Milkalyser – bringing the gold standard of fertility detection into the milking parlour

Professor Toby Mottram at the Royal Agricultural University[1] has developed a patented digital system that allows dairy farmers to track their herd's fertility via smartphone, supported by BBSRC Follow-on funding and a BBSRC/Royal Society of Edinburgh Enterprise Fellowship.

The Milkalyser[2] brings hormone-based fertility detection technology out of the lab and installs it into milking parlour machinery, replacing older, less reliable methods and potentially saving farmers thousands of pounds. It is due to be tested on working farms in late 2016.

How to track fertility?

Poor fertility is a growing problem in the dairy industry. The average 100-cow farm loses an estimated £25,000 per year through failure to get cows pregnant on a regular schedule. For the best chance of pregnancy, farmers must inseminate each cow during oestrus, a brief peak in fertility occurring roughly every 21 days. Oestrus produces distinctive changes in behaviour that farmers traditionally used to identify fertile animals. However, modern breeds tend to undergo a shorter oestrus and display less obvious behaviour[3], making it harder for farmers to time insemination accurately.

Cows produce a number of hormones during their fertility cycle, including progesterone, which can be detected in milk and undergoes a sudden, distinctive drop in production shortly before oestrus. Tracking the progesterone content of milk is non-invasive and highly reliable, detecting up to 99% of oestrus events compared to 78% for traditional methods[4]. However, current methods of progesterone analysis are impractical for large modern farms. Milk samples must be analysed off-site in laboratories or with manual testing kits, making it too costly and time-consuming to regularly test a large number of animals.

Instead, many farmers rely on technology to detect the behaviours associated with oestrus, which can be unreliable. Mottram's background in engineering led him to question this approach. "Other systems always get tested against laboratory analysis of progesterone," says Mottram. "My engineering ethos was, why not put that gold standard into a box?"

Off the shelf, into the dairy

Mottram has worked to provide technological solutions for improving dairy cow health for many years via his company eCow Ltd, which offers wireless systems to collect health data from the stomachs of cows. However, he has also been working to bring progesterone analysis into the milking parlour for several decades[5]. He developed a prototype sensor with support from Defra and the BBSRC between the late 1990s and early 2000s, but the project was put on hold.

Failure to get cows pregnant on schedule can cost farms £25,000 per year. *Image: Daniel Rowe, Flickr. CC BY-NC 2.0*

In 2014, he successfully applied for a BBSRC Follow-on Fund, which allows researchers to explore the practical applications of their previous BBSRC-funded projects. This allowed him to build on his earlier work and construct an off-the-shelf sensor suitable for installation in milking parlour machinery. "We're putting a whole lot of existing technology into a box," he says. "It is very much an engineering project."

The funding has allowed Mottram to take advantage of technology that has emerged since the beginning of the project; "In the past fi e years we've seen a revolution in the availability of the internet in people's hands, and that has allowed us to do things that we couldn't before." He has also

IMPACT SUMMARY

Professor Toby Mottram at the Royal Agricultural University has produced a sensor that analyses hormones in milk to track cows' fertility, with support from BBSRC and Innovate UK. The Milkalyser could save farmers around £150 per cow, and will be tested on farms in late 2016.

Failure to detect peaks in fertility and thus get cows pregnant on schedule costs the average 100-cow farm £25,000 per year. Laboratory-based hormone analysis detects 97% of peaks in fertility, but is too time-consuming for large modern dairies.

Supported by BBSRC follow-on funding, an Innovate UK SMART award, and a BBSRC/Royal Society of Edinburgh Enterprise Fellowship, Mottram has created a hormone sensor that fits into milking parlour machinery and analyses each cow's milk, displaying fertility data on the user's smartphone.

been able to streamline the installation process so that the device can be fit ed quickly, a unique selling point for large farms whose machinery may have little downtime between milkings. “Our previous systems required lots of plumbing and wiring, whereas the new version will not,” Mottram explains.

Getting down to business

Mottram is close to completing a BBSRC & Royal Society of Edinburgh fellowship. The scheme provides Fellows with a year of intensive business skills training and support, allowing them to build a functional business plan and develop the commercial potential of products from their research. “It has been absolutely critical in enabling me to focus on getting Milkalyser to market,” says Mottram, praising the intensive nature of the course. “Because it’s relatively short-term, you know that you’ve got to get on with it and come up with a result within the 12 months.”

He has also received a SMART award from Innovate UK to build a working Milkalyser prototype[6]. It is expected to be ready for testing on farms in the near future, and eCow Ltd has received plenty of interest from potential users. “We’ve already had two farmers wanting to talk about installing it, even though we’re not ready for another month or two,” Mottram adds.

Mottram anticipates that the Milkalyser could pay for itself in under 18 months through increased milk yields and a reduced need to replace livestock, saving the average 100-cow farm about £150 per animal per year. It could also save many cows from unnecessary slaughter, by allowing farmers to distinguish between truly infertile animals and those that fail to conceive for other reasons.

Mottram’s work led to him being shortlisted for BBSRC’s Innovator of the Year award in 2016, and the publicity arising from the nomination changed his outlook on the project. “It forced us to think about how to present ourselves,” he says. His team is now looking into crowdfunding to drive the next stage of Milkalyser’s development, including development of user-friendly software and infographics for the finished ystem.

“The BBSRC has been encouraging more applied and commercialisable research in recent years,” he says. “It’s helped us to support the project in the transition between public and industry funding.”

A milking parlour. Milkalyser allows farmers to analyse progesterone levels on-site.
Image Morten Just, Flickr. CC BY-NC 2.0

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