



Final report

Feedlot Covered Housing Systems – Best Practice Design and Management Guide

Project code: B.FLT.4018

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Date published: 23 May 2023

PUBLISHED BY
Meat & Livestock Australia Limited
PO Box 1961
NORTH SYDNEY NSW 2059

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

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Abstract

The Australian Lot Feeders' Association has developed a shade policy, with a goal for all cattle in feedlots to have access to shade or shelter by 2026. The use of covered housing systems has emerged as a potential solution for protection of feedlot cattle from summer heat and wet winter weather and may also deliver other benefits.

Industry adoption of covered housing is in its pioneering stages. This project has delivered design and management recommendations for covered housing systems based on available information via key outputs:

- 1) a literature review of best practice design and management of covered housing systems; and
- 2) covered housing systems: best practice design and management manual.

This report represents the Final Report for the project. The manual provided as a separate output is illustrated with schematic drawings, photos and case studies. It includes a table to identify the common/mandatory components of covered housing systems, case studies from operating facilities and a comparison of the capital costs of a model covered feedlot with a model uncovered 'open lot' feedlot of equivalent capacity.

The covered housing systems: best practice design and management manual will benefit industry by providing key guidance for constructing and operating a covered housing system.

Executive summary

Background

Most cattle feedlots in Australia are kept in uncovered pens. Sometimes shade is provided but there are still some feedlots with no shade or shelter. Summer heat and wet winter weather raise welfare and productivity concerns in this system. The Australian Lot Feeders' Association has developed a shade policy, with a goal for all cattle in feedlots to have access to shade or shelter by 2026. The use of covered housing systems has emerged as a potential solution for protection of feedlot cattle from summer heat and wet winter weather and may also deliver other benefits. While the feedlot sector has some experience with covered housing, a lack of independent guidance on design, cost of construction, production response, management and regulatory controls may present an adoption barrier. Hence, this project was conceived to identify and describe best practice design and management for covered housing systems in a written manual.

The primary target audience for this project is lot feeders. However, it will also be of interest to regulators seeking to assess applications for covered housing systems.

The covered housing systems: best practice design and management manual will deliver key guidance for anyone considering the implementation of a covered housing system to provide shelter for cattle.

Objectives

The main objective of the project was to deliver a covered housing systems: best practice design and management manual, backed by a literature review of national and international developments in covered housing systems. Included in this document were a comparison of the capital costs of a covered feedlot versus an uncovered feedlot, an evaluation of any ancillary economic benefits/opportunities of covered housing, a review of regulations for approval, construction and operating covered housing facilities and case studies.

Methodology

The project commenced with a review of the international and Australian literature pertaining to covered housing systems for feedlots. Local state and federal regulators were interviewed to find how they do / would regulate covered housing systems. Additionally, twelve feedlots with full or partial coverage of pens were visited, with eight feedlots and an export yard participating in a comprehensive survey. Feedlot designs were developed for uncovered and covered feedlots and cost data collected and collated to provide a capital cost comparison of the two systems.

Results/key findings

The project identified that there is strong interest in covered housing systems in the Australian feedlot industry. However, independent research to support the development of these facilities is lacking.

While the project delivered a covered housing systems: best practice design and management manual, this was challenging as:

- Australian-based design and management research on covered housing systems is very limited. There is only a small number of covered housing systems in Australia and these

cover a broad range of building geometries and management. Most sites with established covered housing systems have refined their design and management over time; and

- covered housing systems used in north America and Europe are primarily designed to manage livestock in cold climates, often with snow. Most of the research from these is not applicable to Australian systems.

A key finding is that the cost of construction of covered housing systems is very site and design-specific and material and labour costs vary considerably between regions and over time.

Benefits to industry

The covered housing systems: best practice design and management manual will assist producers in making decisions around whether to implement covered housing on their farm and provide guidance for constructing and managing same. It also provides information that will assist regulators assessing applications for covered housing systems, which will help industry to navigate the regulatory approvals process.

Future research and recommendations

Design and management knowledge for Australian covered housing systems is limited and largely based on trial and error at this stage. Research needs to happen quickly to help early adopters avoid mistakes. We recommend a review and update of the manual as soon as new research is completed.

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1. Background

Most cattle feedlots in Australia have uncovered pens. However, summer heat and wet winter weather raise welfare and productivity concerns in this system. The Australian Lot Feeders' Association (ALFA) has announced an initiative to encourage all feedlots to provide cattle under their care with access to shade by 2026. While traditional shade is an option, covered systems are an alternative. This project aimed to provide lot feeders with practical guidance for producing grainfed beef under permanent covered structures. The Australian feedlot sector has some experience with covered housing and more recently there have been several feedlots install covered housing. MLA has also funded preliminary research in this area using a two-tier water-proof fabric system at the University of New England. This achieved a 7 kg hot standard carcass weight response last summer and improved feed efficiency (Matt Van Der Saag, pers. comm. 13th January 2022). However, lack of independent guidance on design, cost of construction, expected production response, management and regulatory controls may present an adoption barrier.

2. Objectives

The objectives of the project are to deliver to MLA by the agreed date:

- 1) A literature review of best practice design and management of common corrugated iron shed designs, concrete slatted floor facilities, water-proof fabric based structures, hoop shelters and compost bedded pack facilities. This will cover:
 - a) design, layout and orientation,
 - b) floor surface,
 - c) stocking density,
 - d) pen cleaning or bedding considerations and their interaction with stocking density,
 - e) lighting and ventilation considerations,
 - f) nutritional considerations (bunk space, water and vitamin requirements),
 - g) animal health considerations,
 - h) manure/effluent management and value, and
 - i) facility life and repairs and maintenance.
- 2) The difference in labour units and removable plant and equipment required for each system in feedlots of different size/scale.
- 3) A comparison of the capital costs of a model covered feedlot with a model uncovered feedlot of equivalent capacity for a greenfield site.
- 4) An evaluation of any ancillary economic benefits/opportunities associated with each facility type (e.g. cattle cleanliness, water capture, reducing effluent pond size/construction etc.)
- 5) A review of regulations (local, state and national) required for building and operation of covered housing facilities.
- 6) A best management practice guide including case studies in a word document with the findings from objectives 1-5.

While most objectives were successfully achieved, the project was unable to completely deliver on objective 2. While the types of removable plant and equipment used in covered housing systems was identified, it was not possible to properly evaluate labour inputs for covered housing systems of different scales compared with uncovered feedlots due to limited data availability. There are simply not enough established systems with only covered housing and those that have not settled on routine management at this stage. It is, however, possible to identify that:

- a covered housing system will usually require more labour units for adding bedding to pens compared with an uncovered feedlot. However, some outdoor feedlots use bedding in the wetter part of the year and some covered housing systems are experimenting with using no bedding for part of the year;
- the time spent on pen cleaning is highly variable in both uncovered feedlots and covered housing systems. While covered housing systems must remove manure plus bedding, the harvested manure may be cleaner than that of outdoor feedlots that harvest considerable pad material, so the overall volume may be less. However, pen cleaning may be slower per unit area due to smaller pens, smaller equipment and the presence of posts in pens. Additionally because of the higher stocking densities used in covered housing, the manure

will generally be spread over a much smaller area (e.g. half the area) than in an uncovered feedlot;

- while the covered feedlot may sometimes have more bedding to compost (or manage), the manure from these systems may be cleaner and easier to manage (e.g. no / less rocks), allowing it to be processed more easily and quickly and potentially have a greater value;
- covered housing systems will spend less / no time cleaning sediment basins and managing the wet solids removed; and
- covered feedlots that separate roof runoff from contaminated stormwater / effluent will have less or no effluent to irrigate.

3. Methodology

The project methodology consisted of six stages that are detailed below.

1.1 Industry consultation

A meeting between the project team and MLA and other relevant stakeholders was undertaken to plan the mechanics of the project, especially relating to the economic and regulatory aspects that will be covered.

A consultative meeting between the project team and MLA/ALFA was held on 21 May 2022.

Attendees included:

- Matt Van Der Saag representing MLA,
- Grant Garey, Christian Mulders and Jeff House representing ALFA,
- Danny Meehan (observer), and
- Robyn Tucker, Rod Davis, Eugene McGahan and Rob Lawrence representing the project team.

Joe McMeniman (MLA) and Justin Galloway (project team) were invited but unable to attend.

The meeting was used to discuss a range of topics. A summary of discussions is presented below:

- 1) plan for incorporation of the regulatory requirements for covered housing approvals:
 - guidelines to signpost requirements for planning / development permits /approvals; environmental approvals / permits licences; and building and fire rules.
 - details vary between states and over time so only general guidance will be presented.
 - separation distances / odour modelling is outside the scope of this project
 - a summary of regulatory requirements will be delivered as part of Milestone 2 due 15 October 2022.
- 2) lot feeders, facility manufacturers and industry subject matter expert interview plan:
 - the project team has identified most lot feeders with covered housing. It is intended that members of the project team will visit most of these feedlots to interview the managers and take photos.
 - a draft questionnaire for the feedlot interviews has been prepared and provided to MLA. It has been trialled at one feedlot and worked well. The questionnaire will be modified for application to facility manufacturers and industry experts.
 - some facilities manufacturers and industry experts have been identified and preliminary contact has been made with them.
 - additional facilities manufacturers and industry experts will be identified through interviews with feedlot managers, and discussions with other contacts. The meeting identified that specialist feedlot nutritionists and veterinarians may be able to contribute knowledge / experience but may also identify be able to identify other industry experts.
 - care will need to be taken with transferring designs from other industries and from overseas. There is a need to understand which problem/s the Australian industry is hoping to solve with covered housing and to design to address these.
 - interviews will be completed as part of Milestone 2 due 15 October 2022.

- 3) agreement that photos and illustrations used as part of the project must be unique or have the producers / manufacturers signed permission on file and provided to MLA, and de-identified of name/location:
 - MLA has provided their standard image release deed poll. This will be used for photographs used in any publications.
 - Completed and signed image release deed polls need to be provided to MLA.
- 4) MLA to provide style and formatting guide
 - to come
- 5) plan for capital cost comparison
 - costs can go out of date very quickly, so need to be clear regarding this.
 - plan is to prepare a capital cost comparison for model greenfield sites: uncovered feedlot, fully covered feedlot and possibly a partially covered feedlot.
 - Intention is to identify the big picture elements and the differences between the options.
 - the possibility of a case study describing an actual design with a breakdown of capital costs was also viewed favourably. However, this relies on finding a feedlot willing to share this information.
 - the capital cost comparison will be provided as part of Milestone 3 due 15 May 2023. Any case study would also be provided as part of this milestone.
- 6) any other discussion topics as deemed relevant by MLA / ALFA.
 - there was some good discussion around stocking rates in covered housing due to the potential overlap with another project which is due to be completed in June 2022.
 - it was identified that not many meetings have been scheduled as part of the methodology. More may be needed to satisfy ALFA / MLA requirements.
 - we suggest meetings around:
 - 29 October 2022 – 14 days after Milestone 2 is submitted
 - 7 January 2023 – about midway between submission of milestones 2 and 3
 - 15 May 2023 – feedback on MLA deliverables provided

After the meeting, a written document outlining the project plan with timelines on each phase was to be provided within 14 days to MLA. This was done.

1.2 Literature review

A comprehensive review of the literature was undertaken. This focussed on best practice design and management of housing systems and covered:

- design, layout and orientation,
- floor surface,
- stocking density,
- pen cleaning or bedding requirements and management implications (e.g. bedding type, moisture management and drying, use of additives to promote composting process),
- lighting, ventilation and cooling considerations (e.g. fans and evaporative cooling)
- feeding and nutritional considerations
- animal health considerations (e.g. elimination of mechanical and bacterial-induced lameness),

- manure / effluent management and value, including the possibility of GHG mitigation and energy capture,
- facility life and repairs and maintenance; costs of construction,
- return on investment, and
- additional benefits (e.g. cleaner cattle, reduced cattle maintenance energy requirements, reduced controlled drainage area, reduced effluent pond size, water capture and reuse, energy generation from solar panels and potential for reductions in greenhouse gas emissions and energy capture from bedding management).

1.3 Interviews

The project team interviewed lot feeders, covered housing facility manufacturers and industry subject matter experts as part of this project.

A pro-forma was developed to collect from lot feeders' information about the design, management, operating and maintenance requirements, benefits, economic costs and opportunities and any unknowns or downsides of covered housing systems. Twelve feedlots with full or partial coverage of pens were visited, with eight feedlots and an export yard participating in the survey. The information collected from feedlot operators was used to provide a practical basis for the manual.

Covered housing manufactures and industry subject matter experts were contacted to clarify particular points throughout the project.

A regulator questionnaire was developed and various local state and federal regulators were interviewed to find how they do / would regulate covered housing systems

1.4 Regulatory review and capital cost model

The project team reviewed the national and state regulations for building and operating covered housing facilities, including planning, environmental and building requirements. A summary is presented in the manual.

The project team prepared capital costings of a model uncovered feedlot with a model covered housing system of equivalent capacity for a greenfield site. The data for the capital cost estimates was collected from interactions with lot feeders and shed builders. We suggest including a blank version of this table in the best practice manual, making it easy for lot feeders to see the elements they need to consider in a capital costing.

1.5 Development of the manual

The project team synthesised information from the literature review, site visits and interviews, and consultation with shed designers / builders into a best practice design and management manual that is illustrated with schematic drawings, photos and practical case studies. The finished manual provides an independent and comprehensive resource to guide the decision-making of lot feeders considering implementing covered housing. It clearly identifies the benefits of covered housing, while also describing the management and maintenance requirements for these systems.

1.6 Development of standalone case studies

MLA's priority for this project was addressing the previous five stages of the methodology. Consultation with MLA during the project identified that case studies for feedlot components, rather

than standalone case studies of individual feedlots, would be suitable for incorporation into the manual. Hence, the case studies developed highlight particular aspects of the design and management of covered housing systems throughout the manual as appropriate.

4. Results

The main result of this project is a covered housing systems: best practice design and management manual, which is provided as a separate document. The review of literature, feedlot surveys and photos from each feedlot represent additional intellectual property.

5. Conclusion

This section summarises the key insights and implications from the project, including learnings, benefits to industry and future research and recommendations.

5.1 Key findings

Australian-based design and management research on covered housing systems is very limited.

Covered housing systems used in north America and Europe are primarily designed to manage livestock in cold climates, often with snow. Most of the research from these is simply not applicable for Australian conditions.

While there is only a small number of covered housing systems in Australia, every one is different. There is a broad range of building geometries and management. Most sites that have used covered housing systems have made changes over time, by refining their design and management based on practical experience.

There is strong interest in covered housing systems in the Australian feedlot industry. Research needs to happen in a number of key areas quickly to avoid some of the mistakes made by early adopters.

5.2 Benefits to industry

The covered housing systems: best practice design and management manual will assist producers in making decisions around whether to implement covered housing on their farm and provide guidance for constructing and managing same. It also provides information that will assist regulators assessing applications for covered housing systems, which will also help lot feeders to navigate the regulatory approvals process.

6. Future research and recommendations

Design and management knowledge for Australian covered housing systems is limited and largely based on trial and error at this stage. We recommend a review and update of the manual as soon as new research is completed.

We also recommend research into:

- building geometry to optimise natural ventilation (e.g. using numerical analysis techniques such as Computational Fluid Dynamics modelling; monitoring of constructed facilities etc);
- the need for and design of ridge vent caps;
- the optimum stocking density for maintaining bedding under different climatic conditions and seasons and with different bedding management;
- bedding types and management, including potential to use no bedding;
- the potential use of composting barns;
- minimum bunk space requirements;
- water consumption in covered housing systems compared with uncovered feedlots;
- odour emissions from covered housing systems and manure storage / composting areas versus those from uncovered feedlots;
- the development of a covered housing system s-factor methodology for determining separation distances to sensitive land uses;
- animal welfare implications of using higher stocking densities than cattle in uncovered feedlots. (This is important since feedlots are one of the only intensive livestock sectors that are intensifying, most are providing more space per animal);
- the potential use of automation / robots e.g. for feeding, for tilling manure; and
- opportunities for energy recovery from manure (cleaner manure / bedding than from outdoor feedlots).