

# Dairy Extension

## Cow sensor technologies - What have we seen?

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Some of you might have recently attended the World Dairy Expo - Dairy in our DNA! It is always mind boggling to see how many products, technologies and services are available today to make the dairy world run. Such a complex production system requires a lot to operate at its best. In recent years, our dairy team has been quite interested in precision dairy technologies, including individual cow sensors. We are using some of those technologies in our university herds for day-to-day monitoring and for research, along with conducting research on commercial dairy farms. Colleagues at various universities around the world also are investigating the use of these technologies.

What has the research shown about the relationship between transition cow health and behaviors monitored by individual cow sensors? We are interested in automated ways to identify cows at risk for health disorders during early lactation because a large percentage of cows die or are culled in the first 30 days in milk, resulting in economic loss for the dairy and representing a serious welfare problem. In a recent study we published in the Journal of Dairy Science evaluating about 6 million lactation records from DHIA herds in the Midwest, we showed that the average mortality rate in the first 30 days in milk is about four times greater than later in lactation. We expect that early detection of health problems during the transition period can reduce on-farm mortality and improve cow performance.

An early work with sensors was conducted by Edwards and Tozer (2004) using data collected from 1445 dairy cows in three Florida herds. They found that changes in daily walking activity and milk yield could possibly detect cows with ketosis, left displaced abomasum, and general digestive disorders about 5 to 6 days before clinical signs.

Research in Italy using rumination sensors showed that cows with reduced rumination time before calving also had reduced rumination time after calving and greater disease incidence than cows with greater rumination time before calving. In addition, cows that had only mild inflammatory conditions and no health disorders or only mild health disorders in early lactation, had a greater average rumination time during the first 10 days of lactation than cows with subclinical diseases or health disorders. In another study in Italy published in the Journal of Dairy Science in 2014, it was found that severe inflammation around the time of calving was associated with a slower increase in rumination time right after calving; therefore, it was suggested that monitoring rumination time during the first week of lactation could be used to identify cows at a greater risk of developing a disease in early lactation.

One of our studies published last month in the Journal of Dairy Science used 300 cows fitted with rumination/activity sensors. We found significant associations between rumination time and/or activity during the transition period (21 days pre- and post-calving) and some transition cow disorders, such as retained placenta, subclinical ketosis, metritis, and delivery of stillborn calves. However, further research is needed to better understand how to utilize this measurement to detect cows at risk for these disorders.

Producers have mentioned they have seen benefits to their transition cow program from using rumination/activity sensors beyond their use for heat detection.

In our St. Paul dairy barn we have used temperature-sensing reticular boluses as a management tool to help us detect individual cow or environmental changes. A study from Canada published in 2011 showed that temperature boluses had the potential to help detect subclinical ruminal acidosis and fever on farms. Another study from Colorado (2013) showed that cows with clinical mastitis and pneumonia were more likely to have an increase in temperature above the baseline than control healthy cows; therefore, authors suggested the boluses can be a useful tool for early detection of these diseases.

Other cow sensors are now available in the market that can also measure feeding time and resting time, including one sensor that measures these behaviors in addition to rumination, activity and ear temperature. In one of our recent studies, we found that mature transition cows diagnosed with metritis, retained placenta, displaced abomasum, lameness at calving or lameness at 35 days in milk had decreased feeding times during the close-up dry period than healthy cows. We also found some relationships between resting behavior and lameness, subclinical ketosis and metritis.

A review paper from the Netherlands (2013) summarized information from 126 studies on sensors for mastitis, fertility, locomotion, and metabolic disorders. Most of those studies were focused on mastitis and fertility, with limited work on transition cow health and they suggested that more work is still needed on how to use sensors to identify sick cows. Additionally there was a lack of studies focusing on the economic aspects of these technologies. All systems studied had developed techniques to measure something about cows and most had developed a way to interpret and summarize the data but integration of that information with other information to produce advice or to have the system make a decision autonomously hadn't been done. So, the search continues...

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