

*Robert E. Taylor Memorial Symposium*  
**Applied Reproductive Strategies in  
Beef Cattle**  
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# Natural Service Mating with Bulls - - Management Considerations - -



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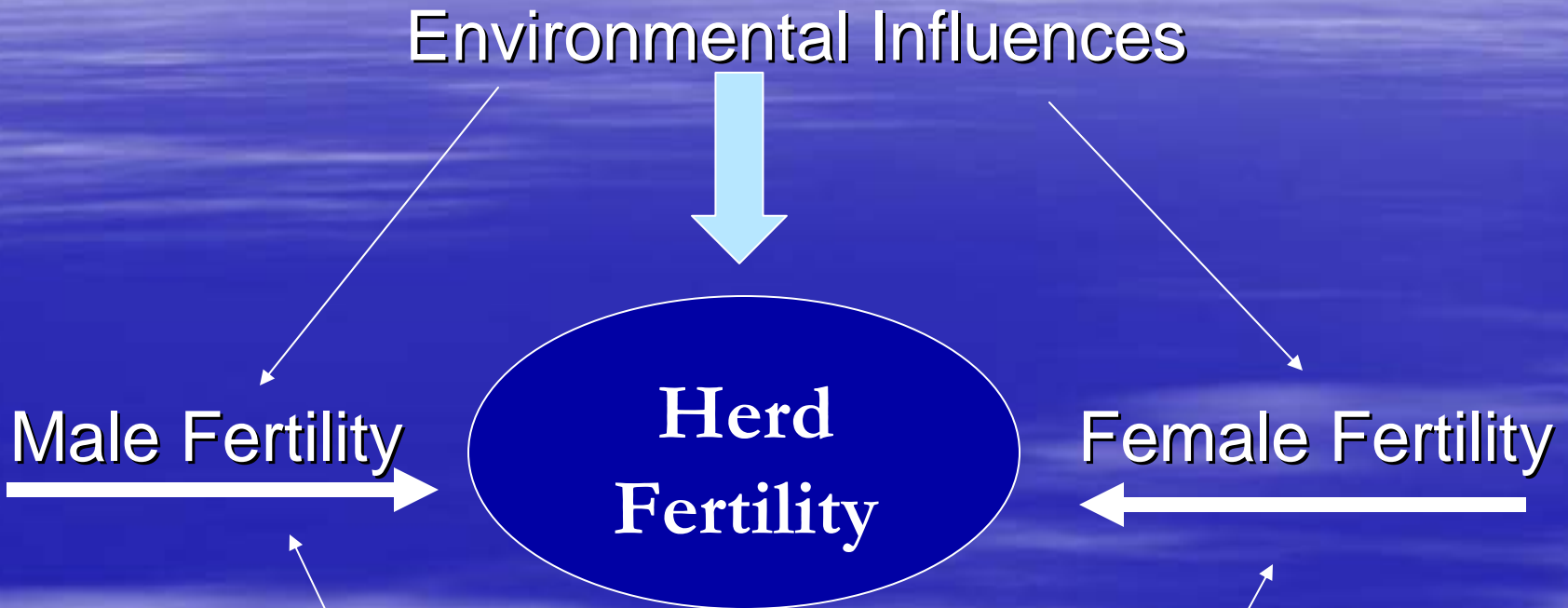
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# Equation for Reproduction



# 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  $8.8 \pm 1.0$

(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

# 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)
  - Vaccinations
  - Environmental adaptation
  - Feed management



Social adaptation –  
New bull additions  
Mixed-aged groups





# 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)

# BSE – Scrotal Circumference

## Guidelines for minimum scrotal circumference measurements

Age (months)	<15	>15-18	>18-21	>21-24	>24
Scrotal circumference (cm)	30	31	32	33	34

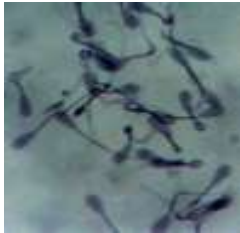


Source: Chenoweth PJ, Spitzer JC, Hopkins FM 1992 A new bull breeding soundness form. Proc of Ann Mtg, Soc for Theriogenology

# 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**

# Factors Contributing to Variation in Bull Fertility

- ✓ Physical faults or injuries
- ✓ Reproductive faults or injuries
- ✓ Abnormal sexual behavior
- ✓ Social dominance effects
- ✓ Age – immaturity and advanced age
- ✓ Environmental influences - insults
- ✓ Management constraints or limitations
- ✓ Breed - Genotype
- ✓ Nutritional effects
- ✓ Diseases, toxins and chemicals
- ✓ Female factors



# 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

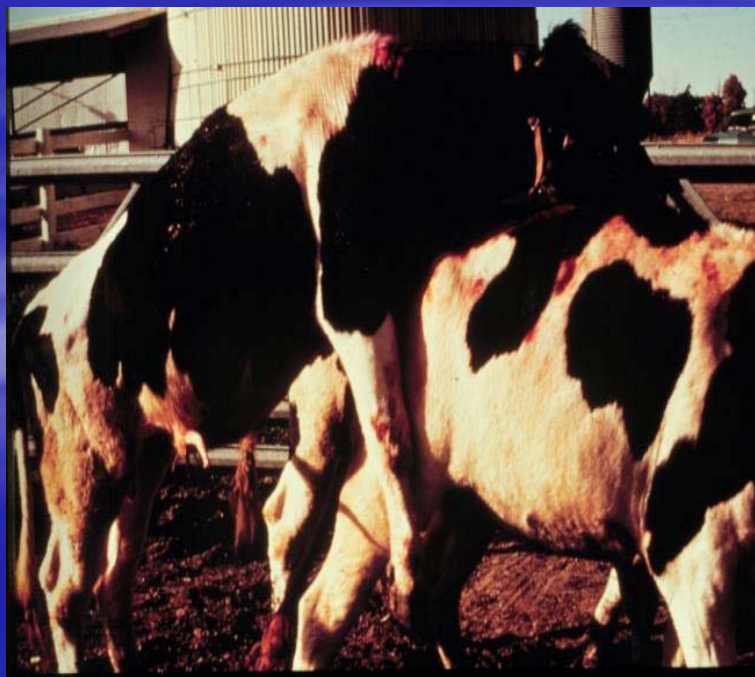
# Libido / Serving Capacity

Methods to assess sex drive and mating ability

## Merits and usefulness

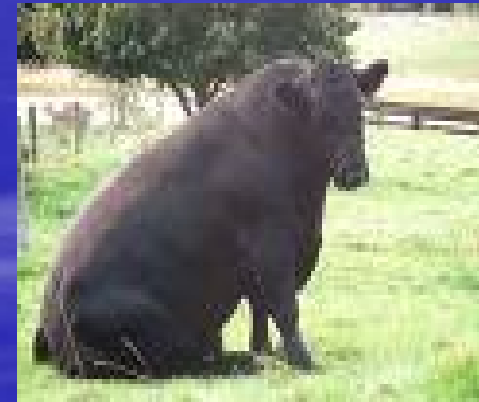
1. Positive correlations with fertility in mature bulls with previous mating experience
2. Ability to identify extreme weaknesses
3. Detection of specific penile defects

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.)*





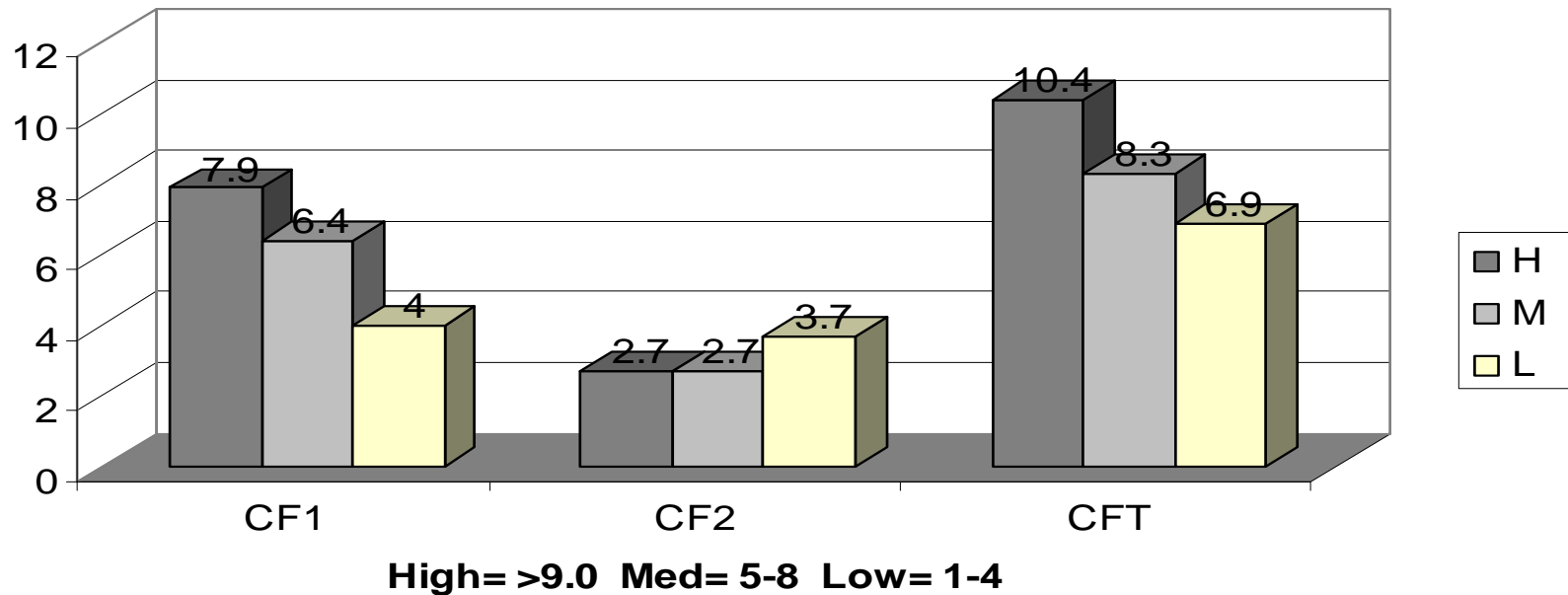
# Factors influencing sex drive



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



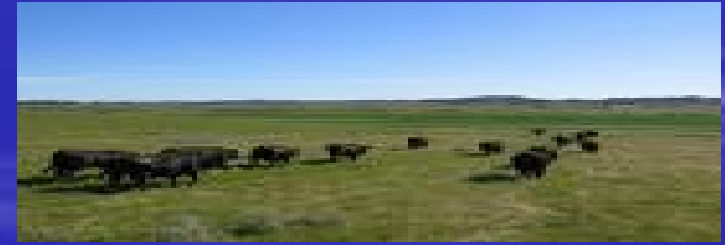
Social rank	Pasture				
	1	2	3	4	5
<b>Bull 1</b>	<b>30 percent</b>	<b>34 percent</b>	<b>44 percent</b>	<b>92 percent</b>	<b>75 percent</b>
<b>Bull 2</b>	<b>21 percent</b>	<b>29 percent</b>	<b>18 percent</b>	<b>3 percent</b>	<b>25 percent</b>
<b>Bull 3</b>	<b>12 percent</b>	<b>21 percent</b>	<b>16 percent</b>	<b>3 percent</b>	<b>0 percent</b>
<b>Bull 4</b>	<b>10 percent</b>	<b>6 percent</b>	<b>4 percent</b>		
<b>Bull 5</b>	<b>9 percent</b>	<b>4 percent</b>	<b>4 percent</b>		
<b>Bull 6</b>	<b>9 percent</b>	<b>1 percent</b>	<b>4 percent</b>		
<b>Bull 7</b>	<b>5 percent</b>	<b>1 percent</b>	<b>2 percent</b>		
<b>Bull 8</b>			<b>2 percent</b>		
<b>Bull 9</b>			<b>2 percent</b>		
<b>Bull 10</b>			<b>0 percent</b>		
<b>Number of calves born</b>	<b>73</b>	<b>64</b>	<b>43</b>	<b>28</b>	<b>32</b>

- Source  
Adapted from Lehrer, A.R., M.B. Brown, H. Schindler, Z. Holzer, and B. Larsen. 1977. *Paternity tests in multisired beef herds by blood grouping*. Acta Vet. Scand. 18:433 to 441.

# 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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Colorado State University





# Thank You

*Management is doing the right things at the right times*

## CSU BEEF TEAM

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- ✓ Cooperative Extension Specialists
- ✓ County and Regional Extension Educators
- ✓ Dept. of Animal Science and Agriculture faculty
- ✓ Dept. of Veterinary Medicine faculty – ILM
- ✓ Beef industry affiliates

“ a team approach to problem-solving”

