- Luteal Phase
- Follicular Phase

Graph showing the levels of estrogen and progesterone over the days of the estrous cycle.
Physiology of the Estrous Cycle
Correct Timing of AI

Secondary heat signs

Standing heat

Ovulation

Fertile egg life

27 h

Normal fertile sperm life

(Dr. Jeff Stevenson)
Prostaglandin F$_{2\alpha}$

- Injection to regress the CL, thus a functional CL must be present to have any effect
- In cattle, PGF$_{2\alpha}$ will affect a CL from d 5 of cycle to d 17
- Brand names
  - Lutalyse
  - Estrumate
  - ProstaMate
  - estroPLAN
  - In-Synch
Hormones for Estrus Synchronization

PGF$_{2\alpha}$
Progesterone

• During its administration, the animal will not ovulate but after its withdrawal, the group will come into estrus about the same time
• Progesterone can also ‘jumpstart’ anestrous animals into cycling
• P4 can be given orally or intravaginally
  – Orally: Melengestrol acetate (MGA)
  – Intravaginally: Controlled Internal Drug Release (CIDR)
Hormones for Estrus Synchronization

Progestins

Corpus Luteum

Progesterone

Ovulation
CIDR vaginal insert
GnRH

- Injection to induce ovulation
- A large “enough” follicle must be present on ovary
- Can also “jumpstart” some anestrous females
- Brand names
  - Cystorelin
  - Factrel
  - Fertagyl
  - Ovacyst
Hormones for Estrus Synchronization

GnRH

- Corpus Luteum
- Progesterone
- Follicle
- Ovulation
Estrous Synchronization Protocols
**Heat Detection**

Select Synch

![Diagram of Heat Detection Select Synch]

Select Synch + CIDR®

![Diagram of Heat Detection Select Synch + CIDR®]

PG 6 day CIDR®

Heat detect & AI days 0 to 3. Administer CIDR® to non-responders and heat detect & AI days 9 to 12. Protocol may be used in heifers.

![Diagram of Heat Detection PG 6 day CIDR®]

**Heat Detect & Time AI (TAI)**

Select Synch & TAI

Heat detect and AI day 6 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.

![Diagram of Heat Detect & Time AI (TAI) Select Synch & TAI]

Select Synch + CIDR® & TAI

Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.

![Diagram of Heat Detect & Time AI (TAI) Select Synch + CIDR® & TAI]

PG 6 day CIDR® & TAI

Heat detect & AI days 0 to 3. Administer CIDR® to non-responders & heat detect & AI days 9 to 12. TAI non-responders 72 - 84 hr after CIDR® removal with GnRH at TAI. Protocol may be used in heifers.

![Diagram of Heat Detect & Time AI (TAI) PG 6 day CIDR® & TAI]

**Fixed-time AI (TAI)**

7 day CO-Synch + CIDR®

Perform TAI at 60 to 66 hr after PG with GnRH at TAI.

![Diagram of Fixed-time AI (TAI) 7 day CO-Synch + CIDR®]

5-day CO-Synch + CIDR®

Perform TAI at 72 ± 3 hr after CIDR® removal with GnRH at TAI. Two injections of PG 8 ± 2 hr apart are required for this protocol.

![Diagram of Fixed-time AI (TAI) 5-day CO-Synch + CIDR®]

**Fixed-time AI (TAI)***

for *Bos indicus*-influenced cows only

PG 5-day CO-Synch + CIDR®

Perform TAI at 60 ± 2 hr after CIDR® removal with GnRH at TAI. Two injections of PG 8 ± 2 hr apart are required for this protocol.

![Diagram of Fixed-time AI (TAI) PG 5-day CO-Synch + CIDR®]

* The time listed for “Fixed-time AI” should be considered as the approximate average time of insemination. This should be based on the number of cows to inseminate, labor, and facilities.
HEAT DETECTION
1 Shot PG

7-day CIDR®-PG

MGA®-PG

HEAT DETECT & TIME AI (TAI)
Select Synch + CIDR® & TAI
Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.

MGA®-PG & TAI
Heat detect and AI day 33 to 35 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.

14-day CIDR®-PG & TAI
Heat detect and AI day 30 to 33 and TAI all non-responders 72 hrs after PG with GnRH at TAI.

FIXED-TIME AI (TAI)*

7-day CO-Synch + CIDR®
Performs TAI at 54 - 56 hr after PG with GnRH at TAI.

MGA®-PG
Perform TAI at 72 - 74 hr after PG with GnRH at TAI.

14-day CIDR®-PG
Perform TAI at 68 - 70 hr after PG with GnRH at TAI.

* The times listed for “Fixed-time AI” should be considered as the approximate average time of insemination. This should be based on the number of heifers to inseminate, labor, and facilities.
Protocols for **cows** using *heat detection*

- **Select Synch**
  - GnRH: Day 0
  - PG: Day 6
  - Heat detect & AI: Days 7 to 13

- **Select Synch + CIDR®**
  - GnRH: Day 0
  - PG: Day 7
  - CIDR®: Days 0 to 7

- **PG 6-day CIDR®**
  - GnRH: Day 0
  - PG: Days 0 to 3
  - CIDR®: Days 0 to 3
  - Heat detect & AI: Days 0 to 3

*Heat detect and AI days 0 to 3. Administer CIDR to non-responders and heat detect and AI days 9 to 12. Protocol may be used in heifers.*
Protocols for **cows** using **heat detect + timed AI**

### Select Synch & TAI
Heat detect and AI day 6 to 10 and TAI all non-responders 72 – 84 hr after PG with GnRH at TAI.

- GnRH
- PG
- AI
- Heat detect & AI

### Select Synch + CIDR® & TAI
Heat detect and AI day 7 to 10 and TAI all non-responders 72 – 84 hr after PG with GnRH at TAI.

- GnRH
- PG
- CIDR®
- AI
- Heat detect & AI

### PG 6-day CIDR® & TAI
Heat detect & AI days 0 to 3. Administer CIDR to non-responders & heat detect and AI days 9 to 12. TAI non-responders 72 – 84 hr after CIDR removal with GnRH at AI. Protocol may be used in heifers.

- GnRH
- PG
- CIDR®
- AI
- Heat detect & AI
Protocols for cows using fixed timed AI only

7-day CO-Synch + CIDR®
Perform TAI at 60 to 66 hr after PG with GnRH at TAI.

5-day CO-Synch + CIDR®
Perform TAI at 72 ± 2 hr after 1st PG with GnRH at TAI.
Two injections of PG 8 ± 2 hr apart are required for this protocol.
Protocols for **heifers** using *heat detection*

1 Shot PG

7-day CIDR®-PG

MGA®-PG
Protocols for **heifers** using **heat detect + timed AI**
Protocols for **heifers** using **timed AI only**

### 7-day CO-Synch + CIDR®
Perform TAI at $54 \pm 2$ hr after PG with GnRH at TAI.

### MGA®-PG
Perform TAI at $72 \pm 2$ hr after PG with GnRH at TAI.

### 14-day CIDR®-PG
Perform TAI at $66 \pm 2$ hr after PG with GnRH at TAI.
Estrus Synchronization Planner
<table>
<thead>
<tr>
<th>Breed Type</th>
<th>1 = <em>Bos taurus</em>, 2 = <em>Bos indicus</em> influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date to start breeding:</td>
<td>6/1/2012 (Example: 6/1/2013)</td>
</tr>
<tr>
<td>Time of day you want to breed:</td>
<td>9:00 AM</td>
</tr>
<tr>
<td>Detection-Insemination type:</td>
<td>3 = Estrus AI, 2 = Estrus AI &amp; Clean-up AI, 3 = Fixed-Time AI</td>
</tr>
<tr>
<td>Estrus synchronization system:</td>
<td>22 = 7 Day CO-Synch+CIDR with Fixed-Time AI - 66</td>
</tr>
<tr>
<td>Days from last AI to bull turn in:</td>
<td>9</td>
</tr>
<tr>
<td>Trips through the working facility:</td>
<td>3</td>
</tr>
</tbody>
</table>
**Estrus Synchronization Planner**

<table>
<thead>
<tr>
<th>Date</th>
<th>Producer Name</th>
<th>Address</th>
<th>Phone Number</th>
<th>Date to start breeding:</th>
<th>Date</th>
<th>Producer Name</th>
<th>Address</th>
<th>Phone Number</th>
<th>Date</th>
<th>Producer Name</th>
<th>Address</th>
<th>Phone Number</th>
<th>Date</th>
<th>Producer Name</th>
<th>Address</th>
<th>Phone Number</th>
<th>Date</th>
<th>Producer Name</th>
<th>Address</th>
<th>Phone Number</th>
</tr>
</thead>
</table>

- * Insert CIDR device in all females *
- Inject GnRH - all females
- * Remove CIDRs *
- * Inject PG - all females*
- * GnRH injection & Fixed time AI (60-66 hrs after PG)
- * Turn in Bull Power
Which Protocol?

Determine potential results and costs

- Select the best system for YOUR situation

Advantages and tradeoffs must be weighed in terms of:

- Cost
- Time
- Facilities
- Labor Requirements
- Cows
Heat Detection

• Amount needed depends on system selected

• Must be done carefully as part of the synchronization program
  – Many females exhibit heat at the same time
Labor Needs

• Insemination
  – Inseminator fatigue

• Semen thawing, preparation of insemination equipment and record keeping

• Working cattle through facilities
  – More people = better efficiency ???

• Heat detection
  – People and hours depend on selected system
Facilities

• Need to be in good repair
  – Pressure of more animals in a shorter time frame

• Fixed-time A.I. program
  – Holding pen space
Identification

- Really important for heat detection
- Essential to get maximum value from A.I. program
  - Keep “barn sheet”

<table>
<thead>
<tr>
<th>Cow ID</th>
<th>Date/Time in heat</th>
<th>Date/Time A.I.’d</th>
<th>Sire</th>
<th>Tech.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>133</td>
<td>5/13 6:00AM</td>
<td>5/13 6:00PM</td>
<td>HCC Hero</td>
<td>LJ</td>
<td>Good Tone</td>
</tr>
<tr>
<td>169</td>
<td>5/14 6:00PM</td>
<td>5/15 6:00AM</td>
<td>HCC Firecracker</td>
<td>LJ</td>
<td>Showed no signs of heat</td>
</tr>
</tbody>
</table>
Conditions Affecting Cycling

Beef Cows

• Two Factors:
  – Rest after calving
  – Body condition after calving

• The better the BCS and the longer after calving the more likely to enter heat

• Proper nutrition is essential after calving
  – Nutritional requirements double while nursing a calf
### Percent Likelihood of Estrus After Calving

<table>
<thead>
<tr>
<th>Interval After Calving (days)</th>
<th>Body Condition (% cows cycling)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thin</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>30</td>
<td>3</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>40</td>
<td>19</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>50</td>
<td>34</td>
<td>45</td>
<td>42</td>
</tr>
<tr>
<td>60</td>
<td>46</td>
<td>61</td>
<td>91</td>
</tr>
<tr>
<td>70</td>
<td>55</td>
<td>79</td>
<td>96</td>
</tr>
<tr>
<td>80</td>
<td>62</td>
<td>88</td>
<td>98</td>
</tr>
<tr>
<td>90</td>
<td>66</td>
<td>92</td>
<td>100</td>
</tr>
</tbody>
</table>

*(ABS Global A.I. Management Manual, 5th ed.)*
Conditions Affecting Cycling

• **Beef First Calf Heifers**
  – Take longer to begin cycling than cows
  – Higher nutritional demands
    • Must support their growth and milk production for calf
  – Good nutrition can shorten recovery time after calving
  • Require special attention to improve cycling rate
    – Separate heifers from cows several months before calving
    – Feed with goal of heifers being in moderate to good condition
  – As virgin heifers, inseminate 2 to 3 weeks before older cows
Conditions Affecting Cycling

Beef Virgin Heifers

• 3 factors affect when cycling begins
  – Age
  – Weight
  – Breed

• Inseminate 2 to 3 weeks ahead of cows
  – Provides more time for recovery before rebreeding

• Nutrition must be carefully watched to ensure:
  – High percentage are cycling
  – Heifers respond to synchronization drugs
QUESTIONS??