Dairy Australia

Australian Government

Department of Agriculture, Water and the Environment

VIRTUAL HERDING RESEARCH UPDATE

TECHNOTE 2: WELFARE ASSESSMENT OF APPLYING VIRTUAL HERDING TECHNOLOGY IN CATTLE

Background

State and territory animal welfare legislation determine where and what type of electronic devices can or cannot be used to contain livestock. As at 1 January 2020, the Virtual Herding (VH) neckbands can be used commercially in Queensland and Tasmania. Currently, the neckbands cannot be used commercially in Victoria, New South Wales, South Australia, Western Australia, Northern Territory and the Australian Capital Territory. Exemption permits have been obtained in Victoria, New South Wales and South Australia, for the use of the VH neckbands in these States in experiments approved by the respective Animal Ethics Committees of the research institutions. One of the principal aims of the VH project was to gather information to quantify any effects of the technology on physiological and behavioural indices of animal welfare to ensure the welfare of livestock is not compromised by the technology.

Potential measurements that may adequately assess any effect of the VH technology on animal welfare

The Project has identified some key measures of welfare assessment during the initial contact with the virtual fence, during the learning phase and during long term application of the technology. Some of the more promising practical measures include:

- The percentage of audio:total audio and electrical cues after the initial learning phase
  - This is a measure of learning to respond to the audio cue and avoid the electrical cue at the virtual fence line. This percentage often approached 90 per cent in many of the trials in the Project. A minimum level of 80 per cent once animals are trained, may be considered as a target for acceptable animal welfare.
- Spatial distribution of animals within the inclusion area
  - Using GPS, "heat maps" can be generated of the spread of animals in a paddock and these may indicate if there are any welfare issues. For example, animals following fixed fences may indicate a lack of understanding of where the virtual fence is located. Uniformity of the paddock and position of preferred resources such as water points should be considered when interpreting these spatial patterns.
- Time budgets
  - The proportion of time the animal spends lying, walking, grazing, etc compared to accepted norms. For example, cows are motivated to achieve between 12 to 13 hours of lying time per day (Jensen et al., 2005) and disturbances in normal time budgets can indicate welfare issues. Presently the time budget data are being collected in R&D studies by the use of commercially available Ice-Qubes® and MooMonitors®, but there is potential to integrate and validate this type of data into the neckband (Figure 1).
- Behavioural response to the cues
  - For example, how long does it take for the animal to return to normal patterns of behaviour such as

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grazing, after receiving the cues. In addition to the practical measures outlined above, some of which may be used to assess the welfare of animals in commercial production, the Project has also collected data on both:

- Behavioural measures, such as an ethogram or a quantitative description of the animal's behavioural response to the audio and electrical cues,
- Physiological measures, such as cortisol concentration which may be an indicator of stress.

Furthermore, a framework has been proposed to assess welfare outcomes and the learned ability of animals to predict and control engagement when exposed to new technology (Lee et al., 2018).

Figure 1 Steer wearing the neckband device and Ice-Qubes® on their front leg for measuring behavioural time budgets.

CASE STUDY

In a study conducted in Armidale, NSW, the welfare impacts of a virtual fence, in comparison to an electric tape fence, were assessed in beef cattle (Campbell et al., 2019). The study used eight groups of eight 12-month old steers each within a six hectare area across eight separate paddocks for four weeks. Faecal samples for measuring cortisol metabolite concentrations from each animal were taken weekly (Figure 2). Lying and standing time were measured, as well as the GPS location of the animals across the trial and all audio and electrical stimuli that were received by the animals. Cattle with both fence types were maintained within their allocated area across the four-week period.

There was no difference in faecal cortisol concentrations between fence types (Table 1), and concentrations decreased over time. Cattle from the virtual fence groups were found to be standing (rather than lying) longer than those from the electric tape groups, but the difference was less than 20 minutes per day, and lying time of cattle exposed to both fence types fell well within the expected ranges with both groups exceeding 11 hours (Table 1). Cattle learned to respond to the audio cue alone although learning rate varied between individual animals. The average percentage of audio:total audio and electrical cues received by the cattle in the virtual fence group once they were trained was 82 per cent.

Figure 2 Collecting faecal samples from individual animals for analysis of stress hormones.

Table 1 The welfare assessment of cattle exposed to either an electric fence or a virtual fence.

Welfare parameter	Electric Fence	Virtual Fence
Lying time (hr/day)	11.8	11.6
Number of lying bouts each day	10.7	10.3
Faecal cortisol (ng/g)	18.2	16.4

The results from this experiment indicate that VH technology can effectively contain animals in a prescribed area and that it does not have large behavioural and welfare impacts on the cattle.

References

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