Managing dairy cows with Halter virtual-fencing technology

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Research results

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Virtual-fencing is an emerging technology with the potential to revolutionise livestock management.

How does the technology work?

Virtual-fencing requires each cow to wear a collar that communicates to the animal using sensory cues, rather than relying on stock-people and electric fencing.

The Halter virtual-fencing system uses sound (called 'piezo'), electrical (called 'pulse'), and vibration cues.

Cows are confined to a pasture allocation using the piezo and pulse cues. A 'virtual-fence' is set via GPS and its location is communicated to each collar. As the cow approaches the virtual-fence, the collar emits a benign piezo cue. If the cow ignores the piezo, the collar delivers a pulse. However, if the animal stops walking or turns around at the piezo, no pulse is delivered.

Halter can also remotely shift cows to the dairy using piezo and vibration cues. The piezo guides cows in the right direction, while the vibration encourages them to continue moving forward. A pulse is only delivered if the piezo and vibration cues are ignored.

Over time, the cow learns to avoid a pulse by responding to the piezo or vibration cues.

What was examined?

The Tasmanian Institute of Agriculture, in collaboration with Halter, assessed the effectiveness of this technology to manage lactating dairy cows.

What was the outcome?

Cows quickly learned the cue associations. After training, most cows received ≤1 pulse per 100 piezo cues when confined to a pasture allocation and ≤1 pulse every 4 transitions to the dairy.

KEY POINTS

This is the longest study of virtual-fencing on lactating dairy cows, and the first to study the application of Halter technology.

Eighty mid-lactation dairy cows were split into two groups and managed with Halter virtual-fencing system for a 10-day training and 4-week management period.

Cows quickly learn to respond to the sound cue when the technology is holding them in a paddock. Most of this learning occurs within one day.

Transitioning is a more complex function so takes longer to learn, but cows start shifting unassisted within a week of the start of training.

During the management period cows received 2.6 pulses per 100 piezo cues.

The ratio of pulse: piezo observed in this study is lower than previously reported in the literature using other technologies.

Ratio of pulses to piezo cues declined over time

At day 1, at least 60% of piezo cues resulted in a pulse.

From days 2-10, 6.4% of piezo/vibration cues resulted in a pulse.

In the management period, 2.3% of piezo/vibration cues resulted in a pulse.

What did the trial involve?

Conducted at the Tasmanian Institute of Agriculture's Dairy Research Facility, this trial examined how cattle adjusted to the Halter virtual-fencing system. The study considered two time periods:

T The training period occurred over 10-days. Stock people and electrified tape were gradually removed over the training period as dependence on the collar cues increased.

M The management period was 4-weeks long, starting after training ended. In this time cows were managed entirely with the Halter technology.

Cows were milked twice per day. They were fed 9 kg pasture DM/day in a 24-h allocation, supplemented with 7 kg silage DM/day and 6 kg grain DM/day fed in the dairy.

What were the findings?

The training period

Cows quickly started responding to the piezo when in the paddock, and most of this learning occurred within one day.

Learning to transition took longer, but cows were shifting from the paddock to the dairy unassisted by day 4.

The management period

When in the paddock, 90% of cows spent ≤ 1.7 mins/d over the virtual-fence (≤0.15% of daily paddock time).

Most cows interacted with the virtual-fence at least once/d (10th percentile for interactions 1.14), but seldom received more than 1 pulse/d (90th percentile 0.71 pulses/d).

More than half of cows received ≤1 pulse/100 piezo cues when in the paddock, and few exceed 7 pulses/100 piezo.

Vibration was active for 4.4% of transition time. Cows received ≤10 piezo and ≤0.43 pulses/d during transitions (50th percentiles). With two transitions to the dairy each day, this equates to <1 pulse every 4 transitions.

During week 4, 50% of cows received zero pulses in the paddock and 35% received zero pulses while transitioning.

Median (or 50th percentile) for number of cues delivered per day of each time period (with 5th to 95th percentiles in parenthesis).

Variable	Training Period		Management Period			
	Day 1	Days 2 to 10	Week 11	Week 21	Week 31	Week 4
In the paddock						
Piezo	19.0 (7.2-32)	7.3 (2.6-52.1)	4.4 (1.0-61.9)	6.4 (1.1-82.7)	5.1 (0.41-110)	4.7 (0.41-71.3)
Pulse	11.0 (4.0-20.0)	0.56 (0.0-2.3)	0.14 (0.0-1.6)	0.14 (0.0-1.8)	0.14 (0.0-1.7)	0.0 (0.0-1.2)
Pulse: Piezo	0.600 (0.3-0.95)	0.045 (0.0-0.17)	0.018 (0.0-0.12)	0.013 (0.0-0.09)	0.006 (0.0-0.12)	0.00 (0.0-0.07)
Transitions						
Piezo	N/A	20.5 (10.5-46.6)	9.0 (5.6-18.2)	9.2 (6.0-16.6)	7.0 (2.9-13.2)	5.3 (2.7-9.3)
Pulse	N/A	1.44 (0.67-2.5)	0.33 (0.0-1.14)	0.17 (0.0-0.67)	0.17 (0.0-0.59)	0.14 (0.0-0.44)
Pulse: Piezo	N/A	0.072 (0.02-0.21)	0.036 (0.0-0.13)	0.019 (0.0-0.09)	0.021 (0.0-0.13)	0.018 (0.0-0.17)
Daily total						
Piezo	N/A	31.9 (16.8-90.5)	14.7 (8.0-63.8)	16.5 (8.2-109)	13.6 (5.2-118)	11.1 (4.1-76)
Pulse	N/A	2.0 (1.2-4.0)	0.67 (0.17-1.7)	0.40 (0.0-2.6)	0.43 (0.0-1.9)	0.29 (0.0-1.12)
Pulse: Piezo	N/A	0.064 (0.03-0.16)	0.033 (0.01-0.11)	0.021 (0.0-0.06)	0.024 (0.0-0.11)	0.017 (0.0-0.07)

N/A no transition data recorded this day due to technical error of unknown cause.