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Ruminant Fertility
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FERTILITY PROBLEMS IN DAIRY CATTLE

Causes, consequences and suggestions for prevention

Fertility problems in dairy cattle

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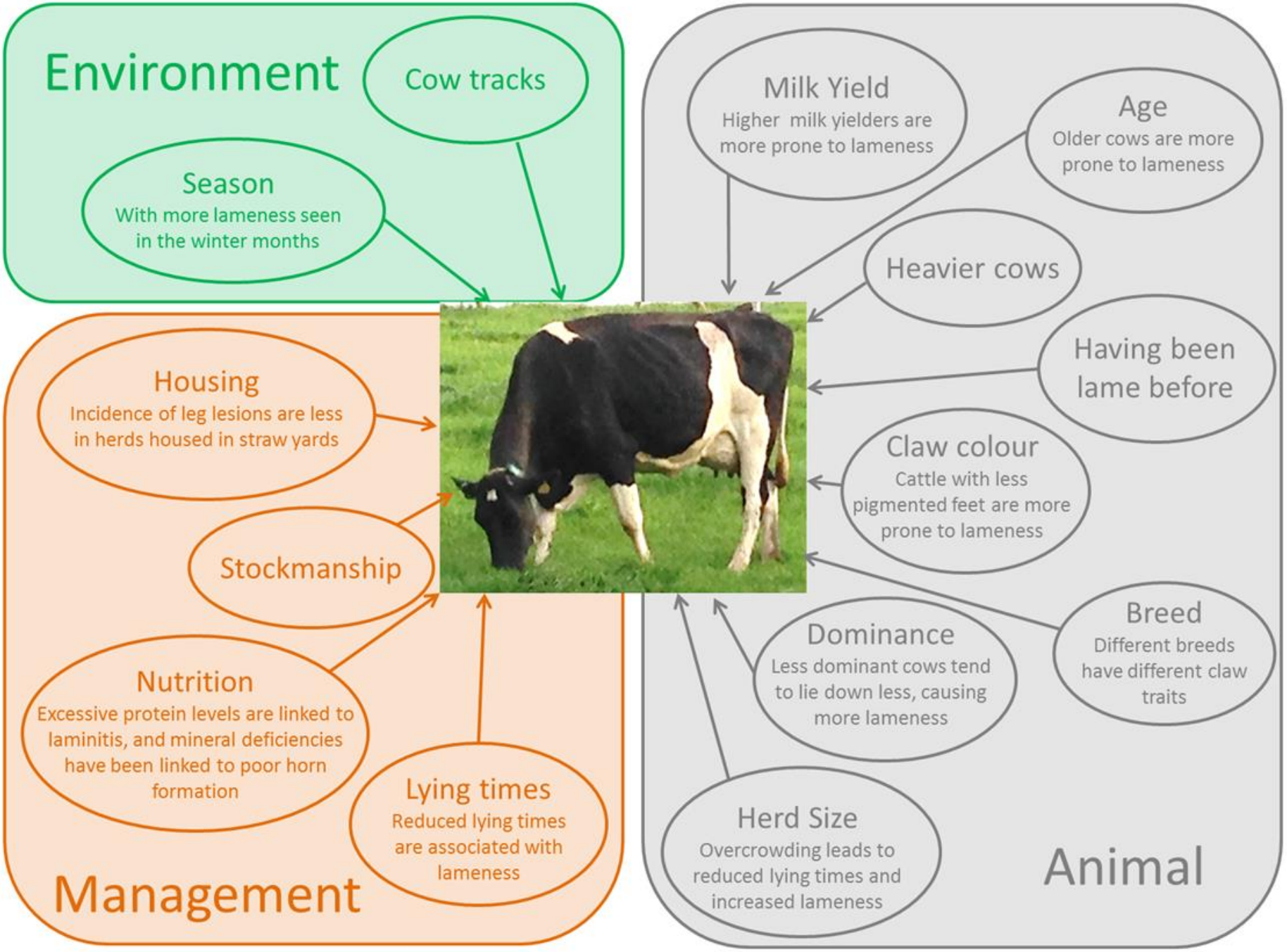

Environment
Cow tracks
Season
With more lameness seen in the winter months
Milk Yield
Higher milk yielders are more prone to lameness
Age
Older cows are more prone to lameness
Heavier cows
Having been lame before
Claw colour
Cattle with less pigmented feet are more prone to lameness
Breed
Different breeds have different claw traits
Dominance
Less dominant cows tend to lie down less, causing more lameness
Herd Size
Overcrowding leads to reduced lying times and increased lameness
Animal
Housing
Incidence of leg lesions are less in herds housed in straw yards
Stockmanship
Nutrition
Excessive protein levels are linked to laminitis, and mineral deficiencies have been linked to poor horn formation
Lying times
Reduced lying times are associated with lameness
Management

1. Introduction

In modern high-yielding dairy herds, fertility is of major economic importance. Many efforts are being made to try to maintain good fertility levels. This is a review of the most important problems that lead to infertility in dairy herds: main causes and some suggestions on how to control and prevent diseases that affect fertility.

2. Retained foetal membranes

Foetal membranes are normally expelled in 3-8 hours. However, retained foetal membranes (RFM), are retained for more than 24 hours.

Ninety four percent of cows that cleaned within 24 h did so in 12 h.

In 50 studies, the median incidence of RFM is 8.6%, (1.3-39.2%).

Maternal immunological recognition of foetal MHC class I proteins –which are expressed by trophoblast cells– triggers an immune/inflammatory response that contributes to placental separation at parturition. When cotyledon-caruncle attachment fails to separate at the right time after delivering the calf, retained placenta occurs.

The incidence of retained placenta can be increased by several factors related to management, health and nutrition.

2. Retained foetal membranes

Lack of uterine motility plays little or no role in the occurrence of retained placenta. Moreover, cows with retained placenta have normal or increased uterine activity in the days after calving.

2. Retained foetal membranes

Possible factors involved

Induction of parturition with corticosteroids

Acute mastitis at calving

Metabolic diseases

Abnormal deliveries

- Twins
- Caesarean sections
- Dystocia
- Abortions
- Premature calvings

Nutritional deficiences

- Energy or protein deficiency during pregnancy
- Vitamin A deficiency
- Selenium deficiency
- Iodine deficiency
- Vitamin E deficiency

Infectious diseases

- Brucellosis
- Leptospirosis
- Listeriosis
- IBR virus, BVD virus

Management problems

- Stress
- Obesity
- Over-conditioning of dry cows
- Prolonged dry period

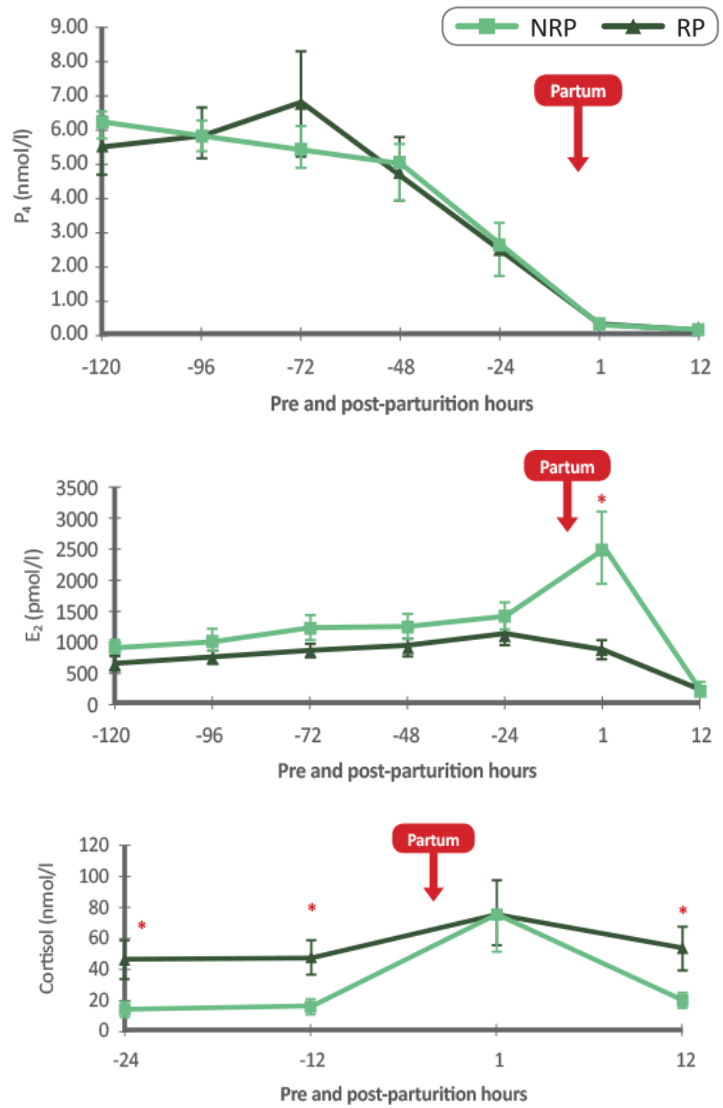
Heat stress

2. Retained foetal membranes

Pathogenesis

Cows with RFM have similar progesterone levels, but also…

- Lower oestradiol
- Lower $PGF_{2\alpha}$
- Higher PGE_2:$PGF_{2\alpha}$ ratio



Plasmatic concentrations of steroids (P_4, E_2 and cortisol) in normal (NRP) cows and cows with placental retention (PR). The asterisk represents P<0.05.

From: Wischral A, Limac SB, Hayashi LF, Barnabe RC. Pre-parturition profile of steroids and prostaglandin in cows with or without foetal membrane retention. Animal Reproduction Science 67 (2001) 181–188.

2. Retained foetal membranes

Placental retention creates a large number of potential problems:

- Increases contamination and delays involution of the uterus.
- Increases the risk of metritis and endometritis.
- Strong association with poor reproductive performance **= ↑ 11-26 days open.**
- The impact is likely mediated through metritis and endometritis, not RFM itself.
- No direct increment in deaths or later culling.
- Only a problem if associated conditions occur.

Strategies to prevent placental retention

- **Test for specific infections.** → **If an infection is identified, treat, vaccinate or cull infected cows.**
- Minimise stressful conditions during the dry period and at calving.
- **Minimise exposure to non-specific organisms.** → **Keeping calving areas clean and well-bedded.**
- Provide supplemental selenium and vitamin A.
- Avoid over-conditioning (high BCS) and overcrowding in dry off period.
- Prevent milk fever (hypocalcaemia).
- **Use bulls with a record of easy calving.** → **And provide assistance in a clean manner if necessary.**

3. Metritis

It is the inflammation of the endometrium, underlying mucosa and muscular layers of the uterus.

How to detect it?

- Cows normally have a **red-to-brown discharge after calving**. If it persists beyond 2 weeks or if it is foul-smelling, it is an evidence of metritis.
- **Complete physical examination** including attitude, hydration status and rectal temperature.
- **Rectal palpation:** increased size and thickness of the uterine wall.

Metritis may be…

- **Puerperal metritis** is characterised by the presence of an abnormally enlarged uterus, a watery, purulent or brown and foul-smelling vaginal discharge associated with signs of systemic illness, and a rectal temperature > 39.5 °C.
- **Clinical metritis** is evident in animals with an enlarged uterus, a similar vaginal discharge and with or without fever (> 39.5 °C).

Metritis affects about 20% of lactating dairy cows, with an incidence ranging from 8 to > 40% on some farms.

Possible causes involved

- Injury to the reproductive tract due to a difficult calving. → **Facilitates the contamination of the reproductive tract at calving, when cows and heifers are highly susceptible to infection.**
- Systemic infections can spread to the uterus. → **IBR, BVD and leptospirosis.**
- Common inhabitants of the vagina. → **Ureaplasma, mycoplasma and *H. somnus.***
- Venereal infections during natural breeding. → **Campylobacteriosis and trichomoniasis. infection can be transmitted either by an infected bull or carried by the bull to a susceptible female from an infected female.**

3. Metritis

And also…

- Injury to dystocia and retained placenta.
- Immune deficiency in the transition period.
- Feeding behaviour during the early transition period.
- Selenium or vitamin E deficiency.
- Over-conditioning.
- Poor-quality water from a contaminated well or other water source.

3. Metritis

Effects on productive and reproductive performance

As mentioned above, metritis has an incidence rate of up to 20 % in lactating cows. Therefore, the economic consequences are very significant and they are calculated to reach up to US $354 per case.

In brief, metritis causes:

- Decreased pregnancy per artificial insemination.
- Increase in days open.
- Decreased milk production.
- Increased culling rates.
- In heifers, metritis risk is greater in winter (calves are 7 % larger).
- If cows do get metritis in summer it is more likely to be severe.

3. Metritis

Maintaining a healthy uterus during and after calving is critical. It is essential to promote uterine health and immune function by:

- **Looking for signs of hypocalcaemia and ketosis if the incidence of retained placenta is greater than 8 %.**
- **Housing calving cows in a clean place with optimal ventilation and sanitary conditions.**
- **Using feeding strategies: supplemental selenium administration to milking and dry cows and avoiding over-conditioning during late lactation and dry period.**
- **Using a proper vaccination programme as it aids in the prevention of diseases that can cause metritis.**

4. Cystic ovarian disease

Cystic ovarian disease (COD) is one of the most common reproductive disorders in dairy cows.

Ovarian cysts are follicular structures with a diameter of at least 17 mm, which persist for more than 10 days in absence of corpus luteum detectable by ultrasound.

An incidence of 6 to 23% has been reported in dairy cow herds and COD has also been associated with a 10- to 20-day increase in days open, and a 20 - to 30-day increase in the calving-to-pregnancy interval.

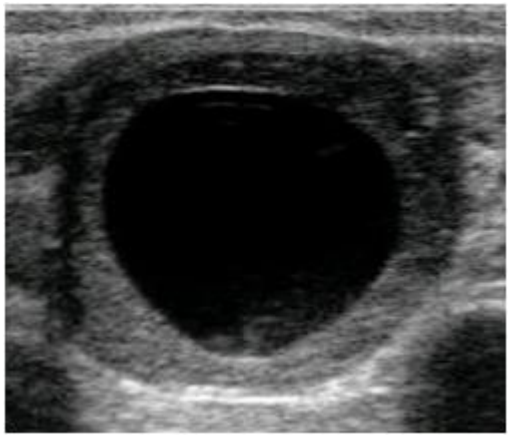
Not many studies have shown the economic impact of COD, which has been calculated to be US $137 per case, but with large variations between countries, regions and seasons.

4. Cystic ovarian disease

Ovarian cysts can be classified as…

Follicular cysts

Blister-like structures which result from failure of ovulation and luteinisation.



Luteal cysts

They apparently fail to ovulate but some luteinisation occurs.

Factors predisposing to COD

Cow-level factors associated with an increased risk of COD:

- Parity
- Constitutional weakness
- BCS
- Genetic factors

- **Occurrence of COD predisposes an animal to COD in the following lactation.**
- **Several studies have found that COD is associated with twinning.**
- **High milk yield may contribute to negative energy balance, which can result in metabolic and hormonal adaptations which influence follicle growth and cyst development.**
- **Calving season or lactation number are also risks factors suggested by several studies.**

4. Cystic ovarian disease

Recommendations about COD diagnosis and treatment

Wait until approximately one month post-calving before attempting to diagnose cystic ovarian disease.

- Rectal ultrasonography can be used to differentiate cysts from corpora lutea and may be helpful in diagnosing cyst type.
- History, conformation and uterine changes, when present, provide supplemental diagnostic evidence.

After a first diagnosis by ultrasound, cows should be treated with GnRH. Seven days later they should be checked and treated again if necessary with an Ovsynch® protocol plus a Progesterone Releasing Intravaginal Device (PRID).

4. Cystic ovarian disease

Recommendations on COD diagnosis and treatment

GnRH analogues: a combination of GnRH and prostaglandin (Ovsynch® protocol) is recommended to reduce the time to reintroduction into breeding.

GnRH followed by PGF2α after 7 days or complete Ovsynch® protocol.

Progesterone: they not only induce ovulation of the new dominant follicle, but also provide progesterone priming, which prevents recurrence of cystic condition.

Although **manual rupture** has often been used without any problems, the potential risk of causing trauma to the ovary and haemorrhage with subsequent local adhesions should not be overlooked.

5. Repeat breeding

Repeat breeding can be a major factor involved in infertility.

Keeping and analysing good oestrus and breeding records is key to calculate the percentage of repeat breeders in a herd. In general, if more than 15% of the cows require three services or more, repeat breeding should be considered a problem.

A repeat breeder cow is an animal that **has been inseminated at least 2-3 times without becoming pregnant,** despite having regular normal oestrus cycles, normal oestrus behaviour and no clinical abnormalities of the reproductive tract.

What are the possible causes involved?

Problems in the herd

- Inadequate oestrus detection.
- Inadequate semen or insemination techniques.

Problems with cows

- Endocrine disorders.
- Ovulation disorders.
- Early embryonic mortality caused by infections of the reproductive tract, etc.

A more recent study showed that repeat breeding in cows is a multifactorial problem involving both management and environmental factors, as well as factors related to the individual cow. They found that the risk of repeat breeding increased with:

- A decreased size of herd.
- An increased incidence of clinical mastitis and other disorders.
- An increased age.
- More calving difficulties (dystocia was the most significant risk factor directly associated with repeat breeding).
- Being repeat breeders in the previous lactation.

The treatment depends on the cause…

- The specific treatment programme for repeat breeding will depend on the **underlying cause or causes.**
- For example, it can be necessary **to check the efficacy of heat detection in the herd.** If it is adequate, the next step is to check the pattern of oestrus signs or the signs of uterine infections.
- Checking the **insemination technique** or the **timing of insemination** is also essential.
- If the herd has poor heat detection, **synchronization protocols** (with PRID®) need to be implemented in order to increase the service rate.

6. Abortion

Abortion in dairy cattle is commonly defined as a loss of the foetus between day 90 and day 265 of pregnancy.

Pregnancies lost between 30 to 90 days are usually referred to as early embryonic deaths.
Calves born dead between 260 days and full term are defined as stillbirths.

An annual abortion rate of up to 10 % is considered to be normal. However, a sudden and dramatic increase can be common and needs prompt action.

Common causes of abortion

The most frequent causes of abortions are infectious agents, but other factors not related to diseases should be taken into account.

Infectious causes

Bacteria

- *Actinomyces pyogenes*
- *Bacillus spp, Streptococcus* spp
- *Brucella abortus*
- *Haemophilus somnus*
- *Leptospira* spp
- *Listeria monocytogenes*
- *Ureaplasm diversum*
- *Mycoplasma bovigenitalium*

Virus

- BVD
- IBR

Other agents

- Fungi
- *Neospora caninum*
- *Trichomonas foetus*
- *Campylobacter fetus*

Non-nfectious causes

- Genetic abnormalities
- Heat stress
- Nutrition: phytotoxins

What to do in case of abortion?

First, collect samples to submit to the lab

Save and place the whole foetus and placenta in a clean bag, and refrigerate it as soon as possible. **Paired blood samples** may also help to diagnose an active infection in the cow, such as BVD or leptospirosis.

The first one, taken as soon as possible after the abortion is noted.

The second one after 2-4 weeks.

Then, prevent abortion problems

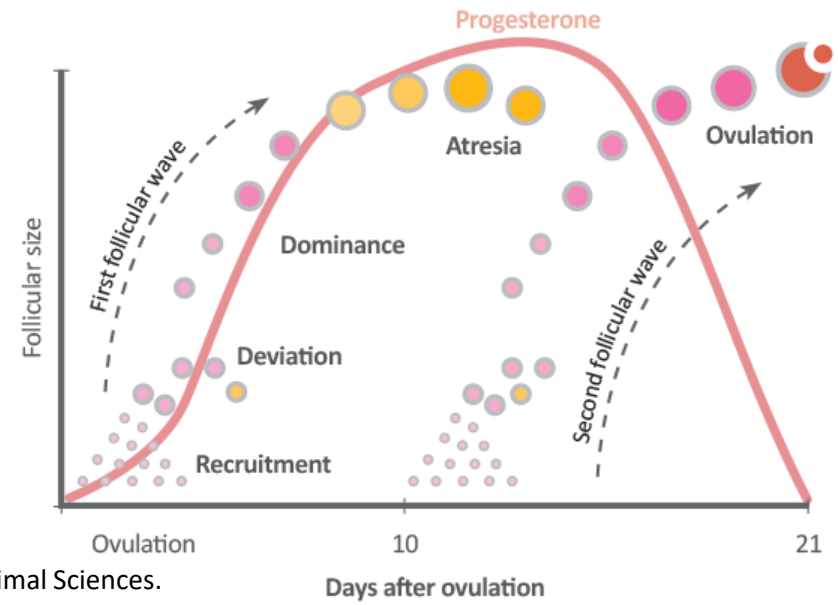
- Establish biosecurity practices to minimise the risk of introducing diseases onto the farm and the spread of disease within the herd.
- Maintain health and immune function of cows.
- Evaluate the feed for mycotoxins and other phytotoxins.
- Check the vaccine programme against infectious diseases that can cause abortions.
- Be careful not to administer drugs that can cause abortions to pregnant cows.
- Focus your attention on the bulls' health status.

7. Anoestrus

Fertility in the postpartum period is negatively influenced by the incidence of anoestrus, a condition characterised by the absence of oestrous behaviour.

The primary factors that affect reestablishment of ovarian cyclicity are the deviation and fate of the dominant follicle.

Anoestrus can be classified based on the three functional states of follicular development; that is, follicle emergence, deviation, and ovulation.



From: UW-Madison Animal Sciences.

Anoestrus and anovulation are very different conditions!

Anoestrus is the failure of cows to exhibit estrous; it is more commonly a problem related to oestrus detection.

While these cows are not observed in oestrus, they have normal oestrous cycles and will respond well to ovulation synchronisation programmes.

Anovulation is the failure of cows to ovulate. These animals have abnormal follicular development and abnormal oestrous cycles.

Classification of ovulatory failure

Ovulatory failure may be classified into three categories.

Very rare condition.

It may be due to a lack of follicle stimulating hormone (FSH).

Anovulation with follicle growth to emergence (< 9 mm small follicle)

Common occurrence, especially in prepubertal animals and in the postpartum period.

Characterised by the absence of a corpus luteum with follicles of ovulatory size.

Caused by a disruption of LH pulses that does not allow the final growth or oestradiol production by the post- deviation dominant follicle.

Anovulation with follicle growth to deviation (from 9 to 16 mm ovulatory size)

Caused by a lack of LH surge that does not allow the ovulation of the dominant follicle.
The physiological basis for large anovulatory follicles seems to be blockade of oestradiol-responsiveness at hypothalamus

Anovulation with follicle growth to ovulatory or larger size (> 16 mm large follicle)

The absence of oestrus behaviour may be an indication of…

… low body condition score (BCS)	Poor transition period management
… pathological conditions	Chronic debilitating diseases or uterine and ovarian diseases
… other factors	Body condition, lactation, breed, age…

It is well established that a poor nutritional status and negative energy balance are responsible for the majority of anoestrus cases in dairy cattle.

When and how to treat anoestrus and anovulation

It is important to identify and prevent the underlying cause of anoestrus. The treatment basically involves:

- **Optimal nutrition during the transition period and early lactation.**
- **Hormonal treatments.**

If oestrus is not detected…

… it is essential to synchronise oestrous with a synchronisation protocol (Ovsynch®), to establish good fertility records and to increase service rate.

If there is anovulation with follicle growth up to the emergence stage…

… FSH/PMSG treatment combined with PRID® can increase follicle growth. Once growth is enhanced, GnRH stimulates maturation and ovulation of the dominant follicle.

If there is anovulation with follicle growth up to the deviation phase…

… the Ovsynch® protocol together with PRID can help since many anovulatory cows have follicles of sufficient size and ovulatory capacity but lack of LH surge.

Thank you!