OLDS COLLEGE
OF AGRICULTURE & TECHNOLOGY | TECHNOLOGY ACCESS CENTRE FOR LIVESTOCK PRODUCTION

Technology Access Centre for Livestock Production (TACLP)

2020-2021 Study: Optimizing Grazing Management Through Technology: A Western Canadian Study

INTRODUCTION

In Western Canada, particularly Alberta, cattle producers face significant challenges due to labour shortages and rising operational costs. Effective grazing management – notably rotational grazing – is essential for enhancing soil health, pasture productivity and animal well-being. However, its implementation requires thorough oversight and resource-intensive management.

This two-year study focuses on evaluating a range of technologies aimed at enhancing the monitoring and management of grazing cattle, particularly within rotational grazing systems.

OBJECTIVES

- Evaluate the functionality, connectivity, user-friendliness and practical challenges of various technologies aimed at optimizing cattle production efficiencies in a Western Canada grazing context.

STUDY DETAILS

- This study was conducted during the summers of 2020 and 2021 on a 49-acre field at Pitstra Farm (near Carstairs, Alta.) which is part of the Olds College Smart Farm.
- The field was separated in half to accommodate two grazing systems: conventional and rotational.
- A total of 26 cow-calf pairs grazed on the conventionally grazed pasture, and an identical number grazed on the rotationally grazed pasture (ensuring a consistent comparison between both systems).
- The rotationally grazed pasture was subdivided into eight paddocks separated by poly-wire electric fencing, each of which was grazed for approximately two to four days at a time. The animals in the conventional pasture were allowed to freely graze across the entire pasture for the duration of the trial. Overall, the grazing season lasted approximately two months each year from mid-June to mid-August.
- Two separate LoRaWANs (local wireless networks) were used: one connected the EF-NODE to the internet to upload device data, while the other connected the two iMetos stations.

TECHNOLOGIES TESTED

Solar Water Pumping and Hydros 21 - Water monitoring

- A Solar Water Pumping (Sungod Solar, Sundre, Alberta, Canada) portable water tank and pump system was used to supply water to several water trough locations on both the conventional and rotational grazing pastures at Pitstra Farm (Figure 1). In parallel, an attempt was made to integrate Hydros 21 water sensors (Meter, Pullman, Washington, United States) for real-time monitoring of water levels within the troughs (Figure 2).

Figure 1: Solar Water Pumping.

Figure 2: Hydros 21 water sensor.

EF-NODE sensors - Electric fence monitoring

- The EF-NODE Electric Fence Node (ICT International, Armidale, New South Wales, Australia) is a wireless sensor for detecting faults in electric fences (Figures 3a and 3b). The EF-NODE continuously checks for the presence of a radio-frequency signal caused by the electric fence and shows it on a graph of current on an online platform called Eagle IO, accessed by the user. The technology was used in the rotational pasture only, as the conventional pasture did not have any electric fence.

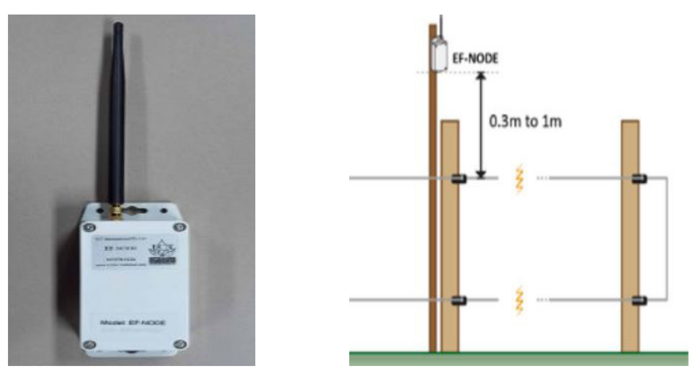

Figure 3: a) EF-NODE and b) Its disposition in relation to electric-fence.

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TECHNOLOGIES TESTED *(continued)*

Allflex SenseHub ear tags - Animal activity monitoring

- Ear tag monitoring system (Allflex, Irving, Texas, United States) offering detailed insights into animal activity (Figure 4). The tags are equipped with accelerometers and utilize Allflex's algorithm to categorize various behaviours in cattle. The system includes a proprietary router, which was strategically positioned near a water trough. This setup ensured when animals approached to drink, the data collected by each ear tag was downloaded to the router. The data was uploaded to the Allflex online platform via cellphone network, allowing for comprehensive analysis and visualization of the behaviour patterns.

Figure 4: Allflex ear tags.

iMetos ECO D3 station - Soil monitoring

- Solar-powered data logger (Pessl Instruments, Weiz, Austria) capable of collecting soil moisture (volumetric water content), soil temperature, and rainfall in real-time (Figure 5).

iMetos 3.3 IMT 180 station - Weather monitoring

- Solar-powered weather station (Pessl Instruments, Weiz, Austria) used to measure air temperature, air relative humidity and rainfall (Figure 6).

Figure 5: iMetos ECO D3 station.

Figure 6: iMetos 3.3 IMT 18.

Jenquip EC-10 plate meter - Estimating available pasture biomass

- A rising plate meter (Feilding, New Zealand) used to more accurately and quickly estimate available pasture biomass. Clippings from the rotationally grazed pasture were collected and used to calibrate a rising plate meter model Jenquip EC-10 and demonstrate its use in estimating available pasture biomass (Figures 7a and 7b).

RESULTS

Sundog Solar

The Sundog Solar proved to be a robust system for supplying water to cattle, reliably pumping water to troughs up to 650 meters away. Its ease of transportation and setup proved it a viable tool for improving water distribution efficiency at Pitstra Farm.

Hydros 21

The Hydros 21 water level sensors, which were intended to provide data on water availability in troughs, faced installation challenges. Despite multiple attempts and troubleshooting efforts, the sensors could not be successfully installed or connected to the Pitstra Farm LoRaWAN network, indicating a need for further exploration of other more compatible and resilient water level monitoring technologies.

EF-NODE sensors

Setting up the EF-NODE sensors was a detailed process, involving firmware updates and requiring technical support, which extended the setup duration. Once in place, the sensors reliably monitored electric fence voltage, providing essential data for managing fences effectively. Despite their functionality, the system did encounter some issues. The web platform used for viewing data was not user-friendly, and the lack of a cell phone app made monitoring less accessible. Additionally, the sensors were prone to damage from curious cattle, pointing to a need for more durable designs that can endure the demands of an active grazing environment. However, the EF-NODE sensors showed promise in simplifying the management of electric fences, emphasizing the importance of easy-to-use interfaces and sturdy construction for the adoption of technology in rotational grazing systems.

Figure 7: a) (left) Jenquip EC-10 for pasture biomass estimation; b) (right) Display showing available biomass (dry matter basis).

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RESULTS *(continued)*

Allflex SenseHub ear tags

The ear tags consistently provided daily insights into cattle behaviour, tracking activities such as eating, resting and panting (Figure 8). While no health issues occurred during the trial, these ear tags have the capability to alert producers to potential health concerns such as heat stress, offering a proactive approach to animal well-being. Despite their utility in health monitoring, the system often faced connectivity challenges. These issues were mainly due to limited cell phone network coverage in the area, a critical factor for the successful transmission of data from the ear tags. This obstacle highlights the importance of developing reliable connectivity solutions, especially in remote grazing locations, to ensure uninterrupted data flow and effective herd management.

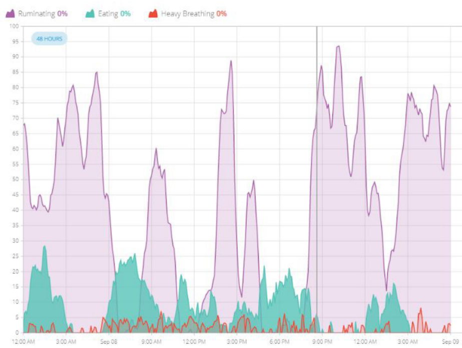

Figure 8: Allflex SenseHub's data as visualized on the Allflex online platform.

iMetos ECO D3 and iMetos 3.3 IMT 180 stations

The ECO D3 stations effectively captured crucial data points such as soil moisture, temperature and rainfall with precision (Figure 9). While there were occasional connectivity disruptions attributed to LoRaWAN issues, these incidents were infrequent.

The 3.3 IMT 180 stations consistently provided accurate measurements of air temperature, humidity and rainfall – and operated flawlessly. This comprehensive data set, particularly the soil moisture readings, empowers informed grazing management decisions. It provides insights critical for preventing soil compaction during vulnerable periods of soil wetness and for optimizing water resource management, particularly in anticipating and mitigating the impacts of potential drought conditions.

Jenquip EC-10 rising plate meter

The Jenquip EC-10 meter demonstrated a moderate correlation with standard forage clipping methods, achieving an R^2 value of 0.6. This suggests that 60% of the variation in measured biomass can be explained by the meter readings. The presence of weeds likely impacted accuracy by altering pasture height measurements. Despite these challenges, the rising plate meter holds promise for enhancing biomass estimation and subsequently improving grazing rotation decisions, pending further calibration and adjustments.

CONCLUSION

This project has demonstrated the potential of remote monitoring technologies to enhance grazing management and livestock productivity in Western Canada, particularly within Alberta's unique environmental and operational landscape. Technologies like the Sundog Solar system, EF-NODE sensors, and Pessl/iMetos stations have shown promise in improving water distribution, fence monitoring, and providing critical soil and weather data. However, challenges related to connectivity, user interface, and durability against cattle interaction underscore the need for further refinement and adaptation to local conditions.

A notable area for ongoing work is the calibration of tools – such as the Jenquip EC-10 rising plate meter – to the region's specific conditions, addressing issues like weed interference. This project highlights the importance of developing advanced technologies along with ensuring their practicality and reliability in the field, setting the stage for future enhancements and the potential for these technologies to significantly contribute to the efficiency and sustainability of cattle grazing practices in Western Canada.

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Figure 9: iMetos ECO D3's rainfall data as displayed on Pessl Instruments online platform FieldClimate.