Use of Proximity Loggers for the Detection of Oestrus Behaviour in Grazing Dairy Cows

D.M. McNeill[AC], G.J. Bishop-Hurley[B], L. Irvine[A] and M. Freeman[A]

[A]University of Tasmania, TIAR Dairy Research Centre, Burnie T.A.S., 7320
[B]CSIRO, Livestock Systems Group, Pullenvale Q.L.D., 4069
[C]Current address: University of Queensland, School of Veterinary Science, Gatton Q.L.D., 4343

Remote-sensing devices could reduce the cost of labour on dairy farms by removing the need for constant visual checks on cows during critical periods such as mating. Proximity loggers have been used successfully to quantify animal interactions, for example cow-calf relationships (Swain and Bishop-Hurley 2007). The purpose of this study was to test, in a preliminary sense, whether proximity loggers have the potential to detect which cows in a herd are in oestrus and therefore ready for artificial insemination (AI).

The trial was conducted at the TIAR Dairy Research Facility at Elliott in Northwest Tasmania (Lat., -41.082072, Long., 145.779628). A herd of 50 Holstein-fresian (HF) and HF cross cows were selected from a 300 cow commercial herd of spring-calving cows to reflect the larger herd's age structure and managed as one herd from September to December 2009. The cows grazed a new area of a predominately perennial ryegrass pasture (12-15 kg DM allocated/cow/day) after each of two daily milkings (7-9am; 4-6pm) where they were supplemented with grain (4 kg DM/cow/day).

Each cow was fitted with a proximity logger mounted on a neck-collar (Sirtrack Ltd., Havelock North, New Zealand) for the duration of the trial, starting at just over one oestrus cycle length (21 days) prior to the planned start date for AI and extending for a further three cycles after that. The tail paint technique combined with direct observation of cows allowing other cows to mount them (standing heat) was used as the standard method of oestrus detection. Proximity data was downloaded periodically (1-2 weeks) per collar, during the morning milking, and the data combined to produce an almost continuous record, to the nearest second, of a cow's interaction with its herd mates over the entire study. The proximity loggers function by transmitting a signal several times a second and when two collars come to within a 4-5m proximity of each other the identification number of the adjacent collar is recorded on each collar, together with the start and finish times of that interaction. This allows the durations of each interaction of a given collar with another to be calculated and summed over a period of relevance. These periods, each of 6 hours duration, were outside of the time spent being milked, twice a day, and walking to and from milking, leaving three periods of interest per 24 hours: 0000 – 0600 hours, 0900 – 1500 hours, and 1800 – 2400 hours. An increase beyond either 15 or 45 minutes thresholds in the duration of time spent with at least one other cow in the herd per 6 hour period for at least two consecutive 6 hour periods was taken to indicate the cow was in oestrus. These timings were then reconciled against dates of oestrus defined using the normal observed standing heat /tail paint method used for the herd.

Preliminary analysis indicates that when the threshold was set at either 15 or 45 minutes of sustained proximity to at last one other herd-mate, the capacity of the proximity logger technique to detect tail paint records declined from a rate of 0.74 to 0.32, with error rates of 0.77 and 0.50 respectively. Detection rate was calculated as sum of proximity logger records that exceeded threshold on the date before or on the same day a tail paint record was defined, divided by sum of all tail paint records. Error Rate was defined as sum of proximity logger records that exceeded threshold minus sum of proximity logger records that exceeded threshold on the date before or on the day a tail paint record was defined, divided by sum of proximity logger records that exceeded threshold.

At this early stage of algorithm development and in the knowledge that the tail paint method is an imperfect means of defining oestrus, the detection rates noted provide sufficient support for further experimentation. We plan now to compare proximity data with a more definitive measure of oestrus such as changes between milkings in the concentration of progesterone in each cow's milk. Proximity data will also be collected in real-time to allow uploading and assessment against a broad range of algorithms, immediately prior to each milking. To conclude, proximity loggers do have the potential to detect oestrus in dairy cows.

Funding for this work from DairyTas is gratefully acknowledged.

Swain D.L. and Bishop-Hurley, G.J. (2007). *Appl. Anim. Behav. Sci.* **102**, 1.

Email: d.mcneill@uq.edu.au