final report

Project code: P.PSH.1041

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Date published: 21st June 2018

PUBLISHED BY
Meat and Livestock Australia Limited
Locked Bag 1961
NORTH SYDNEY NSW 2059

Increasing uptake of performance-recording genetics through automated livestock management systems (Phase 1)

Final Report

This is an MLA Donor Company funded project.

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Abstract

The project has deployed automated livestock management systems (ALMS) and engaged in training a number of groups of cattle. The pregnancy scanning equipment is in place, which will be used alongside crush side data recording to validate the ALMS system. The Belmont property data including mapping and all cattle information is available via the DataMuster database and web-based application. During the Beef Australia 2018 Expo the project team were able to engage with more than 500 producers and provide them with information on the project and the importance of automated phenotyping. The delay in finalising the contracting of Phase 2 of the project means the work planned for July and August associated with training the calving groups has not been started. However, the project team will continue to undertake this work until to ensure the evaluation of induction of the cattle into the calving paddocks is considered as part of Phase 2 of the project.

Executive summary

This project laid the foundations for the evaluation of automated livestock management systems (ALMS) to deliver more cost-effective and accurate performance recording that can be used in genetic improvement programs. It is hoped that developing and delivering automated cattle performance recording within genetic improvement programs will encourage greater uptake and use of estimated breeding values (EBVs).

The project has established baseline software and hardware tools that will underpin automated performance recording. These tools were deployed at Belmont Research Station to deliver whole-of-herd automated performance recording for cattle weights and dates of birth. In addition to the automated recording, the project also established tools to provide independent performance recording to validate the ALMS systems. The project deployed four ALMS systems including using the DataMuster software to manage and report on the performance recording data.

The project has also started to raise industry awareness about the assessment of ALMS tools and the potential benefits to industry. During the 2018 Beef Australia Expo held in Rockhampton on early May over 200 producers were able to visit Belmont to see the ALMS system in place and hear about the opportunities for performance recording. The project was also reported at the CQUniversity trade stand and during a number of presentations that the team made during the week.

This report covers Phase 1 of a two-phase project. Phase 1 established the baseline recording for a whole of herd performance recording system and has provided important information regarding considerations for deploying ALMS for performance recording. Phase 1 of the project demonstrated the importance of good data recording and selecting paddocks that maximise the number of cattle that come to water. There was great interest from producers and there are a number that have expressed interest in testing the systems on their own properties. It will be important for Phase 2 of the project to go ahead to fully evaluate and validate the ALMS performance recording.

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1 Background

This project aimed to address the challenge of increasing uptake of genetic performance recording in extensive beef production systems that are typical of northern Australia. In particular the goal is to develop, test and validate the use of automated livestock management systems (ALMS) to provide more cost effective and accurate data on cattle performance. These data could be used in genetic improvement programs.

There is low uptake of performance-recorded genetics in the extensive production systems of northern Australia and a disconnect between seedstock producers and extensive commercial operations. The participation in performance-recorded genetics is in part limited by the perceived challenge of collecting accurate, BREEDPLAN compliant, performance data. This challenge is particularly acute for more difficult to record data such as birth dates and birth weights and these are the very traits that have the potential to have the greatest positive impact on production.

It is proposed that this challenge be addressed in a project which explores the potential for ALMS to simplify collection of critical performance data to aid greater adoption of performance recording and genetic evaluations in northern Australia. ALMS can provide more accurate, more frequent and more reliable measures of performance than traditional methods.

Belmont Research Station will act as a “hub” of intensive research activity to be linked with a series of producer-owned “spokes” to ensure high-quality research, direct engagement and participation with end-users and an efficient vehicle for extension to producers and industry. There are a number of producers that have expressed interest in participating in this project.

This document is the Final Report for Phase 1 of what was proposed to be a two-phase project. The first phase of the project aimed to raise awareness of the potential for ALMS and to develop the infrastructure at Belmont Research Station to deliver long-term performance recording including data validation for cattle that are managed as a single herd.

The future for genetic improvement in northern Australian beef herds requires more cattle to have more accurate, more frequent and more reliable performance measures. In extensive beef production systems that are typical of northern Australia there are significant costs associated with performance recording. Therefore, future genetic improvement programs need to capture data at lower costs and with less labour. The Beef CRC put significant resources into supporting data capture for genetic improvement in northern Australia. Dedicated researchers supported the data capture and while the data has proven valuable it is challenging for producers to replicate the quality and quantity of data capture that occurred in the CRC. While seed-stock producers capture important information that is used in BREEDPLAN to generate estimated breeding values (EBVs), this has not resulted in wide-scale commercial producers buying bull genetics that are based on quantitative traits (1,2). Industry anecdotes suggest that commercial producers are not confident in the current methods that are used to derive estimates of genetic value. This project will build on the work that members of the CQUniversity Precision Livestock Management (PLM) team have published (3,4,5,6,7,8) on both growth rates and measures of reproductive performance using automated

performance measures. The project will focus on validating the value of ALMS in the context of a seedstock operation.

The detailed data from Belmont Research Station will be used via simulation to provide a set of quality control standards that can be used to identify when data quality does not meet the requirements for robust genetic evaluation. In so doing it will consider how the technology can fit within the whole operation of extensive livestock operations. The extension of the project to extensive beef production systems will allow further refinement under a more extensive breeder operation. For the beef industry to have confidence in using ALMS within performance-recorded genetic improvement programs, work needs to be completed to address issues associated with the practical application of the technologies. In particular the importance of ensuring cattle regularly access the ALMS even when there is significant water available on the ground. Work already completed by the CQUni team has shown that there are differences in how cattle interact with ALMS when there is standing water. However, the location, water quality and the use of supplements has the potential to overcome the impact of standing water.

By improving the ease of collection of objective genetic information and promoting the uptake of these tools, the project will address the NLGC Terms of Reference by delivering tools to enable the ease of application and use of livestock genetics; and providing new data to contribute to industry's 'Breeding Value Services' and the 'Accessible National Data Platform'. The project will therefore support the NLGC in achieving its KPIs of doubling the rate of genetic gain and increasing the number of animals with EBVs. This in turn will assist in meeting the MISP objectives of northern beef productivity growth.

2 Project objectives

The objectives of Phase 1 of the project are to:

- Provide a whole of property reference point for the broader industry to see how automated data capture systems can be deployed
- Validate existing automated measurement systems for the purposes of collecting phenotypic data for inclusion in BREEDPLAN

Phase 1 activities included:

- Install prototype ALMS at strategic watering points across Belmont Research Station, each featuring walk-over-weigh (WoW) platforms, portable panels, water meters, cameras and telemetry systems
- Training of 1100 head at Belmont in the use ALMS stations
- Data recording and database management to enable processing of manual and automated data input, ensure RFID files align with life data and continually update trait files and ensure DataMuster™ front end can monitor and track stock movement, weight gain etc.
- Begin trialling the ALMS to establish the practical method to derive traits for genetic evaluation e.g. maternal parentage in groups (n=100+) of cows and calves, bull exposure date, pregnancy diagnosis and calving date to automatically derive Days to Calving. Currently the algorithms are run as standalone tools, the automation of these algorithms to run either

directly at the ALMS or on the virtual server will be an important part of the practical deployment of a long-term study.

- Develop the project communications strategy and begin implementation through a field day at Belmont Research Station, project fact sheets summarising activities and objectives and demonstration of ALMS and DataMuster™ at Beef Australia 2018.

3 Methodology

3.1 Deploy and train cattle on ALMS

The four ALMS in place at Belmont use slightly different layouts and infrastructure but all incorporate portable panels formed into a compound surrounding the watering point with a race leading cattle past an RFID reader and over a weigh platform. The cattle utilising each system have been put through a training program (following the CQUni/MLA training guide protocol) to get them accustomed to walking down a race, over the weigh platform and through the entry spear gates. A training package has been designed using a 15-day training period. The recording of radio frequency identification (RFID) numbers is used throughout the training period to determine the usage on a daily basis and whether additional training is required. Limited meaningful weight data is recorded during the training program, however, following completion of the 15-day period typically all animals are recording weight data.

A method has been devised to account for erroneous weight data and extrapolate an average weekly weight per animal with all weights for a particular animal in a particular week needing to be within a standard deviation of 15kg. For example, if an animal has 7 weights recorded in a week the standard deviation is calculated and if greater than 15kg the weight furthest from the mean will be removed first. A new standard deviation is calculated and this process continues until all weights are within a standard deviation of 15kg. If, however, less than 4 weights remain before the standard deviation is less 15kg the animal is excluded from having a weekly average weight calculated. If a weekly average weight is generated it is saved to the database. Not all animals will generate an average weekly weight but of those that do their weights are used to generate the mean average weekly weight for the mob. The mean average weekly weight for the mob is then used to generate the growth path for the animals on that particular ALMS unit. The functionality has been built into the DataMuster application to allow the user to select the individual paddocks containing the ALMS so as to see the growth paths for that particular mob.

In addition to recording the weight data and monitoring the daily usage during the training program, the four ALMS have been progressively being modified to allow the capture of separate files for weight and electronic identity data. The weight data file records both the weight and the linked RFID number, whereas the electronic identity file is extracted straight out of the RFID reader and hence only records the RFID number, the date and time and the ALMS unit name. This data then allows the DataMuster user to monitor daily usage based solely on RFID reads rather than the weight dataset, which could be modified to remove erroneous data and hence provide a reduce usage figure.

Whenever an ALMS unit is installed in an area that has mobile phone reception, which is the case at Belmont, all the data processing is done once the weight and electronic identity files reach the

CQUniversity server. Every 5 minutes, if data has been recorded by an animal passing through the ALMS, it is sent via a Telstra Next G modem to a CQUniversity server. However, in the event of no mobile phone telephony, CQUniversity staff have written the code for the processing to be done locally. In the situation when satellite communication is the only option, the on-board Raspberry Pi computer sends a single packet of data daily with the number of RFIDs read and sends once per week the calculated average weekly weight for those animals that meet the criteria.

Another additional piece of hardware that has been incorporated into ALMS units and has captured data throughout the breeding season is a static camera. A camera was mounted above the race on one unit giving a view of the weigh platform and code was written to trigger the camera to take an image as each RFID device is read. The images are then transmitted through the Telstra Next G network to the CQUniversity server for viewing by the Precision Livestock Management Research Group (PLM) staff.

Code has also been written to incorporate daily water usage for a number of the watering points in which the ALMS operate. The water flow and telemetry data is provided by a Taggle water sensor on the water troughs. The water sensor data is transmitted from the Taggle network to a CQUniversity server periodically throughout the day and the values per 24-hour period are accumulated and presented graphically within DataMuster.

Recently CQUniversity has formed an alliance with Stark Engineering for the manufacture of self-contained Walk-over-Weighing systems. The systems can be transported to the paddock and sat in place with all but the electronic components included into the system. The electronic components, which comprises the solar regulator, 12v batteries, RFID reader & antenna, liveweight scale indicator and the computer and telemetry components, are housed in a rugged plastic box and simply connected for the system to be operational. Stark Engineering has also built the components to provide auto-drafting functionality with CQUniversity staff providing the electronic componentry to operate the gates.

3.2 Install pregnancy scanning equipment to validate fertility data

All breeder groups on Belmont were mustered on the week beginning 21 May 2018. Calves were separated and cows processed through the cattle crush with their RFID number being read using a Gallagher HR5 Handheld EID Tag Reader. The Gallagher Reader transmitted the RFID number to a Gallagher TSi with the historic information compared and validated against the NLIS tag was number. Each cow was pregnancy scanned using transrectal palpation with ultrasonic assessment (Honda HS-2200V using a 7.5-MHz linear array transducer, Honda Electronics Co Ltd, Toyohashi, Japan). The pregnancy scanning equipment allowed confirmation of pregnancy via evidence of a foetus from 28 days post conception. Bulls were removed from the cow mobs on the 5th April 2017 ensuring that the latest conception would be greater than the cut-off date for diagnosis using ultrasound. Cows that were diagnosed as non-pregnant were removed from the herd and in the case of the paddocks with ALMS units, additional cows were added to these mobs.

On completion of the pregnancy testing of the Belmont breeder mobs the data was downloaded from the Gallagher TSi. Data was extracted as separated CSV files for each paddock. Upon checking of the data, the files were uploaded to the DataMuster database and matched with existing data based on the primary identifier, the RFID number. Once uploaded to the database further

parameters can be generated through DataMuster including “Weeks to Calving” and “Calving Interval” assuming there is historic information on the particular mob.

Data collected from the ALMS during the mating period included RFID sequence in 3 single-sire groups (total of 120 cows) using WoW units. One group of 40 cows was also fitted with proximity loggers and accelerometers. Data from the sensors will be used to predict oestrus events and hence time of conception to compare with the foetal aging data recorded at pregnancy test using the ultrasound scanning equipment.

A further objective is to use the ALMS data recorded during the calving period (September to December) to predict calving date and maternal parentage in groups of 100+ breeders. This will be compared with daily calving and mothering details recorded by the stock-crew.

3.3 Provide maps of ALMS locations and confirm data is being recorded

An extensive amount of code has been written to enable the mapping of Belmont and to display it within a web interface. Each piece of infrastructure (fence line, water point, sheds etc.) has been included in the database and coordinates allocated so that they appear on the map.

Animal level data is being updated from the ALMS units and water sensors on a daily basis. In addition to those mobs that have access to an ALMS, information is available on mobs in non-ALMS paddocks, including the most recent static weights presented as a histogram and Weeks to Calving from the breeder groups. The user is also presented with summary information including number of animals within each class in each paddock. The web application allows the user to choose between

- Map style - base map or satellite map
- Paddock Groups - Whole property, individual paddocks or sentinel groups (ALMS groups)
- Males & Females (animal gender) – All cattle, Males or Females
- Breeders or Growers (animal classes) – All cattle, Breeders or Growers
- Weight Range – All cattle or Weight Range and when weight range is selected the user can then select within a scale of between 50 and 1000kg.

This project is able to utlise the DataMuster data management system that has been developed as part of separately funded CQUniversity projects to develop agricultural software decision support tools.

3.4 Deliver field day and engage with participating producer groups

The approach to producer adoption is based on direct engagement with producers to demonstrate the technologies capabilities, and supporting this through reference materials to aid adoption, as well as pathways to participate in research activities.

During Beef 2018 CQUniversity arranged two field days to Belmont Research Station as well as provided an interactive display within our trade fair site at the Rockhampton Showgrounds. In addition, information was available on the DataMuster application at both the Meat & Livestock Australia and Telstra trade fair sites.

Producers showing an interest in any components of the ALMS were asked to complete a questionnaire so that CQUniversity could capture their contact details and areas of interest. Currently that information is being collated and producers are being contacted to assist with project participation and technology adoption.

The Belmont property tours were delivered around the concept of discussing the uses and functionality of the DataMuster application at the CQUniversity campus before venturing out to Belmont to show the individual aspects at work. At Belmont speakers discussed data collection including the use of smart tags to record behavioural patterns for early disease identification; how CQUni is capturing static data using NLIS technology to build into BREEDPLAN-compliant datasets; how ALMS units operate with auto-drafting; how ALMS units can be used to capture growth paths, maternal parentage and calving dates; and how AMLS could be used to address animal welfare issues and minimise calf loss.

CQUniversity produced a considerable amount of hardcopy material and online content for people interested in ALMS. This included a 16-page practical guide to installing Walk-over-Weighing (an output from a previous MDC-funded project); a brochure on DataMuster; a pamphlet on the Central Queensland Centre of Excellence and an 8-page brochure on CQUniversity's Precision Livestock Management research. In addition to the hardcopy information, the DataMuster homepage (https://www.datamuster.net.au/) provides information on the DataMuster application including a link to the demo site; the PLM team; how it works with information on detection of oestrus, mothering up and the property mapping functionality; how producers can register their interest and make contact with the PLM Research group.

4 Results

4.1 Deploy and train cattle on automated livestock management systems

CQUniversity has deployed four ALMS at Belmont Research Station. These units are being utilised by a group of 40 mid-pregnancy Belmont Red cows, 40 mid-pregnancy Brahman cows and 40 mid-pregnancy maiden three-year-old heifers. The fourth unit was setup during Beef 2018 in Paddock 1 with a small cow/calf group to demonstrate ALMS with auto-drafting and the separation of cows from weaners. The cows and calves have now been removed from the unit in Paddock 1 with the calves being weaned and the cows returning to the composite breeder mob (paddocks 35/66/67). A further three units are waiting to be deployed and final cattle training prior to calving in September will be carried out in the calving paddocks during July and August.

Table 3 below shows the class and numbers of animals currently utilising ALMS at Belmont plus the planned deployments until the end of 2018.

Paddock	Pdk. Size (ha)	Animal Class	Breed	ALMS Deployment Date	No. of Animals
No. 35/66/67	89	Mature cows	Composite	Deployed	40
No.17/18	65	Mature cows	Brahman	Deployed	40
No.19/20	62	Joined 3yo	Composite	Deployed	40

		heifers			
Kratz Paddocks	393	Weaner Bulls	Brahman & Composite	01/08/2018	250
MacKenzie	607	Mature cows	Composite	15/08/2018	236
Horse/Lily	132	Mature cows	Composite	01/09/2018	100
Cotton	444	Joined 3yo Heifers	Composite	15/09/2018	208
				Total	914

The focus of the work within the last six months has been deploying ALMS units as well as the ensuring data integrity for example removing erroneous data and adding the data to the database for viewing through DataMuster. Recent technology developments such as auto-drafting systems have been tested including capturing still images for vision recognition. The project is using Stark Engineering units and also Tru-Test WoW platforms. It is envisaged that as more ALMS units are installed at Belmont some will incorporate auto-drafting and future trial work deriving the efficacy of the drafting.

Figure 1: Image of the first ALMS built at Belmont in paddock 35/66/67 with two cows and a calf crossing the unit.

Figure 2. An overhead image of a Brahman cow crossing the ALMS unit in paddock 17/18 at Belmont. The overhead photos have been used to decipher whether Kamar heat detection devices have ruptured (not shown in this photo).

Figure 3. Preliminary work in paddock 1 using the Stark Engineering Walk-over-Weighing unit with auto-drafter to separate cows (drafted right) from weaners (drafted left).

Final training of the calving cattle still needs to be completed. These cattle have recently been moved to the calving paddocks and their training will occur through July and August in preparation for the start of calving in September.

4.2 Install pregnancy scanning equipment to validate fertility data

In the week beginning 21 May all calves were weaned from the breeder mobs and cows pregnancy scanned using ultrasonic imaging by an experienced operator. Cows that were diagnosed non-pregnant were removed from the herd and additional animals have recently been added to the ALMS, where applicable.

The data recording was completed by recording RFID numbers and parameters into a Gallagher Touch Screen indicator (TSi) that had historic information recorded on all animals. The data extracted from the indicator has now been uploaded to the DataMuster database.

All breeding-aged cows at Belmont are now pregnancy assessed with the use of ultrasound and manual palpation at the annual weaning/pregnancy diagnosis round. All data is digitally-recorded using the RFID number as the primary identify and a management tag as a backup identification. Information that is recorded includes liveweight (kg), body condition score (1 – 5 with 0.5 increments), pregnancy status with time in calf (0 = Empty, 8 – 36 weeks), P8 Fat depth (0 – 30mm) and Lactation Status (Wet or Dry).

Figure 5. Nick Corbet performing pregnancy diagnosis using ultrasound assessment at the Belmont main yards.

Table 4. Belmont Pregnancy Diagnosis Results

Paddock	Pdk. Size (ha)	No. of Females*	Breed	Percentage Pregnant
No.35/66/67	50	40 cows	Composite	100%
No.17/18	65	41 cows	Brahman	88%
Selection	87	44 cows	Composite	91%
No.58	65	33 heifers	Brahman	100%
No.19/20	62	40 heifers	Composite	88%
No.14/15/16	77	38 cows	Brahman	95%
No.22/23	48	42 cows	Composite	86%
No.234	21	39 cows	Composite	41%
Horse/Lily	132	98 cows and heifers	Composite	74%
MacKenzie	607	234 cows	Composite	58%
Cotton	444	208 heifers	Composite	93%
Total		858		

*Heifers = 2.5yo females at first bull exposure; Cows = lactating females 3.5 years and older

The pregnancy scanning identified low pregnancy rates in Paddock 234 (single-sire) and Mackenzie Paddock (multi-sire). All breeders have been vaccinated against *Leptospirosis* and the males against *Vibriosis*. The owner of the stock will have the mating sires tested for abnormalities of sperm morphology and make culling decisions based on those results. Non-pregnant first-calf cows from Paddock 234 will be given another chance to conceive in the following mating period.

Historic information on ALMS-derived maternal parentage, calving date and post-partum anoestrus interval is currently being collated. The results from historic data on calving date and return to oestrus postpartum will be compared and contrasted with the pregnancy diagnosis results to see how well the data aligns.

Information recorded by the manager at Belmont, including the bull in date and the calving date for each cow, is used within DataMuster to calculate the Weeks to Calving value. The information can be shown by paddock, sentinel group (ALMS unit) or the whole property. Figure 6 below shows the data for a mob of 230 cows. The manually-recorded calving date will be used to do further validation of the algorithm devised to derive the calving date based on the cow losing approximately $1/13^{th}$ of her body weight at calving. Although the analysis is not yet completed, using the method of calculating a weekly average weight it appears that the drop in weight is easily visible in the cow's growth path (Figure 7) so CQUniversity staff are optimistic that the algorithm will derive the calving date in a high percentage of cows.

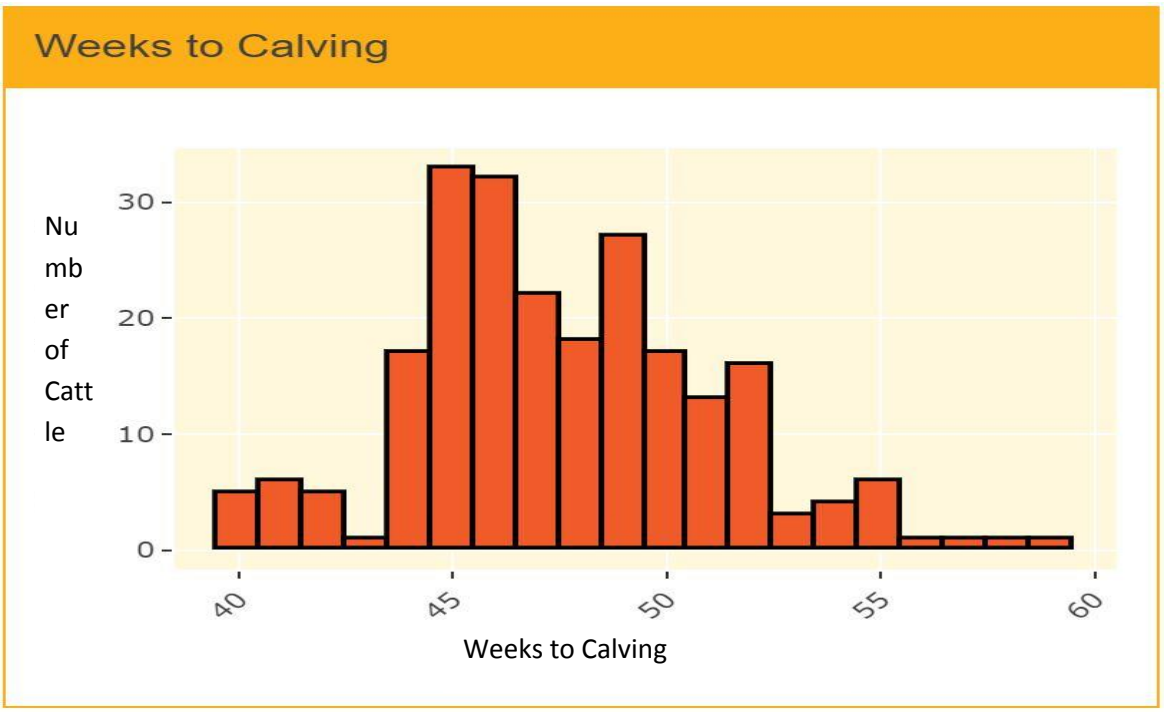

Figure 6. Weeks to Calving for a mob of 230 cows at Belmont showing that some cows conceive as soon as the bull is added to the mob and have a Weeks to Calving value of just over 40 weeks. Whereas a small percentage of cows are still conceiving between 3.5 and 4.5 months after the bull has been added to the mob.

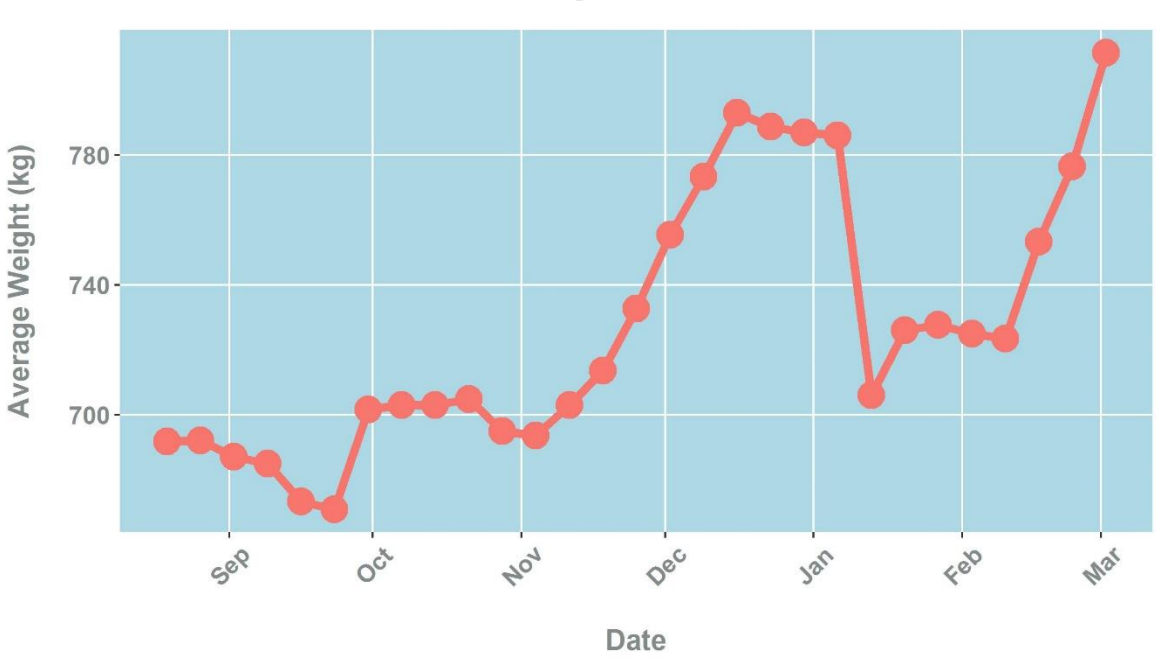

Figure 7. The growth path of a cow from late August to March showing that in early January the cow was approximately 780kg just prior to the observed calving date of the 12th January at which point she lost approximately 65kg.

Future research will investigate whether, based on the associations between a cow and the bull/s during the breeding season, those cows that have longer postpartum anoestrus periods can be identified prior to pregnancy diagnosis. Preliminary work has already shown that the animal associations can be derived from the time between a cow and a bull crossing the ALMS unit and therefore could be used as an early indicator of cows having extended post-partum anoestrus periods or conceiving early, suffering early embryonic loss and then returning to oestrus, reconceiving and having a calf out of season.

4.3 Provide maps of ALMS locations and confirm data is being recorded

All paddocks at Belmont have been mapped and the DataMuster application shows the total view of Belmont plus the outline of all paddocks and other infrastructure including water points with sensors and ALMS. In addition, those mob that are not assessed through an ALMS are still shown on the map although only limited information is available.

Both ALMS and static recording data is flowing through to DataMuster and available for viewing in the web interface (Figure 8). The user can drill-down to specific paddocks, genders, classes or weight ranges and show information such as the number of head meeting the criteria, a weight histogram of the mob, their frequency to enter the ALMS unit, their water consumption and fertility parameters. The data on the sentinel groups (those cattle with access to an ALMS unit) can be used to infer the growth paths of other mobs, assuming the same pasture quality and stocking rates.

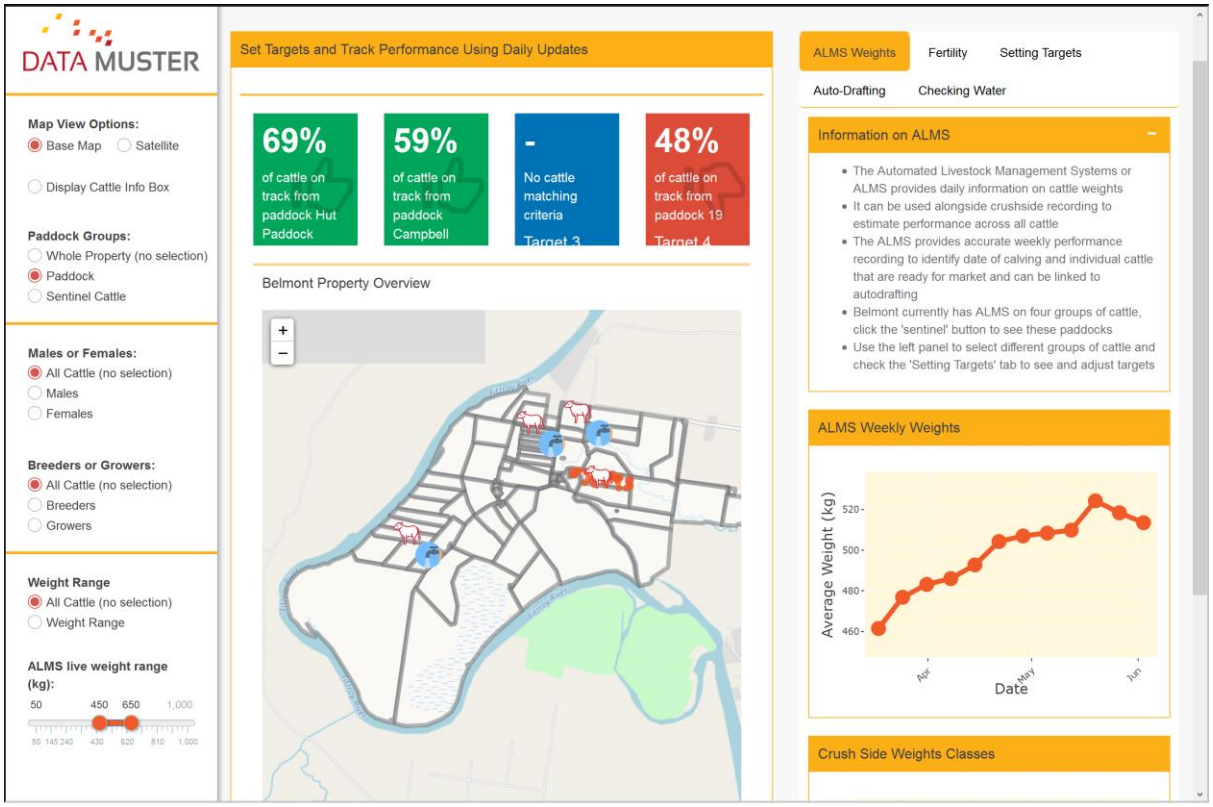

Figure 8. An example of the DataMuster web interface viewable through the demonstration site (https://cattle.datamuster.net.au/app/DataMuster) showing the growth paths of the 40 3-year-old heifers in paddock 19/20.

Currently the database contains information on 1,562 animals we have a regular group of cattle that access the ALMS units and strategic deployments for specific recording periods e.g. calving. The rest of the animals having crush side recorded information that is also entered into the overall database. The four ALMS units are currently providing daily EID and weight data into DataMuster. Daily water consumption data is currently being recorded into DataMuster from one of the water troughs linked to the ALMS units.

4.4 Deliver field day and engage with participating producer groups

During the Beef Australia Belmont Property Tour approximately 150 delegates were introduced to the ALMS and given a demonstration of the DataMuster application. In addition, a further 50 producers associated with the Commonwealth Reef Trust's Project Pioneer III were given a private tour encompassing the same aspects as the Belmont Property Tour. CQUniversity received a very positive response to these activities.

Figure 9: Some of the 150 Beef Australia Belmont Property Tour delegates listening into the introductory session.

The trade fair site within the Beef Australia arena had a huge amount of interest with it estimated that 1000 people visited the site and gleaned information from the CQUniversity staff. Demonstrations at the trade fair site including an ALMS unit with an auto-drafter and participants were able to capture their weight and operate the draft gates.

Figure 10: External view of the CQUniversity trade fair site and CQUniversity researcher Lauren O'Connor discussing DataMuster with Beef Australia delegates.

In addition to the trade fair site and the various tours to Belmont, Prof Dave Swain delivered a presentation on "Agritech: Solving real production problems in the digital age" at CQUniversity Beef Australia Industry Symposium to approximately 300 delegates.

Following the interaction with numerous delegates during the Beef 2018, CQUniversity has received a commitment to implement ALMS from 30 delegates. The PLM team are currently following up on these inquiries.

5 Discussion and conclusions/recommendations

Overall the project has made good progress. The data capture systems are in place and the project is on track to progress to Phase 2. The delay in confirming whether Phase 2 of the project will go ahead has created some uncertainty.

The first objective to provide an industry reference point for the use of automated livestock performance recording is well underway. The project has provided valuable learnings on balancing aspirational goals and practical constraints. Optimising paddocks that are best suited to ensure cattle access the ALMS on a regular basis is critical. While standing water can restrict cattle access this does not always happen. The ability to show producers ALMS on the ground at Beef 2018 was invaluable in getting feedback on the issues that will be important to the broader industry. The positive response to the project has validated the value of delivering a working example of automated performance recording.

The second objective to validate ALMS performance recording is well underway and results from early work on date of calving and cattle weights has been prepared and presented to producers at the Beef 2018 expo. These algorithms are now being finalised and will be run in the fully automated mode from July 2018. In particular the cattle weights and date of calving will be predicted using the automated performance recording and compared with independent performance measures. The project team is working on finalising long-term data capture and validation to enable producers to have confidence in the ALSM derived performance measures.

While Phase 1 of the project has provided a good starting point the real value of this first piece of work will come from the long-term whole-of-herd performance recording. The project team

recommeds that MLA contracts Phase 2 of the project and the team look forward to progressing this work and to be able to fully evaluate automated performance recording for key cattle performance traits.

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