Topic 8: Nutritional Management of lambs for Finishing

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Learning Objectives

On completion of this topic you should be able to:

- Understand why protein and energy requirements change during life of the lamb
- Explain the difference between supplementation, substitution and complementation when feeding lambs
- Describe non-nutritional issues that affect lamb performance and their management
- Discuss finishing options for lambs used in the Australian lamb industry

Introduction

Growing lambs require a balance of energy and protein in their diet for optimal growth. In some situations lambs will have to be fed supplements with the intention of maximizing lamb growth to achieve target market specifications. Sometimes it may be more economic to allow slower growth rates and have lambs reach target weights when prices are higher.

8.1 Maximising lamb growth

Although much attention is given to nutrition of the ewe during joining and pregnancy, the diet during lactation itself has the strongest impact on daily milk production and lamb growth. This is evident in the study of Cowan *et al.* (1980) where liveweight of lambs at 42 days of age was little affected by feeding level *pre-partum*, but liveweight was increased by 2.1 – 3.2 kg by providing a high energy intake *post-partum* (Table 8.1).

Table 8.1: Effect of pre-partum and post-partum nutritional plane on production of milk and rearing of twin lambs by mature crossbred ewes (Cowan *et al.* 1980).

Feeding level pre-partum	**Fed to requirement**	***Ad-libitum* feed**	**Fed to requirement**	***Ad-libitum* feed**
Post-partum diet*	0% Barley (7.9 MJ/kg)		30% Barley grain (9.2 MJ/kg)	
Post-lambing performance				
LW post-lambing (kg)	73.8	68.2	80.4	74.7
Dry Matter intake (kg/d)	2.50	2.64	2.76	3.33
Energy intake (MJ ME/d)	20.1	21.2	27.0	31.3
Milk output (MJ ME/d)	13.0	11.5	16.8	16.5
Maternal tissue loss (MJ/d)	14.4	6.0	6.1	-0.4
Lamb weight at 44 d. (kg)	24.9	23.8	27.0	27.0

*: Diets offered post-partum were both complete diets available ad-libitum, differing in energy content due to differences in the proportions of barley grain and milled hay they contained.

For the first 3 weeks of life the lamb is totally dependent upon ewe milk for its nutrition, with pasture becoming increasingly important from 4 to 12 weeks of age. By 8 weeks of age the lamb is effectively competing against the dam for available pasture and, although suckling, is receiving little of their energy and protein requirements from milk consumed. With the consumption of pasture comes the need for an efficiently operating rumen microbial population. Successful feeding of the lamb (maximum growth rates) is achieved by supplying the correct balance of nutrients required to (1) maximise ruminal fermentation and (2) augment the lamb with nutrients not adequately supplied by rumen microbes. Correct nutritional management of lambs is dependent upon knowing how the growth of the lamb (and therefore its nutrient requirements) changes over time.

8.2 Growth and development of lambs

Under conditions of adequate feeding, the growth rate of lambs is sigmoid or 'S' shaped from birth to maturity (Butterfield 1988) with growth rates (Figure 8.1) and feed use efficiency (Figure 8.2) highest between birth and puberty, reducing as the lamb approaches maturity. Most prime lambs are slaughtered when reaching 50 to 60% of their mature weight (Tribe and Coles 1966 p97). Daily energy and protein requirements change as a lamb matures and must be met to achieve optimum growth rates.

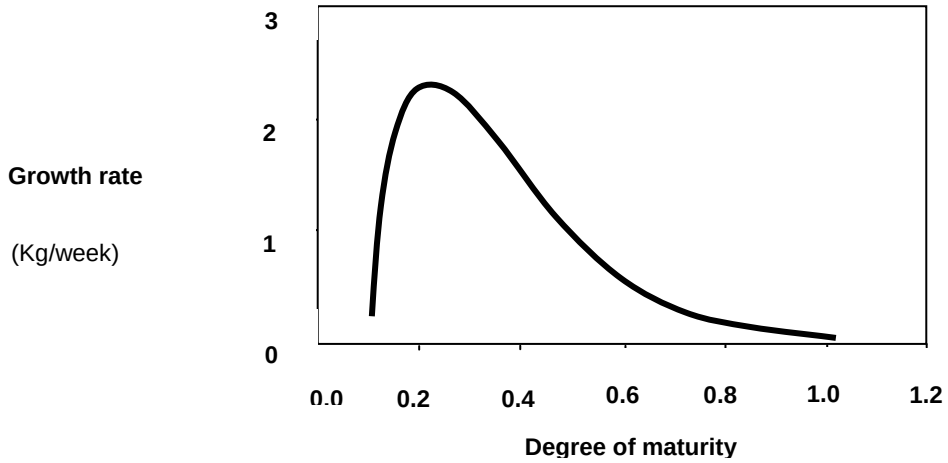

Figure 8.1: Weekly growth rate of Merino sheep which receive no check in growth from conception to maturity (Butterfield 1988).

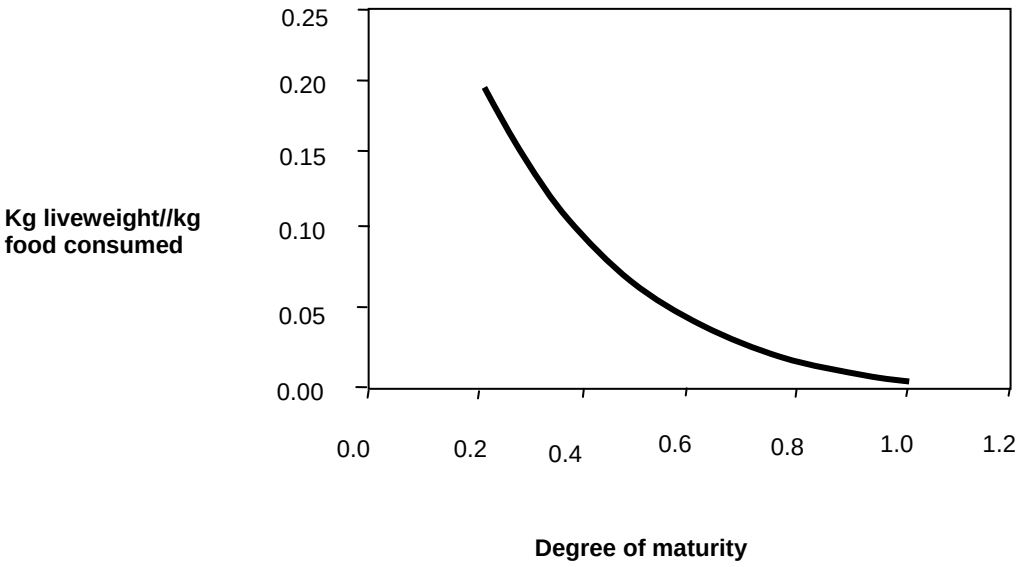

Figure 8.2: Efficiency of feed conversion from birth to maturity (Butterfield 1988).

Not only does rate of growth decline by weaning, but composition of growth also changes, with rate of protein accretion declining and the rate of fat accretion accelerating beyond 25-30kg LW in most lambs (Figure 8.3).

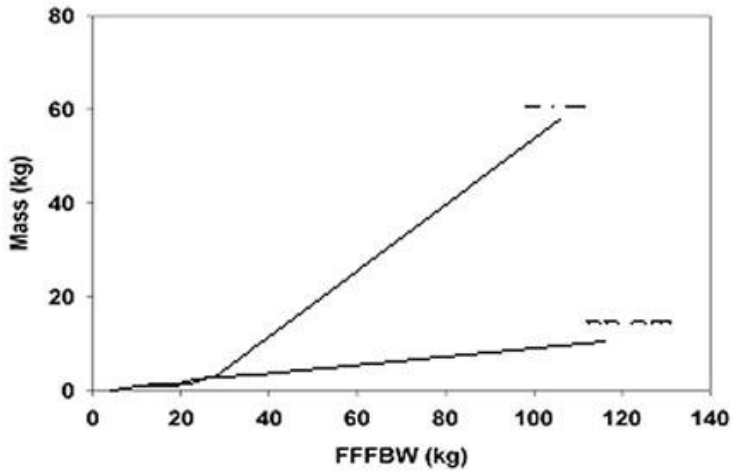

Figure 8.3: Cumulative mass of muscle and fat in the fleece free fasted body weight (FFFBW) of sheep during development (Searle *et al.* 1972).

Under normal conditions, light (pre-weaning) lambs have low total intakes but are depositing maximum lean tissue. Daily dry matter intake is generally 4 to 5% of liveweight at these weights. This means the protein content of the diet must be high to meet rumen and tissue requirements. By the time lambs are approaching common slaughter weights (generally >35kg LW) skeletal and muscle development are almost complete, fat deposition increases and lambs consume 2.5 to 3.5% of liveweight on a dry matter basis. Throughout the maturation process the ratio of muscle to bone (M:B) increases from 2:1 at birth to 3:1 at 10% maturity up to 4:1 at 60% maturity. This ratio appears to increase only slightly until maturity (Paterson 2003) beyond which fat deposition increases at significantly higher rates.

Consequently, as a lamb matures the quantity of protein (energy content = 23.6 MJ/kg) in every kilogram of body gain decreases while the proportion of fat (energy content = 39.3 MJ/kg) increases. Every additional kilogram of gain therefore contains more energy than the one before as illustrated in Figure 8.4.

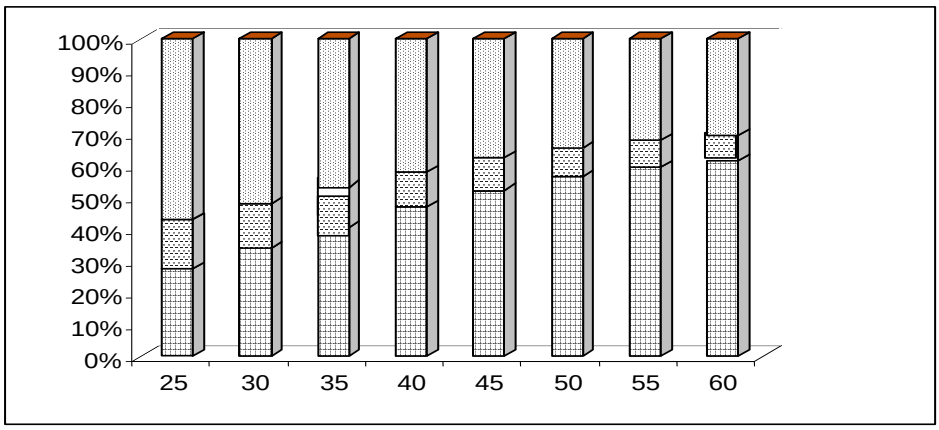

Figure 8.4: Proportion of protein (spots), water (lines) and fat (grid) in each additional kilogram of empty body weight for lambs indicating that composition of gain changes as lambs approach maturity. Calculations based on equations 1.32 and 1.34 (SCA 1990).

Considered at the same weight lamb sex will have a significant effect on carcase composition with the following likely when lambs are compared at the same weight:

- ewe and wether carcases may contain up to 15% more fat than wether and entire male carcases respectively
- between breed differences in fat could be as high as 25%
- within a breed, variation could be greater than between breeds
- varying protein and energy intakes may vary carcase fatness by up to 5% respectively (Hall and Holst 1994)

8.3 Energy and protein

Because the daily rate of protein deposition in young lambs is high while their voluntary intake of feed is low, a high protein percentage in the diet is essential. Conversely, finishing lambs (>35 kg) are principally depositing fat and have a high daily feed intake, so the dietary protein percentage can be low while dietary energy content must be high to maximise growth rate.

Nutritional management requires ensuring (1) the nutrient requirements of the rumen microbes are met (thereby maximising feed intake) and (2) supply of additional protein as required in a protected or bypass form to augment microbial protein production and meet the amino acid requirement of the lamb's tissues (Figure 8.5). Maximising rumen fermentation and microbial crude protein (MCP) production requires that rumen degradable protein (RDP) be provided at a rate of 10g RDP/ MJ of metabolisable energy (ME) consumed (SCA 1990). Since forage protein is typically 70% degradable, this necessitates providing 14.3 g crude protein/ MJ ME consumed. If the RDP:ME ratio is less than this, voluntary feed intake will fall below the potential intake of the lamb, microbial protein synthesis will decline and lamb growth rates will be reduced.

For small (<35 kg) lambs, the microbial protein cannot met the amino acid requirements of the lamb's tissues and dietary undigestible protein (DUP; protected or bypass protein) must be provided to maximise growth (Figure 8.5).

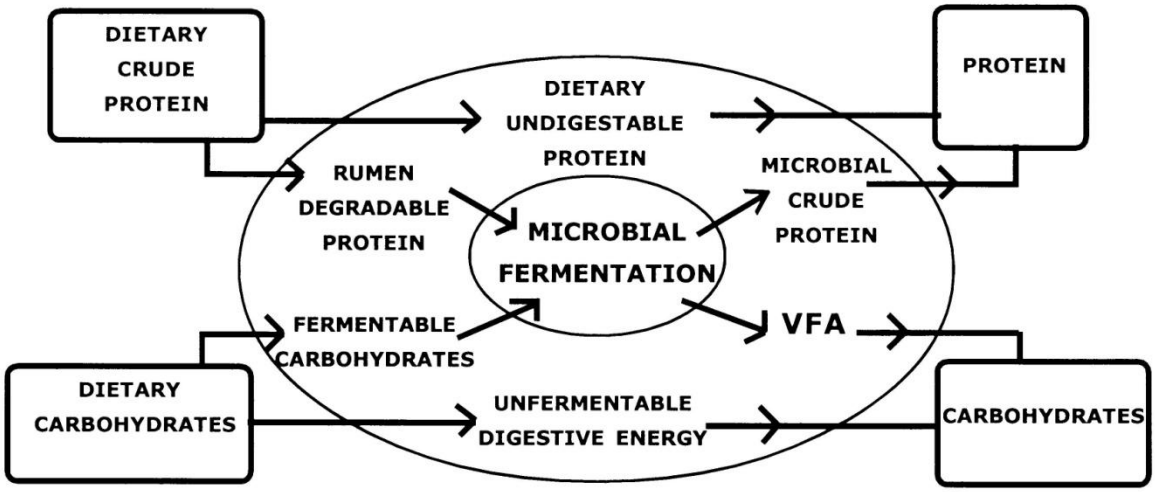

Figure 8.5: Process and products of rumen fermentation of feed. Dietary protein is either degraded in the rumen (RDP) or passes through to the abomasum without being fermented (DUP). RDP is resynthesised into microbial crude protein that flows to the abomasums (Tribe and Coles 1966).

Regardless of breed or sex it is essential that lambs are provided with a balanced ration (energy/protein) rich in all necessary vitamins and minerals if optimum lamb growth rates are to be obtained. A lambs protein and energy requirements in a 'balanced' ration for 4 weight categories is shown in Figure 8.6.

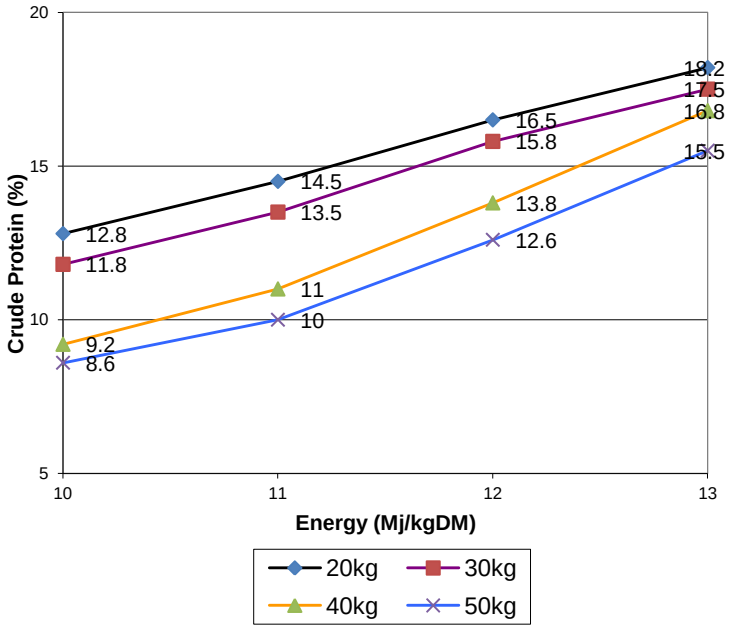

Figure 8.6: Crude Protein requirements relative to feed energy intakes in balanced rations. Predictions assume ration protein degradability in the rumen of 80% at maintenance. Young lightweight lambs (<35 kg liveweight) require a higher dietary protein percentage than do more mature lambs (>35 kg liveweight) at any given energy level. For example, 30 and 50kg lambs fed a diet providing 11 Mj ME/kg DM would require 13.5 and 10% crude protein respectively -the 30kg lamb requiring greater protein due to their relatively higher protein need for muscle development. In comparison 50kg lambs have generally reached maturity in terms of muscle development and now have a preferential requirement for energy maintenance and fatty tissue development rather than protein (Grazfeed® 2004).

8.4 Practical finishing options for lambs

GrassGro™, a computer based decision support system has been used to evaluate finishing large lean lambs in eastern Australia. GrassGro™ analysis has shown that while supplementing to heavy weights increases gross margins at low stocking rates (SR), at a high SR the large and variable cost of supplement to finish lambs reduces the gross margin (Salmon *et al.* 2004).

It is important to set realistic pasture and lamb growth targets as shown in the example in Figure 8.7.

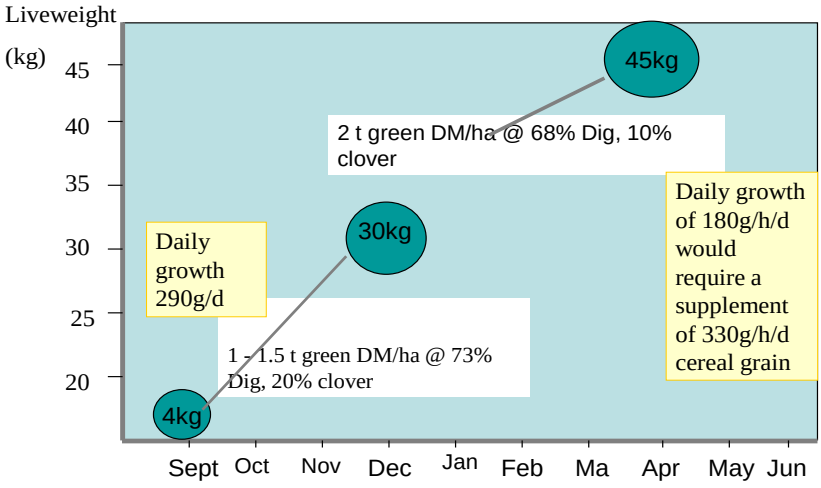

Figure 8.7: Example lamb growth and pasture targets from birth to slaughter (Grazfeed® 2004).

Finishing on pasture

The most cost effective way to finish lambs is on high quality pasture. The quality of the pasture is critical to lamb growth. Digestibility is the most useful measure of quality. Growth rates decrease considerably as pastures mature and digestibility declines. For fast lamb growth of 250g per day or better, a green pasture of 70% or higher digestibility and 1500kg green DM/ha is required. Legume content increases pasture quality by improving palatability and digestibility (Table 8.2). Ideal pastures for lamb finishing have 30% legume.

Table 8.2 Pasture benchmarks(Kg DM/ha) for sheep (Grazfeed® 2004).

Sheep Category		**Digestibility**		
		75%	**68%**	**60%**
Adult Dry Sheep		400	600	1200
Finishing Weaned Lambs				
Percent of potential Grown Rate				
30% (90g/d)		400	700	1700
50% (150g/d)	600	1000	ns	
70% (190g/d)	800	1700	ns	
90% (250g/d)	1600	ns	ns	

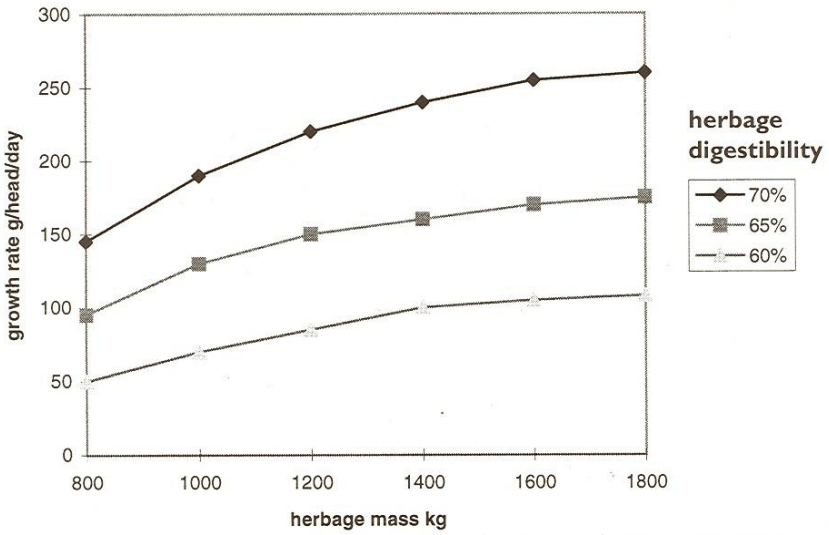

Figure 8.8: The effect of pasture digestibility on growth rate of 32kg 2nd cross lambs (Grazfeed® 2004).

Spring pastures generally provide adequate feed (quality and quantity) to achieve 'reasonable' lamb growth rates post-weaning. As spring pastures mature and quality declines it becomes however increasingly difficult to achieve high target post weaning growth rates of 150, 250 and 300 g/hd/d for Merino, first and second cross lambs respectively. Perennial grass pastures may be grazed heavily to retain a prolonged vegetative stage however such pastures need to set seed on a regular basis to ensure stand persistence and grazing may be limited on such stands when required.

Alternative summer active pastures such as lucerne and chicory should also be considered given that well managed stands are capable of producing high lamb growth rates. Well managed and adequately fertilised lucerne will achieve high growth rates during spring and early summer and enable finishing of lambs at relatively high stocking rates. A fodder budget for the area of lucerne can be calculated by using pasture growth rates and the and GrazFeed to predict intakes for the number of lambs to be finished, for example, at least 50 to 60 ha of well managed lucerne is needed to provide enough high quality feed to finish the offspring of a 1000 ewes in most seasons. Specialist fodder crops such as fodder brassicas, millet and cow peas may also help to achieve target growth rates over summer. It must be remembered that establishing these crops can be costly and their use often means sacrificing stored soil moisture in fallowed paddocks possibly to the detriment of the next crop.

Supplementary feeding

When lamb growth rates cannot be maintained from pastures alone then supplementation can be considered. Supplementary feeding is the provision of feed to sheep on pasture to improve animal

performance. If the animal eats the supplement and pasture intake is not reduced, then this is supplementation. If pasture intake is reduced, then this is substitution. A good example of substitution is providing lambs with cereal grain when grazing limited amounts of lucerne. Experience has shown that feeding 3-400g per head per day will extend the grazing time of lambs on lucerne by two to three weeks and ensure high lamb growth rates. Since the cost of feed is usually higher than pasture, substitution feeding carries a cost. This cost has to be recovered by finishing animals to market specifications, maintaining high stocking rates across the whole farm or saving pasture for a more critical time such as lambing. Complementation is where a supplement increases pasture intake eg. protein supplements on dead pasture or crop residue.

There is considerable variation in the amount consumed by individual sheep when supplemented on pasture. High intake sheep usually eat faster, shy feeders eat slower. In drought conditions, known shy feeders can be drafted off and fed separately however if the pasture is of sufficient quality, then those sheep eating less supplement will eat more pasture. It is important that when finishing lambs that they be trained to recognise and eat the supplement. The best procedure is to train or “imprint” lambs feeding behaviour prior to weaning. This education process will require three to four ”free” feeds of the supplement the lambs are going to be given after they are weaned.

Supplement delivery

The method of dispensing the supplement affects the cost, how much a sheep eats and the amount of wastage.

Wastage of grain can be high when fed in a trail on the ground to sheep so providing grain in a self feeder will help reduce wastage however, it is often difficult to regulate intake from self feeders. 'Lick' self feeder designs (pictured) are recommended to help control intakes and reduce the risk the risk of digestive problems.

Figure 8.9: Cowra Lick Feeder. Lick feeders limit intake through limiting accessible feed area. Lambs must 'lick' grain from the modified trough which minimises engorgement and acidosis risk and allows the producer to regulate daily intake levels (Ashley White and Roger Hegarty, NSW DPI).

Creep feeding

In poorer seasons, unweaned lambs can be creep fed on a high protein ration or pasture to supplement their milk intake. Creep feeding utilises exclusion gates to enable lambs access to high quality feed while excluding dams. An example of a creep feed gateway is shown in Figure 8.10.

Creep feed diets must be high in protein (>16%). The extra feed for lambs should improve their growth rates and reduce stress on ewes. Economic advantages also result from faster growth rate of lambs, reduced feed costs (through feeding high protein supplements to lambs only), a reduction in body

condition loss in ewes and the likelihood of faster recovery of ewe body weight/fat score.

Figure 8.10: Creep gate access to creep feeding area. 225mm vertical spacings with a 450mm horizontal bar will allow lamb access while excluding ewes (Ashley White and Roger Hegarty, NSW DPI).

In very poor seasons (ie drought) it may be more cost efficient to wean the lambs as young as 8 weeks of age. Lambs may then be given preferential access to better pasture or fodder crops (if available), supplemented and/or lotfed to increase lamb growth rate.

In very dry years a full production ration may be needed to achieve the target weight gains for these heavy lambs. This strategy should be carefully evaluated to ensure its economic viability as it may be more profitable to simply market these lambs at lighter weights rather than invest in supplementary feed to achieve heavier market targets. It may also be more profitable in some years to lower target growth rates and supplement levels as pasture quality and availability declines. The costs and benefits of this strategy can be examined each year using Grazfeed as turnoff time will be delayed but supplement costs may be reduced and high growth rates can be targeted later in the growth path following rain events and subsequent quality pasture growth.

Finishing on stubbles

In Western Australia and sporadically in the sheep/wheat belt of eastern Australia, lambs are placed on cereal crop stubble residues are frequently grazed over summer by ewes and/or lambs.. In general the stubble paddocks offer insufficient energy, RDP and UDP to optimise lamb growth and significant variability in stubble quality means no single type or rate of supplement can be recommended. Grazfeed can be used to explore different supplementary feeding options. Reliably achieving lamb growth rates in excess of 150 g/d requires significant input of these balanced supplements. Benefits obtained from grazing cereal stubble is generally physical (knockdown stubble, reduce weeds) or a grazing management tool to minimise worm uptake rather than to deliver high lamb growth rates.

Lamb feedlotting

Lot feeding of lambs has increased in use and importance during the past decade. Generally most lamb lot feeding operations are opportunistic by nature with producers using feedlot facilities during drought or periods of low pasture quality and/or availability and to strategically prepare lambs for sale during periods of higher returns.

Prior to establishing a feedlot facility, be it an on-farm opportunistic program or a commercial feedlot, producers must consider other management and marketing options and the relative cost:benefit of each. For example, producers may find it more profitable to agist or sell lambs as 'feeders' than to lotfeed during periods of high feed input price (eg drought). Producers should carefully consider all options and to prepare a thorough gross margin analysis to ensure reasonable profits margins can be generated through lot feeding. An achievable target market weight should be set prior to lot feeding and contingency plans (eg early sale) be considered and implemented if necessary.

If the decision to lot feed has been made producers must provide a safe, secure low stress environment for lambs (functional feedlot pen design and area, shade, shelter etc), feed (grain and hay (fibre) in suitable feeders/troughing) and, importantly, quality water. Provision of a low-stress environment, a balanced ration and quality water should ensure lamb growth rate targets are met. Monitoring of

liveweight and fat score is recommended to maximise lamb number reaching target market specifications, reduce time on feed (through lamb removal from the feedlot before excessive fat deposition) and minimal feed cost per lamb.

An awareness and adherence to Local and State Environmental Laws and Statutes is essential prior to and during feedlot establishment and operation.

Worm monitoring

To maintain high lamb growth rates, conduct a Worm test (worm faecal egg count) on lambs within 4 weeks after the weaning drench as excessive worm burdens will reduce growth rates. Seek veterinary advice regarding specific integrated worm control programs to manage lamb growth rates and the development of anthelmintic resistance for each farm. Observe withholding periods and Export slaughter intervals if another anthelmintic treatment is required close to slaughter.

Readings

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Revision Questions

1. How do the nutritional needs of lambs change from birth to maturity and how can these changing needs be met?

2. Describe some of the methods that may be used to meet the nutritional needs of lambs and when they might be used.

3. How does the sex of the lamb influence growth and development?

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