Precision Dairy Farming Symposium: Precision Dairy (PD) Management Today

315 Precision dairy research and user update: Dairy cattle reproduction. R. L. A. Cerit*, B. F. Silper1, T. A. Burnett2, A. M. L. Madureira1, L. B. Polsky1, M. Kaur1, R. F. Cooke2, and J. L. M. Vasconcelos1, 1Applied Animal Biology, University of British Columbia, Vancouver, BC, Canada, 2EOARC, Oregon State University, Burns, OR, 3Department of Animal Production, Sao Paulo State University, Botucatu, SP, Brazil.

The aim of this summary is to provide new insights into the use of data from estrus events and automated activity monitors as a tool to predict fertility. Recently, more studies have demonstrated how estrus events and intensity is associated with ovulation, ovarian and uterine function, and fertility. In one study, the likelihood of ovulation was greater for high vs. low relative increase estrus, but a more detailed experiment also showed slight differences in the timing of ovulation. Expression of estrus near AI also modified the expression of genes related with the immune system, adhesion molecules and prostaglandin synthesis in the endometrium (MMP19, COX2, SLPI, OTR and CXCL10, IGL11) and those related with apoptosis, P4 synthesis and prostaglandin receptor (CYP11A, BAX and FPR) in the CL. The expression of estrus (yes vs no) was associated with increased P/AI for timed-AI (38.9 vs. 25.5%) and embryo transfer (46.2 vs. 32.7%) protocols. Moreover, there was a decrease in pregnancy loss in both programs. Data from other recent studies involving spontaneous and induced estrus have shown that greater relative increase and longer duration of estrus, captured by different activity monitors, significantly improve P/AI (over 12% points across different studies). Intensity and duration of estrus were correlated with BCS, parity, milk production and secondary behavior signs as expected, but surprisingly not associated with follicle diameter and concentration of estradiol at estrus. Collectively, ovulation could partly explain the observed reduction in fertility, but it is clear that the endometrium and the CL play an important role.

Quantitative information from estrus events could be used to improve estrous detection quality and develop decision-making strategies at the farm level. Further studies in this field should aim to 1) better understand ovarian, embryo and endometrium mechanisms associated with either the expression or intensity of estrus and, 2) refine the collection of phenotypes related to estrus (i.e., relative increase, absolute increase, baseline levels, duration, and repeatability within cow) to improve estrous detection and possibly genetic selection.

Key Words: activity monitor, dairy cow, estrous expression

316 Dairy cattle health and welfare in the precision dairy world. D. Kelton*, University of Guelph, Guelph, ON, Canada.

Precision dairy farming can be defined as the use of sensor technologies to measure the physiology, behavior and production of individual animals for the purposes of managing the herd or individuals within the herd. With increasing herd size and automation, the regular intimate contact between the farmer and his animals is decreasing, and in some cases being replaced by technologies that could serve the function of identifying individuals or groups of animals which need attention because they are diseased or in distress. In the context of dairy cattle health and welfare there are many sensors and systems that have been developed to monitor or detect mastitis, metabolic disease, lameness, calf disease and overall cow comfort. This review will highlight some of the currently available technologies, including their associated opportunities and challenges. The opportunities to use inputs from multiple sensors to inform robust decision support systems are intriguing. However, there are 3 major issues that limit the widespread reliance on these sensor technologies at this time. First, most sensor systems have not been thoroughly evaluated and validated against appropriate reference methods or across a broad range of animal and farm environments. Second, the decision support systems underlying these technologies are often simplistic, not transparent to the user, and don’t make use of the broad range of inputs that are often available. Third, there is a lack of experience, expertise and support among dairy herd advisors who are working with dairy producers trying to incorporate these technologies into their management programs. Until these issues are addressed, the widespread reliance on precision dairy technologies for managing dairy cattle health and welfare will not reach its potential.

Key Words: health, welfare, precision dairy

317 Producer experience with precision dairy. B. Biehl*, Corner View Farm, Kutztown, PA.

Corner View Farm began milking a couple cows in 1915 by Ammon Biehl. It was a typical farm in Berks County, PA, with 14 cows in a tie stall arrangement. The family farmed 93 acres to support the dairy and crop sales. At that time, there was one hired employee to help with the chores. Five generations later, young Blake (age 13) and Baxter (age 11), live on the same property and walk around the same farm with their iPhones in a very different time. They can watch over the cows with IP cameras and control barn functions from their remote touch screens. All of this transformation has been witnessed by second generation, Leroy Biehl, who recently turned 92 years old. In December 2011, the Biehls began milking in their new free-flow, 3-row, 120-stall robotic milking facility, equipped with the Astrea 20.20 robot, supplied by AMS Galaxy USA, The foundation of the robot is a standard Motoman HP20 industrial robotic arm that has 6 axis for 6 degrees of freedom allowing it to prep and attach cows in a milking stall on each side of the central milking unit. The single robotic system has milked up to 125 cows at time. Brad not only watches from his smart phone, he has the ability to navigate the Saturnus 20.20 robotic milking and herd software. From anywhere, he can track activity monitoring, milking statistics, sorting sick cows, separating milk for treated cows, and managing herd records. However, it doesn’t stop there. From the touch screen of his phone, Brad can fully control, 5 fans, 2 curtains, sprinkler system, 4 fans, thermostats for floor heating, roll-up doors, and 6 sections of lighting control technology. All of the automation is also controlled by programming that keeps curtains closed when it’s raining, curtains open when the barn is warm, curtains closed when it’s too cold, lighting controlled to maximize cow traffic / production, and fans running only when needed to conserve energy. In 2015 and 2016, Corner View Farm added additional enhancements including the Hettwin automatic feed pusher, Hettwin Bedding robot, and Urban Alma Automatic Calf Feeders. Other new precision dairy include the Galaxy Heat Herd Health module that monitors activity, chewing monitoring, and cow position. These additional precision dairy monitors continue to enhance cow health.

Key Words: Corner View Farm, robotic milking
Precision dairy technologies are technologies that collect data by monitoring physiological, behavioral, or production indicators related to health or fertility of individual cows (e.g., automated detection of estrus, mastitis, or lameness). Goals of these technologies are to support management, improve animal health and welfare, and increase profitability. Demands for these technologies are rising, driven by increasing farm management complexity, availability of cheaper technologies, and societal concerns around animal health and welfare. Despite the rising demand, to date adoption of most sensor technologies have been modest. For instance, attempts to automate lameness detection involve automated gait analysis, such as force platforms, 3D-accelerometers or image-based technologies. However, adoption is low since most of these technologies are not (yet) ready to function under practical circumstances. Moreover, there are uncertainties on what exactly needs to be monitored, and what action is required once an alert for lameness is generated. This lack of knowledge inhibits economic calculations on these technologies. Similar adoption issues are seen with clinical mastitis detection in conventional milking parlors. The monitored indicators are proxy measures for clinical mastitis, resulting in suboptimal detection performance (too many cases are missed, and too many false alerts are generated). Also, technical failures are common, and investment costs can be significant. These shortcomings led to the conclusion that investing in automated mastitis detection systems was not profitable for an average-sized pasture-grazed New Zealand farm. The aforementioned examples deduct essential criteria to ensure adoption of precision dairy technologies: indicators have to be associated with events of interest, it should be clear what exactly has to be monitored, reflecting farmers’ needs, and this in turn has to be associated with a clear (autonomous) management action. A positive economic benefit will further fuel adoption, but is not crucial. These criteria are all met by estrus detection systems, and thus, it should be no surprise that these are one of the most successful precision dairy technologies today?

Key Words: sensor technologies, economic value, adoption criteria