cafre
College of Agriculture, Food & Rural Enterprise

DAIRY HERD FERTILITY
CHALLENGE NOTE 4G - Artificial Control of the Oestrous Cycle

The oestrous cycle of cows can be controlled to induce oestrus and ovulation at a pre-determined time. This can be done through the synchronisation of a group of cycling animals or through the treatment of individual non-cycling (anoestrus) cows or those with abnormal cycles after calving (see Challenge Note 4d: The Problem Cow After Calving). The aim of controlled breeding is to:

- induce oestrus and ovulation at a pre-determined time;
- increase heat detection/submission rate or reduce need for heat detection;
- synchronise the oestrous cycles of a group of animals;
- allow fixed-time insemination.

Contents

Benefits of controlled breeding:

- higher heat detection rates with fewer missed heats and improved fertility, for example, reduced calving interval;
- infertile cows can be treated and served while still economically viable, and can reduce the need for culling;
- group synchronisation aids manage-ment as more cows exhibit oestrus on the same day with greater display of oestrous behaviour;
- AI can be used instead of natural service, particularly in heifers, where the rate of improvement in genetic merit can be increased;
- aid to achieving a tighter calving pattern,
- reduced financial losses from infertility.

Controlled breeding is only part of a package for improving fertility that involves both veterinary and nutritional management. Fertility problems are usually symptomatic of an underlying problem, frequently nutritional, which must be addressed first. Without correcting the underlying problem, a heat, even if induced, is likely to result in poor fertility. Selection of suitable candidates for controlled breeding result in conception rates of 60-70% in heifers and 50-55% in cows.

Synchronising a Group of Cycling Animals

To understand how sychronisation works, it is important to have a basic understanding of the oestrous cycle and the hormones involved (see Challenge Note 4A: **The Oestrous Cycle**). The oestrous cycle is generally controlled by manipulating the level of progesterone. This is done by treating a cow to either shorten or lengthen the progesterone phase of the oestrous cycle.

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Shortening the Progesterone Phase (Prostaglandin)

Prostaglandin is released naturally by the uterus at around day 16-18 of the oestrous cycle and causes a rapid decline in progesterone concentrations allowing the follicle present on the ovary at that time to mature and ovulate. The injection of prostaglandin derivatives (for example, Dalmazin, Enzaprost, Estrumate, Lutalyse, Prosolvin, etc) have the same effect but are only effective when a corpus luteum is present on one of the ovaries, that is, approximately days 6-17 of the cycle (Figure 1).

Injection of prostaglandin has no effect in controlling the oestrous cycle if no corpus luteum is present and progesterone concentrations are low. This includes the following groups of animals:

1) Cycling animals without an active corpus luteum - days 0-5 and days 18-21 of the oestrous cycle;
2) Cows that have not resumed oestrous cycles following calving or are undergoing a period of nutritional anoestrus;
3) Pre-pubertal heifers.

In a group of normally cycling animals at different stages of the oestrous cycle only 50-60% can respond to a single injection of prostaglandin. Therefore, synchronisation programmes using prostaglandin are based on two injections administered 10-12 days apart. At the second injection all animals should have an active corpus luteum, and respond to prostaglandin in about 90% of cases.

While the prostaglandin is an effective means of synchronising animals, the onset of oestrus can be spread over 2-5 days due to differing stages of follicle development on the ovaries at the time of injection. Various synchronisation programmes using prostaglandin have been devised as seen in Table 1.

Lengthening the Progesterone Phase (Progesterone)

Progesterone based systems of oestrous synchronisation lengthen the duration of the oestrous cycle by mimicking the production of progesterone by the corpus luteum. Progesterone is usually delivered through a progesterone-impregnated coil inserted into the vagina (for example, CIDR, PRID) and removed after a period of generally 10-12 days.

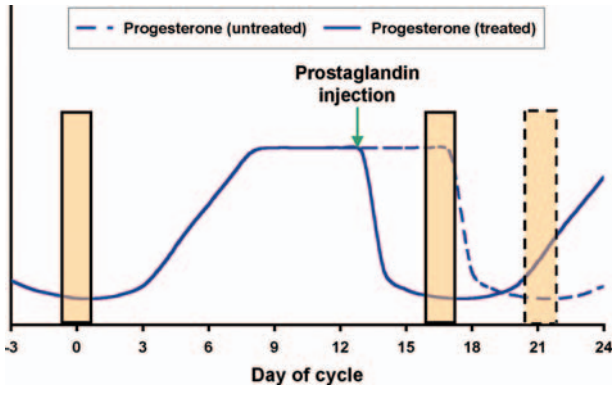

Figure 1: Shortening the oestrous cycle through prostaglandin injection. This is only effective when there is an active corpus luteum and progesterone concentrations are high.

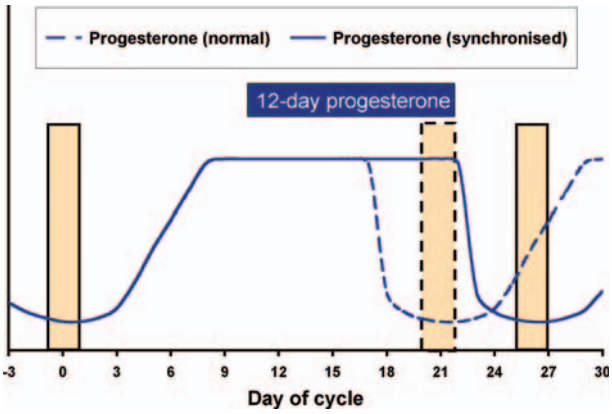

Figure 2: Lengthening the oestrous cycle through insertion of a progesterone device, which after removal induces heat and ovulation within a few days.

Table 1: Synchronisation regimes using prostaglandin.

a) Prostaglandin only and heat detect	
Method:	Inject prostaglandin and serve on visible heat. Re-inject at 11 days any cows that were not served, and fixed time AI at 72 and 96 hours.
Disadvantages:	Cows must be cycling. Better for cows than heifers, but requires heat detecting.
b) Prostaglandin only and fixed-time A.I.	
Method:	Two injections of prostaglandin given 11 days apart, so that cows which do not respond to the first injection are responsive to the second. In the USA an interval of 14 days is used, possibly reflecting longer inter-oestrus intervals in Holsteins.
Service:	Do not heat detect, but conduct fixed time AI at 72 and 96 hours (conception rates to double AI is 5-10% higher).
Disadvantages:	Cows must be cycling. Tightness of synchrony in cows is poor leading to poor conception rates, so best used in heifers with fixed time AI.
c) Prostaglandin and GnRH (Intercept or Ovsynch regime):	
Method:	Day 0 Inject with GnRH (e.g. Receptal or Fertagyl) to induce ovulation. Day 7 Inject prostaglandin to destroy corpus luteum. Day 9 Inject GnRH to tighten synchrony of ovulation. Day 11 Fixed time AI
Disadvantages:	Better than prostaglandin alone for anoestrus cows. Results have been variable, but better in cows than heifers.

Since the corpus luteum produces progesterone to maintain pregnancy, prostaglandin should NOT be administered to pregnant cows as it will cause embryo or foetal loss up to the fifth month of pregnancy. Breeding records should be checked and/or pregnancy diagnosis performed to ensure that there is no possibility of the cow being pregnant before administering prostaglandin.

Table 2: Synchronisation regimes using progesterone.

a) 12-day progesterone device (PRID) with oestradiol capsule:	
Method:	Simple programme. 85-90% of cows are in heat 2-4 days after removal. AI at 56 hours, or at 48 and 72 hours. Normal fertility compared to natural heats. Discharge at removal of implant is temporary, and does not affect fertility.
Disadvantages:	8-12% not well synchronised, so continue to heat detect, and AI at visible heat. Cost. 5% implant loss. Trimming length of strings helps.
b) 8-day progesterone device (CIDR) with prostaglandin 1 day before removal:	
Method:	Day 0 Insert CIDR. Optional oestradiol/GnRH gives better synchrony. Day 7 Inject prostaglandin. Day 8 Remove CIDR. Day 10 A.I.
Disadvantages:	8-12% not well synchronised, so need to continue heat detecting. Cost. 5% implant loss.

After removal of the progesterone device, concentrations of progesterone decrease as seen in Figure 2, allowing a large follicle on the ovary to develop to maturity and ovulate. The majority of animals come into heat 2-3 days after the end of progesterone treatment. Synchrony with progesterone-based systems tend to be much tighter than those based on prostaglandin. They are therefore more effective for programmes using fixed time AI and embryo transfer where tight synchrony is critical.

The duration of progesterone treatment can be reduced to 8 days if prostaglandin is injected at progesterone device removal. This causes the level of natural progesterone to fall in animals that have an active corpus luteum. Various synchronisation programmes using progesterone are shown in Table 2.

Any synchronisation regime can give acceptable results but there are weakness in all programmes, Early pregnancy diagnosis at around 42 days from the start of the synchronisation programme is essential for early identification of non-pregnant cows.

Reasons for Failure of Controlled Breeding Programmes

The greatest cause of poor results is poor selection of candidate animals. Cows should be at least 42 days calved, with a body condition score of 2.0+ and on a rising plane of nutrition. Loss of body condition from calving should not be excessive and changes in diet should be avoided. Other points to consider should include:

- Sympathetic handling to reduce stress;
- Vaccination regimes, for example, BVD;
- Routine treatments should be given prior to service, for example, boluses;
- Heifers of sufficient age and liveweight;
- Poor timing of AI;
- Poor semen quality or AI technique;
- Overwork of bull, or undiagnosed sub-fertility if using natural service.

Summary

- The oestrous cycle can be controlled to induce heat in individual animals or groups of animals at a pre-determined time.
- Prostaglandin is used to shorten the oestrous cycle but is not effective in all animals as it relies on the presence of an active corpus luteum.
- Progesterone is used to lengthen the oestrous cycle and can be used to stimulate the resumption of cyclicity in non-cycling (anoestrus) cows.