VIRTUAL HERDING RESEARCH UPDATE

TECHNOTE 4: USE OF VIRTUAL HERDING TECHNOLOGY TO IMPROVE PASTURE UTILISATION

Background

Pasture is the cheapest and easiest way of feeding cattle. Maximising the proportion of fresh pasture in the diet of cattle is a key driver of profit and resilience in pasture-based livestock production systems. Grazed pasture makes up between 40 per cent and 90 per cent of the cow's diet in pasture based dairy systems in Australia. In Australia, the dairy industry achieves at least 65 per cent to 70 per cent of grown pasture utilised compared to often only 30 per cent to 40 per cent of pasture being utilised in the beef industry. Intensive and targeted grazing management practices enable a more consistent and efficient utilisation of pasture, which improves productivity per hectare while reducing feeding costs.

There is an opportunity for more sophisticated grazing management regimes to improve pasture utilisation and consequently increase livestock productivity, particularly for grass-fed beef production. Until recently such grazing regimes have been limited by costs associated with increased labour and fencing requirements. Virtual Herding (VH) technology may remove some of these barriers and facilitate the implementation of complex and more intensive grazing regimes in pasture-based livestock production systems. The research described in this technical note is the first to apply VH technology to manage intensive grazing of livestock.

Potential application of VH technology to increase pasture utilisation

Potential ways that VH technology can be applied to better control grazing management and increase pasture utilisation include:

- Providing fresh pasture in more frequent allocations
  - Replacement dairy heifers represent a significant capital investment in the future of the dairy herd. Improving management of dairy heifers by better nutrition benefits their lifelong productivity and longevity. However, heifers are often left grazing a single paddock that is located away from prime grazing areas (i.e., runoff block) for weeks or even months. An experiment conducted at the Tasmanian Institute of Agriculture (TIA) found that providing pregnant heifers access to fresh pasture each day increased their live weight gain by 8 kg over the 12 week period and improved pasture re-growth compared to providing access to fresh pasture twice weekly. Heifers that have experienced an intensive grazing regime may also adapt more quickly to the intensive grazing systems when they join the milking herd.

- Cell grazing, particularly in beef production
  - Cell grazing is an intensive version of rotational grazing. It involves grouping animals at high stocking densities and moving them through a series of small paddocks (i.e., cells) so when they have finished grazing the last cell in a series the first cell is ready to be grazed again. TechnoGrazing is an intensive

rotational grazing system that facilitates cell grazing by dividing a larger paddock into lanes using semi-permanent electric fencing, with each lane being further subdivided into cells using temporary electric front and back fencing. Research conducted at the TIA suggests that VH technology may be able to replace the temporary front and back fences in these systems and animals can be moved to new cells remotely.

- Provide fresh pasture to livestock when they are more likely to graze.
  - The success of intensive grazing regimes may be dependent on protocols that support the natural ingestive and social behaviours of cattle over the day. VH technology may be able to improve pasture utilisation by ensuring fresh pasture is available at times that the animals are naturally inclined to graze, rather than when it is convenient for the dairy farmer to move fences.
  - Incrementally shifting the grazing front as cows return from the dairy to ensure animals at the end of the milking order have access to fresh pasture. Preliminary data from the TIA indicate that this grazing practice can increase milk yield from cows that are towards the end of the milking order.

Strip-grazing dairy cattle using virtual fencing

The R&D group at TIA intensively grazed a herd of 30 multi-parous dairy cows in early lactation. Fresh pasture (14-15 kg DM/cow/day) was allocated every 24 hours in a new paddock, and cows were removed from the paddock twice per day for milking (at about 0700 and 1430 h). Cows were grazed for 10 days using an electrified strip-fence, followed by three days of training to the virtual fence technology in a large paddock, and then 10 days of grazing using a virtual front fence (Figure 1).

All animals had responded to audio alone by the end of a 3 day training period. After training the ratio of audio:electrical stimuli remained above the minimum level of 0.80 while grazing with the virtual fence. This observation indicates that cows quickly learnt the association between audio and electrical cues in the VH technology and were able to apply these learnings to applied grazing conditions.

The virtual front fence was as effective as the electric front fence in keeping the cows within their allocation (see Figure 2) and GPS data suggest that the cows had adapted to the virtual fence within four days. The estimated pre-grazing pasture mass was 2785 ± 468 kg DM/ha and post-grazing residual was 1698 ± 209 kg DM/ha. The milk production and live weight of cows did not differ between the electric fence and the virtual fence, but the estimated pasture consumed appeared to be greater with an electric fence (Table 1).

Figure 1 Dairy cattle grazing at the virtual front fence

Figure 2 Pasture depletion at the virtual fence. 'Inclusion zone' refers to the area where cows could move freely. Stimuli were delivered when cows crossed the virtual fence to enter the 'exclusion zone'
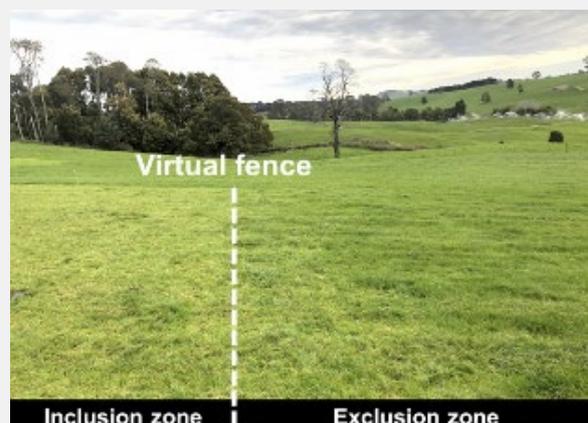
Table 1 Average daily milk production and estimated pasture consumption over 10 days of grazing with an electric front fence (30 cows) and 10 days of grazing with a virtual front fence (29 cows). The time cows spent ruminating and grazing from days six to eight with an electric fence and days 4 to 6 with a virtual fence are also presented. Mean values ± standard deviations are presented.

Measure	Electric Fence	Virtual Fence
Milk yield (kg/day)	25.6 ± 3.3	26.5 ± 3.5
Estimated pasture consumed (kg DM/cow/day)	13.1 ± 2.2	11.7 ± 2.8
Rumination (% of time in paddock)	33.4 ± 3.8	38.3 ± 4.5
Grazing time (% of time in paddock)	34.8 ± 4.9	28.2 ± 4.6

While cows appear to avoid grazing near the virtual fence for 6 to 12 hours after entering the paddock in the first few days with a virtual fence, grazing behaviour soon became evenly distributed along the length of the paddock over the 24 hour allocation (Figure 3). This is in agreement with data indicating that pasture depletion was evenly distributed across the paddock in both treatment periods.

The daily provision of fresh pasture in a new paddock meant that the cows had to rediscover the location of the virtual fence each day. There were some indications of a disruption of behavioural time budgets as cows in the VH treatment spent more time ruminating and less time grazing than cows in the electric fence treatment (Table 1). Consistency in the location and movements of the virtual fence may be particularly important if this technology is to be used to implement intensive or complex livestock grazing regimes.

Figure 3 From GPS records, the average percentage of time per day that cows were recorded in the exclusion zone (EZ) and in each twentieth of the paddock (Zone01 being closest to the front fence) during 10 days of grazing with an electric front fence (dark blue) and 10 days of grazing with a virtual front fence (light blue).
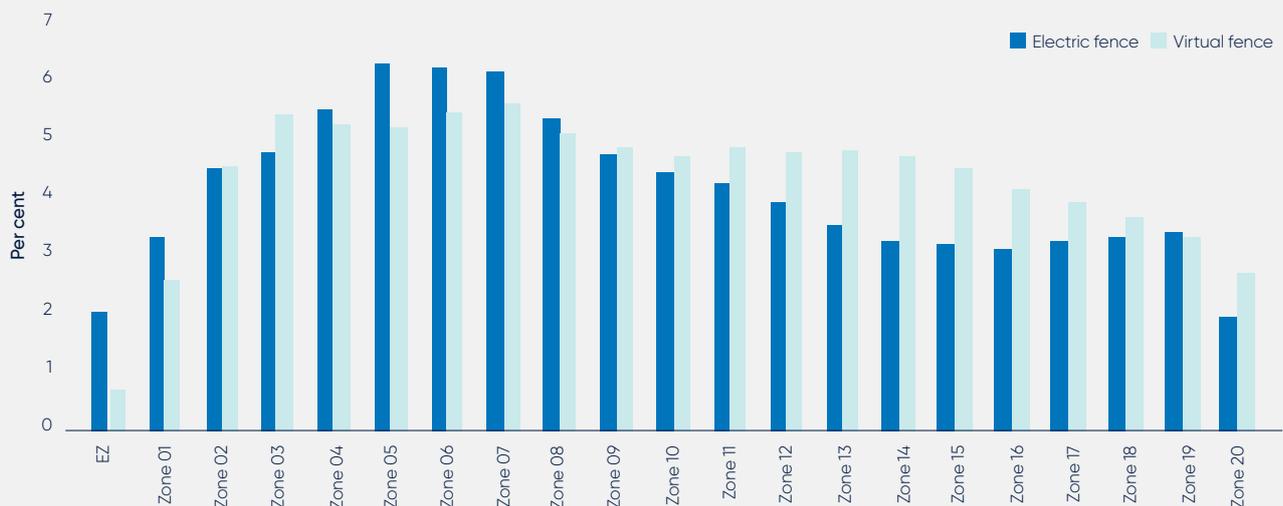
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