DAIRY HERD FERTILITY
CHALLENGE NOTE 2A - Heat Detection

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A high rate of heat detection is critical to achieving a successful breeding programme to artificial insemination (AI). To ensure efficient heat detection, it is important for dairy farmers to have an awareness of both primary and secondary signs of heat. This Challenge Note outlines factors that affect the cows' behaviour while on heat and management factors that affect heat detection efficiency on commercial dairy farms and aims to make you more efficient at heat detection.

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Primary Sign of Heat

The primary sign of oestrous activity is when a cow stands to be mounted by another animal. Therefore cows should be able to interact freely with each other to encourage heat activity and heat detection. The average duration of standing heat was generally considered to last 15-18 hours, but recent studies have shown that in today's dairy cow:

• Heats are shorter (5-10 hours);
• Fewer cows show standing heat;
• There are fewer mounts (5-10 mounts).

Figure 1: The primary sign of heat – cow standing to be mounted.

Secondary Signs of Heat

It is increasingly important to look for the numerous secondary signs of heat to improve heat detection efficiency (Figure 2). These are displayed in the days before, during and after the period of standing heat and can help draw attention to particular animals to observe more closely.

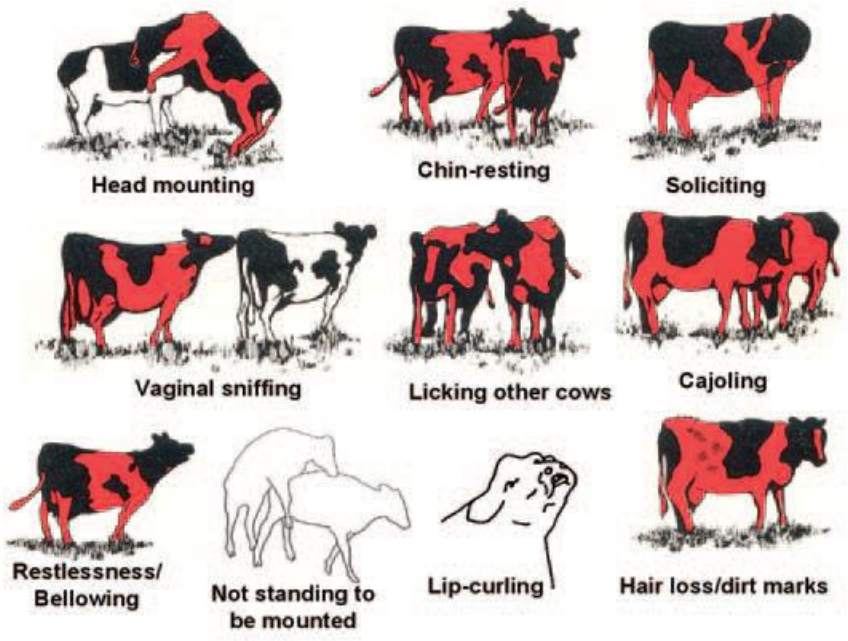

Figure 2: Secondary signs of heat.

The list in Figure 2 is not definitive, with other secondary signs of heat including:
• Reddening of the vulva;
• Reduced appetite and milk production;
• Eating at times when other cows are resting;
• Bloody mucous 1-3 days after heat.
In herds where the incidence of standing heats is low, it is essential that farmers look for secondary signs of heat and know the relative importance of these compared to the primary sign of heat (Table 1). Breeding records can be a useful aid to heat detection, particularly a calendar, diary or breeding board which can be used to identify cows likely to come on heat based on heats or services 3 weeks previously.

Table 1: Relative importance of the secondary signs of heat.

Behaviour	Importance
Standing heat	**********
Head mounting	*****
Attempting to mount others	*****
Chin resting	***
Vaginal sniffing/lip curling	**
Not standing to be mounted	**
Restlessness	*
Cajoling	*
Soliciting	*
Vaginal mucous discharge	*

Source: adapted from van Eerdenberg (Holland)

Factors that Affect Heat Behaviour in Dairy Cows

The ability of a cow to express heat is affected by a number of factors:

Stage of oestrous cycle - cows on heat are more likely to be involved in mounting activity than cows in the few days before or after heat (Table 2).

Presence of bull - Cows in heat generally seek out the bull. Therefore the bull pen should be convenient to the winter cow housing, and ideally located adjacent to free roaming space where cows tend to gather and exhibit oestrus behaviour. The placement of bull pens in milking parlour collecting areas should be avoided as this may restrict cow flow through the parlour.

Table 2: Stage of cycle effects on mounting activity.

Stage of cycle	% of mounts
Pre-heat	19
Heat	67
Post-heat	9
Mid-cycle	5

Number of animals in heat - When more than one cow is in heat at the same time, the number of mounts per cow can be more than doubled (Table 3). This happens more frequently in seasonal calving herds where a number of cows are ready for breeding around the same time and heat detection efficiency tends to be higher

Table 3: Effect of number of cows in heat on mounting activity.

Number of cows in heat	Avg. no. mounts per cow in heat
1	11
2	37
3	53
4 or more	50

Source: University of Guelph (Canada)

Nutritional status - Any sort of stress can shorten or inhibit the display of heat. Loss of body condition after calving is normal but excessive negative energy balance in early lactation can prolong the interval to resumption of normal oestrous cycles, increase the incidence of abnormal /irregular oestrous cycles and possibly reduce the amount of oestrous activity in cows that are cycling regularly.

Lameness/disease - Lame cows are less likely to mount, but if they are in a lot of pain may stand to be mounted rather than move away, giving rise to false heats. They also tend to have reduced forage intake and negative energy balance. Any disorder that places the cow in negative energy balance or reduces normal behavioural activity can reduce heat activity.

Housing factors - Cows must have adequate space and sure footing to promote mounting activity and allow sufficient cow interaction. Footing is generally better outdoors than in housed accommodation (Table 4). When housed, high stocking densities can reduce the amount of heat behaviour and increase the risk of inaccurate cow identification. Ideally, a loafing area with plenty of space and a solid non-slip surface should be provided to encourage mounting activity as cows are less likely to mount on slippy or uneven surfaces. Cows on slatted floors have shorter heats and only half as many mounts as cows on softer underfoot conditions such as grass, straw-bedded yards or woodchip pads.

Table 4: Heat activity of cows housed over winter and at pasture during summer.

	Winter housed	Summer pasture
Standing heat (hrs)	8-16	16-28
No. of mounts	40-80	80-120

Source: Webster (1993)

Weather - Mounting activity is reduced during cold and/or wet weather, especially outdoors, and in very wet ground conditions.

Time of day - Cattle are generally most sexually active around dawn and dusk, but routine practices in the morning such as milking, feeding and cleaning tend to reduce the expression of mounting activity at this time. Heat detection should ideally coincide with the times of greatest sexual activity to maximise heat detection efficiency.

Table 5: Cows showing signs of heat over a 24 hour period.

Time	Cows showing signs of heat (%)
6 a.m. – noon	22
Noon – 6 p.m.	10
6 p.m. midnight	25
Midnight – 6 a.m.	43

Source: Webster (1993)

Mineral status - Low levels of dietary phosphorus, cobalt, copper and manganese can all reduce heat behaviour, while high levels of molybdenum reduce copper availability causing the same effect. It is therefore important to ensure maintenance of the correct mineral and trace element balance.

Management factors - anything that distracts cows attention can be detrimental to mounting activity and heat detection. Cows are more reluctant to show signs of heat around milking and feeding times so heat detection efficiency at these times is reduced. Mounting activity can also be reduced by non-routine practices such as silage making and building work.

Management Factors Affecting the Expression of Heat

While a cow on heat may exhibit mounting behaviour, there are various factors related to environment and general management that can affect the ability of the farmer or stockperson to see cows on heat, and hence heat detection efficiency. These factors include:

Cow identification - Clear and unique identification of all cows in the herd should be possible at a distance of up to 10 metres. While cows can be identified through use of plastic eartags and neckbands, freeze branding is recommended as it permanently identifies cows. This will enable accurate records to be kept, particularly in larger herds where clear identification is crucial for effective staff communication.

Use of records - All pre-breeding heats and services should be recorded as they are a very effective aid to herd management and can be used to predict forthcoming heats. The use of a calendar, diary, 21-day diary, circular breeding board or computer based software are all very effective for generating action lists of cows. Use of these records can identify cows due on heat and improve both the efficiency and accuracy of heat detection.

Table 6: Time spent on observation and heat detection rate (%).

Min. pe observation	Observations per day			
	2	3	4	5
10	18	20	33	37
20	40	51	57	63
30	62	70	79	86

Source: NRS Holland

Spending an extra 30 minutes per day on heat detection can increase heat detection rates by 10% and can reduce the calving index by 5 days and culling rate not-in-calf by 2.5%. For a 100-cow herd with a six month breeding period, this can bring a financial benefit of approximately £2500 worth £30 per hour spent at heat detection, and this figure can be worth as much as £70 per hour in herds with poor heat detection rates.

Duration and timing of observation – Since cows frequently have heats lasting less than 10 hours, it is important to observe them at least twice a day for at least 30 minutes each time. Ideally, heat detection should be timed to coincide with the times of the day with greatest mounting activity, particularly in the evening. The greatest improvement in heat detection rate comes from increasing the time spent at each observation (Table 6).

Heat detection aids - These include a range of aids from tailpaint to sophisticated electronic devices that can help to identify cows in heat. They are especially important in seasonal calving herds (see Challenge Note 2B: **Heat Detection Aids**).It is very important to get an indication of heat detection efficiency as together with conception rate, these have a major effect on overall reproductive efficiency of the dairy herd. Assessment of heat detection efficiency is probably best assessed through calculation of submission rate (see Challenge Note 1C: Submission Rate). For a spread winter calving herd the target would be to have a **submission rate** of 75% to achieve acceptable overall fertility performance.

Summary

- Cows now have shorter heats and fewer mounts.
- Increased need to look out for secondary signs of heat.
- Need to consider factors that:
  - affect the cows ability to express heat behaviour;
  - the farmers ability to see observe cows in heat.
- Recording of heats and services are an important aid to heat detection as they can be used to anticipate future heats.
- Heat detection should be conducted at least twice a day for at least 30 minutes each time.