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Dairy Australia

Virtual herding NEWSLETTER

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Virtual herding research update

'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 project received $2.6 million from the Australian Government through its Rural R&D for Profit program. A further $1.365 million has been provided by a number of Rural Research and Development Corporations and R&D providers. The R&D providers include, CSIRO, the University of Sydney, University of New England, the Tasmanian Institute of Agriculture, University of Melbourne and Agersens Pty Ltd, with additional contributions from Dairy Australia, Meat and Livestock Australia, Australian Wool Innovation and Australian Pork Limited.

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.

Introducing Project Team Members – Ms Tellisa Kearton

Tellisa Kearton began her PhD studies with the University of New England, Armidale, NSW in October 2017. She is jointly supervised by staff at UNE and CSIRO, Armidale and is working on the Virtual Herding project in Subprogram 4.

Tellisa grew up in various locations across Australia including regional and remote Queensland and Western Australia. After completing a Bachelor of Science at the University of Southern Queensland in 2002, she worked in technical roles within both private industry and the public sector, in fields ranging from microbiology to nutritional biochemistry and environmental chemistry, while completing postgraduate coursework in animal science and welfare through Monash University and the University of Queensland in her spare time. More recently, Tellisa completed a Master of Rural Science looking at remote temperature monitoring in sheep.

Tellisa has a strong interest in improving the welfare of animals as technology and agriculture become more integrated in future farming systems. Tellisa's PhD work involves the assessment of sheep welfare as the animals encounter, interact with, and learn from virtual herding systems. This work will help to describe the way animals learn and interact with technology in their environment and how this impacts upon their welfare.

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 program. For information about this project contact Cathy Phelps at Dairy Australia on 0439 555 001 or cphelps@dairyaustralia.com.au or Dr Ray King, Project Manager on 0412 322 047 or r.h.king@bigpond.net.au.

Dairy cows at Camden being acclimatised to wearing the eShepherd collars.

Update on sub-program activities

Sub-program 3: Determine best Sub-Herd and Individual animal management for Dairy and Beef production systems.

Dr. Sabrina Lomax and A/Prof Cameron Clark, alongside PhD candidate Patricia Colusso have been using the Agersens eShepherd automated collars since July 2018. The aim of the current experiments is to assess the role that individuality and feed motivation play in dairy cow learning of, and response to, VH cues.

The first experiment assessed the learning and behavioural response of cows trained to VH cues individually or in groups. The aim of this experiment was to determine how learning transferred across settings, to inform future work for herding individuals and sub-groups within a herd.

Twenty-four Holstein-Friesian dry cows were fitted with the Agersens eShepherd collars. Cows were trained as individuals or in groups of 6 to access a feed attractant of lucerne cubes at the end of a 100m paddock. A virtual fence was then set halfway down the paddock, and cow learning and response to the VF cues was tested either individually or in groups. Each test was 5 mins, and cows were only tested once per day. After daily tests on 4 consecutive days, treatments were crossed over, so that individuals were then tested in groups, and the groups as individuals.

An additional two tests were conducted after the crossover. The number of audio cues and pulses that each cow received were recorded by the collar, in addition to visual observation of whether an individual reached the feed attractant or not.

Preliminary results show no significant difference between individual or group learning on cows crossing the virtual fence line to reach the feed attractant. On the first test, 98% of cows reached the feed attractant, which was dramatically reduced to only 1% of the animals by the 5th test. There was also a reduction in the number of audio and pulses received over time, indicating learning in both settings. These results indicate that training in a group setting should not affect individual learning of VH cues, and vice versa.

The second experiment is being run in three blocks, and aims to evaluate the effect of hunger on cow response to VH cues. The first block was recently completed. Two groups of six cows (within each block) were fitted with the Agersens eShepherd collars.

Cows were trained to VH cues in a 1ha paddock for 6 days. The virtual fence was set at 1/3 of the paddock for days 1-3, and 2/3 at days 4-6. From our anecdotal observations, the majority of animals remained inside the inclusion zone during this training period. Pasture measurements were made on both sides of the fence, and will be combined with the location data to determine pasture utilisation.

We noted that most cows learned the location of the new fence within an hour and by day 4 all cows remained inside the inclusion zone.

For the experiment we evaluated two feed treatments–one group was fed a maintenance ration of lucerne and oaten cubes, and the other provided unlimited access to the cubes prior to testing. Cows were then tested in their treatment groups. For testing, cows entered a mown paddock (100m), with a lucerne cube feed attractant at the end and were left there for 30 mins. Cows were tested 4 times over 3 days. Initial observations indicate that hunger may increase the likelihood of cows crossing the virtual fence to reach the feed attractant, however this may be more an effect of individuality, as some individuals were more motivated than others to reach the feed.

Further work to evaluate the effect of individuality and group dynamics is necessary to make recommendations around herd management. Future studies will investigate feed motivation in a pasture-based setting, and methods for separating sub-groups within a herd.

Sheep in the group dynamics study at Armidale.

Sub-program 4: Identify opportunities for labour savings through the application of VH in sheep wool and meat enterprises.

Drs Danila Marini and Fran Cowley from the University of New England have been working with Dr Caroline Lee from CSIRO to look at the impact virtual fencing has on sheep welfare, along with their PhD student Tellisa Kearton.

To optimise the likelihood of successful implementation, it is important to understand whether the use of audio cues ("beep") and electric stimuli that are an integral part of virtual fencing, have any welfare impacts on the animals. Earlier this year a study was conducted by Tellisa Kearton and Sue Belson to compare the impact of the audio cue and the electrical stimulus with known stressors in sheep, these being dog barking and restraint. Manual collars were used in all these sheep studies. Manual collars are operated by researchers applying the audio and electrical cues manually to each animal. Unlike the cattle work in this Project, automatic collars are yet to be developed for use in sheep.

During the trial, 80 Merino ewes were assigned to either of five treatments; control, beep, dog bark, restraint or electrical stimulus treatments. Both physiological (cortisol, body temperature) and behavioural responses to the treatments were assessed.

The restraint treatment showed an elevated cortisol response when compared with the control. No differences were seen between the other treatments and the control sheep.

There were no differences in body temperature in response to the treatments. When comparing the behaviours of the animals, sheep that were in the bark and beep treatments showed more vigilance (head up and looking around) compared to the control sheep. Sheep that received the electrical stimulus showed more aversive behaviours compared to the control sheep. Ranking of the least to most aversive treatments taking into account behavioural and physiological measurements were in order:

- Control
- Beep
- Barking Dog
- Electrical stimulus
- Restraint

In June this year, the UNE/CSIRO research group also conducted a field trial to determine how group dynamics varied when sheep are subjected to virtual fencing. Movement around the paddock and social interactions of a small flock of 18 sheep was monitored over a two week period. Following this adaptation period, the sheep were split into two groups of 9 sheep and their movement and flock interactions were monitored when a virtual fence was implemented over the following two week period. Preliminary results indicate that some sheep are able to avoid interacting with the virtual fence through social facilitation and following their lead of their peers.

Upcoming studies will look at using virtual fencing to improve pasture utilisation with sheep.

Latest news

- The DAWR research program purchased 150 of the latest pre-commercial prototypes of the e-Shepherd™ collars from Agersens and have used them successfully at their three key R&D sites at Armidale, Elliot and Camden.
- The collars have been used by Dana Campbell at CSIRO, Armidale to successfully herd cattle from one end of the paddock to the other by applying the technology as a movable 'back fence'.
- Sabrina Lomax found that the cattle learnt to respond to the cues in the collar within 2-3 exposures to the technology, irrespective of whether they were tested as individuals or in a group at University of Sydney, Camden.
- Adam Langworthy found that a virtual fence was just as effective as a fixed electric fence in allocating pasture to lactating dairy cows at the TIA Dairy Centre at Elliot in Tasmania.
- Danila Marini, University of New England, Armidale, New South Wales, was named as the Career Professional winner from a strong line-up of finalists in the LambEx 2018 Young Guns Competition that was held at LambEx 2018 in Perth WA between 5 and 7 August 2018. As a finalist, Danila travelled to Perth to attend a Professional Development Workshop and LambEx 2018. All competition finalists held a four-minute presentation on an industry topic before answering four minutes of questions from judges. As the winner of the Career Professional section, Danila was awarded a $1000 prize.

Dairy cattle being constrained by the eShepherd collars to a daily pasture allocation at Elliot,Tasmania.

- Patricia Colusso, University of Sydney, who is doing a PhD in the Virtual Herding project, was awarded the Best Paper at the 2018 Dairy Research Foundation Symposium held on 16 and 17 July, 2018 at Camden, NSW. Patricia received the award for her research on the effect of group size on dairy cow response to a virtual fence.
- After the successful livestock producer workshops last year, Nikki Reichelt from The University of Melbourne held a further three workshops in July and August earlier this year, this time with land managers and agricultural advisors and consultants.
- Agersens has recently setup a new Innovation Centre at the previous Queensland Department of Agriculture and Fisheries, Dairy Research Centre at Mutdapilly in south east Queensland. The centre has been designed as a place to develop the eShepherd animal management platform and act as a permanent demonstration site for virtual fencing. It anticipated that there will be field days, seminars and workshops throughout subsequent years.
- In June, 2018, Agersens appointed Dr Cameron Ralph as Manager, Production Science to support the development and roll out of the automated collar system, eShepherd.
- Dr Ralph was formerly the Science Program Leader at SARDI, Roseworthy, South Australia. He has had over 10 years of research experience in animal physiology, neuroendocrinology and animal welfare. He joins other key animal welfare scientists at Agersens, including Sally Haynes and Bronwyn Stevens.
- AgResearch in New Zealand have purchased 100 eShepherd™ collars and plan to use them in research studies in 2019. Staff from AgResearch visited several of the R&D sites in Australia in October to ensure their planned work is complementary to the R&D program in this DAWR project.
- The fifth of a series of webinars was presented by Dr Sabrina Lomax on 8th November. If people couldn't log into this webinar they can access it by contacting Ray King r.h.king@bigpond.net.au
- The sixth Milestone Report for the project is being prepared and will be submitted to the Department of Agriculture and Water Resources before December, 2018.

Further information

The website for this project has been established on the Dairy Australia website dairyaustralia.com.au/farm/animal-management/technologies/virtual-herding-program.

The site contains information about project activities and recent news about the Project, including links to a number of presentations that members of the Project Team have made to industry over the past few months.

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