CONTRACT REVIEW

HIGH QUALITY CONTAMINANT-FREE LAMB

INTRODUCTION

*D.C. HARRIS**

Australia already produces healthy, contaminant free lamb. The overwhelming proportion is raised and finished on pasture and slaughtered under six months of age. All our lamb is processed and distributed to consumers under a strict quality inspection system. Australian lamb producers do not use hormones or other artificial means of promoting growth and residue testing surveys indicate an extremely low incidence of chemical contamination. A formal monitoring system is in place to ensure the current high standards are maintained.

What is meant by "quality" varies according to each markets preferences and the requirements of each participant in the marketing chain. Over 80 percent of our lamb is consumed on the Australian domestic market. That Australians continue to be the highest consumers of lamb in the world (AMLC 1989; USDA) is perhaps evidence in itself that the majority of lamb enjoys a high "quality" status.

However, our markets are rapidly becoming more diverse in their requirements, competition for the food consumers dollar becoming more severe and the overall viability of our industry becoming more difficult. Despite past scientific recognition of these and other problems (Thatcher and Harris 1983; Thatcher 1986), there is growing industry impatience for faster, more visible progress, Of increasing urgency is a need for industry cohesion, communication and closer working contact between producers, processors and retailers.

This contract highlights the major challenges facing producers and processors in the production and marketing of high quality contaminant-free, lamb and outlines some new developments in genetic improvement, farm management technology.

A PRODUCERS PERSPECTIVE

*Robert GORDON***

The major constraint to the supply of high quality, contaminant free lamb is the relatively low profitability of most lamb producing enterprises. Despite the variety of initiatives taken by industry and government over the past five to seven years (Thatcher 1986) the industry appears to remain fragmented, consumption continues to decline and profitable export markets are proving difficult to find and develop. On a national basis 1988/89 lamb prices were only eight percent higher than 1980/81 while farm costs had increased by 86 percent (ABARE 1988). Maximising net profit per hectare and per dollar invested in the total business are the critical goals for any producer. These are far more important than profit *per* ewe, per lamb or per kilogram of carcase supplied, Significant interaction, and at times conflict, not only exists between enterprises (Reeves 1986) but also between different products within the same enterprise.

Low profitability will inevitably result in reduced interest, effort and resources being put into the lamb enterprise. Producers cannot be expected to produce lamb of a particular specification if it is less profitable than supplying another. Analyses of market reports indicate that N.S.W. producers

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are paid a per kilogram saleyard premium of 13 percent for fat score four *over* fat score three lambs despite a 17 percent penalty for fat score four carcases in the wholesale meat market (K.XcCrae-Smith pers. comm.) and the clear preference for leaner lamb by consumers (Hopkins 1988).

Unfortunately, there is a major lack of useful published data of either a financial or physical nature to clearly communicate to producers the relative cost benefits of not only supplying lambs of different specifications but also the economic consequences of the various production options and systems available. Recent action by the AMLRDC and State Departments to rectify this situation is applauded.

Meeting consumer preferences

Identifying and meeting the requirements of the market is a basic goal for any competitive business. The challenge for the lamb producer is to select that market niche most profitably satisfied from his/her individual farm. There is no "ideal" lamb. Quality like beauty is in the eye of the beholder. Different markets demand different product specifications. Thatcher (1983b) has suggested the following range for Australian lamb:-

Carcase weight (kg)	Fat Score	G.R. (mm)	Market Sector
8-10	1	2-5	Aust. ethnic
10-14	2-3	2-8	Middle East
13-16	2	4-8	Side lambs
16-19	2-3	8-12	Supermarket retail cuts
19-22	3-4	10-18	Most retail butchers
25	2-3	8-12	Alternative cuts

More recently the AXLC has identified 18 to 26 kg fat score 2 and 3 lamb carcases as being required for its "Range Lamb" marketing program in the U.S.A. (AMLC, 1988). While preferred weights may vary considerably, all these sectors prefer lean lamb. In fact, the most commonly preferred fatcover is F.S.two (GR 6-10 mm) (Hopkins *et al.* 1985).

There is still a serious shortage of heavy, lean lamb carcases (22 kg, F.S. 2 to 3). Heavy fat lambs are usually reasonably well supplied unless seasonal conditions are adverse. Producers of these lambs receive higher prices per head but sometimes substantially discounted prices per kg. A premium for heavy lean lamb is required to encourage producers to supply this consumer preferred product.

We are undoubtedly living in an age when customer perception of a product is paramount. Fortunately in regard to lamb the perception, and the reality are both favourable except for fatness. Lamb is generally seen to have a desirable flavour, provides a variety of meals, is easy to use, and is reliably tender (Hopkins and Congram 1985). It has not been associated with substitution 'rackets', chemical residue problems or the use of artificial substances such as growth promotants, Consumers appear to have a 'warm feeling' towards lamb and trust it as a reliable foodstuff. The industry must jealously guard that reputation.

Producers must play their part by adopting management and selling practices that enhance quality and avoid contamination. They should rigidly adhere to manufacturers' dose rates and withholding periods when using any chemicals with the potential to 'contaminate' their lambs. Fortunately, lamb is always marketed as a young animal thereby significantly reducing the risk of acquired quality problems more commonly seen in older livestock.

Unfortunately leaner lambs lose both more live weight and carcase weight off feed than fatter lambs (Thompson *et al. 1987).* Preferred selling methods are those that minimise delays and handling between farm and slaughter. Saleyards are not a desirable way to market prime lambs.

Reliability

Consistency of supply of the right product is often very difficult to achieve under Australian climatic conditions. Lamb is normally processed at 3 to 5 months of age and like most vegetable crops is very susceptible to short term climatic changes.

However, it is important that producers try to minimise fluctuations in supply and quality, Forward contracting of lambs of agreed specifications at specified delivery times is a highly desirable way of doing this, and should be pursued by producers and the trader. Accurate assessment and selection of sale lambs by use of liveweight scales and palpation become more attractive if there is an obvious financial incentive.

Sustainability

Lamb producers are now more acutely aware of the need to preserve and maintain both their production resources and also their customers. Soil acidity, salting, soil compaction and eucalyptus die-back are recognised as dangers to the sustainability of high quality lamb production. Loss of trees mean increased exposure to cold weather resulting in higher feed requirements and increased neo-natal losses. Hydrological changes can also result (George 1984). Sustainable high quality pastures are a fundamental requirement for prime lamb production. Any factor adversely affecting the yield o longevity of these pastures will at best, add to lamb producers cost of production and at worst, put them out of the industry altogether,

Similarly, consumers food preferences and prejudices are formed over a number of years. Lamb producers need to protect the long term demand for their product by taking action today, to satisfy their customers tomorrow,

GENETIC MANIPULATION

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There is considerable scope for lamb producers to use natural, genetic means to improve the efficiency with which they meet market requirements for a high quality healthy product. These means are relatively cheap and take advantage of the large variation already naturally occurring.

The most important genetic traits affecting profitability in lamb production breeding programs are lamb lean growth, ewe reproductive- rate (including seasonality) and wool production. Carcase quality traits, other than fat score, are not well defined by the lamb industry and are of lesser importance with current marketing methods.

Genetic differences for important traits exist both within and between breeds. The existing industry structure takes advantage of both types of variation through crossbreeding (utilizing hybrid vigour) and selection programs within meatsheep breeds. Over 80 percent of Australia's slaughterlambs are crossbreds (ABS 1989). Most commonly first cross Border Leicester x Merino ewes are joined to terminal sires (eg Poll Dorset) in a multi tiered crossbreeding system.

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within breed selection

Growth and fat Atkins (1987) highlighted the importance of increasing growth rate and reducing fatness in breeding objectives for terminal sires. Genetic parameter estimates have indicated moderate levels of heritability for both liveweight and fat depth (Simm et *al.* 1987). Recent analysis *of* a large Poll Dorset data set has supported these earlier estimates and shown a genetic correlation close to zero between growth rate to a constant weight and fat depth at that weight (K. Atkins *et al.* unpublished data). It was concluded that simultaneous selection is possible for reduced fatness and increased growth to a given weight.

The N.S.W. Meatsheep Testing Service (MTS) was established in 1980 by N.S.W. Agriculture & Fisheries to provide to meatsheep breeders within flock animal rankings based on measured live weight and fat depth, adjusted for environmental effects (Harris 1985). This service was valuable in several ways. Firstly, it was widely adopted throughout N.S.W. demonstrating that a simple performance recording system could be wellsupported by stud breeders. Secondly, the performance data collected formed an invaluable data base from which to estimate genetic parameters (heritabilities, genetic correlations etc) relevant to Australian prime lamb performance (K. Atkins *et al.* unpublished data). Thirdly, the service provided a model for a national performance recording scheme for meat sheep breeds which was launched in 'April 1989, as LAMBPLAN (Banks 1990).

LAMBPLAN provides estimated breeding values (EBV's) for growth rate and leanness based on live animal records and pedigree information. The measures are simple and cheap to collect and process, allowing same-day measurement and processing at a cost of around $1.5O–2.OO per head. It is available in all states, and has a uniform national approach. In accord with experience of the MTS, reaction to LAMBPLAN by the industry has been very favourable.

Other Carcase Traits As consumers become more discerning and demanding, it is important to understand and apply the genetics of carcase composition. The first step in this process is to reduce fatness, which can be achieved by using LAXBPLAN EBV's to select against subcutaneous fat. In the longer term, provision of EBV's will be evaluated for muscle measurements, such as shape and size. In addition, current research using computerised tomography (CT) technology will provide information on genetic variation in a wide range of carcase characteristics.

Maternal Traits Breeding objectives *for* maternal and dual purpose breeds include increased lambing rate, out of season breeding ability, wool production, lamb growth and reduced feed intake. Relative importance of these traits and emphasis placed on them in selection depend on the breed and its role in the industry structure (Fogarty 1987). Response to selection for increased lambing rate has been demonstrated. However, further research is required to estimate genetic parameters for various components of reproduction (Fogarty 1984) to allow their incorporation into industry orientated breeding programs. This is being addressed by LAMBPLAN over the next two years. The enhancement of LAXBPLAN will provide maternal and dual purpose meatsheep breeders with a range of breeding objective choices and the relevant EBV's to assist in their selections.

Across flock evaluation

Direct comparison of animals across flocks provides a powerful stimulus to application of improved breeding methods. In line with developments in the beef and dairy cattle industries, LAMBPLAN will establish across-flock evaluation systems with breed societies. In simple terms this wlill allow breeders to compare animals from different studs. The best animals within a breed are then

clearly identified.

Between breed evaluation

New breeds are being developed to provide producers with alternatives to fill particular environmental and market niches (Fogarty 1983). In addition breeds from Europe and North America are currently in quarantine and will be available to Australian producers over the next four years. Information on the comparative performance of currently used and these newly available breeds is limited. There would be considerable value in conducting a well-designed, comprehensive and nationally co-ordinated evaluation of the sire and dam breeds available to the Australian lamb industry.

THE INFLUENCE OF FARM MANAGEMENT ON LAMB CARCASE QUALITY

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A viable prime lamb industry is reliant on the production of quality carcases. "Quality" attributes include carcase composition, meat palatabiliy, freedom from carcase contaminants and damage and any other characteristic thought undesirable by the processor, butcher or consumer. The prime lamb producer can influence carcase quality through on-farm management, husbandry practices, marketing decisions and genetic selection. For lamb producers to adopt these procedures, a marketing system is required that consistently rewards quality.

Carcase composition

Nutrition Black (1983) indicated the extent to which carcase composition could be manipulated through diet was relatively small. However, Kirton (1983) when describing the New Zealand situation observed that overfat lambs are almost never purchased from highly stocked farms. Similarly, rotational grazing and high twinning rates were also considered to contribute to improving carcase composition. It was concluded that these circumstances were difficult to explain other than through nutrition.

Smith (1986) described an experiment where wether lamb growth rates *were* significantly and positively correlated with fat score, dressing percentage, eye muscle area and omental fat when lambs were slaughtered at a common weight. Field observations indicate there are between year differences within individual flocks when pasture conditions allow for rapid growth. Lambs under these circumstances will commonly fatten at lower live weights. More information is required as to why these differences exist and if it is due to nutrition, what are the pasture conditions that contribute to the problem? Prime lamb producers have the potential to modify pasture conditions if it is possible to recognise circumstances which contribute to overfat lambs.

Vipond (1989) demonstrated the potential for modifying the carcase composition of overfat lambs by feeding a submaintanence straw based diet supplemented with fish meal. These experiments indicated the amount of saleable meat can be maintained while substantially reducing fat content. Bell and Bower (1990) reduced carcase fat and increased eye muscle area by feeding barley straw supplemented with 100 g/day cottenseed meal (S. Edwards pers. comm.) obtained similar results by feeding wheat straw supplemented with formaldehyde treated casein.

There appears to be potential for producers to modify carcase composition of overfat lambs to suit consumer requirements. Adoption is unlikely unless financial premiums exist for the modified carcases.

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Ram Lambs/Cryptorchids Research has consistently demonstrated that ram lambs *or* cryptorchids are leaner at a given weight than'wethers (Thatcher 1986; Lee and Harris 1987). The adoption of the ram lamb *or* cryptorchid strategy provides producers with a technique to supply butchers with carcases more in line with todays consumer preferences.

Ram lambs and cryptorchids *grow* faster than wethers and are more efficient at converting feed to lean meat (Thompson and Lee 1984). Despite these benefits to producers, they and the meat trade have been slow to accept ram lambs or cryptorchids although there is some evidence that this attitude may be changing (D.Harris pers. comm).

Producer reluctance to produce ram and cryptorchid lambs is likely to be due to the time required to grow them to heavier than normal weights and the effect this has on stocking rate and the increased possibility of carry over lambs, particularly when seasonal pasture growth terminates early. Such circumstances create additional problems for management due to the larger number of maturing entire males, the possibility of unwanted pregnancies (in the case of ram lambs), the potential disruption to the implementation of the ram effect, lambs caught in fences due to additional horn growth and increased fighting and sexual activity within the ram or cryptorchid lamb flock.

Meat trader reluctance stems from the historical view that ram or cryptorchid lambs are of *poorer* quality and have a higher proportion of *cheaper* cuts than wethers. Where as Campion *et al.* (1976) suggested heavy ram lambs would encounter consumer resistance due to taste and toughness, Kirton *et al,* (1982), Butler-Hogg et *al.* (1984) and recent Australian experience (L. Thatcher and D. Harris pers. comm.) have found consumers are unable to detect differences between ram and wether lamb.

Drafting for slaughter The proportion of carcase fat within genotypes is determined primarily by lamb liveweight at slaughter rather than age "(Tulloh 1964; Kirton 1976). Lambs should be selected for slaughter on the basis of accurate assessment of live weight, carcase weight and fat score. These skills are aided by scales, experience and regular feedback from abattoirs (Harris 1983; W.O'Halloran and N-Jackson-Hope pers. comm.).

Grouping lambs together according to live weight and sex following weaning will lead to more efficient use of farm resources and reduce variation in carcase composition within paddock mobs and sale lots.

Palatability

Lamb, because of its age, is naturally a tender, highly palatable product. Contrary to past opinion tenderness of most lamb processed and stored in modern abattoirs is not enhanced by fatness (Kirton 1983).

Flavour of lamb can be influenced by lamb diet (Ford and Park 1980). However, domestic consumer surveys have yet to indicate flavour to be a significant problem in lamb. No major change to existing production systems would appear to be warranted on the basis of flavour although grazing of species known to be implicated with adverse meat flavours needs to be avoided.

Tenderness may be influenced by treatment immediately prior to leaving the farm, Extended periods off feed and water as well as poor handling procedures may adversely effect tenderness. However stress associated with transport and sale-and problems in slaughter, preservation and cooking are likely to be more important (Kirton 1974).

Contaminants

Farms and farm management practices are a potential source of contamination. Ignoring withholding periods, the use of unregistered pesticides or handling facilities and soil contaminated by undesirable chemicals are reasons identified as having caused high chemical residue in meat. Of the 15449 analyses undertaken on lamb carcases during the 15 months ending September 30, 1989 by the Commonwealth Department of Primary Industries and Energy's National Residue Survey, 10 had results above Australian residue limits (J. Booth pers. comm.). Offending chemicals were cadmium (6), organochlorines(3) and bendzimidazole (1).

Carcase damage

Bruising although less common in lamb than beef is a reason for carcase downgrading. Farmers can reduce bruising by careful handling during drafting and transport and through good design and construction of sheep yards, loading ramps and trucking floats.

Grass seed penetration of carcases leads to trimming and down grading, especially in adult sheep. Hamilton (1978) estimated over 40% of sheep slaughtered at export abattoirs on the North-Western slopes of N.S.W. were down graded as a result of carcase trimming. It can be prevented by pasture improvement and grazing management (Lodge and Whalley 1985).

Production systems

New production systems may be needed to produce lambs to meet changing market requirements especially for larger leaner carcases and year round supply. These production systems require assessment in terms of resource requirements, interaction with other farm enterprises and sustainability. Assessments should have both physical and financial parameters incorporating balance between pasture production and livestock requirements.

Computer models are being developed to allow advisors and farmers to undertake individual farm assessment. A requirement of this approach is a knowledge of the production potential of pastures under grazing. There remains a scarcity of such information in a form suitable for these models over many geographical areas and pasture types. This is being addressed by N.S.W. Agriculture & Fisheries "Pasture and Animal Assessment Project" (PAAP). PAAP commenced in 1988 to provide pasture production data essential for validation of the models and to assess the potential value of the modelling approach for improving farm efficiency.

CONCLUSIONS

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Australian lamb is already a healthy contaminant free product. However, increasing economic pressures and changing market requirements necessitate some industry changes.

LAMBPLAN through both existing and new geneotypes and innovations such as computer modelling, induced cryptorchidism, protected protein diets, more objective marketing and live lamb and pasture assessment methods, offer opportunities for improving both farm efficiency and lamb quality. Similar opportunities exist for improvements in processing.

Of prime importance however, is the need for price signals between retailers, processors and producers to more closely reflect consumer preferences for meatier, leaner lamb cuts. Both producers and processors require clearer

financial incentives to hasten adoption of the technology designed to supply this meat

Technical recommendations need to take full account of the complex physical and financial environment in which lamb producers and processors operate. Closer, more direct communication between both sectors and a more intergrated approach to production and marketing are obvious first steps.

The four year nationally co-ordinated, research and development program recently implemented by the AMLRDC, State Departments and other organisaitons should help the lamb industry achieve this aim and meet these needs.

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