

Terms of Reference

Sensor technologies for feedlot disease prediction, detection and diagnosis

Summary:

Meat & Livestock Australia (MLA) in consultation with the Australian Lot Feeders' Association (ALFA) is seeking MLA preliminary applications from individuals, organisations or project teams with the capability to research sensor technologies for feedlot disease prediction, detection and diagnosis.

Background:

Accurate disease prediction, detection and diagnosis at feedlots are important to improve feedlot performance, health, welfare and carcass characteristics. Bovine Respiratory Disease (BRD) results from the complex interaction of pathogens with animal, environmental and management risk factors. Human observation combined with current diagnostic technologies have only a moderate sensitivity and specificity for diagnosis. Other feedlot disease conditions such as lameness are more visible however, early detection is critical for treatment success. There is an opportunity for improved feedlot health outcomes with adoption of new technologies.

Over the last 5 years, numerous sensor technologies for feedlot animal health have been researched and commercialised with advances in automation and engineering. There is a need for research to carefully evaluate these technologies in a scientifically robust framework, to accurately determine their value proposition for the feedlot industry. Research to properly design, evaluate and calibrate sensor technologies is required.

The Australian feedlot industry is committed to antimicrobial stewardship aligned with the National Strategy for Antimicrobial Resistance (2015). As such the feedlot industry desires to invest in R&D that promotes accurate feedlot disease prediction, detection and diagnosis to ensure judicious use of antimicrobials.

Project Objectives:

- (1) Design, evaluate or calibrate a sensor technology to predict, detect or diagnose a feedlot animal disease
- (2) Determine the specificity and sensitivity of the sensor technology to diagnose feedlot disease relative to the 'gold standard' of conventional diagnostic methods.
- (3) Determine the value proposition to the feedlot industry for sensor technology adoption or further R&D investment.

Methodology:

Whilst not limiting the capacity of the applicant to develop any particular methodology or technique it is envisioned that the methodology may include an assessment the following:

- proof of concept experiments
- disease challenge experiments with serial slaughter of animals
- on-site randomised feedlot experiments

The methodology adopted must be scientifically robust and achievable within the defined project period to meet project objectives. Methodology presented in the MLA full application, must be of a standard and level of detail to be accepted into a leading scientific journal in the field of feedlot veterinary medicine or animal science. MLA full applications must address MLA feedlot program methodology requirements where applicable listed in Appendix 1.

All applications' methodology must include a commissioning phase of appropriate length to ensure correct system operation, prior to commencement of the formal scientific experiment.

All applications must include a suitably qualified on-site project manager (M.S. or Ph.D. qualified) to ensure that project methodology is achieved. On-site project managers should be located at the feedlot or research site for the duration of experimental work for the project.

Prior to submitting the MLA Full application, the applicant must identify research sites or feedlot collaborators if applicable and obtain their support for the MLA full application and methodology. If boluses are involved, agreement of a collaborating abattoir must be obtained to retrieve them at slaughter.

Process:

The MLA feedlot program project application process has two stages:

Stage 1 - Applicants submit a **preliminary application, utilising the MLA Preliminary Application form**, addressing the Terms of Reference. Proposals will be scored against the selection criteria set out in the Terms of Reference.

Preliminary applications must not exceed four (4) pages. MLA will acknowledge receipt of each application. Applicants will be advised in writing of the success or failure of their preliminary application.

Stage 2 - Should your preliminary application be successful, MLA will invite you to submit a **full application, utilising the MLA Full Application form**. Proposals will be scored against the selection criteria set out in the Terms of Reference. Final project approval will be subject to contractual agreement between the applicant/s and MLA.

In particular, the MLA Full Application should detail:

1. Detail the approach that will be adopted to address the project objectives.
2. Detail the specific work activities proposed and timelines for their achievement.
3. Provide details of the information/data to be collected, collated and assessed and how these activities will be undertaken.
4. Include a detailed and fully costed budget that covers all the resources required to undertake the work, including details of basis for charging (daily fees, number of days, expenses, etc.).
5. Propose a payment schedule, taking account of the following:

- Progress payments may be negotiated against project milestones if the size and timescale of the project warrant this. The proposal should propose milestones and payments if required.
 - A minimum of 20% of the project budget must be retained for payment against the final milestone.
 - Payment of fees will be upon MLA acceptance of the attainment of the project milestones.
6. A detailed ex-ante economic Benefit Cost Analysis must be included in the full application for all market categories of Australian feedlot cattle that the research project will utilise to demonstrate the potential economic viability of research treatments. The research application should provide references for assumptions of the analysis where possible to ensure they are reflective of current industry conditions and past research literature. This analysis is in addition to the minimum requirements for information on Benefit Cost-Analysis outlined in 'Live export, grainfed beef and goat levy funded research development and adoption programs: GUIDELINES for preparing MLA full proposals'.

Selection Criteria:

Applications will be reviewed by Meat & Livestock Australia, and selection of the successful proposal will be based on assessment against the following criteria:

Stage 1:

1. Background of Proposed work
2. Outputs, outcomes and impacts of the project
3. Quality of Brief Project Design and Methods to achieve project objectives
4. Quality of Preliminary Budget
5. Value for Money of Preliminary Budget
6. Delivery Timeline

Stage 2:

1. Applications fulfilment of the methodology and terms of reference requirements of the project.
2. Quality of the methodology to achieve project objectives.
3. Quality of budget justification.
4. Value for money of application.
5. Quality of ex-ante economic Benefit-Cost analysis
6. Impact of proposed output on feedlot industry profitability and/or sustainability
7. Delivery timeline.

Reporting Requirements:

The successful applicant will provide milestone reports (if required) and a final report giving full details of the results of the work. Milestone and final reports will be prepared in line with MLA report guidelines and delivered in Microsoft Word format.

In addition to MLA standard reports, the following will also be provided to MLA at the time of delivery of the Final report:

1. a copy of all project data, including meta-data
2. a 600 word (maximum) magazine article with one high resolution image (>1MB file size)
3. a Microsoft Power-point presentation summarizing key project outcomes

MLA encourages publication of project outcomes (upon MLA approval) in relevant scientific journals. Journal publication costs if required to be supported by MLA, should be included in the budget.

Timing:

The duration of the project must not exceed 2 years from project initiation to delivery of the revised final report. However, delivery timeline is a selection criterion at both stages of application assessment and speed to delivery of outcomes for commercial industry will be viewed positively.

Budget:

Indicative budget for the FY18/19 financial year is \$300,000 AUD. There is no set budget for the total project however, applicants should deliver a fully justified budget to achieve project objectives. Value for money is a selection criterion at both stages of application assessment.

Meetings:

The applicant needs to allow for two half-day presentations/meetings with the MLA Feedlot Project Manager, one at project inception and one at the stage of delivery of the final report. The MLA project manager will travel to the applicant in all cases.

The successful applicant shall report directly to Dr. Joseph McMeniman, MLA Feedlot Project Manager.

Confidentiality and IP:

Where further information is available which may assist the successful applicant in meeting the requirements of the project, MLA will provide such information to the successful applicant.

All data and cited references must be acknowledged appropriately in the final publication and it is the sole responsibility of the applicant to ensure copyright laws are not breached.

The successful applicant will be required to enter into a standard agreement with MLA.

Conflict of interest:

Applicants, research teams or subcontractors with any potential conflicts of interest, should thoroughly outline these in this application, including how they propose to manage them, if applicable.

Project Proposal Submissions:

To access the MLA Preliminary and Full application templates (Grain-Fed, Live Export & Goats), go to www.mla.com.au and follow the links to Research and Development, then Funding opportunities and Research organisation funding to download the applications.

MLA applications at either stage must be lodged electronically as Word document to: applications@mla.com.au

Stage 1 MLA Preliminary Applications must be received by Thursday 22nd March at 5pm (Queensland time).

Stage 2 MLA Full Applications must be received by Monday 21st of May at 5 pm (Queensland time).

Strict adherence to the time deadline for applications will occur. Applications received past the deadline will not be assessed. Applications not received in the standard MLA application template will not be assessed.

Further Information:

Dr. Joseph McMeniman
Feedlot Project Manager
Research Development and Innovation
Meat & Livestock Australia

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APPENDIX 1

MLA FEEDLOT PROGRAM METHODOLOGY REQUIREMENTS

The following is provided as a guide to the level of detail required in the methodology of the MLA Full Application. It should be noted that additional information should be added to the methodology to describe experimental treatments, equipment, sampling and procedures to be utilised but not covered in the list below.

Pre-Approval

- Animal Care and Ethics Committee process
- Feedlot or research site co-operators (name, phone number and email)
- Agreeance of feedlot operators that within a replicate, researchers can randomise lots at induction, ensure pens are at similar cleaning status, and slaughter lots at the same days on feed (DOF) endpoint.
- Agreeance of feedlots to supply data and methodology details (de-identified of feedlot name and location).

Facility & Equipment Description

- Dimensions of pens, bunks, waterers and shade in experimental pens
- Slopes and orientation of experimental pens
- Pen capacity (head) and stocking density for experiment
- Make and models of feed-trucks and feed truck weighing equipment to be utilised in the experiment
- Makes and models of experiment specific equipment

Feedlot Arrival & Cattle Description

- Feed & water management of cattle from arrival to induction and treatment allocation
- Timing of arrival, induction and treatment allocation
- Shrink from pay-weight upon arrival
- Methods of treatment identification i.e. tagging systems.
- Induction treatments including active components in products
- Approximate body weight, breed and sex
- Target market and expected days on feed

Diet composition & Mixing

- Diet composition including macro and micro ingredient composition (as-fed or dry-matter basis; nutrition experiments only)
- Nutrient composition (dry matter basis; nutrition experiments only).
- Source of ingredient nutrient composition data for formulation (nutrition experiments only).
- Loading order (nutrition experiments only)
- Mixer test (coefficient of variation) procedures and frequency to determine loading order and mixing time (all experiments)
- Mixer flush procedures (if applicable; nutrition experiments only)

Feeding Conditions

- Feeding time
- Ration split
- Ration types
- Ration transition regimen (duration on each ration)
- Level of intake (ad-libitum/clean-bunk/restricted)
- Water trough cleaning frequency
- Orts (spent/swept/shovelled feed) management

Equipment Calibration & Weighing

- Makes and models of all weighing equipment to be utilised in the experiment
- Scale certification frequency for the experiment
- Scale check weigh frequency for the experiment
- Timing of weighing and/or sampling, relative to feeding time
- Interval of weigh days and/or sampling
- Calibration frequency for other equipment
- Readability of Scales i.e. breaks on scales

Grain and Ingredient Processing

- Type of grain-processing utilised
- Flake weights and target moisture of processed grain
- Roughage particle size

Diet and Ingredient Analysis (all experiments)

- Frequency of diet or ingredient sampling for laboratory analysis
- Nutrients to be analysed during laboratory analysis
- Locations of laboratories where analysis will occur
- Frequency of diet and ingredient sampling for oven dry matter analysis

Implant audits

- Timing and process (implant trials only)

Health Management

- Meta-phylaxis procedures (if applicable)
- Prescribed drug list
- Health protocol and flow of cattle through hospital system
- Dietary management of hospital/buller/chronic cattle
- Decision process for trial exclusions (chronics and bullers)
- Necropsy process

Slaughter

- Approximate time of dispatch, lairage and slaughter
- Distance to slaughter
- Time from slaughter to grading
- Full description of carcass grading data collected
- Protocols to maintain integrity of animal ID at abattoir
- Staffing of grading data collection (abattoir/independent grader)
- Agreeance of abattoirs to facilitate sample collection and grading (if applicable)

Statistical Analysis

- Randomisation framework to treatment and pens and statistical tests to ensure equality of treatment allocation.
- No of replicates per treatment
- Definition of experimental units for different variables
- Power calculations supporting the level of replication
- Framework for statistical analysis of data including statistical model

Weather data

- Source of weather data (brand of weather station, measurements taken).

Data Management

- Staffing of data collection – (feedlot staff or research team)
- Data backup procedures