Alberta Dairy Management
PREPARED FOR AND DISTRIBUTED BY THE DAIRY EXTENSION ADVISORY GROUP

# Getting Cows Bred
## 2. Heat Detection and Insemination

Efficient reproduction in a dairy herd is the primary determinant of profitability. In a study of a 300-cow Michigan dairy herd, a 5% increase in conception rate alone increased yearly net income by $1226. Decreasing days to first service from 80 to 60 days, increasing heat detection efficiency from 50 to 60%, and increasing conception rates from 35 to 50% combined to yield an increased net income of $18,485.

## Heat Detection

The greatest limiting factor to successful fertilization is associated with detection of estrus. It is estimated that approximately 50% of the heats go undetected on the average dairy farm in the U.S. There are two important challenges in heat detection. The first is accurately recognizing signs of estrus and the second is catching all possible heats in breeding heifers and cows.

### Signs of Estrus

Proper timing of insemination only occurs when those doing the inseminating have a thorough understanding of the physiological events associated with estrus, ovulation, and fertilization (see figure 1). Signs of heat such as mounting and standing are influenced by:

- number of sexually active animals in a group;
- freedom for sexually active animals to interact;
- freedom from interfering activities;
- ambient temperature, and;
- footing conditions.

Behavioral signs of heat require that at least two animals interact. Activities or conditions that restrict interactions among cows influence whether cows show heat. Cows that are eating or are crowded in holding pens or alleys do less mounting. Cows that are on slippery alleys, frozen ground, or any surface that makes footing tenuous show less mounting activity.

Table 1 indicates relative mounting activity that one might expect to observe in various locations and conditions on dairy farms. A value of 1.0 is assigned to mounting activity expected to occur on a relatively dry, grooved concrete alley. A higher or lower index means more or less mounting activity, respectively. Secondary signs such as butting, licking, and head-resting are influenced less by environmental conditions than are the primary signs of heat, such as mounting and standing.

Energy balance during the early postpartum period can influence whether a cow is detected in heat at the beginning of the first postpartum cycle. Once cycles have begun, energy balance does not seem to affect intensity or duration of heat, but might affect level of fertility.

Extremes in temperature affect intensity of heat. Mounting activity is lower on very hot or cold days than on days when the temperature is near the thermoneutral zone of the cow (0 - 10°C).

### Ovulation

Ovulation occurs 24 to 30 hr after the onset of heat (average of 27 hr) and is triggered by the hormones that also cause the cow to display estrus. Once the egg is ovulated, its viable life is less than 12 hr unless it becomes fertilized (see figure 1). Secondary signs of estrus may be visible for up to 40 hr before and up to 20 hr after the onset of heat.

## Insemination

### Viable Sperm Life

If frozen-thawed semen is properly handled, it will have a viable life span of approximately 24 hr in the female reproductive tract. Sperm are not capable of fertilizing the egg immediately upon thawing and deposition into the uterine body of the female. They must traverse the uterine horns

| Location of cows during heat detection | Mounting Index |
|---|---|
| Milking parlor | 0.1 |
| Feed bunk while eating | 0.2 |
| Holding pen | 0.3 |
| Dry concrete alley | 1.0 |
| Dry concrete alley + movement | 1.1 |
| Dry dirt lot | 1.6 |
| Dry dirt lot + movement | 1.8 |

*Table 1: Relative indexes of mounting activity.*

to the uterotubal junction, enter the oviduct, and complete a maturation process known as capacitation. It requires about 6 hr for normal, motile sperm to reach the lower portion of the oviduct, during which time the process of capacitation is completed. The subsequent 16 hr is the period of maximal fertile life of the sperm, followed by rapidly declining motility and fertility.

## Semen Handling Techniques

Recommended techniques for handling semen include the following precautions:

- when removing straws for thawing, prevent exposure of other straws by keeping them below the frost line of the tank;
- thaw straws in water at 37°C for at least 40 seconds;
- once thawed, provide thermal protection to the breeding unit in the French gun by keeping it at near body temperature until the semen is deposited in the female.

Failure to observe these precautions may result in damaged sperm membranes, cold and heat shocked sperm, or impaired sperm motility. The final result is an overall reduction in the fertile life of the thawed sperm in the straw. Figure 1b illustrates how reduced fertile sperm life can narrow or restrict the window of opportunity for proper timing of insemination.

## Timing of Insemination

The key to proper timing of insemination and maximizing fertilization rates is to inseminate cows at a time to allow ovulation to occur when there are adequate numbers of motile sperm in the oviduct. Based on observation at 12 hr intervals, cows should be inseminated about 12 hr after first detected in heat. Because we do not know the exact hour when heat begins, we can estimate that on the average, the female detected in heat at either daily observation period has been in estrus for about 6 hr. So, when inseminated 12 hr after first detection, the female is likely bred about 18 hr after the onset of heat or approximately 6 to 12 hr before ovulation.

This breeding scheme allows ample time for sperm transport and capacitation, and allows an overlap of the fertile life of both the egg and the sperm, even if the timing is off by as much as 6 hr.

Inseminations based on secondary signs of heat such as mucous discharge, muddy flanks, activated heat mount detectors, or smudged tail chalk could result in carrying out inseminations too early relative to ovulation (figure 1c). In such cases, the viability of sperm cells is marginal or absent before ovulation. If more than 20% of the cows are still exhibiting standing activity 12 or more hours after insemination, it is possible that the inseminations were performed too early in estrus.

## Semen placement

Improper placement of semen in the reproductive tract can also limit fertilization. The target for insemination is the uterine body although, when in doubt, deposition of the semen slightly into one or both uterine horns is less likely to compromise fertility than when placed only in the cervix. Because approximately 85 to 90% of the inseminate is expelled from the female by retrograde flow, it is critical that all of the semen be placed in the uterus.

Errors in semen placement are common among professional technicians. A recent survey indicated that below-average technicians only placed the inseminate in the target site (body of uterus) about one-third of the time compared to 85.7% accuracy by above-average technicians. Nearly 25% of the time, semen was not even placed in the uterus by below-average technicians.

*adapted and condensed from a presentation at the 1997 Western Canadian Dairy Seminar by:*

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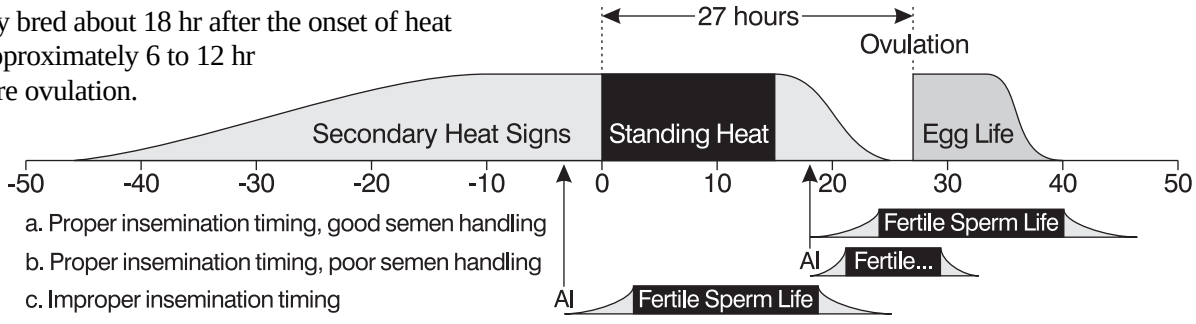


*Figure 1 : Time scale summary of physiological events associated with estrus and AI timing.*