

Estrus synchronization in cattle

Reasons for estrus control

The estrous cycle can be regulated pharmacologically to induce or control the time of estrus and ovulation. The main reasons for estrus control are:

- 1- Induction of estrus in dairy cows not observed in estrus by 45 days post partum.
- 2- Synchronisation of groups of heifers for insemination with semen of 'easy calving' bulls.
- 3- Reduction of the time necessary for estrus detection.
- 4- To facilitate the use of AI under extensive conditions.
- 5- Synchronisation of donor and recipient cattle for embryo transfer.

Methods of estrus control

In cattle with active ovaries, the estrous cycle can be manipulated in three ways:

- 1- by the use of prostaglandins, to induce early regression of the corpus luteum.
- 2- by the sequential use of prostaglandins and GnRH analogues to obtain synchronised follicular development after an induced luteolysis
- 3- by the use of progestagens that act as an artificial corpus luteum.

Prostaglandins

Between day 6 and day 16 of the cycle (the period of natural progesterone release) an injection of prostaglandin (Prosolvlin®, Preloban®, Iliren®) will induce regression of the corpus luteum ending the luteal phase. A new follicular phase begins and the animal will come into oestrus and ovulate. The fertility at the induced oestrus is similar to that of a natural oestrus.

For the synchronisation of a group of cyclic animals, likely all to be in different and unknown stages of the cycle, one injection is not sufficient. A second injection should be given 11-13 days later, because, by then, all animals should have a functional corpus luteum.

Insemination at an observed oestrus will give the best conception rates and is recommended for adult dairy cows in particular.

Heifers show a more synchronous response. Fixed time insemination at 72 and 96 hours can be used in cycling beef and dairy heifers. Because prostaglandins act on the corpus luteum, they can only be effective in cycling cattle.

First injection of PGF@ 0 day

Pro-estrus	not respond	➔	Di- estrus (after 10 days later)
Estrus	===	➔	Di- estrus (after 10 days later)
Met- estrus	===	➔	Di estrus (after 10 days later)
Di-estrus	respond	➔	estrus (2-3 days) ➔ Diestrus (after 10 days later)

Second injection of PGF@ 10 days later

All animals will respond and enter to estrus stage

Application in dairy heifers.

Generally the objective is to synchronise oestrus in groups of animals intended to be bred by artificial insemination. Ovarian inactivity is rare in well-managed dairy heifers. Two injections with an interval of 11 days, followed by insemination at 72 and 96 hours is the most practical program.

Application in dairy cows.

Failure to detect oestrus is the main cause of sub-optimal fertility in dairy cows. Control of the timing of luteolysis will help estrus detection. Commonly these cows are examined per rectum to determine the stage of the cycle.

When treated after day 6 of the cycle, cows can be inseminated at the next observed oestrus, 3-4 days after prostaglandin injection. For animals in pro-oestrus, no treatment is required and estrus can be predicted. In both cases the farmer knows which animals to watch closely, which will greatly improve the estrus detection rate.

Cows in the early luteal phase will not respond to prostaglandins. They can be treated with prostaglandins one week later .

Groups of dairy cows can be synchronised using two prostaglandin injections 11-13 days apart, but the degree of synchronisation achieved means that better results are obtained by insemination at the next observed oestrus than by fixed time insemination.

Prostaglandins and GnRH analogues

The program sometimes known as Ovsynch. is primarily indicated for dairy cows and involves two injections of a GnRH analogue separated by a single administration of PGF_{2a}.

GnRH ----- PGF₂----- GnRH ----- AI

It has been shown that gonadotrophin-releasing hormone analogues administered during the luteal phase will bring ovulation or atresia of the dominant follicle leading to the emergence of a new wave of synchronised follicular development. The optimal period between the first GnRH and the prostaglandin injection is mainly determined by the sensitivity of the developing corpus luteum to the luteolytic action of prostaglandin. A period of 7 days is postulated by most authors. If prostaglandin is given approximately 7 days after GnRH then luteolysis occurs when a dominant follicle of a new wave approaches its maturity. The second injection of GnRH advances the time of the LH surge which in turn hastens and synchronizes ovulation.

The ovulatory response in dairy cattle has been tightly synchronised and occurs approximately 26-32 hours after the second GnRH injection. Thus a timed insemination at 17-24 hours after GnRH should result in a high probability of successful conception.

GnRH on day 0, followed by PGF_{2α} on day 7, followed by GnRH on day 9 or 10.

There are two rationales behind the use of the first GnRH treatment.

Firstly, it ensures that a new dominant follicle has emerged at the time of prostaglandin treatment and can grow and ovulate.

Secondly, it can extend the life span of the CL in late dioestrus so that it is still responsive to PGF_{2α} 7 days later.

The second injection of GnRH should ensure better synchronisation of ovulation by stimulating the preovulatory LH surge .

Tighter synchrony of the emerging follicular wave allows for fixed time insemination and eliminates the necessity for close observation. This increases the value of the this program significantly when oestrus detection is the limiting factor in managing a herd's fertility.

Progestagens

Progestagen treatments, such as Crestar®, mimic the luteal phase of the cycle.

To obtain a normally fertile oestrus, the duration of treatment has been set at 10-12 days.

To ensure that the natural corpus luteum has regressed by the end of treatment, progestagens must normally be combined with a luteolytic factor.

In non-cyclic cows the progestagen sensitises the hypothalamopituitary-gonadal axis. This allows the use of progestagens in cattle with inactive ovaries.

The administration of PMSG when the progestagen is removed stimulates follicular maturation and ovulation.

The progestagen priming ensures a normal lifespan for the corpus luteum.

Oestrus and ovulation, after treatment with progestagens, occur earlier and with more precise timing than occur following prostaglandin injection.