National Diploma Animal Production

Livestock Production Part 5

Handout 11

Lamb Feedlot Programme

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Lamb Feedlot Feeding Programme

All feedlot rations should contain grain, roughage and necessary minerals, such as ground limestone and salt. Ground limestone and salt should be included at 1.0%–1.5% of the ration (10–15 kg per tonne of feed), as cereal grains are low in calcium and sodium. Salt may not be necessary if it is present in the water supply. Additional additives may be needed to improve overall lamb performance, depending largely on the quality of the major ingredients of the ration.

These additives could include protein supplements, urea, vitamins, and substances to reduce dust levels in the ration. Others may be added to address potential health problems; for example, to reduce the risk of acidosis.

Feed contamination by moulds, dust or rodents is a common reason for failure. Mouldy hay and rodent contamination reduce palatability, resulting in a reduction in feed intake. Dust may be controlled by adding water, vegetable oil and/or molasses, singularly or in combination, at 0.5%–4% of the ration. However, you should be wary of the potential flow problems of 'high' moisture rations when using self-feeders.

Grain

The energy concentration of the ration is a critical factor influencing lamb growth rate, and therefore the efficiency of the feedlot.

The energy content of feeds is defined in terms of megajoules of metabolizable energy per kilogram of feed dry matter (MJ ME/kg DM, or simply M/D). The average energy contents of commonly used feeds are listed in Table: Crude protein requirements of balanced rations for lambs.

A ration providing a minimum of 12 MJ ME/kg DM is recommended, and generally required, if growth rates in excess of 250 g per head per day are targeted. If growth rates are low, reassess the feed and management program. NSW DPI's district livestock officers can assist with this task.

A sudden change from one grain source to another can cause digestive upsets, live weight loss and/or death. The problem can also occur when feeding different batches of pelleted feed. Avoid losses by organising all grain requirements before starting to feed. Check with the pellet manufacturer to see if a change to the pellet ingredients was made between batches.

If changing grains is unavoidable, start the change before running out of the first grain source. Gradually introduce the new grain by replacing 20% of the old grain with 20% of the new grain (on a weight basis) each day over five days. If lambs begin to scour during the changeover period, or appear to have digestive problems, hold the ration constant and provide additional roughage until droppings return to normal.

Lambs may not have eaten for a day or more due to wet weather, transport, digestive upsets and/or preparation for entry to the feedlot. When this happens, limit access to grain and provide high-quality hay until the lambs' appetites are satisfied.

Cereal Grains

There is considerable variation in quality within grain types. Whenever possible, an analysis of feed components should be obtained. Contact your local NSW DPI livestock officer regarding the availability of analytical services.

Cereal grains are a concentrated source of energy, with much of that energy stored as starch. They are usually the cheapest form of energy. Cereal grains also contribute to the protein component of the ration.

Grains usually comprise 65%–85% of the finishing ration. There is no advantage in cracking, rolling or flaking grains for lambs; doing so may increase the incidence of digestive upsets, by increasing the surface area availability of starch molecules to bacterial breakdown.

Generally:

- all cereal grains have been used successfully for feedlot,
- wheat, triticale and rye are high-starch grains and present the highest risk of acidosis,
- barley is of similar energy value to wheat, but the possibility of digestive upsets is lower due to lower starch, higher oil and higher fibre contents,
- oats have the lowest and most variable energy content. They are generally the safest cereal grain to feed, due to lower starch and higher oil contents. Lower digestibility and higher fibre contents may reduce growth rates if oats make up more than 30% of a ration,
- sorghum and maize are high-energy grains, but protein content can be extremely variable. Much of the starch contained in these grains may bypass rumen digestion and be broken down within the small intestine. Hind gut acidosis risk is therefore high when using such grains. Additionally, sorghum contains tannins that may reduce protein availability, while maize may cause yellow fat in lamb carcases when used at rates of more than 20% of a ration.

Grain Legumes

Grain legumes are also high in energy and substantially higher in protein than cereal grains. On an energy basis they are usually more expensive than cereal grains. They are commonly included to raise the protein content to required levels.

Generally:

- Lupines are higher in protein than all cereal and legume grains. They are a reasonably safe grain due to their low starch content and are often the cheapest form of protein.

- Field peas and faba beans have lower protein values and higher starch levels than lupins. Care should be taken when including these in a feedlot ration, due to acidosis risk.

- Processing grain legumes is unnecessary. The risk of grain poisoning is increased if peas or beans are cracked or rolled. Precautionary measures are required, to minimise this risk.

- Grain legumes can play an important role in raising the ration's protein content to the required level. This can usually be achieved at no more, and often less, than 20% of the ration. Due to their relatively high cost compared with cereal grains, the addition of grain legumes will increase the cost per tonne of the ration.

Other Feeds/Additives

Other concentrate feeds for potential use in feedlot rations include molasses, oilseeds (e.g. cottonseed, linseed, and sunflower) and the meals derived from oilseeds. Meals are protein-rich feeds which provide high levels of bypass protein and a convenient source of most vitamins and minerals.

When using oil seeds or meals, ensure the oil content of the total diet does not exceed 7%–8%, as high oil/fat contents may affect rumen function, the efficiency of digestion and palatability, due to rancid flavours. Meals may also create problems in self-feeder systems, due to bridging or blocking of feed flow. If possible use at a rate of less than 15%.

Roughage

As with all ruminants, lambs need roughage to ensure the efficient functioning of the digestive system. Roughage usually comprises 10%–30% of the finishing ration. If the roughage is of a high quality (M/D greater than 9), it can be included at up to 30% of the ration. Good-quality legume hays can make a substantial contribution to dietary protein, as well as helping to ensure that energy levels of the total ration remain high. High-quality silage has been used successfully as the roughage component of rations, usually when used within a total mixed ration. High silage use, however, may create issues with gut fill, excess non-protein nitrogen and ammonia production within the rumen, and reduced cud chewing and saliva production. The latter reduces sodium and potassium bicarbonate production, reducing the buffering effect on rumen acid levels and increasing acidosis risk.

Low-quality roughages, such as straws, should only be included at 10%–15% of the ration. They reduce the energy content of the ration, and therefore the potential growth rate of lambs. They are also less palatable, but hammer milling and mixing with the grain will encourage intake. Intake can also benefit

from the addition of a 4:1 water/molasses mix. This has the added benefit of reducing ration dust problems.

High-quality hay should always be fed during the lambs' first few days in the feedlot, to ensure they start eating as quickly as possible. If necessary, poorer hay can be substituted for the good hay during the grain introduction period.

As with grain, a feed analysis provides a valuable guide for purchasing roughages and for ration formulation.

Calculating a Ration's Energy and Protein Contents

Energy

Energy is provided through the breakdown of carbohydrates, protein and oils/fats within the rumen and small intestine.

The 'form' in which a grain's energy is stored will influence metabolisable energy levels, rumen function, health (e.g. acidosis risk), growth rates and feed conversion efficiencies.

While starch is the most common form of carbohydrate found in cereal grains, excess protein can be used to provide additional energy for feedlot lambs; however, it is less efficient than starch digestion in terms of energy production.

Oils/fats are energy-rich forms which provide as much as 2.25 times the energy of starch. Unfortunately, levels exceeding 7%–8% in ruminant diets can lead to a decrease in rumen efficiency, poor growth rates and poor feed conversion efficiencies.

Protein

Protein is necessary for muscle development, wool production and appetite. Inadequate protein can lead to a reduction in rumen bug numbers and activity, a reduction in intake and slower growth rates.

Crude protein (CP) requirements vary according to the nation's energy content, as well as a lamb's age and live weight.

Younger, lightweight lambs require higher levels of protein at any given energy intake due to their higher requirement for muscle development. Heavier and older lambs require a lower protein content to achieve a balanced ration. Older lambs have undergone the majority of their structural development and partition more energy to fat deposition.

The higher levels of 'bypass protein' within meals may be particularly beneficial in the diets of lightweight lambs, while the protein requirements of larger and older lambs are usually met by cereal grain and pulses.

Urea is a cheap form of non-protein nitrogen that the rumen microbes are able to turn into protein for the lamb's use. Urea can be included – usually at 1%–2% of dry matter – to raise the crude protein content of the ration. In the process of conversion into protein, urea is temporarily converted to ammonia by rumen microbes. A sudden surge of rumen ammonia can be fatal, so it is important that urea is evenly mixed in the ration and its concentration slowly increased over 7–10 days during introduction.

A mix-all is one method of incorporating urea. An alternative is to spray a 50% urea solution evenly onto the feed. This means dissolving 10 kg of urea in 20 L of warm water to treat one tonne (dry matter) of ration. This inclusion of urea as 1% of the ration will increase the crude protein content of the total ration by about 2.5%. Urea should not contribute more than 25% to a ration's total crude protein content and should not be included at levels greater than 3%, due to the likelihood of urea poisoning. Small (< 30 kg) lambs should not be fed rations containing urea, as their rumens are not yet fully functional and cannot efficiently utilise the non-protein nitrogen urea supplies.

The average crude protein contents of commonly used feeds are shown in Table 2. Where possible, have each of the major feeds analysed for protein, as individual grain and roughage types vary.

Average energy and protein content of various feeds. These values are on a dry matter basis. As grains, hays and meals contain about 10% water, an adjustment of this magnitude may need to be made to 'as fed' feeding levels.

Feed	Energy M/D	Crude protein %
Grains		
Maize	13.5	10.0
Grain sorghum	12.4	10.0
Wheat	13.0	13.5
Barley	13.0	11.3
Oats	11.5	10.5
Rice	13.0	8.0
Triticale	13.0	13.0
Lupins	13.0	32.0

Peas	13.0	24.5
Grain by-Products		
Mill mix	11.5	16.5
Rice pollard/polishings	14.0	14.0
Hays		
Lucerne	9.2	17.0
Clover	9.0	15.5
Pasture		
Mainly clover	8.5	14.0
Mainly grass	8.0	10.0
Oaten	8.0	9.0
Wheaten	8.0	9.0

Soybean	8.5	15.0
Sorghum/millet	8.0	8.0
Peanut	8.5	9.5
Low quality roughages		
Oat, barley or wheat straw	6.0	4.0
Cottonseed hulls	4.5	5.0
Silages		
Lucerne silage*	8.5	17.0
Maize silage*	9.5	8.0
Protein meals		

Peanut meal	11.5	42.0
Cottonseed meal†	11.0	43.0
Sunflower meal†	10.0	32.0
Safflower meal†	11.0	45.0
Copra meal†	12.0	20.0
Soybean†	13.0	49.0
Miscellaneous		
Brewers grains (dry)	10.0	20.0
Molasses 80% DM	13.0	4.5
Sheep and cattle nuts	11.0	15.0

* Silage protein is very soluble, so use values of 70% of that shown when formulating rations.

† Solvent extracted

Crude Protein Requirements of Balanced Rations for Lambs*

Ratio Energy M/D	**Lamb Live Weight**			
	20 kg	30 kg	40 kg	50 kg
Crude Protein (%)				
13	18.2	17.5	16.8	15.5
12	16.5	15.8	13.8	12.6
11	14.5	13.5	11.0	10.0
10	12.8	11.8	9.2	8.6

Source: Grazfeed®

*Predictions assume ration protein degradability in the rumen of 80% at maintenance.

The following example shows how to calculate the energy and protein content of a mixed ration containing different proportions of various feeds. Producers may also use the Lamb Feedlot Calculator.

The amount of energy and protein contained in these feeds was obtained from above Table.

	ME/kgDM	Protein (%)
35% wheat	13.0	13.5
30% barley	13.0	11.3
10% lupins	13.0	32.0
25% Lucerne hay	9.2	17.0

Using the following process, energy content of this ration is:

$$\frac{(35 \times 13.0)+(30 \times 13.0)+(10 \times 13.0)+(25 \times 9.2)}{100}$$

$$= \frac{455 + 390 + 130 + 230}{100}$$

$$= \frac{1205}{100}$$

= 12.1 MJ/ kg DM

The ration's crude protein content would be 15.6% using the same process but substituting the energy values used for protein values for each feed shown in Figure 2.

This ration would supply enough protein for lambs heavier than 30kg live weight but would be protein-deficient if fed to lighter weight lambs based on an energy content of 12.1 MJ /kg DM.

Minerals

Lambs need a range of minerals to maintain good health. Of the major minerals required, only three – calcium, sodium and selenium – have been recognised as likely to be deficient in feedlot rations. Most cereal-based grain rations will provide adequate levels of remaining minerals.

Selenium deficiency is related more to soil selenium levels and may be area-specific (e.g. tablelands). If a deficiency is likely, selenium supplementation is recommended. It is usually administered with a 5-in-1 vaccine that includes selenium.

Cereal grains are low in calcium, and supplementation is needed for all high-grain diets. To correct the deficiency, add 1.0%–1.5% by weight of finely ground limestone (calcium carbonate). This also reduces the risk of acidosis. Alternatively, acid salts (e.g. ammonium chloride, magnesium sulphate) may be added to the ration (add 0.5% on a weight basis) to stimulate the absorption of calcium from within the lamb's small intestine, to counteract calcium/phosphorus imbalances. A low calcium to phosphorous ratio may lead to urinary calculi (bladder stone) development. Acid salts acidify urine and assist with dissolving bladder stones; however; they are extremely bitter and may affect ration intake.

Cereal grains are also low in sodium. This deficiency need not be corrected if the feedlot water contains reasonably high levels of salt. If additional sodium is needed, however, fine salt should be added at a rate of 0.5%–1.5%. Lower rates can be added if sodium bicarbonate is used in the ration. Salt will increase ration intake and encourage water consumption. The latter will help reduce the risk of bladder stones.

Vitamins

As lambs are held in feedlots for only a short time, vitamin deficiencies are unlikely, particularly if lambs have previously grazed green pasture.

Vitamins A, D, E and B_{12} can be added as a vitamin/mineral premix to the ration, by oral drenching with a commercial supplement at feedlot entry or via vaccination. Vitamin supplements are recommended when it is known that the lambs have not had recent access to green pasture, or where their previous history is unknown – particularly during drought.

High-quality green hay or silage will help to correct many mineral and vitamin deficiencies.

Starting to Feed

Rations used for feedlot fall into two broad categories: the starter and the finisher.

- The starter ration allows lambs to become accustomed to the high grain content of the finisher ration, while minimising the risk of grain poisoning.
- The finisher ration should be high in energy, low in roughage and well-balanced for protein, as this will optimise growth rate within the limitations of feed availability and cost. Lambs may eat 4%–5% of their live weight on diets with an 80% or higher grain component.

Following is a guide to average performance levels of 40 kg lambs in a well-managed feedlot on a good-quality finisher ration. The range is what might be expected in similar circumstances across a range of lamb weights and ages.

	Average 40 kg	**Range 30–50 kg**
Intake (kg DM/day)	1.6	1.0 to 1.8
Live weight gain (g/day)	250	200 to 320
Feed conversion	6.5:1	5:1 to 10:1

Starter Rations

Lambs not accustomed to grain must be gradually introduced to the high-grain diet of the finisher ration. The starter ration allows lambs to do this while minimising the risk of grain poisoning.

The starter ration is actually a series of rations. The first is a total roughage ration that is gradually replaced by grain until the desired concentration is obtained; for example, 70% grain concentrate to

30% hay. A minimum 14-day changeover period is needed to ensure that lambs do not suffer from digestive disorders.

Keep lambs on the hay-only ration until all lambs are feeding. Likewise, lambs should remain on the low-grain ration until all lambs have started grain feeding.

It is critical to use good quality Lucerne or pasture hay for the early starter rations. This will encourage lambs to accept the new feeding system. If it is necessary to use poor-quality hay in the finisher ration, introduce it gradually towards the end of the grain introduction period.

If grain is mixed with processed hay, the mixture should be provided ad lib in troughs or self-feeders. With starter rations, where the hay and grain are fed separately, grain must be fed in troughs where adequate space is available to allow all lambs access.

Guide to the proportions of concentrate to hay for introducing lambs to high-grain rations

Day	Concentrate % including grain, and protein meals	Hay % chaffed and mixed
Until all lambs are feeding	0	100
2 to 4	20	80
5 to 7	40	60
8 to 10	50	50
11 to 13	60	40
14 and on (Finisher ration)	70 to 85%	15 to 30%

Grain introduction schedule when using unprocessed hay (high quality hay always freely available and grain fed separately)

Day	Concentrate head/day
Until all lambs are feeding	Nil (hay only)
2 to 4	100 g
5 to 7	250 g
8 to 10	400 g

11 to 13	550 g
14 and on (Finisher ration)	700 g *

* After 2–3 days of feeding at this level, ad lib feeding is possible

Finisher Rations

The final or finisher ration should be a high-energy ration consisting of 65%–85% concentrate (principally cereal grain), and 15%–35% roughage (hay or silage). Ensure energy and protein levels within the ration are balanced and meet the lambs' age and weight requirements.

Higher growth rates and an efficient feed conversion can only be obtained via a well-balanced high-energy ration. If low-quality roughage is used, the concentrate portion of the ration can be increased, and the roughage component reduced to 10%.

Three example finisher rations are shown below

Ration 1	**ME Supplied**	**Protein Supplied**
70% wheat (13 M/D; 12% CP)	9.1	8.4
29% lucerne hay (9 M/D; 16% CP)	2.6	4.6
1% urea (0 M/D; 250% CP)		2.5
1.5% lime		
1.5% salt		
Totals	M/D 11.7	CP% 15.5

This ration should be capable of achieving growth rates of about 290 g a day, but this will vary with age and weight. The ration is probably protein-deficient for light lambs.

Ration 2	**ME supplied**	**Protein supplied**
65% wheat (13 M/D; 12% CP)	8.5	7.8
20% clover hay (9 M/D; 14% CP)	1.8	2.8
15% lupin (13 M/D; 30% CP)	2.0	4.5
1.5% lime		

1.5% salt		
Totals	M/D 12.3	CP% 15.1

This ration should be capable of achieving growth rates of about 290 g a day, but this will vary with age and weight. The ration is probably protein-deficient for light lambs.

Ration 3	**ME Supplied**	**Protein Supplied**
65% barley (13 M/D:12% CP)	8.5	7.8
14% wheat straw (5 M/D:4% CP)	0.7	0.6
15% lupin (13 M/D:30% CP)	2.0	4.5
5% lucerne hay (10 M/D:16% CP)	0.5	0.8
1% urea (0 M/D:250% CP)		2.5
1.5% lime		
1.5% salt		
Totals	M/D 11.7	CP%16.2

This ration should be capable of achieving growth rates of about 270 g a day, but this will vary with age and weight. Protein should be adequate for all lambs.