INTRODUCTION

Marketing in secondary industry includes in-depth analysis of consumer requirements. The product is then produced to meet consumer perceived needs and marketed with a strong promotional campaign. This procedure is generally reversed in the meat industry. Only in the pig industry have efforts been made to determine consumer requirements, and to meet them.

Lamb consumption in Australia has declined from 24.5 kg/head in 1972 to 15 kg/head in 1980. This will only be arrested by a stronger emphasis on marketing. This symposium aims to show interdependence of consumer requirements and production, marketing and distribution systems for lamb, whilst demonstrating the key role of an objective method of description.

IDENTIFICATION OF CONSUMER REQUIREMENTS FOR LAMB

During the past decade, countries in the Middle East have become major export markets for Australian lamb. They require lean lamb, generally with 1-2mm fat over the loin. Lear (1978) found that the weight requirements varied between countries, for example, Iran requested carcases of 12-18 kg, United Arab Emirates 10-14 kg, and Oman 9-16 kg.

Publicity about overseas markets for lamb tends to disproportionately divert emphasis from the domestic market which has always taken from 80-90% of total Australian production. Despite this the Australian market remains largely unidentified, with some basic principles only to guide the distribution of lamb. Particular requirements of specific sections of the market have not been identified or quantified.

FACTORS LIKELY TO INFLUENCE CONSUMER REQUIREMENTS

A number of factors, or a combination of them, are likely to influence the consumer choice of lamb.

Tenderness is the factor most required by consumers in the United Kingdom (Baron et al. 1973). Whilst no similar work is available in Australia, Barwick and Thwaites (1980) used standards described for American consumers (Anon. 1966) and found that less than 1% of lambs sampled in Northern New South Wales abattoirs were outside the acceptable range. Processing techniques can cause toughness but standards are enforced to minimise the likelihood of this.

Sex of lambs slaughtered in Australia are almost entirely wethers and ewes and no evidence is available to show that consumers can differentiate between them. Furthermore, Kirton (1968) showed an inability

* Rutherglen Research Institute, Rutherglen, Vic, 3685.
to distinguish between roast legs from rams and wethers. This contrasts with "accepted wisdom" within the meat industry that consumers do not like the ram taint in sheep meat. In some Middle Eastern markets and in the ethnic trade in Australia there is a preference for ram lambs.

Meat colour can influence consumers as Hood and Riorden (1973) showed a strong bias against brown pigmentation in favour of bright, red meat. Attitudes to light coloured meat have not been examined.

Fat colour is not a problem for lamb in Australia. Yellow fat is unacceptable but is not prevalent.

Water retention of meat is important, particularly in pre-packed lamb. Drip occurs when pH falls too rapidly (Cuthbertson and Kempster, 1978) and is unsightly in displays.

Eye muscle area (area of Longissimus dorsi muscle) or the size of the Chop affects consumer acceptance. Southam and Field (1969) demonstrated that rib and loin chops from a 30 kg lamb carcass were preferred to those from a 23 kg carcass. Furnival et al. (1977) found a preference for the largest eye muscle possible in loin chops. However, Thatcher and Couchman (unpublished) found that there was a point where increasing eye muscle area became undesirable (Table 1). In their study where fatness was kept constant, the preference was for the second largest eye muscle (replicates I and II in Table 1 represent the same material presented in different arrangements in the display). The eye muscle areas in their study were larger than the maximum used by Furnival et al. (1977).

**TABLE 1** Consumer choice for eye muscle area on loin chops

<table>
<thead>
<tr>
<th>Area (cm²)</th>
<th>Percentage choosing Replicate I</th>
<th>Percentage choosing Replicate II</th>
</tr>
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<tbody>
<tr>
<td>14.00</td>
<td>22.8</td>
<td>20.0</td>
</tr>
<tr>
<td>17.75</td>
<td>55.7</td>
<td>62.0</td>
</tr>
<tr>
<td>16.75</td>
<td>21.0</td>
<td>16.0</td>
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</table>

Joint size is also important and Southam and Field (1969) found leg roasts from 23 kg lambs were preferred to those from 30 kg lambs in the United States. Similarly, in the United Kingdom, Wilson et al. (1974) showed that legs from lighter lambs were preferred.

Leanness of lamb was the feature which most affected consumer preference for chops in the United Kingdom (Wilson et al. 1974). In Australia, Furnival et al. (1977) showed a decline in the desirability of rib and loin chops as fat depth over the eye muscle increased above 2.4 mm.

Thatcher and Couchman (unpublished) showed a preference on loin chops for around 3 mm of fat (Table 2). For replicates I and II there was a clear preference for 3 mm fat, but the gap to the next fat depth left uncertainty. New experimental material in replicate III confirmed a preference for 3 mm, in this case the leanest chop
animal production in australia on offer.

Table 2: Consumer selection for fat depth over loin chops

<table>
<thead>
<tr>
<th>Fat depth over eye muscle (mm)</th>
<th>Percentage choosing Fat depth over eye muscle (mm)</th>
<th>Percentage choosing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Replicate I</td>
<td>Replicate II</td>
</tr>
<tr>
<td>2</td>
<td>3.9</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>81.0</td>
<td>90.0</td>
</tr>
<tr>
<td>7</td>
<td>5.2</td>
<td>4.0</td>
</tr>
<tr>
<td>8</td>
<td>9.1</td>
<td>2.0</td>
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</table>

Most lamb sold in Australia has more than 3mm fat. In fact livestock buyers often seek this despite consumer dislike for fat because of the wastage involved and the unpleasant feel it leaves on the palate (Cuthbertson and Kempster 1978). Some fat is necessary to protect the carcass from drying in the chiller (Cuthbertson and Kempster 1978), and from bacterial infection. However, contrary to some meat industry opinion, fat does not affect taste and juiciness (Rhodes 1976).

Interaction between factors may influence consumer appraisal of lamb more than selection for individual factors. Furnival et al. (1977) showed that acceptability reached a peak when a certain ratio of fat:lean was reached. Too much or too little fat with similar eye muscle led to reduced acceptability. Thatcher and Couchman (unpublished) showed that consumers with distinct choices for single factors, showed less certainty when selecting for a combination of factors.

Identification of consumer preferences

The current limited information available for Australian lamb suggests that factors such as tenderness, meat and fat colour generally meet acceptable standards. Weight and fat cover are two of the most variable factors, and are those most likely to influence consumer choice.

Current information about consumer preference for lamb is confused. This may be because, consumers cannot consistently identify their needs, important factors influencing choice may not yet have been identified, or a range of very individual needs become less conclusive when data are consolidated and averaged.

More definitive work is required under Australian conditions particularly of consumer attitudes towards lamb, the identification of particular market segments and the characteristics of these segments. This would involve detailed survey analysis of stratified samples of the population. Most taste panel work with lamb in Australia has been undertaken to identify differences between experimental treatments. More is needed with an orientation towards product development.

This intensive market research is needed to ensure that lamb and lamb products are of a nature most likely to succeed on the
Modern marketing techniques are centered on the commercial satisfaction of consumer demand. To adequately achieve this Australian lamb suppliers need to be aware of the consumer requirements and the price they are prepared to pay to be fully satisfied. A common language to describe lamb carcase characteristics which are commercially relevant is needed to facilitate communication between consumer, retailer, processor, wholesaler and producer.

The previous paper concluded that fatness and weight were important factors in terms of consumer acceptability. However, as most Australian prime lamb producers do not sell direct to consumers, the price differentials they receive for different levels of fatness are usually small, badly distorted and a poor reflection of consumer preferences. The reason for this may be due to:

(i) Retail lamb cuts are usually not trimmed of excess fat, and therefore 'yield' variation in terms of lean meat is not readily apparent despite its obvious importance to the consumer
(ii) Until recently there has been no standard description system to enable retailers to specify price differentials for fatness to wholesalers
(iii) As wholesalers are paid on a cents per kilogram basis with most of their costs being on a per head basis, they have an incentive to sell carcases as heavy as possible, regardless of fat content
(iv) In the absence of appropriate price per kilogram penalties for fatness it is in the best financial interest of most producers to sell lambs as heavy as possible for the highest possible price per head.

Hence an effective language for commercial processing operations must be developed to describe carcase composition with accuracy and reliability.

**CARCASE MEASUREMENTS**

Carcase weight is the main determinant of carcase value as the industry generally trades on a cents/kilogram basis. Carcase weight is also related to composition, with heavier carcases having lower proportions of bone and muscle and greater proportions of fat (Kirton 1976).

Consumer acceptability is affected by the size of a cut which is a direct reflection of carcase weight. Problems associated with larger cut size in the heavier carcases may, however, be overcome by the introduction of different cutting techniques (eg. Anon 1974), provided fatness can be reduced in these heavier carcases.

Fatness. The relationship between fat measurements (both fat depth and scores) and percentage fat in the carcase is weight dependent (Kempster and Cuthbertson 1977; Thompson and Atkins 1980; Thompson and Clements 1981). Despite this strong relationship there remains large variation in the fatness of individual carcases after

* Agricultural Research Centre, Orange, N.S.W. 2800.
adjusting for carcase weight. The prediction of carcase fat has generally relied on objective (fat depth measurements) or subjective (fat scores) assessments of the subcutaneous fat depot. Comparisons of the accuracy of measurements and scores have generally shown fat depths are the 12/13th rib junction (either as fat depth over the eye muscle 'C' or fat depth 110 mm from the midline 'J110') provided the most accurate prediction of carcase composition. Fat scores were less accurate but still accounted for significant variation in percentage carcase composition after adjustment for carcase weight (Kempster et al. 1976; Thompson and Clements 1981).

In the commercial situation with high chain speeds fat scoring would be necessary to assess fat. However this must account for the relationship between weight and fat since at the same percentage fat a heavy carcase will have a higher fat score than a light carcase. Recent results from Blayney indicated that fat scores were not sorting carcases independently of weight (Lee unpublished).

Single fat depth measurements do not account for variation in the distribution of fat within a depot. Neither do fat measurements or scores account of variation in the partitioning of fat between depots. Consequently the relationship between the fat measurement and carcase fatness is often breed dependent (Kempster et al., 1976; Thompson and Atkins 1980; Wood and MacFie 1980; Thompson and Clements 1981). The practical importance of this must be assessed over a range of breed types, with concurrent work on breed distribution of abattoir throughputs.

Conformation (as a score, weight length ratio or a fleshing index) is often proposed for inclusion in carcase classification systems. Although as a single measurement, conformation does have some relationship with carcase composition, after taking account of weight and fatness, conformation did not improve the prediction of carcase composition (Kempster et al., 1976; Thompson and Atkins 1980; Thompson and Clements 1981). In an evaluation of lamb carcase measurements Thompson and Clements (1981) found that, after correction for weight and fatness, breed effects were largely independent of conformation. Therefore the inclusion of conformation as a predictor of carcase composition in a classification scheme could not be justified.

Live animal assessment of carcase weight and fatness would enable suppliers to select slaughter lambs to meet predetermined specifications. After adjusting for variation in factors such as fleece weight, liveweight can be used to predict carcase weight. Clements et al. (1981) concluded that condition scoring by an experienced operator could sort live animals on the basis of carcase fatness, independently of liveweight. However, variation between operators indicated the need for adequate training and testing procedures.

CONCLUSIONS

A reliable carcase classification scheme for lambs based on carcase weight and fatness would provide the basis for a common language to ensure more effective communication between the various sectors of the meat trade. Although less accurate than fat depth measurements, fat scores provide the only practical means of assessing fatness at this stage. It is important that fat scores be defined in terms of an objective fat measurement that recognised the dependence
between fat scores and carcase weight in predicting carcase composition. The success of a carcase classification system as a basis for trading carcases will be enhanced by effective means of selecting live animals to meet predetermined carcase specifications.

SHORT TERM STRATEGIES AVAILABLE TO MANIPULATE LAMB CARCASE TRAITS

T.G. TRUSCOTT*

This paper considers means by which the degree of fatness and the partition of fat within the body at a particular carcase weight can be manipulated by essentially non-genetic factors.

BODY WEIGHT EFFECTS

Carcase fatness can be influenced by altering the degree of overall body fatness or by altering the partition of fat between depots within the body. Differential relative growth rates of tissues and chemical components have long been recognised (Wood et al., 1980; Searle et al., 1972). In the "prefattening ruminant phase" of development, Searle et al. (1972) showed that lipid formed 27% of body weight gain and that this increased to 65% in the "fattening ruminant phase". Similarly, Wood et al. (1980) showed that subcutaneous fat and intermuscular fat increase at different rates over a given carcase weight range.

Fat depots also develop at different rates. Wood et al. (1980) have listed the order of relative growth of tissues in lambs as subcutaneous fat > omental fat > peritoneal and retroperitoneal fat > intermuscular fat > lean > bone. Therefore, within a breed and sex, choice of slaughter weight will influence the relative proportions of the fat depots as well as having a major bearing upon the total amount of fat in the carcase.

NUTRITIONAL EFFECTS

Although simulation models (Black 1974) have indicated a potential to manipulate body composition by nutritional means in sheep, it has been concluded by others (eg. Garret 1980) that within usual economic restraints, nutritional manipulations have a relatively small influence on the carcase compared to genetic effects.

Growth pattern Feeding levels of a given diet can be manipulated to alter the shape of the growth curve. In weaned ruminants on high energy rations, higher levels of feeding resulting in higher growth rates tend to increase carcase fatness especially at higher weights. However, where only modest growth rates have been achieved, higher growth rate sheep were not significantly fatter (Searle and Hilme 1977; Murray and Slezacek 1976). Realimentation after weight loss or weight stasis has produced small but variable effects on body composition at the same weight (see Searle and Graham 1975).

The limited data available indicates a tendency for ruminants on better feed to deposit more subcutaneous fat but in most experiments the effects are small and variable between animals (Murray and Slezacek 1976; Murray et al., 1974).

Composition of the diet High levels of grain feeding or diets of
high energy density, whether resulting in higher growth rates (Purchas 1978) or not (Mukhoty et al. 1970) tend to produce fatter carcases.

The effects of nutrition on body composition are not simple, with interactions occurring between level of nutrition, chemical composition of the diet and state of maturity of the animal (Black 1974). Black's (1974) simulation model suggested that differences in fat deposition in excess of 8% of body weight are unlikely between diets adequate in protein and that these differences will be even smaller as the animal approaches maturity. Differences in fat deposition exceeding 50% of body weight are theoretically possible from alteration of the protein content of the diet (ie. low protein levels resulting in high fat deposition) according to Black (1974), but such diet's would also result in low growth rates. There is little evidence (eg. Griffiths 1978) to suggest that high levels of protein will increase protein deposition. Higher growth rates appear to affect fat partitioning. High energy grain based diets have led to faster growth rate and greater levels of subcutaneous fat (Purchas 1978).

Weaning effects Increased fatness results from prolonged suckling of milk alone, and weaning leads to decreased fatness, particularly below 35 kg live weight (Searle and Griffiths 1976a). Kirton (1978) found that 3 weeks grazing after weaning at 12 weeks had little effect on fat depth but increased carcass weight. In contrast, Purchas (1979) found slower growth rates after weaning 4 to 6 weeks prior to slaughter at the same weight at 16 weeks of age. Geenty et al. (1979) found only minor differences in carcass fatness in lambs with different ages at weaning and slaughter.

Feed additives Feed additives (monensin or avoparcin) alter ruminal fermentation, and improve efficiency of food utilization (Johnson et al. 1979). However, the evidence suggests they have no effect on carcass characteristics beyond the effect of increased body weight per se (Potter et al. 1976; Johnson et al. 1979).
interaction is likely to have a similar, minimal effect to alteration of growth rate per se on body composition.

Few experiments have specifically examined sex effects on fat partition and distribution at similar levels of fatness. Purchas'
(1978) data suggests that there are no major differences in fat partition between wethers and rams, Thompson et al. (1979a) found no difference between wether and ewe lambs in the partition of carcass fat between subcutaneous and intermuscular depots, nor in the distribution of fat within depots (Thompson et al. 1979b) at the same weight of fat. In contrast, recent findings in Dorset Horn sheep (R.M. Butterfield and J.M. Thompson unpublished data) indicate that wethers may have proportionately more (ca. 15%) subcutaneous but less (ca. 17%) intermuscular fat than rams with no difference in intra-abdominal depots when compared at the same weight of dissectible body fat (23 kg).

Exogenous hormones It is considered (Armstrong 1981) that maximal effects of anabolic agents on liveweight gain in ruminants are achieved by using an androgen in females, an androgen plus oestrogen in castrate males and an oestrogen in males. The effect of these agents is to potentiate male growth in female or castrate animals and as such result in increased N retention and muscle growth. Implantations in young lambs, especially prior to production of substantial levels of androgens in males, might be expected to result in leaner carcasses at a given body weight.

Potential hormonal manipulations The future holds several potential short-term methods of manipulation of hormone levels for the alteration of production efficiency and body composition. For example, exposure of the foetus or neonate, at critical periods of development, to exogenous hormones which subsequently alter the action of the same or other endogenous hormones.

The development of auto-immunity to specific endogenous hormones also offers a potent means of manipulating specific hormone levels in animals and thus altering growth and body development (eg. immunization against somatostat in lambs - Spencer and Williamson 1981).

CONCLUSIONS

Manipulation of diet and level of feeding has some potential for alteration of body composition and fat partition but responses are likely to be small and variable in relation to the effects of sex and body weight at slaughter.

GENETIC MANIPULATION OF FATNESS IN LAMB CARCASES

J.M. THOMPSON*

The prospects of fulfilling consumer requirements for leaner lamb with short-term management practices is limited. The scope for genetic manipulation of total body fat and its partitioning between, and distribution within, the fat depots of the body is examined in this paper.

TOTAL BODY FAT

Between breed Differences in total body fat between breeds have been demonstrated (Fourie et al. 1970; Searle and Griffiths 1976b; Wood et al. 1977).

* Dept. of Veterinary Anatomy, Sydney University, N.S.W., 2006.
Generally at the same body weight, sheep from a large mature weight strain or breed, had less total body fat than sheep from a small mature weight strain or breed. Trying to explain these differences McClelland & Russell (1972) proposed that when breeds which differed in mature weight were slaughtered at the same proportion of their mature weight, differences in percentage body fat would be minimal. Subsequently, McClelland et al. (1976) demonstrated that in four sheep breeds of widely different mature weights, differences in body composition due to breed were largely eliminated by comparison at the same proportion of maturity.

In a crossbreeding programme the use of a large mature size breed will reduce fatness, whereas a small mature size breed will increase fatness, at a particular weight. After adjustment for carcase weight, there appears to be little heterosis for carcase characteristics (Long and Gregory 1975) and therefore crossbreed progeny can be expected to have carcase composition near the average of the two parents.

Within breed, carcase characteristics, particularly the amount of fat in the various fat depots, are moderately to highly heritable (Botkin et al. 1969; Wolf et al. 1981). This suggests that selection within a breed would provide an effective means of manipulating fatness in the long-term. An accurate way to measure fatness of the live animal is needed. Several ultrasonic machines have been developed, although evaluations have concluded that the level of precision in measuring subcutaneous fat thickness was relatively low (Kempster et al. 1977; Thompson et al. 1977; Clements et al. 1981) and this would effectively lower the heritability and consequently the expected progress in a selection programme. The effect of selection for change in one depot on total body fat is not clear.

Results from evaluations of weaning-weight plus and minus sheep selection flocks (described by Pattie 1965) in conjunction with results from comparative breed studies (McClelland et al. 1976) would tentatively suggest that age of selection may provide an indirect means of manipulating body fatness. Pattie and Williams (1966) examined carcase composition from weaning-weight plus and minus selection flock wethers, slaughtered at ca. 3 months of age and concluded that differences in composition were proportional to differences in carcase weight. Preliminary results from further work conducted due to the limited range in ages within flocks, and the overlap in weights between flocks showed that, although lambs from the weaning-weight plus and minus flocks differed by ca. 30% in body weight at 12 months of age, there was little difference in dissectable body fat when compared at the same body weight (Thompson unpublished data). Also, the fat in the weight-plus line was partitioned in a less mature pattern than in the weight-minus line which would suggest that the weight-plus animals will be heavier and have a greater percentage of total body fat at maturity. This disagrees with the between breed, maturity/body composition concept, where breeds of different mature size are of similar percent-age composition at maturity (McClelland et al. 1976).

This apparent discrepancy may be explained using the model proposed by Hayes and McCarthy (1976) on the effect of age of selection for body weight on body fatness in mice. The model proposes that at an early age, variation in growth is mainly due to variation in food intake and so selection for body weight is essentially selection for appetite. When compared at a given age, the heavier animals are fatter simply because they are heavier, and when compared at the same body weight,
have a similar body composition to both the controls and the low lines selected at the same age. At later ages during the fattening phase in growth, in addition to variation in appetite, there is considerable variation in the partitioning of energy for growth into either lean or fat deposition. Selection for body weight at later ages, thus favours animals that have a large appetite and are relatively lean since the energy cost of depositing a kilogram of lean is considerably less than for a kilogram of fat. At selection Clarke (1969) proposed that weight selected and control animal differed little in percentage fat, although after selection the weight selected animals became progressively fatter. Possibly the weight-selected animals have a greater capacity for lean deposition and an increased appetite up until the age of selection, after which the rate of lean tissue growth declines, and as intake remains high the residual food energy is laid down as fat.

The results from the weaning weight selection flocks are consistent with the above model. Selection for weight gain at an early age has been effectively for appetite with no change in fat at the same body weight. In the development of breeds, selection of replacement stock was made just prior to use in the breeding flock which, under good nutrition was close to maturity. Therefore selection for size whether directly or indirectly, resulted in animals of different mature size but similar body composition at maturity. At the same body weight the larger breed or strain would have less fat, which is consistent with results from most breed studies.

It is tentatively suggested that varying the age of selection for body weight may provide an indirect means by which total body fat may be manipulated. It is important however that the model be tested by evaluating body composition of other lines selected for weight at various ages.

PARTITIONING OF FAT

Between breed. There are numerous reports on breed differences in the partitioning of fat in domestic species (e.g. review by Kempster 1980). In sheep, most reports on fat partitioning have been confined to differences between the carcase and non-carcase depots (Wood et al. 1980; Geenty et al. 1979) although Kempster (1980) cited several studies where differences in the subcutaneous to intermuscular ratio have been reported between sheep breeds. For Dorset and Border Leicester rams crossed with either Border Leicester-Merino, Corriedale or Merino ewes, Thompson et al. (1979a) reported no differences in the partitioning of fat between the subcutaneous and intermuscular depots. Their results did, however, suggest differences in the partitioning of fat between the carcase and internal fat depots, whereby the progeny of Dorset Horn rams and the progeny of Merino ewes had a greater proportion of internal fat than the progeny of Border Leicester rams, and Border Leicester-Merino and Corriedale ewes respectively. Geenty et al. (1979) have shown Dorset Horn and Corriedale breeds have a greater proportion of their fat in internal depots relative to the Romney. Butterfield and Thompson (unpublished data) found no differences in the Partitioning of fat in strong and fine wool Merino rams, although Merino rams had a greater proportion of their fat in the internal depots relative to Dorset Horn rams.

In an attempt to explain differences between breeds in fat partitioning, Wood et al. (1980) suggested that breeds with a greater
internal fat deposition were generally the more prolific or heavy milking breeds. This is also consistent with between breed variation in cattle (Kempster et al. 1976) however, the negative correlations between percentage omental fat and milk yield reported by Mason et al. (1972) would not support such a proposition.

Within breed. In most lamb studies from which genetic parameters have been derived only one fat depot has been measured, although where more than one depot was measured, genetic correlation between individual depots are often low (Wolf et al. 1981) and sometimes negative (Olsen et al. 1976). These correlations suggest that direct selection for a change in one depot may not result in concomitant changes in other fat depots within the body. At present, live animal predictors of fatness are generally based on the subcutaneous fat depot and may result in a change in only this depot, rather than total body fat.

Kempster (1980) stressed the need to determine the genetic parameters associated with fat partitioning, to avoid unfavourable changes in fat partitioning in response to selection in breed improvement schemes. Allen and McCarthy (1980) reported that selection for body weight at both early and late ages in mice altered fat partitioning. However results in sheep from the weaning-weight plus and minus selection flock evaluations suggest that differences in fat partitioning at the same total fat weight are consistent with differences in maturity (Thompson unpublished data).

DISTRIBUTION OF FAT

Kempster (1980) reviewed results from Britain and concluded that between breed variation in the distribution of fat existed though the differences were small. Seebeck (1968) showed that Merino lambs had a greater proportion of subcutaneous and intermuscular fat in the loin and flank joint and less in the thorax than the Dorset Horn X Border Leicester-Merino.

CONCLUSION

Fat is the most variable tissue in the body both in total amount and its partition within the body. The total amount of fat in the body may be manipulated by the use of large or small maturing breeds. High heritabilities for the level of fatness would suggest the possibility of manipulation within a breed. In practise this option is limited by the lack of a cheap and accurate technique for estimation of fatness in the live animal. Age of selection for weight would appear to offer some scope for manipulation, although the results are somewhat tentative at this stage and require further testing.

As an alternative to producing a leaner carcase by reducing total body fat, the partitioning of fat within the body may be altered by the use of breeds which differ in fat partitioning. Relative to variation in the total amount and partitioning of fat in the body the variation in the distribution of both subcutaneous and intermuscular fat would appear to be limited.
CONCLUSION

L.P. THATCHER

The theme of this symposium has been the development of integrated production and marketing systems for lamb in which producers may respond to variable and changing consumer requirements. Lamb producers must be able to develop the most profitable production systems within their environment to meet the particular market sector they are aiming for.

There has been limited work under Australian conditions attempting to identify consumer requirements. The available studies suggest that weight and fat are the two factors most affecting consumer choice, although they do not preclude the possibility that other factors as yet unidentified may be involved. Also it is likely that within the domestic market there are a number of market sectors with particular requirements and these need to be identified.

If it is accepted that weight and fat are prime factors for marketing lamb, then in the short term it appears that the best way to manipulate the carcase is by using the sex status of the lamb to determine its potential for carcase production. Other short term options are limited. Although the quantity and quality of the diet do affect carcase composition, it is unlikely that the effects are great enough to be meaningful in the market place. There is some potential for implanted growth promoters, though none of these are at present registered for use in sheep in Australia.

In the longer term there is evidence that breeding and selection will provide avenues to control the production of particular types of carcases. There is genetic variation between breeds providing the opportunity for crossbreeding, whilst within breeds there are data to suggest that some opportunities for carcase manipulation are available. Selection at different ages may provide the basis for changing the carcase composition. The objective of the selection and breeding program may either be to alter the relationship between weight and fatness or to redistribute the total fat between the fat depots within the body.

In order for the correct messages to be passed through the marketing chain there is a need for an objective system of classifying carcases. This system must be meaningful in describing market requirements, and be objective to ensure consistency both through time and between users. This must be supported by an accurate method of assessing important carcase characteristics on the live animal. This would provide a vehicle for producers to ascertain readiness of lambs for market and also to assist breeders in selection programs.

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