

R&D Round-Up

A summary of MLA's latest R&D reports



Welcome to *R&D Round-Up* – a summary of MLA's recently completed R&D projects **plus** summaries of projects that are currently in progress.

Completed MLA R&D projects

All livestock species

- **Climate modelling** and **rainfall indicators** have used past positive and negative trends to inform **future trends** and agricultural **impact studies**. [Read more](#).
- MLA has explored options to **improve** on-farm **connectivity** to **increase efficiency** of livestock management and enterprise **productivity**. [Read more](#).

Sheep, lamb & goats

- Demonstration sites have shown that **monitoring ewes** with **electronic identification** technology can deliver a **2.5–5 return on investment**. [Read more](#).
- Exploratory research will help processors trial **flavourless smoke** on a commercial basis to help **improve** the **shelf life** of **lamb**. [Read more](#).

Grassfed & grainfed cattle

- MLA-funded research gauged **consumer** sensory and attitudinal **response** to a range of **burger products**, including meat-free and beef blend products, to compare **protein alternatives**. [Read more](#).
- A new, successful approach to connecting the complex **beef supply chain** with a **digital traceability** solution has effectively **captured** the various processes and movements from **paddock to plate**. [Read more](#).

MLA R&D projects currently in progress



Animal health and welfare

- Following the 2019 **Australian bushfires**, MLA is working with industry to understand the **effects** of bushfire on **livestock wellbeing**. [Read more](#).
- Ongoing research is investigating the **extent** and **timing** of **reproductive loss** in sheep to help **reduce foetal** and **lamb losses** in young ewes. [Read more](#).
- New research is aiming to identify **new drug** therapeutics that **prevent chronic pain** following **tail docking** in sheep. Read [more](#).
- MLA is partnering with skilled veterinarians to develop a **phone app** that will allow producers on farm to **diagnose** the type and stage of **eye disease** in cattle. [Read more](#).



Have your say

If you would like additional information on any of the projects featured in this newsletter, or if you have suggestions or requests regarding MLA's R&D reporting, please contact reports@mla.com.au.



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Baseline consumer sensory testing of alternate protein burgers

Did you know that MLA is actively investigating the diversity between meat and plant-based protein products available in the Australian market?

Summary

There has been a recent increase in the range of plant-based protein burgers in the Australian market. This trend has also included other meat and plant-protein blended products, such as reduced meat content sausages.

This project was established to gauge untrained consumer sensory and attitudinal response to a range of burger products, including meat-free and beef blend products. Six products were tested with two non-meat offers, two beef blends, one high beef content and a benchmark 100% beef patty with no additives.

While further improvement may occur in the non-meat products, this trial found that associated value claims would need to heavily relate to perceived benefits unrelated to the eating experience.

Objectives

The main objectives of this project were to:

- design and deliver a Meat Standards Australia (MSA) protocol sampling plan for five different burger patties
- procure burgers, recruit panellists and complete sensory tests
- record shrinkage yields from cooking from the sample size in terms of weight loss and diameter of the patties from pre- and post-cooking across the four burger types.

Key findings

- Blended beef patties were rated the highest by everyday Australian consumers.
- Plant-based burgers performed the worst with many (51%) rated as unsatisfactory.
- 100% beef patties were rated above plant-based products but below the beef blends. This correlates with increased cook loss and may reflect overcooking due to the standardised cooking times needed to achieve an internal temperature of 70°C, required for plant-based burgers.
- Other factors affecting resilience to high temperature cooking could include lower fat content and, for the pure beef items, the lack of any ingredients that might reduce cook loss or enhance flavour.

Benefits to industry

The project has revealed that plant-based products are not well liked by Australian consumers, as they were scored lower than beef and beef blends and had a far greater percentage judged unsatisfactory. However, these alternatives are rapidly improving and seeking to mimic meat including flavour, texture and cooked appearance.

These market changes, and in particular aggressive promotion of an anti-meat agenda linked to claims relating to climate change, human health and animal welfare, represent a well-funded challenge to the industry.

MLA action

MLA is scoping investment into additional research regarding the topic of alternate protein beef burgers.

Future research

This project only represents a small number of samples and consumers, so some more work in this space would lead to more conclusive results and increased reliability.

It is recommended that further work be conducted to better define relationships to fat level in high beef content burgers and to both minor ingredient additions and cooking regimes that may reduce cook loss, which was correlated strongly with reduced tenderness and juiciness in this study.

Related resources

- Taylor, J., Ahmed, I.A.M., Al-Juhaimi, F.Y. and Bekhit, A.E.D.A., 2020. Consumers' perceptions and sensory properties of beef patty analogues. *Foods*, 9(1), p.63.
- Watson R, Gee A, Polkinghorne R and Porter M. (2008a). Assessor publication. MSA sensory testing protocols. *Australian Journal of Experimental Agriculture*, 48(11), 1360-1367.
- Watson R, Gee A, Polkinghorne R and Porter M. (2008b). Consumer assessment of eating quality - development of protocols for Meat Standards Australia testing. *Australian Journal of Experimental Agriculture*, 48, 1360-1367.

Evidence-based digital traceability trials for beef exports to China - Digital / physical supply chain verification

Summary

Within the Australian red meat industry, there are barriers and opportunities for using a blockchain enabled supply chain traceability technology to connect the physical end-to-end beef supply chain with the digital supply chain.

This project analysed a fully integrated beef supply chain traceability solution that connects a producer and exporter to international retailers and end-consumers.

The project demonstrates the ability to capture the various processes and movements from paddock to plate, highlighting a pragmatic, trusted and effective approach to connect this extraordinarily complex beef supply chain with a digital traceability solution.

Objectives

The project's primary objective was to further understand the intricacies of the physical beef supply chain for retail ready product, allowing the Aglive supply chain traceability solution to meet the needs of complex process components. This would further increase the usage of such solutions across the beef supply chain, supporting the elimination of food fraud and increasing the efficiency (speed, accuracy and quality) of the beef product through its supply chain from origin to end-consumer.

Key findings

- Through its blockchain-enabled supply chain traceability technology partner, Aglive, an Australian Black Angus Beef company has been able to capture the various processes and movements in the supply chain from paddock to plate.
- There is a clear ability for a blockchain-enabled supply chain traceability solution to remediate and ultimately eliminate fraud, increase product quality and provide closer communication between the producer and the consumer.
- The trials demonstrated that Aglive technology is solid (from a technical perspective) for this application.

Benefits to industry

It is expected that an end-to-end supply chain traceability solution will be of benefit to other supply chains. This solution would provide producers with increased transparency of where their product ends up, while supporting future customer requirements.

MLA action

MLA will investigate funding further demonstration projects to allow industry to evaluate their suitability.

Future research

- Supply chain traceability and information systems need to be further developed and demonstrated to offer benefits to supply chain participants and consumers.
- Demonstration of commercial systems in real supply chains allows opportunities for demonstration and learning, not only by the participants but also by the wider industry. Further attention needs to be given to understanding consumer responses to systems.

PDS: Using eID to improve ewe performance

Did you know that that monitoring ewes with electronic identification technology can return a 2.5—5 return on investment?

Summary

Monitoring ewes' bodyweight and condition score gives producers the opportunity to improve production and welfare outcomes for individual animals, flocks and the industry as a whole. Electronic identification (eID) and its associated technologies are now readily available to producers, but many are unsure of how it can be best used in their commercial sheep enterprises.

In this Producer Demonstration Site (PDS), ewes were monitored through regular weighing and condition scoring, and ewes in low body condition score during the summer were preferentially fed before joining. Individual scanning results of ewes, and mob marking and weaning percentages were recorded on each farm.

These approaches resulted in some production increases, showing potential benefits if implemented on-farm. Producers also benefited from using eID on their farms to measure the effect of their management strategies, which in turn increased their confidence in making changes on a larger scale.

Objectives

The aim of this project was for producers to become confident in the use of technology associated with eID and to use the data generated by eID to improve the productivity of their ewes and profitability of their sheep enterprise.

This project also investigated the barriers to effective adoption and use of eID technology to change ewe management in commercial sheep enterprises.

Key findings

- Weight differences between control and monitored ewes were recorded and differences in scanning and marking results were able to be recorded during the project. This suggests that regular monitoring can improve management of ewes, through increased awareness of ewe bodyweight or condition.
- There were fewer differences between the control and monitored ewes at the end of the project when the ewes were under more nutritional pressure, during late pregnancy or lactation.
- If monitoring is continued, even during favourable seasons, producers can have more confidence around opportunistic decisions about the use of surplus feed.
- The use of eID is beneficial not just for livestock management but for other parts of the farm system, including pasture utilisation.

Benefits to industry

Producers gained skills and knowledge in using eID-related equipment and learned practical skills to implement the processes on-farm.

Monitoring ewes returned a positive return on investment (2.5—5 times) in 3 of 6 occasions; of the other 3 occasions, external factors (excellent season and loss of unexpected number of lambs in one mob) may have affected the results.

Related resources

- *Producer Demonstration Site (PDS): Integrating dual-purpose crops and eID into mixed farming systems*, MLA final report, 12 November 2020
- *Maximising the value of eID technology for sheep producers*, MLA final report, 24 May 2019

MCV5 – Changes in summer rainfall and implications for agriculture

Did you know that MLA uses climate models and rainfall indicators to determine if the positive or negative trends in the past will continue into the future, to inform agricultural impact studies?

Summary

Annual and seasonal rainfall are important drivers of agricultural productivity and profitability in Australia. Various climatological and synoptic drivers influence rainfall patterns in Australia's diverse climate.

This study detected trends in past and future annual, seasonal and extreme rainfall across three important agricultural production regions in the Australian midlatitudes using station and gridded data from 1907 to 2018.

Apart from region-wide changes, there was a positive trend in summer rainfall for two of the seventeen studied locations and a negative trend in winter rainfall for five of the seventeen locations.

Objectives

The objectives of this project were to:

- provide detailed new knowledge about any changes in summer rainfall over the study area (in northern New South Wales, southern Queensland extended to the coast, the northern Murray Darling Basin and at similar latitudes in Western Australia – the central/southern Wheatbelt)
- assess the potential causes of any such changes and attribution to climate change, along with a discussion about the potential impact on agriculture in the area.

Key findings

- Robust trends with significant and long-term changes in seasonal rainfall and summer rainfall were noted for two out of the seventeen stations studied and for the Western Australia Wheatbelt.
- Spatial heterogeneity in rainfall is very high, which makes it challenging to establish any regional trends from local observations.
- Although some locations experienced a long period of summers with below average rainfall, this does not constitute part of a long-term trend for the time period 1907-2018/19 and current results suggest that they are part of natural variability in seasonal rainfall.
- Among the large-scale climate influences on seasonal rainfall in the Western Australia Wheatbelt, the El Nino-Southern Oscillation, the Southern Annular Mode and atmospheric blocking are the main influences on warm season rainfall.
- The decline in winter rainfall in Western Australia is expected to continue as there is high agreement in climate models for further declines in winter rainfall, while changes in rainfall in eastern Australia are less certain.

Benefits to industry

Agricultural impact studies could use the climate models and the rainfall indicators identified in this project to determine if the positive or negative trends in the past continue into the future.

For the Western Australia Wheatbelt where the direction of change in seasonal rainfall is more certain, this knowledge can assist in developing coping strategies or inform transformation processes.

MLA action

This project was commissioned and funded by MLA, [GRDC](#), [CRDC](#), [Sugar Research Australia](#) and [AgriFutures Australia](#) through the [Managing Climate Variability Program](#) Phase 5 project and the results will be shared with industry via the [Climate Kelpie website](#) and MLA website.

Future research

Future research should focus on extending the analysis provided to include locations in the New England and northwest region in NSW and far west and Orana region in NSW to confirm whether the high anomaly in summer rainfall in the recent decade found for Narrabri and Curlewis can be observed elsewhere.

It would also be beneficial to extend the list of rainfall variables used here to consider not only changes in the growing season rainfall and extreme rainfall across the year, but also changes in rainfall related to specific management decisions such as planting or to specific adverse events such as droughts increasing in frequency or intensity.

Related Resources

[Australian Rainfall Trend Explorer](#)

Understanding the value of farm specific sensors with LoRaWAN

Did you know that improved on-farm connectivity can increase efficiency of livestock management and enterprise productivity?

Summary

Telecommunications coverage remains a challenge across Australian agriculture from both a coverage and price perspective.

This project sought to prove that adoption of reliable internet of things (IoT) networks could provide value to the livestock industry. Eight demonstration properties representing different livestock enterprise types were selected for the trial.

Site specific LoRaWAN network connectivity proved to be sufficiently reliable to support deployment of any IoT sensor solution, however topography impacted total available coverage from a single installation.

Objectives

The main objectives of this project were to:

- install LoRaWAN network coverage across eight identified properties
- install nominated sensors on each of the eight properties
- assess network and sensor performance, integration and technology issues and other on-farm value added opportunities for IoT
- undertake pricing model analysis for sensor connections.

Key findings

- The three key solutions that producers see as driving efficiencies and benefit on their farms are:
 - water trough sensing solutions
 - water tank monitoring solutions
 - livestock tracking solutions.
- Producers have an appetite to pay up to \$5,000 for farm specific connectivity if the attached solutions provide value.
- Solution providers should be weighted to an up-front model, with a small annual recurring fee to provide the close level of support expected by livestock producers.
- Post installation solutions need to be robust and protected enough to withstand both interactions with livestock and the extreme climate conditions experienced across seasons in rural and remote Australia.
- Despite the speed at which technological solutions on farm are being developed, connectivity and pricing aspects that this project sought to understand remain to be a challenge to broader value realisation and adoption of IoT in the livestock industry.

Benefits to industry

The resounding feedback from providers through the course of the project was that they see the highest level of value from IoT in the ability to remotely monitor water supply points across their farm, as well as near-real time tracking of their livestock.

MLA action

Outcomes of the project demonstrated the feasibility of LoRaWAN to support the deployment of Digital AG IoT devices and informed future strategic pathways for Digital Agriculture projects.

Future research

Future research will include quantification of value propositions for IoT use cases.

Preliminary evaluation of flavourless smoke in chilled Australian lamb

Did you know that flavourless smoke can maintain the natural state of high-quality fresh meat for up to 30% longer than non-smoked meat?

Summary

The addition of flavourless smoke as a "processing aid" in red meat has shown promising results to date, yet there remains no commercial uptake, a lack of clarity for food labelling and no optimal application process.

This project was undertaken to explore the use of flavourless smoke to improve the colour and shelf life of lamb to create higher value for the Australian industry.

This exploratory research has produced the foundational information for a business case analysis to help processors see the benefits of flavourless smoke on a commercial basis.

Objectives

This project intended to create value for the Australian lamb industry by:

- defining the value proposition(s) for flavourless smoke inclusion with Australian sheepmeat
- undertaking trials to develop pathways and proof of concept development and specifications
- seeking market feedback and legislative positions regarding its inclusion, food labelling laws and target market.

Key findings

- Flavourless smoke can maintain the natural state of high-quality fresh meat for up to 30% longer than a control product.
- Flavourless smoke can slow the rate of colour oxidation to enhance shelf presentation.
- From a technology perspective, the flavourless smoke generation process is achievable.
- Food labelling does not appear to be a barrier for red meat processors subject to the approvals of State authorities.
- Although further research is required, indications of profitability are achievable for the right applications of flavourless smoke.

Benefits to industry

Specific benefits to the red meat industry from this project include:

- flavourless smoke can provide a superior visual experience for consumers
- longer shelf-life
- opportunities for product differentiation
- potential to generate an acceptable return on investment.

MLA action

MLA continues to invest in projects that explore opportunities to extend shelf life and improve market access.

MLA continues to seek the support of State food authorities in these activities.

Future research

Further trials are required to determine the shelf-life for different packaging methods and their associated return on investment for different cuts and input costs.

It is recommended that these trials involve a State-based food authority to set a jurisdictional precedent and to encourage adoption from other States and processing companies.

Bushfire implications for livestock wellbeing

Did you know that MLA is working with industry to understand the effects of bushfire on livestock wellbeing?

Summary

The 2019-20 summer bushfires devastated south-eastern Australia and caused the death of tens of thousands of livestock. Although most livestock survived, the extent to which they suffered burn wounds, smoke inhalation or immune fitness impacts is not fully understood.

The purpose of this project is to investigate the impacts of bushfires on the health and welfare of livestock in Australia and to suggest mitigation strategies to reduce impacts in future years. The project is a collaboration between Ausvet, University of Sydney (USYD) and the University of Melbourne (UoM).

Objectives

This research considers how bushfires impact on animals, their health and welfare and on the red meat supply chain. The outputs will be:

- synthesis of current understanding of bushfire impacts on livestock (literature review)
- new understanding of how bushfires affect livestock in terms of:
 - pathology
 - immune fitness and association with reproduction and production
 - welfare
 - biosecurity
 - meat quality
- understanding which paddock features are associated with the risk of burning
- identification of mitigation and recovery strategies
- a livestock bushfire preparedness manual for producers.

Benefits to industry

One of the major outputs of this project will be the development of an evidence-based Livestock Bushfire Preparedness Manual for producers. The manual will create a better understanding of what bushfires do to livestock and beef and sheep production systems, and how to prepare and respond. This will be an invaluable tool for producers living in high bushfire areas of Australia.

Related resources

[MLA Bushfire resource hub](#)

[Bushfire implications for livestock wellbeing](#)

Reducing foetal and lamb losses in young ewes

Did you know that new research is investigating the extent and timing of reproductive loss in sheep?

Summary

Overseas studies suggest that foetal losses during mid- to late-pregnancy may be an important source of wastage in young ewes. However, the relative contribution of foetal loss between scanning and lambing for maiden ewes in Australia is not well studied.

There are substantial differences in the number of sheep foetuses at pregnancy scanning and the number of lambs born in well-managed flocks of first lambing ewes, but the causes of these apparent foetal losses are unknown.

This project is researching the extent and timing of reproductive wastage, whether infectious diseases are associated with foetal losses and the role of nutrition and management as part of a multifactorial problem.

Objectives

The specific objectives of this project are to address four research questions:

- Is foetal loss a significant contributor to overall reproductive wastage from young ewes between scanning (day 42 pregnancy) and marking, and if so, when are losses occurring?
- What is the background prevalence in young ewes for infectious diseases that have potential to cause abortion?
- Is exposure to infectious disease associated with foetal loss in young ewes, and if so, what is the relationship between the timing of exposure and outcome for pregnancy?
- Can management strategies reduce the risk of foetal loss between day 42 and lambing, and increase overall marking rates from young ewes?

Benefits to industry

Improving the reproductive performance of ewes is a priority for the Australian sheep industry and is pivotal for re-building the Australian flock and improving farm profitability.

Developing and implementing objective sheep lifetime pain measurement and mitigation strategies

Did you know that new research is addressing long term pain management in sheep following tail docking?

Summary

Pain is an experience that we are currently unable to reliably diagnose or measure in livestock because of the inability to objectively measure it. In sheep production, acute pain is experienced when management procedures are undertaken. These include castration, mulesing and tail docking. However, the presence of persistent pain in sheep production has not been measured.

This project will identify new drug therapeutics that prevent chronic pain following sheep tail docking. In addition, sheep-specific biomarkers of objective pain state and the creation measurement tools that are able to reliably diagnose the presence of pain will be identified.

Objectives

The main objective of this project is to create:

- measures of pain biomarkers from the central nervous systems of lamb carcasses
- cross species validation of the pain biomarkers following defined husbandry procedures
- evidence of a platform technology used to measure persistent pain biomarkers at line speed in lamb carcass processing facilities.

Benefits to industry

Targeted prevention, diagnosis and treatment of persistence of pain in sheep is critical, so there is a pressing need for tools that can objectively diagnose and measure pain in sheep, with associated innovations in pain mitigation. This project will develop innovations in lifetime pain measurement and mitigation for sheep that will be designed for widespread adoption and directly lead to quantifiable gains in productivity.

Artificial Intelligence (AI) powered mobile app for the assessment of eye disease in cattle

Did you know that MLA is partnering with skilled veterinarians to develop a phone app that will allow producers on farm to diagnose the type and stage of eye disease in cattle?

Summary

Eye disease impacts animal health and welfare and poses occupational health and safety risks for personnel working with animals that have an eye disorder. It also causes significant productivity and economic losses in Australia.

Apart from services of skilled veterinarians who can correctly diagnose eye disease, there is no other mechanism to make an assessment. This is particularly challenging in remote areas of Australia.

This project will develop a computer aided cutting edge assessment tool for eye disease, which will be delivered in the form of an app that uses artificial intelligence.

Objectives

This project is developing:

- an objective scorecard for the identification of different stages of eye diseases in cattle
- a cloud-based resource database by collecting and annotating images and video clips of eye diseases
- learning models for automatic classification of eye images into diseased and non-diseased eyes, for scoring of lesions and determination of the stage of the disease
- a smartphone app for the routine assessment of eye diseases by cattle producers and traders.

Benefits to industry

Pinkeye is the most common form of eye disease and is variable in acute versus chronic stages. Further, sometimes scar tissue can be confused as a new lesion therefore treating an animal at this stage is pointless. The app will assist with this real time understanding and assessment.

This technology will be valuable for producers, agents and other personnel that have had little or no exposure to eye disease. The tool will be developed by skilled veterinarians but won't require vets on farm to diagnose the type or stage of eye disease, which will enable early correct diagnosis.

Cattle with visible eye lesions, whether active or not, are frequently rejected for sale or downgraded, particularly for sale to feedlots or for export. The development of an AI powered app will prevent unnecessary rejection or downgrading.