16. Lamb or Sheep Feedlotting

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Learning objectives

On completion of this topic students will have an understanding of:

- management issues and systems
- lamb nutritional requirements
- factors that impact on the profitability of feedlot systems.

Key terms and concepts

Feedlot systems may be defined as *'an on-farm system where sheep and/or lambs are kept within a controlled space and environment and where all feed, health, water and animal welfare requirements are met for the purpose of increasing carcase weight and/or quality'*. Most are based on a cereal grain rations with additional roughage, protein, vitamin and minerals added. Pelletised feeds may also be described as a grain based ration component.

16.1 Introduction

Historically, a few lambs have been grown in feedlots, often by grain producers utilising surplus or damaged grain. During the late 1970's and early 1980's there was increased interest in intensive feedlots in Australia although interest diminished due to problems with adaptation to sheep to the diet and confinement and due to marginal profitability. In recent years consumer pressure for a more consistent supply and quality of lamb, drought and poor seasonal conditions and the ability to value-add low prices cereal grain, have all renewed interest in, and the use of, intensive grain finishing systems nationally.

16.2 Why use grain finishing systems on-farm?

There are two types of production based grain finishing systems: opportunistic and commercial. Opportunistic systems are usually short-term feeding programs carried out when prices are low for both store lambs and grain. Commercial systems are generally established to supply a particular market specification. Systems may also be used to meet breeding animals' maintenance requirements during periods of low pasture availability due to poor seasonal conditions or drought.

16.3 Infrastructure and management within grain finishing systems design

Feedlot design will depend on area available, personal preference, capital input, labour and equipment availability. While there is no perfect feedlot design there are basic design and infrastructure principles and recommendations that can be incorporated into any design chosen.

General design recommendations include:

- provide a minimum of 5m² per animal
- maximise the distance between water and feed troughs to minimise contamination of water from dropped feed particles
- provide adequate shade and shelter
- site feed troughs on the upward slope to minimise the risk of areas becoming boggy during periods of wet weather

- select a site that is well drained. Medium clay loams soil types are preferred (clay based sites dry slowly increasing odour and welfare problems and sandy/light soils have high infiltration rates and are prone to erosion)
- provide adequate trough space per animal (5-10cm if using self feeders, 10-15cm or more if using open trough systems)
- lift troughs so upper edges are 45-55cm off the ground surface. Doing so minimises contamination of grain ration through lambs pawing at the feed mix and/or defecating in troughs. Same applies to watering points

Feeder types

There are two basic design systems available. These are open trough bunker style systems and self feeder systems. Both can provide total mixed ration (TMRs) where grain and fibre are combined in a single mix or separate grain and fibre feeding options depending on equipment available and personal preference.

Open trough systems may be cheaply constructed and may reduce the incidence or risk of acidosis when using TMR's. Unfortunately they require specialised equipment, are labour intensive (may require twice a day feeding) and may lead to a higher incidence of shy feeders if trough length per animal is limited.

Self feeder systems are generally preferred within industry. These systems ensure rations are available at all times, reduce the risk of shy feeders, reduce labour input and have been shown to increase intake, weight gain and feed conversion efficiency (FCE) provided adequate trough space is available. They can however be difficult to manage when changing grain types or mixes, do not generally enable the feeding of TMR's due to feed blockages and can be expensive to purchase. Such systems usually require fibre to be fed separately, preferably in delivery racks that minimise spoilage and waste. Substitution of fibre for grain (reducing growth rates) and/or increased acidosis risk through grain engorgement are also possible.

Self feeders such as the Cowra Lick Feeder effectively restrict intake to short 'licking' bursts after which the lamb will tire, seek water and rest. This process minimises engorgement and reduces acidosis risk.

General management recommendations

On induction, lambs should be:

- vaccinated (5 or 6 in 1, Vitamin A,D and E)
- shorn (improves intakes, growth rates and skin values) and/or crutched depending on time of year and wool lengths
- drenched with an effective drench (reduces worm burdens)
- separated into weight groups (ease of management and marketing)
- fed a high fibre, low grain introductory ration. Ration mix should change over to high grain, low fibre mix used during the finishing phase of program within 10-14 days of entering a feedlot
- monitored regularly

16.4 Feedlot nutrition

The importance of fibre

A ruminants 4 part stomach is designed to digest cellulose rich feeds (pasture, hay and straw) provided most energy, protein, vitamin and mineral requirements are met in their diet. For normal rumen function ruminants require a minimum of 10 to 15% effective fibre in their diet. Effective fibre physically stimulates the rumen and forms a rumen mat that traps incoming feed, slowing the rate of passage and reducing the risk of acidosis.

Effective fibre in the form of higher quality hay is preferred but is not mandatory. Poorer quality roughages may be used to meet fibre requirements. Palatability may be improved through a molasses and water mix poured over the roughage.

Fibre may be fed through ad lib systems or provided every 2nd day. The latter will ensure lambs do not substitute the roughage for the higher energy pellet or grain based ration, wastage is minimised and fibre requirements are met to maintain rumen balance and reduce grain poisoning risk. Total mixed ration containing fibre, grain and additives may be used but generally require specialised equipment during ration preparation.

Which grain and why?

Cereal grains provide a range of nutrients including energy, protein, vitamins and minerals. They are generally the cheapest in terms of cost per unit of energy while pulses (lupins, peas and beans) and manufactured meals are generally cheaper on a protein basis. Most cereal grains contain high levels of soluble starch and are highly digestible. Starch content and solubility, the degree of rumen breakdown and a grains fibre and oil component are important issues to consider when selecting a grain for use in a feedlot ration. A grains oil levels are also important in terms of overall energy and feed value. Oil within a grain has 2.25 times the energy value of starch without the acidosis risk. Table 16.1 illustrates the average starch, fibre and oil levels found within most cereal grains and pulses.

Table 16.1 : Average Values (Grains). Source: Duddy, (2005a)

Grain	Energy	Protein	Starch	Fibre	Oil
Wheat	13.5	13%	76%	2-3%	1-2%
Triticale	13.0	13%	76%	2-3%	2-3%
Maize	13.0	8%	76%	2-3%	2-3%
Sorghum	13.0	12%	70%	3-5%	3-4%
Barley	13.0	12%	61%	5-7%	1-2%
Oats	12.0	10%	42%	12-25%	7-10%
Lupins	13.0	35%	10%	10-15%	5-9%
Peas	12.5	25%	48%	9%	0.5%
Beans	12.5	25%	37%	11%	1.5%

High starch grains such as wheat increase acidosis risk due to the rapid production of lactic acid within the rumen during the fermentation of starch particles. Such grains should be introduced slowly over a 2 week period to allow rumen microbes to adjust to the increasing starch levels. Maintaining adequate roughage and/or the addition of a number of additives will help reduce acidosis risk and maintain rumen health. Oats, with low starch, high oil and greater fibre levels are generally the safest to feed of all cereal grains. Unfortunately oats are also generally lower in digestibility and may reduce feed conversion rates and ultimately, growth rate potentials. Barley, with a lower starch and higher fibre content has a generally lower acidosis risk rating than wheat or maize.

Pulses are lower in starch than cereals and generally pose a lower acidosis risk. Lupins may be cracked to reduce a lamb's ability to select against such grains and help to ensure protein requirements are met. Lupins have very low starch levels and a high oil content which provide additional feed energy value with a lowered acidosis risk. Peas and beans have reasonably high starch levels and may lead to acidosis if cracked or further processed.

Is processing necessary?

Cereal grains should not be cracked, milled or processed. Doing so will increase the likelihood of acidosis due to an increase in total starch surface area available to rumen microbes. Trial results indicate that feeding lambs whole grain may increase feed intake, growth rates and feed conversion efficiencies by 25, 20 and 10% respectively, reduce the risk of damage to the rumen lining and increase the likelihood of a firmer fat finish on the carcase.

While pelleted feeds are a convenient means of supplying a balanced ration pellets are generally dearer per unit of energy and protein, may contain poor quality roughages (husks, hulls, stubbles) effectively reducing ration digestibility and palatability. Intake of pelleted diets is generally higher than mixed grain rations due to small particle size and increased gut flow. High flow rates generally lead to increased intake (up to 40%) and a reduction in the efficiency of digestion. It is therefore important that additional roughage be provided within the ration to reduce gut flow in these circumstances. While convenience can be factored in to justify pellet use a thorough cost/benefit analysis should be undertaken before deciding to base a ration on pelleted diets alone.

Additives – what and why

Cereal grains are generally able to meet the bulk of mineral and vitamin requirements. They are however deficient in calcium and sodium and present an acidosis risk if high in starch. The following additives should be considered where possible.

Limestone / calcium carbonate (finely ground) increases calcium levels in a ration and will help buffer acid levels within the small intestine. Add a minimum of 10kg/tonne (1%) of ration. Dolomite ($CaCO^3$ plus $MgCO^3$) will provide additional magnesium and buffering capacity as well as calcium.

Acid salts such as ammonium and calcium chloride increase the absorption of calcium from the small intestine and stimulate the mobilisation of calcium from body reserves. If used add at 5kg/tonne. Palatability is a major issue.

Salt will correct sodium deficiencies, increase intake of ration and water and reduce the risk of acidosis due to increased gut flow. Add 5 to 10kg/tonne.

Urea may be used to increase nitrogen available to gut microbes. The bacteria can utilise the ammonia directly (to produce microbial protein) which is then used by the lamb. Unfortunately lighter lambs (<30kg live weight) may not have a fully functional rumen and it may take 3 to 4 weeks to adjust to the urea component in a ration. Urea is also extremely toxic if absorbed directly by the lamb and should not constitute any more than 25% of the rations protein component.

Bentonite, a sodium clay, may be included to provide some protection against acidosis. It is not a true 'buffer' and its precise mode of action is not well understood. Its small particle size means that it has a large effective surface area to which ions. It has been claimed that bentonite also reduces the loss of microbial protein within the rumen through its negative effect on gut protozoa (which consume bacteria), increasing protein availability and that it slows passage rate, increasing the potential for nutrient digestion but reasons for it's efficacy are not well understood and research findings, equivocal. Bentonite can be used as a pellet binder and will help to 'firm' up faeces but is unpalatable and may settle out within a grain based ration. Add 10kg per tonne of feed if used.

Sodium bicarbonate is a buffer that attempts to maintain rumen pH at neutral (pH 7) levels. It is produced naturally by sheep (in saliva) when feed is ingested and/or regurgitated (cud chewing). Low fibre levels in the diet reduce chewing time and saliva production, increasing acidosis risk. Add at 20kg/tonne during the first 1-2 weeks of feeding and 10kg thereafter.

Lasalocid (Bovatec®) is an ionophore that alters rumen fermentation and ultimately volatile fatty acid (VFA) patterns, reduces energy losses, reduces the risk of coccidiosis (blood parasite) and improves feed conversion efficiencies. Many pellets and premixes may contain Bovatec. It is difficult to include in a on-farm mix unless in a premix or pelleted supplement due to a low inclusion rate (30-70g/tonne of feed).

Virginiamycin (Eskalin®) is an antibiotic that prevents the excessive production of lactic acid within the rumen upon the introduction of starch rich grains or pellets. Virginiamycin is an S4 drug and therefore needs veterinary approval for inclusion in a feedlot ration.

Mineral blocks. Blocks, particularly the 'shotgun' types, can be inefficient in the correction of vitamin or mineral deficiencies as intake varies considerably in a mob. Supplements should be provided within the grain ration to ensure all sheep receive levels required.

Vitamins are seldom deficient but are cheap to prevent through vaccination or supplementation. Vitamins A, D and E are fat soluble vitamins synthesised by ruminants. Vitamin A, produced through the conversion of carotene (in green feed) within the rumen lining, is needed for the control of many physiological processes in the body including normal bone growth and development. It is stored in the liver and drawn upon when required however prolonged dry feed conditions and/or a drought may deplete body reserves - particularly in young lambs. Deficiencies are usually seen as 'night blindness'.

Vitamin D is synthesised from direct sunlight. It acts as a hormone in regulating calcium and phosphorus balance by promoting calcium absorption and mobilisation of calcium and phosphorus from body reserves. Deficiencies are rare. Vitamin E plays an important role in maintaining cell membranes. It is not stored in the body in appreciable amounts and young lambs may require supplementation. Deficiencies may occur if soils are deficient in selenium. Vitamin B12 assists with the production of glucose from volatile fatty acids produced within the rumen. Its role is therefore related to the efficiency of energy production and use within the sheep or lamb. Deficiencies may occur if cobalt in soils is limiting or if grazing grass or cereal pastures.

What about water?

It is critical that animals receive a constant, clean supply of quality water within a feedlot system. Any issue that reduces water intake will impact on feed intake and growth rates and should be corrected for as soon as possible. Lambs will generally consume from 4 to 6 litres daily. Hot weather, inadequate shade, salty or high roughage rations will further increase water requirements.

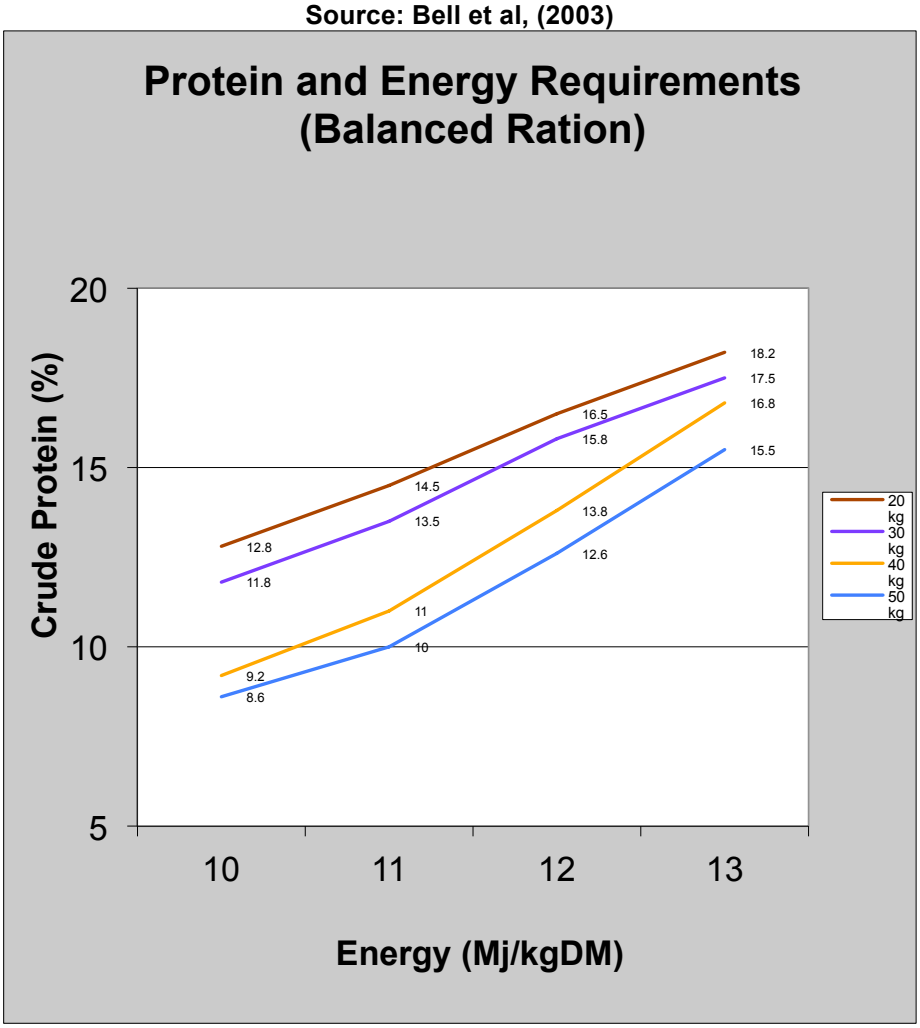
Water trough allocation per lamb is not as critical as a constant, pressured supply. Sheep or lambs will not all seek to drink simultaneously but will need to have water available on demand. Raise troughs 30-40cm, site as far away from feed sources as possible and clean regularly to reduce contaminants.

What are a lambs specific feed requirements?

Growing lambs have high energy and protein requirements. Protein is required for muscle development and normal rumen function. Inadequate protein will lead to a reduction in gut bacteria, a slowing in rate of digestion and reduced intake while excess protein may be lost in urine and faeces. It is therefore important to provide a balanced ration in terms of a lambs energy and protein requirements based on weight and production stage (growth rate).

Light lambs (15-25kg) have an extremely high protein requirement at any given energy intake level as shown in Figure 1. Use of high protein feeds such as lupins or processed meals such as canola or cottonseed meal is recommended during early growth stages. As a lamb matures protein requirement declines at any given energy intake level. As shown below (Figure 16.1), a 50 kg lamb consuming 12 MJ of ME per kilogram of dry matter requires 12.5% crude protein for optimum growth. Lighter 20kg lambs however would require 16.5% crude protein due to their higher protein requirement. Rations should be ‘balanced’ in terms of a lambs protein and energy requirements if growth rates are to be optimised. All feed components should therefore be analysed prior to formulating a feedlot ration

Figure 16.1.Protein and Energy Requirements for Balanced Rations.
Source: Bell et al, (2003)



16.5 Health and disease

There are a number of health and disease issues producers should be aware of when feeding cereal grain and/or pellets based rations.

Acidosis is a term used to describe the drop in pH within the rumen following ingestion of starch rich grains and pellets. If not properly introduced and/or protected high starch levels will lead to an increase in lactic acid production and acidic rumen fluids (between pH of 4 to 6). The end result will generally be a loss in condition, dehydration, damage to the rumen wall, scouring and possibly death. When introducing high risk grains and pellets it is therefore important that they be introduced slowly and protected through the use of buffers etc. Changing from one grain to another (eg barley to wheat); between varieties or sources (eg from on-farm to purchased grain of the same variety) and from one batch of pellets to another (regardless of whether or not the pellets are from the one manufacturer) can precipitate acidosis. Mix the new 'batches' with the old over a 7-14 day period to reduce the risk.

Urinary Calculi (Bladder Stones) may form due to a calcium:phosphorus imbalance. Survival is rare. A 2:1 Ca:P ratio within the ration is recommended to minimise the risk of stones development. Additives such as limestone and acid salts may improve calcium intake levels and calcium availability. Adding salt to a ration will also assist by increasing water intakes and gut flow and by 'flushing' the urinary tract.

Eye disorders such as 'night blindness' and pink eye may occur during dry, windy conditions. Eye problems may be indicative of a Vitamin A deficiency and/or a function of close contact as in a feedlot situation (as is the case with pink-eye). Pink-eye, a bacterial infection, can be transmitted during grazing. If possible affected animals should be removed and isolated in a dust free, shaded area. Unless both eyes are affected treatment is not recommended as the infection will run its course within 7-10 days and the animal should recover.

16.6 Assessing profitability

Grain finishing programs can be used as a management tool to help control feed availability, limit soil erosion and seed contamination and improve stock condition (Anon 1998). While grain finishing provides producers with the flexibility to finish animals irrespective of seasonal conditions, options such as selling lambs as stores, maintaining lambs until quality fodder crops or pasture or both are available, agisting lambs and contract feeding (Bell et al 2003) should also be considered. Store lamb values in particular have had a significant affect on feedlotting profit margins and cost/benefits in recent years (Duddy 2005a).

Many factors will impact on the profitability of grain based finishing systems. While feed cost, initial and finished lamb values have the greatest affect on profitability specific lamb and management issues also impact on operational success. Lamb specific issues include a lamb's genetic potential, sex and live weight, lambs specific energy, protein, vitamin, mineral and effective fibre requirements, intake and feed conversion efficiencies, average daily gain, health and disease status; skin quality etc. Management related issues include feedlot design; feed system (trough versus self feeders); ration type (grain and hay separate, pelleted, total mixed ration); grain and roughage type or form (processed versus whole grain, *ad lib* versus processed roughage etc); activities such as shearing, crutching and monitoring live weight and health status; social stress issues; labour availability and cost; equipment on-farm; transport and livestock commission rates.
It is essential that producers understand the impact the above factors have on production potential and monitor and modify if necessary, specific lamb or management issues if feedlotting is to meet production objectives and ultimately, improve profit margins.

Feedlotting Lamb Cost/Benefit Calculator

Budgeting is an essential part of any operation but even more important in a grain finishing system as it indicates expected costs and returns before the enterprise is established (Anon 1998). Producers must carefully identify the likely costs and returns, risks and possible lamb losses, and where possible get involved in a specialty market to strengthen chances of success (Thatcher, 1994). NSW DPI and the National Sheep CRC have recently developed a feedlotting analysis program (http://www.sheepcrc.org.au/articles.php3?rc=311) that enables producers to accurately estimate the likelihood of feedlotting profitability available on-line for both opportunistic and commercial grain finishing systems.

The Cost/Benefit Calculator was developed in an effort to assist producers with their feedlotting decision making process. The Excel based algorithms allow producers to insert known variables and/or use default values if objectively measured input values are not readily available. Users are required to provide basic information relating to lamb inputs (breed, weight etc), production inputs (variable management costs), feeding costs, fixed capital costs and ration details. Default feed values for energy, protein and minerals are provided however it is recommended that components or rations be tested by recognised testing organisations prior to the beginning of a feedlot program (Duddy *et al* 2006). Outputs are dynamic and are displayed when a change to any input is made. It is possible to test various options and when satisfied print one or several reports. Information relating to profit margins, cost/benefit and value adding of ration component estimates are generated.

Profit margins, while important, are not necessarily the main driving force behind the recent surge in interest and use of grain finishing systems. Producers have used such systems as a 'vehicle' to value-add their on-farm grain and fibre reserves. Value adding of ration components (average cost $144/tonne) was shown to exceed 300% and average greater than 175% during November 2003 to February 2005 (Duddy, 2005b) despite generally low average profit margins (<$10) per lamb finished. The analysis also indicated that although there were periods when it was worthwhile on a value adding basis to feedlot lamb using dearer rations these periods were irregular and greatly influenced by the store to finished lamb price difference and are difficult to predict.

The Future

Grain finishing in feedlots is now firmly entrenched as management tool nationally. Producers and industry however need to critically analyse the profitability of these systems before embarking on a full feeding program. Producers are urged to consider all input costs and to seek contracts before undertaking a feedlotting program. In many cases sale of store lambs is likely to be the better option when costs of production are known.

Readings

Readings 1 and 2 are provided on CD; further suggested readings include:

1. Bell, A.K., Shands, C.G., Hegarty, R.S. and Duddy, G.R., 2003. 'Feedlotting Lambs,' retrieved July 20th, 2006 from http://www.agric.nsw.gov.au/reader/sheep-grazing/ dai42ed2.pdf. New South Wales Department of Primary Industry, 'Feedlotting Lambs.'
2. Duddy, G.R., 2005c. 'To Feed or Not to Feed – If Only Hamlet Had the Calculator. ' Proceedings of Western Australian Agribusiness Sheep Updates Conference. Retrieved July 10th, 2006 from http://www.agric.wa.gov.au/ols/portal30/docs/FOLDER/IKMP/AAP/SL/ Tool_01.pdf.
3. Duddy, G.R., 2005a. 'Nutrition management the key to feedlot success.' Kondinin Group *Farming Ahead* No 161 June 2005 pp 54-57
4. Duddy, G.R., 2005b. 'Lamb Feedlotting – Is it Profitable?.' NSW Department of Primary Industries Sheep Conference Proceedings pp 109-112
5. McIntyre, B.L., Holst, P.J. and Kirby, R.M., 2004. 'The Sheep Meat Industry.' Feeding Grain For Sheep meat Production pp 1-11

Activities

@ Available on WebCT

Multi-Choice Questions

@ Submit answers via WebCT

Useful Web Links

@ Available on WebCT

Assignment Questions

@ Choose ONE question from ONE of the topics as your assignment. Short answer questions appear on WebCT. Submit your answer via WebCT

Summary

Producers can feedlot sheep and lambs successfully and profitably by careful attention to nutrition and management. Feedlotting allows producers to finish stock to market specifications during droughts or poor pasture conditions while reducing grazing pressure, erosion and loss of pasture base during such periods. It is an on-farm management tool but does not necessarily guarantee profitability.

Producers are urged to seek professional advice related to feedlot management, nutrition and design; do a thorough budget prior to deciding to feedlot and if possible obtain contracts for finished stock if available

References

Anon, 1998. 'Lotfeeding lambs." Farming Ahead. Number 76, April 1998. Kondinin Group, pp. 64-77.

Bell, A.K., Shands, C.G., Hegarty, R.S. and Duddy, G.R., 2003. 'Feedlotting Lambs,' *NSW Agriculture Agnote* DAI/42* pp. 1-12

Duddy, G.R., 2005a. 'Nutrition management the key to feedlot success.' Kondinin Group. *Farming Ahead* No 161 June 2005 pp. 54-57

Duddy, G.R., 2005b. 'Lamb Feedlotting – Is it Profitable?' NSW Department of Primary Industries Sheep Conference Proceedings pp. 109-112

Duddy, G.R., Stanley, D. and Semple, S., 2006. 'Feedlot Calculator.' National Sheep CRC Conference Proceedings pp. 261

Thatcher, L., 1994. 'Feedlots for lambs; proceed with caution.' *Australian Farm Journal*, August, 1994, pp. 33-35.

Glossary of terms

Feedlotting	An on-farm system where sheep and/or lambs are kept within a controlled space and environment and where all feed, health, water and animal welfare requirements are met for the purpose of increasing carcase weight and/or quality
Opportunistic feedlots	Opportunistic feedlots are usually short-term feeding programs carried out when prices are low for both store lambs and grain
Commercial feedlots	Commercial systems are generally established to supply a particular market specification
Lick Feeders	Lick Feeder effectively restrict intake to short 'licking' bursts after which the lamb will tire, seek water and rest. This process minimises engorgement and reduces acidosis risk.
Effective Fibre	Fibre that physically stimulates the rumen. It forms a rumen mat that traps incoming feed, slowing the rate of passage and reducing the risk of acidosis.
Ionophore	a type of antibiotic that actively alters rumen fermentation and ultimate volatile fatty acid (VFA) patterns, reduces energy losses, reduces the risk of coccidiosis (blood parasite) and improves feed conversion efficiencies
Virginiamycin	an antibiotic that prevents the excessive production of lactic acid within the rumen
Acidosis	a term used to describe the drop in pH within the rumen following ingestion of starch rich grains and pellets