CHAPTER 7

NUTRITION AND FEED FOR LIVE SHEEP EXPORTS

7.1 'Shy feeders' is a term commonly used in the live sheep export trade. It refers to inappetence or the inability or unwillingness to eat fodder aboard ship or in the feedlot. One explanation for this inappetance is the quality and type of the fodder used and its administration. Professor McManus of the University of New South Wales gave evidence that export sheep arrived at feedlots in conditions of stress. He regarded it as important that sheep be introduced to a diet which was not only nutritionally correct but was palatable. If the sheep did not eat, they would enter a fasting or starving state.

Feed Quality

7.2 There is evidence that prior to 1980 there was no feed quality control available to the industry. In that year Dr P. Arnold and Dr. D. Franklin approached Professor R. Leng of the University of New England to assess the quality of feed given to export sheep. Professor Leng analysed samples until mid-1984.[1]

7.3 The marine surveyors of the DOT are empowered to stop the loading of sheep if, on the advice of the quarantine veterinary officer, feed quality is not satisfactory.[2] The Chief Marine Surveyor in the DOT told the Committee that fodder has never had to be replaced onboard a ship.

> 'Many have been borderline, from comments surveyors have made but I have certainly not been consulted by veterinarians on the matter or told that it was unsatisfactory. I cannot

remember a ship being detained until the fodder was replaced - not in the past 12 years.'[3]

Several deficiencies in feed quality have been reported to the Committee.

Dusting, Powdering and Crumbling of the Pellet

7.4 The Chief Marine Surveyor advised the Committee that marine surveyors at the loading ports had reported that pellets have been seen 'to be powdering and falling to pieces.'[4] Another witness, a licensed special constable under the Western Australian Prevention of Cruelty to Animals Act, also reported the disintegration of pellets.[5] Dr Temple Grandin reported that some batches of Western Australian pellets were 50 per cent dust when they reached the trough aboard ship.[6] Crumbling and dusting of the pellet has been recognised as a problem by the AMLC and the South Australian Department of Agriculture, among others.[7]

7.5 Pellet dust may clog the automated feed distribution system aboard ship. It is less palatable and nutritious[8] and may cause 'pinkeye' and respiratory problems. The cause of crumbling has been attributed to the mechanical rubbing in the handling equipment and the lack of a suitable binding agent.[9]

7.6 The ALEA responded that there has been much more research done on fodder production since early 1983 and that the dust problem has been reduced substantially. However, the ingredients of the pellets, such as grain, hay and oat husks would produce dust if put through the system by themselves.[10] The handling systems have changed radically over the last two to three years. Pneumatic air systems have given way to belt systems, pully systems or screw worm augers.[11] In addition the particle size has been increased which has diminished the dust problem.[12]

7.7 Binding agents are used to prevent crumbling of the pellet. There are active binders and passive or inert binders. Among the latter are wheat proteins, advocated by Professor Leng, but as yet unaccepted by the industry because of the fear of lactic acidosis;[13] molasses, the use of which has become quite widespread;[14] and, possibly, sodium bentonite, regarded by some authorities as a binding agent. Of active binders, the example has been given of alkali binding agents which induce chemical changes in the pellet material.[15] Binding agents encourage voluntary feed intake and enhance digestibility, but there is a delicate balance between a pellet that will not crumble and one that is too hard for the sheep to eat.[16]

7.8 There is also evidence that, in order to reduce dust, the pellet material should not be hammer milled or ground but should be available as chaffed materials.[17] At least one feed mill has discarded hammer mills and invested in production equipment for chaffed materials.

7.9 The Committee RECOMMENDS that the DOT, in consultation with the ALEA and AAHQS, commission research into the use of binders and other methods to reduce the incidence of pellet crumbling and dusty feed in feedlots and aboard ships and to establish a minimum standard of pellet cohesion to be incorporated in the Marine Orders and Code of Practice.

Digestibility

7.10 The digestibility of pellets varies widely. The ALEA stated that optimum in vivo digestibility was in a range of 50-60 per cent in the rumen sac after an elapsed time of 24 hours. At times, however, it has been as low as 30 per cent.[18] Other evidence indicated that it could be lower than 20 per cent. Pellets of low digestibility accounted for five to ten per cent of the samples taken by Professor Leng.[19] Determining the

digestibility of a feedstuff is not a simple procedure. The in vitro method of analysis attempts to simulate in a laboratory, the digestive system of a sheep. It is time-consuming and expensive[20] but accounts for about 90 per cent of all analyses.[21] The protein content is often analysed but the digestible energy is rarely analysed. In Western Australia, analyses are done by the Department of Agriculture, not by the industry.[22]

7.11 The results of some analyses conducted on commercially prepared feedstuffs, as used by the Sheep and Wool Branch of the Western Australian Department of Agriculture in the course of experiments done in 1982 on the behaviour of sheep during export, are as follows:

Table 7.1: Analyses of Feed

Experiment	Crude Protein (DM%)	Crude Fibre (DM%)	In-Vitro Digestibility (DM%)
1	12.8	13.0	65
2	12.9	13.0	65
3	9.9	11.8	68

Source: WA Department of Agriculture, Supplementary Evidence, 9 November 1984, Attachment 3.

7.12 Dr D. Franklin, representing the ALEA, said that a low level of digestibility had only been a problem in Victoria at a fairly new mill which has now improved its equipment and handling systems.[23] He stressed, however, that high rather than low digestibility may be more significant because it may indicate a high grain content which may lead to digestive problems, such as acidosis. This was confirmed by Professor Leng.[24] Low digestibility may not be a problem if sheep are given enough feed to meet their energy needs. In fact, it may be a safer feed.[25]

7.13 Particle size is important for digestibility. If composite particles are too fine, it can lead to the condition 'parakeratosis', a thickening of rumen papillae, which is a major site of nutrient absorption from this organ. In vitro studies do not account for what happens in the rumen because particles are being removed from that system all the time. If a fibre particle is too fine it will be swept out of the rumen sac before it has been digested.

7.14 There is the further complication that the pellet manufacturing process requires a small particle size.[26] The ALEA commented that exporters have created problems for the feedmills, which have traditionally manufactured pig and poultry pellets, because the latter do not need the same type of roughage. The particle size can be changed by changing the size of the screen on the hammer mill.[27]

7.15 It has been argued that the percentage of digestible fibre is determined by economics.[28] For example, if a diet is administered which is high in energy, approximately 16.5 megajoules, the sheep would require approximately 50 per cent less feed which is about 8 megajoules of energy. If it is highly digestible the sheep may only require 10 megajoules. It is a trade-off between price and quality (digestibility).

7.16 The Committee received information that Australian feed manufacturers were being driven by market forces to put lower and lower nutrient quality into their products. Professor Leng commented that the pellet price was always too cheap at about $120 per tonne. The millers had attempted to correct these feed problems but were constrained by the price level.[29]

Low Protein, Low Energy, Insufficient Roughage in the Pellet

7.17 The ALEA stated:

> 'At times we have found that the protein level has been slightly too low. We will then immediately advise the manufacturer or whoever, depending on who owns it. The necessary adjustment would then have to be made to bring it back up. There will be slight variations in the nutritive value of hay from different areas. The nutritive value of grain, oats or barley will vary from one year to another and from one area to another so you have to regularly test this.'[30]

7.18 The Victorian and Western Australian Departments of Agriculture conduct tests for crude protein level. The latter commented that the exporters tend to use protein as an index of feed quality. Energy content of the ration is also important,[31] but is meaningful only when considered in terms of digestibility, that is, available energy.

7.19 Low energy content interacts with a number of other environmental and nutritional variables such as previous nutrition, exercise, temperature, response to noise or restraint and cumulative stress. There is little available research on these interactions.

7.20 Some pellets have insufficient roughage or fibre. There is a conflict between the need for fibre and a pellet which can be handled in big bulk feeding systems.[32] A sheep requires structural fibre but the pellet specification may completely overlook this and the pellet analysis also may not refer to it. The optimum type or length of roughage has not yet been determined.[33] Ruminants in university laboratories have made do with minimal roughage, with materials which are basically powders, but the experience of the industry is that roughage is necessary to help digestion. This roughage requires a minimum length and size.[34]

7.21 Professor Leng commented that fibre is a difficult material to include in the pellet in terms of both economics and logistics, but is more effective than ground fibre in inhibiting acidosis. He suggested that the problem could be overcome by the use of bentonite and buffers.[35]

7.22 There is also evidence that manufacturers produce pellets which contain high levels of low quality fillers such as rice hulls with 12 or 13 per cent digestibility[36] in an effort to reduce cost.[37] Mould may also become a problem in the feed bins if moisture levels are high and the bins are not cleaned out after each voyage.

Feed Standards

7.23 There is no single uniform feed standard for the livestock export industry.[38] Standards do apply to feed for Australian domestic livestock consumption. Livestock export feed standards should at least match these domestic standards. The considerable variation in the analysis of the pellet produced, compared with the specification of the pellet requested by the exporter,[39] indicates the need for a uniform standard to act as the basis for some form of regulation. The uniform standard would redress the problem of the efficiency of in vitro testing procedures in that it could specify a standard testing procedure.

7.24 The Committee RECOMMENDS that AAHQS arrange for research to be done to draw up minimum standards for pellets to maintain body weight and to ensure the nutritional welfare of the sheep in the feedlot and aboard the carrier.

7.25 The Committee also RECOMMENDS that a uniform pellet testing procedure be carried out either by a government authority or an independent body for each shipment of sheep and that the results of these tests be forwarded to the feedmill, the shipper, the relevant State Department of Agriculture and the AAHQS.

Feed Pellets: Possible Alternatives and Modifications

7.26 The Committee has received criticism that 'the pellet was designed for ships and not sheep'[40] and the industry is only now starting to recognise the problems of content and administration of pellets. Some alternatives have been suggested and these are discussed below.

7.27 Straight grain feeding is one alternative as it does not require processing. However, grain feeding gives rise to the problem of acidosis or 'grain poisoning' in sheep that have not been prepared for a diet with a high grain content. Inadequate preparation for such a diet will also cause pulpy kidney.

7.28 The ALEA also commented that there has been concern in the industry about the feeding of grain in large quantities to groups of sheep where their individual intake cannot be controlled. This concern has delayed extensive research into feeding of grain. Nevertheless, a number of companies have done small trials with grain.[41]

7.29 The Victorian Department of Agriculture conducted trials on grains added to feed rations to determine whether this 'would provide some advantages for the pelleting of the feedstuff, its palatability, its acceptability to sheep and its safeness in being provided as a feed'.[42] The assumption was that the high fibre content of oats and the low starch content of whole peas would minimise acidosis. Legume grains were known to have a high protein and calcium content which correct these

deficiencies in the oat ration.[43] The research found that it was not beneficial to the sheep and in certain mixtures was disadvantageous. The Western Australian Department of Agriculture also had reservations:

> 'Cereal grain is readily available and it has a high energy content; it has normally got adequate protein, is easy to handle, and you can put it on board ship. It sounds like very logical feed stuff, but I think it is this problem of acidosis in newly introduced sheep which has prevented the industry from adopting the cereal grain feeding.'[44]

7.30 Professor McManus argued against straight grain feeding and commented that of the mortalities suffered,on the early shipments which used straight grain feeding, 20 to 30 per cent could have been attributed to lactic acidosis.[45]

7.31 There is also considerable variation in grain quality owing to seasonal conditions and regional differences. This is reflected in the price of the grain.[46]

7.32 Hay was the feed used aboard ships in the early days of the industry and is still used in the feedlots for adaptation to pellets. Hay was discontinued as a shipboard feed because of the large amount of space required to store it and the extensive handling systems needed to distribute it.[47] Hay also presented a greater risk of spontaneous combustion and fire.[48]

7.33 Some of the problems associated with hay have been solved. Hay wafers are a possible type of feed. American companies now make mini-bales of hay two cubic centimetres in size.

7.34 There have also been attempts at using alkali treated straw in pellets together with some grain and urea and additives but this has been rejected because of the high salt content.[49]

However, there is contrary evidence that alkali treatment of fibre materials in pellets will increase overall hardness and digestibility.

7.35 Professor Leng said alkali treatments presented the logistical problem of amassing large quantities of straw and materials close to the mill. He believed that the treatment was unnecessary as it increased digestibility from 50 to 60 per cent for only 30 to 40 per cent of the diet. He regarded it as an academic approach rather than a practical approach.[50]

7.36 Professor Leng advocated the use of urea as a protein supplement in pellets but he believed that the importing companies in the Middle East wrongly believed that urea was a dangerous compound and would not allow its use.[51]

7.37 Sodium bentonite has been suggested as a suitable buffering agent in pellet feed for the prevention of lactic acidosis by modifying rumen fermentation.[52] Evidence suggests that it also increases the acceptance of pelleted feeds by sheep, thereby reducing the incidence of shy feeders. It also improves the binding of the pellet. Bentonite may be administered as a supplement to pellet rations in the form of a stock block.[53]

The Handling and Administration of Fodder

7.38 It has been argued that if sheep have to change from one type of pellet to another, they may suffer a digestive upset. The further argument is that few mills are able to produce enough of one type of pellet for ships with a capacity of 80 000 sheep or more. The ALEA responded that there is a slight variation from feedmill to feedmill. However, in terms of nutrition, the variation is limited provided the same basic raw materials are used and the specifications are adhered to. Some companies use more than one feed supplier to ensure that they

have adequate feed for loading. Conversely, there is evidence that some feed companies alter the composition of the pellet without the knowledge of the exporter.

7.39 The same argument of continuity of pellet supply would apply in the feedlot vis-a-vis livestock carrier. The ALEA replied that there is no evidence that a change of pellet necessarily makes any difference:

> 'A pellet is hay and grain plus some additives. So if you are feeding those out separately you are basically adapting the animal to the pellet.'[54]

7.40 There is also the requirement for feed which will ensure the adaptation from paddock feed to pellet hence the use of high fibre pellets, those which may break down with the use of shipboard handling systems.[55]