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Virtual herding NEWSLETTER

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Virtual herding research update

Enhancing the profitability and productivity of livestock farming

'Enhancing the profitability and productivity of livestock farming through virtual herding technology' is a four-year project to evaluate the application of virtual herding (VH) technology across different production systems and examine the responses of different livestock (dairy cattle, beef cattle, sheep) to various cues and stimuli to improve productivity and profitability in the livestock industries.

The Project

The four year project received $2.6 million from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit programme. A further $1.365 million has been provided by a number of Rural Research and Development Corporations and R&D providers.

The project is a partnership between CSIRO, the University of Sydney, University of New England, the Tasmanian Institute of Agriculture, University of Melbourne and Agersens Pty Ltd, with contributions from the respective livestock RDCs: Dairy Australia, Meat and Livestock Australia, Australian Wool Innovation and Australian Pork Limited.

The project aims to evaluate the on-farm application of virtual herding (VH) technology; demonstrate its implementation; and, quantify and extend its benefits across Australia's major livestock industries.

Using VH, the research team will investigate the potential to constrain animals to certain areas (better grazing management and environmental outcomes), autonomously herd animals, or move individual or groups of animals in a herd differently to the rest of that herd. Fundamental research involving behavioural observations and physiological measurements will be critical to ensure that the technology does not compromise animal welfare.

Project Farmer Panel

The project team felt that the outcomes of this work would be enhanced by the establishment of a Farmer Panel, comprising livestock farmers who are aware of the potential of VH technology for their respective industries. Approximately 25 farmers from across various livestock industries have agreed to form this panel.

It is expected that members of the Farmer Panel would liaise with the project team to provide input into the direction of the R&D; become industry advocates for the outcomes;

This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit programme. For information about this project contact Cathy Phelps at Dairy Australia on 0439 555 001 or cphelps@dairyaustralia.com.au

Dr Dana Campbell

Dr Dana Campbell attaching the VH device to beef cattle

and, assist the livestock industries to implement VH technology on-farm.

Introducing Project Team Members – Dr Dana Campbell

Dr Dana Campbell started her research career as a student, identifying insects caught in pitfall traps to determine the potential food abundance for the translocation of endangered bats to a predator-free island in New Zealand. She then went on to complete her PhD at the University of Auckland observing behavioural choices of captive-reared zebra finches.

Dana moved to the University of Guelph in Canada to undertake postdoctoral research on the impact of environmental enrichment on the behaviour and welfare of minks in commercial farms. She then joined Michigan State University, studying the behavioural response of laying hens to aviary housing systems.

In 2014, Dana moved to Australia and conducted further postdoctoral research at the University of New England in a joint program with CSIRO in Armidale, NSW. She spent two years using radio-frequency identification technology to track individually-tagged laying hens in a free-range system to gain a greater understanding of how birds use the range and the impact that it may have on the behavioural and physiological welfare.

In January 2017, Dana joined the Animal Behaviour and Welfare team at CSIRO, Armidale as a research scientist, working on optimising the virtual herding technology for beef cattle. She is looking forward to spending the next three years understanding the best stimulus cues to use for effective operation of virtual herding and how animals respond to moving fence lines. She will focus on behavioural (e.g. daily activity patterns) and physiological (e.g. body temperature) responses to VH to ensure animals are effectively controlled by the technology without any compromise to their welfare.

Update on Animal Studies

Sub-Program 1: Optimising the animal response to virtual herding technology

Over recent months, Dr Dana Campbell has worked with Dr Caroline Lee, CSIRO technicians Jim Lea and Troy Kalinowski and the team at Agersens, to test the automated virtual herding collar prototypes with beef cattle.

The complex algorithm within these automated collars detects the animal's location using GPS technology and emits a single continuous audio tone when the animal approaches the virtual fence; followed by an electrical stimulus, if the animal continues to walk further towards the virtual fence. The best way to determine the strength and duration of the electrical stimulus that is required is to observe the animal's response.

The team has been running experiments to keep individual animals away from highly palatable and good quality hay located at one end of a test paddock by placing a virtual fence line in front of it. Using this experimental set-up, different electrical intensity levels have been tested to select the optimal electrical stimulus level required to keep animals away from the hay, without any accompanying negative behavioural effects.

The project team has observed that cattle will quickly learn (within three to five times of approaching the virtual fence line) to turn away from the virtual fence after receiving the required collar cues and do not attempt to reach the hay. The effective operation of these automated collars is essential for the further development of the virtual herding technology. Over coming months, the collars will be put on a small group of cattle in a six hectare paddock to observe group behaviour when a virtual fence line restricts them to specific parts of the paddock at different times.

Sub-Program 2: Determining best livestock and pasture management for intensive dairy and beef through more controlled pasture allocation

Dr Megan Verdon and Mark Freeman from the Tasmanian Institute of Agriculture (TIA) recently completed a month-long field trial at their Dairy Research Facility to examine the impacts of more regular and tightly controlled stock movement on pasture utilisation and dairy cow productivity.

Megan presented the results of this first study at the Tasmanian Dairy Conference last month.

Sixty mid-lactation dairy cows were assigned to one of two treatments. The experimental treatment group simulated one possible application of virtual herding technology on dairy farms by providing cows with frequent access to fresh pasture by manually

Dairy cows allocated to more frequent access to fresh pasture at the TIA Dairy research facility at Elliott, Tasmania

shifting cows seven times each day; while the control cows grazed as normal with the full allocation of fresh pasture available twice each day.

Cows were fitted with MooMonitor collars (Dairy Master, Tralee, Ireland) which continuously record ruminating, feeding and resting behaviours.

Providing cows with access to fresh pasture more frequently had no effect on pasture utilisation, milk composition (total and percent fat and protein), energy corrected (fat and protein) milk yield and time spent feeding or resting. However, cows in the experimental treatment produced 1.3 litres less milk and spent 24 minutes less time ruminating each day than cows in the control treatment.

There are three possible explanations for these unexpected results:

- More frequent movement of stock may have disrupted rumination.
- Pasture allocations and pasture intake may have been below ideal levels.
- Providing pasture in small strips may inadvertently increase competition for access to higher quality swards, which could result in social stress amongst the cows.

These hypotheses will be assessed in a new study later this year, exploring the effects of marginal pasture allocation and less frequent fence shifts on the productivity and behaviour of dairy cows in early lactation. Subsequent experiments to improve pasture utilisation at TIA may use the virtual herding collars as they become commercially available.

Further information

Visit the Virtual Herding Project online at Dairy Australia.

The site contains information about project activities and recent news about the Project, including CSIRO's Dr Dave Henry's presentation on virtual fencing from the Australian Dairy Conference in Adelaide in February.

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