

final report

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Current State of R&D in the Australian Lamb Feedlotting Sector – A brief report

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Abstract

This is a component report of L.LSM.0022 - Sheep Feedlotting and Containment Management Guidelines Update – and was put together to provide a brief updated review of the current state of R&D in the Australian lamb feedlotting sector.

This report is comprised of:

1. A brief review of previously identified knowledge gaps
2. An insight into research undertaken in the last 10 years
3. A summary of current knowledge gaps and priorities
4. Recommendations for a strategic approach to industry investment

Other core project deliverables include the updating of two-industry documents and the collation of accompanying producer factsheets:

1. *A producers' guide to production feeding for lamb growth*
2. *National Procedures and guidelines for intensive sheep and lamb feeding systems*

Executive summary

Seasonal and market conditions over the last 3 years have significantly increased the use of both containment areas and lamb feedlots. Similarly, there has been a large increase the number of companies producing products to support sheep in intensive feeding environments including aspects such as feeding, animal health, nutrition and pen design.

Given the low level of definitive data supporting ideal systems for intensive feeding of sheep and lambs, a wide range of recommendations are being provided to industry, sometimes with little supporting evidence available. An opportunity exists to both identify and deliver a range of key industry knowledge gaps to provide stakeholders with important information relating to best practice animal management in intensive feeding systems.

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1 Background

Recent drought conditions have driven an increase in containment management of sheep and lambs. There has also been an overall increase in interest in strategic feedlot finishing of lambs particularly with recent high lamb prices.

Sheep Producers Australia (SPA), Meat and Livestock Australia (MLA) and various state farming organisations are looking to ensure that producers have access to up to date extension materials available on best practice management of sheep in containment or feedlot situations. As such, SPA & MLA commissioned AgriPartner Consulting to refresh, refine and to update previously published documents with a focus on updating the relevant information on best practice management, performance targets, new R&D outcomes and key information sources.

This project has revised and updated two key industry reports:

1. A producers' guide to production feeding for lamb growth
2. National procedures and guidelines for intensive sheep and lamb feeding systems

The documents have been updated with, key new information from recent published research, updated benchmarks, market information and images. The project has also completed a brief review of the state of R&D in the Australian lamb feedlotting sector, the focus of this component report.

2 Project objectives

2.1.1 Component objective five

Provided MLA with recommendations – following consultation with a minimum of three key industry advisors and five major feedlotters - for future industry investment regarding lamb feedlotting and containment area management given current industry status and knowledge gaps.

This component of the project focused on:

1. A review the currency of knowledge gaps identified in previous publications such as “Best practice for production feeding of lambs: A review of the literature”
2. Consultation with key industry advisors and major feedlotters to identify current perspectives on key areas for future research
3. Development of a brief summary document (2-3 pages), detailing:
 - a. Current knowledge gaps in both containment area and feedlotting design and management, including the importance and priority of each
 - b. Recommendations future industry actions to develop a more strategic approach to investment in the management of containment areas and lamb feedlots, e.g. industry surveys or stocktake etc.

This component of the proposal was not intended to create a full strategic and R&D investment plan for the lamb feedlotting industry. It is to simply revisit the relevance of knowledge gaps identified in previous publications, combine this with the experience of this author and other key industry personnel, to create a brief report recommending a priorities and path forward for future industry investment.

3 Methodology

3.1 Consultation – advisors and feedlotters

To assist in identifying and prioritising knowledge gaps relevant to lamb feedlotting and sheep containment areas, several key industry advisors (from NSW and QLD) and feedlotters (2,000 – 100,000 lambs per annum covering SA, VIC and NSW) were consulted via phone and in person. These consultations were designed to allow these key stakeholders the opportunity to identify knowledge gaps and important pieces of work that they viewed important for the industry to undertake. Their views, in combination with previously identified knowledge gaps and more recent work, have been incorporated into Section 6 Current knowledge gaps and research priorities.

4 Previously identified knowledge gaps

Several past MLA projects have identified key knowledge gaps in both the lamb feedlot and containment feeding areas. Conclusions from these projects are detailed in the following reports:

1. Best practice for production feeding of lambs: A review of the literature (B.SCC.0118, Oct 2010)
2. Australian Lamb Finisher Scoping Workshop (SCSB.064, Feb 2006)
3. Sheep Confinement Feeding Systems Workshop (SCSB.047, Oct 2003)

The literature review conducted in 2010 is the most current and extensive piece of work and the key recommendations for future research identified in this report are detailed in **Error! Reference source not found..** In addition, Table 1 shows where key recommendations from the literature review were also supported in industry workshop reports from 2003 and 2006.

4.1.1 Table 1 - Key areas for recommended further research as identified in 'Best practice for production feeding of lambs: A review of the literature.'

Key area of recommended further research	Also identified in Confinement feeding workshop 2003?	Also identified in Australian Lamb Finishers Scoping workshop 2006?
<u>Nutrition</u>		
Protein and energy requirements of growing lambs	Yes	Yes
Fibre requirements	Yes	Yes
Water trough design to optimise water intake		
Managing dietary change	Yes	

Factors influencing growth and feed conversion ratio of lambs	Yes	Yes
Effects of nutritional restriction during pregnancy on lamb growth and carcase quality		
Determine the effect of magnesium and chromium supplementation in the diets of lambs		
Effects of ration design on lamb performance	Yes	Yes
Determine the effect of restricted feeding on feed efficiency		
Cost benefit of a choice feeding system		
<u>Feedlot design</u>		
Determine optimum feeding space allowance for self feeders	Yes	
Determine the number of feeders required per pen	Yes	
Determine the role of "lick feeders" in controlling acidosis and optimising lamb growth		
Identify the effects of feeder design on growth and performance	Yes	Yes
Development of a hay delivery system that minimises waste		
Identify any effects of water trough space and design on lamb growth rate	Yes	Yes
Identify the effects of water pressure (return rate) on growth rates		Yes
Determine the relationship between the number of lambs per pen, stocking density and pen shape on lamb growth rate	Yes	Yes
Determine the optimum feedlot layout		Yes
Determine the optimum feedlot slope		Yes
Determine the difference in growth rate between paddock and feedlot finishing		
<u>Animal welfare</u>		
Effects of animal behaviour on lamb growth - socialisation, mixing of groups and effect of temperament.		
Effect of pen enrichment on growth rate of lambs		
Incidence and causes of shy feeders	Yes	Yes
Shy feeder behaviours relative to feeding and use of shade		
Determine the amount of shade required to optimise lamb performance	Yes	Yes
Cost efficiency of shearing to optimise skin value		
Determine predisposing factors leading to pleurisy and pneumonia in paddock and feedlot finished lambs		
<u>Management</u>		
Determine the influence of genes on the rate of adaptation of lambs to a feedlot	Yes	Yes
Investigate the cause of low utilisation of breeding values in feedlots		Yes
Determine the reasons for success and failure of supply chains	Yes	

Investigate the cost efficiency of automatic weighing and drafting systems		
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It can be seen from Table 1 that the key areas identified as requiring further research were focussed on nutritional requirements and ration formulation, feedlot design including pens, feeding and watering equipment, as well as the effect of management and genetics on lamb performance and shy feeders. These key themes should be considered sound areas for further research as they align closely to the profit drivers of intensive finishing systems, as well as important management aspects of containment systems for ewes.

5 Research undertaken in last 10 years: a brief summary

In the years following these earlier reports, a limited amount of research has been conducted in the area of lamb feedlotting and containment area management. A brief summary of the research conducted is below, identified within each of the key themes of required research presented from Table 1.

1. Nutritional requirements and ration formulation

- No significant work published.
- Ruminant feeding standards review project, lead by Hutton Oddy (NSW DPI), may provide information to allow some refinement of nutritional requirements of lambs and sheep in intensive systems. Results yet to be published.

2. Feedlot design including pens, feeding and watering equipment

- *Jongman et al, 2017. The effect of trough space and floor space on feeding and welfare of lambs in an intensive finishing system. Applied Animal Behaviour, 186:16-21.*

This research provides sound data on the effect of changes for feed trough and stocking density pen design on lamb performance in feedlots. This is a valuable piece of work for lamb feedlotting, however further work would be required for containment feeding situations with mature ewes.

- *Rice et al. 2016. Characterisation of Shy-Feeding and Feeding Lambs in the first week in a feedlot. Applied Animal Behaviour, 179:39-45.*

Whilst this study found some interesting conclusions regarding the classification of shy feeders based on their feeding duration, this research provides data on the incidence of shy feeders at the stocking density and feed trough length used in this trial, albeit not comparing directly to other options. Further work would be necessary to support the single trial results published in this article.

- *Dundon and Mayer, 2015. Pen parameters for improving the performance of sheep imported from Australia to Persian Gulf feedlots. Small Ruminant Research, 126:16-25.*

This report contributes useful data on feed trough length, water trough length and stocking density for feedlot design. Stocking densities tested in this work are higher than many Australian feedlots operate, nonetheless the work is relevant to some situations here.

3. Effect of management and genetics on lamb performance and shy feeders

- *Rice, et al. 2016. Relationships between temperament, feeding behaviour, social interactions, and stress in lambs adapting to a feedlot environment. Applied Animal Behaviour, 183:42-52.*

This research provides highly detailed research into behavioural and temperament interactions with stress responses in animals. It provides good insight in some behavioural indicators of shy feeders/poor performers. Further work should be conducted in assessing these responses in more commercial environments as these trials were conducted with a small number of animals at a high stocking density compared to most commercial feedlots.

6 Current knowledge gaps and research priorities

Following a review of previously identified research priorities, whilst considering more recent and relevant research outcomes, and in consultation with key industry advisors and feedlotters, the following key research questions have been identified based on their importance and potential impact on industry performance.

6.1 Near term issues and priorities

6.1.1 Nutritional requirements and ration formulation

- 6.1.1.1 Nutrient requirement recommendations for fast growing lambs (of different genotypes) vary and require testing to develop a comprehensive set of guidelines that can be adopted by industry. Note; the knowledge surrounding the nutritional requirements of mature ewes in containment is considered satisfactory at this stage.
- 6.1.1.2 Fibre requirements of lambs in feedlots requires investigation to determine the minimum and optimal amount required. This work is particularly relevant given an increasing promotion of zero roughage diets for lamb feedlots.

6.1.2 Feedlot design including pens, feeding and watering equipment

- 6.1.2.1 Feed space allocation required for trough feeding in a containment feeding scenario where restricted feed allocations are provided.
- 6.1.2.2 Assessment of the use of lick feeders for limit feeding animals during introduction or containment feeding. What is the ideal feed space allocation and number of feeders? How consistent is intake between animals accessing a lick feeder and how does this compare to trail feeding? What are the limitations of restricting access to lick feeders for ewes, i.e. what are the realistic minimum amounts that can be delivered, how much does this vary between groups of animals and are there any other negative effects of providing small amounts per head such as increased variance between animals?
- 6.1.2.3 Shade requirements for optimal performance during hot conditions
- 6.1.2.4 Identify the impact on lamb performance of water trough space allocation and design.

6.1.3 Effect of management and genetics on lamb performance and shy feeders

- 6.1.3.1 Investigate the incidence and causes of shy feeders, including interactions with pen design and feed rations.
- 6.1.3.2 Impact of early life rumen development on lamb feedlot performance. Can significant improvements to lamb feedlot performance be achieved through manipulating feed to optimise rumen development in early life and are these changes to rumen development a 'lifetime effect'?
- 6.1.3.3 The impact of pen enrichment on animal performance in intensive feeding systems.

- 6.1.3.4 Identify key management practices for successful early yard-weaning of lambs during dry times. Note; this topic has been raised given the recent seasonal conditions, as well as the likelihood that many of the best practice early yard weaning techniques will improve subsequent lamb feedlot performance.

6.2 Long term issues that require consideration

1. The use of ionophores such as lasalocid (Bovatec) and monensin (Rumensin) will come under increasing levels of pressure to be removed from lamb and sheep diets. Future research to assess alternative, acceptable options should be considered where possible. The focus of these alternatives will typically be on improving feed efficiency, however these ionophores also have an important role in controlling coccidiosis and alternative control options for this disease should be investigated.
2. Environmental impact of lamb feedlots and containment areas. As more lamb feedlots and containment areas are constructed and utilised, regulatory bodies such as EPA and local councils are becoming increasingly aware of the impact of these areas from an environmental protection and community amenity perspective.

A purpose of the National Procedures and Guidelines for Intensive Sheep and Lamb Feeding Systems was to provide best practice environmental protection and community amenity guidelines for any stakeholders to use as required. However, given the large lack of sheep specific data available, the guidelines were largely adapted from cattle guidelines with appropriate conversions for stock size incorporated where appropriate. It was always known that there are significant differences between manure and urine production between sheep and cattle and as such, waste collection systems and odour modelling from lamb feedlots should reflect these differences. However, without any baseline data, these could not be reflected in the guidelines. As lamb feedlotting and utilisation of containment areas increases, further consideration should be given to now engaging with environmental consultants to better understand how sheep and lamb environmental protection and community amenity guidelines should be reviewed and what necessary monitoring data is required to better define the standards required of intensive sheep systems.

7 Recommended actions for a strategic approach to industry investment

Largely, the current lamb finishing industry has developed on a 'trial and error' basis, in combination with anecdotal information supported by a small amount of fragmented research. In order for the industry to continue to grow, it will require a strategic approach to industry investment.

To understand the industry and justify future investment, a lamb feedlot stocktake should be conducted to estimate the total number of lambs that are feedlot finished per year. This work would allow an estimate of the growth of the industry from previous surveys/estimates (albeit they are limited in availability), and importantly provide a sound comparison point for future

surveys/stocktakes. Such a survey could also allow the demographics of the industry to be better understood, including the knowledge gaps relevant to each part of the industry. Having semi regular industry stocktakes would allow the ability to track the growth of the industry and plan for future requirements.

The direction of industry R&D at this stage, will likely be driven by MLA, its consultation processes, key producers and industry stakeholders. In more mature industry sectors such as the beef feedlot sector, specific organisations have developed to represent the needs members. Previous attempts have been made to create a lamb feedlotters association (or similar) and whilst this could provide many benefits to the industry, the initiation of such an organisation should be driven by lamb feedlotters themselves to ensure industry commitment. It is likely that as the industry grows this will be a development that takes place.

In the meantime, the identified priority knowledge gaps and research questions may provide some guidance to focussing industry research funding in areas that can create the greatest benefit for the lamb feedlotting and sheep containment feeding sector.

8 Key messages

Seasonal and market conditions over the last 3 years have significantly increased the use of both containment areas and lamb feedlots. Similarly, there has been a large increase the number of companies producing products to support sheep in intensive feeding environments including aspects such as feeding, animal health, nutrition and pen design.

Largely, the current lamb finishing industry has developed on a 'trial and error' basis, in combination with anecdotal information supported by a small amount of fragmented research. In order for the industry to continue to grow, it will require a strategic approach to industry investment.

Several industry activities over the last 15 years have identified key knowledge gaps and subsequent research priorities for the lamb feedlotting and sheep containment sector (detailed in this report). Whilst some recent research has been undertaken into these knowledge gaps, a more strategic approach is required to coordinate a planned and prioritised path of research. This will ensure that any research undertaken is conducted in a way that includes all relevant components and can resolve the knowledge gap for industry.

Key knowledge gaps identified as requiring further research were focussed on nutritional requirements and ration formulation, feedlot design including pens, feeding and watering equipment, as well as the effect of management and genetics on lamb performance and shy feeders. Key research questions have been detailed in this report and should be used to guide future research priorities in the industry.

In addition, to assist with improving the understanding of the importance of the industry, as well as tracking industry growth, an industry survey/stocktake should be conducted to better understand the proportion of lambs finished in a feedlot environment as anecdotal evidence suggests a significant increase has occurred in the last 3 years.