Natural Service Mating with Bulls
--- Management Considerations ---

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Equation for Reproduction

Environmental Influences

Male Fertility  Herd Fertility  Female Fertility

Management Influences
Three Major Goals

- Achieve highest pregnancy rates, early in breeding season (Breeding efficiency)
- Highest possible number of offspring from bulls of highest genetic value
- Achieve both as economically as possible
Essential Attributes for Fertility

- Physical capability to mate
- Willingness and eagerness to mate – LIBIDO
- Capacity to produce spermatozoa / semen
- Functionally normal spermatozoa
- Additional Needs -

Adaptability to environmental and management constraints of the breeding season

Adaptability and survival in the social hierarchy of the herd to compete for mating preference

LUCK to remain injury free – Mating is a hazardous occupation for bulls
Bull Fertility Estimations

- One in five unselected, mixed-aged bulls is sub-fertile
  (Carroll et al, 1963)
- 25 to 40% of beef bulls are sub-fertile or inefficient breeders
  (Coulter, 1991)

The minority (<30%) generally sire the majority of calves (>65%)
All Bulls do not perform Equally

Variability in fertility and reproductive performance is common – biological variation within populations

✓ Individual variation in pregnancy rates
✓ Variation in calves sired between bulls in multi-sire groups - the minority sire the majority

25 to 40% of bull population have weaknesses (sub-fertility)
Individual Bull Reproductive Performance

Mean calf output  8.8 ±1.0
(Expected 9.5 calves per bull)
Range of calf output  0 to 31
40% of bulls sired 73% of calves
27% of bulls sired less than 2 calves each

- Top 20% of bulls sired 48% of calves
- Bottom 20% of bulls sired less than 3% of calves

( Ellis et al, unpublished)
Pre-Breeding Management

- New bull additions should be acquired at least 60 days prior to start of breeding
  - Biosecurity - Isolation and testing (BVD, Trichomoniasis, Johne’s)
  - Breeding Soundness Exam (BBSE)
- Social adaptation - New bull additions
  - Mixed-aged groups
- Vaccinations
- Environmental adaptation
- Feed management
Assessment of Fertility

BULL BREEDING SOUNDNESS EVALUATION

Standardized, comprehensive, feasible, applicable

- History and management
- Physical examination
- Reproductive examination – Scrotal Circumference
- Seminal examination – spermatozoa quality
- Guidelines – American Soc. for Theriogenology (1992)
## Guidelines for minimum scrotal circumference measurements

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>&lt;15</th>
<th>&gt;15-18</th>
<th>&gt;18-21</th>
<th>&gt;21-24</th>
<th>&gt;24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrotal circumference (cm)</td>
<td>30</td>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
</tr>
</tbody>
</table>

BSE: Semen Quality

% Progressive Motility
Minimum of 30%
individual motile sperm
or
fair classification on gross motility

% Normal Spermatozoa
Greater than 70%
sperm with normal morphology

Source: Guidelines for using the Bull Breeding Soundness Evaluation form
Soc. For Theriogenology, 1993
Bull Conditioning

- **Body Condition**
  - Yearling bulls – 6.0 ideal
  - Mature bulls – 5.0 to 6.0 ideal
  - **Avoid over-conditioned, fat bulls**

- **EXERCISE**
  - Highly critical to sustain mating activity, libido, semen quality, reduce injuries
  - **requires several weeks of conditioning**
Expectations

- Improved pregnancy rates over bulls not selected for fertility potential and soundness
  
  *5 to 10% performance improvements*

Prediction of reproductive performance of individual bull is not reliable

*Risk management for sub-fertility prior to the breeding season*
Factors Contributing to Reproductive Variability of Bulls

- Physical characteristics
- Reproductive attributes

Components of BBSE

Both can rapidly change during the breeding season

Fertility = dynamic state of change and potential alterations on a day-to-day basis
<table>
<thead>
<tr>
<th>Factors Contributing to Variation in Bull Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Physical faults or injuries</td>
</tr>
<tr>
<td>✓ Reproductive faults or injuries</td>
</tr>
<tr>
<td>✓ Abnormal sexual behavior</td>
</tr>
<tr>
<td>✓ Social dominance effects</td>
</tr>
<tr>
<td>✓ Age – immaturity and advanced age</td>
</tr>
<tr>
<td>✓ Environmental influences - insults</td>
</tr>
<tr>
<td>✓ Management constraints or limitations</td>
</tr>
<tr>
<td>✓ Breed - Genotype</td>
</tr>
<tr>
<td>✓ Nutritional effects</td>
</tr>
<tr>
<td>✓ Diseases, toxins and chemicals</td>
</tr>
<tr>
<td>✓ Female factors</td>
</tr>
</tbody>
</table>
Sexual Behavior - Libido

- Under some degree of genetic control
- Age and sexual maturity are major determinants
- Improves with mating experience
- Pre-stimulation accentuates the response
- Competition influences responses
- Use of high libido bulls has shown benefit to pregnancy rates and time of conception
Relationship to Fertility

- Conflicting reports of relationships (+ or -)
- Mature bulls – positive advantages to herd fertility
- Young bulls – variable reports

General statement: Augments seminal and physical selection for fertility, Additive effect
Libido / Serving Capacity

Methods to assess sex drive and mating ability

Merits and usefulness

1. Positive correlations with fertility in mature bulls with previous mating experience
2. Ability to identify extreme weaknesses
3. Detection of specific penile defects

However, these assessments are minimally used due to time and resource limitations, risk of injury and difficulty in standardization and interpretation of test
Management Alternatives

“Sex Education”- pre-breeding season exposure to limited mating experience, observation for aggressiveness, responsiveness, mating ability, aberrations of mating ability

Breeding Season Observations
Rest and recuperation, fresh stimulus
Rotation of fresh bulls to replace exhausted bulls
Provide mating competition in single-sire systems
Limit breeding exposure for young bulls (<30 days ??)
Learning Curve for Sexual Behavior

Suggested from findings:
Sexually immature bulls should be allowed a “sex education” period prior to the planned mating exposure – facilitates:

- mating experience
- physical conditioning
- social interaction with females
- improved mating efficiency

(Boyd et al, Godfrey and Lunstra, Ellis et al.)
Factors influencing sex drive

- Age and experience
- Nutritional effects
- Disease/injury effects
- Social effects – dominance in multi-sire settings

No significant associations with components of breeding soundness evaluations, testicular or seminal traits, or physical traits.
Yearling Beef Bulls: Libido Effects

Calves sired for High-Medium-Low Libido Ranked Bulls

Pasture observations and scoring to establish rankings
Unpublished reports
Social Dominance

- Social hierarchy in beef herds –
  - Seniority of bulls, physical size, horns
  - 4-6 year old bulls
  - 2-3 year old bulls
  - Mature cows
  - Yearling Bulls – Heifers

Dominance is exerted when resources are limited – expressed more when less available females to breed – later part of breeding season or at low bull-to-female ratios
Effects on Reproductive Performance

Negative effects when dominant bull controls mating activity –

- Sires disproportionate number of calves
- If sub-fertile, limits mating and reduces pregnancy rates

Most common in mixed-age bull groups

Recommendation: Do not include yearling bulls with older bulls, Young bulls (2-3 yr. olds) should be the core bull battery, Bull rotations may be useful to use mixed-aged bulls
Multi-sire bull mating

- Bulls of same size and age
  Mature (>3 yrs. together)
  Young bull groups – 2 and 3 year olds
  Yearling bull groups

Caution: Yearling bull groups with mature cows

Bull rotations – enhanced bull power utilization
<table>
<thead>
<tr>
<th>Social rank</th>
<th>Pasture</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Bull 1</td>
<td>30 percent</td>
<td>34 percent</td>
<td>44 percent</td>
<td>92 percent</td>
<td>75 percent</td>
</tr>
<tr>
<td>Bull 2</td>
<td>21 percent</td>
<td>29 percent</td>
<td>18 percent</td>
<td>3 percent</td>
<td>25 percent</td>
</tr>
<tr>
<td>Bull 3</td>
<td>12 percent</td>
<td>21 percent</td>
<td>16 percent</td>
<td>3 percent</td>
<td>0 percent</td>
</tr>
<tr>
<td>Bull 4</td>
<td>10 percent</td>
<td>6 percent</td>
<td>4 percent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull 5</td>
<td>9 percent</td>
<td>4 percent</td>
<td>4 percent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull 6</td>
<td>9 percent</td>
<td>1 percent</td>
<td>4 percent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull 7</td>
<td>5 percent</td>
<td>1 percent</td>
<td>2 percent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull 8</td>
<td></td>
<td></td>
<td>2 percent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull 9</td>
<td></td>
<td></td>
<td>2 percent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bull 10</td>
<td></td>
<td></td>
<td>0 percent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of calves born</td>
<td>73</td>
<td>64</td>
<td>43</td>
<td>28</td>
<td>32</td>
</tr>
</tbody>
</table>

Source
Breeding Season Management

- Bull-to-Female Mating Load (BFR)
  No one ratio is optimal for all ranches or small herd operations

General recommendations:
- Yearling bulls: 1: 15 – 20
- Mature bulls: 1: 25 – 40
- Mature, intense mgmt: 1: 40 - 60
Factors Influencing Mating Load

- Distribution of breeding females
  - Terrain
  - Water availability
  - Carrying capacity
  - Pasture adaptation
  - Pasture size
- Bull factors – Age, Fertility, Social behavior, multi-sire
- Management decisions
  - Breeding season duration, Breeding intensity, Amount of time for observation, bull rotations
Management of Yearling Beef Bulls

- Selection and development
  - Age – 14 months or older
  - Body condition score – 5 to 6
  - Structural soundness, Physical fitness

- Testicular development - >34cm SC
- Semen quality – advanced puberty
- Disease status
Management of Yearling Beef Bulls

- Limited mating loads 1:15 to 1:25
- Limited breeding season
- Physical adaptation – nutrition is important
- Pre-breeding season mating experience
- Do not mix with older bulls

OBSERVE frequently for loss of physical condition, decreased libido, injuries and declining health

Post-breeding nutritional management to assure continued growth and sexual maturation.
Bull Observation

- High frequency observations during the early breeding season - - -
  - Observe heat activity – mating activity
  - Observe bull condition – soundness
  - Observe bull mating defects
  - Observe dominance patterns
  - Observe pasture distribution
Other Roles of Bulls with AI or Natural Breeding

- Biostimulation
- Heat Detection Aids
- Natural mating with synchronization
Natural Mating with Synchronization

- **Keys:**
  - Bull soundness and fertility, mating experience and libido
  - Social adjustment and reduced dominance
  - Mature bulls preferred (2-4 yr old)

- Extra bull power – replacements
- Rest and recovery after intense mating periods
Guidelines for Natural Mating with Estrus Synchronization

- Turn bulls out prior to expected synchrony of estrus
- Avoid programs that produce tight synchrony (fixed time AI protocols)
- Use small pastures or lots with sound footing and easy monitoring – limit travel
- Use 2-4 yr. old, experienced bulls
- Single-sire or multi-sire ??
- Bull-to-female ratios 1:15 to 1:25
- Allow 2-5 day mating exposure, monitor mating activity and have replacement bulls available
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Thank You

Management is doing the right things at the right times

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