Advancing Reproductive Management

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Cost of Infertility

• $6.25/cow exposed for every 1% decrease in pregnancy rates (Lamb et al., 2011)

Factors Affecting Fertility in Beef Females

• Postpartum anestrus
• Suckling stimulus
• Age
• Genetics
• Nutrition
• Body weight

• Body condition score
• Reproductive management
• Plane of nutrition
• Body composition
• Animal handling
Maximize pregnancy rate early in the breeding season and develop/select replacement heifers that are highly fertile at the lowest cost possible
Reproductive Efficiency

= Management + Nutrition + Selection pressure + Reproductive technologies
Management

Individual Identification
Management

Accurate Records
Record Keeping

- Dam ID – sire information
- Date of birth
- Birth weight
- Weaning weight
- BCS at calving and breeding
- Health records
- Temperament
- Breeding
Management

• Identify your good cows
  • Calve without assistance
  • Pregnant early
  • Maintain BCS
  • Wean a calf
    • 50% of cow’s BW
• NOT CRAZY!
## Temperament and Fertility

*Bos taurus* beef heifers in VA

<table>
<thead>
<tr>
<th>Location</th>
<th>n</th>
<th>Chute Score</th>
<th>Exit Velocity</th>
<th>Temperament Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43</td>
<td>2.1 ± 0.5</td>
<td>2.9 ± 0.5</td>
<td>2.5 ± 0.5</td>
</tr>
<tr>
<td>2</td>
<td>206</td>
<td>2.4 ± 0.6</td>
<td>2.7 ± 0.6</td>
<td>2.6 ± 0.5</td>
</tr>
<tr>
<td>3</td>
<td>48</td>
<td>2.8 ± 0.5</td>
<td>2.4 ± 0.8</td>
<td>2.6 ± 0.5</td>
</tr>
<tr>
<td>Overall</td>
<td>297</td>
<td>2.4 ± 0.5</td>
<td>2.6 ± 0.6</td>
<td>2.6 ± 0.5</td>
</tr>
</tbody>
</table>
Temperament and Fertility

*Bos taurus* beef heifers in VA

Temperament by Location

- **Glade**: 91% Calm, 9% Excitable
- **Southampton**: 65% Calm, 35% Excitable
- **VT**: 77% Calm, 23% Excitable
- **Overall**: 71% Calm, 29% Excitable

(Dias et al., 2018)
Temperament and Fertility

*Bos taurus* beef heifers in VA

**TAI Pregnancy rate by Temperament**

- Calm: [VALUE]%
- Excitable: [VALUE]%

*Temperament P = 0.042*
*Location P = 0.235*
*Temp* *Loc P = 0.364*
## Temperament and Fertility

### Bos taurus beef cows

<table>
<thead>
<tr>
<th>Item</th>
<th>Temperament type&lt;sup&gt;1&lt;/sup&gt;</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adequate (n = 324)</td>
<td></td>
</tr>
<tr>
<td>Cow parameters&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cow BCS</td>
<td>4.65 ± 0.02</td>
<td>0.17</td>
</tr>
<tr>
<td>Plasma cortisol, ng/mL</td>
<td>17.8 ± 0.6</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Pregnancy rate, %</td>
<td>94.6 ± 1.4</td>
<td>0.03</td>
</tr>
<tr>
<td>Pregnancy loss, %</td>
<td>2.83 ± 0.95</td>
<td>0.63</td>
</tr>
<tr>
<td>Calving rate, %</td>
<td>91.8 ± 1.6</td>
<td>0.04</td>
</tr>
<tr>
<td>Cow-calf production parameters&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kg of calf born per cow exposed, kg</td>
<td>36.8 ± 0.7</td>
<td>0.05</td>
</tr>
<tr>
<td>Calf loss from birth to weaning, %</td>
<td>1.92 ± 0.70</td>
<td>0.54</td>
</tr>
<tr>
<td>Weaning rate, %</td>
<td>89.9 ± 1.7</td>
<td>0.09</td>
</tr>
<tr>
<td>Kg of calf weaned per cow exposed, kg</td>
<td>223 ± 4</td>
<td>0.08</td>
</tr>
</tbody>
</table>

(Cooke et al., 2012)
Reproductive Efficiency

= Management + Nutrition + Selection pressure + Reproductive technologies
Body Condition Score

BCS 3
Body Condition Score

BCS 7
Body Condition Score

BCS 5
Nutrition, Nutrition, Nutrition!!

BCS 3

BCS 5

BCS 7
Nutrition

BCS 1

BCS 3

BCS 5

BCS 7

BCS 9
Reproductive Efficiency = Management + Nutrition + Selection pressure + Reproductive technologies
Cow and Heifer job description

- Must calve by 24 months of age
- Cow must have a calf every 365 days
- Cow must calve without assistance
- Calf must be genetically capable to perform
- Cow must provide sufficient resources for the calf to reach it’s genetic potential
- Cows must maintain their body condition score for management conditions
- Must not be crazy!
Selection Pressure

- Breeding Season

![Bar chart showing the length of breeding season in days for Operations and Cows across different ranges.](chart)

- Length of breeding season, days:
  - < 64: Operations 26.2, Cows 22.8
  - 64 to 84: Operations 12.7, Cows 15.5
  - 85 to 105: Operations 21.9, Cows 23.5
  - 106 to 149: Operations 16.8, Cows 18.2
  - > 149: Operations 22.4, Cows 20.0

- 61% of the data falls within the 85 to 105 days range.

(NAHMS, 2008)
Establishing a Breeding Season

• Remove your bulls from the cows!!!
• When do you want your calves to be born?
  • Nutrition
  • Cow performance
  • Calf performance
  • Cattle Market
Establishing a Breeding Season

• 365 days is not a breeding season!
• When do you want your calves to be born?
• Establish goals
  • 45-120 days
  • 10-15 days per year decrease

<table>
<thead>
<tr>
<th>Breeding Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calving Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle Market</td>
</tr>
</tbody>
</table>
Maximize pregnancy rate early in the breeding season and develop/select replacement heifers that are highly fertile at the lowest cost possible.
Selection Pressure

• Influence of Calving Period on Weaning Weights

5 calves
Selection Pressure

- Influence of Calving Period on Reproductive Longevity

(Cushman et al., 2012)
Reproductive Efficiency

= Management
+ Nutrition
+ Selection pressure
+ Reproductive technologies
Pregnancy Diagnosis
Reproductive Efficiency

= Management

Culling Open Cows!!

+ Selection pressure

+ Reproductive technologies
Pregnancy Diagnosis

(NAHMS, 2008)
Reproductive Efficiency

= Management + Nutrition + Selection pressure + Reproductive technologies
Reproductive Technologies

- Breeding season management
- Breeding soundness exam
- Pregnancy diagnosis
- Weaning
- Culling open females
- Crossbreeding
- Artificial insemination
- Estrus synchronization
- Fixed-time AI
- Embryo transfer
- *In vitro* fertilization – IVF
- Somatic cell nuclear cloning
- Transgenic technologies
Estrous Synchronization

• Pharmacological control of the estrous cycle

• Advantages of Fixed-Timed Artificial Insemination - TAI
  • Induction of cyclicity
  • No heat detection
  • Optimization of labor
  • Increase proportion of females exposed to AI
  • More females pregnant to AI in a shorter period
Protocols for Beef Females

**BEEF COW PROTOCOLS - 2015**

**HEAT DETECTION**
- **Select Synch**
  - Treatment day: 0
  - Heat detect: 5

- **Select Synch & CIDR***
  - Treatment day: 0
  - Heat detect: 5

**HEAT DETECT & TIME AI (TAI)**
- **Select Synch & TAI**
  - Heat detect and TAI: 7 to 9 and TAI: all non-responders 72 - 84 hr after PG with CIDR at TAI.

- **Select Synch & CIDR* & TAI**
  - Heat detect and TAI: 7 to 9 and TAI: all non-responders 72 - 84 hr after PG with CIDR at TAI.

**PG 6-day CIDR* & TAI**
- Heat detect and TAI: day 0 to 3. Administer CIDR to non-responders until heat detect and TAI: days 0 to 3. Protocol may be used in buffer.

- **PG 6-day CIDR* & TAI**
  - Treatment day: 0
  - Heat detect: 5

**FIXED-TIME AI (TAI)***
- **7-day CO-Synch + CIDR***
  - Treatment day: 6 - 10 hr after PG with CIDR at TAI.

- **5-day CO-Synch + CIDR***
  - Treatment day: 7 - 12 hr after PG with CIDR at TAI.

**BEEF HEIFER PROTOCOLS - 2015**

**HEAT DETECTION**
- **1 Shot PG**
  - Heat detect & TAI: 7 to 9 and TAI: all non-responders 72 - 84 hr after PG with CIDR at TAI.

- **7-day CIDR* & TAI**
  - Heat detect and TAI: day 7 to 9 and TAI: all non-responders 72 - 84 hr after PG with CIDR at TAI.

- **MGA* & TAI**
  - Heat detect and TAI: day 7 to 9 and TAI: all non-responders 72 - 84 hr after PG with CIDR at TAI.

- **14-day CIDR* & PG & TAI**
  - Heat detect and TAI: day 14 to 16 and TAI: all non-responders 72 - 84 hr after PG with CIDR at TAI.

**FIXED-TIME AI (TAI)***
- **7-day CO-Synch + CIDR***
  - Treatment day: 5 + 1 hr after PG with CIDR at TAI.

- **5-day CO-Synch + CIDR***
  - Treatment day: 5 + 1 hr after PG with CIDR at TAI.

**Long-term Protocols**
- **14-day CIDR* & PG**
  - Treatment day: 7 to 9 hr after PG with CIDR at TAI.

- **MGA* & PG**
  - Treatment day: 7 to 9 hr after PG with CIDR 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 cows inseminated, labor, and facilities

Approved 10-07-2014

Beef Reproduction Task Force

Virginia Cooperative Extension
 Virginia Tech — Virginia Commonwealth University

www.ext.vt.edu
Why folks choose not to TAI?

“Too many hassle factors…”

“PREGNANCY RATES TO TAI ARE TOO LOW…”

• 40-60% pregnancy rates to TAI
• It is a process that will take time and commitment!
• 1,700 cows on 8 operations
TAI Pregnancy Rates by Herd

Using TAI for the first time

Herd

<table>
<thead>
<tr>
<th>Herd</th>
<th>Pregnancy Rate, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56.9</td>
</tr>
<tr>
<td>2</td>
<td>62.1</td>
</tr>
<tr>
<td>3</td>
<td>45.2</td>
</tr>
<tr>
<td>4</td>
<td>65.8</td>
</tr>
<tr>
<td>5</td>
<td>44.4</td>
</tr>
<tr>
<td>6</td>
<td>50.4</td>
</tr>
<tr>
<td>7</td>
<td>45.2</td>
</tr>
<tr>
<td>8</td>
<td>48.5</td>
</tr>
</tbody>
</table>
TAI Pregnancy Rates by Herd

Using TAI for at least 5 years

Pregnancy rate, %

Herd

1  2  3  4  5  6  7  8

56.9  62.1  65.8  44.4  50.4  50.4  45.2  48.5
Distribution of Days Postpartum

- **Herd 5** – 44.4% PR, TAI for the first time

Standard deviation:
Herd 5 – 16.9 days
• **HERD 4 – 65.8% PR, TAI for 7 years**

Standard deviation: Herd 4 – 5.6 days
The benefits of TAI go beyond genetic improvement!
UF-NFREC Case Study

University of Florida
Institute of Food and Agricultural Sciences
North Florida Research and Education Center
Marianna
Beef and Forage Programs
Bull Test Programs

UF | IFAS Extension
UNIVERSITY of FLORIDA

UF | IFAS Research
UNIVERSITY of FLORIDA
UF-NFREC CASE STUDY

Cow and Heifer job description

• Must calve by 24 months of age
• Cow must have a calf every 365 days
• Cow must calve without assistance
• Cow must provide sufficient resources for the calf to reach it’s genetic potential
• Calf must be genetically capable to perform
• Cows must maintain their body condition score for NFREC conditions
• Must not be crazy (disposition)

Mercadante et al., 2016
UF-NFREC CASE STUDY

2009
- TAI heifers: 1
- TAI cows: 8
- TAI late calving cows: 49
- TAI late, late calving cows: 65
- Remove bulls: 88

2010
- TAI heifers: 1
- TAI cows: 8
- TAI late calving cows: 49
- Remove bulls: 80

2011
- TAI heifers: 1
- TAI cows: 8
- TAI late calving cows: 49
- Remove bulls: 75
UF-NFREC CASE STUDY

2012

TAI heifers
TAI cows

1 8

Remove bulls

70

2013

TAI heifers
TAI cows

1 8

Remove bulls

72
UF-NFREC CASE STUDY

Percentage vs. Calving day for different years:
- Red: 2006
- Brown: 2007
- Yellow: 2008
- Orange: 2009
- Blue: 2010
- Green: 2011
- Black: 2012
- Cyan: 2013
## UF-NFREC CASE STUDY

### Breeding season pregnancy rates:

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breeding season length</strong></td>
<td>120</td>
<td>120</td>
<td>110</td>
<td>88</td>
<td>80</td>
<td>75</td>
<td>70</td>
<td>72</td>
</tr>
<tr>
<td><strong>Pregnancy rates</strong></td>
<td>81%</td>
<td>86%</td>
<td>84%</td>
<td>86%</td>
<td>82%</td>
<td>94%</td>
<td>92%</td>
<td>93%</td>
</tr>
<tr>
<td><strong>Mean calving day</strong></td>
<td>79.2</td>
<td>80.9</td>
<td>59.2</td>
<td>56.2</td>
<td>53.7</td>
<td>47.2</td>
<td>39.5</td>
<td>38.7</td>
</tr>
</tbody>
</table>
**UF-NFREC Case Study**

### Change in calf value:

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean calving day</td>
<td>79.2</td>
<td>80.9</td>
<td>59.2</td>
<td>56.2</td>
<td>53.7</td>
<td>47.2</td>
<td>39.5</td>
<td>38.7</td>
</tr>
<tr>
<td>Difference from 2006/2007</td>
<td>0</td>
<td>0</td>
<td>21.7</td>
<td>24.7</td>
<td>27.2</td>
<td>33.7</td>
<td>41.4</td>
<td>42.2</td>
</tr>
<tr>
<td>Per calf increase in value</td>
<td>0</td>
<td>0</td>
<td>$65</td>
<td>$74</td>
<td>$82</td>
<td>$101</td>
<td>$124</td>
<td>$127</td>
</tr>
<tr>
<td>Herd increase in value</td>
<td>0</td>
<td>0</td>
<td>$19,530</td>
<td>$22,230</td>
<td>$24,480</td>
<td>$30,330</td>
<td>$37,260</td>
<td>$37,980</td>
</tr>
</tbody>
</table>
Recipe for a calf
Bull Fertility

Essential Attributes for Fertility

- Physical capability to mate
- Capacity to produce spermatozoa / semen
- Functionally normal spermatozoa

Breeding Soundness Exam - BSE

- Willingness and eagerness to mate – LIBIDO
Breeding Soundness Exam

Herd Size

- 1 to 49: 10.9%
- 50 to 99: 33.2%
- 100 to 199: 45.9%
- > 200: 56.8%
- All Operations: 19.5%

(NAHMS, 2008)
Reproductive Efficiency

\[ \text{Reproductive Efficiency} = \text{Management} + \text{Nutrition} + \text{Selection pressure} + \text{Reproductive technologies} \]
YOU DECIDE WHEN YOUR COWS GET PREGNANT!!

- Maximize cows exposed to AI
- Maximize pregnancy rate
- More cows pregnant earlier
- More calves born earlier
- Heavier weaning weights
Contact Information

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