

# Heat Detection – the “State-of-the-Art”

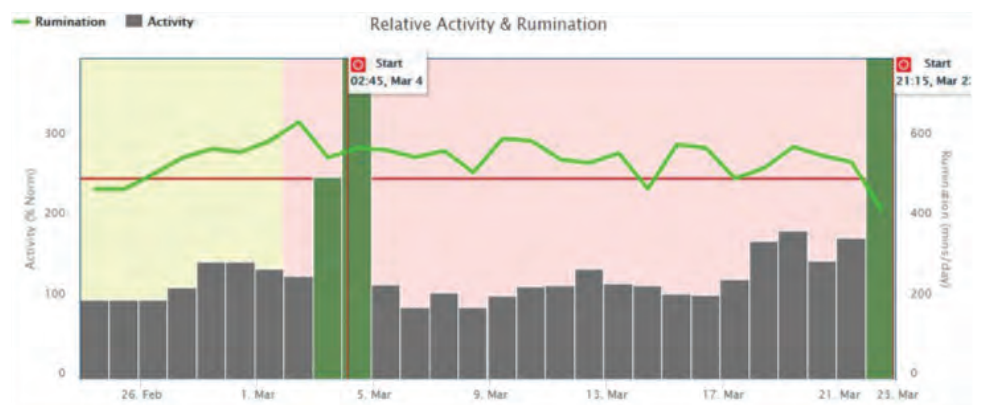
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## Background

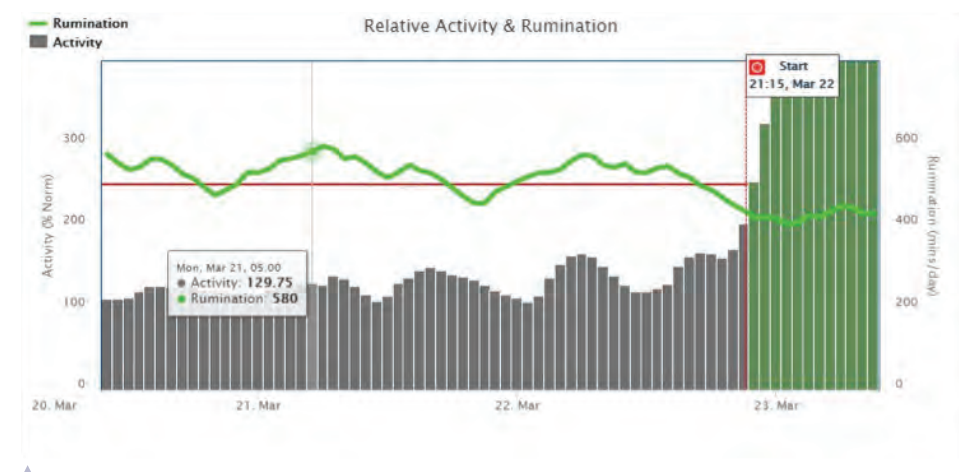
Knowing which cows to inseminate and when to inseminate them has been an important part of managing dairy herds with artificial insemination (AI) ever since its first use in dairy herds nearly 100 years ago. For many years we relied solely on direct observation of cow behaviour to detect cows in heat. Later, with the advent of heat detection aids such as tail paint and heat mount detectors we were able to get indirect insight into what had been happening when we were not looking. Now 24hrs a day and from anywhere in world we can receive text messages and push notifications from smart phone applications connected to the internet giving us real-time information about which cows are on heat and exactly when the heat began. We can also get a whole range of other useful nutritional and health information in real-time such as the cow's grazing, resting and rumination patterns. Amazingly the principles used by current 21st century technology to detect cows in heat have been known about for a very long time. It was as early as 1954 when E. J. Farris first used mechanical pedometers to show the relationship between cow walking activity and time of heat. It has taken all this time for technology to catch up and for us to use this knowledge in a practical way in commercial herds, but automated heat detection is now a reality.

## How good is technology for detecting cows in heat?

Most cow activity meter systems will detect about 80-95% of cows on heat with about 80-95% of the alerts they create consisting of cows truly on heat. To understand this better let's use an example of a herd that has around 200 open and cycling cows ready for insemination. Without the use of any synchronisation treatments there will be approximately 10 cows on heat on any given day. Most activity meter systems will alert approximately 10 cows per day as being on heat in this scenario. However, those 10 alerts will consist of 8 or 9 cows from the 10 cows that are actually on heat



**Image 1** Screen shot from Moo Monitor + showing changes in relative activity and rumination over a 30 day period.



**Image 2** Screen shot from Moo Monitor + showing the hourly change in relative activity and rumination over a 4 day period.

and 1-2 cows from the rest of herd that are not on heat. So how does this compare with your current performance using visual observations with or without tail paint or heat mount patches? The only way to know is if you measure your current performance. It is not easy to do this accurately but there are a number of ways you can get a rough idea on current performance. To do this it is a good idea to get help from an InCalf accredited adviser who can create a Fertility Focus report or use other tailored methods to help you work this out. Contact details of current advisers are listed on the Dairy Australia website.

### How good is technology for knowing when to inseminate cows?

The onset of increased cow activity associated with heat has been shown to be a very good predictor of when the cow will ovulate and occurs roughly 30 hrs before ovulation. This makes it an ideal indicator of when best to inseminate a cow. Most commercial activity meter systems report activity in 1-2 hour time blocks which means that you can know very precisely when the cow came on heat and make the best decision about when to inseminate them. The reported optimal time for insemination following the onset of increased activity varies between studies but is approximately 16 hours. However, there is a wide range of

times either side of this where acceptable conception rates are likely to be achieved.

### What will it cost me?

There are around a dozen different heat detection technology systems available in Australia at present and the price of each system can vary greatly depending on what features you want. For example, if you just want heat detection by itself or if you wish to include other features such as monitoring of rumination, grazing or temperature etc. Other differences affecting setup costs include real-time monitoring of cows in the paddock versus only downloading of information at milking time. As a rough guide, the total setup costs for a 200 cow herd could set you back between \$30,000 to \$50,000. This is made up of per cow device costs of approximately \$100-\$200 and infrastructure costs of around \$5,000-\$15,000. A prerequisite for many of the systems is a computer and internet access close to the dairy.

### What does it look like and how would I use it on my farm?

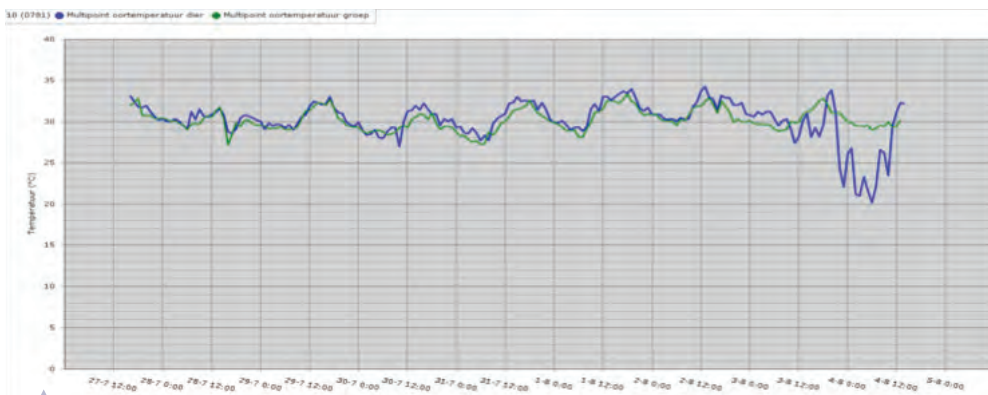
Image 1 and 2 are screen shots from the Dairymaster's MooMonitor+. This is one of the many products available in Australia. These graphs along with a range of other cow reports and data can be accessed by logging in on any web browser in the world connected to the internet or using a free downloadable

app on a smart phone. That makes it extremely accessible wherever you are. All information is stored in the cloud so there is no software, networking or back up of data required to be managed by the farmer. Image 1 shows the cow's relative rumination and heat behaviour readings over roughly a one month period. There are two clear periods of heat behaviour about 20 days apart and the second period of heat behaviour is also accompanied by a marked drop in rumination.

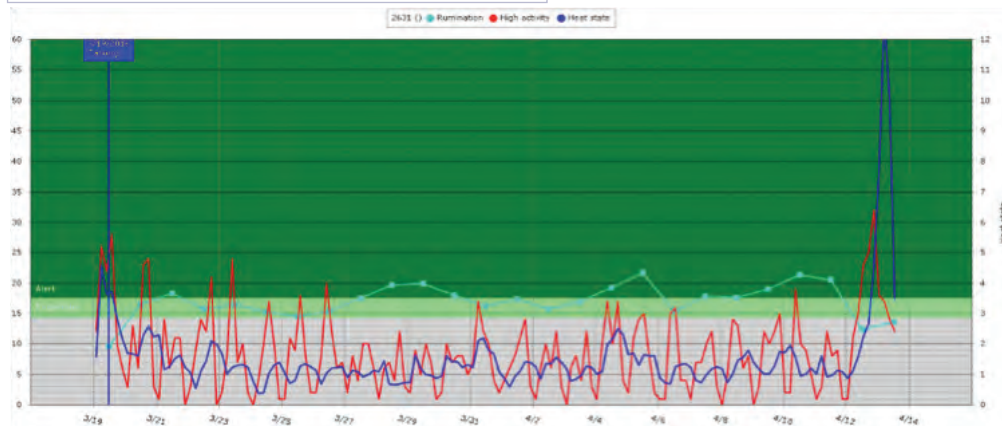
Image 2 is a close up of the heat behaviour and rumination during the last 3 days in the first image and shows the precise time of onset of heat behaviour.

Alerts are created by the program when a cow is on heat, or when its behaviour changes beyond a threshold from what has been its normal behaviour over the recent past. This can be a change in feeding, a change in resting, a change in rumination, a change in its activity levels or a combination of these factors. These alerts can be sent to you by push notifications using the app on your smartphone or you can log in on any internet device and retrieve reports in real-time whenever it suits you. All reports can be exported to csv or pdf and automated rules can be created to set drafting of cows based on alerts.

Another heat detection system available in Australia is the Cow Manager. The Cow Manager system shares many of the same features with the Moo Monitor + but also includes the addition of a temperature sensor and instead of being held against the cow's neck with a collar it is held on the ear by attaching to an NLIS tag. Monitoring changes in a cow's rumination and activity behaviour along with temperature can give a very early indication of sickness. Despite core temperature increasing in many diseases ear temperature will normally decrease due to reduced blood flow to the periphery. Images 3, 4 and 5 are screen shots from the Cow Manager browser. Image 3 shows the drop in a cow's ear temperature relative to the rest of it's herd mates at the time that cow became ill.



**Image 3** Screen shot from Cow Manager showing the change in ear temperature in a sick cow relative to the herd.



**Image 4** Screen shot from Cow Manager showing change in activity and rumination across two heats.

Image 4 shows a graph of the changes in cow rumination, high activity periods and heat status over a full heat cycle. Similar to the first Moo Monitor + image, this graph also shows a clear example of rumination decreasing and high activity increasing at the time of heat onset. While both of these changes don't always occur together in all heats the use of more than one parameter to determine the heat status increases the accuracy of heat detection compared to just using any one parameter alone.

By classifying cow behaviour into rumination, eating, not active, active, and highly active the Cow Manager can show a wide range of changes that take place during many health or reproductive events. An example of this is shown in image 5 which highlights the marked changes that occurred in these parameters for a cow at time of calving.

Another useful application of these parameters is monitoring changes in herd level nutrition by creating a "Feed Factor" parameter that is made up of the combined rumination, eating and inactive behaviour of the group. By monitoring changes in the herd's "Feed Factor" the whole herd feed intake reactions from feed ration and pasture management changes can be observed in real time so steps can be taken sooner to reduce any negative consequences of a nutritional upset.

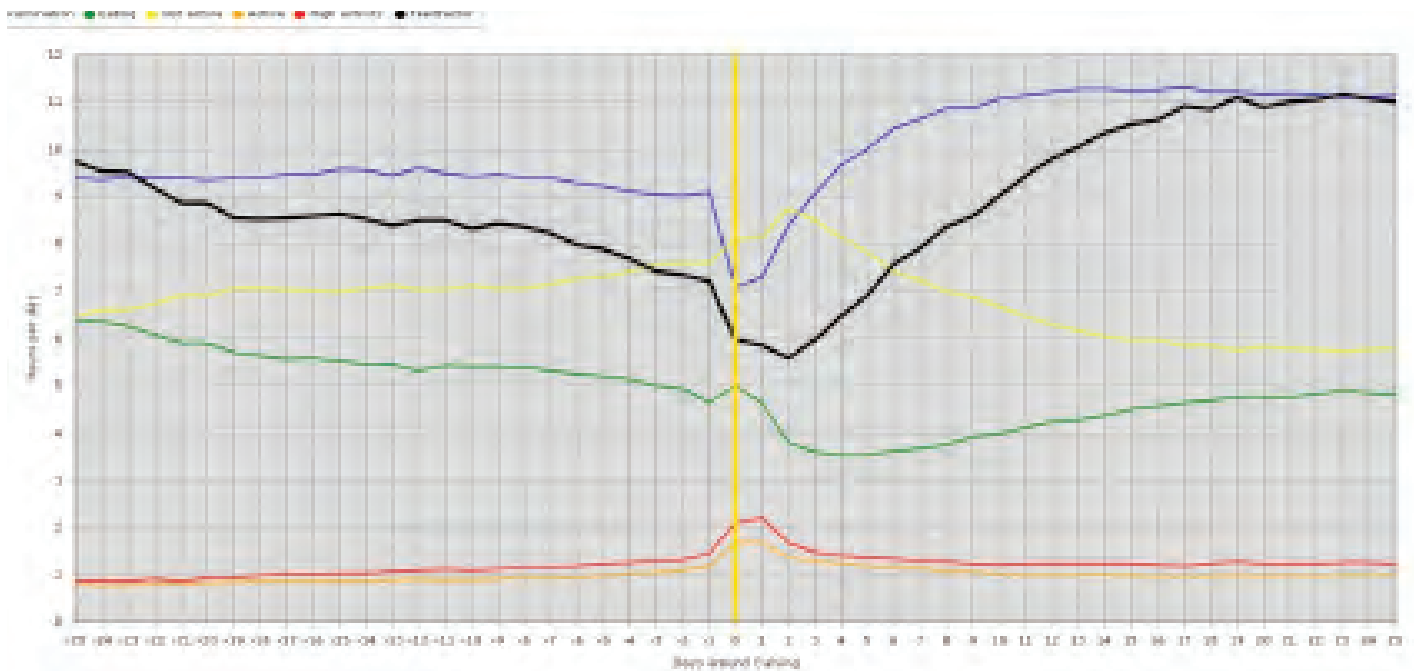
## Getting the most from technology

Regardless of the brand you choose no automated technology should be treated as a set and forget system. To get the most from these technology systems you will want to review the computer generated alert reports at least one or more times a day and then look at each set of graphs for cows on the alert list and interpret them in light of any previous known history and current direct physical observations. Combining computer generated alerts and data with direct knowledge of cows allows you to make the most informed decisions on each cow's status and take the most appropriate and timely action for either reproduction, health or nutrition.

## Conclusion

Technology for detecting cows in heat has come a long way over the years. Current technology can now provide practical and accurate ways to know which cows are on heat and when to inseminate them. These are two critical questions being asked every day in herds managing reproduction with AI. The big questions now are not what might be possible with technology or does the technology really work? The important questions are; do I need this technology on my farm; is it going to add value to my enterprise above its costs; and if so how do I best use it to maximise the return it will bring me? The answers to these questions are going to be different for each farm. When answering these questions take your time, do your homework, know there are plenty of options on the market and don't be afraid to seek help from someone independent that you trust. ■■

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**Image 5** Screen shot from Cow Manager showing the changes in rumination, eating, not active, active and highly active periods around the time of calving.

For more information on what to consider when purchasing heat detection technology download a free guide to automated heat detection from Dairy Australia's website. [www.dairyaustralia.com.au/Animal-management/Fertility/Heat-detection.aspx](http://www.dairyaustralia.com.au/Animal-management/Fertility/Heat-detection.aspx)