

HIGH QUALITY LAMB - AN INTEGRATED APPROACH TO PRODUCTION,
PREPARATION AND MARKETING

INTRODUCTION

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In the past the lamb industry has struggled to achieve recognition. In Australia, lamb is rarely a specialist enterprise, and is produced in association with wool, beef or grain. In an organisational sense, both Producer and Government organisations have invariably linked lamb to beef, often in a secondary role.

However, in recent years an industry consciousness has begun to develop. At a recent workshop, specialists from all fields of production, research and marketing made a number of recommendations (see Thatcher and Harris, 1983), and many of these have been implemented (APC 1985). There have been many lamb "crisis" meetings in New South Wales and Victoria (for example, Cameron 1985) and a market awareness has been created throughout the industry.

The approach to maintenance and then expansion of markets has generally followed the procedures suggested by Thatcher and others (1982) and concentrated on consumer demands and developing efficient systems to both produce and market products. This contract outlines further developments in consumer research, using existing production research results, together with projects funded by the Australian Meat and Livestock Corporation seeking more information about consumers, and at Rutherglen Research Institute the production and marketing of "High Quality New Cuts of Lamb".

DEVELOPING MARKETS FOR THE PRIME LAMB INDUSTRY

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PROBLEMS IN THE LAMB INDUSTRY

The Australian lamb industry is confronted with a number of problems which must be resolved if real returns (and profitability) to producers are to improve. These problems include; an alarming general trend away from red meat consumption (lamb in particular) in favour of poultry and fish; a declining share of Australian exports in overseas lamb markets; rising production costs threatening the financial performance of the industry (Weeks and Reeves 1983); and the threat of lamb imports, particularly from New Zealand.

FACTORS AFFECTING DOMESTIC LAMB CONSUMPTION

The general lack of knowledge about the Australian lamb consumer prompted the AMLC to undertake a number of major market studies. Research revealed that lamb consumption was being undermined by a complexity of interacting problems. Some of the key problems are:

(i) Changing consumer attitudes, which include - growing nutrition consciousness and the linking in consumers' minds between too much red meat in the diet and life threatening diseases; a perception that red meat in general, and lamb in particular, is not interesting or versatile compared to other protein products available; a perception that lamb is inconsistent in quality.

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(ii) Changing consumer behaviour where - changes in lifestyle have produced dramatic changes with respect to food buying, preparation and eating. Less time is spent preparing food, with an increase in purchases of convenient, semi-prepared products and a greater tendency to eat meals away from the home; a growing percentage of consumers will shop in the evening making restrictive trading hours for meat an increasingly more important issue.

AMLC LAMB MARKETING INITIATIVES

The Corporation's activities are directed at developing and promoting markets for meat and livestock, and encouraging the supply of products meeting consumers' specifications. Successful initiatives in these two areas will increase the competitiveness and profitability of the Australian lamb industry.

DOMESTIC LAMB MARKETING PLAN

The AMLC has developed a comprehensive domestic lamb marketing plan based on the following major domestic consumer surveys:

(i) A Quantitative Assessment of Consumer Attitudes, Opinions and Behaviour with Regard to Red Meat Compared with Other Protein Rich Foods (McKinna 1984a). The survey sought an understanding of the inter-relationships of meat and protein alternatives, and to understand buyer behaviour. The study was designed to assist in the development of Corporation marketing strategies; specifically, to provide direction for the creative promotion process.

(ii) Performance Monitor of the 1984 Spring Lamb Promotion Campaign (McKinna 1984b). The research measured price and volume aspects, and the effectiveness of the promotion campaign% message and media reach. The study provided feedback important in improving subsequent promotions.

(iii) Evaluation of Test Marketing of New Lamb Cuts (McKinna 1985). The test market revealed strong consumer acceptance of the boneless lamb cuts and provided data on product specifications and marketing/promotional strategies.

Using these reports as a basis, a lamb marketing plan was developed. The plan comprises an array of activities including new product development (including smoked lamb, lambburgers, restructured products, rotisserie roast lambs and cooked chilled catering packs), merchandising, nutrition education, consumer liaison and education, sales promotion and advertising. It aims to create a new "brand" image for lamb. Point of sale material is meal oriented, rather than the traditional "abattoir" style of meat selling. Lamb promotion will be continuous with intense activity in spring.

A serious issue is the susceptibility of the consumer to claims about good health and nutritional value of meat. The Corporation considers that inundating the public with facts will not provide more rational debate and the approach is to be more subtle, establishment of an information data bank; a survey of doctors, dietitians and home economists to determine their attitudes to red meat, health and diet; and the development of educational material. The aim is for the Corporation to be accepted as a credible authority on the nutritive aspects of meat.

IMPROVING PRODUCTION AND MARKETING EFFICIENCY

The principal objective is to ensure that domestic and overseas consumer preferences are effectively communicated through the marketing chain back to the producer. The basis for this would be a national uniform trading language

describing carcasses and meat in a way linked to retailers needs for supplying consumers. Harris (1982) indicated that a system fully accepted by all sectors of the industry would provide clear messages to producers, and communicate incentives for the preferred product. A uniform product description would provide a basis for computer livestock selling and thus this would reduce selling costs (e.g. saleyard expenses and saleyard costs). It is anticipated that the Computer Aided Livestock Marketing (CALM) system, which offers a number of advantages to lamb producers, will be in operation by April 1986.

Already underway is the conceptual development of a consumer identification system for beef and lamb, incorporating concepts such as "Meatmark", colour labelling and cut specification. Negotiations are underway in Tasmania to implement such a system for both beef and lamb. Once satisfactorily implemented, the system will be vigorously promoted in other States.

EXPORT MARKET RESEARCH AND DEVELOPMENT

The Corporation has developed a comprehensive marketing program for Australian chilled lamb in Japan. Research into lamb preparation suitable for Japanese consumers, education of the Japanese trade in lamb preparation and presentation, and convincing the trade of the viability of Australian lamb sales. The success of the program has been encouraging with some 350 supermarket stores selling Australian lamb, including Japan's two largest chains, Ito Yokada and Daiei.

Recent surveys targeted specific market segments with potential in Canada. The aim was to assess whether advertising and promotional activity would assist in developing the market for Australian lamb.

A campaign is planned in Saudi Arabia and the United Arab Emirates which have the greatest potential for sales of Australian chilled lamb in the Middle East region.

The countervailing duty imposed in the United States of America on imports of New Zealand lamb created an opportunity for more competitive marketing of Australian lamb. The AMLC supported test marketing with Safeways supermarkets in the United States of America to gauge potential for an on-going program.

In future, the Corporation may include exporters in the development of overseas promotion. Also, co-operative promotions with New Zealand may be possible following New Zealand's agreement not to sell lamb in Australia during 1985.

THE BASIC AMLC APPROACH

Through extensive research, the Corporation has obtained the information necessary to analyse markets and develop marketing plans for lamb, both in Australia and overseas. However, it is felt that the most fundamental industry problem lies within the meat marketing chain itself. Currently preferences cannot be communicated to the producer, nor are producers rewarded for turning off stock which meet these preferences.

The adoption of description methods and selling systems for livestock and meat, which will link the producer to the consumer, is probably the most important single issue facing the industry. In the long run, effective marketing is totally dependent upon the ability of the industry to supply the product that the consumer desires.

MEETING PRESENT AND FUTURE CONSUMER REQUIREMENTS

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Falling lamb consumption figures indicate that consumers are not completely satisfied with lamb that is available at present, as highlighted by the previous paper. The objective in changing this must be to satisfy some "target" consumer more precisely.

MARKET REQUIREMENTS

Since the 1970's consumers in Britain have been indicating that lamb was too fat, wasteful, not versatile, difficult to carve and poor value for money (Baron et al. 1973). In Australia, insufficient consumer research had been carried out to know what the attitudes to lamb were. Thatcher (1982) reviewed the factors likely to influence consumer choice of lamb and suggested the need for more intensive consumer research to identify particular market segments and their characteristics.

RECENT CONSUMER RESEARCH

Recent Australian research in Brisbane and Melbourne (Hopkins and Congram 1985) has shown that lamb is considered too fat, with too much bone and not enough meat. Product tasting (Hopkins et al. 1985) confirmed the earlier work of Thatcher and Couchman (1983) that a majority of consumers (75%) favoured cuts of lamb from lean carcasses (GR of 6-10 mm) weighing more than 20 kg. In Victoria during 1983 and 1984 only 27.8% of lambs marketed had a carcass weight greater than 19 kg and nearly all of these lambs had a GR of 15-20 mm. Thus, carcass types which would satisfy most consumers are rare (Hopkins et al. 1985).

Historically, producers have aimed at an 'ideal' lamb, but Thatcher (1983) challenged the concept of an 'ideal' lamb and suggested the following ranges of market requirements already existed, each being 'ideal' to particular consumers.

Carcass Weight	Fat Score	GR	Market Sector
8-10	1	2-5	Ethnic market Australia
10-14	2-3	2-8	Middle East markets
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

The major problem at present is that most lambs are too fat. For example, New Zealand data (Kirton and Shadbolt 1985) showed that the proportion of fat (P) and leaner (Y) grade carcasses was 50% and 35% respectively, while a better balance would be 35% P grade and 60% Y grade carcasses.

ALTERNATIVE CUTS OF LAMB

As lamb has been identified as being old-fashioned, lacking in versatility, overfat and wasteful, new lamb products low in fat and bone may appeal to particular market segments. For example, those with an active life-style and little time for meat preparation may wish to have more lamb products available in takeaway shops, restaurants, pre-cooked freezer packs or in more quickly cooked

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forms. Alternative cutting methods provide lamb steaks of various types, additional to the traditional chops which may be quickly cooked.

Alternative methods for presenting lamb to consumers were developed by the British Meat and Livestock Corporation, and at Rutherglen Research Institute. The Regency Park School of Food and Catering (Adelaide) has worked on the British boneless cuts of lamb.

The intention in developing alternative cutting techniques is to extend the range of lamb cuts and not to replace the traditional cuts. Alternative cutting techniques require larger and leaner lamb carcasses to make the cuts attractive and the boning process economical. The South Australian work suggested that carcasses of above 20 kg and with a fat score less than 3 were required, whilst at Rutherglen the preferred carcass is 25 kg and fat score 2-3.

William Angliss College (Melbourne) and Rutherglen staff have co-operated to develop alternatives (i.e. other than the British system) for cutting up heavy, lean lambs. The most promising method results in a short leg roast with bone left in, "topside" roast or schnitzels produced from the leg; steaks from the chump; steaks with mince insert or valentine steaks from the loin and ribloin; bone-in eye steaks and a rolled roast from the forequarter; mince from the neck, shank and flank. This method is favoured because butchers can experiment with one primal joint in the alternate style rather than being committed to the whole lamb in alternative cuts.

Meat or retail yield using alternative cutting techniques on carcasses of fat score 2 or 3 with most bone removed is about 60% compared with 70% for the bone-in traditional method (S.A. State Lamb Committee 1985). If meat scraps are used in mince, yield is improved by about 10% (R. Baker, pers. comm.), though yields vary with carcass fatness. More data to provide specifications for various cuts are currently being developed.

CONSUMER REACTION TO ALTERNATIVE CUTS OF LAMB

Consumer reaction to the Rutherglen cuts is being examined by a display and questionnaire technique and test-marketing. Part of the marketing drive for the alternative cuts will include recipes developed for the cuts by the Dried Fruits Council of Australia and the Emily McPherson College in Melbourne.

Test-marketing of the boneless lamb cuts developed by the British Meat and Livestock Corporation has been carried out in South Australia through retail butchers and by the Safeways supermarket chain. Reaction to the cuts was positive both in the South Australian study (S.A. State Lamb Committee 1985) and through Safeways in Victoria (McKinna 1985). The major problem experienced both in South Australia and by Safeways was the availability of sufficient numbers of suitable large yet lean lamb carcasses all the year round (Chessher 1985). This stresses the problem of the supply of such carcasses as retailers cannot order the carcasses they need for particular purposes by description.

OBJECTIVES FOR PRODUCTION RESEARCH

The objective this provides for production systems is to be able to increase lamb size from around an average 16-17 kg with fat score 3-4, to at least 25 kg with a fat score of 2 or 3. Furthermore, such systems must be able to produce these animals efficiently and profitably throughout the year.

IMPACT OF RESEARCH ON THE LAMB INDUSTRY
- PRODUCTION SYSTEMS FOR ENTIRE MALES

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Between 1963/64 and 1983/84 total lamb production in Victoria expanded by 9%, lambing percentages were 85% and 83% in the respective years, and carcass weights rose from 14 to 17 kg (BAE 1973; AMLC 1984). Since these are gross statistics it is difficult to quantify the effect of research on the lamb industry. However, it is reasonable to suggest that there has rarely been any attempt to integrate data in a way which is beneficial for all industry sectors.

RESEARCH OBJECTIVES

Aside from reducing risks due to uncertain weather, the objective of applied agricultural research has generally been couched in terms of efficiency, i.e. increasing production per unit of input. This has not always made good sense. For example, there has been considerable research funding aimed at increasing reproductive performance on the naive basis that two lambs must be better than one. In fact, Patterson (1983) showed that any producer whose flock had average reproductive performance would find little economic incentive for raising lambing percentage either in a prime lamb or wool growing enterprise. Ironically, a more rational marketing environment with premiums for meat with low fat would probably make twinning a more attractive goal for lamb producers.

Consumer research has shown that the major problems for the lamb industry are in marketing the product at a "reasonable" price. It therefore makes more sense to set research objectives in terms of a particular market requirements. In this context, Gregory and Riggs (1979) identified a requirement on a beef cattle research station to develop "... technology for optimizing the conversion rate of production resources ..." "... into beef of high nutritive value and desirable palatability characteristics".

Even this may not be specific enough. The program at Rutherglen has the objective to "develop a system of production, handling and marketing which provides high quality new cuts of lamb". Thus, having developed the appropriate product, the research sought a production system to efficiently provide the necessary lamb carcasses, and handling systems which ensured a high quality product.

POTENTIAL BENEFITS OF RAM LAMBS

It was shown in the previous paper that most carcasses produced are unsuitable for producing boneless lamb cuts. The carcass required for these was considered to be 25-30 kg with a GR of 8-14 mm.

The most immediately available strategy which may produce the required type of lamb is to leave male lambs entire. Many workers have shown that at any carcass weight the entire male is leaner than wethers and ewes (for example, Seideman et al. 1982; Kirton et al. 1982) and that more of the body fat is in non-carcass depots (Butterfield et al. 1985). Jones et al. (1983) reported that ram lamb had more muscle in the shoulder and less muscle in the leg than ewes, although Wynn and Thwaites (1981) concluded that muscle distribution did not vary in any "... economically important way". In achieving the higher proportion of lean meat, ram lambs were more efficient converters of feed to carcass (for

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example, Thompson and Lee 1984), and therefore could be attractive to lamb-producing systems.

Despite the apparent benefits of ram lambs, strong resistance to using them for meat production is encountered in the meat industry where they are generally considered to have poorer quality than wethers or ewes. Real evidence for this is equivocal. For example, Kirton et al. (1982) and Butler-Hogg (1984) found consumers could detect no differences between ram and wether, whereas Misock et al. (1976) suggested rams had inferior quality at three different carcass weights, and increasing age also reduced quality. Campion et al. (1976) suggested that heavy ram lambs would encounter consumer resistance due to toughness and taste.

DEVELOPMENT OF MANAGEMENT SYSTEMS FOR RAM LAMBS

The translation of research findings about ram lambs into a reality in the Australian lamb industry has raised a number of difficulties. Primarily, producers, processors, retailers and consumers do not seem to regard the scientific literature as a basis for acceptance and introduction of entire lambs on farms, and their subsequent use as larger carcasses for alternative lamb cuts.

Aside from the non-acceptance of ram carcasses from beyond the farm gate due to suggested quality deficiencies there are no suggestions on management of ram lambs on farms. Major difficulties are likely to include the additional time required to grow the heavier ram carcasses, (there is indication of variation between seasons); the desirability of weaning ram lambs some time prior to sale and the effect on quality; the problem of carrying fertile males not required in breeding programs (cryptorchids offer an alternative); the interference ram lambs might cause to ram isolation practices prior to joining (Reeve and Charnley 1984); the possibility of carryover lambs during summer and the development of rations for them; the likely effect of grain rations on carcass fat in ram lambs (i.e. the possibility of low melting point fat affecting desirability of the carcass). The timing of operations, in particular lambing, in a mixed farming area where competition for labour could arise, also needed clarification.

The Rutherglen program was therefore developed to tackle the problems likely to be associated with the management of ram lambs for a breed combination (Poll Dorset x Border Leicester/Merino) rarely represented in the literature. Scientific data were required on growth and development of lamb sexes for the breed combination used, the usefulness of the carcasses for the alternative cutting procedures together with the quantification of retail yields for traditional and alternative cuts. Factors affecting carcass quality pre- and post-slaughter in order to ensure high quality meat for the new products were also examined. Also an industry awareness program was developed within the research package. The availability of carcasses from the research program allowed for a campaign to demonstrate to consumers and retailers that the discrimination against ram lambs on quality grounds was unreasonable.

Data has also been generated to show weight and fatness relationships in terms of the characters measured in carcass description. This was important because of the large differences in the GR fat measurement at any given carcass weight between rams and ewes in particular, but also with wethers.

The current management system being recommended on annual pastures in S.E. Australia is to use techniques which restrict joining time (ram isolation); cryptorchidise ram lambs; mark lambs born after June 1st; wean lambs and separate sexes at 10-12 weeks. Grain rations with 30-50% lupins ensure growth in summer if there are carryovers, but the economics of this practice needs analysis.

OPPORTUNITIES FOR PRODUCING LARGER, LEANER LAMBS

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There are three possible avenues for producing larger and leaner lambs - nutritional, hormonal or genetic manipulation. This paper discusses the potential of these approaches and some difficulties encountered in using existing information to develop appropriate and reliable production systems.

The value of lamb carcasses depends on several factors: weight; conformation; relative proportions of muscle, fat and bone; the distribution of those tissues through the carcass; muscle thickness and meat quality (Kempster 1983). This list can be extended to include several other factors identified as being important by consumers, such as tenderness; meat colour; fat colour; water retention of meat; eye muscle area and leanness (Thatcher 1982). Invariably, published research on factors affecting carcass composition of lambs has provided only very rudimentary information with respect to factors which are known to influence consumer demand for lamb.

NUTRITIONAL MANIPULATION

The various means by which the degree of fatness and the partitioning of fat within the lamb carcass of a particular genotype, sex and carcass weight might be manipulated by nutritional means have been covered by Truscott (1982), Black (1983) and Kirton (1983). There is a close relationship between body composition and liveweight (Tulloch 1964). The extent to which body composition of lambs can be manipulated by dietary means is relatively small (Black 1983).

Published research in this field generally refers to carcass composition in basic terms of muscle, fat and bone. More information is needed on the effects of nutrition on more refined aspects of carcass composition and tissue distribution. For example, in an experiment where wether lambs were grown at rates ranging from 80 to 320 g/d and slaughtered at 36 kg liveweight, there were significant, positive correlations between growth rate and condition score, dressing percentage, eye muscle area and omental fat (G.H. Smith and L.P. Thatcher, unpublished data).

HORMONAL MANIPULATION

Hormonal effects on lamb carcass traits have been reviewed by Truscott (1982). The common action of all anabolic agents is to increase nitrogen retention and protein deposition (Van der Wal 1976). Implantation of trenbolone acetate in conjunction with oestradiol-17- β has been shown to increase liveweight gain and carcass weight in wether lambs (Coelho et al. 1981). However, in general, the expectation that anabolic agents should produce leaner carcasses at a given bodyweight has not been supported by published results. For example, zeranol did not affect the carcass composition of ram, wether, ewe or cryptorchid lambs (Wilson et al. 1972). Considering the relatively large number of publications about the effects of anabolic agents on performance of livestock, few describe observations on carcass quality. In most published research the anabolic agents have been administered to lambs at 12-14 weeks of age i.e. when lambs in S.E. Australia are almost ready for market. Here again, the research is not relevant to the production and marketing systems.

Autoimmunization is a modern concept in animal production (Scott 1984) which involves immunizing against naturally-occurring body substances to deregulate

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hormonal control. Immunization of lambs against somatostatin may substantially improve growth rates, but lambs appear to have the same carcass composition at the same weight (Spencer et al. 1983).

There is already evidence of an emotional reaction by some consumers against the use of artificial substances (hormone manipulation) in red meat production.

GENETIC MANIPULATION

It is commonly accepted that there is greater variation within breeds for particular genetic traits than there is between breeds (e.g. Wolf and Smith 1983). However, there has been no systematic attempt to explore and exploit the apparent genetic variation in leanness to the benefit of the prime lamb industry. The available evidence suggests that carcass parameters in sheep are relatively highly heritable (Cotterill and Roberts 1976; Wolf et al. 1981).

To capitalize on the apparent variation that exists in leanness within a breed and the heritable nature of the trait it is necessary to accurately identify individuals that carry traits necessary for leanness. This either requires the use of equipment that accurately measures fatness in young, potential sires or alternatively, the use of progeny testing. The precision in measuring subcutaneous fat depth in live sheep is improving. Correlation coefficients of up to 0.91 between ultrasonic measurements over M. longissimus at the last rib and the corresponding carcass fat depths have been recorded in unshorn lambs (Gooden et al. 1980). Accurate measurement of fat in potential sires is necessary to avoid the use of progeny testing with its disadvantages of higher cost, lower selection intensity and increased generation interval relative to the performance test (Wolf et al. 1981).

In line with the objective of identifying and promoting the use of leaner, prime lamb sires, the New South Wales Department of Agriculture now operates a testing service for meatsheep (Harris and Luff 1981). The service measures fatness (by ultrasonics - Gooden et al. 1980) and growth rate in young rams and this information is used by stud and commercial breeders in their breeding programs (Harris 1985). After conducting progeny tests of selected lean and fat rams, Fennessy et al. (1982) concluded that selection of sires on the basis of backfat thickness could be an effective means of reducing carcass fat thickness in lambs.

The reservations about the accuracy of ultrasonic fat-measuring equipment requires that attention is given to other approaches that might be used in selecting sires. One option is to explore the relationships between carcass composition of lambs and measurable phenotypic traits of their sires (other than fatness) such as various structural parameters. Thompson (1982) has proposed that varying the age of selection for body-weight of prime lamb sires might be an indirect means of manipulating total body fat.

There is a dearth of published information relating heritabilities of important carcass parameters both within and between breeds involved in the prime lamb industry. Available information covers only very basic carcass characteristics and appears to be quite variable. It is feasible that the partitioning of fat within a carcass might be altered by the use of breeds that differ in fat partitioning. However there have been few published reports, such as Thompson et al. (1979), that provide a comprehensive picture of fat distribution across even the basic retail cuts of lamb for various breeds.

A FARMING SYSTEMS APPROACH TO LAMB PRODUCTION

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Farming systems involve complex interactions between biological, environmental, economical, sociological and sometimes political factors. Rarely is it possible to ignore one of these without significantly detracting from ultimate efficiency and productivity. Despite this knowledge, it has been, and indeed still is, common practice to conduct agricultural research on a single enterprise basis with a strong orientation towards increased biological production. Often too little attention has been focussed upon interactions with other farm enterprises, market requirements, the ability of farmers to effectively utilize the new technology and most importantly, the sustainability of the new production systems. At Rutherglen we have attempted to take a farming systems approach to the production of larger, leaner lambs, embracing where possible all the above factors in the overall research program. My colleagues have outlined the market 'target', consumer-oriented approach taken in this project; I wish to highlight aspects of this and cover two further topics - enterprise interactions and sustainability of production.

ENTERPRISE INTERACTION

Commonly, lamb is produced on farms where cropping and/or other livestock enterprises, such as beef production, are also carried out. The mixed farmer is quite naturally concerned with whole farm profitability rather than profit from any single enterprise. The pursuit of larger, leaner lambs is then only one of the objectives for the mixed farmer and as such it must relate to other activities on the farm. These relationships can range from complementary effects through compromises and integration to straight out conflicts. Some of the factors impinging on lamb production are considered.

Labour and timeliness of operations are often the most limiting factors for the producer and for example, work peaks can coincide for the sheep/wheat farmer in S.E. Australia. In April-May cultivation/seeding may coincide with lambing while in June/July post-emergence herbicide application may coincide with lamb marking. Similarly competition for land is greatest in autumn/early winter when lambing ewes have a high nutritional requirement, and the overall availability of grazing is reduced due to cultivation of cropping paddocks.

Concurrent research has shown that the regulation of time and duration of lambing using ram isolation and progesterone priming techniques is of considerable aid in allowing lambing to be completed during 'off-peak' times for cropping. In addition crop establishment using minimum tillage techniques obviates the need for early cultivations thereby allowing longer access to grazing on paddocks to be cropped. Also direct drilled crops provide better access for livestock with reduced 'pugging' if winter grazing of cereals is desired. Another alternative is to arrange lambing after cropping is completed, this can be optimized by joining ewes after harvest, on lupin stubbles rather than on dry pasture. An average increase of 24% extra lambs has resulted from this technique (Roberts and Kenney 1986). This range of research results is by no means comprehensive but enables the provision of management packages for producers that not only facilitate the efficient production of lambs but also integrate this activity with other farm enterprises. Under these circumstances it is more likely that producers will adopt the new technology and make the necessary managerial inputs for success in the lamb enterprise. It is likely

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that the use of computer-based farm management models (e.g. Morrison et al. 1985) would aid decision-making.

MARKET-CONSUMER ORIENTATION

Setting market requirements as the target for research necessarily involves some 'crystal ball' gazing as to what the consumer is likely to want when the research comes to fruition. Aiming for what the consumer wants (or perhaps what we think he/she should want) does not necessarily have unanimous support in all sections of the industry. Participants in the lamb marketing chain have different requirements (Harris 1982). As a consequence that most effective agent of change, the market signal or price, does not always reflect that larger, leaner lamb is what the consumer wishes to have on his plate. Yet when we talk to consumers, clearly this is their preference. Accordingly consumer-orientation for research is not necessarily the panacea that it may appear. For research to be effective it is apparent that not only must the consumer be a target but also the requirements of buyers, processors and butchers must all be closely considered when directing the research program. Accompanying educational and extension programs also need to be broad ranging in terms of the target audiences.

SUSTAINABILITY OF PRODUCTION

In S.E. Australia the grazing of sheep and cattle has generally been considered to be less demanding on soil fertility, particularly soil structure, than has cropping with its associated cultivation. However it is now clear that pasture decline associated with soil problems including compaction, acidity and salinization is threatening the productivity and stability of these grazing enterprises (for example, Reeves 1984). The loss of trees on farms with associated hydrological changes is probably a contributing factor (George 1984).

It is therefore a major requirement that any production system developed recognizes that the environment is changing and that sustainability of production from our farmlands is no longer a guarantee. For this research project, the quest for larger, leaner lambs has as a pre-requisite a sound economically produced feed base. Companion research is therefore addressing this area with regard to restoring pasture productivity and also understanding the factors affecting pasture selection by sheep.

CONCLUSION

Surveys of the market place for lamb and lamb products have identified groups of people who find the current product unsatisfactory. This may be because the current cuts are 'old-fashioned', lack versatility, and are overfat and wasteful. These attitudes would have led to a significant decline in consumption in recent years if real prices for lamb had not also declined.

The Rutherglen research program has 'targetted' consumer groups identified in the AMLC research that now find lamb unsatisfactory and it has aims to re-establish them as consumers. In developing a range of new products it has become obvious that the lamb industry does not currently provide the desired raw material, lamb carcasses are simply too fat and not large enough.

The original aim of the AMLC funded project 'High quality, new cuts of lamb' was to use existing research results to develop management systems which provide larger, leaner lambs. Difficulty in integrating these results into a suitable management package identified the problems producers and extension officers have in practically adapting such findings. Quite simply, much research had not taken

into account the need to develop results within the framework of management systems aimed at satisfying the consumer. Although real problems had been identified and studied, the results still did not appear in a form directly applicable to a management system. The challenge for research today is to more efficiently produce products that are needed in the marketplace. Increased productivity in the lamb, and other industries, not only produces more output per unit of input, but also releases some farm resources for redirection into new production and marketing initiatives. This flexibility is essential if resources are to be expeditiously moved from enterprises of lower demand to those with higher demand.

Finally, even when dealing within an enterprise, from production to marketing, it is not only necessary to remember the wider context of the range of enterprises on the farm, but also the conservation of its basic resources - the people and the land. Research must not only 'be biologically sound, but must also acknowledge the needs for sustainability and economical and sociological acceptability if the long-term viability of the farm is to be ensured.

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