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PROGRESS REPORT ON THE DEVELOPMENT OF
CARCASE CLASSIFICATION SYSTEMS IN GREAT BRITAIN

by
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The Meat and Livestock Commission was formed by Act of Parliament in 1967 and came into operation the following year, financed by a levy on the industry. Its prime objective is to promote greater efficiency in the meat and livestock industries. One of the main ways of doing this is through the provision of standard methods of describing or classifying as fully as practicable those characteristics of a carcass which are the principal features of interest to those who trade in them, and for the marking of carcasses according to that description or classification.

It is important, particularly in Great Britain where trade requirements for carcasses are so diverse, to draw the distinction between classification and grading, as there is frequently confusion. Classification is intended to be purely descriptive of the important physical characteristics and does not impute generalised relative values to them such as occurs in grading. It is for the individual trader (whether wholesaler or retailer) to decide what is good (and, therefore, of highest value) and what is poor in relation to his own business; however, if he can describe his requirements in the terms of a generally accepted descriptive classification scheme, understanding will be increased and result in greater efficiency in trading. Additionally, it provides the mechanism for providing premiums and incentive payments to producers to encourage improvement in carcass traits, and a better matching of supply and demand.

The Commission formed an advisory committee of producer, wholesaler, retailer and consumer representatives to advise on classification schemes for cattle, sheep and pigs. It started by devising a scheme for pigs, since more was known about variations in carcass characteristics and methods of assessing these under abattoir conditions than for beef and sheep.

PIGS

Over the years various methods of assessing the merit of carcasses for different types of trade (fresh meat, bacon cured by various methods, manufacturing) have been established by traders and these were considered by the Commission's advisory committee on carcass classification.

The following components were among those considered for the scheme:

1. Carcass weight; 2. Sex; 3. Breed (or type as determined by an examination of the carcass); 4. Age (actual or subjectively determined by an examination of the carcass); 5. Fat depths, firmness and colour of fat; 6. Amount of internal (or flare) fat; 7. Thickness, colour and moistness of lean; 8. Length; 9. Thickness and width of belly; 10. Conformation of the hind leg and carcass; 11. Skin abnormalities.

On the basis of the advice given to it, the Commission decided that an acceptable classification scheme could be based on the following characteristics, and it was offered to the industry on a voluntary basis from March, 1971:

1. Cold carcass weight;
2. Back-fat thickness by one of two methods. Method 1 - back-fat thickness measured with an optical probe at 4½ cm (P₁) and 8 cm (P₂) from the mid-line of the back at the head of the last rib. Carcasses are described by the sum of the 2 measurements. Method 2 - an optical probe measurement of back-fat thickness taken at 6½ cm (P₂) from the mid-line at the head of the last rib together with measurements in the mid-line at the fattest part of the shoulder and at the minimum depth of fat over the m.gluteus medius. Carcasses are described by these 3 measurements individually; 4
3. Length at the option of the trader;

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4. A visual assessment which identifies certain extreme types of carcass which are classed as Z (covering carcasses falling into one or more of the following categories - scraggy, deformed, blemished, pigmented, coarse skinned, soft fat, pale muscle, partially condemned).

Carcass weight may vary from 27 to 100 kg, but traders tend to confine themselves to one weight range which they deem to be suitable to their cutting technique and clientele. Within a weight range, fatness is the characteristic of greatest importance in affecting profitability. As noted above, the MLC is offering 2 methods of fat measurement, one involving 2 optical probe measurements which can be applied to split or unsplit carcasses, and the second which can be applied only to split carcasses involving a single probe measurement supplemented by a measurement in the mid-line at the shoulder and loin. Evidence collected by the Pig Industry Development Authority and the MLC on pigs covering common commercial weight ranges which have been measured and then dissected, has shown that mid-line fat measurements are less well related than fat measurements over the m. longissimus dorsi (eye muscle) to, for example, the fat content of the back and of the overall carcass and, since there is relatively little variation in bone content, lean content. However, within the bacon curing industry there is still a widely held belief about the value of shoulder and loin fat measurements and, while it remains, a classification scheme must allow for these measurements. So far as the choice of sites for optical probe readings is concerned, the evidence is that in terms of predicting characteristics like overall leanness, the region of the last rib is about as good as any other site and that there is no justification for varying the probing distances from the mid-line according to the weight of carcass. Given fat measurements, knowledge of the sex of a carcass is of no importance in estimating fatness or leanness.

Side length can be provided in the classification scheme if a trader so wishes. In the past, considerable emphasis was placed on the length measurement, but in studies involving varying types of pigs it became clear that amongst carcasses of given weight and fatness the longer carcass did not, for example, have more lean overall or more of its lean in the back. The length measurement is now generally confined to pigs sent to traditional Wiltshire bacon curing factories and here its importance has been reduced so that now there is only a minimum length requirement of 775 mm in carcasses of about 70 kg.

In the classification scheme carcass conformation is currently given little emphasis. Only carcasses with extremely poor conformation are distinguished whereas many traditional traders would like to see it play a more important role in classification. Indeed, some traders using the classification as the basis for buying are incorporating their own conformation assessment into a "Q" grade. They believe that good conformation carcasses have a higher proportion of the high priced cuts and a greater proportion of the total lean within them than do poorer conformation carcasses. Since the MLC is required to devise classification schemes for describing the features of interest to those who trade in carcasses, it has agreed to examine further, in the first year of operation, the need to distinguish carcasses of different conformation and, if necessary, introduce a way of classifying for conformation. The introduction of uniform classes for conformation would enable the industry to discover the extent to which traders consider it important among carcasses of the same weight and fatness.

Conformation, which is taken to be the thickness of lean plus fat in relation to the size of the skeleton, is the result of many factors. There is a trend for better conformation carcasses to be shorter and to have a greater thickness of flesh. When cuts are sold with the bone in this could help to make them more attractive and, though there is no clear experimental evidence, perhaps reduce cooking losses and allow them to be carved more easily. The possibility of measuring the thickness of lean directly in the area of the last rib has been investigated but no accurate method of doing so has yet been found.

Some evidence which shows the relative importance of fatness and conformation is given in the following table: It shows the results of some cutting tests on a balanced sample of 80 commercial carcasses, with about ten at each of two weights, at each of two

fatness levels and with either good or poor conformation.

	Effect of weight		Effect of $P_1 + P_3$		Effect of conformation	
	45 kg	60 kg	Low probe	High probe	Good conformation	Poor conformation
On cutting the carcasses, the retailer would have found -						
Fat measurements (mm $P_1 + P_3$)	32	38	29	41.5	35.5	34
Yield of high-priced cuts (%)	52.0	51.8	51.1	52.5	53.4	52.0
Fat trim (%)	5.7	7.7	4.6	8.8	6.8	6.7
Eye muscle area (sq cm)	22.7	28.7	26.7	25.0	26.6	24.7
On purchasing the trimmed cuts, the consumer would have found the following % fat remaining in the						
Loin	25.3	25.6	24.0	27.0	24.3	26.3
Ham	18.6	19.9	17.8	21.0	19.6	19.1

The two major factors in classification - weight and fat thickness - are seen to have an impact on retail fat trim (subcutaneous fat on major cuts reduced to a minimum of 10 mm) and the fat remaining in the high priced cuts (loin and ham) after trimming was also greater in the carcasses with the higher fat measurements. Eye muscle area was slightly smaller on average in the fatter group. The comparison of carcasses of good and poor conformation (but with similar weight and fatness) showed a slight advantage in favour of the former in terms of yield of high priced cuts and eye muscle area.

The reason why traders' beliefs in the importance of conformation are not confirmed by such tests is probably that in the commercial situation traders find it difficult to make comparisons at constant weight and fatness. At constant weight only, better conformation carcasses tend to be fatter.

Some account is taken of the quality of meat in the classification scheme. However, in the absence of objective measurement techniques which can be applied under factory slaughter-line conditions, the subjective assessment is intended only to pick out extreme characteristics. It is hoped that instrumental methods of assessing, for example, muscle colour by simple probing of the intact carcass will be developed soon.

Since the scheme was announced, there has been an enthusiastic response from the trade. As hoped, many of them are using the classification information as a basis for their contracts. At the time of writing, some 250 wholesalers (including bacon factories) have applied for the service out of about 1000 possible wholesalers. However, they cover about 60% of all pigs in Great Britain which are presented for deadweight certification under the Government's Fatstock Guarantee Scheme. Although the principles were widely understood and, in certain sectors of the industry, in use on an individual abattoir basis, the introduction of the scheme has achieved wider adoption and more uniform definition and application.

BEEF

A beef carcass classification scheme is now being devised. It must fit in with existing trade practices since there would be little hope of acceptance of any voluntary scheme, however desirable in theory, if it demanded much change in current practice. For example, it is not general trade practice to quarter (or even partially quarter) sides of beef at any fixed time post-slaughter; in fact, it is usual to quarter sides (at a variety of positions) only immediately before despatch and after personal inspection by buyers should

they visit the abattoir. Similarly, there is no guarantee that sides would now always be available for inspection 24 hours after slaughter and where they were they could be packed tightly in cold rooms. For these reasons it is considered that, for the moment, the basic classification scheme can only involve an inspection or measurement of the hot carcass sides as they hang in the abattoir. However, it is recognized that this is likely to lead to less precise classification than would inspection of the cold quartered side for the following reasons:

- (a) the quartered side allows an appraisal of the fat thickness over the eye muscle, which would improve the assessment of the general level of fatness of the carcass;
- (b) it allows an appraisal of the eye muscle area which is a characteristic important in its own right, although not too closely related to the lean meat content of the whole carcass;
- (c) it allows a better appreciation of the colour, moistness and texture of the lean meat and the degree of marbling in it than can be achieved from an intact side; in particular it is not always possible to detect extreme dark-cutters as intact sides.

Given, then, that the basic classification is confined to intact sides, one is left with the following observable factors which are indicative of traders' requirements:

- (a) Weight; (b) Age (Maturity); (c) Sex; (d) General level of fatness; (e) Conformation;
- (f) Colour of fat and (g) Colour and texture of lean.

(a) Weight

Unlike some European countries, meat traders in Great Britain have generally tighter carcass weight requirements, and producers are penalised if the carcass is above or below a certain weight range. For classification purposes, it may be sufficient to classify sides into approximately 10 kg weight ranges to assist in distribution.

(b) Age

What is required is an indication of the stage of maturity of the animal. Consideration has been given to assessing maturity at slaughter by either dentition or by an examination of the degree of bone development or by a combination of both. On balance, dentition is favoured with separate categories for calf teeth, 2 permanent incisors (2 PI), 4 PI, 6 PI, 8 PI and 8 worn permanent incisors.

An objection to using dentition as an indicator of age is that the time of eruption is known to vary a good deal and to be influenced by nutrition. However, the quality factors of which age is in an index are related more to physiological than to chronological age so that the state of the teeth (or bones) may be a better indicator of quality than actual days of age. No evidence has been seen which shows that the stage of cartilage and bone development is a better way of assessing relative maturity than teeth development. It is considered that more work should be done to examine the relationships between chronological age, teeth development, bone development and eating characteristics of animals on different nutritional regimes.

(c) Sex

Many of the differences between the carcasses of steers, heifers, bulls and cows are adequately described by other characteristics, particularly maturity, fatness and conformation. There are, however, some exceptions such as the development of shoulder muscles in bulls beyond 18 months of age and of the fat depots typical of each sex, the cod or udder fat. There are already definitions of sex classes being used for the Fatstock Guarantee Scheme and, while it lasts, it would be difficult to operate other definitions.

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(d) General level of fatness

This is of major importance in a beef carcass classification scheme since it influences the characteristics of the meat and the amount of waste in the form of fat trim.

The following five components of fatness are important:

- (i) Kidney knob and channel fat;
- (ii) Intermuscular fat;
- (iii) Subcutaneous fat;
- (iv) The distribution of subcutaneous fat over the carcass and, in particular in fairly well finished carcasses by British standards (that is over-finished by most European standards), the degree of "patchiness"; in practice patchy subcutaneous fat is frequently trimmed off the hot carcass to improve presentation;
- (v) Intramuscular fat.

All these components are inter-related, but variations from the norm occur and are important to traders. In particular, the development of (i) above in relation to other depots varies with age and breed and variations in the yield of this depot have been shown to be a major factor influencing retail value. The process of classification would, therefore, be much simplified if kidney knob and channel fat were removed hot, but since it would involve an alteration to the Fatstock Guarantee Scheme and there is still some trade opposition to it, the change cannot be effected quickly.

The intermuscular and intramuscular fat depots are largely invisible in the intact side and are not capable of easy direct measurement or assessment, although the fat development over and between the ribs may be some help. If one leaves aside the problem of the kidney knob and channel fat, it is thus a question of assessing the general level of fatness by inspection or measurement of subcutaneous fat. To assist in the subjective assessment of the proportion of subcutaneous fat, a 7 point photographic scale has been produced by the Meat Research Institute. The definition of fat classes in terms of the proportion of fat is favoured, particularly in the subjective assessment over carcasses of varying weight. The scale starts at 1 which represents 3.5% subcutaneous fat in the side (excluding kidney knob and channel fat) and increases by steps of 2% to 15.5% subcutaneous fat. The scale enables judges to be more consistent in their assessments between and within judging sessions, and it should be particularly useful if used in classification where it will be important to maintain standards amongst a large number of classifiers. With training in the use of the scale it has been found that most judges are capable of assessing the proportion of subcutaneous fat to within $\pm 2\%$ of the actual. On present evidence, this is rather better than can be achieved by probing for the depth of subcutaneous fat over the eye muscle on the intact side, but the exploration will continue for objective measurements of fatness suitable for application under abattoir conditions.

(e) Conformation

Among carcasses of the same weight and fatness, significant variations occur in the conformation or thickness of lean plus fat in relation to bone. There is a clear need to separate carcasses of the same weight and fatness into a number of classes and the current view is that 5 classes may be necessary for steers, heifers and bulls. Three classes are likely to be needed for cows to distinguish those suitable for manufacturing and those suitable for sale in the form of retail cuts. Currently, subjective judgements of conformation are being tried but the possibility of assessing this characteristic by measurement is also being explored. At given weight and fatness, a better conformation carcass will tend to be shorter and deeper.

(f) Colour of fat

This can be assessed subjectively as yellow, creamy or white. No doubt finer distinctions could be drawn at any time or place by individual classifiers, but this would be neither suitable for application in a national scheme nor of much

value to traders. The latter are generally more concerned to avoid excessively yellow carcasses at all times and to avoid the display of creamy side-by-side with white fat at certain times. It is considered that there is a need to survey variations in fat colour through the year and to investigate objective methods of measurement for definition, standardization and training purposes.

(g) Colour and texture of lean

This is determined to a degree by sex and age, which are dealt with separately. It is not considered that fine distinctions in the quality of lean meat, or even detection of dark cutters, can be made with sufficient confidence without quartering; thus it is not thought that these characteristics can be included specifically in classification at this stage.

The stage has now been reached when a possible beef classification scheme is being pilot tested in 5 co-operating abattoirs in different parts of the country. Most of the throughput of cattle at these abattoirs is being classified in terms of weight, maturity, sex, subcutaneous fat and conformation. The weight of the kidney knob and channel fat is also being estimated. From this test information will be obtained on variations in the carcass characteristics of cattle passing through each abattoir. It will be possible to look at, for example, the relationships between weight and maturity, weight and fatness, fatness and conformation within sex categories within and over all abattoirs. Wholesalers are receiving the data and will be able to comment on the usefulness of the suggested classification for their particular trade. It will be important to know how easily the information may be utilized in devising their buying and/or selling grades.

In the near future, it is hoped to extend the pilot test to wholesalers in areas of the country not presently represented. This will provide information on variations in a wider cross-section of cattle and on the reaction of other wholesalers to the scheme. Given general acceptance of the pilot scheme by the co-operating wholesalers, demonstrations will be given to all sections of the trade in different parts of the country with a view to launching a formal scheme sometime in 1972.

SHEEP

Information on variations in sheep carcasses is being accumulated and ways are being explored of describing these variations simply for use in a classification scheme. It is considered that the trader buying carcasses needs to know:

- (a) the general condition of the carcass;
- (b) the nature of the flesh from two points of view - the visual appeal of the meat in terms of colour, fatness, texture, etc., and the likely eating characteristics of the meat;
- (c) the size and neatness of the joints he may reasonably be able to cut from the carcass, and
- (d) the degree of finish, the proportion of high and low priced retail cuts and the amount of waste (essentially fat trimmings) that will be left.

As far as possible, classification of sheep should be fitted in with variations in trade practice although some methods of dressing carcasses obscure certain essential features and make descriptive classification in a standard manner extremely difficult. For example, to enhance the conformation of the shoulder the fore legs are often skewered to the thorax or tied up towards the neck and at certain times of the year, in some parts of the country, lambs have their ribs broken back and skewered and the caul fat wrapped round the hind leg.

It is thought that the varying types of sheep carcasses produced and marketed in Great Britain can be described adequately by a classification scheme involving category (age/sex groups), weight, the general level of fatness of the carcass, conformation and, in extreme cases only, colour of fat.

Category

A classification scheme devised now must take into account the distinctions built into the Fatstock Guarantee Scheme. Substantially different definitions for lambs, hoggets, and older animals to those now prevailing in this scheme would be impossible to use, leading to two descriptions of the same animal. If and when the Fatstock Guarantee Scheme were phased out then the whole situation could be re-appraised. Meanwhile it is considered that the categories could be:

- (a) Lambs (to include castrated males and uncastrated males not showing ram characteristics in the carcass and ewe lambs) with the proviso that some consideration should be given to the need to differentiate milk lambs (and possibly intensively-fed lambs);
- (b) Hoggets, to include all other clean sheep;
- (c) Rams, being all males of whatever age showing definite ram characteristics in the carcass, and
- (d) Ewes, being all females that are or have been pregnant as evidenced by pronounced effects on the carcass.

Fatness

The evidence collected so far indicates that there is a close relationship between subcutaneous fat and total fat, and this suggests that classification by the level of subcutaneous fat would provide an adequate description of total fat in the carcass. It is now in progress to assess the ability of classifiers to estimate subjectively, with the aid of a photographic scale, the proportion of subcutaneous fat in the intact carcass. Using trained judges, present evidence is that this can be done sufficiently accurately for classification purposes. While the possibility of measuring fat thickness is being explored, it seems likely that because of the relative thinness and uneven distribution of subcutaneous fat, it will be a less satisfactory basis for classification of fatness than subjective judgements by trained classifiers. The possibility is being investigated of modifying the fatness class according to the amount of kidney knob and channel fat present.

Conformation

As with other species, there is a need to discriminate for conformation amongst carcasses of the same weight and fatness. In trial work so far conformation judgements have been made on a 7 point scale, but for classification purposes this will have to be reduced to, perhaps, 5 or even 3 classes.

To obtain evidence to assist in devising a possible scheme, a wide range of breeds and crosses has been examined in connection with sheep improvement work, but the whole spectrum of British breeds and crosses has not yet been included. It is now intended to remedy this by examining in some detail the carcasses of lambs marketed through the year to test out the basic fatness classification over lamb types which may well vary quite considerably in the distribution of fat through the carcass. It is also hoped to discover the extent of the conformation scale necessary to classify lambs of markedly different types. A simple classification of conformation into good, average and poor may be inadequate to deal with type variations as seen by the meat trade.