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New Zealand export carcass grades of lamb, mutton and beef: past, present and probable

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ABSTRACT

Some information on the first exports of frozen meat from New Zealand is given partly as a background to the development of export carcass grade standards. Investigations that have examined the physical and/or chemical composition of carcasses according to grade are reviewed as are examples of research studies that have used carcass grade as one of the traits considered.

On the basis of very limited evidence, it is concluded that selection of meat animals for carcass grade is unwarranted but that improvement in carcass quality through breeding should take into account the need to reduce fat content and increase the depth of muscling both of which are, or should be, closely related to carcass grade. It is emphasised that those who produce meat animals of high carcass merit should be properly rewarded for their effort.

A brief speculation into the future of carcass grades is made, but whether grading will be replaced by a carcass classification scheme or some other procedure that is automatic, quick and pertinent remains in the future.

The first frozen meat from New Zealand left in the sailing ship *Dunedin* of 1250 tons from Port Chalmers on 15 February 1882 under the command of Captain John Whitson, aged 41. The *Dunedin* arrived at the East India Dock on 24 May after an adventurous voyage of 98 days. Thus the New Zealand frozen meat industry was born. Total exports of meat in that first year amounted to 774 tonnes. Meat available for export in 1980 amounted to 882,500 tonnes or more than a thousand times higher than in 1882.

That pioneer cargo comprised some 4311 carcasses of mutton, 598 carcasses of lamb, 22 carcasses of pork, 2226 sheep tongues, some dairy produce and an assortment of hare, pheasant, turkey and chicken. Apart from the very fat mutton carcasses weighing over 45 kg (with several heavier than 68 kg and 1 weighing 83 kg) the mutton was regarded as being quite suitable for the market. The average weight of the mutton carcasses was 35 kg, that of the lambs 18 kg, and the pork carcasses averaged 42 kg. Of the whole consignment, only 1 mutton carcass was condemned on arrival in London as being unfit for human consumption.

The mutton carcasses were from two-tooth, six-tooth and full-mouth Merino wethers or first-cross English Leicester-Merino or of Lincoln-Merino breeding. Some of the lambs, and a few of the sheep, were Southdown-cross or Shropshire-cross Merino.

The price received in Great Britain for the mutton carcasses on this inaugural shipment averaged 6.54 pence per lb (British currency) (about NZ13.2 cents/kg) and the lamb carcasses averaged 6.45 pence per lb (about NZ13.0 cents/kg). It is difficult to appreciate that 100 years ago the price of lamb was below that of mutton.

In 1913, 30 years after the first shipment, exports from New Zealand totalled 7.2 million mutton and 5.6 million lamb carcasses. However, by 1927 exports of lamb were 10.2 million carcasses, twice the number of mutton carcasses shipped overseas in that year. Currently the ratio of sheep to lamb slaughterings in New Zealand would be approximately 1 to 5 with most of the sheep killed being old ewes rather than wethers in contrast to the situation in the early years of the trade.

Very soon after the first cargo arrived in London there were reports received in New Zealand that the meat was too fatty. One person said in 1883 that kidney fat [in the carcasses] was not wanted (Lind, 1981). About 96 years later it became mandatory to remove this fat (and also the channel fat) from the carcass along with the kidneys so that they could be eviscerated for meat inspection purposes.

The early shipments contained a heterogeneous assembly of carcasses from sheep of varying ages, levels of fatness and weights. With increasing volumes of imported meat on the British market, the need to segregate the main kinds of carcasses would be an obvious and necessary aid in marketing. That this was required was evident from the outset when, in one instance, out of a lot of 460 carcasses described as young wethers, there were 14 old ewe carcasses sent with other parcels to Britain on the sailing ship *Opawa*, which in 1883 carried the first frozen meat from the port of Bluff (Lind, 1981).

The Development of Carcass Grades

There do not appear to be any records extant which could throw light on the introduction of grading of export carcasses or of the basis on which grade and

carcass weight-range distinctions were made. Each exporting company doubtless had its own grade standards at least by the beginning of the twentieth century. This led to a multiplicity of grades and caused much confusion in the trade and increased the costs of sorting carcasses on the dock at the port of arrival. Pricing, wholesaling and market reporting would be difficult under these circumstances and could be misleading to producers and others who were anxious to ensure that the fledgling industry would survive and prosper. Other aspects of marketing such as timing of arrivals of ships carrying meat from New Zealand, freight charges and promotion of meat were exercising the minds of farming leaders and politicians in New Zealand. Indeed heated arguments and counter-arguments raged on these and related issues and the Government, under the Prime Minister, W. F. Massey, forced through Parliament legislation (Meat Export Control Act 1921-22) that brought the New Zealand Meat Producers Board into existence on 11 February 1922. One of the statutory functions of the Board enabled it to "... have full authority to make such arrangements and give such directions as it thinks proper ... for the grading, handling, pooling and storage of meat ..." (Hayward, 1972). This Act provided the first opportunity to 'regularise grading and set grade standards for export carcasses.

The Board's first supervisor of grading and shipping was the late Sam S. Timbs of Wanganui who was born in Oxford, England, and became a well-known retail butcher, stock drafter, and livestock judge in his adopted land. He resigned from the Board's employment because of its "... reversal of its original policy ..." at the end of the first year of the Board's operations (Timbs, 1939). In his short period of work for the Board, Timbs in 1923 supervised and standardised carcass grades. He believed the Southdown-cross lamb was a superior article and probably this was the basis for the original Prime Down Cross grade in the North Island. In support of this contention Timbs stated: "The Southdown conformation [of the Southdown-cross lamb] and its quality of flesh, if under 34 lb has kept the New Zealand lamb on top of all its competitors. Also it has dragged up along with it, because of close association (a mixture of types) many lambs that have received more than their due." At the other end of New Zealand the Southland Frozen Meat and Produce Export Co. Ltd (now Southland Frozen Meat Ltd) was also much attracted to the qualities of the Southdown-cross lamb and in 1924 founded a Southdown flock on one of its properties.

According to Hayward (1972) the first grade standards laid down by the Board were very simple. Carcasses were classed prime, second grade or they were rejected for export. The Board in its first annual report for the year ending 30 June 1923 stated: "We

aim to give an unchallengeable guarantee that the whole of the huge quantity of frozen meat sold by New Zealand on the world's markets is strictly according to grade specified and thus inspire confidence in the buyer. It is this confidence which will enable the meat to be sold in advance and not after inspection. . . . If this can be accomplished and the New Zealand grading accepted as final at the other end [mainly Great Britain] it will mean many thousands of pounds [money] to the meat producers of the Dominion".

The grade standards set by the Board at the outset of its coming into existence have been amended from time to time, especially following the reports of 2 independent committees appointed by the Board (Smallfield, 1965; MacIntyre, 1974). Other changes to the standards have introduced new grades or have reduced the level of fat content that is acceptable in the prime grades. Grade names, or symbols and weight ranges, have also been altered down through the years. The requirements of old and new markets for carcasses of various types and changes in these requirements over time, are the main reasons for amending grade standards. However, changing patterns of production and in the breeding of meat animals, have also been factors that have necessitated amendments to the standards.

Grade Descriptions

Descriptions of the grades in existence in the past have been given by Barton (1947, 1960) for lamb and lamb and mutton, respectively; for beef carcasses by Barton (1970a) and Nicol (1976); for beef and veal carcasses (Barton, 1958). Smith-Pilling (1959) described, with illustrations, grades of lamb, mutton, and beef. Kirton and Jury (1970) and Frazer (1976) also described lamb and mutton grades. Botherway (1974) outlined the new and present grade standards for beef. The current grade standards are briefly set out in a pamphlet issued by the New Zealand Meat Producers Board (NZMPB, 1979).

It should be mentioned that apart from fat level and carcass shape as factors taken strongly into account in grading, defects such as excessively yellow-coloured fat will either condemn the carcass for export or require it to be allocated to the lowest grade (Kirton *et al.*, 1975).

Each of the grade descriptions referred to above fails to provide any quantitative information relative to each grade; they are purely descriptive and, accordingly, lack the precision of quantitative specifications. To date, carcass grading has remained rather subjective in practice; attempts to introduce standards that would be practical and acceptable to the industry and to markets, have not been successful. Nevertheless, some elements of a classification scheme are incorporated in the present grade standards in New Zealand. These include, for

example, approximate age of animal at slaughter (that is, B grade lamb, up to 6 weeks of age; lamb up to 30 September in the year after its birth and/or not heavier than 25.5 kg carcass weight; hogget; mutton; veal; ox and heifer; and cow). Segregation of the sexes in the case of mutton and beef carcasses has long been normal practice as has been the allocation of each carcass to a defined weight range. The estimated depth of subcutaneous fat and fat distribution over the carcass, are also important characteristics taken into account in determining the grade of the carcass. Measurements of fat depth are not, however, taken on all carcasses other than some of those considered by the grader to be close to the borderline between adjacent grades. From the instances given here it is fair to say that in the grading of carcasses destined for export from New Zealand there are similarities to carcass classification schemes operating or under development in a number of countries (Harrington, 1969, 1976; Barton, 1970b; Everitt and Evans, 1970; Cuthbertson and Harrington, 1973; Luckock, 1976; and Moxham and Brownlie, 1976). Kirton and Colomer-Rocher (1978) have referred to it as the New Zealand sheep and lamb export carcass classification system. This it cannot be in the absence of precise specifications and greater objectivity in determining the fat content and the thickness of the musculature of the carcass. The current grade symbols would also need to be replaced with numerals so that each class does not have an assumed "quality" connotation as is traditionally inherent in carcass grade standards.

The proposed Australian carcass classification schemes have been evaluated by the Bureau of Agricultural Economics (BAE, 1978) and a number of pertinent issues have been raised in that report. Some of these are of relevance to all carcass classification schemes.

Physical and Chemical Composition of Lamb Carcasses in Various Grades

A small number of investigations have provided quantitative and/or qualitative information on carcasses of various New Zealand export lamb and mutton grades. The first of these was undertaken in 1942 at Massey Agricultural College (now Massey University) and at Lincoln College at the request of the British Ministry of Food. The Ministry required a body of data on the physical composition of lamb, ewe and wether mutton carcasses and their anatomical joints (cuts) of each export grade and weight range. The chemical composition of the dissected edible tissues was also determined. The physical and chemical data were needed for the effective organisation of food rationing and the determination of Britain's food import policies

during World War II. By April 1943 the British Government was able to buy the entire exportable surplus of meat from New Zealand in the 1942/3 season without limitation as to quantity. By then the United States Joint Purchasing Board was procuring considerable quantities of meat from New Zealand.

The results of this early investigation were published by Clarke and McMeekan (1952) and Barnicoat and Shorland (1952) together with calculations of the nutritive status of the edible tissues of the carcasses in the various grades. Barton (1960) presented a statistical analysis of the raw data of Clarke and McMeekan (1952) based on the North Island grades only for lamb, ewe and wether mutton carcasses. He showed that there was a significant difference in mean weight of bone between a number of grades. For instance, the carcasses in the Prime Down Cross grade in the weight range 23 to 36 lb (10.5 to 16.5 kg) had significantly lighter bone than the carcasses of all other grades of lamb. Of all lamb carcass grades, the Prime Down Cross carcasses, irrespective of weight, had the least amount of muscular tissue in spite of the fact that this grade had the so-called "best" conformation. This grade also contained carcasses with the greatest amount of dissectible fat.

A more detailed study of 9 North Island grades of lamb was carried out by Kemp and Barton (1966). They found that, in general, carcasses of the Prime Down Cross (Down grade) and Prime Crossbred (Prime) grades of comparable weight were similar in composition while carcasses of the Y and Alpha grades contained more lean and bone and less fat and had more protein and moisture and less chemical fat than the carcasses in the Down and Prime grades. Mean external and internal carcass measurements showed that angular carcasses of the Y grades were longer and generally narrower in the forequarter, and had smaller and shallower ribeyes than the carcasses of the Down grades. The carcasses of the Down grades had heavier ribeyes in the 7-rib rack than those of the Prime and Y grades. Cut-out data (U.S.-style cutting) for the leg, loin, rack, shoulder, breast plus flank, and neck did not differ between grades in analyses using carcass weight as a covariate.

The data of Kemp and Barton (1966) were re-analysed on the basis of the New Zealand lamb carcasses being graded to U.S. standards (Kemp and Barton, 1969). In general, the composition of the carcasses in each of the U.S. grades (Prime, Choice, Good and Utility) was similar to that of carcasses of comparable type produced in the United States. The calculated composition of the carcasses showed that the mean percentages of fat, muscle and bone for each of these grades were: Prime, 35.1, 51.7, 21.1; Choice, 31.0, 53.9, 14.5; Good, 25.1, 57.7, 16.1; Utility, 20.7, 59.3 and 18.3.

The Physical Composition of Beef Carcasses in Various Grades

Beef carcasses of various grades have been compared by Barton (1972) and by Barton and Armstrong (1974). They found that the steer carcasses in the GAQ and Chiller grades had more subcutaneous fat, larger ribeye areas, proportionally more excess fat, slightly more trimmed boneless meat and less bone than those in the FAQ, YAQ, Boner or Manufacturing grades. Breed differences in grade attainments of beef carcasses have also been noted in a series of trials involving a number of breeds and breed crosses e.g., Barton (1975), Bass *et al.* (1975), Bass *et al.* (1976).

It should be mentioned that although grades for lamb, mutton, and beef carcasses have been changed since most of the investigations reviewed in this paper were made, the findings have general relevance. The type of carcass analysed when each project was undertaken, is still present among the current grades. The proportion in any one grade, of a particular type of carcass, has been varied by merely altering the boundaries between the grades.

Carcass Grade as a Trait

A number of lamb studies, apart from those already cited, have included carcass grade as one of the traits assessed, but not all of these can be referred to here because of space restrictions. The first large-scale experiment that used carcass grade in this way was that of Clarke *et al.* (1953) who over 7 years collected information on 889 Southdown-Romney cross lambs and their carcasses. The lambs were slaughtered as each animal reached a live weight of approximately 32 kg. Data from the first 2 years of that experiment have been analysed further than was the case in the initial report. It was found that lambs whose carcasses were graded Prime Down Cross had significantly heavier omental fat, lighter kidneys, lighter empty stomach and lighter lungs, head and left metacarpal bone than lambs whose carcasses were graded Prime Crossbred or Y grade (R. A. Barton., unpublished). The Prime Down Cross carcasses had shorter measurements of the leg, forearm, and body, were wider in the rib cage and forequarter, but shallower in the thorax. Fat-depth measurements were greater in the Prime Down Cross carcasses and the cross-sectional length of the *longissimus dorsi* muscle at the 12th rib was shorter than that of the carcasses of the other 2 grades.

A small sample of Omega grade lamb carcasses was compared with Prime grade carcasses by Kirton (1971). The 6 Omega grade carcasses of a mean weight of 14.1 kg were 34 mm longer in the tibia bone and their chemical fat percentage was 3.7 higher than the 15 Prime grade carcasses (mean weight 13.9 kg) with which they were compared. The cross-sectional width and depth of the *longissimus dorsi* muscle of

the Omega carcasses were 4.1 mm and 4.0 mm less wide and less deep respectively, compared with the same measurements taken on the Prime carcasses. The Omega carcasses were therefore, fatter, longer in the leg, and their muscle development was poorer than the Prime grade carcasses.

Breed and sex differences in grade have been demonstrated in a number of studies already referred to by Kirton *et al.* (1967), Kirton and Pickering (1967) and Barton and Purchas (1974). The progeny of contrasting types of Southdown rams have been shown to differ in their carcass grades (Barton *et al.*, 1949; Barton and Phillips, 1950). These findings are of importance relative to recent changes in type of Southdown sheep (Barton, 1981). Similarly different types of Romney ewes mated to Southdown rams produced offspring whose carcasses differed in grade (McMeekan and Walker, 1951).

The heritability estimate of carcass grade for Romney wether lambs has been found to be very low.

Selection for carcass grade *per se* is unlikely to be used as a criterion in breed improvement; rather emphasis should be placed on fat status, muscling and various dimensions of the body in an effort to enhance the acceptability of the carcass and its cuts. Concomitant changes in grade attainments should follow from selection for improvement in a number of the key characteristics of the carcass. In addition, it would be unwise to place selection pressure on carcass grade since grade standards can be changed arbitrarily whereas fat levels in carcasses, for example, often need to be reduced. Improved thickness of the musculature, provided this is not negatively related to other important attributes of the carcass, similarly should be emphasised in the improvement of most meat animals.

The Need for Objectivity in Grading or Classifying Carcasses

It is unlikely that subjective grading as currently practised in New Zealand will, in the reasonably near future, become entirely objective in operation. A great deal of investigation and developmental work needs to be done before this utopian situation is reached. This would involve a more precise understanding of market requirements in major outlets and the development of equipment to instantly measure and record the principal features of each carcass that are known to be important in most markets. This goal will be reached eventually and its attainment will be determined largely by the order of priority accorded to it.

The level of sophistication required in grading needs also to be studied, especially from the standpoint of the retailer and ultimate consumer. It must be orientated to the requirements of the marketplace or grading has no meaning and grade standards should not be set entirely in relation to

what is sent to slaughter. On the contrary, grade standards should provide the targets to which meat producers should aim if they are to satisfy the needs of markets and maximise their profits. They must, however, be fully rewarded if they produce superior carcasses. For this to be achieved, grades must be set in tune with market realisations. A carcass classification scheme, on the other hand, does not need to relate in any way to market financial returns. Nevertheless each of the factors taken into account in classifying carcasses must, in some way, be individually associated with requirements of perhaps the majority of consumers in any one market.

At the threshold of the next century of meat exporting, New Zealand is well placed to bring about changes in any aspect of meat production, processing, or marketing. It has a large body of practical and scientific knowledge and skill to call upon so that changes in any facet of the industry can be quite rapidly made provided people, the biology of meat animals, the environment in which they live, and the need for monetary profit are each taken into account. Carcass grading, or carcass classification, or some procedure not even dreamt of, can be developed to meet these often conflicting elements. That there will be changes in grades, and most other aspects of the meat industry, is inevitable and these should be welcomed if they bring real progress.

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