Characteristics of successful breeding programs include having a large number of females pregnant in a short breeding season and to have successful matings that occur within the first two to three estrous cycles. In order to achieve these goals, both the female and the male must be reproductively sound.

Requirements

<table>
<thead>
<tr>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Must be cycling</td>
<td>1. Be able to detect heat</td>
</tr>
<tr>
<td>2. Physically mount female</td>
<td>2. Physically mount female</td>
</tr>
<tr>
<td>3. Deposit fertile semen into female tract</td>
<td>3. Deposit fertile semen into female tract</td>
</tr>
</tbody>
</table>

The most reliable measure of fertility is the pregnancy rate a male obtains when bred to normal females.

A useful predictor of selecting possible sires for breeding is the Breeding Soundness Examination. A BSE should be conducted 60 days prior to the breeding season.

Breeding Soundness Examination

- The objective of a BSE is to evaluate and classify the potential breeding ability of a male.
- Components of a BSE include:
  - Physical Examination
  - External and internal evaluation of the reproductive tract
  - Semen collection and evaluation
- A BSE does not guarantee fertility, but helps identify animals with problems
- A BSE does not detect an animals' desire to mate or identify those with low libido

Factors Influencing a BSE

- Age of Male
- Disease
- Heat Stress
- Body Condition
- Breeding Pressure
- Collection Procedure

A breeding soundness exam is an evaluation used to identify satisfactory, questionable, or unsatisfactory breeding sires.
Physical Examination

A. Overall Physical Condition
   1. General Health and Body Condition
   2. Soundness
   3. Eyes and Teeth

B. External Evaluation
   1. Palpation of Scrotum and Testes
   2. Masculinity
   3. Examination of Penis and Sheath
   4. Measure scrotal circumference

Scrotal Circumference

■ An indicator of a males:
   - Production of semen
   - Rate of maturity
   - Potential rate of maturity of his daughters

Physical Examination

c. Internal Exam
   1. Remove fecal material
   2. Allows for closer contact of probes on accessory sex glands
   3. Examination for Abnormalities of the Accessory Sex Glands
      a. Seminal Vesicles
      a. Seminal Vesiculitis – inflammation of the seminal vesicles (enlarged and swollen)
      b. Prostate

Semen Collection Methods

∀ Artificial Vagina (AV) – sire ejaculates into a man-made apparatus that mimics the feel of breeding a female by natural service
   AV Mimics Natural Service in 4 ways:
   Temperature
   Pressure
   Lubrication
   Position (angle)

∀ Electroejaculation – an electrical probe (electroejaculator) is inserted into the rectum to stimulate ejaculation via slight electrical stimulus of the accessory sex glands and pelvic muscles

Semen Evaluation

∀ Volume – measured in mL or cc (1mL = 1cc)

∀ Motility – percent of sperm cells that are progressively moving forward
   ∗ Standard measure for viability of the spermatozoa
   ∗ Most common industry measure for spermatozoal survival once in the female tract:
     ~ 30 hours in the female tract with natural service
     ~ 24 hours in the female tract for AI
Semen Evaluation

- **Concentration** – the number of total sperm cells collected in the ejaculate
  - Hemocytometer
  - Densimeter (Blue Box)
  - Spectrophotometer

- **Morphology** – the evaluation of the sperm cells for abnormalities of the head and/or tail
  - Visual observation
    - Sperm are classified as normal or as having a 1º, 2º, or 3º abnormality
  - Staining ability
    - Live cells = unstained
    - Dead cells = stained

Semen Characteristics

Comparison of Semen Volume and Concentration by Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Volume (ml)</th>
<th>Concentration (x10^6/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ram</td>
<td>1</td>
<td>2000</td>
</tr>
<tr>
<td>Bull</td>
<td>10</td>
<td>1000</td>
</tr>
<tr>
<td>Stallion</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>Boar</td>
<td>200</td>
<td>250</td>
</tr>
</tbody>
</table>

***Notice Trends from largest to smallest and vice versa***

Comparison of Testicular Weight and Daily Sperm Production (DSP) by Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Testicular Weight (gm)</th>
<th>DSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ram</td>
<td>550</td>
<td>14x10^9</td>
</tr>
<tr>
<td>Bull</td>
<td>500</td>
<td>8x10^9</td>
</tr>
<tr>
<td>Stallion</td>
<td>165</td>
<td>3x10^9</td>
</tr>
<tr>
<td>Boar</td>
<td>750</td>
<td>25x10^9</td>
</tr>
</tbody>
</table>

Ejaculate Characteristics

**Bull**
- Single Fraction
- Duration ~ 1 second
- Color = Creamy White
- Volume = 5 – 15 ml
- Concentration = 8 – 1200 x 10^6

**Ram**
- Single Fraction
- Duration ~ 0.6 second
- Color = Creamy
- Volume = 0.8 – 1.2 ml
- Concentration = 2 – 3 x 10^9

**Boar**
- Fractionated Ejaculate
- Accessory Fluid
- Sperm Rich Fraction
- Gel Fraction
- Duration = 5 – 30 minutes
- Color = Milky
- Volume = 150 - 200 ml
- Concentration = 200 – 300 x 10^6

**Stallion**
- Fractionated Ejaculate
- Accessory Fluid
- Sperm Rich Fraction
- Gel Fraction
- Duration = 1 – 2 minutes
- Color = Grayish White
- Volume = 60 – 100 ml
- Concentration = 200 – 500 x 10^6

Classification of a BSE

1. **Satisfactory**
   - Males that meet or exceed all minimum standards for motility, morphology, and scrotal circumference and pass a physical exam

2. **Questionable (deferred)**
   - Males that have the potential to pass all areas of the BSE, but have failed to do so based on some type of temporary illness, injury, or stressor
   - These animals should be re-tested at a later date

3. **Unsatisfactory**
   - Males that do not pass one or more areas of the BSE
   - These animals must be culled
Minimum Requirements for the BSE

<table>
<thead>
<tr>
<th>Bull</th>
<th>Minimum Scrotal Circumference of Bulls Based on Age and Testicular Circumference (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 12</td>
<td>&lt;33</td>
</tr>
<tr>
<td>12-24 months</td>
<td>33</td>
</tr>
<tr>
<td>24 months</td>
<td>35</td>
</tr>
<tr>
<td>≥24 months</td>
<td>37</td>
</tr>
</tbody>
</table>

Mobility = 50%  Morphology = 70%

Serving Capacity Evaluation

Serving Capacity Evaluation is used to assess the desire (libido) to seek out females in estrus and to determine the number of copulations achieved by a male during a specific time period.

A lack of Libido (mating desire) could result in decreased conception rates.

Fertility Associated Antigen

Bulls with increased amounts of FAA are more fertile than bulls without FAA. The lack of FAA does not indicate sterility or infertility.

- Protein produced by the accessory sex glands
- Released into the seminal fluids at ejaculation
- Binds to the sperm cell membrane
- Binds "heparin-like" compounds in the female tract after ejaculation
  - Important for the initiation of capacitation

Semen Extension

- Why Extend?
  1. Increases volume of ejaculate
     - Increase number of potential breedings
  2. Preserve viability of sperm
     - Maintain osmotic pressure of sperm cells

- Ability of Semen to be Extended is Dependent on:
  1. Concentration
  2. Quality – motility and morphology
  3. Fertility of sire
## Semen Extenders

<table>
<thead>
<tr>
<th>Components</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg Yolk</td>
<td>Provides a source of nutrients</td>
</tr>
<tr>
<td>Buttermilk</td>
<td></td>
</tr>
<tr>
<td>Glucose</td>
<td></td>
</tr>
<tr>
<td>Na Citrate</td>
<td>Stabilizes pH</td>
</tr>
<tr>
<td>Na Phosphate</td>
<td></td>
</tr>
<tr>
<td>Glycerol</td>
<td>Protects against temperature shock during cooling and warming</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>Controls metabolic and bacterial activity</td>
</tr>
<tr>
<td>(Penicillin, Streptomycin, etc.)</td>
<td></td>
</tr>
</tbody>
</table>