Pre-Breeding Examination of Beef Heifers

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Reproduction: What do we want?
- A high percentage of cows pregnant during a controlled breeding season
- The herd to be “front end loaded”
- Good reproductive performance every year (low risk of reproductive loss)
  In other words “Positive Momentum”

Reproduction: What are the constraints?
- 60-70% likelihood of a live calf being born from a single mating of a fertile bull and fertile cow/heifer (BonDurant, Theriogenology 2007)
  - Most lost by day 14 and the cow cycles again when expected

Reproduction: What are the constraints?
- Post-partum anestrus lasts an average of 55-65 days for mature cows in good body condition (longer if low body condition)

<table>
<thead>
<tr>
<th>Mean length of postpartum anestrus in beef cows</th>
<th>Mean length of postpartum anestrus</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Cow/Description</td>
<td>Treatment Groups</td>
<td>Mean Length of Postpartum Anestrus</td>
</tr>
<tr>
<td>Charolais x Angus cows</td>
<td>Low Energy pre-partum (7.4 Mcal/d) + Low energy postpartum (10.1 Mcal/d)</td>
<td>72.6 days</td>
</tr>
<tr>
<td></td>
<td>Low Energy pre-partum (7.4 Mcal/d) + High energy postpartum (19.9 Mcal/d)</td>
<td>54.3 days</td>
</tr>
<tr>
<td></td>
<td>Low Energy pre-partum (7.4 Mcal/d) + High energy postpartum (13.1 Mcal/d)</td>
<td>52.9 days</td>
</tr>
<tr>
<td></td>
<td>Maintenance Energy pre-partum (10.7 Mcal/d) + Low energy postpartum (10.1 Mcal/d)</td>
<td>54.3 days</td>
</tr>
<tr>
<td></td>
<td>Maintenance Energy pre-partum (10.7 Mcal/d) + High energy postpartum (13.1 Mcal/d)</td>
<td>55.2 days</td>
</tr>
<tr>
<td></td>
<td>Maintenance Energy pre-partum (10.7 Mcal/d) + High energy postpartum (19.9 Mcal/d)</td>
<td>57.6 days</td>
</tr>
<tr>
<td>Mature cows</td>
<td>Simmental-sired cows (BCS 6)</td>
<td>55.5 days</td>
</tr>
<tr>
<td></td>
<td>Red Angus-sired cows (BCS 6)</td>
<td>57.4 days</td>
</tr>
<tr>
<td></td>
<td>Hereford-sired cows (BCS 6)</td>
<td>58.6 days</td>
</tr>
<tr>
<td></td>
<td>Charolais-sired cows (BCS 6)</td>
<td>59.8 days</td>
</tr>
<tr>
<td></td>
<td>Angus-sired cows (BCS 5)</td>
<td>62.2 days</td>
</tr>
<tr>
<td></td>
<td>Limousin-sired cows (BCS 5)</td>
<td>63.8 days</td>
</tr>
<tr>
<td>Multiparous cows</td>
<td>&lt;5 BCS at calving</td>
<td>93.1 days</td>
</tr>
<tr>
<td></td>
<td>≥ 5 BCS at calving</td>
<td>63.5 days</td>
</tr>
</tbody>
</table>

But, average postpartum length means that about 50% of cows in good BCS have not resumed fertile cycles by 55-65 days
Length of PPI is Influenced by Time of Year (Forage Quality)

Cushman et al., 2007 JAS

Figure 1. Influence of Julian day of calving (JDC) on postpartum interval to estrus (PPIE; n=1355) in Germplasm Evaluation Cycle VII cow. As the JDC and BCS increased, the PPIE decreased (P<0.0001)

Affect of Julian Date and BCS on PPI

Length of PPI is Influenced by Time of Year (Forage Quality)

Mean length of postpartum anestrus in beef first-calf heifers

<table>
<thead>
<tr>
<th>Cow Description</th>
<th>Treatment Groups</th>
<th>Mean Length of Postpartum Anestrus</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-calf heifers</td>
<td>BCS 6-6.5 at calving</td>
<td>120 days</td>
</tr>
<tr>
<td>Ciccioli et al. 17 JAS 81:3107-3120, 2003</td>
<td>Fed to gain 1 lb/d post-partum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BCS 6-6.5 at calving</td>
<td>100 days</td>
</tr>
<tr>
<td></td>
<td>Fed to gain 2 lb/d post-partum</td>
<td></td>
</tr>
<tr>
<td>First-calf heifers</td>
<td>Not exposed to bulls</td>
<td>84-88 days</td>
</tr>
<tr>
<td>Berardinelli and Joshi, 18 JAS 83:2106-2110, 2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exposed to bulls</td>
<td>68-71 days</td>
</tr>
</tbody>
</table>

Reproduction: What are the constraints?

- Post-partum anestrus lasts an average of 55-65 days for mature cows in good body condition (longer if low body condition)
- Post-partum anestrus lasts an average of 80 to 120 days for first-calf heifers in good body condition (100 to 140 days for 90% of first-calf heifers to resume fertile cycles)

Reproduction: What are the constraints?

- Post-partum anestrus lasts an average of 55-65 days for mature cows in good body condition (longer if low body condition)
- Post-partum anestrus lasts 80 to 100 days for first-calf heifers in good body condition
- Gestation lasts 283 days
  
  365 - 283 = 82 days from calving to breeding to maintain yearling calving interval

Reproduction: What are the constraints?

- If cows calve at least 40-50 days before the start of the breeding season (i.e. in the first 30-40 days of the calving season)
  - Have 3 opportunities to become pregnant in a 60-day breeding season
    
    At 60% success → 94% pregnant after 3 opportunities
    At 65% success → 95% pregnant after 3 opportunities
    At 70% success → 97% pregnant after 3 opportunities

Reproduction: What are the constraints?

- If cows calve later in the calving season (more than 40 days after expected start of calving)
  - Have 2 opportunities to become pregnant in a 60-day breeding season
    
    At 60% success → 84% pregnant after 2 opportunities
    At 65% success → 88% pregnant after 2 opportunities
    At 70% success → 91% pregnant after 2 opportunities
Reproduction: What do we want?

• The best we can expect (year-in and year-out)

All cows cycling at start of breeding season & bulls delivering fertile semen
65% of cows open after 21 days of breeding become pregnant at the next opportunity (23% of herd)
65% of cows open after 42 days of breeding become pregnant at the next opportunity (7% of herd)

% of cows calving in each 21-day period

1st 20d 2nd 20d 3rd 20d open

Reproduction: What do we want?

• Yea, but lots of herds fail to have the “ideal” reproductive performance - how bad can that be??

• Spreadsheet evaluation of value of herd reproductive performance

• Good (not ideal) herd:
  1st 21 days – 55% pregnant (vs. 65% for ideal)
  2nd 21 days – 24% pregnant (vs. 23% for ideal)
  3rd 21 days – 13% pregnant (vs. 7% for ideal)
  Open – 8% (i.e. 92% preg) (vs. 5% for ideal)

Reproduction: What do we want?

• It is common for only 50% of cows in the herd to be cycling at the start of the breeding season

• Common herd:
  1st 21 days – 32% pregnant (vs. 65% for ideal)
  2nd 21 days – 20% pregnant (vs. 23% for ideal)
  3rd 21 days – 14% pregnant (vs. 7% for ideal)
  4th 21 days – 13% pregnant
  5th 21 days – 14% pregnant
  Open – 7% (i.e. 93% preg) (vs. 5% for ideal)

Reproduction: What do we want?

Importance of Heifer Fertility at First Breeding on Herd Reproductive Momentum

Important Constraints!

• Gestation lasts 283 days
  365 - 283 = 82 days from calving to breeding to maintain yearling calving interval

• Post-partum anestrus lasts 80 to 100 days for first-calf heifers (or longer if thin)

• Therefore, heifers must calve before the cows to be cycling at the start of their second breeding season
What Kills Momentum?

- Heifers that don’t calve ahead of cow herd
- First calf heifers that calve in thin body condition (PPI can be longer than 100 days)
- Cows that calve in thin body condition (PPI can be longer than 40-60 days)
- Bulls (yearlings or mature) that fail to successfully breed cows in heat
- Disease that ends a pregnancy

Determine Reproductive Maturity of Heifers

- Use combination of:
  - Yearling weight
  - Reproductive tract score
  - Pelvic area

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<table>
<thead>
<tr>
<th>Frame Score</th>
<th>Expected Mature Wt. (lbs.)</th>
<th>55% of Expected Mature Wt. (lbs.)</th>
<th>60% of Expected Mature Wt. (lbs.)</th>
<th>65% of Expected Mature Wt. (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>953</td>
<td>524</td>
<td>572</td>
<td>619</td>
</tr>
<tr>
<td>3</td>
<td>1027</td>
<td>565</td>
<td>616</td>
<td>668</td>
</tr>
<tr>
<td>4</td>
<td>1100</td>
<td>605</td>
<td>660</td>
<td>715</td>
</tr>
<tr>
<td>5</td>
<td>1173</td>
<td>645</td>
<td>704</td>
<td>762</td>
</tr>
<tr>
<td>6</td>
<td>1247</td>
<td>686</td>
<td>748</td>
<td>811</td>
</tr>
<tr>
<td>7</td>
<td>1320</td>
<td>726</td>
<td>792</td>
<td>858</td>
</tr>
</tbody>
</table>

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1. Yearling Weight
Target-weight To Reach Puberty For Different Frame Sizes

Reproductive Tract Score

- Onset of puberty can be estimated by palpation of uterus and ovaries
- Describes the pubertal status of the population
- Subjective evaluation (3-point scale)
  - Cycling
  - Not-cycling (no problem)
  - Immature (problem)

Value of RTS System

- RTS will help predict reproductive performance of yearling heifers
  - Pregnancy percentage to synchronized breeding
  - Pregnancy percentage at the end of the breeding season

Use of RTS in Practice

- The latest heifers should be evaluated is at the time synchronization is initiated
  - Accurately select cycling heifers but no ability to increase number reaching puberty
  - Appropriate for herds using “low-gain / low-input” heifer management
  - Expect some (many) heifers to fail to reach puberty in time for AI mating – only incur cost of synchronization and semen on cycling heifers
Use of RTS in Practice

- The latest heifers should be evaluated is at the time synchronization is initiated
- The earliest heifers should be evaluated is 6 to 8 weeks prior to the breeding season (10.5 to 12 months of age)
  - Sufficient time to improve the likelihood of some heifers reaching puberty prior to the start of breeding
  - Appropriate for herds trying to have as many heifers bred early in breeding season (e.g. AI) as possible

2. Reproductive Tract Score

Use of RTS in Practice: Herd Goal = High % of Cohort Conceive to AI Sire
A minimal goal = 80% cycling at the start of the breeding season

80% cycling x 90% respond to synch x 70% settle = 50.4%

If 100% are cycling at the start of the breeding season
100% cycling x 90% respond to synch x 70% settle = 63%

Immature Tract (problem)
- Infantile reproductive tract - small, flaccid uterus with small, inactive ovaries
- Not near the onset of puberty
  1) simply too young for breeding season
  2) too light to reach target weight
  3) implanted near the time of birth

Intermediate Tract (no problem)
- Heifers nearing the onset of puberty
  - Palpable ovarian structures
  - Slight to good uterine tone

2. Reproductive Tract Score

Use of RTS in Practice

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2. Reproductive Tract Score

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If 100% are cycling at the start of the breeding season
100% cycling x 90% respond to synch x 70% settle = 63%
2. Reproductive Tract Score

Cycling

- Heifers are considered cycling
  - Palpable large follicles or CL
  - Good uterine tone and thickness

3. Pelvic Area Measurement

Pelvic Area Measurement

- Theory / use based on:
  1) Dystocia due to disproportionately large calf compared to pelvic area
  2) Yearling pelvic area is highly correlated to 2-year-old pelvic area
  3) PA is moderately / highly heritable

3. Pelvic Area Measurement

Pelvic Area Measurement

- Criticism:
  1) Pelvic area is positively correlated with mature size and calf birth wt
  2) Selection for maximum pelvic area does not decrease risk of dystocia

3. Pelvic Area Measurement

Pelvic Area Measurement

- Proper use:
  1) Set minimum standard for culling (130-150)
  2) Do not select for maximum PA
  3) Evaluate wt. / RTS / PA together
  4) Consider abnormal pelvic shape

Evaluation of Heifer Breeding Soundness

(Putting it all together)

<table>
<thead>
<tr>
<th>Score</th>
<th>BCS</th>
<th>Weight</th>
<th>Reproductive Tract</th>
<th>Pelvic Area</th>
<th>Pelvic Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>R (Ready)</td>
<td>≥5</td>
<td>55-60% of mature wt. &amp; ≥10 mm follicles with good uterine tone</td>
<td>≥130 sq. cm. or herd-specific cut-off &amp; Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (Intermediate)</td>
<td>≥5</td>
<td>50-60% of mature wt.</td>
<td>≥130 sq. cm. &amp; Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S (Stocker)</td>
<td>&lt;5</td>
<td>&lt;50% of mature wt.</td>
<td>Abnormal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Ready” heifers – ready to put in breeding pool regardless of when breeding season starts

“Intermediate” heifers – depending on goal of producer and timing of evaluation:
- Evaluated at time of synch – place with bulls but do not AI or go ahead and AI but expect poor to moderate success
- Evaluated 4 weeks prior to synch – increase nutrition & attempt AI, increase nutrition & place with bulls
- Manage as stocker heifers

“Stocker” heifers – manage or sell as feeder heifers
### Systematic Evaluation of Heifer Development

#### Assessment 1
- **Pregnant replacement heifers:**
  - Weigh and BCS

- **Mature (multiparous) cows:**
  - BCS

#### Assessment 2
- **Replacement heifers (24 mos of age):**
  - Monitor estrous cycle and failure to ovulate

#### Assessment 3
- **Replacement heifers (16 mos of age):**
  - Determine pregnancy and fertility

#### Assessment 4
- **Newly weaned heifer calves:**
  - Select as potential herd replacements

#### Assessment 5
- **Yearling replacement heifers (18 mos of age):**
  - Weigh
  - Determine pregnancy status and estimate fetal age

#### Timeline (Weeks)
- Synchronization
- Replacement replacements
- Weaning
- Breeding
- Calving

### Calendar for Heifer Development

#### Age Group
- **Meaning to breeding (6-13 mos):**
- **Breed to calving (14-24 mos):**
- **1st-calf heifers and adult cows (24 mos +):**

#### Veterinary Visit or Data Collection
- Sept.-Nov.
- Dec.-Feb.
- April
- May
- July

#### Birthdate (BD)
- Newborn
- Weaned
- Breeding
- Calving

#### Pregnancy check for entire breeding season
- BCS of cows going into winter
- Continue vaccination program

#### BSE of bulls used to breed heifers
- Continue vaccination program

#### Estrous response to synchronization
- BCS of cows going into breeding season

#### All programs include the status and initial BCS

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**Meaning to breeding (6-13 mos):**
- Weigh, BCS, and AOA
- Single vaccination program
- Pregnancy check for entire breeding season
- BCS of heifers

**Breed to calving (14-24 mos):**
- Weigh, BCS, and AOA
- Single vaccination program
- Pregnancy check for entire breeding season
- BCS of heifers

**1st-calf heifers and adult cows (24 mos +):**
- Weigh, BCS, and AOA
- Single vaccination program
- Pregnancy check for entire breeding season
- BCS of cows