1. Domestication

AUROCHS

Ancestor of domestic cattle

Lascaux cave paintings

Domestication: CATTLE

Aurochs → Bos indicus

Aurochs ← Bos taurus
Domestication: BUFFALO

Domestication

- Domestication of cattle started 7000-8000 years ago in Middle East and Pakistan
- Domestic water buffalo is a product of thousands of years of selective breeding
- 97% of domestic water buffalo are in Asia

Domestication allowed people to have a ready supply of meat and milk, draught power and transport and currency. It also required selection for wanted characteristics.

2. WHY IS REPRODUCTIVE MANAGEMENT IMPORTANT?

- More Calves over time
- More Replacements
- Time births to suit farm management (season, nutrition availability, labour availability)
- More income

Main Principle of reproductive Mgt.

Controlled Breeding
3. BASIC REPRODUCTIVE ANATOMY

3. Basic Reproductive Anatomy

Basic Reproductive Anatomy

4. THE REPRODUCTIVE CYCLE

4. The Reproductive Cycle

Beef Year
365 Days

<table>
<thead>
<tr>
<th>40-100 days Breeding Season</th>
<th>63 day Weaning Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-100 days Anestrus</td>
<td>Group Wean</td>
</tr>
<tr>
<td>Lactation</td>
<td>Gestation</td>
</tr>
<tr>
<td>205</td>
<td>63 days</td>
</tr>
<tr>
<td>Calving Season</td>
<td>Calving</td>
</tr>
<tr>
<td>Weaning Weight</td>
<td>BCS</td>
</tr>
<tr>
<td>63 days</td>
<td>63 days</td>
</tr>
</tbody>
</table>

Calving Season
63 days
5. THE OESTRUS CYCLE

- The oestrus cycle of the female bovine as with other species is regulated and determined by interactions between the brain (central nervous system, hypothalamus, pituitary) ovaries and uterus.

The Reproductive Cycle: How does it work?

- 1. Follicular phase: oestrogen
- 2. Luteal phase: progesterone

Hormones in brain stimulate ovaries
Hormones from ovaries stimulate uterus & brain
Hormones from uterus stimulate ovary
**Follicular Phase**
- Dominated by hormone released from follicle
- Oestrogen
- 5 days

**Luteal Phase**
- Dominated by hormones released from CL
- Progesterone
- 16 days

**The Reproductive Cycle: How does it work?**

*Corpus luteum (CL or yellow body)*
- After the dominant follicle has ruptured (ovulated) a Corpus luteum forms at the rupture site on the ovary and begins to produce hormones and chemicals which support pregnancy and stop the cow coming back on heat

**Standing heat**
- Standing heat is when a female cow or buffalo “stands” and lets itself be mated by a bull
- Oestrus last 15 hours average (range 2-30hrs)
The Reproductive Cycle: How does it work?

**Oestrus cycle length**
- The oestrus cycle is the interval between standing heats and is between **18-24 days** in a normal healthy female cow or buffalo.

**Follicular waves**
- During each oestrus cycle, 2-3 waves of follicles develop on the ovary, which are controlled by complex changes in hormone levels and other signaling chemicals in the bloodstream.

**Ovulation**
- Before the onset of heat one of the follicles becomes dominant, ruptures (bursts) and the egg inside the follicle falls into the top of the reproductive tract. This process is called ovulation and occurs 10-12 hrs after the end of standing heat.

- Before the follicle bursts and releases the egg, the follicle helps produce a lot of the hormone oestrogen.
- Oestrogen stimulates the signs of oestrus, which include, standing to be mated, restlessness, mucoid discharge from the vulva.
**Hormone Levels**

- **Fertilization**
  - Requires fertile sperm and ova

**Fertilization**

- Sperm approaching the ova

**The Oestrus Cycle**

- The activity of the ovaries is influenced directly and indirectly by many factors including:
  - Nutrition
  - Genetics
  - Temperature
  - Day length
THE OESTRUS CYCLE

Reproductive efficiency is also influenced by a number of factors including:

- Nutrition
- Season
- Genetics (both within breeds and between breeds)
- Hormone levels/production
- Anatomy

The reproductive cycle: Summary

1. The brain receives a multitude of signals from the environment and the rest of the body
2. If conditions are right it sends signals to the pituitary gland
3. The pituitary gland then sends signals to the ovaries
4. A chain of events is triggered which will lead to an egg being released into the top of the uterus and the female animal being receptive for breeding.
5. Signals are also sent back from the uterus when a fertilized egg takes up residence and tells the relevant organs to send down hormones and chemicals to stop coming back on heat.

Signs of Oestrus: 1. COMING ON

- Sniffing others
- Attempting to mount others
- Increased restlessness
- Frequent urination
- Vulval enlargement/moist
- Other cows interested in mounting but will not stand still

Signs of Oestrus: 2. ON

- STANDING TO BE MOUNTED
- Attempting to ride others
- Frequent bellowing
- Reduced milk yield
- Evidence of being mounted frequently (tail rubs/mud on flanks)
Signs of Oestrus: 3. GOING OFF

- No longer stands to be ridden
- Continued smelling and nudging activity
- Mucoid discharge dried around perineum

6. Reproduction basics in cattle and buffalo

<table>
<thead>
<tr>
<th></th>
<th>Cattle</th>
<th>Buffalo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproductive organs size</td>
<td>Larger than buffalo</td>
<td>Smaller than cattle</td>
</tr>
<tr>
<td>Ovary</td>
<td>Oval about 2 cm x 3 cm</td>
<td>Oval and longer</td>
</tr>
<tr>
<td>Corpus luteum</td>
<td>Protrudes from ovary</td>
<td>Smaller more embedded</td>
</tr>
<tr>
<td>First oestrus</td>
<td>7-18 months</td>
<td>24-36 months</td>
</tr>
<tr>
<td>Average oestrus</td>
<td>15 hours</td>
<td>12-28 hours</td>
</tr>
<tr>
<td>Oestrus cycle</td>
<td>18-24 days, polyoestrus</td>
<td>21-22 days, seasonal polyoestrus</td>
</tr>
<tr>
<td>Oestrous signs</td>
<td>Obvious and easy to detect with some practise</td>
<td>More subtle and harder to detect</td>
</tr>
<tr>
<td>Ovulation</td>
<td>12 hours post oestrus</td>
<td>10 hours post oestrus</td>
</tr>
<tr>
<td>Gestation</td>
<td>around 285 days</td>
<td>300-340 days</td>
</tr>
<tr>
<td>Average age at first calving</td>
<td>2-3 years</td>
<td>3-4 years</td>
</tr>
<tr>
<td>Calving interval</td>
<td>365</td>
<td>400-600 days</td>
</tr>
<tr>
<td>First oestrus post calving</td>
<td>21-42 days</td>
<td>55-90 days</td>
</tr>
</tbody>
</table>

7. OPTIMIZING REPRODUCTIVE PERFORMANCE

- Can be optimized by concentrating on factors which influence
  1. Number of days from calving to first mating
  2. Conception rate
  3. Efficiency of heat detection

ACHIEVING GOOD REPRODUCTIVE PERFORMANCE

How well a herd or individual is performing reproductively is determined by:

- Length of time from calving to mating start date
- Efficiency of heat detection
- Conception rate
- Abortion rate
Achieving good reproductive performance

Parameters in the previous slide vary depending on:

- Disease status of herd or individual
- Nutrition
- General management

Reproductive management

Problems often stem from:

- Late attainment of puberty
- Seasonality of calving
- Extended post partum anoestrus
- Long calving interval
- Heat not detected
- Unwanted or unplanned mating

Measuring Reproductive performance

Many options eg. dairy NSW

- Mean age at first calving
- Mean inter-calving interval
- Mean calving to first oestrus interval
- Mean calving to conception interval
- Mean length of lactation
- Mean length of dry period
- Abortion rate/ culling

Optimal

- two years
- 365 days
- 60 days
- 85 days
- 280 days
- 65 days
- <10 abortions

Measuring reproductive performance

Many options- seasonal dairy

- % of herd pregnant by 30 days after MSD (mating start date)
- % of herd pregnant by 60 days after MSD
- % of herd pregnant 150 days after MSD
- 30 day submission rate
- Conception rate
- % abortions

Embryo searching
Measuring reproductive performance

NRR or non return rate
- NRR is dependant on heat detection efficiency, true conception rate and the level of early embryonic loss

Collecting embryos

Recording reproductive performance

Data recording systems
- Exercise books
- Wall charts
- Card systems
- On farm computer programme
- Centralized herd recording systems
- Veterinary programme

Reproductive goals - beef

Temperate Australia
- Pregnancy rate 90-92%
- Calving rate 85-90%
- Weaning rates 83-88%

Northern Australia
- Pregnancy rate 80-85%
- Weaning rates 83-88%

8. NUTRITION
- The level of nutrition is the single most important factor affecting reproductive performance in the bovine and largely explains the regional differences observed within a country.
- Nutrition not only affects calving to first heat interval but conception rate as well
- Body score (BS) of the mother at calving is the most important factor that affects reproductive performance.
Adequate nutrition throughout pregnancy and after birth ensures a healthy calf. A body score of 3-4 of the mother at birth ensures returning to oestrus quickly and ready for the next mating but also enough milk to raise the calf.

Nutrition

Energy and protein

- Although dietary mineral, fiber, and vitamin intake are important components of the bovine diet, it is principally energy and protein intake which drive growth, pregnancy, lactation, and reproduction.

Poor condition/low body score (BS)

Nutrition

Tropical pastures/feeds

- The crude protein content of tropical pastures and crop by products fed is often below 7.5%
- This affects rumen efficiency and reduces digestibility
- Cows subsequently calve and lose weight

Poor nutrition reduced ovarian activity

Nutrition

Well fed buffalo or cattle will produce:

- More milk
- Raise healthier and stronger calf
- Cycle sooner after calving
- Become pregnant sooner
- Produce more calves in their lifetime

BS 1-8 scale
1=bag of bones 8=can’t get any fatter

Well fed buffalo or cattle will produce:

- More milk
- Raise healthier and stronger calf
- Cycle sooner after calving
- Become pregnant sooner
- Produce more calves in their lifetime
**Nutrition**

**Underfeeding**
- Effects greatest on lactating cows and young stock
- Reduced milk yield
- Reduced calf growth rates
- Reduced weaning rates
- Delayed puberty
- Reduced lifetime potential

**Bovine rescue**

---

**Interesting research data**

- Bartha 1971 found Zebu heifers fed concentrates had first conception advanced 4-18mths
- Penzhorn 1975 found heifers on a restricted diet had puberty delayed 7mths. Heifers reached puberty at body weights of 279-295 kg irrespective of age.

---

**9. BULLS**

**FERTILITY**

- Big variations in fertility exist
- Holroyd 2002 found in one study 7% of bulls produced no calves, 58% individually sired 10% and 13% sired over 30%
Bulls
Male factor infertility
- Genetic defects
- Poor semen quality
- Scrotal circumference
- Poor libido
- Lameness
- Health/general disease status
- Bull power (male/female ratios)

10. REPRODUCTIVE TECHNOLOGIES
- Performance testing of bulls and cows
- Heat detection aids
- Oestrus synchronization
- Oestrus induction
- Hormone treatments for better reproductive performance

Reproduction Technologies
- Artificial Insemination
- Cryo-preservation of semen
- Cryo-preservation of embryos
- Computerized reproductive records- herd recording
- Calving Induction- mainly dairy farms (Australia)

Reproduction Technologies
- Multiple Ovulation and embryo transfer
- Splitting embryos
- In vitro fertilization, culture and embryo transfer
**Reproduction Technologies**

- Embryo Multiplication and transfer (cloning)
- Multiplying embryos and altering genes (making embryonic stem cells)
- Sexed semen
- Sexed embryos
- DNA fingerprinting
- Generating transgenic animals

**References**

- AACV Evaluation and reporting bull fertility
- Investigating shortfalls in Reproductive performance in Dairy herds. Brightling, Larcombe and Malmo. DRDC
- Proc PGF Sydney University. K Entwistle p 311
- The role of nutrition in cattle reproduction. FAO Corporate Document Repository