Best Practice Guide on Reproduction and the use of technology to improve fertility

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Fertility

2015 saw Dairy farming incomes reduced to below costs. While markets are starting to recover, for many, the long-term answer to making their dairy enterprise sustainable, is to increase yields and herd size at the same time as reducing labour costs. Reducing labour on family farms just leads to a longer working day. So what is the impact on fertility?

Higher yields create more nutritional challenges in early lactation and can lead to lower conception rates. It is also well established that higher yielding cows have shorter, and less intense heats that are harder to spot by traditional methods. Inconveniently these also mainly occur at night. The traditional way of detecting heat involves observations of at least 3 sessions of 20 minutes. This is often shortened when a farm has less than the ideal amount of labour, and is less likely to happen at the optimum time – at night.

Traditionally herd fertility has been measured by calving interval. However, this is a historical figure which does not give real time information about what is happening today. Therefore, the preferred key performance indicator (KPI) is **Pregnancy Rate (PR)** and is defined *as the percentage of cows eligible to become pregnant that actually do become pregnant in a given period*.

Eligible cows would consist of non-pregnant cows that have passed the farm's voluntary waiting period, and are not on the cull list.

In this guide pregnancy rates will be quoted over a 21 day period.

PR is the product of Submission Rate (**SR**) and Conception Rate (**CR**)

More information on fertility KPIs is detailed in the fertility Key Performance Indicator glossary

Table 1: 2015 UK Holstein/Friesian Average KPIs

	Average	Top 25%	Top 5 %
CR	32%	39%	50%
SR	33%	41%	58%
PR	11%	15%	22%

Source NMR interherd data

Table 2: UK Trends in KPI 2010-2015

	Average	Average	Top 25%	Top 25%
Year of Study	2010	2015	2010	2015
CR	32%	32%	40%	39%
SR	27%	33%	37%	41%
PR	9%	11%	13%	15%
Calving Interval	424	410	409	396

Source NMR interherd data

Dairy cow fertility has started to improve in the Europe since 2010. This can be attributed to higher submission rates.
There are four reasons for this improvement:

- Increased use of technology
- Increased use of tail paint/chalk
- Genetic improvement in fertility
- Increased use of fertility drug

Worldwide there are good examples of large (1000+) herds with high yields (12000kg +) using accelerometer technology to achieve pregnancy rates consistently above 20%.
It is difficult to precisely evaluate the value of fertility to the dairy farmer, various studies have put the benefit at between 2-6 euros per day of reduced calving interval.
The benefits of using heat detection technology to increase submission can be:

- Increased milk income
- Increased calf income
- Increased herd life
- Lower involuntary culling rate
- Reduced labour requirement
- Reduced veterinary costs
- More accurate veterinary diagnosis
- Reduced use of fertility drugs
- More accurate timing of insemination
- Increased conception rates
- Decreased semen usage
- Improved performance with sexed semen
- Automatic sorting of cows
- Better quality of life for the farmer
- Increased consumer confidence in milk
- Increased genetic progress

The latest technology does more than just heat detection. Be it with rumination, cow behaviour, temperature or cow positioning sensors can be a valuable tool in the early diagnosis of health issues, help to design more cow friendly systems, an aid to optimising rations or even just locating individual cows in the barn.
The question is not *should* I use technology to increase submission rate. On most farms payback will be under 2 years. The question is **which** technology should I use to increase submission rates, and what else can that technology provide that will improve my ability to make management decisions, improve the comfort of my cows, and make my farm more profitable.
There are three main types of heat detection sensors:

- Activity Sensors
- Positioning Sensors
- Milk Analysis

Activity sensors are the most common technology and are based around accelerometers that detect speed and direction of movement. This was an advance on the original pedometers (step counters).
They temporarily store data, averaged in distinct timeslots, and upload to the management software when in range of a receiver.
These systems can be used in both grazing and housed environments.

Positioning sensors work on the real-time position of each animal, and raises alerts based on behavioural changes. These systems may only be suitable for housed herds, but will provide location information for each animal. This is useful for herds with robotic milking, or large herds where treatment takes place in the barn.

Milk analysis, is the most accurate technology available. Herd Navigator from DeLaval works by testing for progesterone levels in the milk. Available for herringbone and parallel parlours, and DeLaval's VMS systems, the software calculates optimal testing frequencies for each animal .

Which Technology Should I buy?

Before purchasing an automatic heat detection system, you should look at the other 4D4F Best Practice Guides and make sure it is appropriate for your herd management practices. Guidance from your vet or other professional advisors is recommended, and also
However the following are points to look out for:

Data Transfer;

Earlier systems needed close proximity to the aerial to transfer data from the sensors, and so data was only available at milking. Later systems work with longer ranges, and so information can be accessed in real time. This is often combined with remote access to data via the cloud.

Attachment Location;

Leg mounted sensors were initially seen to be the most accurate. However the ability of ear and neck mounted sensors to detect rumination rate, and the relationship with lower rumination rates at oestrus, may have moved the balance towards ear and neck sensors. In any case, the accuracy of the alerts will be dependent on the software used to interpret the data coming from the sensors.

Photo 1: Nedap Smarttag Neck collar

Battery Life;

The battery often determines the life of sealed sensors. Newer sensors often quote battery life of up to 8 years. Check if this claim is backed up by the manufacturer's warranty – and if the warranty is a graded one (pays less with older sensors).

Ease of Changing Sensors From Cow to Cow;

Especially important in systems which have replaceable batteries or if, for reasons of saving cost, sensors are removed from cows after pregnancy is confirmed.

System Software and User Interface;

The accuracy of alerts between different systems will largely be down to the algorithms used in the software, and the ability to customise thresholds to each farm's individual circumstances.

- Can the system group cows so that alerts take into account group changes in activity? This will reduce false alerts.
- Does the system automatically reduce thresholds at times when bulling is likely? i.e 19 to 22 days after the previous heat.
- Where is the data stored? If data is stored and alerts generated away from the farm, there is an extra risk of increased downtime of the system.
- Can you identify the time of the onset of standing heat from the userface?
- Can you identify sensors that are not working?
- What percentage of heats are identified and what percentage of false positives do you get?

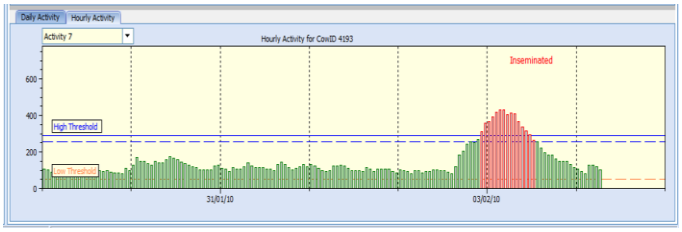

Figure 1: Dairymaster MooMonitor display screen highlighting the time that standing heat started (in red)

Before finally committing to a technology purchase here are some questions you might like to ask the supplier:

- How easy is it to use the system?
- How long will the system last?
- What percent of devices fail per year?
- What is your warranty Policy?
- What support is available?
- What is your policy for upgrading to new versions?
- What is the reliability of the alerts?
- Can the information be accessed remotely?
- Can my farm advisors access the information?
- Can you put me in touch with existing users?
- Who owns the data generated from the sensors?

Best Practice Tips

When buying a heat detection system look at the other functionality that would best suit your farm needs (cow positioning – especially for robotic milking systems, rumination etc). Additionally it has been shown that combining data neck activity, rumination, lying time, step count, feeding time, ear activity and leg activity may give more accurate heat detection rates than any single parameter.

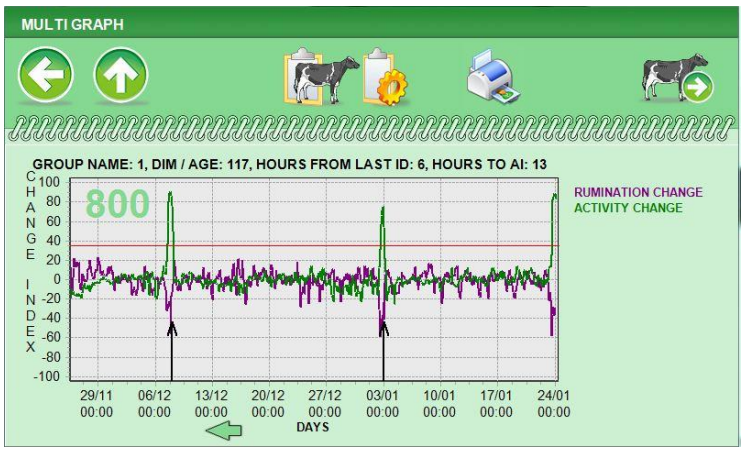

Figure 2: SCR Heatime interface showing how rumination drops when cows are in heat, making heat alerts more reliable.

- Integrate the system with automatic sorting gates – and have access to feed in the holding pen.
- If possible, lower the threshold at which heat alerts are sent, and rectally examine “suspected” heats to confirm oestrus. Whilst increasing false positive alerts, this will ensure that less weaker heats are not missed. Alternatively spend 10 minutes each morning actively looking for raised activity in cows that were bulling 19-22 days previously.
- In conjunction with your vet, use the data and graphs on individual cows to help diagnose the correct treatment for anoestrus cows. Have weekly fertility visits.
- Set fertility targets that are appropriate for your herd yield level, calving pattern and general farm policy.
- Monitor against previous performance and benchmark with other similarly managed dairy businesses.
- Slippery floor surfaces will lead to weaker heats as cows are less sure of their footing.
- Hot weather, crowded conditions, nutritional stress, diet changes and other high stress environments will also give weaker heats.
- Integrate the systems with herd management software. Cloud based systems give the opportunity for remote access to herd and cow data for both farm managers and (if required) farm consultants.
- Timing of insemination is optimal at between 12-16 hours after the onset of standing heat. Standing heat occurs later than the initial increase in activity so make sure inseminations are not carried out too soon. This timing is more critical when using sexed semen.
- If using eartags in conjunction with self locking yokes, make sure the yokes are adapted to minimise entrapment of tags.

It is important that technology is seen as a way of helping cowmen target their stockmanship skills, and not be seen as a replacement for good stockmanship.

Photo 2: Cow Manager eartags used in self-locking yokes. The yokes were adapted to minimise eartag loss.

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