Control of oestrus

Reasons for oestrus control

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

- Induction of oestrus in dairy cows not observed in oestrus by 45 days post partum.
- Synchronisation of groups of heifers for insemination with semen of ‘easy calving’ bulls.
- Reduction of the time necessary for oestrus detection.
- To facilitate the use of AI under extensive conditions.
- Synchronisation of donor and recipient cattle for embryo transfer.
- Induction of ovarian activity in beef cows with lactational anoestrus.

Methods of oestrus control

In cattle with active ovaries, the oestrous 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 prostaglandin F2 release) an injection of prostaglandin (Prosolvin®, 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.

In lactating dairy cows, in particular, the interval between prostaglandin injection and the onset of oestrus is more variable. This variability in response to prostaglandin injection can be explained by the follicular dynamics during the oestrous cycle.

Using ultrasound techniques it has been found that two or three waves of follicle development occur during each ovarian cycle. The interval between injection and oestrus varies depending on the status of the ovary at the time of prostaglandin administration, i.e. the presence of small, intermediate or large (dominant) follicle(s). A large, growing follicle needs less time to mature and ovulate than a small follicle that needs to undergo the complete development process.

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.

Prostaglandins can be used in several different ways for oestrus control depending on the intentions of the herdsman, the type of animal and the conditions on the farm.

**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 programme (see Table 9).

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

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2Bovine Reproduction

oestrus 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 oestrus can be predicted. In both cases the farmer knows which animals to watch closely, which will greatly improve the oestrus detection rate.

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

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 PGF2a.

GnRH ------- PGF2------- GnRH ------- AI

Because, in the field, synchronisation is likely to be used in cows which might be at any stage of the oestrous cycle, combining GnRH with prostaglandin treatment leads to a greater homogeneity of ovarian follicular status at the time of induction of luteolysis. As a result the precision of oestrus after prostaglandin-induced luteolysis and the synchrony of the LH surge are both improved, which allows the synchronisation of both follicular development and regression of the corpus luteum.

This program gives the best results in cows that are already cycling.

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 synchronises ovulation.

The ovulatory response in dairy cattle has been tightly synchronised and occurs approximately 26-32 hours after the second
GnRH injection (Silcox et al., 1993; Burke et al., 1996). Thus a timed insemination at 17-24 hours after GnRH should result in a high probability of successful conception.

Most trials postulate a maximum 24-hour period between the last GnRH and insemination (Peters et al., 1999). Limited variations in that interval should be acceptable, however. Experience from practice indicates that changes in the usual insemination day schedule, made for the sake of the rigorous implementation of the proposed timetable, might affect the results more than AI a few hours later than suggested. 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.

Coleman et al (1991) and Twagiramungu et al (1992) reported that the fertility rate of cows synchronised with GnRH and PGF2α varied between 35 and 65% and was similar to that of control animals inseminated at first observed oestrus.

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. The options are: the administration of oestradiol at the start of the treatment or the injection of prostaglandins at the end. Oestradiol not only shortens the lifespan of the corpus luteum but also affects the follicular dynamics. Oestrogens administered at the time of insertion of the progestagen implant induce the suppression of a dominant follicle and the emergence of a new follicular wave. This treatment has been shown to be effective, in numerous studies, regardless of the stage of dominant follicle development (growing, static or regressing) at the time of treatment (Dierschke et al., 1994; Bo et al., 1995). This improves not only the synchrony of the resultant follicular growth but also the fertility of the induced oestrus.

In non-cyclic cows the progestagen sensitises the hypothalamopituitary-gonadal axis. This allows the use of Crestar® 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. For Crestar® a single, fixed time insemination is recommended.

Application in dairy heifers.
The basic program is recommended in dairy heifers, followed by a single, fixed time insemination at 48 hours after implant removal.

Figure 1 Crestar program for dairy heifers.

Application in dairy cows.

In lactating dairy cows the treatment program includes the administration of PMSG when the implant is removed to stimulate follicular development, ovulation and oestrus. The treatment is also combined with PGF2α two days before removal of the implant. See Table 8.

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2Bovine Reproduction

* For non-cyclic animals 400-500 IU Folligon at implant removal

Crestar implant + injection

AI remove implant*

48 hrs.

Day 0 1 2 3 4 5 6 7 8 9 10 11 12

9 or 10 days

Table 8 Conception rates in dairy cows following different Crestar programmes.
Number of Crestar implant 500 IU PMSG PGF22 days % pregnant from animals + injection at implant before implant AI at induced removal removal oestrus

56 + - - 47
64 ++ - 50
60 + - + 59
60 ++ + 65

Unpublished results Intervet

The rationale for prostaglandin injection lies in the high incidence of persistent corpus luteum in dairy cows. The corpus luteum may persist on the ovary of progestagen treated cows in spite of the earlier oestradiol valerate injection. Bearing this in mind, veterinary practitioners using Crestar synchronisation in high-yielding dairy herds should not omit the prostaglandin injection two days before removal of the implant.

The Crestar program provides a very precise timing of oestrus and ovulation, which allows a single, fixed time insemination at 56 hours after implant removal. See Table 9.

Table 9 Pregnancy rates in dairy heifers and cows following a single fixed time insemination after Crestar treatment.

Number Timing of AI after % pregnant from AI treated implant removal at induced oestrus

Heifers* 189 48 h 66.6
Application in beef heifers.

Because true anoestrus is common in beef heifers, an injection of PMSG when the implant is removed is recommended, followed by a single insemination at 48 hours, as for dairy heifers.

Application in beef cows.

Lactational anoestrus is very common in beef cows; it explains the failure of many synchronisation programs which ignore the fact. By contrast with prostaglandin injections, Crestar® can be used in both cyclic and non-cyclic cattle. To stimulate ovarian activity and to obtain a precise good quality oestrus, the administration of PMSG at the time of implant removal is recommended. Insemination should take place at 56 hours after implant removal.

The dose of PMSG (Folligon®) depends on the breed, the season, the percentage of cycling cattle and their nutritional status. In general, a dose of 400-700 IU is acceptable. Over-dosing with PMSG leads to an increased rate of multiple births. Table 10 shows an example of the efficacy of treatment with Crestar® and PMSG for inducing a fertile oestrus in groups of suckled non-cyclic Salers beef cows.

Prostagens + GnRH
There have been an increasing number of publications showing a possible incorporation of GnRH instead of oestradiol esters into the progestagen-based oestrus synchronisation/induction programs used in the cattle. So far the results obtained with GnRH administration at the start of progestagen treatment have been very encouraging with conception and pregnancy rates comparable to the original programs. Moreover GnRH modified systems maintained their efficacy also in non-cycling animals and seem to be useful also for the heifers.

Table 10 Effect of Crestar and 700 IU of PMSG on the induction of fertile oestrus in suckling beef cows (Salers breed).

<table>
<thead>
<tr>
<th>Year</th>
<th>% of cattle with active ovaries*</th>
<th>% and actual % calving</th>
<th>% twinning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>numbers (..) from AI at calving</td>
<td>from AI at induced oestrus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>Oestrus +</td>
</tr>
<tr>
<td>1978</td>
<td>23</td>
<td>94</td>
<td>63 (99/157)</td>
</tr>
<tr>
<td>1979</td>
<td>17</td>
<td>93</td>
<td>50 (63/127)</td>
</tr>
<tr>
<td>1980</td>
<td>19</td>
<td>96</td>
<td>63 (102/161)</td>
</tr>
<tr>
<td>1981</td>
<td>38</td>
<td>95</td>
<td>65 (99/153)</td>
</tr>
<tr>
<td>1982</td>
<td>27</td>
<td>100</td>
<td>62 (56/90)</td>
</tr>
</tbody>
</table>
Total 23 95 61 (419/688) 79 5

Unpublished results Intervet

* Ovarian activity measured by progesterone levels in plasma (2 samples taken 10 days apart before Crestar - one sampling 10 days after removal of Crestar implant).

** Cumulative calving percentage upon induced oestrus and AI during the 30 day period following the induced oestrus.