Alberta Dairy Management
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Timed Insemination Eliminates Heat Detection

Accurate heat detection has been a long-standing problem in the dairy industry. Current figures indicate that about 50% of heats go undetected in the average North American dairy herd. Further, recent reports indicate that anywhere from 5% to 30% of cows are inseminated when not in estrus. Such inefficiencies result in major economic loss.

Pregnancy rate is the product of heat detection rate and conception rate. For example, if the heat detection rate in a herd is 50% and the conception rate is 50%, then the pregnancy rate of the herd is only 25% (50% of 50%). Therefore, if the inefficiency of heat detection is eliminated from this equation, pregnancy rates could be increased. If both follicular growth and ovulation could be synchronized and cows inseminated at a fixed time, heat detection would become unnecessary.

A recent development makes this possible. The timed insemination protocol involves a series of three injections using gonadotropin releasing hormone (GnRH) and prostaglandin $F_{2\alpha}$ (PGF). This method of synchronization is also known as *Ovsynch*. The injections are administered at strategic intervals. It is convenient and practical to have all injections done at the same hour in the afternoon with insemination performed in the morning. The suggested injection schedule and the purpose of each injection is shown in table 1.

How critical are the time intervals?

The day of the week or time at which the treatment is initiated is not important, but it is important to strictly follow the sequence and time intervals between treatments.

For example, the first day of treatment (day 0) could be any day of the week or of the estrous cycle. However, what is critical is the 7 days between the first GnRH and PGF, 2 days between PGF and second GnRH, and 16 hours between second GnRH and AI. The 16 hour interval between second GnRH and AI is recommended for best conception rates. However, this is somewhat flexible, as acceptable rates of conception occur in cows inseminated anywhere from 0 up to 32 hours after the second GnRH injection.

How do the injections work?

First GnRH injection:

The main purpose of the first GnRH injection is to initiate growth of a new group of follicles, of which one will eventually (10 days later) become the ovulatory follicle. GnRH acts on the pituitary gland to release two hormones, follicle stimulating hormone (FSH) and luteinizing hormone (LH). As its name indicates, FSH stimulates follicle growth in the ovaries, whereas LH acts on large LH-responsive follicles to cause ovulation. LH is also known to enhance corpus luteum (CL) function and increase the secretion of progesterone which, at high blood concentration, prevents the cow from returning to estrus.

If a large follicle happens to be present on the ovary at the time of GnRH administration, it may ovulate in about 50-80% of animals, leading to the formation of either a primary or a secondary

Day of Treatment	Day of Week & Time[a]	What To Do	Main Purpose	Efficiency
0	Monday 4 pm	GnRH[b]	To initiate new follicle growth	100%
7	Monday 4 pm	PGF[c]	To regress corpus luteum	> 90%
9	Wednesday 4 pm	GnRH[b]	To cause ovulation of new follicle	> 95%
10	Thursday 8 am	AI	To get semen into the cow before ovulation occurs	100% Insemination Rate

[a]Day of Week & Time shown are examples only
[b]2 ml of Cystorelin, Factrel, Receptal or Fertiline
[c]2 ml of Estrumate or 5 ml of Lutalyse

Table 1 : Protocol for timed insemination. GnRH: gonadotropin releasing hormone, PGF: prostaglandin $F_{2\alpha}$.

CL. The ovulatory response of the follicle depends on the stage of the estrous cycle. In any case, the newly formed CL would be 6 days old at the time of PGF injection.

PGF injection:

The role of PGF given 7 days after first GnRH is to destroy the CL, causing a sharp decline in blood progesterone concentration. This allows rapid growth of the newly selected follicle and prepares it for ovulation.

Second GnRH injection:

The GnRH injection which is given 2 days after PGF injection causes the release of LH which is essential for ovulation to occur. The interval between the second GnRH and occurrence of ovulation is about 30 hours. Since all animals on the program receive the second GnRH injection at the same time, ovulation is synchronized. For best conception rates, insemination must be done about 15 hours before ovulation occurs.

What if cows are in heat before the appointed time of insemination?

If cows come into heat at or after PGF injection but before the second GnRH injection, they should be inseminated at standing heat or 12 hours after the first signs of observed heat (see article **2B2**), as they are unlikely to conceive to timed insemination at the appointed time. However, only a small percentage of cows (<10%) may show signs of estrus before second GnRH injection. Cows detected in estrus and inseminated before the appointed time need not receive the second GnRH injection.

Advantages and disadvantages of timed insemination

The advantages of timed insemination outweigh the disadvantages. The main advantage is the ability to inseminate cows without heat detection at an appointed time. If properly implemented, this system can be easily integrated into the routine of a dairy operation with no additional labour or time commitment. It allows the producer to precisely control the day of first insemination rather than setting a voluntary waiting period as traditionally done. For animals in poor body condition, first insemination may be delayed until body condition is restored. Since many animals can be inseminated at one time, pregnancy diagnosis and management of pregnant animals, calving management and the care of newborn calves becomes very practical.

The treatment protocol is known to initiate cyclicity in non cyclic postpartum cows. It also significantly reduces days to first insemination and days open. It can be used to effectively synchronize recipients for embryo transfer, making the management of a large number of recipients possible under field conditions, without heat detection.

At current Canadian prices, treatment cost is approximately $12 per cow. Economic evaluation on the use of timed insemination in Canadian dairy farms is not available at present, but a study in Florida reported an increase in net revenue of $118 per cow when timed insemination was implemented under summer heat stress conditions. Costs per cow associated with the control (insemination at detected estrus) and timed insemination groups were calculated after following reproductive performance for a 365 day period. The timed insemination group had a greater percentage (87.0 %) of pregnant cows by 365 days vs control group (77.9 %), 22 less days open (153.2 vs 175.7 days) and fewer cows culled for reproductive failure (12.9% vs 22.0%).

Current results indicate that significant improvement in pregnancy rates cannot be expected in well-managed herds where heat detection is quite efficient. However, in poorly managed herds where heat detection is a perennial problem, timed insemination can improve pregnancy rates considerably. Future research will further refine the timed insemination system, so that a greater percentage of animals will respond to the synchronization procedure, leading to higher pregnancy rates.

An increase in the number of times animals need to be handled and a marginal increase in the cost of drugs are the chief disadvantages. Since the protocol does not yield consistent results in heifers, it is recommended only for cows.

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