THE RELATIONSHIP OF SOME OBJECTIVE AND SUBJECTIVE MEASUREMENTS TO BEEF CARCASS CUTABILITY

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MICHAEL E. DIKEMAN

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ABSTRACT

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by Michael E. Dikeman

The right side of 120 steer carcasses of the three major British beef breeds were selected for chilled carcass weight and 12th rib fat thickness (average of three measurements). Sixty carcasses were selected within each of two weight ranges (light, 500 to 550 lb. and heavy, 700 to 750 lb.). The two weight ranges were further subdivided into four fat thickness groups; 0.26 to 0.50 in., 0.51 to 0.75 in., 0.76 to 1.00 in. and 1.01 to 1.25 in. with 15 carcasses selected within each group. In addition, 15 Holstein carcasses were selected within the 0.26 to 0.50 in. fat thickness group and 700 to 750 lb. weight range for comparison to the British breeds. All carcasses were subjectively scored for each grade factor and carcass length, round length and circumference, brisket depth and 1. dorsi muscle area were measured. Subcutaneous fat thickness probes were made 4, 8 and 12 in. from the dorsal midline perpendicular to the anterior edge of the 5th, 8th and 11th thoracic vertebrae, the 1st, 4th and 6th lumbar vertebrae and the 3rd and 5th sacral vertebrae.

Boneless, closely trimmed (approximately 0.3 in.) retail cuts were made by wholesale cut. The roasts and steaks from each of the four major wholesale cuts were weighed separately from the total retail cuts.

Carcass weight and fat thickness significantly ($P < .01$) affected weight and percent retail and fat trim yields. Fat thickness also significantly ($P < .01$) affected both weight and percent bone yield but

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carcass weight significantly affected only weight of bone. Percent retail and fat trim yields were significantly ($P < .01$) affected by carcass weight and fat thickness interaction.

Retail yield from the round, loin, rib and chuck (RLRC), roasts and steaks from the RLRC, and total carcass retail yield were highly correlated with each other (ranges, 0.96 to 1.00 and 0.96 to 0.99 for weight and percent, respectively). Retail yields were negatively correlated ($P < .01$) with fat trim yields within weight groups but in the combined weight group the correlations for weights of these components were low.

Subjective carcass conformation and grade scores were poorly correlated with carcass retail yields. Fat measurements B and C (12th rib) and the average of fat measurements A, B and C were highly related to retail and fat trim yields. Brisket depth was also significantly ($P < .01$) correlated with fat trim.

Of the wholesale cuts the retail yield of the round was consistently the most highly related to carcass retail yields (range, 0.91 to 0.97). The chuck retail yield was nearly as highly related to total carcass retail yield. Fat trim from the wholesale flank was the most highly related to total carcass fat trim (range, 0.78 to 0.95) while correlations of retail yield from the flank with carcass retail yields were much lower than those of the round or chuck. Since round fat trim was also highly correlated ($P < .01$) with carcass fat trim, this wholesale cut would be very useful for predictive purposes.

The relationship of predicted carcass retail yields from several existing regression equations to actual retail yields were more accurate

within the light weight than the heavy weight group. An equation by Murphey accounted for 67% to 85% of the variation in actual retail yields within weight groups and was consistently the most accurate equation. An equation by Breidenstein accounted for 64% to 79% while an equation by Brungardt and Bray accounted for 56% to 83% of the variation in actual retail yields. Several equations developed by Allen accounted for only approximately 50% of the variation in actual percent retail yields.

The affect of beef type (Holstein versus the three major British beef breeds) upon retail, fat trim and bone yields showed that the light weight group of British breeds had significantly ($P < .01$) greater percentages of retail yield than the Holstein carcasses, but the differences in retail yields between the Holsteins and heavy weight group of British breeds were nonsignificant.

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by

Michael E. Dikeman

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INTRODUCTION

The efficiency of domestic animals in converting plant nutrients to meat proteins is being challenged by scientists and segments of the food industry. Synthetic products pose a threat as a substitute for meat since a unit of these proteins can be produced more efficiently than meat proteins, and furthermore, product composition can be more accurately controlled.

Present consumer demand indicates that Americans select meat for maximum quantity of muscle with a minimum amount of fat and/or bone. In turn the retailer reflects consumer demand for well muscled, trim retail cuts in his purchase of carcasses and/or wholesale cuts. Overfat and light muscled cattle are inefficient in this respect; however, the affect of the latter trait upon retail yield or carcass composition has has not been thoroughly elucidated.

The beef carcass commensurate with present consumer demands should have at least minimum U. S. Choice quality, external fat thickness between 0.25 and 0.5 in. and yield a minumum of 65% boneless closely trimmed retail cuts. Cattle that meet the above specifications exist, but many carcasses have excess fat or deficient muscling and combinations of these two factors. It is anticipated that when practical objective measures become available, they would also provide more objective criteria for selection of breeding stock to improve the cutability of beef cattle.

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The qualitative factors of the present U. S. Department of Agriculture beef grading standards are more widely used throughout the industry than those for evaluating the quantitative differences in beef carcasses. The retail yield grade is an optional feature in the present beef grading specifications.

Physical separation and chemical analyses provide the most accurate methods, to date, for measuring carcass quantitative differences. However, these methods necessitate destruction of at least a portion of the carcass. In addition, these methods generally have no practical application to selection in live animals.

Various objective and subjective factors and combinations of these two criteria are used to evaluate quantitative differences and/or value. These methods are generally non-destructive but none accurately measures these differences. Value differences as great as $10.00 per hundredweight are commonly encountered within the same carcass grade. Composition studies have consistently shown that degree of fatness has a marked effect on carcass retail yield. Yet fat thickness measured at the 12th rib, as is commonly done, accounts for only about 40% of the variation in total carcass fat. The area of the l. dorsi muscle is also commonly measured but again accounts for less than 40% of the variation in boneless retail yield.

Thus, this study was designed to determine the relationship of objective measurements to retail yield. The effects of carcass weight, 12th rib fat thickness and the interaction of these two criteria upon retail yield were studied. Conformation was scored with a conscious

effort to evaluate degree of muscling irrespective of quantity of fat and the relationship of conformation to retail yield and quantity of roast and steaks was studied. The effect of conformation upon retail yield and quantity of roast and steaks was also observed between carcasses of three British beef breeds and the Holstein-Friesian breed for carcasses of approximately the same degree of fatness and carcass weight. In addition the experiment was designed to study the variation in actual boneless trimmed retail yield among steer carcasses of approximately the same weight and degree of fatness from several existing regression equations.

REVIEW OF LITERATURE

Growth and Development

Animals change form (composition) during growth and development. Although the nature of such growth and development processes cannot be clearly distinguished from each other, nor adequately defined, these phenomena are the most important processes in animal agriculture and consist of more than a simple increase in size or weight.

Growth has been defined in many ways. Maynard and Loosli (1962) maintained that "true" growth involves an increase in the structural tissues (muscle, bone and organs) and should be distinguished from the increase that results from fat deposition in the reserve tissues. Brody (1945) defined growth as the production of new biochemical units brought about by cell division, cell enlargement or the incorporation of materials from the environment. Hammond (1952) indicated that growth is an increase in weight until a mature size is reached.

Development has been defined as changes in body shape and/or conformation until the body structure and its various facilities come into being (Hammond, 1952).

Some researchers, therefore, define growth to include development, whereas others use the term "development" to include both growth and development. The distinction between growth and fattening is an arbitrary one and therefore the deposition of fat is usually considered as part of growth. Brody (1945) stated that the deposition of fat should

not be considered as "true" growth, yet from the standpoint of quantitative measurement of growth, one must consider fat as part of the growth process.

According to Brody (1945), the shape of the growth curve is similar in all species. Hammond (1960) reported that the order in which the various parts and tissues develop is much the same in all species, as it is based on the relative importance of the functions of the parts or tissues for survival of the animal.

Luitingh (1962) studied developmental changes in beef steers based on slaughter data from control and fattened groups of steers of different ages. He found that developmental patterns within age groups were similar. The shoulder constituted the slowest growing part in every age group followed (in ascending order) by the round, chuck, loin, plate, neck, brisket and finally by the fat depots, flank, cod and kidney fat. There was a decline in percent hindquarter with increasing age. He also stated that the loin was not the latest developing part in the older groups of steers.

Luitingh (1962) reported that fat deposition is a function of age and physiological maturity. When beef steers are fattened, the most rapid weight gain takes place in those parts of the animal body which command the lowest price and least demand. The proportion of dorsal parts was higher in unfattened steers of every age group. The parts where fat is deposited, kidney and pelvic fat, flank and cod, brisket, plate and neck formed a significantly ($P < .01$) larger percent of fattened than unfattened steers. The round and chuck formed a significantly lower percentage ($P < .01$) of fattened than unfattened steers.

Bone

Bone completes a greater portion of its growth early in post-natal life (Palsson and Verges, 1952) and the ribs are apparently the latest developing bones of the body. Luitingh (1962) also indicated that the rib bones represent the latest maturing bones in the body. Cuthbertson and Pomeroy (1962) reported that the bones of lighter weight swine carcasses grew relatively more in length than in thickness, and changes in the bone of heavier carcasses was characterized by thickening and ossification. Tulloh (1963) presented data to suggest that there is a constant differential growth ratio between weight of carcass bone and empty body weight. The slopes of the lines of a logarithmic plot are all similar and range between 0.7 and 0.8 and, being less than 1.0, indicate that the percentage of bone decreases as body weight increases.

Muscle

Muscle by weight is the major body tissue. Post-natal increase in size results from cell hypertrophy (Joubert, 1956a). Hammond (1960) reported that while an increase in post-natal weight of muscle is by muscle fiber diameter, the maximum adult size of the animal has been fixed at birth since differences in size between breeds within a species are due to differences in muscle cell number and not to cell size. The limit to muscle cell size cannot be exceeded by a high plane of nutrition. However, hexoestrol implantation of steers was shown to increase muscle fiber diameter (Everitt and Carter, 1961).

Joubert (1956a) reported muscle fiber diameter was more closely correlated with muscle weight (0.86) than age of animal (0.75), live weight (0.83) or carcass weight (0.76).

Significant differences in 1. dorsi muscle cell size were found among animals of the same weight and grade (Joubert, 1956a). He also reported that width of this muscle is earlier maturing than depth and the depth responded more to level of nutrition. Luitingh (1962) reported that the 1. dorsi muscle was later maturing (both depth and width) in the 12 to 13th rib and 8 to 11th rib section than in the anterior thoracic region. Width of the 1. dorsi muscle increased more in calves than in 2 or 3 year old steers and was less in 3 year old steers than in 2 year old steers. However, the depth of the 1. dorsi muscle increased more in 2 year old steers followed by calves. The increase in area of the 1. dorsi muscle in the 2 year olds was attributed to increased muscle depth.

After maximum development of specific muscles has been attained, additional gain in weight must, therefore, be due to fat deposition.

Fat

The extent and distribution of fat plays an important role in the composition of the meat animal and subsequent carcass. The major change in composition of the animal body depends on the level of fatness (Callow, 1948). Fat depots appear in young animals around the viscera and kidney, and with increasing age and adequate caloric intake between the muscles (intermuscular fat), beneath the skin (subcutaneous fat), and lastly in the form of marbling (intramuscular fat) (Callow, 1948).

Methods to Evaluate Growth, Development and Subsequent Carcass Composition

Live weight gain

Most beef cattle experiments use some measure of growth, but live weight is unequivocally the most widely used. Growth as measured by weight can be expressed in one of several ways. The most common procedure is the absolute gain in weight per unit of time. However, this method gives no indications of the changes occurring in body or carcass composition. It is generally thought that animals with a higher daily gain will have more muscle than slow gaining cattle. Hedrick et al. (1963) reported a significant correlation coefficient (0.41) between daily gain and trimmed primal cuts among Hereford steers slaughtered at a constant weight. A correlation coefficient of -.26 was obtained between fat thickness and daily gain suggesting that faster growing cattle, when fed to a constant weight, have more lean and less fat.

When cattle are fed for a standard period of time, there is an inverse relationship between daily gain and muscle development (Rollins, 1962). Fattening is a function of a physiological age-weight relationship (Luitingh, 1962) and not of chronological age. Therefore, faster gaining animals (cattle of the three British breeds), fed the same period of time as slow gaining animals, will deposit a greater amount of fat, which when expressed on a part-to-whole relationship will show a positive correlation to rate of gain.

Tulloh (1963) reported that the relation between each of the three body components (muscle, fat and bone) and empty body weight can be

described by linear regression equations using logarithnic values for the variables. Carcass composition appeared to be primarily dependent on body weight and largely independent of age and nutritional history. The differential growth ratios in these equations indicated that as empty body weight increased, the weight of each of the dissected carcass components also increased. In addition, the proportion of carcass bone decreased, proportion of fat increased, and muscle remained almost constant.

Use of relative growth rate and instantaneous growth rate was described by Brody (1945) and suggested as an alternative to average daily gain. Apparently neither of these methods has found widespread use in the meat industry since very little mention is made of them in literature.

Live subjective appraisal

Subjective measures or appraisal are used when beef cattle are sold alive to estimate the expected quantitative and qualitative characteristics of the carcass. Obviously, live weight is also important in considering the value of a beef animal. Gregory et al. (1966) indicated that trained personnel can estimate group means for cutability of live cattle more accurately than for qualitative differences. Live estimated cutability accounted for approximately one-half of the variation in actual cutability of groups of cattle determined by a regression equation using carcass weight, rib eye area, fat thickness at the 12th rib, and

estimated percent kidney knob. When individual cattle were evaluated, subjective measurements accounted for less of the variation (20 to 25%) in carcass traits. Stringer et al. (1963) indicated that estimates of retail yield in the live animal were associated with approximately 15% of the variation in actual retail yield. However, carcass estimates were associated with approximately 50% of the variation in actual retail yield.

These data suggest that the percentage of actual variation in retail cuts which can be accounted for by live estimation is not high. However, these estimates do appear at least as reliable, if not more so, as the traditional estimates of dressing percent and carcass grade.

Dressing percent

Dressing percent gives no indication of composition or quantity of edible or saleable portion. A higher dressing percent in most cases is associated with fatter animals whose carcasses will yield a lower percent of edible portion (Cole et al., 1960a). However, sex, breed, type, fill and individual variation influence this value (Lush, 1926). Thus, it appears that the only contribution of dressing percent to the beef industry is to the packer and only then when he is determining the margin he must receive between the price of live cattle and the price received for dressed beef.

Ultrasonics and live probe

Superior carcass composition among cattle that possess optimum growth potential should be the goal of the beef industry. A more accurate measure of the changes in composition associated with growth and development, and fattening than that of live weight gain would be an invaluable tool for the beef industry. Research conducted by Hedrick et al. (1963) and Brackelsberg (1967) suggest possible methods of measuring beef carcass composition at various intervals of the growth and development period. Hedrick et al. (1963) used an ultrasonic instrument to measure the l. dorsi muscle area of beef steers and bulls at various intervals prior to slaughter. The latter authors reported significant correlation coefficients ranging from 0.59 to 0.71 between estimated l. dorsi muscle area (5 months prior to slaughter) and actual muscle area in the carcass. Brown et al. (1964) and Davis et al. (1965) have also shown that the ultrasonic technique is a relatively accurate method for the determination of l. dorsi muscle area and fat thickness of cattle. Other muscles have also been as accurately measured by this technique as the l. dorsi muscle.

Brackelsberg (1967) used a probe to determine fatness of live animals. He made probes 5, 9 and 13 cm. lateral to the midline of the back at the 12 to 13th rib. He also probed 8 cm. lateral to the thoracic vertebrae at the posterior edge of the scapula, and in addition, lateral to the sacral vertebrae anterior to the os coxae. He used a 16 guage thermister needle probe and reported correlations between live probes

and carcass probes ranging from 0.21 to 0.90. However, the live probe had a correlation of 0.67 with percent carcass fat trim.

Biopsy

Biopsy techniques have been developed which facilitate the study of live body composition without sacrifice of the animal. Bray (1953) suggested that there were limitations to using this technique such as obtaining a representative sample of an individual muscle or of the entire animal. Also, some muscles cannot be used without affecting the normal function of the animal. Bray (1953) discussed the use of the biopsy technique for study of muscle fiber growth, muscle development and fat deposition.

Everitt and Carter (1961) used the biopsy method to determine muscle fiber changes in two and six year old steers as affected by hexestrol implants. They chose the semitendinosus muscle because it was of sufficient size to withstand sampling as well as being readily identified in the live animal. This muscle also is late developing (post-natal) and highly correlated with total muscle mass.

Specific gravity

Carcass density is determined by dividing the carcass weight in air by the total carcass volume. Since the density of fat is considerably less than that of other components (muscle and bone) of the carcass, fatter carcasses will have lower density. Estimation of volume can be made from the Archimedean principle which states that a body immersed

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in water loses weight by an amount equal to the displaced water. Carcass specific gravity then is the ratio of carcass density to the density of the water, at a specified temperature.

Garrett et al. (1959) used 20 sheep carcasses to determine the relationship between percent carcass fat and carcass specific gravity. Each carcass was ground and chemically analyzed for ether extract, moisture, nitrogen and ash. The correlation between the specific gravity and chemical fat analysis was -.90.

Kropf (1959) reported significant correlations between specific gravity measurements of the 9-10-11 rib section and separable components of the rib. Orme et al. (1958) found that specific gravity can be used as a measure of marbling in the l. dorsi muscle or wholesale rib. A correlation of -.81 between specific gravity of l. dorsi muscle of the 9-10-11 rib and percent fat was found. Bieber (1961) observed that specific gravity measurements could be used to estimate fat and muscle content of beef cuts or muscles, but not for ground beef because of incorporated air.

Iwanaga and Cobb (1963) reported that specific gravity of the carcass was highly correlated with yield of trimmed retail cuts (0.75).

Specific gravity has been used to measure the fatness of humans, but Pearson (1955) reported that trying to measure specific gravity of farm animals is cumbersome and controlling breathing is a problem.

Fat measurements

Most all research involving beef carcass composition or retail yield studies report that fat is the most variable component of the beef carcass. These reports clearly show that as fat thickness increased, the yield of separable muscle or retail cuts decreased. Gottsch et al. (1961) reported a correlation coefficient of -.91 between retail lean and fat trim of the carcass. Fat thickness is conventionally measured at the 12th rib and is usually an average of three measurements. However, recent work shows that one measurement taken over the l. dorsi three-fourths of the distance from the medial to lateral edges of the muscle is as reliable as the average of three measurements (Ramsey et al., 1962). Allen (1966) found that the fat measurements most highly related to percent separable components and retail yields were the single measurement at the 12th rib (three-fourths measurement); an average of three measurements over the l. dorsi muscle; and a fat probe 4 in. off the dorsal midline at the 5th thoracic vertebra.

Brungardt and Bray (1963a) found that body wall thickness (a measurement taken along the 12-13th rib separation at 7 1/2 in. laterally from the ventral end of the l. dorsi muscle) was negatively associated with percent retail cuts (-.64). This measures an area where excess fat is deposited.

Lewis et al. (1964) and Allen (1966) took numerous subcutaneous fat measurements at various locations on the carcass and reported that fat thickness measurements taken in the lumbar and thoracic area are more highly related to carcass composition than other fat measurements.

L. dorsi muscle area

A procedure for determining the L. dorsi muscle area was proposed by Mackintosh (1937). Measuring the area of the cross section of the L. dorsi muscle has been used as extensively as any measurement as an index of muscling in the carcass.

The area of this muscle has been reported to vary from right to left side. Hedrick et al. (1965) measured the right and left L. dorsi muscles from 295 steer carcasses ribbed in the conventional manner. The average area of the right muscle was significantly larger (0.65 sq. in.) than the left. However, in this same study, 47 steer carcasses were chilled unsplit. Intact shortloins and ribs were cut into steaks one-half vertebrae in thickness, beginning at the center of the 11th thoracic vertebrae and continuing in sequence to the juncture of the 13th thoracic and first lumbar vertebrae. Bilateral tracings were made of the L. dorsi muscle at 6 locations. There were no significant differences between right and left side in this study.

Several studies have been conducted to determine the relationship between L. dorsi muscle area and carcass lean, fat and bone. In a report by Cole et al. (1960a) the area of this muscle was associated with only 18% of the variation of separable lean of individual wholesale cuts. Similar results were shown by Gottsch et al. (1961) and Hedrick et al. (1963). Cole et al. (1962) found simple correlations of 0.58, 0.59, 0.39 and 0.63 between total separable lean and L. dorsi area at the 5th rib, 12th rib, last lumbar vertebrae and an average of the three

measurements, respectively. An average of the three area measurements multiplied by carcass length increased the accuracy of estimating separable lean (0.73). Cole et al. (1962) reported that there was a tendency for L. dorsi muscle area to decrease and total pounds of separable lean to increase as carcass length increased.

Muscle to bone relationships

Carcass composition has been determined by using muscle to bone relationships. Callow (1961) reported that the ratio of the weight of muscular tissue to the weight of bone in a carcass was a useful measure of carcass composition; a high ratio being more desirable than a low one. Good et al. (1961) reported significant correlations for circumference of cannon bone with muscling score (-.32), circumference of round (0.30) and L. dorsi muscle area (0.13). Miller et al. (1965) found that percent bone removed from the left side of the carcass was positively associated ($P < .01$) with yield of boneless and partially boneless retail cuts of the left and right side, respectively.

McMeekan (1940a) found a positive relationship between bone weight and weight of muscle. In a study by Cole et al. (1960a) the weight of separable carcass lean and separable bone was positively related (0.75). Orme et al. (1959) reported that the weight-length ratio, length and thickness of the fore or hind cannon bones of beef were significantly related to carcass lean.

Muscles and muscle groups

Butterfield (1963a) and Miller et al. (1965) reported significant relationships between several individual muscles and total carcass muscle. A correlation of approximately 0.90 was found between l. dorsi muscle weight and total carcass separable muscle. Butterfield (1963a) found a correlation coefficient between weight of the biceps femoris muscle and total carcass muscle of 0.96. Other researchers (Orme et al., 1960; Allen, 1966) have found similar highly significant correlations between weights of certain individual muscles and total carcass muscle.

Wholesale flank

In the report of Hankins and Howe (1946), data were presented which indicated the fatness of the flank was more highly related to fatness of the entire carcass (0.95) than that of the extensively used 9-10-11 rib section (0.93). Allen (1966) observed correlation coefficients of 0.91, 0.91 and 0.32 between percent separable muscle, fat and bone, respectively, from the wholesale cut flank and percent separable components of the entire carcass. When comparisons were made within weight and fat thickness groups, relationships were consistently higher for percent separable fat and muscle of the flank with the separable components of the carcass than similar comparisons for components of the round. In addition, the latter author found the correlations of the flank and 9-10-11 rib section with carcass separable components were essentially comparable.

Miller et al. (1965) reported that percent retail yield of the flank was significantly related to percent bnneless cuts (0.78) and percent partially boneless retail cuts (0.81) of the carcass. With carcasses of similar weight, the quantity of muscle in the flank is similar; however, since the flank is a fat depot, it is indicative of total fat in the carcass.

Wholesale round

Research reports to date consistently indicate that the trimmed round or boneless closely trimmed cuts from the round are highly related to the retail yield and separable muscle of the entire carcass. Cole et al. (1960a) reported that the separable muscle in the round was associated with 90% of the variation in total separable muscle in the carcass. Allen (1966) reported correlation coefficients of 0.83, 0.91 and 0.83 for percent separable muscle, fat and bone, respectively, of the round and percent of the corresponding separable components of the carcass. Brungardt and Bray (1963a) used percent trimmed round and a single 12th rib fat measurement and accounted for 81% of the variation in percent retail yield. Miller et al. (1965) observed that percent trimmed round was highly related to percent boneless (0.79) and partially boneless (0.84) retail yield of the primal cuts and percent boneless (0.80) and partially boneless (0.88) retail yield of the entire side.

Wholesale rib and rib cuts

The wholesale rib or its parts has been used more extensively than any other method to estimate composition of the entire carcass. Hankins and Howe (1946) analyzed data from steer and heifer carcasses and found that the physical components (muscle, fat and bone) of the 9-10-11 rib section were highly associated with the corresponding components of the carcass. Hopper (1944) earlier found similar results in his study. The correlations for heifers were not as high as those for the steer carcasses. This difference, according to Hankins and Howe (1946), raises some doubt as to the usefulness of applying the reported estimating equations to estimate fat or lean content of carcasses that differ in age, carcass weight, sex or nutritional treatment. The prediction equation of the 9-10-11 rib section has been used to estimate carcass composition of cattle from varied nutritional regimens as well as those of different types and breeds. Yet no additional work has been done since that reported by Hankins and Howe (1946) to compare the separable components of the 9-10-11 rib with separable components of the entire carcass from cattle of varying types, weights, ages, degrees of fatness and nutritional regimens.

Allen (1966) used two weight groups of steer carcasses (carcasses 500 to 550 lb. and 700 to 750 lb.) and related percent separable components of the 9-10-11 rib section with percent separable components of the carcass. The correlation coefficients were lower in the heavy weight group than the light weight group. The correlations for the

heavy group were 0.90, 0.91 and 0.75 for muscle, fat and bone, respectively, and 0.94, 0.95 and 0.78 for muscle, fat and bone, respectively, for the light group. This study indicates that total fat deposition and muscle growth may not proceed proportionately from one part of the body to another.

Crown and Damon (1960) compared the 12th rib section of 24 carcasses with the 9-10-11 rib for predicting separable components of the entire carcass. They found correlation coefficients of 0.96, 0.82 and 0.75 between separable fat, lean and bone, respectively, of the 12th rib section and the corresponding separable components of the carcass. These authors also observed correlations of 0.98, 0.94 and 0.73 between separable fat, lean and bone, respectively, of the 9-10-11 rib section and the corresponding separable components of the carcass.

A core device was used by Kennick and England (1960) to obtain probe samples from the 8-9th rib and the 9-10th rib section. They concluded that such cores could be useful in studying composition of beef carcasses.

Antipyrine

Soberman *et al.* (1950) presented a method for measuring the total water content of the body *in vivo* based on the dilution of antipyrine after its intravenous injection. Kraybill *et al.* (1951) estimated body fat in 30 beef cattle from the measurement of *in vivo* body water by use of the antipyrine method. The fat values derived from body water values

by the antipyrine and specific gravity methods were in close agreement with body fat content determined from chemical analyses of samples from the 9-10-11 rib section. However, to date only limited use has been made of this procedure for estimation of body fat in cattle.

Endogenous radioactive isotopes

The naturally occurring endogenous isotope potassium-40 has been investigated as an index of body composition. Anderson and Langham (1959) reported that potassium-40 comprised 0.011% of the natural potassium.

Kulwich et al. (1961) reported a significant negative correlation coefficient (-.87) between percent separable fat and disintegrations per minute from potassium-40 per pound of intact beef round, and a significant positive correlation coefficient (0.80) between separable lean and potassium-40 disintegrations per minute. Lohman et al. (1964) observed that the fat-free lean tissues from 29 steers were significantly related to live weight and potassium-40 count (0.95 and 0.95). The latter authors also showed that the fat-free lean tissues could be predicted from the potassium-40 count of the carcass. Lohman et al. (1966) suggested use of the potassium-40 method for determining muscle mass in live steers and in the carcass since body potassium can be measured with considerable accuracy. Gillett et al. (1967) found variations as high as 12.91% occurred in the potassium concentration of muscles when means were compared. Variation in the potassium content

of different muscles indicated that constancy does not exist in the potassium-muscle relationship, and therefore suggests that this may be an important source of error in the potassium-40 method for estimating composition.

Photogrammetry

Armour and Company (1962) adapted a technique known as photogrammetry to measure body composition which is reliable and nondestructive. Results indicate that this method is promising to accurately evaluate live animal size, shape, and surface area characteristics; however, evaluation of marbling and fat thickness did not give as high a degree of accuracy. Recently Brinks et al. (1964) reported a higher degree of accuracy for predicting pounds of untrimmed wholesale cuts by the photogrammetric method than percent.

Retail Yield Studies

Variability of retail yield

Research data reported by numerous workers have shown that great variability occurs in the retail yield of beef carcasses. These data indicate that carcass value differences exist within as well as between grades. The use of retail yield has the advantage of measuring the saleable portion of the beef carcass and should accurately reflect important quantitative differences in beef.

Breidenstein (1962) presented a range of 19% in retail yield and $13.55 per hundredweight value difference among 105 steer sides and for

both sides of 94 heifer carcasses within the U.S. Good and Choice grades. He eliminated the extremes from the study, thus leaving a range of 14.4% between the low and high yielding carcasses which still included 95% of the original sample. This represents a value difference between the low and high yielding carcasses of $10.32 per hundredweight or approximately $60.00 for a 600 lb. carcass.

Brungardt and Bray (1963a) studied retail yield of the left sides of 99 U.S. Choice steer carcasses. They studied three weight groups (260 to 288 lb., 300 to 325 lb. and 332 to 360 lb.). The average percent boneless, trimmed retail cuts from the round, loin, rib and chuck was 50.8%, 49.7% and 48.5%, respectively, for the three weight groups. The range included only 22 of 33 in each group closest to the average for the group. The ranges were 47.0 to 54.6%, 46.3 to 53.0% and 45.5 to 51.5%, respectively, for the three groups. The value differences per hundredweight were $6.56, $5.52 and $5.25, respectively, for the light, middle and heavyweight groups.

Kropf and Graf (1959) studied U.S. Choice, Good, Commercial (Standard) grade steer, heifer and cow carcasses from 400 to 900 lb. and they observed total carcass boneless, retail yield varied from 68.1 to 57.3%.

Influence of fat upon retail yield

Ramsey et al. (1962) reported that the external fat thickness at the 12th rib of Choice, Good and Standard grade cattle varied from 0.1 to 1.1 in., while kidney fat ranged from 1.8 to 8.9% and separable carcass fat from 14.3 to 42.8%. Brungardt and Bray (1963b) found the fat

thickness of Good and Choice grade cattle varied from 0.35 to 1.60 in. kidney fat from 2.4 to 7.8% and calculated carcass fat (using 9-10-11 rib separable fat) from 28.5 to 40.5%. Since the quantity of fat varies widely, it becomes obvious that fat is one of the important, if not the most important factor contributing to the variation in the value of beef carcasses.

Zinn et al. (1963) reported a negative correlation (-.81) between percent fat trim and boneless round, loin, rib and chuck in beef carcasses. With multiple regression analysis, they found that each 1% increase in carcass fat trim, resulted in a corresponding decrease of 0.34% of boneless round, loin, rib and chuck. Miller et al. (1965) reported negative and significant correlation coefficients ($P < .01$) for fat trim from the right and left sides with retail yield of the round, loin, rib and chuck and with total carcass retail yield. The latter workers presented data to show that an increase of approximately 1.10% in fat trim decreased partially boneless retail yield 1%. They concluded that variation in percent fat trim accounted for more of the variation in retail yield than any other variable studied.

Brungardt and Bray (1963a) found correlations of external fat thickness measurements taken at various points on the carcass with percent retail yield from the round, loin, rib and chuck ranging from -.63 to -.73. Retail yield was also negatively correlated (-.54) with percent kidney and pelvic fat. Hedrick et al. (1963) and Miller et al. (1965) reported significant ($P < .01$) negative correlations of fat thickness

at the 12th rib, and several other carcass fat measurements with retail yield. Higher correlations were found by Miller et al. (1965) for subcutaneous fat thickness measurements with percent retail cuts than with weight of retail cuts. These authors observed subcutaneous fat probes were nonsignificantly correlated with weight of retail cuts except those probes over the 11th to 12th thoracic vertebrae which were significant ($P < .05$). The latter authors reported all correlations of fat thickness with percent retail cuts were negative and highly significant ($P < .01$). Miller et al. (1965) also stated that probes taken adjacent to the 11th to 12th thoracic vertebrae were more closely related to retail yield than fat thickness measurements at the 12th thoracic vertebra. Degree of fatness had a greater influence upon retail yield than L. dorsi muscle area according to these workers. An increase of 0.16 in. in fat at the 12th rib resulted in a 1% decrease in partially boneless retail cuts.

Murphey et al. (1960) found high, negative correlations of a single fat thickness measurement at the 12th rib and percent kidney knob with percent retail yield (-.83 and -.66, respectively).

These research studies indicate that the amount of carcass fat is a major factor in determining the quantity of trimmed retail cuts.

Subjective conformation and retail yield

Beef cattle breeders have placed emphasis upon conformation in selection for many years. Conformation has been emphasized to improve the distribution of muscling in the high priced regions of the beef

carcass. Considerable emphasis was also directed toward improvement in qualitative traits and efficiency of meat production. Unfortunately, the idea of many producers of superior conformation was not reflected in superior muscling but in fact by greater fatness. In addition, the idea that cattle of beef type or supposedly of superior conformation and concomitant superiority in efficiency of meat production has been seriously questioned by researchers and livestock producers. Further, the idea of superior eating quality of beef cattle compared with other breeds of cattle has also been challenged by researchers.

The beef cattle industry has recently emerged from a period when ideal beef type was thought to be a low set, compact, blocky animal that was thick topped and would have a high proportion of its weight in the high priced cuts. Research studies conducted in this period of time have shown little advantage to this type of animal. Knox and Kroger (1946) pointed out that type affects only size and dressing percent. Butler et al. (1956) expressed some doubt concerning the importance of compactness as a desirable conformation factor in beef cattle. Pierce (1957) found a small but significant positive relationship between conformation grade and yield of closely trimmed retail cuts from the round, loin, rib and chuck. He reported that the relationship between amount of finish and yield of retail cuts was negative and accounted for considerably more of the variation in retail yield than conformation.

The data of Everitt (1963) suggested that conformation and value improved until the stage is reached where fat is rapidly deposited in

the carcass. He observed that the more expensive parts of the carcass become proportionately greater with an increase in muscle to bone ratio, but as fattening proceeds, the advantages of conformation is overcompensated by the depressing effect of fat. Butterfield (1963a) stated that it is generally believed that what is regarded as good conformation is a high proportion of the most valuable meat. However, the differences in carcass conformation are observations of the amount and distribution of fat. Butterfield (1963a) conducted a study with cattle from wide sources including several breeds and crosses as well as "unimproved Shorthorns". His data indicated that there was little doubt that the effect of differences in muscle weight distribution upon the economic value of the carcass is small. He suggested that efforts by breeders to improve the distribution of muscle weight over the carcass have been unproductive. He concluded it would be easier to control the level of finish.

Recent research has not caused any less emphasis to be placed on the extent that fat plays in retail yield in beef carcasses. The question that still remains is how important is the effect of conformation upon retail yield. Selection and breeding of cattle for length and scale with more muscling and less fat so as to yield higher cutability carcasses has been emphasized by all segments of the beef industry. However, a unanimous definition of superior conformation and ideal beef type does not exist among all segments of the industry. Bray (1964) stated that few recent research reports are available which

establish the degree of relationship between carcass conformation and retail yield. Zinn et al. (1961), in a study involving 96 carcasses, reported significant ($P < .01$) correlations between conformation score and carcass fat thickness at the 12th rib (0.50) and with percent trimmable fat (0.69). Briskey and Bray (1964) suggested it is difficult to determine muscular development in heavily fatted carcasses since a heavily finished carcass is more likely to be scored higher in conformation. Allen (1966) observed that conformation scores were more highly related to measurements of fatness than to those of muscle, even though a deliberate attempt was made to score conformation by mentally defatting the carcass.

Breidenstein (1962) reported a low relationship between conformation score and yield of retail cuts in steers grading primarily Good and Choice. However, in heifer carcasses, they observed that a one-third increase in conformation score was accompanied by an increase of 0.34% in partially boneless retail yield. Tyler et al. (1964) compared high Choice conformation and low Good grade conformation carcasses. The average yields of boneless retail cuts from the round, loin, rib and chuck were essentially the same for the two groups. However, in this study the choice conformation carcasses were fatter, suggesting that if fat thickness had been the same the higher conformation carcasses would have yielded slightly higher than the lower conformation scores. However, Stringer et al. (1965) conducted a similar experiment to study the effects of conformation on retail yield of cattle with equal fat

thickness ranges. There were no significant differences in total boneless retail yield or in retail yield of the round, loin, rib and chuck attributable to conformation.

Pearson (1966) concluded from reported research that beef and dairy cattle finished on the same type of ration, under similar environments and the same length of feeding period had similar retail cut-out. Cole *et al.* (1964) worked with British, Zebu and dairy breeds of cattle. They reported that Holstein steers had the highest percent separable muscle in all wholesale cuts except chuck and plate, and the lowest percent of total separable carcass fat. The British breeds yielded the highest percent of total carcass separable fat. They concluded that any effect conformation might exert upon yield of separable muscle was overcome by the depressing effect of fat. Hedrick *et al.* (1963) concluded that it is difficult for superior muscle development to compensate for excess fat deposition.

Martin *et al.* (1966) used ten low Choice and ten high Standard conformation steer carcasses paired on carcass weight, *l. dorsi* muscle area, and fat thickness at the 12th rib to study the yield of closely trimmed boneless thick and thin muscles. The thick muscles of the hindquarter were 5.1 cm. or more in thickness and those of the forequarter were 7.6 cm. Thin muscles were those not meeting the requirements for thick muscles. The most striking advantage of Choice conformation was in the ratio of total muscle to bone and thick, high value muscle to bone. Choice conformation carcasses yielded an average of 0.93% more thick

muscles, 0.82% less thin muscles and 0.11% more total muscle than Standard grade conformation carcasses (significant, $P < .05$).

It appears from the literature that the definition of conformation varies. However, most studies indicate that muscling contributes much less to conformation scores than fat. It is obvious that high conformation scores that include excess external fat are not highly related to retail yield. Whether high conformation carcasses, with similar amounts of fat to those of lower conformation carcasses, differ in retail yield or edible portion is a question that needs further research.

Carcass weight and retail yield

Many research studies have shown that carcass weight is negatively related to retail yield. According to Everitt (1963), development until the stage when the deposition of fatty tissue in the carcass predominates, carcass weight is one of the most accurate determinants of composition and cutability. Also, Tulloh (1964) reported that the muscle to bone ratio increases as cattle grow heavier.

Kropf and Graf (1959) observed that increased carcass weight had a significant depressing effect upon total carcass retail yield. Cole et al. (1962) showed that the average percent of steaks decreased and the percent waste increased as carcass weight increased. Brungardt and Bray (1963) reported that heavier carcasses contained significantly more fat per unit of carcass weight than lighter carcasses. Briedenstein (1962) found that a 100 lb. increase in carcass weight resulted in a 1.42% reduction in retail yield. Murphey et al. (1960) reported a similar relationship.

Swiger et al. (1964) found a simple correlation coefficient between carcass weight and percent retail yield of -.48. DuBose et al. (1967) found a simple correlation coefficient between carcass weight and weight of boneless roast and steak meat of 0.94 and they indicated that carcass weight was the most accurate single indicator of boneless roast and steaks. However, the correlation for percent roasts and steaks was much lower.

Allen (1966) reported that carcass weight had a highly significant ($P < .01$) effect upon pounds of all the carcass separable components, retail and fat trim yields. Carcass weight also had a highly significant ($P < .01$) effect upon percent retail and fat trim yields but not on the percent separable carcass fat, muscle and bone.

L. dorsi muscle area and retail yield

Significant, positive correlation coefficients (0.40 to 0.60) between L. dorsi muscle area and retail yield have been reported (Cole et al., 1960a; Brungardt and Bray, 1963a; Hedrick et al., 1963; Breidenstein, 1962; Gottsch et al., 1961; Butler et al., 1961). These authors suggested that there is a L. dorsi muscle area to weight relationship. Even though this is a nonlinear relationship, these authors showed that on a carcass weight and fat constant basis the correlations of L. dorsi muscle area and retail yield were significantly reduced. In a study by Cole et al. (1960a), when carcass weight was held constant, L. dorsi muscle area was associated with only 5% of the variation in the pounds

of separable lean. Fat thickness was more closely associated with carcass leanness than *l. dorsi* muscle area.

Brungardt and Bray (1963a) reported that 20% of the variation in retail yield could be accounted for by differences in area of the *l. dorsi* muscle. With carcass weight, percent kidney fat and a single fat thickness measurement at the 12th rib held constant, the standard partial regression coefficient of boneless, closely trimmed retail yield from the round, loin, rib and chuck on area of the *l. dorsi* muscle was only 0.16.

Miller *et al.* (1965) measured the areas of the *l. dorsi* muscle at six different locations from the left and right sides. They observed that the *l. dorsi* muscle areas were more highly associated with weight than with percent of retail cuts from the primal cuts as well as those of the entire side. With the exception of the left 13th thoracic-first lumbar vertebrae position, *l. dorsi* muscle area was more highly correlated with the percent retail yield from the primal cuts than with that of the entire side. The various *l. dorsi* muscle area measurements accounted for 5 to 19% and 6 to 25% of the variation in retail yield of the partially boneless and boneless sides, respectively. When correlated with weight, area of the *l. dorsi* muscle accounted for 49 to 69% of the variation in weight of boneless retail cuts and 47 to 62% of the variation in partially boneless retail cuts from the side.

Miller *et al.* (1965) showed that *l. dorsi* muscle area in combination with other carcass measurements gave lower multiple correlation

coefficients than similar combinations which included percent trimmed round.

Briskey and Bray (1964) suggested that even though the influence of area of *l. dorsi* muscle upon retail yield is small compared to that of fat, emphasis upon size of this muscle may be justified because it represents one of the most tender muscles in the carcass and comprises 10% of the weight of the total muscle in the carcass as well as a large proportion of two of the high priced cuts (loin and rib) of the beef carcass.

Trimmed round and retail yield

The yield of trimmed wholesale round has been studied as an indicator of carcass retail yield. Miller *et al.* (1965) reported that the percent trimmed round was significantly correlated with total carcass percent boneless retail yield (0.79), partially boneless (0.84) yield of the primal cuts and percent boneless (0.80) and partially boneless (0.88) retail cuts of the entire side. The correlations for retail yield of the round were followed closely by that of the flank in their study. This supports work of Hedrick *et al.* (1963) and Brungardt and Bray (1963a). Miller *et al.* (1965) showed that an increase of approximately 0.55% in trimmed round was associated with a 1% increase in percent partially boneless retail yield.

Brungardt and Bray (1963a) reported that percent trimmed round and a single 12th rib fat measurement accounted for 81% of the variation in percent retail yield.

Allen (1966) reported correlations of 0.83, 0.91 and 0.83 between percent separable muscle, fat and bone of the round and percent of the corresponding separable components of the entire carcass.

Carcass length and retail yield and carcass composition

The relationship of carcass length to retail yield or separable components of the carcass has been studied by Cole et al. (1960a). They found that carcass length measurements were more closely associated with weight of separable lean than carcass thickness measurements such as round width, chuck width or depth of body. The latter authors reported that linear measurements were more highly related to weight than percent of carcass separable components. They observed that weight of carcass separable lean was significantly ($P < .01$) correlated (0.39) with carcass length. Cole et al. (1960a) also found that length of carcass was negatively associated with external fat thickness and L. dorsi muscle area. Cole et al. (1962) found correlation coefficients of 0.58, 0.59, 0.39 and 0.63 for total separable lean with L. dorsi muscle area at the 5th, 12th and last lumbar vertebrae and an average of the three site measurements, respectively. When an average of the three site measurements was multiplied by carcass length, the accuracy of estimating separable lean was increased (0.75). Hedrick et al. (1965) found carcass length to be highly significantly correlated (0.60) with weight of trimmed wholesale round, loin, rib and chuck. However, the correlation of carcass length with percent trimmed wholesale round, loin, rib

and chuck was negative (-.10) and non significant. DuBose et al. (1967) found that carcass weight was the most accurate single indicator of boneless roast and steak meat. They reported that carcass weight was followed by carcass length.

Prediction equations and retail yield

Lush (1926) and Hankins and Howe (1946) developed estimating equations based on the separable components of wholesale cuts to estimate carcass composition. Murphey et al. (1960) developed an equation to estimate the percent boneless retail cuts from the round, loin, rib and chuck which is as follows: percent boneless retail cuts = 51.34 - 5.784 (fat thickness over the ribeye, inches) - .0093 (carcass weight, pounds) - .462 (kidney fat, percent of carcass) + .740 (area of ribeye, square inches). This equation was modified and is now utilized in the Official Standards for Grades of Carcass Beef (1965) to estimate cutability of beef carcasses.

Cole et al. (1962) found the most valuable prediction equations to estimate retail yield utilized only fat thickness at the 12th rib and carcass weight [Y = 7.12 - 1.15 (fat thickness) + 0.2967 (carcass weight)]. These two measurements were associated with over 70% of the variation in separable lean and were comparable in accuracy to values obtained with the Hankins and Howe (1946) equation of the 9-10-11 rib section.

Another prediction equation for retail yield [Y = 16.64 + 1.67 (percent trimmed round) - 4.94 (single fat measurement at 12th rib)] developed by Brungardt and Bray (1963a) was shown to account for 81% of the variation in retail yield of the round, loin, rib and chuck. The latter equation accounted for more of the variation in yield of retail cuts than application of the equation of Murphey *et al.* (1960), which accounted for only 67% of the variation in this study.

Allen (1966) developed several prediction equations from data obtained from 80 steer carcasses. The prediction equations that accounted for 94% of the variation in total carcass retail yield or of the round, loin, rib and chuck included carcass weight; fat probe at the 5th thoracic vertebra, 4 in. off the carcass dorsal midline or a fat measurement at the 12th rib one-fourth the distance from the medial to lateral edges of the *l. dorsi* muscle; length of round; and percent flank retail yield.

Kropf and Graf (1959) and Breidenstein (1962) reported marked retail yield differences between steer and heifer carcasses and the latter author developed separate regression equations for each sex. He was able to account for 72% of the variation in retail yield of steer carcasses but that for heifers, although similar, was slightly less accurate.

EXPERIMENTAL PROCEDURE

Source of Material: The right side of one hundred and twenty steer carcasses of the three major British beef breeds were purchased from several beef packing companies in central Michigan. Carcass selection involved the following two criteria: 1) chilled carcass weight and 2) average fat thickness (average of three measurements at the 12th rib) (Naumann, 1952). Sixty carcasses were selected within each of two weight ranges; 500 to 550 lb. (light) and 700 to 750 lb. (heavy). The two weight ranges were further subdivided into four fat thickness (12th rib) groups; .26 to .50 in., .51 to .75 in., .76 to 1.0 in., and 1.01 to 1.25 in. with 15 carcasses being selected within each group as shown in table 1. In addition, fifteen Holstein steer carcasses were selected

Table 1. Distribution of carcasses within weight and fat thickness groups.

	Average fat thickness (12th rib)			
Carcass weight	.26 to .50 in.	.51 to .75 in.	.76 to 1.0 in.	1.01 to 1.25 in.
500 to 550 lb. (light)	Group I 15 carcasses	Group II 15 carcasses	Group III 15 carcasses	Group IV 15 carcasses
700 to 750 lb. (heavy)	Groups V & IX 30 carcasses	Group VI 15 carcasses	Group VII 15 carcasses	Group VIII 15 carcasses

within the .26 to .50 in. fat thickness group and the heavy weight range (Group IX) for comparison to the comparable group of the British breeds (Group V). This combination of fat thickness and carcass weight was chosen since it represents the most readily available supply of Holstein carcasses.

Subjective Carcass Evaluation. Each carcass was subjectively scored for the characteristics shown in table 2. Conformation was scored with a conscious attempt made to evaluate degree of muscling irrespective of quantity of fat.

Linear Carcass Measurements

Linear fat measurements at the 12th rib.

The fat thickness measurements obtained at the 12th rib included measurements A, B and C, an average of the three (Naumann, 1952) and four other fat thickness measurements D, E, F and G as described by Allen (1966) and shown in figure 1. These latter four measurements were obtained by determining the perpendicular distance from the outer edge of the subcutaneous fat to points located at the fat seam at the lateral end of the *l. dorsi* muscle (D), at one-fourth (E), one-half (F), and three-fourths (G) the length of the line Y-Z extended from the lateral end of the *l. dorsi* equivalent to the width (medial to lateral edge) of this muscle (line W-X).

Table 2. Characteristics and scores used in the subjective carcass evaluation.

Characteristic	Score
Carcass conformation	_____[a]
Hindquarter conformation	_____[a]
Forequarter conformation	_____[a]
Round conformation	_____[a]
Maturity score	_____[b]
Marbling score	_____[c]
Final grade	_____[a]
Estimated kidney knob weight	_____[d]

[a]Conformation and/or U.S.D.A. grade	Low	Avg.	High
Standard	1	2	3
Good	4	5	6
Choice	7	8	9
Prime	10	11	12

[b]Maturity	-	Avg.	+
A	1	2	3
B	4	5	6

[c]Marbling	-	Avg.	+
Devoid	1	2	3
Practically devoid	4	5	6
Traces	7	8	9
Slight	10	11	12
Small	13	14	15
Modest	16	17	18
Moderate	19	20	21
Slightly abundant	22	23	24
Moderately abundant	25	26	27
Abundant	28	29	30

[d]Estimated kidney knob weight — Weight in pounds

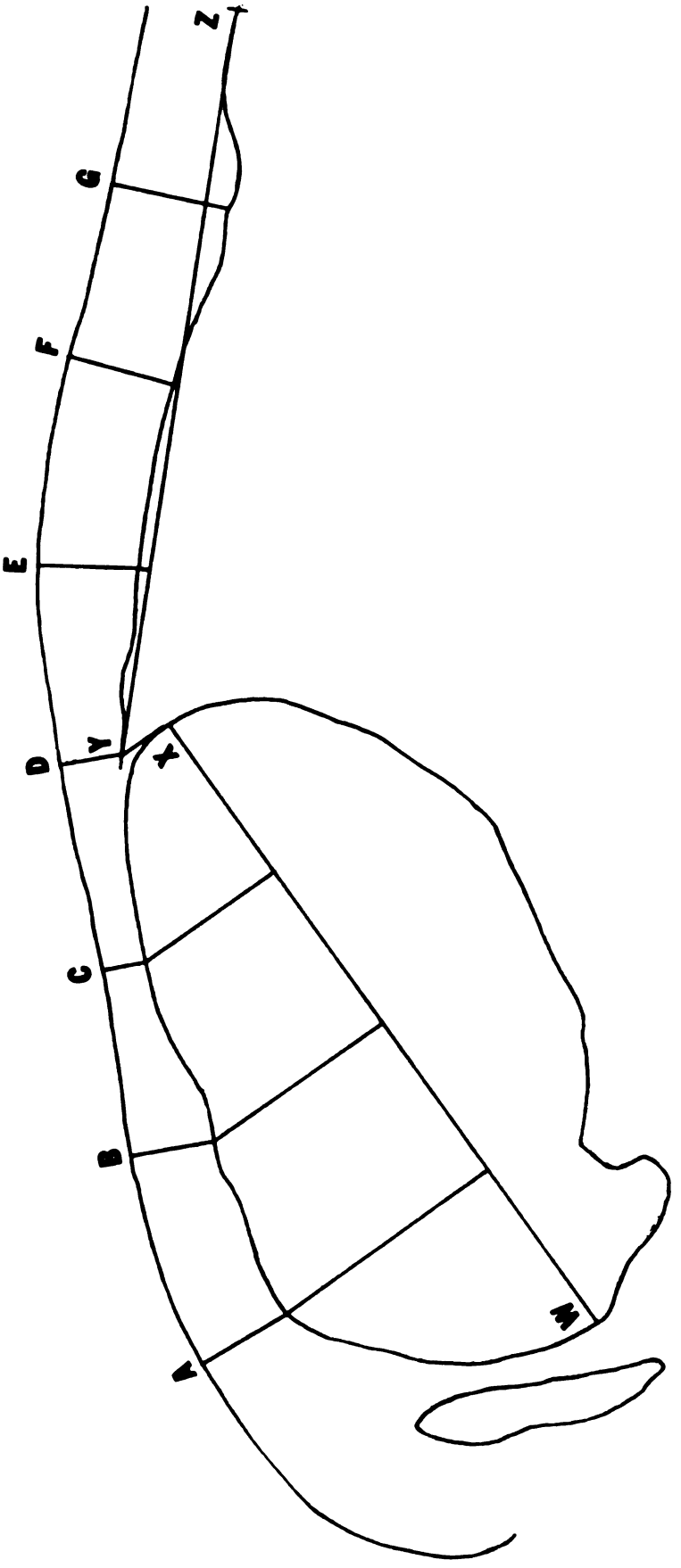

Figure 1. Illustration showing fat thickness measurements taken at the 12th rib.

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Fat Probes

Probes of subcutaneous fat were made on the right side of each carcass as described by Allen (1966). The 5th, 8th and 11th thoracic; 1st, 4th and 6th lumbar and 3rd and 5th sacral vertebrae were used as skeletal reference points for these fat probes as shown in figure 2. The probes were made with a scalpel and metal ruler, perpendicular to the anterior edge of these reference vertebrae, 4, 8 and 12 in. laterally from the dorsal tip of the vertebral cartilage. All probes were recorded to the nearest millimeter.

Length and circumference of round

These measurements were made with a flexible steel tape as described by Naumann (1952).

Length of carcass

This measurement was made with a flexible steel tape from the anterior edge of the first rib (medial to the vertebral column) to the anterior edge of the symphasis pubis.

Depth of Brisket.

This measurement was taken with a sliding T-square, perpendicular to the first sternebra as described by Allen (1966) and shown in figure 3.

Figure 2.

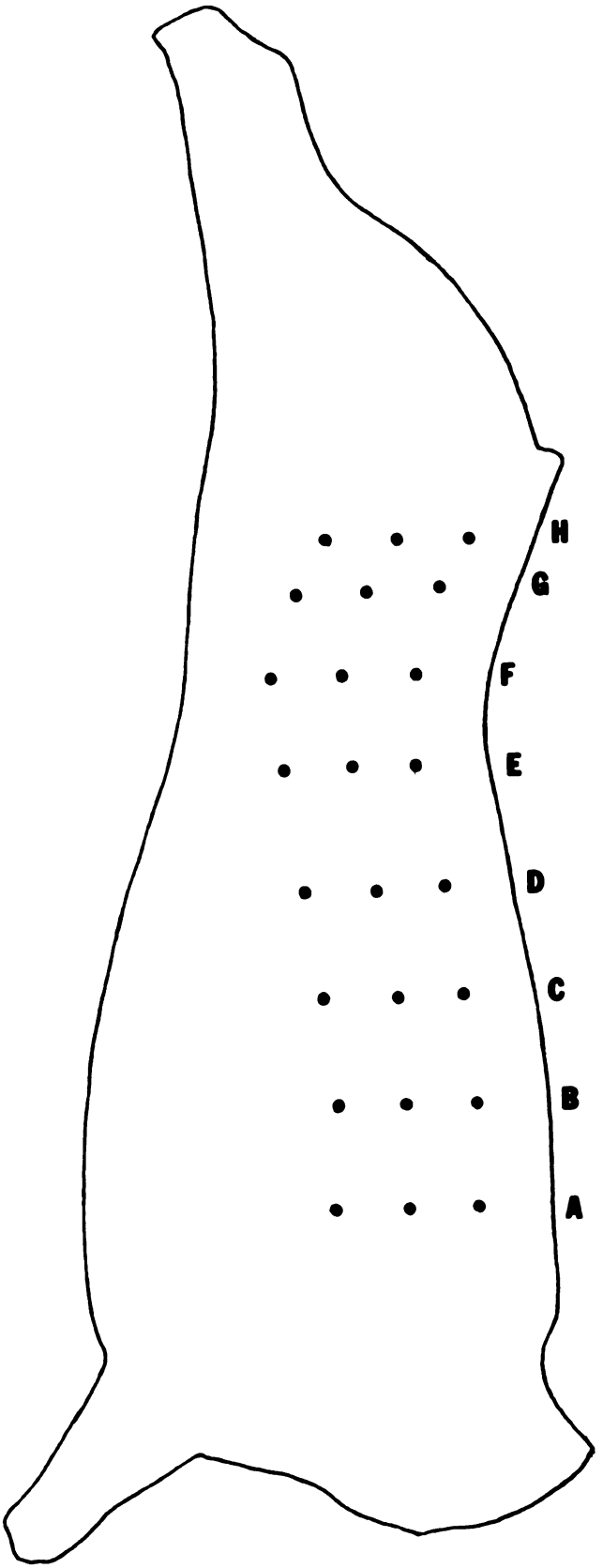


Figure 2. Illustration showing the pattern of the fat probes taken 4, 8 and 12 in. from the dorsal midline on the carcass.

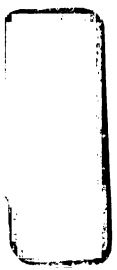


Figure 3.

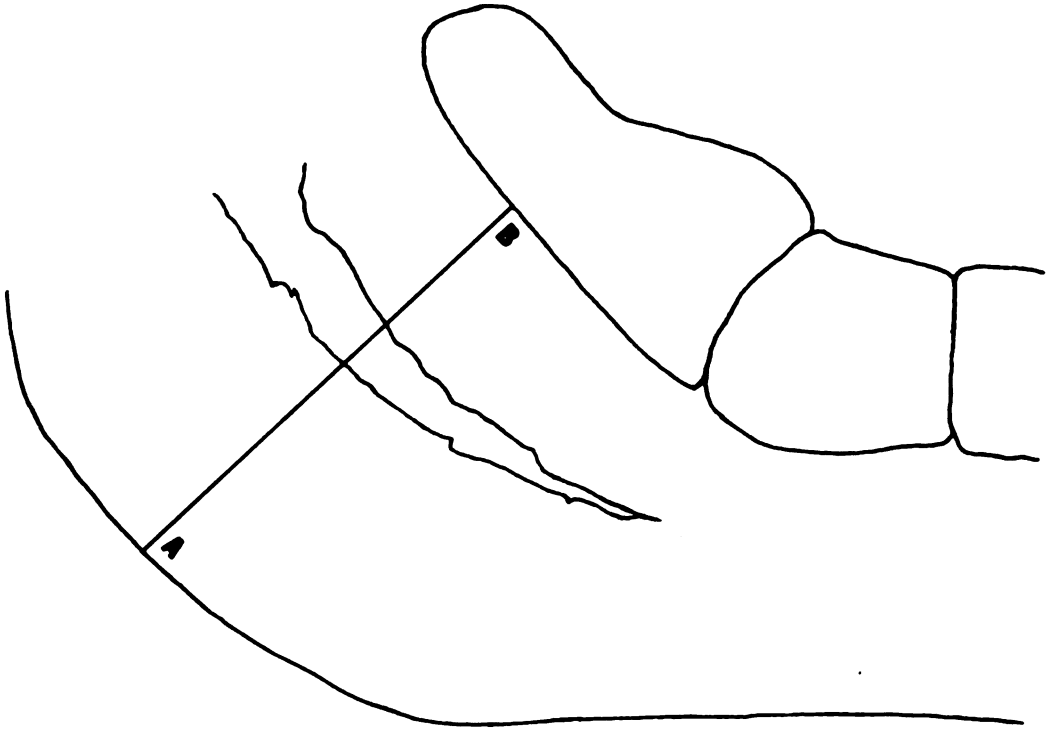


Figure 3. Illustration showing the measurement of brisket depth.

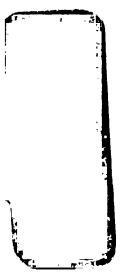
Cutting Procedure

The right side of each carcass was cut into conventional wholesale cuts according to the procedure described by Wellington (1953), with two exceptions outlined by Allen (1966). The plate was removed from the wholesale rib by measuring 10 in. from the ventral tip of the thoracic vertebral column, at both the anterior and posterior ends of the rib, and removing the plate along a line connecting these two points. The brisket was removed from the chuck by extending the cut where the foreshank was removed along a line parallel with the dorsal side of the chuck.

The four major cuts from the right side (round, loin, rib and chuck) were trimmed to approximately 0.3 in. of external fat. Weight of untrimmed and trimmed wholesale cuts and fat trim from each was recorded to the nearest 0.1 lb. All wholesale cuts were then separated into closely trimmed (approximately 0.3 in. fat) boneless retail cuts. The roasts and steaks from the round, loin, rib and chuck (RLRC) were weighed separately from the total retail portion of each of these wholesale cuts to obtain roast and steak yield or yield of thick retail cuts. Weight of all retail cuts, fat trim and bone was recorded for each wholesale cut. The weights of the scapula, humerus, radius plus ulna, femur and tibia plus fibula were also recorded.

Statistical Analysis

Analysis of variance for factorial with replicates design was used to study treatment and interaction effects on several measures of carcass



cutability. The statistical procedures followed were described by Steele and Torrie (1960). One-way analysis of variance (Steele and Torrie, 1960) was used to study the effect of conformation within fat ranges. Simple correlation coefficients were calculated on a combined and within weight group basis. Simple correlation coefficients of predicted retail yields of several existing regression equations and actual boneless retail yield.

RESULTS AND DISCUSSION

The means and error mean squares of the carcass traits which were correlated with all objective and subjective measurements are presented in tables 3, 4, 5 and 6. These means are presented for the combined and individual weight groups, within fat thickness ranges and within weight and fat thickness groups.

Boneless closely trimmed retail yields include total carcass retail yield, retail yield from the RLRC and roasts and steaks from the RLRC. Fat trim yields include total carcass fat trim and external fat trim from the RLRC.

Effect of Carcass Weight upon Weight and Percent of Retail, Fat Trim and Bone Yields. Carcass weight had a highly significant ($P < .01$) affect upon weight of retail, fat trim and bone yields (table 3). Carcass weight also had a highly significant ($P < .01$) affect upon percent retail and fat trim yields but not on percent bone yield (table 5). The light weight group had significantly ($P < .01$) greater percentages of retail yields and lower percentages of fat trim yields than carcasses in the heavy weight group. Similar findings were reported by Brown et al. (1961), Cole et al. (1962), Kropf and Graf (1959), Brungardt and Bray (1963a), Swiger et al. (1964) and Allen (1966).

The light weight carcasses had approximately 0.32 lb. of total retail yield and 0.11 lb. of total fat trim per pound of carcass; whereas, the heavy weight group had corresponding values of approximately 0.30

and 0.12 lb., respectively. These data indicate that the light weight group had more retail cuts and less fat trim per pound of carcass than the heavy weight group, even though fat thickness ranges were identical between the two weight groups. The average fat thickness for corresponding fat groups between the two weight groups was identical except for that of groups I and IV (0.38 and 0.44, respectively). These results concur with those reported by Brungardt and Bray (1963a) and Allen (1966).

Carcasses from the light weight group were obtained from steer carcasses weighing approximately 850 lb. alive and the heavy weight group from 1150 lb. steers. Approximately 52% of the 187 lb. carcass weight difference or approximately 34% of the 280 lb. live weight difference was due to total retail yield. Bone accounted for approximately 10% of the carcass weight difference and fat accounted for the remaining portion of the difference.

Effect of Fat Thickness upon Weight and Percent Carcass Retail, Fat Trim and Bone Yields. Fat thickness (12th rib) had a highly significant ($P < .01$) influence upon weight (table 3) and percent (table 5) of retail, fat trim and bone yields. Similar results were reported by Cole et al. (1962), Ramsey et al. (1962), Brungardt and Bray (1963a), Hedrick et al. (1963), Lewis et al. (1964), Butterfield (1965), Fitzhugh et al. (1965), Miller et al. (1965) and Allen (1966). As expected, the carcasses with the greater fat thicknesses had more fat trim and lower retail yields than trimmer carcasses. Retail yields expressed as either weight or

percent showed a more pronounced change between the first two fat groups (0.26 to 0.50 in. and 0.51 to 0.75 in.) and the last two groups (0.76 to 1.00 in. and 1.01 to 1.25 in.) than between the second and third groups (0.51 to 0.75 in. and 0.76 to 1.0 in., respectively). The difference between the last two fat groups (0.75 to 1.0 in. and 1.01 to 1.25 in.) for both percent and weight of bone and fat trim yields was greater than in the other fat groups. However, the average fat thickness between these two fat groups differed more than between the other fat groups. These data agree with those reported by Allen (1966).

It is interesting to note that carcass length decreased as fat thickness increased in the combined weight groups (table 3) as well as within both weight groups (table 4). There was less difference in carcass length between the middle fat groups (0.51 to 0.75 and 0.76 to 1.0) than the other groups. L. dorsi muscle area also decreased as fat thickness increased within as well as between weight groups, except little difference was found between the last two fat groups (0.76 to 1.0 and 1.01 to 1.25). These findings are in contrast to those of Cole et al. (1962) who reported that L. dorsi muscle area tended to decrease as carcass length increased.

Carcass Weight and Fat Thickness Interactions upon Weight and Percent Carcass Retail, Fat Trim and Bone Yields. Percent retail and fat trim yields were significantly ($P < .01$) affected by carcass weight and fat thickness interaction (table 6). Percent bone was less marked but also

Table 3. Means and error mean squares of weights of retail, roast and steak, fat trim and bone yields; carcass length, L. dorsi muscle area and 12th rib fat thickness for the combined and individual weight groups and fat thickness ranges.

Trait	Weight group			Fat thickness ranges, in. (combined weight group)				EMS[1]
	Combined	Light	Heavy	0.26-0.50	0.51-0.75	0.76-1.00	1.01-1.25	
Retail yield from RLRC[2], lb.	154.98	135.18[a]	174.79[b]	168.39[c]	158.80[d]	150.58[e]	142.16[f]	53.67
Roasts and steaks from RLRC, lb.	127.56	110.89[a]	144.24[b]	138.99[c]	130.15[d]	123.75[e]	117.35[f]	47.05
Total retail yield, lb.	186.34	162.48[a]	210.21[b]	202.67[c]	190.60[d]	181.28[e]	170.82[f]	71.48
Total fat trim, lb.	74.39	59.55[a]	89.23[b]	57.40[c]	66.98[d]	78.56[e]	94.62[f]	73.04
External fat trim from RLRC, lb.	14.19	11.69[a]	16.68[b]	7.62[c]	12.14[d]	15.16[e]	21.83[f]	10.32
Total bone, lb.	36.47	31.54[a]	41.40[b]	40.25[c]	38.13[d]	35.56[e]	31.93[f]	9.34
Carcass length, in.	46.78	44.76	48.97	48.16	47.05	46.65	45.73	
L. dorsi muscle area, sq. in.	11.04	9.94	12.14	12.06	11.22	10.44	10.45	
12th rib fat thickness, in.	0.74	0.74	0.75	0.41	0.62	0.84	1.11	
Carcass wt., lb.	621.68	528.12	715.23	616.05	620.56	621.26	624.38	

[1]Error mean square for weight, fat thickness and weight-fat thickness interaction.
[2]RLRC = Round, loin, rib and chuck.
[a,b]Means on the same line having different superscripts are highly significantly ($P < .01$) different due to the effects of carcass weight.
[c,d,e,f]Means on the same line having different superscripts are highly significantly ($P < .01$) different due to the effects of fat thickness.

Table 4. Means of weights of retail, roast and steak, fat trim and bone yields; carcass length, L. dorsi muscle area and 12th rib fat thickness for the individual fat thickness ranges within each weight group[1].

Trait	Light weight group				Heavy weight group			
	Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII
	0.26-0.50 in.	0.51-0.75 in.	0.76-1.00 in.	1.01-1.25 in.	0.26-0.50 in.	0.51-0.75 in.	0.76-1.00 in.	1.01-1.25 in.
Retail yield from RIRC[2], lb.	148.90	137.60	131.47	122.75	187.87	180.00	169.70	161.57
Roasts and steaks from RIRC, lb.	122.98	111.47	108.11	100.98	154.99	148.84	139.38	133.73
Total retail yield, lb.	179.99	164.75	157.89	147.28	225.35	216.44	204.67	194.37
Total fat trim, lb.	39.27	53.35	64.97	80.58	75.52	80.60	92.15	108.66
External fat trim from RIRC, lb.	5.61	10.70	13.05	17.41	9.63	13.58	17.27	26.25
Total bone, lb.	35.88	32.84	30.72	26.70	44.62	43.43	40.40	37.16
L. dorsi muscle area, sq. in.	10.99	9.93	9.47	9.38	13.12	12.50	11.41	11.51
12th rib fat thickness, in.	0.38	0.62	0.83	1.11	0.44	0.61	0.85	1.11
Carcass wt., lb.	530.24	526.36	534.12	536.00	721.84	714.76	708.40	712.78
Carcass length, in.	46.07	44.73	44.55	43.66	50.25	49.37	48.75	47.80

[1]Error mean squares are the same as those listed in table 3.
[2]RIRC = Round, loin, rib and chuck.

Table 5. Means and error mean squares of percent retail, roast and steak, fat trim and bone yields for the combined and individual weight groups and fat thickness ranges.

Trait	Weight group			Fat thickness ranges, in. (combined weight groups)				EMS[1]
	Combined	Light	Heavy	0.26-0.50	0.51-0.75	0.76-1.00	1.01-1.25	
Retail yield from RLRC[2], %	49.90	50.88[a]	48.93[b]	54.12	51.32	48.58	45.59	4.07
Roasts and steaks from RLRC, %	41.05	41.73[a]	40.37[b]	44.66	42.00	39.93	37.61	3.69
Total retail yield, %	59.99	61.15[a]	58.84[b]	65.17	61.58	58.46	54.76	4.93
Total fat trim, %	23.68	22.36[a]	24.99[b]	17.86	21.42	25.16	30.27	6.34
External fat trim from RLRC, %	4.53	4.39[a]	4.67[b]	2.39	3.93	4.88	6.92	0.91
Total bone, %	11.73	11.87[a]	11.59[b]	12.96	12.32	11.46	10.20	0.93

[1]Error mean square for weight, fat thickness and weight-fat thickness interaction.

[2]RLRC = Round, loin, rib and chuck.

[a,b]Means on the same line having different superscripts are highly significantly ($P < .01$) different due to the effects of carcass weight.

Table 6. Means of percent retail, roast and steak, fat trim and bone yields for the individual fat thickness ranges within each weight group[1].

Trait	Light weight group				Heavy weight group			
	Group I 0.26-0.50 in.	Group II 0.51-0.75 in.	Group III 0.76-1.00 in.	Group IV 1.01-1.25 in.	Group V 0.26-0.50 in.	Group VI 0.51-0.75 in.	Group VII 0.76-1.00 in.	Group VIII 1.01-1.25 in.
Retail yield from RLRC[2], %	56.12	52.28	49.25	45.82	52.07	50.36	47.91	45.36
Roasts and steaks from RLRC, %	46.36	42.35	40.51	37.69	42.96	41.65	39.35	37.54
Total retail yield, %	67.68	62.60	59.15	54.96	62.45	60.56	57.78	54.56
Total fat trim, %	14.81	20.28	24.30	30.07	20.92	22.55	26.02	30.47
External fat trim from RLRC, %	2.11	4.06	4.88	6.48	2.66	3.80	4.87	7.36
Total bone, %	13.54	12.48	11.51	9.97	12.37	12.16	11.41	10.43

[1]Error mean squares are the same as those listed in table 5.

[2]RLRC = Round, loin, rib and chuck.

significantly ($P < .05$) affected by carcass weight and fat thickness interaction (table 6).

The results of this study show that the weight of retail, fat trim and bone yields was greater in the heavy weight group than corresponding means for the light weight group. The weight of retail and bone yields decreased and fat trim increased from the lowest (groups I and V, respectively) to the highest (groups IV and VIII, respectively) fat thickness ranges within weight groups. However, the rate of change among adjacent fat ranges was greater for the heavy carcasses than for the light weight group. These results agree with those reported by Allen (1966).

More variation was observed between fat thickness groups I to IV (light weight group) for percent total retail, fat trim and bone yields (approximately 12.7%, 15.3% and 3.6%, respectively) than corresponding values (groups V to VIII) in the heavy weight group (approximately 7.9%, 9.6% and 1.9%, respectively). However, percent total retail yield was greater and percent fat trim less in the light weight group than in the heavy group. The greatest difference in percent total retail yield occurred between the first two fat thickness ranges in each weight group (I and II, and V and VI). These findings support the work of Allen (1966). Percent retail and fat trim yields were nearly identical between fat groups IV and VIII. Percent bone was less in group IV than group VIII, but greater in group I than group V.

A significant ($P < .01$) interaction between fat thickness and carcass weight indicates that the average change in retail, fat trim and bone

yields was not the same within the light group as it was within the heavy weight group as fat thickness increased from the lowest (groups I and V, respectively) to the highest (groups IV and VIII, respectively) fat thickness.

Relationships Between Weight and Percent Retail, Fat Trim and Bone Yields. Simple correlation coefficients for weight and percent between the retail, bone and fat trim yields for the combined and individual weight groups are presented in tables 7, 8 and 9. It should be emphasized that the correlations were calculated for weights between each of the yield components or for percents between each of those same components, but not between weight and percent.

Correlations of carcass weight with retail, bone and fat trim yields for the combined weight groups are presented in table 7. Carcass weight was positively and highly correlated (0.84 to 0.85) with weight of retail yields but negatively and poorly correlated (-.20 to -.26) with percent retail yields. Cole et al. (1960a) and Butterfield (1963) reported that carcass weight was more highly related to weight of separable muscle than any other single variable. Swiger et al. (1964) found that carcass weight accounted for 93% of the variation in weight of retail yield.

Weight of fat trim yields and carcass weight were positively correlated (0.38 for external fat trim and 0.67 for total fat trim). Correlations of carcass weight with percent fat yields were also positive but lower (0.09 and 0.24 for external and total fat trim, respectively).

Table 7. Simple correlation coefficients of carcass weight, weight and percents retail, bone and fat trim yields with retail, bone and fat trim yields for the combined weight groups.

Carcass wt. and yield components	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone yield	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Carcass wt.	0.84	-.26	0.84	-.20	0.85	-.25	0.67	0.24	0.38	0.09	0.73	-.13
Retail yield from RLRC	1.00	1.00	0.99	0.97	1.00	0.99	0.25	-.96	-.05	-.85	0.89	0.76
Roasts and steaks from RLRC			1.00	1.00	0.99	0.96	0.25	-.93	-.04	-.81	0.89	0.76
Total retail yield					1.00	1.00	0.26	-.97	-.05	-.86	0.90	0.77
Total fat trim							1.00	1.00	0.87	0.89	0.12	-.85
External fat trim from RLRC									1.00	1.00	-.12	-.70
Total bone yield											1.00	1.00

[1] RLRC = Round, loin, rib and chuck.
Correlations > .179 are significant ($P < .05$).
Correlations > .234 are significant ($P < .01$).

Table 8. Simple correlation coefficients of weights and percents retail, bone and fat trim yields for the light weight group.

Yield components	Retail yield from RLRC[1] wt.	Retail yield from RLRC[1] %	Roasts and steaks from RLRC wt.	Roasts and steaks from RLRC %	Total retail yield wt.	Total retail yield %	Total fat trim wt.	Total fat trim %	External fat trim from RLRC wt.	External fat trim from RLRC %	Total bone yield wt.	Total bone yield %
Retail yield from RLRC	1.00	1.00	0.96	0.96	0.99	0.99	-.86	-.90	-.78	-.77	0.82	0.84
Roasts and steaks from RLRC			1.00	1.00	0.96	0.95	-.81	-.97	-.72	-.90	0.81	0.83
Total retail yield					1.00	1.00	-.85	-.98	-.79	-.91	0.82	0.84
Total fat trim							1.00	1.00	0.93	0.93	-.85	-.94
External fat trim from RLRC									1.00	1.00	-.72	-.85
Total bone yield											1.00	1.00

[1] RLRC = Round, loin, rib and chuck.
Correlations > .255 are significant ($P < .05$).
Correlations > .331 are significant ($P < .01$).

Table 9. Simple correlation coefficients of weight and percents retail, bone and fat trim yields for the heavy weight group.

Yield component	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone yield	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Retail yield from RLRC	1.00	1.00	0.98	0.98	0.98	0.98	-.86	-.87	-.78	-.90	0.82	0.84
Roasts and steaks from RLRC			1.00	1.00	0.97	0.96	-.81	-.94	-.72	-.85	0.81	-.83
Total retail yield					1.00	1.00	-.85	-.98	-.79	-.91	0.82	0.84
Total fat trim							1.00	1.00	0.93	0.93	-.85	-.90
External fat trim from RLRC									1.00	1.00	-.72	-.74
Total bone yield											1.00	1.00

[1] RLRC = Round, loin, rib and chuck.
Correlations > .255 are significant ($P < .05$).
Correlations > .331 are significant ($P < .01$).

Carcass weight was highly significantly ($P < .01$) correlated with weight of carcass bone (0.73) but negatively and nonsignificantly ($P < .05$) correlated with percent carcass bone (-.13). These results are similar to those of Cole et al. (1960a), Brown et al. (1961), Cole et al. (1962), Kropf and Graf (1959) and Brungardt and Bray (1963). These authors observed that increased carcass weight had a significant depressing effect upon percent retail yields. These data show that retail yield from the RLRC, roasts and steaks from the RLRC, and total carcass retail yield were highly correlated with each other (ranges, 0.96 to 1.00 and 0.96 to 0.99 for weight and percent, respectively).

Correlations of percent retail yields with percent fat trim yields were highly significant (range, -.77 to -.98, $P < .01$) for the individual and combined weight groups. Highly significant ($P < .01$) correlations were also found between weight of retail yields and weight of fat trim yields within weight groups (range, -.72 to -.86). In the combined weight group, the correlations between weight of retail and fat yields were low (-.05 and 0.25, for external fat trim and total fat trim, respectively).

Retail yields were positively correlated with percent (range, 0.76 to 0.84, $P < .01$) and weight (range, 0.80 to 0.90, $P < .01$) of bone yield. Fat trim yields were negatively correlated with percent bone yield (range, -.74 to -.94, $P < .01$).

These data support results reported by Cole et al. (1960a), Brown et al. (1962), Brungardt and Bray (1963a), Hedrick et al. (1963), Miller

et al. (1965), Allen (1966) and Hedrick et al. (1967). These authors reported high positive correlations for bone yield with retail yields and carcass muscle and high negative correlations for fat trim yields with bone yield, retail yields and carcass muscle.

It is interesting to note that the muscle to bone ratio was almost identical between the light and heavy weight groups. These results disagree with those of Zinn (1967) who reported that the muscle to bone ratio increased with increased weight. Tulloh (1964) also found that bone increased but at a decreasing rate as body weight increased.

Relationships Between Linear Fat Measurements and Retail and Fat Yields

Simple correlation coefficients of linear fat measurements with weight and percent retail and fat trim yields for the individual and combined weight groups are shown in tables 10, 10a, 11, 11a, 12 and 12a.

Correlations of fat measurements with percent retail yields (range, -.04 to -.86) were higher than with weight of retail yields (range, -.03 to -.46) in the combined weight group. However, the within weight group correlations between fat linear measurements and either weight or percent retail yields were similar. The correlations of linear fat measurements with weight or percent fat trim yields were quite similar for the individual and combined weight groups. These data suggest that linear fat measurements, within comparable fat thickness ranges but among different weight groups, were similar in magnitude, although the pounds of retail yields were markedly different between weight groups (table 3). Orme

(1958), Allen (1966), Hedrick et al. (1963), Miller et al. (1965) and Hedrick (1967) found similar differences for correlations of fat measurements and either weight or percent retail yields on a combined weight group basis.

The fat measurements most highly related to percent retail yields for the combined weight groups were: fat measurements B and C (12th rib) and the average of fat measurements A, B, and C (ranges, -.73 to -.75, -.80 to -.83, and -.83 to -.86, respectively). Of the fat probes (sites shown in figure 2), the 6th lumbar probe at 4 in. and the 5th sacral probe at 4 in. were the most highly related to percent retail yields (range, -.50 to -.69). However, these probes were no more highly related to percent retail yields than 12th rib fat measurements A, D, E and F. The latter measurements are more easily obtained than the fat probes.

Of the fat measurements, fat measurement C and the average of measurements A, B and C were most highly correlated with both weight and percent fat trim yields (range, 0.63 to 0.88) in the combined weight group. In addition, correlations of fat measurements B and C and those of the average of A, B and C were most highly related to weight and percent retail yields (range, -.72 to -.86). Of the fat probes in the combined weight groups, the 6th lumbar probe at 8 in. was most highly correlated with weight of retail yields (range, -.45 to -.46) and the correlations were slightly higher than those of fat measurement C and the average of fat measurements A, B and C with weight of retail yields (range, -.39 to -.42).

Table 10. Simple correlation coefficients of linear fat measurements with retail, bone and fat trim yields for the combined weight groups.

Fat probes	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total yield yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
5th Thoracic										
4 in.	-.21	-.50	-.20	-.48	-.22	-.51	0.41	0.54	0.48	0.54
8 in.	-.24	-.54	-.23	-.53	-.24	-.54	0.46	0.58	0.56	0.61
12 in.	-.31	-.31	-.31	-.60	-.32	-.63	0.49	0.64	0.59	0.65
8th Thoracic										
4 in.	-.33	-.33	-.32	-.59	-.33	-.63	0.48	0.67	0.54	0.62
8 in.	-.13	-.14	-.14	-.57	-.14	-.59	0.54	0.61	0.68	0.69
12 in.	-.09	-.09	-.08	-.53	-.10	-.58	0.58	0.62	0.67	0.66
11th Thoracic										
4 in.	-.26	-.26	-.27	-.58	-.26	-.59	0.48	0.61	0.64	0.69
8 in.	-.24	-.24	-.23	-.66	-.23	-.68	0.60	0.71	0.78	0.82
12 in.	-.13	-.13	-.11	-.65	-.13	-.71	0.69	0.75	0.80	0.79
1st Lumbar										
4 in.	-.18	-.18	-.18	-.60	-.18	-.63	0.59	0.66	0.73	0.74
8 in.	-.32	-.32	-.31	-.56	-.31	-.57	0.44	0.61	0.50	0.57
12 in.	-.04	-.04	-.03	-.63	-.04	-.66	0.70	0.70	0.76	0.71
4th Lumbar										
4 in.	-.08	-.08	-.06	-.49	-.08	-.55	0.55	0.57	0.68	0.66
8 in.	-.39	-.61	-.39	-.60	-.38	-.60	0.42	0.61	0.58	0.67
12 in.	-.05	-.57	-.04	-.54	-.05	-.57	0.59	0.62	0.64	0.63

[1]RLRC = Round, loin, rib and chuck.
Correlation $>$ .179 are significant ($P < .05$).
Correlations $>$ .234 are significant ($P < .01$).

Table 10a. Simple correlation coefficients of linear fat measurements with retail, bone and fat trim yields for the combined weight groups.

Fat probes	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
6th Lumbar										
4 in.	-.13	-.54	-.12	-.50	-.12	-.53	0.51	0.57	0.62	0.63
8 in.	-.46	-.66	-.45	-.65	-.46	-.68	0.47	0.70	0.67	0.78
12 in.	0.06	-.54	-.08	-.47	0.06	-.55	0.62	0.57	0.73	0.66
3rd Sacral										
4 in.	-.03	-.61	-.02	-.57	-.03	-.62	0.66	0.67	0.78	0.74
8 in.	-.07	-.58	-.05	-.53	-.07	-.59	0.59	0.62	0.65	0.63
12 in.	-.33	-.56	-.32	-.53	-.34	-.58	0.44	0.61	0.56	0.64
5th Sacral										
4 in.	-.11	-.67	-.09	-.61	-.10	-.66	0.66	0.69	0.76	0.73
8 in.	-.06	-.63	-.05	-.59	-.06	-.63	0.65	0.66	0.73	0.70
12 in.	-.07	-.54	-.06	-.51	-.08	-.57	0.58	0.63	0.65	0.64
12th Rib fat measurements										
A	-.33	-.65	-.32	-.63	-.33	-.65	0.49	0.66	0.63	0.70
B	-.29	-.75	-.29	-.73	-.29	-.75	0.63	0.77	0.69	0.72
C	-.42	-.81	-.42	-.80	-.42	-.83	0.63	0.85	0.76	0.85
D	-.28	-.66	-.27	-.64	-.29	-.67	0.57	0.71	0.78	0.83
E	-.14	-.62	-.13	-.60	-.14	-.64	0.61	0.68	0.77	0.78
F	-.21	-.65	-.19	-.62	-.21	-.66	0.60	0.70	0.77	0.80
G	-.20	-.59	-.19	-.58	-.19	-.58	0.56	0.63	0.71	0.71
Av. A, B, C	-.40	-.85	-.39	-.83	-.40	-.86	0.68	0.88	0.80	0.87
Depth brisket	0.14	-.60	0.15	-.55	0.14	-.62	0.72	0.67	0.60	0.51

[1]RLRC = Round, loin, rib and chuck.
Correlations > .179 are significant ($P < .05$).
Correlations > .234 are significant ($P < .01$).

Table 11. Simple correlation coefficients of linear fat measurements with retail, bone and fat trim yields for the light weight group.

Fat probes	Retail yield from RIRC[1]		Roasts and steaks from RIRC		Total retail yield		Total fat trim		External fat trim from RIRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
5th Thoracic										
4 in.	-.46	-.56	-.41	-.52	-.47	-.57	0.63	0.62	0.61	0.61
8 in.	-.44	-.53	-.40	-.50	-.43	-.53	0.59	0.59	0.58	0.58
12 in.	-.46	-.56	-.42	-.52	-.48	-.58	0.62	0.60	0.57	0.56
8th Thoracic										
4 in.	-.60	-.69	-.53	-.63	-.61	-.71	0.76	0.75	0.70	0.69
8 in.	-.48	-.55	-.45	-.54	-.51	-.60	0.65	0.64	0.69	0.69
12 in.	-.47	-.53	-.39	-.47	-.48	-.55	0.59	0.60	0.59	0.60
11th Thoracic										
4 in.	-.53	-.61	-.52	-.62	-.54	-.63	0.67	0.66	0.75	0.75
8 in.	-.60	-.68	-.56	-.66	-.60	-.69	0.73	0.73	0.80	0.80
12 in.	-.60	-.68	-.53	-.62	-.61	-.69	0.74	0.74	0.73	0.73
1st Lumbar										
4 in.	-.55	-.64	-.53	-.63	-.55	-.64	0.69	0.69	0.69	0.69
8 in.	-.59	-.68	-.55	-.65	-.57	-.66	0.71	0.70	0.68	0.67
12 in.	-.51	-.64	-.49	-.63	-.49	-.62	0.69	0.67	0.70	0.69
4th Lumbar										
4 in.	-.36	-.49	-.28	-.41	-.37	-.50	0.54	0.52	0.57	0.55
8 in.	-.51	-.63	-.48	-.60	-.51	-.63	0.69	0.67	0.72	0.71
12 in.	-.37	-.52	-.32	-.47	-.36	-.52	0.61	0.57	0.64	0.62

[1] RIRC = Round, loin, rib and chuck
Correlations $>$ .255 are significant ($P < .05$).
Correlations $>$ .331 are significant ($P < .01$).

Table 11a. Simple correlation coefficients of linear fat measurements with retail, bone and fat trim yields for light weight group.

Fat probes	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
6th Lumbar										
4 in.	-.39	-.54	-.35	-.50	-.35	-.50	0.58	0.55	0.59	0.57
8 in.	-.69	-.75	-.64	-.72	-.70	-.77	0.79	0.80	0.76	0.76
12 in.	-.36	-.48	-.26	-.39	-.37	-.50	0.57	0.55	0.67	0.65
3rd Sacral										
4 in.	-.61	-.70	-.57	-.67	-.60	-.70	0.77	0.76	0.81	0.80
8 in.	-.56	-.59	-.47	-.51	-.56	-.60	0.64	0.66	0.58	0.60
12 in.	-.58	-.63	-.52	-.58	-.57	-.63	0.66	0.66	0.64	0.65
5th Sacral										
4 in.	-.59	-.66	-.52	-.60	-.59	-.67	0.70	0.69	0.68	0.68
8 in.	-.55	-.69	-.48	-.63	-.54	-.68	0.75	0.72	0.74	0.72
12 in.	-.47	-.57	-.43	-.53	-.49	-.59	0.67	0.66	0.67	0.66
12th Rib fat measurements										
A	-.63	-.69	-.58	-.65	-.63	-.69	0.70	0.71	0.68	0.69
B	-.68	-.73	-.64	-.71	-.68	-.74	0.75	0.75	0.70	0.70
C	-.82	-.89	-.78	-.86	-.83	-.91	0.91	0.91	0.86	0.86
D	-.65	-.76	-.63	-.74	-.65	-.76	0.82	0.81	0.87	0.86
E	-.54	-.65	-.53	-.65	-.55	-.66	0.73	0.71	0.79	0.79
F	-.58	-.65	-.55	-.63	-.58	-.66	0.70	0.70	0.78	0.79
G	-.42	-.48	-.41	-.49	-.41	-.49	0.54	0.54	0.58	0.58
Av. A, B, C	-.83	-.91	-.78	-.87	-.83	-.91	0.92	0.93	0.87	0.88
Depth brisket	-.63	-.66	-.59	-.63	-.63	-.68	0.70	0.71	0.59	0.60

[1]RLRC = Round, loin, rib and chuck

Correlations $> .255$ are significant ($P < .05$). Correlations $> .331$ are significant ($P < .01$).

Table 12. Simple correlation coefficients of linear fat measurements with retail, bone and fat trim yields for the heavy weight group.

Fat probes	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
5th Thoracic										
4 in.	-.43	-.44	-.42	-.43	-.43	-.44	0.43	0.44	0.47	0.48
8 in.	-.57	-.59	-.56	-.58	-.57	-.60	0.60	0.61	0.62	0.63
12 in.	-.74	-.75	-.74	-.75	-.76	-.77	0.74	0.77	0.74	0.76
8th Thoracic										
4 in.	-.52	-.56	-.53	-.57	-.53	-.58	0.61	0.62	0.58	0.58
8 in.	-.56	-.57	-.58	-.59	-.56	-.58	0.54	0.55	0.68	0.69
12 in.	-.55	-.57	-.56	-.58	-.58	-.61	0.63	0.65	0.69	0.70
11th Thoracic										
4 in.	-.58	-.58	-.58	-.58	-.59	-.60	0.59	0.61	0.64	0.65
8 in.	-.63	-.69	-.62	-.67	-.63	-.70	0.71	0.71	0.83	0.83
12 in.	-.67	-.70	-.65	-.68	-.69	-.73	0.75	0.77	0.85	0.85
1st Lumbar										
4 in.	-.59	-.62	-.58	-.61	-.62	-.66	0.68	0.69	0.77	0.77
8 in.	-.50	-.51	-.48	-.49	-.51	-.53	0.54	0.55	0.50	0.50
12 in.	-.66	-.67	-.64	-.65	-.69	-.72	0.74	0.76	0.75	0.75
4th Lumbar										
4 in.	-.55	-.57	-.55	-.57	-.56	-.59	0.61	0.61	0.73	0.73
8 in.	-.68	-.71	-.67	-.70	-.66	-.69	0.62	0.63	0.65	0.66
12 in.	-.56	-.60	-.56	-.59	-.57	-.61	0.64	0.65	0.65	0.65

[1]RLRC = Round, loin, rib and chuck.
Correlations > .255 are significant ($P < .05$).
Correlations > .331 are significant ($P < .01$).

Table 12a. Simple correlation coefficients of linear fat measurements with retail, bone and fat trim yields for the heavy weight group.

Fat probes	Retail yield from RIRC[1]		Roasts and steaks from RLRC		Total yield yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
6th Lumbar										
4 in.	-.54	-.54	-.51	-.51	-.55	-.56	0.58	0.60	0.65	0.66
8 in.	-.68	-.72	-.65	-.68	-.70	-.74	0.72	0.74	0.81	0.82
12 in.	-.50	-.55	-.48	-.53	-.51	-.58	0.59	0.59	0.70	0.70
3rd Sacral										
4 in.	-.57	-.57	-.54	-.53	-.59	-.59	0.62	0.65	0.73	0.74
8 in.	-.53	-.55	-.51	-.52	-.55	-.57	0.57	0.59	0.65	0.66
12 in.	-.49	-.56	-.45	-.52	-.52	-.61	0.66	0.65	0.66	0.65
5th Sacral										
4 in.	-.71	-.69	-.66	-.64	-.70	-.69	0.69	0.72	0.77	0.79
8 in.	-.63	-.61	-.60	-.58	-.64	-.63	0.62	0.65	0.69	0.71
12 in.	-.46	-.47	-.45	-.45	-.50	-.52	0.57	0.58	0.62	0.63
12th Rib fat measurements										
A	-.63	-.66	-.61	-.64	-.63	-.67	0.65	0.66	0.72	0.72
B	-.75	-.78	-.74	-.77	-.76	-.80	0.81	0.83	0.74	0.74
C	-.73	-.76	-.72	-.75	-.75	-.79	0.83	0.84	0.88	0.88
D	-.56	-.60	-.53	-.56	-.58	-.63	0.67	0.68	0.81	0.81
E	-.53	-.57	-.51	-.54	-.56	-.60	0.64	0.65	0.78	0.78
F	-.61	-.65	-.57	-.61	-.62	-.67	0.71	0.71	0.81	0.81
G	-.64	-.73	-.61	-.70	-.63	-.74	0.79	0.77	0.81	0.80
Av. A, B, C	-.80	-.84	-.79	-.82	-.81	-.86	0.87	0.88	0.87	0.88
Depth brisket	-.42	-.44	-.37	-.39	-.44	-.47	0.57	0.58	0.48	0.49

[1]RIRC = Round, loin, rib and chuck.
Correlations > .255 are significant ($P < .05$). Correlations > .331 are significant ($P < .01$).

Within the light weight group, fat measurement C and the average of measurements A, B and C were the most highly correlated with weight (range, -.78 to -.83 and -.78 to -.83, respectively) and percent (range, -.86 to -.91 and -.87 to -.91, respectively) retail yields and weight (range, 0.86 to 0.91 and 0.87 to 0.92, respectively) and percent (range, 0.86 to 0.91 and 0.88 to 0.93, respectively) fat trim yields. The fat probes most highly related to weight and percent fat trim yields were: the 11th thoracic probe at 8 in., the 6th lumbar probe at 8 in., the 3rd sacral probe at 4 in. and the 5th sacral probe at 8 in. These correlations ranged from 0.73 to 0.81 and 0.72 to 0.80 for weight and percent fat trim yields, respectively. All probes and measurements within the light weight group were significantly ($P < .01$) correlated with weight and percent retail and fat trim yields.

Within the heavy weight group, the correlations of fat probes and measurements with weight and percent retail and fat trim yields were lower than in the light weight group. Fat measurements B and C and the average of measurements A, B and C were the mostly highly related to weight and percent retail (range, -.72 to -.86) and fat trim yields (range, 0.74 to 0.88). All probes and measurements were significantly ($P < .01$) correlated with the retail and fat trim yields. These results support the findings of Lewis et al. (1964), Allen (1966) and Allen et al. (1966).

Brisket depth was negatively ($P < .01$) correlated with percent retail yields in the individual and combined weight groups and with weight

of retail yields in the individual weight groups. Correlations of brisket depth with weight and percent fat trim yields were highly (range, 0.48 to 0.72 and 0.49 to 0.71 for weight and percent, respectively, $P < .01$) significant for the individual and combined weight groups. These data also show the correlation of brisket depth with percent bone to be negative and highly significant ($P < .01$) in all weight groups and significant ($P < .01$) with weight of bone within the individual weight groups but not in the combined weight groups.

These data show that the fat probes and 12th rib fat measurements are generally more highly related to weight and percent external fat trim from the RLRC than to total fat trim. The correlations of these fat measures with retail and fat trim yields were higher in the light group than in the heavy weight group. The data also show that fat measurement C and the average of measurements A, B and C are consistently more highly related to retail and fat trim yields than any of the probes or other (12th rib) measurements. While the magnitude of the correlations of fat measurement C and those of the average of measurements A, B and C with retail and fat trim yields were usually greater for the latter fat measurement, the differences were small.

Relationships Between some Linear and Area Carcass Measurements and Retail, Bone and Fat Trim Yields. Simple correlation coefficients of some linear and area carcass measurements with retail, bone and fat trim yields are presented in table 13. Correlation coefficients of circumference of

Table 13. Simple correlation coefficients of some linear and area carcass measurements with retail, bone and fat trim yields for the combined and individual weight groups.

Linear or area measurement	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Combined weight groups[2]												
Carcass length	0.88	0.10	0.88	0.15	0.88	0.10	0.30	-.15	-.01	-.29	0.88	0.28
Length of round	0.83	0.22	0.83	0.27	0.81	0.21	0.14	-.29	-.08	-.33	0.89	0.44
Circ. of round	0.65	-.23	0.64	-.21	0.65	-.22	0.60	0.28	0.42	0.19	0.50	-.22
L. dorsi area	0.80	0.25	0.80	0.30	0.81	0.27	0.16	-.23	-.04	-.28	0.65	0.15
Light weight group[3]												
Carcass length	0.64	0.54	0.66	0.59	0.64	0.55	-.56	-.61	-.51	-.54	0.70	0.63
Length of round	0.68	0.64	0.70	0.69	0.66	0.64	-.69	-.72	-.59	-.61	0.82	0.78
Circ. of round	0.07	-.04	0.01	-.10	0.10	-.01	0.14	0.10	0.12	0.10	-.14	-.21
L. dorsi area	0.72	0.68	0.73	0.72	0.72	0.67	-.62	-.66	-.56	-.58	0.54	0.51
Heavy weight group[3]												
Carcass length	0.58	0.58	0.57	0.57	0.57	0.57	-.66	-.68	-.68	-.69	0.70	0.67
Length of round	0.57	0.52	0.57	0.53	0.56	0.51	-.60	-.64	-.50	-.51	0.74	0.69
Circ. of round	-.03	-.12	0.02	-.07	-.04	-.14	0.26	0.23	0.32	0.31	-.18	-.23
L. dorsi area	0.59	0.51	0.59	0.51	0.62	0.53	-.41	-.46	-.34	-.36	0.19	0.11

[1]RLRC = Round, loin, rib and chuck.
[2]Correlations $>$ .179 are significant ($P < .05$). Correlations $>$ .234 are significant ($P < .01$).
[3]Correlations $>$ .255 are significant ($P < .05$). Correlations $>$ .331 are significant ($P < .01$).

round with weight and percent retail, bone and fat trim yields were generally lower and less consistent between weight groups than correlations of other linear measurements.

Carcass length was significantly ($P < .01$) correlated with weight (range, 0.57 to 0.64) and percent (range, 0.54 to 0.58) retail yields within weight groups. In the combined weight group, these same correlations were high with weight (0.88) but low and nonsignificant with percent (range, 0.10 to 0.15) retail yields. Correlations of carcass length with weight and percent fat trim yields ranged from -.51 to -.68 and -.54 to -.69, respectively, for the individual weight groups. In the combined weight group these correlations were low. Carcass length was also highly correlated with weight (0.70 and 0.70) and percent (0.63 to 0.67) bone yield within the light and heavy weight groups. In the combined weight group, the correlation with weight of bone yield was high (0.88) while that with percent was much lower (0.28).

These data indicate that the relationship of round length to retail, bone and fat trim yields was very similar to the relationship of carcass length to these components. Round length was highly correlated with weight and percent retail yields within the light and heavy weight groups (range, 0.56 to 0.70 and 0.51 to 0.69, respectively). These correlations were higher with weight (0.82 to 0.83) and lower with percent (0.21 to 0.27) retail yields in the combined weight group. The correlations of round length with pounds and percent fat trim yields were very similar to those of carcass length with fat trim yields. Round length was more

highly correlated with weight and percent bone yields (range, 0.74 to 0.89 and 0.44 to 0.78, respectively) than carcass length. These findings are similar to those of Cole et al. (1962) who reported that carcass length was negatively related to fat trim and positively related to weight of carcass lean. Orme (1963) reported measurements of carcass length and length of hind leg in lamb carcasses were negatively related to measures of carcass fat. Du Bose et al. (1967) also found that with the exception of carcass weight, carcass length was the most accurate single indicator of weight of boneless roast and steak yield in beef carcasses.

L. dorsi muscle area was significantly ($P < .01$) correlated with weight and percent retail yields for the individual and combined weight groups. Although the correlations of L. dorsi muscle area with percent retail yields was significant ($P < .01$) in the combined weight group, the relationship was markedly lower than for the individual weight groups (range, 0.67 to 0.72, 0.51 to 0.53, and 0.25 to 0.30 for the light, heavy and combined weight groups, respectively). The correlations with weight and percent fat trim yields were negative and highly significant ($P < .01$) for the individual weight groups, but not for the combined weight group. These correlations were greater in the light weight group than in the heavy group. L. dorsi area was significantly ($P < .01$) related to both pounds and percent bone in the light weight group but only to pounds of bone in the heavy and combined weight groups. Cole et al. (1962), Allen (1966) and Henderson et al. (1966) found similar relationships between L. dorsi muscle area and weight and percent of carcass yields.

Round circumference was negatively correlated with percent retail yields in the combined weight group and most correlations were non-significant. The correlations with weight of retail yields were highly significant ($P < .01$) (range, 0.64 to 0.65) in the combined weight group but nonsignificant (range, 0.01 to 0.10, $P > .05$) within the individual weight groups. Round circumference was positively correlated with pounds and percent fat trim yields. This relationship was higher for pounds than percent and higher in the combined weight group than in the individual weight groups. Round circumference was negatively correlated with both weight and percent bone within weight groups and with percent bone in the combined weight groups.

Relationships of Wholesale Cut Retail, Fat Trim and Bone Yields to Total Carcass Retail, Fat Trim and Bone Yields. Correlation coefficients of wholesale cut retail yield with total carcass retail, bone and fat trim yields for the combined and individual weight groups are presented in tables 14, 15 and 16. The corresponding correlations of wholesale cut fat trim yield with total carcass retail, bone and fat trim yields are presented in tables 17, 18 and 19, while the correlation coefficients for wholesale cut bone yield with total carcass retail, bone and fat trim yields appear in tables 20, 21 and 22.

The correlations were calculated for weight of wholesale cut retail, bone and fat trim yields with weight of total carcass retail, bone and fat trim yields. Similarly correlations for each of the components were calculated between percents of these same characteristics.

Table 14. Simple correlation coefficients of wholesale cut retail yield with total carcass retail, bone and fat trim yields for the combined weight groups.

Wholesale cut	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	0.97	0.95	0.96	0.92	0.97	0.95	0.12	-.92	-.16	-.80	0.88	0.74
Loin	0.95	0.86	0.93	0.79	0.94	0.82	0.24	-.80	-.05	-.70	0.84	0.63
Rib	0.79	0.53	0.79	0.49	0.80	0.54	0.30	-.47	0.09	-.30	0.61	0.24
Chuck	0.98	0.86	0.97	0.87	0.98	0.85	0.32	-.84	0.01	-.81	0.89	0.72
Brisket	0.63	0.47	0.64	0.47	0.67	0.54	0.11	-.51	-.04	-.37	0.56	0.36
Foreshank	0.71	0.73	0.68	0.66	0.72	0.76	-.16	-.76	-.34	-.61	0.71	0.63
Plate	0.87	0.50	0.87	0.52	0.90	0.59	0.31	-.61	0.03	-.59	0.82	0.51
Flank	0.74	0.37	0.74	0.37	0.78	0.46	0.32	-.43	0.06	-.39	0.64	0.24

[1]RLRC = Round, loin, rib and chuck.
Correlations $>$ .179 are significant ($P < .05$).
Correlations $>$ .234 are significant ($P < .01$).

Table 15. Simple correlation coefficients of wholesale cut retail yield with total carcass retail, bone and fat trim yields for the light weight group.

Wholesale cut	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	0.95	0.96	0.91	0.91	0.95	0.96	-.87	-.93	-.80	-.87	0.80	0.81
Loin	0.86	0.86	0.77	0.76	0.84	0.84	-.74	-.84	-.67	-.77	0.71	0.72
Rib	0.60	0.61	0.56	0.56	0.61	0.61	-.44	-.56	-.36	-.48	0.42	0.45
Chuck	0.91	0.91	0.92	0.92	0.90	0.90	-.75	-.89	-.68	-.82	0.74	0.76
Brisket	0.54	0.53	0.54	0.54	0.60	0.60	-.52	-.59	-.46	-.52	0.55	0.55
Shank	0.76	0.77	0.66	0.68	0.78	0.80	-.74	-.79	-.68	-.72	0.71	0.72
Plate	0.74	0.72	0.75	0.73	0.81	0.79	-.66	-.77	-.65	-.76	0.65	0.64
Flank	0.53	0.44	0.53	0.45	0.59	0.52	-.34	-.49	-.35	-.49	0.36	0.33

[1]RLRC = Round, loin, rib and chuck.
Correlations $>$ .255 are significant ($P < .05$).
Correlations $>$ .331 are significant ($P < .01$).

Table 16. Simple correlation coefficients of wholesale cut retail yield with total carcass retail, bone and fat trim yields for the heavy weight group.

Wholesale cut	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	0.95	0.94	0.93	0.92	0.93	0.92	-.80	-.88	-.73	-.79	0.65	0.63
Loin	0.84	0.83	0.82	0.80	0.79	0.77	-.66	-.72	-.63	-.66	0.50	0.48
Rib	0.46	0.38	0.49	0.40	0.48	0.39	-.23	-.26	-.20	-.21	-.02	-.08
Chuck	0.91	0.90	0.90	0.88	0.91	0.90	-.80	-.89	-.77	-.83	0.70	0.69
Brisket	0.34	0.24	0.35	0.27	0.42	0.34	-.23	-.26	-.20	-.21	0.08	0.02
Foreshank	0.63	0.62	0.61	0.59	0.67	0.66	-.66	-.69	-.60	-.61	0.57	0.55
Plate	0.43	0.34	0.43	0.34	0.55	0.47	-.48	-.54	-.46	-.50	0.44	0.39
Flank	0.30	0.21	0.29	0.19	0.41	0.33	-.26	-.28	-.28	-.29	0.13	0.09

[1] RLRC = Round, loin, rib and chuck.
Correlations $>$ .255 are significant ($P < .05$).
Correlations $>$ .331 are significant ($P < .01$).

Relationships Between Wholesale Cut Retail Yield and Carcass Retail, Fat Trim and Bone Yields. The simple correlation coefficients of each wholesale cut retail yield with retail, fat trim and bone yields are presented in tables 14, 15 and 16. With the exception of the flank retail yield within the heavy weight group, the retail yield of each wholesale cut was highly significantly ($P < .01$) correlated with both weight and percent retail yields for the individual and combined weight groups. Wholesale cut retail yield was slightly more highly related to total carcass retail yield and retail yield from the RIRC than to roasts and steaks from the RIRC. Of the wholesale cuts, the retail yield of the round and chuck had the highest correlations with both weight and percent retail and bone yields in the individual and combined weight groups. Retail yields of these two wholesale cuts were also the most highly correlated with both weight and percent fat trim yields within weight groups; however; in the combined weight group the correlations with weight of fat trim yields were much lower than for percents of these fat trim yields.

Correlations of round retail yield with weight and percent of total carcass retail yields ranged from 0.91 to 0.97 and 0.91 to 0.95, respectively, among the combined and individual weight groups. The correlations ranged from -.79 to -.93 between round retail yield and percent fat trim yields among all weight groups. Within weight ranges, the correlations with weight of fat trim yields were slightly lower and ranged from -.73 to -.87. In addition, correlations of round retail yield with weight and percent bone yields among all weight groups were slightly lower (0.65

to 0.88 and 0.63 to 0.81, respectively, $P < .01$) than with retail yields. These findings are similar to those reported by Brungardt and Bray (1963a) who observed that among the wholesale cuts round retail yield was the most highly related to carcass retail yields. Tuma et al. (1967) observed a correlation coefficient of 0.89 between weight of round retail cuts and weight of carcass trimmed retail cuts. Allen (1966) reported correlations ranging from 0.66 to 0.88 for percent and 0.74 to 0.95 for weight of round retail yield with total carcass retail yields which were among the highest of all the wholesale cuts.

The wholesale chuck retail yield was also highly correlated with total carcass retail yields. Correlations ranged from 0.85 to 0.90 for percent and 0.90 to 0.98 for weight of retail yields, from 0.69 to 0.76 for percent and 0.74 to 0.89 for weight of bone yields, and from -.81 to -.89 for percent fat trim yields. The wholesale loin retail yield was the next most highly related to carcass retail yields. These results for the chuck and loin agree with those reported by Cole et al. (1960a), Cole et al. (1964) and Allen (1966). Allen found that of the wholesale cuts the chuck showed the highest relationship to carcass retail yield.

Hankins and Howe (1946), Hedrick et al. (1963), Miller et al. (1965) and Allen (1966) found high relationships between retail yield of the wholesale flank and total carcass retail yields. The correlations in the present study for the wholesale flank retail yield with percent carcass retail yields range from 0.19 to 0.52 for the combined and individual weight groups. Within weight ranges, retail yield of the flank

accounted for the least variation in carcass retail yields of all the wholesale cuts. The differences between these observations and the high correlations previously observed by others cannot be explained.

These results indicate that either the round or chuck retail yield should be used to predict total carcass retail yields. The wholesale round would be the most practical for such predictive purposes since it is much easier and faster to separate into boneless retail cuts and it also accounts for more of the variation than the chuck.

Relationships Between Wholesale Cut Fat Yield and Total Carcass Retail, Fat Trim and Bone Yields. Correlation coefficients of wholesale cut fat trim yield with total carcass retail, fat trim and bone yields for the combined and individual weight groups are presented in tables 17, 18 and 19. The correlations of wholesale cut fat trim with either weight or percent total carcass fat trim yields were significant ($P < .01$) for the combined and individual weight groups. With the exception of the wholesale loin fat trim in the heavy weight group, the correlations of wholesale cut fat trim yields with both weight and percent retail yields were highly significant ($P < .01$) and all were negative within the individual weight groups. However, in the combined weight group the correlations of wholesale cut fat trim yield with weight of retail yields were positive and most were significant ($P < .01$). In the individual weight groups, the correlations of wholesale cut fat trim with both weight and percent bone yields and with percent bone in the combined weight group were negative

Table 17. Simple correlation coefficients of wholesale cut fat trim with total carcass retail, bone and fat trim yields for the combined weight groups.

Wholesale cut	Retail yield from RIRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	0.50	-.70	0.49	-.69	0.50	-.72	0.85	0.72	0.63	0.56	0.41	-.52
Loin	0.48	-.51	0.48	-.49	0.48	-.53	0.71	0.57	0.40	0.29	0.31	-.56
Rib	0.46	-.73	0.46	-.69	0.46	-.74	0.89	0.77	0.64	0.53	0.30	-.65
Chuck	0.28	-.70	0.27	-.72	0.23	-.72	0.87	0.75	0.65	0.59	0.09	-.75
Brisket	0.14	-.75	0.14	-.74	0.15	-.75	0.84	0.77	0.67	0.68	0.03	-.68
Foreshank	0.43	-.66	0.43	-.62	0.43	-.68	0.85	0.73	0.73	0.59	0.28	-.62
Plate	0.23	-.85	0.22	-.83	0.23	-.86	0.93	0.88	0.71	0.67	0.07	-.81
Flank	0.26	-.92	0.26	-.89	0.27	-.92	0.95	0.92	0.80	0.79	0.15	-.77

[1]RIRC = Round, loin, rib and chuck.
Correlations $>$ .179 are significant ($P < .05$).
Correlations $>$ .234 are significant ($P < .01$).

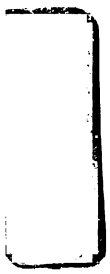


Table 18. Simple correlation coefficients of wholesale cut fat trim with total carcass retail, bone and fat trim yields for the light weight group.

Wholesale Cut	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	-.67	-.76	-.67	-.77	-.68	-.78	0.82	0.81	0.76	0.75	-.66	-.70
Loin	-.65	-.71	-.61	-.68	-.63	-.70	0.75	0.74	0.59	0.57	-.77	-.78
Rib	-.76	-.82	-.71	-.80	-.76	-.83	0.85	0.85	0.73	0.72	-.80	-.82
Chuck	-.72	-.79	-.71	-.81	-.72	-.81	0.83	0.82	0.72	0.69	-.75	-.77
Brisket	-.63	-.79	-.66	-.77	-.68	-.78	0.80	0.79	0.74	0.73	-.69	-.72
Foreshank	-.70	-.73	-.57	-.68	-.63	-.73	0.80	0.79	0.73	0.72	-.70	-.74
Plate	-.80	-.89	-.76	-.86	-.80	-.89	0.92	0.91	0.78	0.76	-.82	-.85
Flank	-.82	-.93	-.77	-.89	-.81	-.93	0.93	0.92	0.85	0.84	-.77	-.81

[1] RLRC = Round, loin, rib and chuck.
Correlations $>$ .255 are significant ($P < .05$).
Correlations $>$ .331 are significant ($P < .01$).

Table 19. Simple correlation coefficients of wholesale cut fat trim with total carcass retail, bone and fat trim yields for the heavy weight group.

Wholesale cut	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	-.48	-.55	-.47	-.54	-.47	-.56	0.54	0.53	0.52	0.51	-.21	-.22
Loin	-.07	-.06	-.05	-.04	-.10	-.09	0.15	0.16	-.04	-.04	-.24	-.22
Rib	-.61	-.60	-.59	-.58	-.61	-.61	0.69	0.70	0.54	0.53	-.67	-.62
Chuck	-.55	-.65	-.56	-.68	-.56	-.68	0.74	0.74	0.51	0.51	-.71	-.74
Brisket	-.62	-.73	-.61	-.72	-.61	-.74	0.77	0.77	0.59	0.65	-.58	-.61
Foreshank	-.36	-.47	-.37	-.48	-.39	-.51	0.62	0.60	0.64	0.59	-.45	-.49
Plate	-.68	-.79	-.67	-.78	-.68	-.80	0.84	0.84	0.60	0.60	-.71	-.73
Flank	-.77	-.89	-.76	-.87	-.76	-.89	0.90	0.90	0.78	0.78	-.68	-.71

[1] RLRC = Round, loin, rib and chuck.
Correlations > .255 are significant ($P < .05$).
Correlations > .331 are significant ($P < .01$).

and most were significant ($P < .01$); however, in the combined weight group the correlations with weight of bone were positive and low. The correlations between all wholesale cut and carcass components within the light weight group were significant ($P < .01$) and higher than those for the heavy group. These findings agree with those reported by Allen (1966).

Among the wholesale cuts, wholesale flank fat trim was consistently most highly correlated with total carcass fat trim yields (ranges, 0.80 to 0.95 and 0.78 to 0.92 for weight and percent, respectively) for all weight groups. Within weight groups, flank fat trim was more highly related to weight and percent retail yields (ranges, -.76 to -.82 and -.87 to -.93, respectively) than the fat trim from the other wholesale cuts. The corresponding correlations with weight of retail yields were much lower in the combined weight group.

Fat trim yield of the wholesale plate was the second most highly correlated with total carcass percent retail (range, -.78 to -.89), bone (range, -.73 to -.85), and fat yields (range, -.79 to -.89). The wholesale loin fat trim yield was highly related ($P < .01$) to total carcass retail, bone and fat yields in the light weight group, but in the heavy group the correlations were low and most were nonsignificant. Allen (1966) reported similar relationships between the wholesale cuts and carcass retail, fat trim and bone yields.

The difference in magnitude of the correlations between the two weight groups indicate that the site and quantity of fat deposition differs between weight groups. Allen (1966) found similar differences between these two weight groups.

Relationships Between Wholesale Cut Bone Yield and Total Carcass Retail, Bone and Fat Trim Yields. Tables 20, 21 and 22 present simple correlation coefficients of wholesale cut bone yields with total carcass retail, bone and fat trim yields for the combined, light and heavy weight groups, respectively. With the exception of the wholesale flank and rib, the bone yield of each wholesale cut was significantly ($P < .01$) correlated with both weight and percent total carcass retail yields and with percent total carcass bone and fat trim yields in all weight groups. Chuck and round bone yields were more highly correlated with both weight and percent of total carcass bone and retail yields, and with percent fat trim yields in all weight groups than any of the other wholesale cuts. Correlations of wholesale chuck bone yield with weight of total carcass bone ranged from 0.90 to 0.95 and with percent bone from 0.90 to 0.95. Corresponding correlations for wholesale round bone yield with weight and percent total carcass bone ranged from 0.89 to 0.96 and 0.89 to 0.93, respectively. The wholesale round bone yield was slightly more highly correlated with weight and percent retail yields than wholesale chuck bone yield. The bone yield of the wholesale foreshank was highly correlated (range, 0.85 to 0.88 and 0.85 to 0.89 for weight and percent, respectively) with total carcass bone yield. The correlations for the wholesale loin bone yield with total carcass bone yield were similar to those for the foreshank. These results concur with those reported by Cole et al. (1960a) and Brungardt and Bray (1963a).

These results indicate that separation of the wholesale round into retail, fat trim and bone yields would be the most useful wholesale cut

Table 20. Simple correlation coefficients of wholesale cut bone yield with total carcass retail, bone and fat trim yields for the combined weight groups.

Wholesale cut	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	0.88	0.73	0.88	0.73	0.87	0.73	0.11	-.80	-.13	-.68	0.96	0.91
Loin	0.82	0.65	0.82	0.67	0.82	0.65	0.10	-.71	-.09	-.57	0.92	0.85
Rib	0.72	0.53	0.73	0.53	0.73	0.55	0.12	-.63	-.03	-.44	0.81	0.77
Chuck	0.84	0.70	0.84	0.70	0.84	0.70	0.10	-.77	-.13	-.64	0.95	0.93
Brisket	0.49	0.48	0.51	0.50	0.51	0.52	-.10	-.57	-.08	-.41	0.71	0.59
Foreshank	0.87	0.71	0.86	0.68	0.87	0.72	0.15	-.79	-.19	-.64	0.88	0.87
Plate	0.83	0.49	0.83	0.50	0.84	0.51	0.20	-.59	-.10	-.63	0.79	0.71
Flank	0.30	0.14	0.29	0.10	0.30	0.14	0.14	-.17	0.04	-.11	0.00	0.19

[1]RLRC = Round, loin, rib and chuck
Correlations > .179 are significant ($P < .05$).
Correlations > .234 are significant ($P < .01$).

Table 21. Simple correlation coefficients of wholesale cut bone yield with total carcass retail, bone and fat trim yields for the light weight group.

Wholesale cut	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	0.79	0.80	0.78	0.79	0.79	0.80	-.80	-.85	-.72	-.72	0.93	0.93
Loin	0.72	0.75	0.72	0.76	0.72	0.75	-.78	-.81	-.70	-.69	0.89	0.89
Rib	0.58	0.61	0.58	0.60	0.58	0.61	-.64	-.68	-.58	-.58	0.81	0.82
Chuck	0.78	0.80	0.77	0.79	0.78	0.80	-.80	-.85	-.72	-.71	0.95	0.95
Brisket	0.57	0.56	0.59	0.58	0.59	0.58	-.58	-.64	-.51	-.52	0.71	0.70
Foreshank	0.78	0.79	0.75	0.75	0.79	0.80	-.76	-.83	-.72	-.72	0.88	0.89
Plate	0.61	0.64	0.62	0.64	0.64	0.66	-.68	-.72	-.71	-.72	0.79	0.80
Flank	0.00	0.19	0.00	0.12	0.00	0.15	0.00	-.17	-.29	-.22	0.00	0.20

[1]RLRC = Round, loin, rib and chuck.
Correlations $>$ .255 are significant ($P < .05$).
Correlations $>$ .331 are significant ($P < .01$).

Table 22. Simple correlation coefficients of wholesale cut bone yield with total carcass retail, bone and fat trim yields in the heavy weight group.

Wholesale cut	Retail yield from RIRC[1]		Roasts and steaks from RIRC		Total retail yield		Total fat trim		External fat trim from RIRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Round	0.65	0.66	0.65	0.66	0.63	0.64	-.76	-.76	-.64	-.64	0.89	0.89
Loin	0.52	0.54	0.53	0.55	0.50	0.52	-.61	-.59	-.46	-.45	0.79	0.80
Rib	0.31	0.29	0.33	0.32	0.33	0.32	-.47	-.45	-.30	-.29	0.71	0.72
Chuck	0.58	0.56	0.58	0.56	0.58	0.56	-.63	-.66	-.55	-.56	0.90	0.90
Brisket	0.34	0.25	0.36	0.27	0.39	0.30	-.33	-.36	-.57	-.30	0.45	0.40
Foreshank	0.57	0.56	0.55	0.53	0.58	0.56	-.69	-.71	-.29	-.57	0.85	0.85
Plate	0.51	0.51	0.50	0.49	0.54	0.54	-.65	-.65	-.62	-.62	0.74	0.73
Flank	0.11	0.07	0.09	0.05	0.13	0.09	-.13	-.14	-.09	-.10	0.26	0.25

[1]RIRC = Round, loin, rib and chuck.
Correlations $>$ .255 are significant ($P < .05$).
Correlations $>$ .331 are significant ($P < .01$).

for prediction of these same components in the carcass. Retail and bone yields of the round were consistently the most highly related to carcass retail and bone yields. Round fat trim yields were also highly significantly ($P < .01$) correlated with carcass fat trim yields. The correlations for retail and bone yields for the wholesale chuck with corresponding carcass components were quite similar, although slightly lower than those for the round. However, the round is much easier to separate and would be more useful as a measure of carcass retail and bone yields. This concurs with the findings of Brungardt and Bray (1963a). Carcass fat trim yields were most accurately predicted by the fat yield of the flank for both the individual and combined weight groups. Wholesale plate fat yield was also highly related to carcass fat trim yields. However, the flank is much easier and more rapidly separated than the plate or round and with less economic loss to the carcass. Thus, since the flank is essentially a "fat" wholesale cut, it is recommended for predicting carcass fat yield. These findings for the flank agree with those reported by Hankins and Howe (1946), Hedrick et al. (1963), Miller et al. (1965) and Allen (1966).

Relationships Between Certain Bones and Bone Groups and Total Carcass Retail, Bone and Fat Trim Yields. Highly significant correlation coefficients for the radius plus ulna, femur, tibia plus fibula, scapula and humerus with total carcass bone for the combined and individual weight groups are shown in table 23. Correlations for the individual bones and

Table 23. Simple correlation coefficients of certain bones and bone groups with total carcass retail, bone and fat trim yields for the combined and individual weight groups.

Bones	Retail yield from RIRC[1]		Roasts and steaks from RIRC		Total retail yield		Total fat trim		External fat trim from RIRC		Total bone	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Combined weight groups[2]												
Radius + ulna	0.87	0.21	0.86	0.24	0.87	0.22	0.18	-.27	-.05	-.32	0.95	0.46
Humerus	0.82	0.22	0.82	0.25	0.86	0.23	0.14	-.29	-.09	-.35	0.91	0.47
Scapula	0.81	0.20	0.80	0.21	0.81	0.21	0.17	-.24	-.06	-.32	0.84	0.38
Femur	0.86	0.27	0.86	0.30	0.83	0.26	0.13	-.31	-.08	-.34	0.94	0.50
Tibia + fibula	0.83	0.30	0.83	0.33	0.83	0.31	0.06	-.36	-.17	-.42	0.89	0.48
Light weight group[3]												
Radius + ulna	0.78	0.74	0.75	0.74	0.79	0.76	-.77	-.80	-.65	-.67	0.89	0.85
Humerus	0.76	0.74	0.73	0.73	0.77	0.76	-.77	-.80	-.64	-.66	0.92	0.89
Scapula	0.59	0.58	0.53	0.53	0.59	0.59	-.59	-.62	-.53	-.55	0.68	0.66
Femur	0.77	0.78	0.74	0.77	0.77	0.78	-.80	-.82	-.67	-.68	0.90	0.89
Tibia + fibula	0.75	0.72	0.73	0.73	0.76	0.74	-.76	-.79	-.66	-.67	0.88	0.84
Heavy weight group[3]												
Radius + ulna	0.56	0.55	0.52	0.51	0.56	0.55	-.67	-.69	-.53	-.54	0.86	0.83
Humerus	0.42	0.48	0.41	0.46	0.42	0.48	-.63	-.63	-.54	-.54	0.70	0.71
Scapula	0.51	0.55	0.50	0.53	0.53	0.57	-.61	-.62	-.52	-.52	0.64	0.64
Femur	0.59	0.62	0.60	0.63	0.56	0.59	-.68	-.69	-.52	-.52	0.84	0.83
Tibia + fibula	0.62	0.64	0.59	0.61	0.61	0.65	-.71	-.72	-.61	-.61	0.71	0.70

[1] RIRC = Round, loin, rib and chuck.

[2] Correlations > .179 are significant ($P < .05$). Correlations > .234 are significant ($P < .01$).

[3] Correlations > .255 are significant ($P < .05$). Correlations > .331 are significant ($P < .01$).

bone groups with total carcass bone for all weight groups ranged from 0.64 to 0.95 for weight and 0.64 to 0.89 for percent. Within weight groups, these bones and bone groups were significantly and positively ($P < .01$) correlated with both weight and percent of total carcass retail yields and negatively correlated with weight and percent fat trim yields. Most of these correlations were higher within the light weight group than the heavy group.

In the combined weight group, weight and percent radius plus ulna and that for the femur were more highly related to weight and percent total carcass bone (0.95 and 0.94, respectively, for weight, and 0.46 and 0.50, respectively, for percent) than any of the other bones or bone groups. Within the light weight group, both weight and percent humerus and femur were the most highly correlated with weight (0.92 and 0.90, respectively) and percent (0.89 and 0.89, respectively) of total carcass bone. In the heavy weight group, correlations for radius plus ulna and that for the femur were 0.86 and 0.84, respectively, for weight and 0.83 and 0.83, respectively, with percent total carcass bone. These results indicate that the femur was consistently more highly correlated with weight and percent total carcass bone than the other bones or bone groups. Similar results for individual bone and bone groups were reported by Allen (1966).

Correlation coefficients for the individual bones and bone groups with weight of total carcass retail yields ranged from 0.41 to 0.87 within as well as for the combined weight groups. The corresponding

correlations with percent total carcass retail yields, within weight groups, were markedly similar to the correlations with weight of retail yields; whereas, the correlations for the combined weight group were much lower for percent than for those between weight of retail yields.

These data indicate that individual bone and bone groups could be useful for predicting total carcass bone yield, but they would not be good predictors of carcass retail or fat trim yields. Butterfield (1963) developed several prediction equations for estimating carcass bone yield from weights of various bones as the independent variables. Allen (1966) also reported prediction equations for the combined weight groups for estimating total carcass bone yield from individual bone and bone group weights and accounted for over 90% of the total variation.

Relationship Between Subjective Carcass Scores and Total Carcass Retail and Fat Trim Yields. Simple correlation coefficients of subjective carcass scores with total carcass retail and fat trim yields for the combined and individual weight groups appear in tables 24, 25 and 26. Carcass, hindquarter, forequarter and round conformation scores (see table 2 for scoring procedure) were low, but significantly ($P < .05$) correlated with weight of retail yields for the combined weight group (range, 0.18 to 0.21). Carcass, hindquarter and round conformation scores were positively, but nonsignificantly, correlated with percent retail yields in the combined and individual weight groups. In contrast to the combined and heavy weight groups, hindquarter and round conformation scores in the

Table 24. Simple correlation coefficients of subjective carcass scores with total carcass retail, bone and fat trim yields for the combined weight groups.

Subjective score	Retail yield from RIRC[1]		Roasts and steaks from RIRC		Total retail yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Conformation:										
Carcass	0.19	0.11	0.17	0.07	0.19	0.10	0.08	0.01	-.01	-.06
Hindquarter	0.21	0.14	0.19	0.11	0.20	0.14	0.05	-.03	-.03	-.09
Forequarter	0.21	-.15	0.19	-.18	0.21	-.15	0.30	0.22	0.17	0.11
Round	0.21	0.17	0.19	0.13	0.21	0.16	0.02	-.06	-.05	-.11
Carcass:										
Maturity	0.36	0.02	0.37	0.06	0.36	0.02	0.10	-.09	0.05	-.06
Marbling	-.24	-.44	-.24	-.43	-.25	-.46	0.32	0.46	0.29	0.34
Grade	-.21	-.36	-.20	-.36	-.21	-.37	0.29	0.41	0.24	0.27

[1]RIRC = round, loin, rib and chuck.
Correlations > .179 are significant ($P < .05$).
Correlations > .234 are significant ($P < .01$).

Table 25. Simple correlation coefficients of subjective carcass scores with total carcass retail, bone and fat trim yields for the light weight group.

Subjective score	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Conformation:										
Carcass	0.18	0.21	0.09	0.12	0.17	0.20	-.12	-.11	-.19	-.11
Hindquarter	0.22	0.24	0.14	0.16	0.21	0.23	-.15	-.15	-.19	-.15
Forequarter	-.21	-.16	-.33	-.29	-.24	-.18	0.18	0.21	-.10	0.21
Round	0.24	0.26	0.14	0.17	0.22	0.25	-.18	-.17	-.24	-.17
Carcass:										
Maturity	0.09	0.07	0.14	0.12	0.08	0.06	-.14	-.15	-.06	-.15
Marbling	-.48	-.50	-.46	-.49	-.48	-.51	0.52	0.54	0.38	0.53
Grade	-.37	-.38	-.38	-.40	-.37	-.39	0.44	0.45	0.29	0.45

[1] RLRC = Round, loin, rib and chuck.
Correlations > .255 are significant ($P < .05$).
Correlations > .331 are significant ($P < .01$).

Table 26. Simple correlation coefficients of subjective carcass scores with total carcass retail, bone and fat trim yields for the heavy weight group.

Subjective score	Retail yield from RLRC[1]		Roasts and steaks from RLRC		Total retail yield		Total fat trim		External fat trim from RLRC	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Conformation:										
Carcass	0.12	0.09	0.12	0.08	0.13	0.09	0.08	0.06	0.01	0.01
Hindquarter	0.17	0.13	0.16	0.13	0.17	0.14	0.03	0.01	-.03	-.04
Forequarter	0.02	0.01	0.05	0.04	0.04	0.03	0.12	0.12	0.06	0.07
Round	0.17	0.16	0.16	0.15	0.18	0.17	-.01	-.02	-.04	-.04
Carcass:										
Maturity	0.22	0.18	0.21	0.17	0.22	0.18	-.21	-.23	-.11	-.11
Marbling	-.38	-.38	-.35	-.35	-.41	-.42	0.37	0.38	0.31	0.31
Grade	-.38	-.36	-.34	-.31	-.40	-.38	0.37	0.39	0.27	0.27

[1]RLRC = Round, loin, rib and chuck.
Correlations > .255 are significant ($P < .05$).
Correlations > .331 are significant ($P < .01$).

light weight group were significantly ($P < .05$) correlated with percent retail yield from the RIRC (0.24 and 0.26, respectively) and round conformation score was significantly ($P < .05$) correlated with percent total retail yield (0.25).

Most correlations were low and many were negative between the conformation scores and either weight or percent fat trim yields in the individual and combined weight groups (range, -.24 to -.30). Carcass, hindquarter and round conformation scores were more highly related to weight and percent retail and fat trim yields in the light weight group than in the heavy group.

Forequarter conformation score was negatively correlated with weight and percent of retail yields in the light weight group. Correlations between these same characteristics were essentially zero but positive in the heavy weight group, while those in the combined weight group were positive and significant ($P < .05$) for weight and negative for percent retail yields. These results support the work of Breidenstein (1962) and Branaman *et al.* (1962) who found no significant correlation between conformation score and yield of retail cuts in steers grading primarily Good and Choice. Pierce (1957), Goll *et al.* (1961a), Hedrick *et al.* (1963), Bray (1964), Briskey and Bray (1964), Cole *et al.* (1964) and Allen (1966) reported that conformation affects retail yield to a far lesser extent than degree of fatness.

Maturity scores were positively correlated with weight (range, 0.08 to 0.36) and percent (range, 0.02 to 0.18) retail yields and negatively

correlated with percent (range, -.06 to -.23) fat trim yields. These correlations were highest in the heavy weight group.

Marbling score was negatively ($P < .05$) correlated with weight (range, -.24 to -.48) and percent (range, -.38 to -.51) retail yields and positively ($P < .05$) correlated with weight (range, 0.29 to 0.52) and percent (range, 0.31 to 0.54) fat trim yields in the individual and combined weight groups. The correlations of marbling score with retail and fat trim yields are very similar to those for carcass grade with retail and fat trim yields. This relationship would be expected since marbling score was highly related to carcass grade (0.86, 0.87 and 0.84 for the combined, light and heavy weight groups, respectively).

Carcass grade was negatively (most were significant, $P < .05$) correlated with weight (range, -.20 to -.40) and percent (range, -.31 to -.40) retail yields and positively ($P < .05$) correlated with weight (range, 0.24 to 0.44) and percent (range, 0.27 to 0.45) fat trim yields for the combined and individual weight groups. These correlations were higher in the light weight group than in the combined or heavy groups. Carcass grade was more highly correlated ($P < .01$) with weight and percent total fat trim from the carcass than with external fat trim from the RIRC ($P < .05$).

Effect of Conformation upon Retail, Fat Trim and Bone Yields for Individual Fat Groups Within Each Weight Group. Carcasses within individual fat groups for each weight group were approximately equally divided on

conformation ($\leq$ low Choice and $\geq$ high Choice). Conformation scores (see table 2 for scoring procedure) ranged from low Good to average Prime. One-way analysis of variance (Steel and Torrie, 1960) was used to determine the effect of conformation upon carcass retail, fat trim and bone yields within each fat group (I to VIII).

Although the tabular data are not presented, the results showed that higher conformation carcasses had slightly greater retail yields (percent) while lower conformation carcasses had slightly higher percent of bone. However, none of these differences were significant ($P < .05$). Lower conformation carcasses also had slightly greater percents of fat trim yields; however the differences were nonsignificant ($P < .05$).

Even though an attempt was made to evaluate that proportion of conformation attributable to muscling by mentally defatting the carcass in the processing of determining conformation score, these results indicated that superior muscling is insignificant in comparison to the depressing effect of fat upon retail yield. Carcasses with similar muscling but with differences in degree of fatness had significant differences in percent retail yields. These relationships were applicable irrespective of the portion of the carcass scored for conformation by this procedure. Also, it is difficult to accurately evaluate muscling when carcasses have large external fat deposits. These findings further support those of Pierce (1957), Goll et al. (1961a), Breidenstein (1962), Brungardt and Bray (1963a), Hedrick et al. (1963), Bray (1964), Briskey and Bray (1964), Cole et al. (1964), Butterfield (1965), Stringer et al. (1965), Miller et al. (1965) and Allen (1966).

Relationship of Predicted Carcass Retail Yields from Several Existing Regression Equations to Actual Retail Yield. Several existing regression equations were used to predict percent carcass retail yields (table 27). These equations were selected since they have been shown (Breidenstein, 1965; Allen, 1966) to account for much of the total variation in retail yield.

Equations developed by Murphey et al. (1960), Brungardt and Bray (1963a), Breidenstein (1962) and several equations developed by Allen (1966) were used to predict percent carcass retail yields.

The correlation coefficients between predicted percent retail yields and the actual percent retail yields for each of these equations are presented in table 28 for the combined and individual weight groups. Only those equations that had correlations of 0.70 or greater were included in these results. Percent roasts and steaks from the RLRC, RLR and RL are shown in addition to total carcass retail yield and retail yield from the RLRC.

The equation of Murphey et al. (1960) was consistently the most accurate in predicting percent carcass retail yields and was followed closely by the equation of Breidenstein (1962) and then by the equation by Brungardt and Bray (1963a). The three equations developed by Allen (1966) were not as highly related to actual retail yields as those of the other authors.

In the combined weight group, the equation of Murphey et al. (1960) accounted for 74% of the variation in total carcass retail yield and 72%

Table 27. Some existing multiple regression equations for estimating percent retail yield in the combined and individual weight groups.

Murphey	$\hat{Y} = 51.34 - 5.784\ (X_1) - 0.0093\ (X_2) - 0.462\ (X_3) + 0.74\ (X_4)$
Breidenstein	$\hat{Y} = 67.99 - 0.0142\ (X_7) - 6.39\ (X_6) - 0.38\ (X_8) + 0.37\ (X_4) + 0.14\ (X_9)$
Brungardt and Bray	$\hat{Y} = 16.64 + 1.67\ (X_5) - 4.94\ (X_6)$
Allen (Equation 3)	$\hat{Y} = 40.969 - 0.014\ (X_7) - 0.049\ (X_{10}) - 0.128\ (X_{11}) + 0.407\ (X_{12}) + 0.235\ (X_{13})$
Allen (Equation 4)	$\hat{Y} = 40.614 - 0.014\ (X_7) - 0.129\ (X_{11}) - 0.031\ (X_{14}) + 0.429\ (X_{12}) + 0.235\ (X_{13})$
Allen (Equation 8)	$\hat{Y} = 45.402 - 0.014\ (X_7) - 0.1\ (X_{11}) - 0.03\ (X_{14}) + 0.436\ (X_{12}) + 0.388\ (X_{13})$

$\hat{Y}$ = Estimated % retail yield
X_1 = Fat thickness at 12th rib, in.
X_2 = Hot carcass wt., lb.
X_3 = Kidney fat, % of carcass.
X_4 = L. dorsi muscle area, sq. in.
X_5 = % trimmed round.
X_6 = Single fat measurement at 12th rib.
X_7 = Carcass wt., lb.
X_8 = Kidney fat wt., lb.
X_9 = Conformation grade.
X_{10} = Fat probe 5th thoracic vertebra, 4 in. off the carcass dorsal midline (mm.).
X_{11} = Fat probe 3rd sacral vertebra, 12 in. off the carcass dorsal midline (mm.).
X_{12} = Round length, in.
X_{13} = % flank retail yield.
X_{14} = Fat measurement A at 12th rib.

Table 28. Simple correlation coefficients of predicted retail yields (percent) from several existing regression equations with the actual percent retail yields for the individual and combined weight groups.

	Total carcass retail yield	Retail yield from RLRC[1]	Roasts and steaks from RLRC[1]	Roasts and steaks from RLR[2]	Roasts and steaks from RL[3]
		Combined weight groups[4]			
Murphey	0.86	0.85	0.83	0.78	0.82
Breidenstein	0.85	0.85	0.80	0.84	0.82
Brungardt and Bray	0.83	0.81	0.80	0.73	0.77
Allen (Equation 3)	0.70	0.70	0.70	0.63	0.63
Allen (Equation 4)	0.73	0.72	0.68	0.66	0.66
Allen (Equation 8)	0.72	0.72	0.68	0.66	0.66
		Light weight group[4]			
Murphey	0.92	0.91	0.87	0.88	0.89
Breidenstein	0.89	0.89	0.83	0.88	0.87
Brungardt and Bray	0.91	0.89	0.86	0.86	0.86
Allen (Equation 3)	0.70	0.70	0.66	0.64	0.66
Allen (Equation 4)	0.73	0.73	0.69	0.68	0.69
Allen (Equation 8)	0.72	0.73	0.69	0.67	0.69
		Heavy weight group[4]			
Murphey	0.86	0.84	0.82	0.76	0.78
Breidenstein	0.86	0.86	0.85	0.78	0.78
Brungardt and Bray	0.79	0.76	0.75	0.66	0.71
Allen (Equation 3)	0.66	0.64	0.62	0.46	0.52
Allen (Equation 4)	0.69	0.67	0.65	0.50	0.55
Allen (Equation 8)	0.69	0.67	0.66	0.51	0.56

[1]RLRC = Round, Loin, Rib and chuck. [2]RLR = Round, loin and rib. [3]RL = Round and loin.
[4]All coefficients are significant ($P < .01$)

of the variation in percent retail yield from the RLRC. This equation, as well as the other equations used, was less accurate in predicting roasts and steaks from the RLRC, RLR and RL than for retail yields. The equation by Breidenstein (1962) was similarly related to actual retail yields. This equation accounted for 72% of the variation in total retail yield and retail yield from the RLRC and 64% to 71% of the variation in roasts and steaks (RLRC, RLR and RL) in the combined weight group. The equation of Brungardt and Bray (1963a) accounted for 69% of the variation in total retail yield and 66% of the variation in RLRC retail yield. From 54% to 64% of the variation in roasts and steaks (RLRC, RLR and RL) was accounted for by this same equation. The equations of Allen (1966) accounted for only approximately 50% of the variation in retail yields.

The equations of Murphey et al. (1960), Brungardt and Bray (1963a) and Breidenstein (1962) were more accurate in predicting percent retail yields within the individual weight groups than for the combined weight group. The equation of Murphey et al. (1960) accounted for 85% and 83% of the variation in total carcass retail yield and RLRC retail yield, respectively, in the light weight group, while Breidenstein's (1962) equation accounted for 79% and 79% and the equation of Brungardt and Bray (1963a) accounted for 83% and 79% of the variation in these same components, respectively. The equations of Murphey et al. (1960), Brungardt and Bray (1963a), and Breidenstein (1962) were almost identical in their predictive values of roasts and steaks from the RLRC, RLR and RL (range, 71% to 79%). The equations of Allen (1966)) were nearly identical in their predictive value for the light and combined weight groups.

In the heavy weight group the equations of Breidenstein (1962) and Murphey et al. (1960) were essentially similar in predicting percent retail yields and roasts and steaks (range, 0.78 to 0.86 and 0.76 to 0.86, respectively) and they were more accurate than the equation of Brungardt and Bray (1963a) (range, 0.66 to 0.79). The equation of Brungardt and Bray (1963a) accounted for 62% of total retail yield and 58% of RLRC retail yield while the equations of Murphey et al. (1960) and Breidenstein (1962) accounted for 71% to 74% of these same components. Although the correlations were lower, similar relationships were found among these three equations for prediction of roasts and steaks. The equations of Allen (1966) were less accurate in the heavy group than in the light and combined weight groups. These equations accounted for 38% to 48% of the variation in retail yields and roasts and steaks from the RLRC.

Breidenstein (1965) reported that 77.26% of the variation in retail yield from the RLRC was accounted for by the equation of Murphey et al. (1960) and 67% by the Brungardt and Bray (1963a) equation, while only 60.22% of the variation was accounted for by the equation of Breidenstein (1962). Brungardt and Bray (1963a) reported that their equation accounted for 81% while that of Murphey et al. (1960) accounted for only 67% of the variation in percent retail yield.

These results indicate that certain of these equations are useful for prediction of percent retail yields. The equations most accurate for the combined weight group were even more accurate within weight groups.

The Effects of Beef-Type (Holsteins versus the Three Major British Beef Breeds) upon Retail, Fat Trim and Bone Yields. The means of some linear and area measurements and subjective carcass scores for steer carcasses of Holsteins (within 0.26 to 0.50 in. fat thickness range and heavy weight group) and the combined means of the three major British beef breeds (within the 0.26 to 0.50 in. fat thickness range in both the light and heavy weight groups) are presented in table 29. Although all of the carcasses were within the same fat thickness range (0.26 to 0.50 in.) the British breeds had more fat at the 12th rib than Holsteins. This difference was most marked between the Holsteins (0.32 in.) and British breeds (0.44 in.) within the same weight (heavy) group.

The average carcass conformation and grade scores for the British breeds in the light and heavy weight groups were low Choice; whereas, the Holsteins had corresponding scores of high Standard. In addition, the carcass grades reflect the differences in degree of marbling. The British breeds had marbling scores of modest- and small+ (adjacent degrees) for the heavy and light weight groups, respectively; while the Holstein marbling scores averaged slight+.

The light weight British breed carcasses were the shortest (46.1 in.) and had the smallest 1. dorsi muscles (11.00 sq. in.) but the area of the Holsteins (11.52 sq. in.) was quite similar. However, the heavy weight British breeds (same weight as the Holsteins) had considerably larger (13.12 sq. in.) 1. dorsi muscle areas. As expected, the Holstein carcasses were the longest (53.3 in.) and the heavy weight British breeds were intermediate (50.3 in.) in length of carcass.

Table 29. Means of some linear and area measurements and subjective carcass scores for steer carcasses of Holsteins and the combined means of the three major British beef breeds.

Breed and weight group	Carcass wt., lb.	Av. 12th rib fat thickness, in.	Av. carcass length, in.	L. dorsi muscle area sq. in.	Av. conf. score	Av. U.S.D.A. grade score[1]	Av. marbling score[2]
Holsteins (heavy group)	715.6	0.32	53.3	11.52	2.8 (high standard)	3.4 (high standard)	12.3 (slight+)
British breeds (heavy group)	721.9	0.44	50.3	13.12	7.2 (low choice)	6.9 (low choice)	16.0 (modest-)
British breeds (light group)	530.2	0.38	46.1	11.00	7.3 (low choice)	6.9 (low choice)	15.3 (small+)

[1]Score of 1 = low standard, 2 = av. standard, etc., through 12 = high prime.

[2]Score of 1 = devoid minus, 2 = devoid, etc., through 30 = abundant plus.

The means for weight and percent retail, fat trim and bone yields comparing the Holstein steer carcasses with the combined means of the three major British beef breeds are presented in table 30. The light weight group of British breeds had significantly ($P < .01$) greater percentages of retail yields than the Holstein carcasses, while within the heavy group there were essentially no differences in retail yields.

In the heavy weight group, the British breeds yielded a slightly higher percent and weight of roasts and steaks from the round, loin and rib but this difference was nonsignificant. Although nonsignificant, the Holsteins had a slightly higher percent and weight of total retail yield (64.22% vs. 62.45% and 229.65 lb. vs. 225.35 lb.) and slightly more retail yield from the RLRC (53.19% vs. 52.07% and 190.21 lb. vs. 187.87 lb.) than the British breeds. These results agree with those reported by Branaman et al. (1962) comparing dairy and beef-type carcasses.

When comparing the heavy weight group, the results show that the British breeds had significantly ($P < .01$) more external fat trim from the RLRC (9.63 lb. vs. 3.99 lb. and 2.66% vs. 1.12%) and more total carcass fat trim (75.52 lb. vs. 58.15 lb. and 20.92% vs. 16.26%) than the Holsteins even though both groups were within the same fat thickness range (0.26 to 0.50 in.). The Holsteins had significantly ($P < .01$) more bone (54.21 lb. vs. 44.62 lb. and 15.16% vs. 12.37%) than the British breeds.

When comparing the Holsteins with the light weight group of British cattle, the latter had significantly ($P < .01$) greater percentages of

Table 30. Mean weights and percents retail, fat trim and bone yields for steer carcasses of Holsteins and the combined means of the three major British beef breeds.

Breed and weight group	Total retail yield	Retail yield from RLRC[1]	Roasts and steaks from RLRC[1]	Roasts and steaks from RLR[1]	Roasts and steaks from RL[1]	Roasts and steaks from R[1]	Total fat trim	External fat trim from RLRC[1]	Total bone
				Weight of retail, fat trim and bone yields[2]					
Holstein (heavy group)	229.65[a]	190.21[a]	153.96[a]	91.77[a]	79.77[a]	49.25[a]	58.15[a]	3.99[a]	54.21[a]
British breeds (heavy group)	225.35[a]	187.87[a]	154.99[a]	94.95[a]	81.72[a]	50.11[a]	75.52[b]	9.63[b]	44.62[b]
				Percent of retail, fat trim and bone yields[3]					
Holstein (heavy group)	64.22[c]	53.19[c]	43.05[c]	25.66[c]	22.30[c]	13.77[c]	16.26[c]	1.12[c]	15.16[c]
British breeds (heavy group)	62.45[c]	52.07[c]	42.96[c]	26.32[c]	22.65[c]	13.88[c]	20.92[d]	2.66[d]	12.37[d]
British breeds (light group)	67.89[d]	56.17[d]	46.36[d]	28.66[d]	24.54[d]	15.13[d]	14.81[c]	2.11[d]	13.54[d]

[1]RLRC = Round, loin, rib and chuck; RLR = Round, loin and rib; RL = Round, loin; R = Round.

[2]Means for weight of retail, fat trim and bone yields with different superscripts in the same column are significant ($P < .01$).

[3]Means for percent of retail, fat trim and bone yields with different superscripts in the same column are significant ($P < .01$).

retail yields (67.89% vs. 64.22%, 56.17% vs. 53.19% and 46.36% vs. 43.05% for total carcass retail yield, retail yield from RLRC and roasts and steaks from RLRC, respectively). The Holsteins had a significantly ($P < .01$) greater percentage of bone (15.16% vs. 13.54%), while the British breeds had a higher ($P < .01$) percent of external fat trim (2.11% vs. 1.12%). However, it is interesting to note that the Holsteins had slightly more total fat trim (16.26% vs. 14.81%) but this difference was nonsignificant. The Holstein carcasses had more fat in the body cavity including kidney knob and more intermuscular fat which compensated for the difference in external fat trim from the RLRC.

These data suggest that there is a difference between Holsteins and the British breeds in their composition-weight relationship or stage of development. There was a difference in the distribution and amount of fat deposited. The heavy British group had significantly ($P < .01$) more external and total carcass fat trim (percent) than the Holsteins; however, when comparing percents of the light British group to the Holsteins, they had significantly more external fat but less total carcass fat trim than the Holsteins. This would indicate that the British breeds deposit most of their fat as subcutaneous fat initially and as fattening proceeds, fat is deposited in the belly cuts, between the muscles and then in the body cavity. Such findings were reported by Callow (1948) and Zinn (1967) for beef cattle. Holstein carcasses have a higher proportion of fat in the body cavity and between muscles (intermuscular fat) and a smaller proportion of subcutaneous fat than British breeds. This supports conclusions of Callow (1961).

The data show that British breeds which had the higher conformation scores also had a higher muscle to bone ratio. Martin et al. (1966) reported similar results for conformation scores and muscle to bone ratio. The effect that muscle development has upon retail yields is less marked then the influence of the amount and distribution of the fat within the carcass as evidenced by the comparison of these three groups of cattle. Although the muscle to bone ratio for the two British groups was nearly identical and higher than that for the Holsteins, the light British group was superior in retail yields to that of the Holsteins because fatness was quite similar between these two groups. Additionally there was no significant difference in retail yields between the heavy British group and the Holsteins because the British group had more fat trim which compensated for their superior muscle development (muscle to bone ratio).

These results indicate that the stage of fattening and muscle development at the time of slaughter was different for these three groups of cattle. The light weight British group was slaughtered during the period when muscular tissue was increasing at a greater rate than adipose tissue. At this stage, fat was deposited primarily as subcutaneous fat (hence the identical 12th rib fat thickness measurement with that of the heavy British group) with minimal amounts of body cavity and intermuscular fat. In contrast, the heavy weight British group was slaughtered when adipose tissue was being deposited in greater proportions in the belly cuts, as intermuscular and kidney and pelvic fat since more total fat trim was obtained but 12th rib fat thickness was almost identical to the light

weight British group. The Holstein carcasses were intermediate in the stage of fat development and deposition. Holstein cattle do not have the inherent capacity to develop a high muscle to bone ratio but they more closely approximated the light British group in muscle to fat ratio than the heavy weight British group.

It should be pointed out that the interaction between type and carcass weight was not obtained since a light weight group of Holsteins was not included in this experiment; primarily because Holstein carcasses in this weight group with 0.26 to 0.50 in. of fat thickness are very difficult to obtain. It should be recognized that the possibility of an interaction between type and carcass weight exists, since lighter weight carcasses yield a higher percent of retail yields (less total fat) than heavier carcasses, at least within the British breeds. Therefore the inferences drawn from these comparisons may not be completely valid.

SUMMARY

The right side of 120 steer carcasses of the three major British beef breeds were selected for chilled carcass weight and 12th rib fat thickness (average of three measurements). Sixty carcasses were selected within each of two weight ranges (light, 500 to 550 lb. and heavy, 700 to 750 lb.). The two weight ranges were further subdivided into four fat thickness groups; 0.26 to 0.50 in., 0.51 to 0.75 in., 0.76 to 1.00 in. and 1.01 to 1.25 in. with 15 carcasses selected within each group. In addition, 15 Holstein carcasses were selected within the 0.26 to 0.50 in. fat thickness group and 700 to 750 lb. weight range for comparison to the British breeds. All carcasses were subjectively scored for each grade factor and carcass length, round length and circumference, brisket depth and 1. dorsi muscle area were measured. Subcutaneous fat thickness probes were made 4, 8 and 12 in. from the dorsal midline perpendicular to the anterior edge of the 5th, 8th and 11th thoracic vertebrae, the 1st, 4th and 6th lumbar vertebrae and the 3rd and 5th sacral vertebrae.

Boneless, closely trimmed (approximately 0.3 in.) retail cuts were made by wholesale cut. The roasts and steaks from each of the four major wholesale cuts were weighed separately from the total retail cuts.

Carcass weight and fat thickness significantly ($P < .01$) affected retail and fat trim yields. Fat thickness also had a highly significant ($P < .01$) affect upon both weight and percent bone yield but carcass weight significantly affect only weight of bone. Percent retail and

and fat trim yields were significantly ($P < .01$) affected by carcass weight-fat thickness interaction, while percent bone was less affected ($P < .05$).

Retail yield from the RLRC, roasts and steaks from the RLRC, and total carcass retail yield were very highly correlated with each other (ranges, 0.96 to 1.00 and 0.96 to 0.99 for weight and percent, respectively). Correlations of weight and percent retail yields with weight and percent fat trim yields, respectively, were highly significant ($P < .01$) within weight groups. In the combined weight group, correlations between percent retail and percent fat trim yields were also highly significant while those between weights of these same components were low. Retail yields were highly correlated with weight and percent bone yield.

Fat probes and several linear fat measurements were positively correlated with fat trim yields. Within weight groups, correlations of fat measurements with either weight or percent retail yields were negative and most were significant ($P < .01$). In the combined weight group, correlations with percent retail yields were higher than those for weight. Fat measurements B and C (12th rib) and the average of fat measurements A, B and C were the most highly related to retail and fat trim yields in all weight groups. Brisket depth was negatively ($P < .01$) correlated with percent retail yields in the individual and combined weight groups and with weight of retail yields in the individual weight groups. Correlations of brisket depth with fat trim yields were positive and highly significant ($P < .01$).

Carcass length and round length were highly significantly ($P < .01$) correlated with weight and percent retail and bone yields within weight groups. In the combined weight group, the correlations with percent retail and bone yields were low and nonsignificant, while those with weight were high. Carcass length and round length were highly related to fat trim yields within weight ranges but the correlations in the combined weight group were low.

L. dorsi muscle area was significantly ($P < .01$) related to retail yields. The correlations with fat trim yields were negative and highly significant ($P < .01$) within weight groups but not for the combined weight group.

Of the wholesale cuts, the retail yield of the round was consistently the most highly related to total retail yields of the carcass (ranges of 0.91 to 0.97 and 0.91 to 0.95 for weight and percent, respectively). Round and chuck bone yields were the most highly related to carcass bone yield (ranges of 0.89 to 0.96 and 0.89 to 0.95 for weight and percent, respectively). Fat trim yields of the round and chuck were also highly significantly ($P < .01$) correlated with carcass fat trim. However, the fat trim from the wholesale flank was the most highly related to total carcass fat trim (ranges, 0.80 to 0.95 and 0.78 to 0.92 for weight and percent, respectively). These data indicate that the retail, fat trim and bone yields of the round would be the most useful wholesale cut for prediction of these same components in the carcass.

Correlations of subjective carcass conformation and grade scores with retail yields were positive but they were negative with fat trim

and most were nonsignificant ($P > .05$). Carcasses with higher conformation scores had slightly greater retail yields (percent) while lower conformation carcasses had slightly greater yields of percent fat trim and bone. Even though an attempt was made to evaluate that proportion of conformation associated with muscling by mentally defatting the carcass during the process of determining conformation score, these results indicated that superior muscling was insignificant in comparison to the depressing effect of fat upon retail yields.

The relationship of predicted carcass retail yields from several existing regression equations to actual retail yield were more accurate within the light weight group than for the heavy and combined weight groups. The equation of Murphey was consistently the most accurate in predicting percent total carcass retail yield, RIRC retail yield and roasts and steaks from the RIRC (range, 67% to 85% of the variation in actual retail yields). An equation by Breidenstein followed closely in predictive value (range, 64% to 79% of the variation in actual retail yields), while the equation by Brungardt and Bray was less accurate and accounted for 56% to 83% of the variation in actual retail yields. Several equations developed by Allen accounted for only approximately 50% of the variation in actual retail yields.

The effects of beef-type (Holsteins versus the three major British beef breeds) upon retail, fat trim and bone yields showed that the light weight group of British breeds had significantly ($P < .01$) greater percentages of retail yields than the Holstein carcasses, but differences

in retail yields between the Holsteins and heavy weight group of British breeds were nonsignificant. These data reflect a difference between Holsteins and the British breeds in their composition-weight relationship or stage of development. There was a difference in muscle to bone ratio and the distribution and amount of fat deposited. Although the muscle to bone ratio for the two British groups was nearly identical and higher than that for the Holsteins, the light British group was superior in retail yields to that of the Holsteins because fatness was quite similar between these two groups. Additionally there were no significant differences in retail yields between the heavy British group and the Holsteins because the British group had more fat trim which offset their superior muscle to bone ratio.

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APPENDIX

APPENDIX I A CARCASS EVALUATION - SUBJECTIVE SCORES

Steer No.	Breed	Round Score	Overall Conf.	Hindquarter Conf.	Forequarter Conf.	Maturity Score	Marbling Score	Final Grade
Group I .26 to .50 in.								
1	1	08	08	08	06	2	17	08
2	1	06	06	06	06	4	09	03
3	2	05	05	06	04	4	13	05
4	1	05	05	05	07	2	11	04
5	3	07	07	07	07	4	10	04
6	1	07	07	07	07	3	19	08
7	1	07	07	07	08	2	18	08
8	2	07	07	07	07	2	17	08
9	1	07	07	07	08	2	17	08
10	1	08	08	08	08	1	16	08
11	1	08	08	08	08	1	16	08
12	2	07	07	07	07	1	16	08
13	1	09	09	09	08	2	17	08
14	1	09	09	09	08	1	16	08
15	2	09	09	09	09	2	17	08
Eng. Mean		7.3	7.3	7.3	7.2	2.2	15.3	6.9
Metric Mean		7.3	7.3	7.3	7.2	2.2	15.3	6.9
Group II .51 to .75 in.								
1	1	06	06	06	08	3	17	07
2	1	08	08	08	09	2	13	06
3	2	05	05	05	06	3	12	04
4	1	09	08	08	09	2	17	08
5	1	08	08	08	09	2	18	08
6	2	08	08	08	09	2	13	06
7	2	06	06	06	06	3	16	06
8	2	06	06	06	08	3	16	06
9	2	07	08	06	09	2	18	08
10	1	08	08	08	08	2	24	09
11	2	07	07	07	08	3	09	04
12	1	08	08	08	09	2	17	08
13	1	07	07	07	08	2	18	08
14	1	10	10	10	10	2	14	07
15	2	06	06	06	08	3	14	05
Eng. Mean		7.3	7.3	7.1	8.3	2.0	15.7	6.7
Metric Mean		7.3	7.3	7.1	8.3	2.0	15.7	6.7

APPENDIX I A (CONTINUED)

Steer No.	Breed	Round Score	Overall Conf.	Hindquarter Conf.	Forequarter Conf.	Maturity Score	Marbling Score	Final Grade
Group III .76 to 1.00 in.								
1	1	08	08	08	08	2	16	07
2	1	07	07	07	09	3	29	10
3	1	07	07	07	08	3	20	08
4	1	07	07	07	08	3	24	09
5	1	09	08	08	08	4	13	05
6	2	08	08	08	08	3	14	06
7	2	07	07	07	08	3	10	04
8	1	08	08	08	09	2	15	07
9	1	07	07	07	08	3	18	08
10	1	08	08	08	10	2	27	10
11	1	05	05	05	08	2	20	09
12	1	07	07	07	09	2	24	09
13	1	08	08	08	10	2	18	08
14	1	07	08	08	08	2	16	07
15	1	08	08	08	08	2	20	09
Eng. Mean		7.4	7.4	7.4	8.5	2.5	18.9	7.7
Metric Mean		7.4	7.4	7.4	8.5	2.5	18.9	7.7
Group IV 1.01 to 1.25 in.								
1	1	05	06	06	09	3	18	07
2	1	05	05	06	07	2	23	09
3	1	07	07	07	08	2	23	09
4	2	07	07	07	08	2	14	07
5	1	07	07	07	07	2	17	08
6	1	05	05	05	07	2	19	07
7	1	06	06	06	07	2	18	07
8	1	07	07	07	08	2	20	09
9	1	07	07	07	08	2	22	09
10	1	08	08	08	07	2	19	08
11	1	06	06	06	08	2	26	09
12	1	07	07	07	07	2	21	09
13	1	07	07	07	08	2	23	09
14	1	08	09	08	08	2	15	07
15	1	05	06	06	08	2	29	09
Eng. Mean		6.5	6.7	6.7	7.7	2.1	20.0	8.2
Metric Mean		6.5	6.7	6.7	7.7	2.1	20.0	8.2

APPENDIX I A (CONTINUED)

Steer No.	Breed	Round Score	Overall Conf.	Hindquarter Conf.	Forequarter Conf.	Maturity Score	Marbling Score	Final Grade
Group V .26to .50 in.								
1	1	08	08	08	09	5	16	06
2	2	07	07	07	08	4	15	06
3	1	06	07	07	08	2	12	06
4	2	08	08	08	08	2	11	05
5	2	08	08	08	08	3	16	07
6	1	09	09	09	11	4	16	07
7	1	07	07	07	09	2	17	08
8	1	08	08	08	09	2	17	08
9	2	07	07	07	08	3	16	07
10	2	08	08	08	09	4	13	06
11	2	05	05	05	07	3	18	07
12	1	07	07	07	08	3	16	07
13	1	07	07	07	09	3	21	09
14	1	06	06	06	07	2	16	07
15	1	06	06	06	06	3	19	07
Eng. Mean		7.1	7.2	7.2	8.3	3.0	15.9	6.9
Metric Mean		7.1	7.2	7.2	8.3	3.0	15.9	6.9
Group VI .51 to .75 in.								
1	3	05	05	05	06	4	21	07
2	2	07	07	07	08	4	19	08
3	2	06	06	06	08	4	19	08
4	2	05	05	05	08	4	16	05
5	2	07	07	07	08	4	20	08
6	2	06	06	06	08	3	16	06
7	1	10	10	10	10	5	11	04
8	1	10	10	10	11	3	17	08
9	1	08	08	08	10	3	16	07
10	3	07	07	07	08	2	17	08
11	1	09	09	09	08	1	12	06
12	1	08	08	08	08	3	20	08
13	1	09	09	09	10	2	17	08
14	1	10	10	10	10	2	17	08
15	1	08	07	07	09	3	15	07
Eng. Mean		7.7	7.6	7.6	8.7	3.1	16.9	7.1
Metric Mean		7.7	7.6	7.6	8.7	3.1	16.9	7.1

APPENDIX I A (CONTINUED)

Steer No.	Breed	Round Score	Overall Conf.	Hindquarter Conf.	Forequarter Conf.	Maturity Score	Marbling Score	Final Grade
Group VII .76 to 1.00 in.								
1	1	07	07	07	08	3	16	07
2	1	09	08	08	08	3	18	08
3	1	11	10	10	10	4	12	05
4	2	04	04	04	06	3	22	07
5	1	08	09	08	08	2	22	09
6	1	06	06	06	07	4	18	06
7	1	07	08	07	09	3	20	08
8	1	11	11	11	11	2	23	10
9	1	09	09	09	11	2	20	09
10	1	06	07	07	09	2	21	09
11	1	08	08	08	09	3	13	06
12	1	09	09	09	08	2	18	08
13	2	07	07	07	08	2	14	07
14	2	08	08	08	09	3	10	05
15	1	07	07	07	09	2	17	08
Eng. Mean		7.8	7.9	7.7	8.7	2.7	17.6	7.5
Metric Mean		7.8	7.9	7.7	8.7	2.7	17.6	7.5
Group VIII 1.01 to 1.25 in.								
1	2	06	06	06	09	3	20	09
2	1	09	09	09	10	3	27	10
3	2	06	06	06	07	3	24	09
4	2	07	07	07	09	4	21	08
5	2	07	07	07	08	2	15	07
6	2	08	09	09	08	2	14	07
7	2	08	08	08	09	2	18	08
8	1	07	07	07	10	3	21	09
9	1	07	07	07	08	2	19	08
10	2	09	09	09	11	2	16	07
11	1	08	09	08	10	3	24	09
12	1	08	08	08	09	3	16	07
13	1	06	06	06	08	2	18	07
14	1	05	05	05	07	2	19	07
15	2	07	07	07	09	3	17	07
Eng. Mean		7.2	7.3	7.3	8.8	2.6	19.3	7.9
Metric Mean		7.2	7.3	7.3	8.8	2.6	19.3	7.9

APPENDIX I B CARCASS EVALUATION - OBJECTIVE FAT MEASURES

Steer No.	Carc. Wt.	5th Thor. 4 in.	5th Thor. 8 in.	5th Thor. 12 in.	5th Thor. Avg.	8th Thor. 4 in.	8th Thor. 8 in.	8th Thor. 12 in.	8th Thor. Avg.	11th Thor. 4 in.	11th Thor. 8 in.
Group I .26 to .50 in.											
1	557	14	22	17	17.67	14	14	20	16.00	08	13
2	534	09	14	13	12.00	07	11	08	8.67	11	09
3	526	05	11	08	8.00	06	09	08	7.67	10	13
4	549	04	06	08	6.00	02	04	04	3.33	05	05
5	498	03	06	13	7.33	04	09	06	6.33	08	10
6	538	05	08	15	9.33	04	08	07	6.33	06	09
7	504	07	13	07	9.00	09	06	05	6.67	07	06
8	508	05	08	12	8.33	04	08	06	6.00	08	06
9	546	04	12	07	7.67	09	10	06	8.33	07	08
10	528	08	07	12	9.00	08	08	08	8.00	09	13
11	528	07	12	13	10.67	08	06	07	7.00	08	06
12	535	06	16	12	11.33	05	12	09	8.67	10	09
13	546	07	21	10	12.67	06	10	08	8.00	07	08
14	522	08	23	11	14.00	05	08	08	7.00	10	14
15	549	06	18	11	11.67	06	13	10	9.67	10	11
Eng Mean	531.2	.26	.51	.44	.41	.26	.36	.31	.31	.33	.37
Metric Mean	241.0	6.5	13.1	11.3	10.3	6.5	9.1	8.0	7.8	8.3	9.3
Group II .51 to .75 in.											
1	543	05	17	20	14.00	04	11	10	8.33	07	07
2	511	07	07	10	8.00	07	05	05	5.67	08	08
3	535	06	14	08	9.33	06	11	07	8.00	10	13
4	503	08	11	12	10.33	05	09	06	6.67	09	10
5	535	08	18	14	13.33	10	10	08	9.33	08	12
6	514	07	10	17	11.33	06	14	08	9.33	10	12
7	531	12	22	17	17.00	12	18	12	14.00	15	16
8	526	07	20	17	14.67	07	20	21	16.00	12	15
9	516	07	19	16	14.00	09	11	10	10.00	10	12
10	515	10	24	24	19.33	13	21	12	15.33	10	13
11	547	10	12	16	12.67	10	06	08	8.00	10	07
12	531	13	22	23	19.33	11	16	10	12.33	14	17
13	533	09	18	16	14.33	06	11	09	8.67	08	10
14	541	06	22	21	16.33	06	19	18	14.33	17	17
15	528	10	11	14	11.67	06	13	13	10.67	13	11
Eng Mean	509.7	.33	.65	.64	.54	.31	.51	.41	.41	.42	.47
Metric Mean	231.2	8.3	16.5	16.3	13.7	7.9	13.0	10.5	10.4	10.7	12.0

APPENDIX I B (CONTINUED)

Steer No.	Carc. Wt.	5th Thor. 4 in.	5th Thor. 8 in.	5th Thor. 12 in.	5th Thor. Avg.	8th Thor. 4 in.	8th Thor. 8 in.	8th Thor. 12.in.	8th Thor. Avg.	11th Thor. 4 in.	11th Thor. 8 in.
Group III .76 to 1.00 in.											
1	514	07	09	12	9.33	06	13	07	8.67	10	12
2	541	07	21	19	15.67	09	18	15	14.00	10	12
3	547	07	11	06	8.00	08	11	10	9.67	12	17
4	540	08	13	15	12.00	07	09	09	8.33	11	10
5	550	08	24	20	17.33	08	12	12	10.67	12	15
6	530	11	21	21	17.67	09	21	15	15.00	15	16
7	548	11	16	28	18.33	09	21	14	14.67	13	20
8	505	10	21	16	15.67	10	11	08	9.67	09	12
9	526	05	12	21	12.67	09	16	08	11.00	08	10
10	540	11	23	20	18.00	09	17	17	14.33	11	11
11	531	12	17	25	18.00	13	15	12	13.33	14	11
12	538	08	12	20	13.33	12	21	08	13.67	13	19
13	528	11	20	18	16.33	07	15	10	10.67	11	11
14	531	08	15	19	14.00	09	16	12	12.33	08	15
15	556	23	22	15	20.00	15	13	15	14.33	17	17
Eng Mean	535.0	.39	.67	.72	.59	.37	.60	.45	.47	.46	.54
Metric Mean	242.7	9.8	17.1	18.3	15.1	9.3	15.3	11.5	12.0	11.6	13.7
Group IV 1.01 to 1.25 in.											
1	550	12	29	23	21.33	19	21	11	17.00	17	23
2	535	11	18	15	14.67	12	17	12	13.67	15	20
3	542	12	28	18	19.33	15	17	16	16.00	14	15
4	512	14	22	09	15.00	13	19	16	16.00	23	22
5	554	11	14	17	14.00	14	11	11	12.00	16	17
6	552	10	36	26	24.00	15	15	11	13.67	15	21
7	555	09	12	14	11.67	15	15	13	14.33	10	16
8	555	18	37	43	32.67	23	23	22	22.67	19	22
9	517	16	28	27	23.67	27	20	18	21.67	10	16
10	560	14	27	34	25.00	16	24	11	17.00	18	13
11	513	10	11	16	12.33	15	18	15	16.00	13	11
12	565	11	16	24	17.00	16	20	16	17.33	14	20
13	480	10	26	20	18.67	11	16	23	16.67	13	19
14	527	13	28	26	22.33	14	24	16	18.00	14	18
15	532	10	28	32	23.33	15	15	14	14.67	15	18
Eng Mean	536.6	.48	.94	.90	.78	.63	.72	.59	.64	.59	.71
Metric Mean	243.4	12.1	24.0	22.9	19.7	16.0	18.3	15.0	16.4	15.1	18.1

APPENDIX I B (CONTINUED)

Steer No.	Carc. Wt.	5th Thor. 4 in.	5th Thor. 8 in.	5th Thor. 12 in.	5th Thor. Avg.	8th Thor. 4 in.	8th Thor. 8 in.	8th Thor. 12 in.	8th Thor. Avg.	11th Thor. 4 in.	11th Thor. 8 in.
Group V .26 to .50 in.											
1	747	07	15	12	11.33	07	16	10	11.00	10	14
2	721	06	15	15	12.00	10	16	12	12.67	11	12
3	749	08	22	14	14.67	08	11	08	9.00	08	11
4	721	03	13	07	7.67	03	10	09	7.33	08	13
5	694	05	05	05	5.00	02	14	07	7.67	04	04
6	748	09	21	12	14.00	11	17	08	12.00	07	12
7	700	09	08	14	10.33	07	08	09	8.00	09	10
8	747	13	25	20	19.33	09	10	11	10.00	09	10
9	719	11	18	15	14.67	12	12	11	11.67	10	09
10	741	08	11	11	10.00	07	10	12	9.67	10	11
11	722	07	10	10	9.00	06	13	10	9.67	10	10
12	736	10	16	11	12.33	07	09	09	8.33	05	06
13	699	08	08	10	8.67	06	13	09	9.33	16	09
14	680	08	14	08	10.00	07	14	09	10.00	06	09
15	715	06	10	10	8.67	06	07	06	6.33	06	10
Eng Mean	722.6	.31	.56	.46	.44	.28	.47	.37	.37	.34	.39
Metric Mean	327.8	7.9	14.1	11.6	11.2	7.2	12.0	9.3	9.5	8.6	10.0
Group VI .51 to .75 in.											
1	700	11	13	18	14.00	10	16	11	12.33	11	12
2	706	08	23	09	13.33	09	14	07	10.00	11	12
3	722	07	10	10	9.00	05	19	07	10.33	07	13
4	718	07	08	08	7.67	05	12	12	9.67	12	14
5	704	12	26	18	18.67	07	14	12	11.00	13	15
6	737	08	14	18	13.33	07	16	13	12.00	15	14
7	741	07	14	15	12.00	10	16	10	12.00	07	14
8	713	10	19	16	15.00	06	12	07	8.33	08	11
9	727	07	07	22	12.00	08	13	08	9.67	14	15
10	701	10	21	17	16.00	08	16	13	12.33	10	15
11	749	08	15	14	12.33	09	19	19	15.67	11	16
12	704	08	11	19	12.67	08	16	11	11.67	11	11
13	715	06	14	16	12.00	08	08	07	7.67	09	11
14	700	12	20	11	14.33	11	08	08	9.00	10	10
15	695	11	21	16	16.00	04	10	12	8.67	09	13
Eng Mean	715.5	.35	.62	.59	.52	.30	.55	.41	.42	.41	.52
Metric Mean	324.6	8.8	15.7	15.1	13.2	7.7	13.9	10.5	10.7	10.5	13.1

APPENDIX I B (CONTINUED)

Steer No.	Carc. Wt.	5th Thor. 4 in.	5th Thor. 8 in.	5th Thor. 12 in.	5th Thor. Avg.	8th Thor. 4 in.	8th Thor. 8 in.	8th Thor. 12 in.	8th Thor. Avg.	11th Thor. 4 in.	11th Thor. 8 in.
Group VII .76 to 1.00 in.											
1	701	04	08	20	10.67	05	12	06	7.67	08	10
2	741	08	13	09	10.00	08	09	13	10.00	07	11
3	689	12	23	22	19.00	13	16	11	13.33	08	08
4	706	07	17	18	13.00	08	23	23	18.00	14	15
5	731	10	24	21	18.33	15	16	13	14.67	12	14
6	714	10	24	18	17.33	11	15	18	14.67	11	15
7	698	10	17	25	17.33	12	26	25	21.00	09	14
8	709	08	11	23	14.00	18	17	14	16.33	10	14
9	708	09	14	08	10.33	06	07	09	7.33	13	10
10	724	11	12	16	13.00	11	11	16	12.67	12	09
11	713	13	19	19	17.00	10	20	22	17.33	11	12
12	715	11	09	13	11.00	13	15	08	12.00	12	16
13	705	07	25	24	18.67	08	24	19	17.00	17	22
14	688	13	28	18	19.67	11	25	19	18.33	14	20
15	697	08	16	18	14.00	12	11	12	11.67	11	16
Eng Mean	709.3	.37	.68	.71	.59	.42	.65	.60	.56	.44	.54
Metric Mean	321.7	9.4	17.3	18.1	14.9	10.7	16.5	15.2	14.1	11.3	13.7
Group VIII 1.01 to 1.25 in.											
1	704	11	18	24	17.67	09	27	19	18.33	08	19
2	731	06	10	14	10.00	06	13	13	10.67	13	11
3	735	15	34	28	25.67	13	30	13	18.67	22	27
4	712	09	24	25	19.33	14	27	23	21.33	19	24
5	686	10	23	22	18.33	09	18	15	14.00	20	20
6	746	11	30	17	19.33	13	16	22	17.00	15	20
7	700	13	27	25	21.67	11	25	27	21.00	22	23
8	702	04	40	22	22.00	13	19	15	15.67	15	18
9	702	11	25	24	20.00	09	08	18	11.67	20	18
10	704	13	32	20	21.67	19	18	14	17.00	18	17
11	716	08	29	30	22.33	17	22	22	20.33	19	23
12	718	12	25	25	20.67	17	15	13	15.00	14	22
13	683	14	28	29	23.67	14	21	19	18.00	15	18
14	740	13	16	22	17.00	09	19	15	14.33	15	17
15	725	17	20	27	21.33	13	22	22	19.00	09	24
Eng Mean	713.6	.44	1.0	.93	.79	.49	.79	.71	.66	.64	.79
Metric Mean	323.7	11.1	25.4	23.6	20.0	12.4	20.0	18.0	16.8	16.3	20.1

APPENDIX I B (CONTINUED)

Steer No.	11th Thor. 12 in.	11th Thor. Avg.	1st Lumb. 4 in.	1st Lumb. 8 in.	1st Lumb. 12 in.	1st Lumb. Avg.	4th Lumb. 4 in.	4th Lumb 8 in.	4th Lumb. 12 in.	4th Lumb. Avg.	6th Lumb. 4 in.
Group I .26 to .50 in.											
1	13	11.33	11	18	20	16.33	17	25	30	24.00	17
2	06	8.67	09	14	12	11.67	09	15	07	10.33	06
3	08	10.33	07	13	14	11.33	07	12	07	8.67	07
4	04	4.67	03	06	08	5.67	06	12	02	6.67	03
5	06	8.00	05	10	07	7.33	07	13	08	9.33	08
6	05	6.67	08	12	09	9.67	08	12	11	10.33	05
7	05	6.00	08	14	04	8.67	07	10	02	6.33	05
8	08	7.33	06	20	11	12.33	06	14	19	13.00	07
9	10	8.33	06	27	14	15.67	06	17	13	12.00	07
10	08	10.00	10	19	10	13.00	09	21	06	12.00	05
11	08	7.33	09	13	11	11.00	07	16	12	11.67	04
12	08	9.00	09	19	21	16.33	14	28	17	19.67	13
13	07	7.33	06	17	07	10.00	06	13	09	9.33	07
14	07	10.33	09	17	13	13.00	08	19	18	15.00	11
15	07	9.33	10	22	14	15.33	10	19	08	12.33	10
Eng. Mean	.29	.33	.30	.63	.46	.46	.33	.65	.44	.47	.30
Metric Mean	7.3	8.3	7.7	16.1	11.7	11.8	8.5	16.4	11.3	12.0	7.7
Group II .51 to .75 in.											
1	08	8.33	07	13	16	12.00	09	09	11	9.67	11
2	05	7.00	07	10	08	8.33	11	15	05	10.33	07
3	06	9.67	08	20	07	11.67	12	22	10	14.67	06
4	06	8.33	05	19	13	12.33	08	10	02	6.67	05
5	12	10.67	07	18	16	13.67	09	20	16	15.00	07
6	07	9.67	07	19	06	11.67	09	18	07	11.33	06
7	16	15.67	08	28	21	19.00	12	26	21	19.67	13
8	15	14.00	09	18	18	15.00	12	28	15	18.33	09
9	09	10.33	08	29	25	20.67	10	22	09	13.67	10
10	12	11.67	10	20	17	15.67	08	23	15	15.33	05
11	08	8.33	10	18	17	15.00	07	23	13	14.33	10
12	11	14.00	11	17	16	14.67	11	21	08	13.33	09
13	07	8.33	09	14	17	13.33	09	14	14	12.33	07
14	15	16.33	11	22	20	17.67	15	30	21	22.00	13
15	11	11.67	11	16	22	16.33	08	26	12	15.33	07
Eng Mean	.39	.43	.33	.74	.63	.57	.39	.81	.47	.56	.33
Metric Mean	9.9	10.9	8.5	18.7	15.9	14.5	10.0	20.5	11.9	14.1	8.3

APPENDIX I B (CONTINUED)

Steer No.	11th Thor. 12 in.	11th Thor. Avg.	1st Lumb. 4 in.	1st Lumb. 8 in.	1st Lumb. 12 in.	1st Lumb. Avg.	4th Lumb. 4 in.	4th Lumb. 8 in.	4th Lumb. 12 in.	4th Lumb. Avg.	6th Lumb. 4 in.
Group III .76 to 1.00 in.											
1	08	10.00	07	17	13	12.33	07	18	14	13.00	07
2	12	11.33	10	32	25	22.33	10	26	21	19.00	08
3	08	12.33	06	18	22	15.33	12	21	05	12.67	09
4	11	10.67	08	20	10	12.67	22	25	09	18.67	10
5	16	14.33	12	28	30	23.33	11	26	37	24.67	20
6	13	14.67	11	20	21	17.33	15	23	22	20.00	10
7	16	16.33	11	21	25	19.00	16	18	23	19.00	11
8	10	10.33	09	23	20	17.33	14	23	15	17.33	07
9	10	9.33	11	24	12	15.67	09	22	07	12.67	05
10	10	10.67	09	19	27	18.33	12	28	28	22.67	09
11	10	11.67	11	16	16	14.33	09	25	13	15.67	09
12	11	14.33	12	18	20	16.67	11	18	11	13.33	11
13	10	10.67	11	20	24	18.33	09	23	27	19.67	07
14	17	13.33	12	16	14	14.00	10	24	17	17.00	10
15	16	16.67	10	57	19	28.67	13	28	37	26.33	31
Eng. Mean	.47	.49	.39	.92	.78	.70	.47	.92	.75	.71	.43
Metric Mean	11.9	12.4	10.0	23.3	19.9	17.7	12.0	23.3	19.1	18.1	10.9
Group IV 1.01 to 1.25 in.											
1	11	17.00	18	28	27	24.33	16	40	23	26.33	07
2	18	17.67	18	45	30	31.00	14	40	32	28.67	11
3	10	13.00	14	31	23	22.67	11	19	17	15.67	24
4	25	23.33	15	32	32	26.33	12	28	26	22.00	19
5	17	16.67	14	26	16	18.67	16	30	22	22.67	16
6	19	18.33	14	40	37	30.33	11	31	41	27.67	24
7	16	14.00	16	35	25	25.33	21	33	23	25.67	21
8	22	21.00	15	47	34	32.00	11	33	41	28.33	18
9	30	18.67	11	19	16	15.33	10	23	23	18.67	10
10	15	15.33	10	24	24	19.33	11	19	15	15.00	11
11	11	11.67	15	33	18	22.00	15	29	16	20.00	13
12	19	17.67	09	25	26	20.00	25	34	43	34.00	14
13	17	16.33	12	31	21	21.33	13	25	19	19.00	13
14	19	17.00	13	33	24	23.33	20	37	33	30.00	12
15	15	16.00	15	52	33	33.33	15	36	27	26.00	09
Eng. Mean	.69	.67	.55	1.31	1.01	.96	.59	1.20	1.05	.94	.58
Metric Mean	17.6	16.9	13.9	33.4	25.7	24.4	14.7	30.5	26.7	24.0	14.8

APPENDIX 1 B (CONTINUED)

Steer No.	11th Thor. 12 in.	11th Thor. Avg.	1st Lumb. 4 in.	1st Lumb. 8 in.	1st Lumb. 12 in.	1st Lumb. Avg.	4th Lumb. 4 in.	4th Lumb. 8 in.	4th Lumb. 12 in.	4th Lumb. Avg.	6th Lumb. 4 in.
Group V .26 to .50 in.											
1	11	11.67	09	16	14	13.00	09	23	17	16.33	09
2	13	12.00	07	15	23	12.67	12	14	18	14.67	07
3	09	10.00	11	17	10	12.00	10	18	09	12.33	08
4	09	5.00	07	18	11	10.00	09	09	16	11.33	06
5	07	8.67	08	10	12	14.67	11	12	09	10.67	06
6	07	9.33	07	18	19	11.00	06	10	18	11.33	04
7	09	9.67	08	14	11	15.33	10	15	17	14.00	07
8	10	9.67	09	17	20	15.33	18	23	15	18.67	09
9	10	9.67	08	20	20	16.00	10	17	12	13.00	10
10	10	10.33	12	16	19	15.67	14	14	16	14.67	14
11	10	10.00	07	16	28	17.00	07	07	15	9.67	09
12	07	6.00	06	11	09	8.67	07	11	11	9.67	09
13	10	11.67	08	19	13	13.33	10	10	07	9.00	05
14	07	7.33	08	17	08	11.00	08	09	12	9.67	07
15	08	8.00	13	13	08	11.33	10	14	13	12.33	06
Eng. Mean	.36	.37	.33	.62	.59	.52	.40	.57	.54	.49	.30
Metric Mean	9.1	9.3	8.5	15.8	15.0	13.1	10.1	13.7	13.7	12.5	7.7
Group VI .51 to .75 in.											
1	12	11.67	10	10	15	11.67	12	26	27	21.67	09
2	11	11.33	07	14	19	13.33	09	20	12	13.67	09
3	09	9.67	06	17	13	12.00	11	19	12	14.00	06
4	11	12.33	07	17	18	14.00	10	24	16	16.67	14
5	17	15.00	11	22	22	18.33	12	23	14	16.33	08
6	19	16.00	09	29	25	21.00	17	29	35	27.00	08
7	14	11.67	12	20	22	18.00	11	15	20	15.33	13
8	12	10.33	07	15	12	11.33	08	14	24	15.33	07
9	10	13.00	10	12	14	12.00	08	27	17	17.33	05
10	11	12.00	10	17	17	14.67	13	25	18	18.67	13
11	13	13.33	08	14	24	15.33	11	11	17	13.00	10
12	10	10.67	06	14	19	13.00	07	16	18	13.67	07
13	10	10.00	06	25	27	19.33	07	33	18	19.33	07
14	13	11.00	09	23	22	18.00	08	13	25	15.33	06
15	15	12.33	10	20	23	17.67	13	15	21	16.33	14
Eng. Mean	.49	.47	.33	.70	.77	.60	.41	.81	.77	.67	.81
Metric Mean	12.5	12.0	8.5	17.9	19.5	15.3	10.5	20.7	19.6	16.9	9.1

APPENDIX I B (CONTINUED)

Steer No.	11th Thor. 12 in.	11th Thor. Avg.	1st Lumb. 4 in.	1st Lumb. 8 in.	1st Lumb. 12 in.	1st Lumb. Avg.	4th Lumb. 4 in.	4th Lumb. 8 in.	4th Lumb. 12 in.	4th Lumb. Avg.	6th Lumb. 4 in.
Group VII .76 to 1.00 in.											
1	09	9.00	09	15	10	11.33	10	20	13	14.33	06
2	13	10.33	09	20	08	12.33	10	17	20	15.67	08
3	10	8.67	10	13	20	14.33	18	20	09	15.67	07
4	12	13.67	13	22	20	18.33	21	23	19	21.00	16
5	11	12.33	10	20	36	22.00	12	27	26	21.67	10
6	11	12.33	10	22	26	19.33	08	18	17	14.33	02
7	17	13.33	11	31	31	24.33	09	24	19	17.33	22
8	14	12.67	09	21	27	19.00	11	20	18	16.33	15
9	13	12.00	11	28	35	24.67	09	14	23	15.33	10
10	11	10.67	10	21	24	18.33	11	13	16	13.33	16
11	20	14.33	11	17	23	17.00	15	27	45	29.00	12
12	15	14.33	13	49	32	31.33	13	29	22	21.33	12
13	21	20.00	17	31	36	28.00	20	36	26	27.33	20
14	22	18.67	16	35	40	30.33	21	28	29	26.00	26
15	17	14.67	11	48	33	30.67	10	27	34	23.67	08
Eng. Mean	.56	.52	.44	1.03	1.05	.84	.52	.90	.88	.77	.50
Metric Mean	14.3	13.1	11.3	26.2	26.7	21.4	13.2	22.9	22.4	19.5	12.7
Group VIII 1.01 to 1.25 in.											
1	17	14.67	14	21	24	19.67	18	29	30	25.67	18
2	13	12.33	09	15	18	14.00	13	24	29	22.00	08
3	26	25.00	22	24	40	28.67	17	29	31	25.67	13
4	34	25.67	18	34	54	35.33	20	31	27	26.00	12
5	16	18.67	13	32	35	26.67	13	17	24	18.00	15
6	21	18.67	20	28	34	27.33	25	23	27	25.00	27
7	30	25.00	17	19	36	24.00	27	26	26	26.33	27
8	19	17.33	13	22	37	24.00	18	31	43	30.67	19
9	20	19.33	16	30	45	30.33	18	32	29	26.33	13
10	20	18.33	11	27	33	23.67	22	29	24	25.00	28
11	25	22.33	28	31	59	39.33	21	27	44	30.67	18
12	17	17.67	12	27	32	23.67	17	31	27	25.00	20
13	20	17.67	16	21	35	24.00	14	27	26	22.33	20
14	20	17.33	11	34	34	26.33	14	20	24	19.33	16
15	24	19.00	19	57	32	36.00	22	30	29	27.00	22
Eng. Mean	.85	.76	.63	1.11	1.44	1.06	.73	1.07	1.15	.98	.72
Metric Mean	21.5	19.3	15.9	28.1	36.5	26.8	18.6	27.1	29.3	25.0	18.4

APPENDIX I B (CONTINUED)

Steer No.	6th Lumb. 8 in.	6th Lumb. 12 in.	6th Lumb. Avg.	3rd Sacral 4 in.	3rd Sacral 8 in.	3rd Sacral 12 in.	3rd Sacral Avg.	5th Sacral 4 in.	5th Sacral 8 in.	5th Sacral 12 in.	5th Sacral Avg.
Group I .26 to .50 in.											
1	18	30	21.67	14	16	12	14.00	15	12	07	11.33
2	09	08	7.67	05	02	05	4.00	09	00	00	3.00
3	06	11	8.00	08	04	03	5.00	14	03	02	6.33
4	04	06	4.33	04	02	03	3.00	10	02	03	5.00
5	11	10	9.67	09	07	03	6.33	15	03	04	7.33
6	12	03	6.67	07	02	05	4.67	12	03	00	5.00
7	12	06	7.67	09	07	05	7.00	20	07	02	9.67
8	10	08	8.33	08	03	05	5.33	12	03	06	7.00
9	09	10	8.67	11	06	05	7.33	18	08	05	10.33
10	08	07	6.67	08	04	06	6.00	09	05	03	5.67
11	15	05	8.00	09	08	06	7.67	13	08	07	9.33
12	12	18	14.33	14	10	08	10.67	21	06	10	12.33
13	10	04	7.00	11	11	08	10.00	13	06	05	8.00
14	12	09	10.67	12	06	07	8.33	15	06	07	9.33
15	08	19	12.33	13	15	05	11.00	19	10	08	12.33
Eng Mean	.41	.41	.37	.37	.27	.22	.29	.57	.22	.18	.32
Metric Mean	10.4	10.3	9.4	9.5	6.9	5.7	7.4	14.4	5.5	4.6	8.1
Group II .51 to .75 in.											
1	14	12	12.33	11	05	04	6.67	18	07	07	10.67
2	12	06	8.33	08	06	06	6.67	12	05	02	8.00
3	08	22	12.00	10	05	06	7.00	22	04	03	9.67
4	13	11	9.67	12	07	05	8.00	18	05	04	9.00
5	12	12	10.33	10	05	08	7.67	16	07	02	8.33
6	16	09	10.33	12	03	17	10.67	09	05	09	7.67
7	15	29	19.00	15	13	10	12.67	08	16	07	10.33
8	27	22	19.33	12	06	07	8.33	20	08	02	10.00
9	20	18	16.00	12	06	13	10.33	16	07	03	8.67
10	12	14	10.33	11	07	08	8.67	19	07	05	10.33
11	10	11	10.33	08	06	05	6.33	13	06	04	7.67
12	26	13	16.00	16	11	09	12.00	34	06	06	15.33
13	09	13	9.67	08	05	10	7.67	11	09	06	8.67
14	26	31	23.33	16	06	04	8.67	21	05	03	9.67
15	14	07	9.33	09	03	07	6.33	13	06	05	8.00
Eng Mean	.61	.60	.52	.52	.25	.31	.33	.66	.27	.18	.37
Metric Mean	15.6	15.3	13.1	11.3	6.3	7.9	8.5	16.7	6.9	4.5	9.5

Steer No.	6th Lumb. 8 in.	6th Lumb. 12 in.	6th Lumb. Avg.	3rd Sacral 4 in.	3rd Sacral 8 in.	3rd Sacral 12 in.	3rd Sacral Avg.	5th Sacral 4 in.	5th Sacral 8 in.	5th Sacral 12 in.	5th Sacral Avg.
Group III .76 to 1.00 in.											
1	13	14	11.33	13	12	11	12.00	19	08	05	10.67
2	13	25	15.33	10	10	13	11.00	33	07	07	15.67
3	18	09	12.00	14	06	15	11.67	20	10	06	12.00
4	21	12	14.33	09	09	11	9.67	17	10	06	11.00
5	15	16	17.00	07	08	12	9.00	10	06	05	7.00
6	24	20	18.00	12	06	05	7.67	12	06	03	7.00
7	24	20	18.33	15	08	09	10.67	21	15	08	14.67
8	15	22	14.67	12	11	15	12.67	23	13	07	14.33
9	27	12	14.67	12	10	11	11.00	18	08	05	10.33
10	20	19	16.00	11	10	30	17.00	21	09	07	12.33
11	17	11	12.33	13	13	26	17.33	18	14	09	13.67
12	17	15	14.33	12	09	08	9.67	18	10	05	11.00
13	17	21	15.00	09	10	14	11.00	16	11	07	11.33
14	22	18	16.67	21	09	10	13.33	26	12	08	15.33
15	20	20	23.67	19	15	15	16.33	32	16	09	19.00
Eng Mean	.74	.67	.61	.50	.38	.54	.47	.80	.41	.26	.49
Metric Mean	18.9	16.9	15.6	12.6	9.7	13.7	12.0	20.3	10.3	6.5	12.4
Group IV 1.01 to 1.25 in.											
1	39	18	21.33	16	12	17	15.00	22	15	09	15.33
2	22	24	19.00	20	15	13	16.00	27	12	05	14.67
3	23	16	21.00	18	17	14	16.33	28	10	07	15.00
4	27	20	22.00	19	16	31	22.00	29	10	10	16.33
5	27	30	24.33	17	20	33	23.33	37	16	10	21.00
6	20	18	20.67	13	13	21	15.67	23	10	10	14.33
7	21	23	21.67	21	17	14	17.33	27	24	17	22.67
8	36	34	29.33	19	12	20	17.00	28	33	11	24.00
9	28	20	19.33	15	13	19	15.67	24	13	13	16.67
10	20	15	15.33	13	10	14	12.33	16	09	08	11.00
11	30	10	17.67	13	09	10	10.67	18	09	09	12.00
12	38	35	29.00	20	20	18	19.33	27	15	12	18.00
13	27	20	20.00	14	32	18	21.33	23	09	08	13.33
14	29	22	21.00	17	15	16	16.00	28	11	10	16.33
15	27	25	20.33	17	17	16	16.67	30	15	07	17.33
Eng Mean	1.09	.87	.85	.66	.63	.72	.67	1.02	.56	.38	.65
Metric Mean	27.6	22.0	21.5	16.8	15.9	18.3	17.0	25.8	14.1	9.7	16.5

APPENDIX I B (CONTINUED)

Steer No.	6th Lumb. 8 in.	6th Lumb. 12 in.	6th Lumb. Avg.	3rd Sacral 4 in.	3rd Sacral 8 in.	3rd Sacral 12 in.	3rd Sacral Avg.	5th Sacral 4 in.	5th Sacral 8 in.	5th Sacral 12 in.	5th Sacral Avg.
Group V .26 to .50 in.											
1	19	24	17.33	14	14	10	12.67	25	11	05	13.67
2	10	10	9.00	10	08	04	7.33	18	07	03	9.33
3	14	11	11.00	13	07	05	8.33	19	08	03	10.00
4	06	12	8.00	15	08	04	9.00	17	05	04	8.67
5	07	08	7.00	11	06	08	8.33	18	07	05	10.00
6	14	12	10.00	12	02	07	7.00	15	04	07	8.67
7	07	14	9.33	09	09	11	9.67	10	20	06	12.00
8	11	11	10.33	13	12	13	12.67	19	06	07	10.67
9	11	17	12.67	13	10	06	9.67	09	08	05	7.33
10	09	11	11.33	12	12	10	11.33	12	14	12	12.67
11	07	18	11.33	10	09	06	8.33	18	06	06	10.00
12	10	11	10.00	07	07	05	6.33	13	07	05	8.33
13	09	11	8.33	10	06	05	7.00	19	08	06	11.00
14	08	08	7.67	08	07	03	6.00	11	03	04	6.00
15	09	08	7.67	13	10	05	9.33	13	11	05	9.67
Eng Mean	.40	.49	.40	.44	.33	.27	.35	.62	.33	.22	.39
Metric Mean	10.1	12.4	10.1	11.3	8.5	6.8	8.9	15.7	8.3	5.5	9.9
Group VI .51 to .75 in.											
1	18	12	13.00	12	06	04	7.33	24	09	03	12.00
2	07	11	9.00	08	11	04	7.67	14	07	03	8.00
3	07	12	8.33	09	06	05	6.67	18	02	03	7.67
4	17	27	19.33	20	08	03	10.33	26	07	04	12.00
5	22	17	15.67	17	06	06	9.67	25	11	05	13.67
6	15	31	18.00	14	11	12	12.33	17	13	08	12.67
7	16	36	21.67	18	15	13	15.33	19	09	08	12.00
8	12	18	12.33	06	06	08	6.67	07	04	04	5.00
9	07	21	11.00	09	08	06	7.67	17	04	06	9.00
10	18	22	17.67	18	19	10	15.67	25	17	10	17.33
11	13	32	18.33	15	12	11	12.67	17	08	07	10.67
12	08	11	8.67	11	05	09	8.33	11	08	05	8.00
13	09	25	13.67	11	07	07	8.33	18	07	07	10.67
14	06	18	10.00	15	09	06	10.00	23	06	03	10.67
15	08	31	17.67	15	09	11	11.67	25	16	14	18.33
Eng Mean	.48	.85	.56	.52	.36	.30	.39	.75	.33	.24	.44
Metric Mean	12.2	21.6	14.3	13.2	9.2	7.7	10.0	19.1	8.5	6.0	11.2

APPENDIX I B (CONTINUED)

Steer No.	6th Lumb. 8 in.	6th Lumb. 12 in.	6th Lumb. Avg.	3rd Sacral 4 in.	3rd Sacral 8 in.	3rd Sacral 12 in.	3rd Sacral Avg.	5th Sacral 4 in.	5th Sacral 8 in.	5th Sacral 12 in.	5th Sacral Avg.
Group VII .76 to 1.00 in.											
1	16	13	11.67	11	04	05	6.67	18	05	03	8.67
2	07	19	11.33	11	04	06	7.00	16	06	06	9.33
3	09	12	9.33	10	07	10	9.00	21	08	06	11.67
4	20	34	23.33	14	14	08	12.00	18	12	11	13.67
5	15	21	15.33	17	20	27	21.33	27	17	06	16.67
6	20	31	17.67	15	08	04	9.00	23	09	08	13.33
7	16	12	16.67	17	13	18	16.00	26	16	09	17.00
8	17	25	19.00	17	15	12	14.67	27	13	11	17.00
9	12	25	15.67	12	14	09	11.67	23	15	09	15.67
10	09	17	14.00	13	11	12	12.00	26	08	07	13.67
11	14	25	17.00	10	13	15	12.67	19	09	08	12.00
12	12	18	14.00	20	10	04	11.33	23	14	04	13.67
13	28	27	25.00	17	18	10	15.00	28	20	11	19.67
14	32	41	33.00	23	25	19	22.33	31	21	13	21.67
15	16	22	15.33	19	18	07	14.67	39	18	04	20.33
Eng. Mean	.64	.90	.68	.59	.51	.44	.51	.96	.50	.30	.59
Metric Mean	16.2	22.8	17.2	15.1	12.9	11.1	13.0	24.3	12.7	7.7	14.9
Group VIII 1.01 to 1.25 in.											
1	40	46	34.67	36	32	17	28.33	46	40	08	31.33
2	17	23	16.00	17	18	17	17.33	24	11	12	15.67
3	23	41	25.67	13	17	16	15.33	28	14	13	18.33
4	37	44	31.00	26	21	23	23.33	43	23	07	24.33
5	17	27	19.67	26	10	06	14.00	30	13	12	18.33
6	28	20	25.00	25	12	10	15.67	41	21	09	23.67
7	24	35	28.67	27	22	12	20.33	42	21	14	25.67
8	20	25	21.33	18	15	18	17.00	34	12	10	18.67
9	27	31	23.67	20	18	18	18.67	35	16	11	20.67
10	15	43	28.67	35	32	16	27.67	47	37	10	31.33
11	34	48	33.33	25	30	35	30.00	36	22	15	24.33
12	26	30	25.33	30	11	08	16.33	31	31	11	24.33
13	28	19	22.33	27	18	08	17.67	44	31	15	30.00
14	16	42	24.67	19	19	18	18.67	30	20	13	21.00
15	35	31	29.33	21	30	22	24.33	27	29	11	22.33
Eng. Mean	1.02	1.33	1.02	.96	.80	.64	.80	1.41	.89	.45	.92
Metric Mean	25.8	33.7	26.0	24.3	20.3	16.3	20.3	35.9	22.7	11.4	23.3

Steer No.	Fat Th. A	Fat Th. B	Fat Th. C	Fat Th. D	Fat Th. E	Fat Th. F	Fat Th. G	Avg. A, B, C
Group I .26 to .50 in.								
1	14	07	06	09	08	08	19	09.00
2	11	09	06	08	08	09	15	08.67
3	17	05	05	08	08	11	12	09.00
4	10	05	03	04	03	04	06	06.00
5	05	15	05	06	04	06	09	08.33
6	06	24	05	08	07	05	08	11.67
7	13	10	06	09	05	04	10	09.67
8	07	08	07	07	08	06	16	07.33
9	09	17	06	09	11	14	09	10.67
10	07	20	10	05	06	09	12	12.33
11	07	13	07	06	07	05	12	09.00
12	10	10	10	11	13	13	11	10.00
13	12	16	06	08	07	07	16	11.33
14	11	17	07	13	20	24	30	11.67
15	15	11	09	12	20	16	12	11.67
Eng. Mean	.41	.49	.26	.32	.35	.37	.52	.38
Metric Mean	10.3	12.5	6.5	8.2	9.0	9.4	13.1	9.8
Group II .51 to .75 in.								
1	13	16	10	10	09	10	12	13.00
2	11	29	10	07	07	04	15	16.67
3	14	27	09	10	09	14	17	16.67
4	19	17	09	07	11	15	13	15.00
5	22	13	09	12	14	16	16	14.67
6	05	27	10	10	13	20	20	14.00
7	25	16	09	16	22	22	28	16.67
8	13	15	12	14	16	16	17	13.33
9	16	21	12	13	09	11	26	16.33
10	16	27	12	11	10	12	13	18.33
11	28	18	08	08	09	09	21	18.00
12	12	14	17	14	13	15	12	14.33
13	20	20	09	09	06	07	08	16.33
14	17	19	12	17	23	22	29	16.00
15	15	13	19	10	11	08	14	15.67
Eng. Mean	.66	.77	.44	.44	.48	.53	.69	.62
Metric Mean	16.4	19.5	11.1	11.2	12.1	13.4	17.4	15.7

APPENDIX I B (CONTINUED)

No.	Fat Th. A	Fat Th. B	Fat Th. C	Fat Th. D	Fat Th. E	Fat Th. F	Fat Th. G	Avg. A, B, C
Group III .76 to 1.00 in.								
1	24	25	13	14	17	19	11	20.67
2	20	20	19	16	16	21	22	19.67
3	17	24	22	12	15	20	22	21.00
4	29	25	15	08	12	18	12	23.00
5	28	22	15	11	15	19	32	21.67
6	23	23	21	13	21	25	19	22.33
7	14	27	18	18	19	26	31	19.67
8	21	27	12	12	09	08	20	20.00
9	18	36	16	12	10	09	20	23.33
10	16	31	19	11	07	09	21	22.00
11	16	31	13	10	10	09	23	20.00
12	13	29	22	16	13	14	12	21.33
13	18	27	14	13	12	13	15	19.67
14	21	28	18	16	18	22	18	22.33
15	12	26	24	16	14	15	15	21.00
Eng. Mean	.76	1.05	.69	.52	.55	.65	.77	.83
Metric Mean	19.3	26.7	17.4	13.2	13.9	16.5	19.5	21.2
Group IV 1.01 to 1.25 in.								
1	32	30	29	26	24	29	21	30.33
2	21	35	27	20	21	28	24	27.67
3	35	38	24	16	17	22	21	32.33
4	35	24	21	22	25	37	33	26.67
5	22	33	22	18	22	23	20	25.67
6	18	40	24	22	22	26	25	27.33
7	27	39	24	18	20	18	17	30.00
8	26	25	39	24	24	24	20	30.00
9	23	37	25	14	15	22	26	28.33
10	29	31	19	14	15	18	28	26.33
11	20	34	23	12	15	20	19	25.67
12	28	42	24	21	22	21	31	31.33
13	32	24	31	16	14	14	18	29.00
14	23	32	22	21	24	31	31	25.67
15	28	25	26	19	23	29	32	26.33
Eng. Mean	1.05	1.28	1.00	.74	.80	.95	.96	1.11
Metric Mean	26.6	32.6	25.3	18.9	20.2	24.1	24.4	28.2

APPENDIX I B (CONTINUED)

Steer No.	Fat Th. A	Fat Th. B	Fat Th. C	Fat Th. D	Fat Th. E	Fat Th. F	Fat Th. G	Avg. A, B, C
Group V .26 to .50 in.								
1	14	13	10	09	11	08	19	12.33
2	11	13	09	09	12	08	17	11.00
3	11	18	08	11	16	11	12	12.33
4	11	16	08	09	10	06	12	11.67
5	13	13	11	13	17	21	16	12.33
6	07	18	10	09	12	13	19	11.67
7	12	18	07	10	08	12	15	12.33
8	13	15	09	12	13	19	27	12.33
9	11	18	08	10	09	09	12	12.33
10	09	13	09	13	17	13	08	10.33
11	07	10	06	10	14	14	17	07.67
12	10	19	07	05	09	05	05	12.00
13	07	21	09	08	09	04	07	12.33
14	08	07	05	08	10	07	13	06.67
15	08	16	07	10	10	05	07	10.33
Eng. Mean	.40	.60	.32	.38	.46	.41	.54	.44
Metric Mean	10.1	15.2	8.2	9.7	11.8	10.3	13.7	11.2
Group VI .51 to .75 in.								
1	09	25	07	06	06	08	08	13.67
2	12	19	08	10	12	11	18	13.00
3	25	15	09	10	10	15	15	16.33
4	21	11	07	10	16	18	12	13.00
5	24	18	12	12	19	20	19	18.00
6	16	25	12	11	15	15	25	17.67
7	08	22	16	15	17	15	31	15.33
8	14	23	12	05	10	12	18	16.33
9	18	19	10	11	09	09	10	15.67
10	18	13	12	10	17	17	17	14.33
11	22	18	11	10	12	15	13	17.00
12	12	24	11	09	10	10	20	15.67
13	22	20	10	07	09	08	14	17.33
14	07	22	12	09	13	14	10	13.67
15	14	12	13	11	15	20	16	13.00
Eng. Mean	.63	.75	.43	.38	.50	.54	.65	.60
Metric Mean	16.1	19.1	10.8	9.7	12.7	13.8	16.4	15.3

	Fat Th. A	Fat Th. B	Fat Th. C	Fat Th. D	Fat Th. E	Fat Th. F	Fat Th. G	Avg. A, B, C
Group VII .76 to 1.00 in.								
1	16	33	10	08	09	12	13	19.67
2	18	26	15	13	17	25	23	19.67
3	26	27	11	09	10	09	06	21.33
4	22	21	16	12	13	14	23	19.67
5	17	35	15	15	16	20	29	22.33
6	20	24	15	11	11	15	20	19.67
7	18	34	19	13	10	14	17	23.67
8	21	32	21	16	19	22	22	24.67
9	20	27	14	13	16	22	18	20.33
10	22	29	17	12	13	13	10	22.67
11	17	35	21	07	16	17	14	24.33
12	15	28	17	15	15	23	22	20.00
13	26	24	19	22	21	21	21	23.00
14	22	19	18	26	33	37	26	19.67
15	16	34	18	16	21	30	37	22.67
Eng. Mean	.78	1.12	.65	.55	.63	.77	.79	.85
Metric Mean	19.7	28.5	16.4	13.9	16.0	19.6	20.1	21.6
Group VIII 1.01 to 1.25 in.								
1	22	32	24	17	18	29	41	25.67
2	35	31	15	12	16	30	28	27.00
3	34	33	25	26	29	35	46	30.67
4	26	40	30	30	28	30	31	32.00
5	15	37	25	20	24	21	20	25.67
6	25	37	25	21	20	20	27	29.00
7	27	30	26	25	29	24	32	27.67
8	21	46	18	13	17	23	27	28.33
9	33	30	20	12	15	24	26	27.67
10	29	26	23	19	22	23	19	26.00
11	24	39	25	26	31	43	37	29.33
12	24	34	28	15	19	32	38	28.67
13	32	39	20	17	20	19	26	30.33
14	26	39	25	19	26	28	36	30.00
15	20	33	24	28	30	32	27	25.67
Eng. Mean	1.03	1.38	.93	.79	.90	1.08	1.21	1.11
Metric Mean	26.2	35.1	23.5	20.0	22.9	27.5	30.7	28.3

CARCASS EVALUATION - OBJECTIVE MEASUREMENTS

No.	Rib eye area	Carcass Length	Round Length	Round Circumference	Brisket Depth
Group I .26 to .50 in.					
1	11.75	45.5	28.6	34.5	4.40
2	11.70	46.3	30.2	31.7	3.90
3	12.45	48.1	30.1	31.2	4.00
4	10.95	48.6	30.1	31.8	4.40
5	11.30	44.7	27.0	33.4	4.40
6	11.20	47.0	30.1	29.5	4.10
7	10.60	44.4	27.9	31.4	3.80
8	09.70	45.7	28.4	32.8	4.30
9	10.80	47.8	28.3	31.7	4.00
10	10.45	45.4	27.8	34.3	4.20
11	11.05	44.4	27.3	35.1	4.70
12	09.85	47.8	28.1	32.2	4.40
13	10.30	44.9	26.7	34.4	4.70
14	11.00	45.7	27.3	33.6	4.00
15	11.80	44.8	27.7	34.8	3.90
Eng. Mean	10.99	46.1	28.4	32.8	4.2
Metric Mean	70.91	117.1	72.1	83.3	10.7
Group II .51 to .75 in.					
1	11.70	46.0	28.6	31.8	3.80
2	09.40	45.5	28.3	31.6	4.10
3	10.30	47.3	29.7	29.9	4.20
4	09.65	44.4	26.5	31.3	5.00
5	12.00	43.5	26.7	33.0	4.90
6	10.25	43.8	27.5	33.9	4.70
7	08.95	44.4	27.7	34.4	4.70
8	10.15	43.9	27.8	31.8	4.60
9	09.50	44.3	26.2	36.0	4.20
10	09.95	44.2	27.1	31.2	4.20
11	09.10	45.2	29.1	34.4	3.90
12	08.95	44.7	28.0	32.0	4.90
13	09.80	45.7	28.6	31.4	4.80
14	10.00	42.7	26.7	36.9	3.70
15	09.20	45.4	27.9	32.9	4.30
Eng. Mean	09.93	44.7	27.7	32.8	4.4
Metric Mean	64.07	113.5	70.4	83.3	11.2

APPENDIX I C (CONTINUED)

	Longissimus dorsi area	Carcass Length	Round Length	Round Circumference	Brisket Depth
Group III .76 to 1.00 in.					
1	10.20	45.2	27.2	31.3	3.80
2	9.20	44.6	28.3	31.8	4.40
3	9.35	44.4	26.7	34.2	4.90
4	8.95	45.1	28.8	31.6	5.40
5	10.40	44.1	26.0	35.7	4.40
6	8.90	45.0	27.8	32.9	4.80
7	7.40	44.7	28.5	35.0	4.60
8	9.85	42.6	26.2	34.1	4.40
9	8.80	44.0	26.5	31.6	4.90
10	9.25	44.5	28.0	33.4	5.80
11	9.45	45.5	27.9	30.2	4.70
12	10.05	45.8	27.8	31.4	4.50
13	11.15	44.4	27.2	32.0	4.80
14	9.35	44.3	26.8	33.1	5.30
15	9.70	44.1	26.0	33.9	5.10
Eng. Mean	9.47	44.6	27.3	32.8	4.8
Metric Mean	61.10	113.3	69.3	83.3	12.2
Group IV 1.01 to 1.25 in.					
1	9.60	43.4	26.7	33.1	5.30
2	9.40	44.3	26.7	32.0	4.40
3	8.70	43.9	25.7	33.2	5.50
4	9.10	42.4	26.8	33.1	5.20
5	9.55	44.2	26.5	34.5	4.90
6	9.65	45.2	26.8	31.4	4.40
7	9.50	45.6	26.2	34.1	5.50
8	8.80	42.5	25.4	33.8	5.20
9	9.50	43.2	25.5	33.0	5.60
10	9.80	44.8	27.1	33.7	5.20
11	10.05	43.0	25.8	31.7	5.30
12	10.55	44.3	26.3	33.8	6.10
13	7.50	41.4	26.0	31.2	6.00
14	10.75	43.3	26.1	34.2	4.80
15	8.30	43.4	25.2	33.3	5.60
Eng. Mean	9.38	43.7	26.2	33.1	5.3
Metric Mean	60.52	111.0	66.5	84.1	13.4

	Rib eye area	Carcass Length	Round Length	Round Circumference	Brisket Depth
Group V .26 to .50 in.					
1	12.55	48.2	29.9	37.4	5.10
2	13.90	50.8	31.9	36.0	4.90
3	13.55	50.4	32.2	36.4	4.60
4	13.30	49.9	31.1	37.1	4.30
5	10.35	49.0	30.9	36.9	4.90
6	15.95	49.1	30.1	37.1	5.20
7	12.75	50.8	29.8	34.5	5.50
8	13.10	50.1	29.5	37.7	6.40
9	11.40	50.4	31.8	36.6	5.00
10	15.60	50.1	32.4	36.6	4.60
11	13.50	52.5	34.3	34.1	4.80
12	11.65	50.8	31.3	36.1	4.80
13	13.30	49.9	30.1	34.9	4.90
14	14.35	49.5	31.0	35.8	5.10
15	11.55	52.3	32.3	34.2	4.40
Eng. Mean	13.12	50.3	31.2	36.1	5.0
Metric Mean	84.65	127.8	79.2	91.7	12.6
Group VI .51 to .75 in.					
1	9.04	54.5	33.4	33.7	5.10
2	14.95	49.8	30.8	35.4	3.80
3	13.50	50.2	32.6	34.8	4.20
4	13.25	48.8	31.4	34.7	4.70
5	10.65	48.6	29.8	37.8	5.30
6	11.60	48.9	30.6	35.8	5.20
7	15.10	48.9	31.0	38.3	6.00
8	12.00	48.4	28.2	36.5	4.80
9	11.60	48.8	29.4	34.8	4.90
10	10.55	50.0	31.0	36.7	5.40
11	12.70	48.9	30.3	38.0	5.60
12	12.50	49.5	29.3	35.3	5.20
13	11.80	49.9	28.7	37.7	5.20
14	15.40	47.3	29.4	37.8	4.80
15	12.90	48.0	30.2	37.6	5.10
Eng. Mean	12.50	49.4	30.4	36.3	5.0
Metric Mean	80.65	125.5	77.2	92.2	12.8

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APPENDIX I C (CONTINUED)

No.	L. dorsi area	Carcass Length	Round Length	Round Circumference	Brisket Depth
Group VII .76 to 1.00 in.					
1	10.05	50.3	30.4	34.4	5.00
2	13.15	49.1	30.0	36.5	5.20
3	11.85	48.7	29.9	35.4	5.90
4	11.40	49.1	30.2	34.0	4.20
5	12.65	46.4	29.2	37.5	5.60
6	12.00	49.2	30.3	35.1	4.40
7	9.85	48.1	28.5	34.9	5.50
8	12.40	48.0	28.7	37.6	5.30
9	11.00	48.1	28.2	36.4	5.80
10	9.95	49.1	30.8	35.8	5.70
11	11.40	48.8	26.7	32.2	5.10
12	11.60	47.8	29.1	36.3	5.70
13	11.30	48.8	29.6	37.5	4.70
14	11.95	47.3	29.3	37.0	5.40
15	10.60	48.2	28.2	34.6	62.0
Eng. Mean	11.41	48.5	29.3	35.7	5.3
Metric Mean	73.62	123.2	74.4	90.7	13.5
Group VIII 1.01 to 1.25 in.					
1	11.40	47.0	29.2	37.8	4.80
2	14.50	49.9	29.5	35.8	5.70
3	11.05	47.9	30.3	35.4	5.80
4	10.25	46.3	29.4	36.4	6.30
5	10.90	48.7	29.1	36.6	5.60
6	12.40	48.0	29.6	38.6	5.20
7	11.95	46.9	28.9	38.0	5.80
8	9.70	47.4	28.2	33.2	5.80
9	11.85	47.8	28.7	36.5	5.70
10	10.70	48.0	29.6	39.2	6.30
11	12.80	46.8	27.9	38.2	6.00
12	11.55	48.1	28.9	37.4	5.80
13	11.30	46.3	28.4	36.0	5.60
14	11.40	49.5	31.1	36.9	5.10
15	10.95	48.4	28.7	36.6	5.30
Eng. Mean	11.51	47.8	29.2	36.8	5.7
Metric Mean	74.26	121.4	74.2	93.5	14.4

APPENDIX II ▲ WHOLESALE CUT YIELD

No.	Rt. Side Wt.	Wt. Untrmd. Round	Wt. Trmd. Round	Wt. Untrmd. Loin	Wt. Trmd. Loin	Wt. Untrmd. Rib	Wt. Trmd. Rib	Wt. Untrmd. Chuck	Wt. Trmd. Chuck
Group I .26 to .50 in.									
1	278.50	66.50	63.80	43.30	41.50	21.80	21.00	80.30	79.40
2	266.90	61.90	59.90	37.50	36.50	18.80	18.20	82.40	82.20
3	262.60	63.70	62.00	40.70	39.10	22.50	21.50	76.70	75.40
4	274.00	65.00	62.70	40.20	39.40	21.10	20.60	78.60	77.70
5	248.20	61.40	58.90	35.30	34.30	21.10	20.60	73.90	73.20
6	266.90	57.00	55.20	39.40	38.20	20.30	19.80	74.00	73.20
7	251.30	56.50	54.70	34.80	33.90	20.50	20.10	71.70	70.50
8	254.00	60.30	58.80	40.80	40.10	20.20	19.50	70.80	70.00
9	272.70	57.10	55.30	41.40	39.90	22.40	21.40	94.60	77.80
10	263.60	61.40	59.90	42.40	39.80	20.60	19.80	74.50	72.80
11	263.50	65.80	63.50	36.50	35.40	21.50	20.80	73.70	72.70
12	267.10	66.60	63.10	44.10	41.10	20.50	19.40	71.30	69.40
13	272.70	63.30	60.50	39.80	38.20	21.90	21.00	79.70	77.70
14	260.70	61.10	58.20	41.00	38.70	21.60	20.30	72.50	70.50
15	274.10	65.50	64.50	41.90	39.00	23.10	22.20	77.90	76.70
Eng. Mean	265.10	62.20	60.10	39.90	38.30	21.10	20.40	75.80	74.60
Metric Mean	120.30	28.20	27.30	18.10	17.40	9.60	9.30	34.40	33.80
Group II .51 to .75 in.									
1	271.10	60.30	55.30	40.50	37.10	23.60	22.10	74.80	71.90
2	255.10	57.80	54.90	34.80	33.20	20.40	19.40	72.80	69.90
3	267.30	59.00	54.80	39.90	35.90	21.00	19.20	78.40	75.80
4	251.10	53.70	50.40	37.00	34.30	21.00	19.30	74.80	72.10
5	266.90	58.70	56.80	40.00	37.50	23.80	22.40	72.40	70.40
6	256.60	60.20	56.20	39.50	36.40	22.30	20.60	69.50	67.60
7	264.80	59.40	54.10	38.50	33.50	23.50	20.30	73.90	70.60
8	263.00	55.50	52.90	39.00	35.10	24.70	22.50	72.10	70.10
9	257.60	49.90	47.50	39.60	36.00	22.60	21.00	69.80	68.70
10	256.80	51.20	48.80	40.20	36.90	23.40	21.20	73.60	71.30
11	273.00	61.90	59.80	41.40	39.20	21.50	20.40	75.70	73.00
12	265.00	59.20	55.10	40.40	35.80	24.70	22.20	72.30	70.60
13	266.30	59.40	56.30	41.00	38.40	21.00	19.90	75.50	74.30
14	270.30	64.70	61.10	40.20	36.60	23.50	21.30	80.90	77.80
15	262.80	59.20	55.90	38.80	36.30	20.80	19.50	72.80	70.00
Eng. Mean	263.20	58.00	54.70	39.40	36.20	22.50	20.80	74.00	71.60
Metric Mean	119.40	26.30	24.80	17.90	16.40	10.30	9.40	33.50	32.20

No.	Side Wt.	Wt. Untrmd. Round	Wt. Trmd. Round	Wt. Untrmd. Loin	Wt. Trmd. Loin	Wt. Untrmd. Rib	Wt. Trmd. Rib	Wt. Untrmd. Chuck	Wt. Trmd. Chuck
Group III .76 to 1.00 in.									
1	256.40	53.80	50.10	39.60	35.80	23.10	20.80	70.60	67.90
2	270.10	57.70	52.80	39.30	34.30	22.60	20.30	78.70	75.20
3	273.30	57.50	52.80	39.00	34.80	24.80	22.30	69.40	66.50
4	269.70	54.50	50.90	36.90	33.20	22.70	21.00	74.60	71.70
5	274.40	57.50	54.20	41.80	38.40	23.20	21.20	75.50	73.10
6	264.40	58.70	54.50	39.50	34.90	23.60	20.90	71.40	68.70
7	273.50	60.00	54.70	40.70	36.50	22.70	20.30	73.20	71.40
8	252.10	54.80	51.10	35.10	32.40	21.90	20.30	69.50	66.90
9	262.40	54.00	50.70	39.50	35.60	21.80	20.20	71.40	69.50
10	269.40	56.70	53.90	39.60	35.90	23.50	21.30	71.40	69.30
11	265.00	53.30	49.00	41.40	36.20	22.70	20.80	75.80	73.00
12	268.60	55.90	52.60	43.30	38.20	24.90	22.30	71.00	69.70
13	264.00	58.80	55.70	43.00	38.90	23.90	21.80	70.50	68.80
14	264.90	55.50	52.00	35.90	31.20	26.00	22.30	67.90	64.00
15	277.80	58.10	51.70	41.90	36.30	22.40	21.00	72.90	69.40
Eng. Mean	267.10	56.50	52.50	39.80	35.50	23.30	21.10	72.30	69.70
Metric Mean	121.10	25.60	23.80	18.00	16.10	10.60	9.60	32.80	31.60
Group IV 1.01 to 1.25 in.									
1	275.00	52.30	48.00	39.60	34.00	25.30	21.70	77.60	70.80
2	267.00	53.20	48.90	42.10	35.10	23.10	20.00	69.60	66.70
3	270.40	53.70	48.20	38.70	33.30	25.20	22.60	67.20	63.20
4	255.60	57.90	51.80	37.80	32.20	22.80	18.70	67.70	63.20
5	276.60	59.20	53.80	39.60	33.90	24.90	22.30	74.10	71.00
6	275.60	54.70	49.60	38.00	32.50	24.60	21.30	75.20	70.70
7	277.40	57.20	51.90	43.20	36.00	23.50	20.50	76.10	72.10
8	277.20	55.00	48.20	41.00	33.20	23.00	19.40	70.20	64.70
9	258.10	52.70	47.20	36.70	32.70	24.50	21.50	68.60	65.10
10	279.90	59.40	55.80	39.40	35.80	22.80	20.40	77.80	74.30
11	256.40	52.50	48.30	38.40	34.60	21.90	19.80	73.00	69.50
12	282.20	56.80	50.80	42.60	36.40	27.00	23.80	74.50	70.00
13	239.40	49.70	46.30	35.20	31.50	21.30	19.10	64.50	61.00
14	263.50	57.40	53.50	38.70	33.90	23.20	20.60	71.70	68.10
15	265.60	51.20	46.20	38.00	32.00	23.40	20.40	69.40	66.40
Eng. Mean	268.00	54.90	49.90	39.30	33.80	23.80	20.80	71.80	67.80
Metric Mean	121.60	24.90	22.60	17.80	15.30	10.80	9.40	32.60	30.80

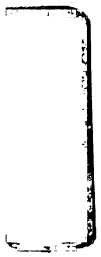
No.	Carcass Wt.	Wt. Untrmd. Round	Wt. Trmd. Round	Wt. Untrmd. Loin	Wt. Trmd. Loin	Wt. Untrmd. Rib	Wt. Trmd. Rib	Wt. Untrmd. Chuck	Wt. Trmd. Chuck
Group V .26 to .50 in.									
1	373.40	79.90	75.30	52.50	48.50	30.40	28.60	106.60	104.00
2	360.20	82.80	79.30	50.60	47.30	28.00	26.70	101.20	98.50
3	374.40	85.20	81.00	49.80	48.30	27.20	25.90	105.30	101.90
4	360.40	85.90	82.10	52.30	50.00	27.50	26.50	99.90	98.10
5	346.00	84.20	79.20	52.30	49.50	28.40	26.90	98.70	95.70
6	374.00	82.10	78.60	55.40	52.00	31.00	28.60	108.00	104.70
7	349.50	77.90	74.30	52.20	49.10	27.40	26.30	99.40	97.20
8	373.50	80.00	74.90	53.10	49.30	29.70	27.30	106.00	100.90
9	358.90	83.30	79.60	53.40	50.70	24.90	23.70	103.20	101.30
10	370.10	86.20	82.70	58.80	57.50	28.60	27.00	104.80	102.40
11	360.80	85.60	83.80	55.10	53.60	27.30	26.30	102.50	101.30
12	367.40	79.30	76.10	47.50	46.70	27.40	26.70	101.60	100.40
13	349.20	70.70	68.10	48.60	47.40	28.20	27.20	101.00	98.50
14	339.20	77.40	74.90	52.80	51.40	29.40	28.40	92.10	90.00
15	356.90	81.80	79.50	56.10	55.00	25.50	24.70	107.30	106.20
Eng. Mean	360.90	81.50	78.00	52.70	50.40	28.10	26.70	102.50	100.10
Metric Mean	163.70	37.00	35.40	23.90	22.90	12.70	12.10	46.50	45.40
Group VI .51 to .75 in.									
1	349.70	76.40	71.50	49.80	46.00	26.70	25.20	100.20	97.80
2	353.00	78.30	73.40	49.70	47.00	28.30	26.20	98.90	95.80
3	360.70	83.00	78.00	50.00	47.30	27.10	25.20	103.40	101.00
4	358.80	80.20	75.40	51.50	47.70	28.80	26.30	101.80	98.00
5	351.70	79.60	70.60	48.80	43.30	28.60	25.50	92.70	88.00
6	368.10	79.30	71.30	51.00	45.20	27.30	25.10	103.00	99.90
7	370.20	82.40	77.80	57.90	52.20	31.80	29.90	97.00	94.90
8	356.10	73.90	69.40	55.20	51.40	27.00	25.60	98.80	96.10
9	363.40	73.30	70.90	50.80	48.40	27.50	25.80	104.00	100.50
10	350.40	76.90	71.80	50.30	46.10	26.80	24.90	98.70	96.10
11	374.10	82.00	77.60	62.50	57.80	32.10	29.80	98.80	95.60
12	351.40	73.80	69.70	52.00	49.30	26.70	24.60	106.60	103.60
13	357.10	77.20	73.40	56.40	53.40	27.30	25.60	102.10	100.00
14	349.30	80.80	77.90	53.70	50.60	29.90	28.50	98.00	95.60
15	346.70	80.50	76.10	55.30	50.10	28.10	26.30	97.70	95.50
Eng. Mean	357.40	78.50	73.70	53.00	49.10	28.30	26.30	100.10	97.20
Metric Mean	162.10	35.60	33.40	24.00	22.30	12.80	11.90	45.40	44.10

			Wt. Trmd. Round	Wt. Untrmd. Loin	Wt. Trmd. Loin	Wt. Untrmd. Rib	Wt. Trmd. Rib	Wt. Untrmd. Chuck	Wt. Trmd. Chuck
1	349.50								
2	370.10	74.20	69.10	52.00	47.90	25.80	23.90	101.50	97.20
3	343.80	81.90	75.40	53.00	47.20	32.00	28.80	109.00	103.20
4	352.90	75.80	72.10	48.00	44.60	28.70	27.10	93.30	95.10
5	364.80	71.20	66.20	50.40	45.30	27.40	25.20	100.50	96.20
6	356.70	74.20	66.50	51.10	43.90	32.60	28.80	89.30	84.00
7	348.60	77.60	73.20	51.00	46.40	27.70	25.40	101.40	97.60
8	354.50	69.30	64.50	51.60	45.80	30.90	27.40	94.90	90.80
9	353.80	74.80	68.20	54.00	47.70	30.20	27.50	95.00	91.50
10	361.60	73.30	69.20	54.70	50.50	28.80	26.80	101.00	98.10
11	355.90	80.60	75.50	56.00	51.70	27.90	26.20	103.50	101.00
12	357.20	74.90	69.30	51.50	46.10	29.00	26.30	94.80	91.60
13	352.30	75.30	69.90	50.30	44.90	29.20	26.60	100.90	96.60
14	343.40	79.40	73.70	56.50	50.20	27.90	24.60	91.40	87.30
15	347.90	72.50	66.20	56.20	47.80	29.30	25.80	89.00	85.60
Eng. Mean	354.20	71.10	66.70	47.30	42.10	30.90	28.50	91.10	87.90
Metric Mean	160.70	75.10	69.70	52.20	46.80	29.20	26.60	97.40	93.60
		34.10	31.60	23.70	21.20	13.30	12.10	44.20	42.5
Group VIII 1.01 to 1.25 in.									
1	351.70	74.70	62.80	49.60	41.20	31.60	27.20	91.70	87.50
2	364.90	77.10	71.60	52.30	46.70	32.70	30.20	103.40	99.60
3	367.10	76.10	66.10	52.10	42.90	31.40	25.20	93.20	85.10
4	355.80	74.40	64.80	51.60	41.70	32.60	26.90	94.50	86.70
5	342.50	74.40	68.00	54.50	48.10	30.20	27.60	93.60	90.10
6	372.80	78.00	66.70	53.20	43.70	29.50	25.80	99.70	93.60
7	349.30	77.10	68.60	53.10	44.60	30.50	26.40	95.30	88.70
8	350.60	65.40	60.00	50.50	43.60	29.00	26.10	95.50	88.50
9	350.50	69.40	64.40	53.30	44.80	29.20	25.70	95.90	92.40
10	351.70	83.50	76.70	56.90	49.10	28.60	26.00	93.70	90.10
11	357.90	75.50	66.30	56.00	46.10	32.10	26.90	97.10	89.70
12	358.70	71.70	63.70	52.50	44.40	30.10	26.30	98.40	92.10
13	340.30	72.40	62.60	48.50	40.80	29.50	25.20	85.80	78.30
14	369.90	75.80	69.20	56.60	47.20	32.10	28.20	92.30	86.80
15	362.20	77.40	69.70	54.20	46.20	32.20	27.60	98.20	92.50
Eng. Mean	356.40	74.90	66.80	53.00	44.70	30.80	26.80	95.20	89.50
Metric Mean	161.70	34.00	30.30	24.00	20.30	14.00	12.20	43.20	40.60

	Wt. Brisket	Wt. Plate	Wt. Flank	Wt. K. K.	Wt. of Untrmd. Primal Cuts	Wt. of Belly Cuts + K. K.	Trmd. Primal Cuts	Ext. Fat Trim
Group I .26 to .50 in.								
1	9.00	10.20	23.20	17.50	6.70	211.90	73.30	205.70	6.20
2	8.40	11.50	22.50	13.10	10.80	200.60	77.10	196.80	3.80
3	8.80	11.50	19.20	13.00	6.50	203.60	65.50	198.00	5.60
4	8.90	11.80	22.70	16.30	9.40	204.90	78.50	200.40	4.50
5	8.50	9.90	18.00	14.80	5.30	191.70	61.80	187.00	4.70
6	9.30	12.90	22.30	17.40	14.30	190.70	90.50	186.40	4.30
7	7.50	8.80	21.10	17.60	12.80	183.50	80.60	179.20	4.30
8	9.50	9.90	19.00	14.80	8.70	192.10	70.60	188.40	3.70
9	7.50	11.30	23.40	19.20	10.80	200.50	83.00	194.40	6.10
10	8.80	8.80	21.40	17.00	7.70	199.90	71.40	192.30	5.60
11	8.50	10.90	22.50	18.50	5.60	197.50	71.60	192.40	5.10
12	8.60	10.20	19.60	18.00	8.20	202.50	72.80	193.00	8.50
13	8.10	9.80	24.20	18.50	7.40	204.70	75.40	197.40	7.30
14	8.10	8.30	23.50	17.00	7.60	196.20	72.10	187.70	8.50
15	9.20	10.40	22.40	16.60	7.10	208.40	72.80	202.40	6.00
Eng. Mean	8.60	10.40	21.70	16.60	8.60	199.30	74.50	193.40	5.60
Metric Mean	3.90	4.70	9.80	7.50	3.90	90.40	33.80	87.70	2.50
Group II .51 to .75 in.									
1	8.00	11.60	23.40	16.60	12.30	199.20	84.20	186.40	12.80
2	7.90	10.50	22.40	17.80	10.70	185.80	80.00	177.40	8.40
3	7.50	8.00	19.10	19.70	14.70	198.30	83.70	185.70	12.60
4	7.00	8.10	22.10	18.00	9.40	186.50	74.00	176.10	10.40
5	7.60	11.00	22.60	18.70	12.10	194.90	84.10	187.10	7.80
6	7.70	10.00	19.90	15.30	12.20	191.50	77.30	180.80	10.70
7	7.20	10.20	21.30	21.60	9.20	195.30	78.70	178.50	16.80
8	8.60	12.60	23.20	16.30	11.00	191.30	82.70	180.60	10.70
9	7.60	11.40	26.30	18.20	12.20	181.90	87.90	173.20	8.70
10	7.40	12.20	21.60	15.00	12.20	188.40	80.60	178.20	10.20
11	8.00	10.70	22.40	17.40	14.00	200.50	86.50	192.40	8.10
12	7.90	9.00	21.50	17.60	12.40	196.60	80.80	183.70	12.90
13	8.90	12.10	22.00	16.30	10.10	196.90	79.50	188.90	8.00
14	8.30	9.80	20.10	18.10	4.70	209.30	65.70	196.80	12.50
15	8.30	12.00	19.90	20.60	10.40	191.60	81.60	181.70	9.90
Eng. Mean	7.90	10.60	21.90	17.80	11.20	193.90	80.50	183.20	10.70
Metric Mean	3.60	4.80	9.90	8.10	5.10	87.90	36.50	83.10	4.90

No.	Shank	Brisket	Plate	Flank	K. K.	Untrmd. Primal Cuts	Belly Cuts + K. K.	Trmd. Primal Cuts	Ext. Fat Trim
Group I .26 to .50 in.									
1	9.00	10.20	23.20	17.50	6.70	211.90	73.30	205.70	6.20
2	8.40	11.50	22.50	13.10	10.80	200.60	77.10	196.80	3.80
3	8.80	11.50	19.20	13.00	6.50	203.60	65.50	198.00	5.60
4	8.90	11.80	22.70	16.30	9.40	204.90	78.50	200.40	4.50
5	8.50	9.90	18.00	14.80	5.30	191.70	61.80	187.00	4.70
6	9.30	12.90	22.30	17.40	14.30	190.70	90.50	186.40	4.30
7	7.50	8.80	21.10	17.60	12.80	183.50	80.60	179.20	4.30
8	9.50	9.90	19.00	14.80	8.70	192.10	70.60	188.40	3.70
9	7.50	11.30	23.40	19.20	10.80	200.50	83.00	194.40	6.10
10	8.80	8.80	21.40	17.00	7.70	199.90	71.40	192.30	5.60
11	8.50	10.90	22.50	18.50	5.60	197.50	71.60	192.40	5.10
12	8.60	10.20	19.60	18.00	8.20	202.50	72.80	193.00	8.50
13	8.10	9.80	24.20	18.50	7.40	204.70	75.40	197.40	7.30
14	8.10	8.30	23.50	17.00	7.60	196.20	72.10	187.70	8.50
15	9.20	10.40	22.40	16.60	7.10	208.40	72.80	202.40	6.00
Eng. Mean	8.60	10.40	21.70	16.60	8.60	199.30	74.50	193.40	5.60
Metric Mean	3.90	4.70	9.80	7.50	3.90	90.40	33.80	87.70	2.50
Group II .51 to .75 in.									
1	8.00	11.60	23.40	16.60	12.30	199.20	84.20	186.40	12.80
2	7.90	10.50	22.40	17.80	10.70	185.80	80.00	177.40	8.40
3	7.50	8.00	19.10	19.70	14.70	198.30	83.70	185.70	12.60
4	7.00	8.10	22.10	18.00	9.40	186.50	74.00	176.10	10.40
5	7.60	11.00	22.60	18.70	12.10	194.90	84.10	187.10	7.80
6	7.70	10.00	19.90	15.30	12.20	191.50	77.30	180.80	10.70
7	7.20	10.20	21.30	21.60	9.20	195.30	78.70	178.50	16.80
8	8.60	12.60	23.20	16.30	11.00	191.30	82.70	180.60	10.70
9	7.60	11.40	26.30	18.20	12.20	181.90	87.90	173.20	8.70
10	7.40	12.20	21.60	15.00	12.20	188.40	80.60	178.20	10.20
11	8.00	10.70	22.40	17.40	14.00	200.50	86.50	192.40	8.10
12	7.90	9.00	21.50	17.60	12.40	196.60	80.80	183.70	12.90
13	8.90	12.10	22.00	16.30	10.10	196.90	79.50	188.90	8.00
14	8.30	9.80	20.10	18.10	4.70	209.30	65.70	196.80	12.50
15	8.30	12.00	19.90	20.60	10.40	191.60	81.60	181.70	9.90
Eng. Mean	7.90	10.60	21.90	17.80	11.20	193.90	80.50	183.20	10.70
Metric Mean	3.60	4.80	9.90	8.10	5.10	87.90	36.50	83.10	4.90

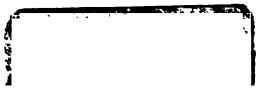
No.	Shank	Wt. Brisket	Wt. Plate	Wt. Flank	Wt. K. K.	Wt. of Untrmd. Primal Cuts	Wt. of Belly Cuts + K. K.	Trmd. Primal Cuts	Ext. Fat Trim
Group III .76 to 1.00 in.									
1	6.90	8.70	22.70	20.20	10.80	187.10	80.10	174.60	12.50
2	7.30	9.50	25.00	20.10	9.90	191.30	81.70	182.60	15.70
3	8.00	13.80	23.30	24.80	12.70	190.70	95.30	176.40	14.30
4	7.10	11.30	24.20	21.50	16.90	188.70	97.90	176.80	11.90
5	7.70	12.30	22.10	20.20	14.10	198.00	90.50	186.90	11.10
6	8.20	11.30	20.50	18.50	12.60	193.20	83.70	179.00	14.20
7	8.20	11.50	24.40	21.60	11.20	196.60	88.10	182.90	13.70
8	7.10	11.50	20.90	20.70	10.60	181.30	81.40	170.70	10.60
9	7.50	11.10	25.20	19.90	12.00	186.70	87.70	176.00	10.70
10	8.60	11.90	25.20	20.30	12.20	191.20	90.40	180.40	10.80
11	8.00	10.20	22.60	18.40	12.60	193.20	84.40	179.00	14.20
12	8.00	9.90	24.00	20.00	11.60	195.10	85.10	182.80	12.30
13	7.70	12.10	21.80	16.90	9.30	196.20	77.10	185.20	11.00
14	7.50	14.10	25.80	21.20	11.00	185.30	90.60	169.50	15.80
15	7.90	11.70	26.80	24.80	11.30	195.30	93.80	178.40	17.00
Eng. Mean	7.70	11.40	23.60	20.60	11.90	191.80	87.20	178.80	13.10
Metric Mean	3.50	5.20	10.70	9.40	5.40	87.00	39.60	81.10	5.90
Group IV 1.01 to 1.25 in.									
1	6.70	10.90	27.00	23.90	11.70	194.80	91.90	174.50	20.30
2	6.80	10.70	23.60	24.00	13.90	188.00	92.90	170.70	17.30
3	7.60	13.00	27.40	23.70	13.90	184.80	99.50	167.30	17.50
4	9.30	15.60	22.10	17.50	8.90	182.20	82.30	165.90	20.30
5	6.80	9.80	24.20	24.10	13.90	197.80	92.70	181.00	16.80
6	7.30	13.30	28.30	23.00	11.20	192.50	94.30	174.10	18.40
7	7.60	11.40	24.30	24.00	10.10	200.00	87.50	180.50	19.50
8	7.80	14.00	24.10	28.30	13.80	189.20	101.80	165.50	23.70
9	6.40	10.40	25.60	21.10	12.10	182.50	87.70	166.50	16.00
10	7.90	13.00	26.30	21.70	11.60	194.40	92.10	186.30	13.10
11	6.60	9.00	22.90	23.30	8.80	185.80	79.40	172.20	13.60
12	7.50	14.80	25.50	22.90	10.60	200.90	91.90	181.00	19.90
13	5.40	11.00	22.50	18.50	11.30	170.70	80.00	157.90	12.80
14	6.40	11.50	23.20	20.20	11.20	191.00	83.70	176.10	14.90
15	6.80	10.40	30.90	22.30	13.20	182.00	96.80	165.00	17.00
Eng. Mean	7.10	11.90	25.20	22.60	11.80	189.40	90.30	172.30	17.40
Metric Mean	3.20	5.40	11.40	10.25	5.30	85.90	41.00	78.20	7.90



APPENDIX II A (CONTINUED)

Steer No.	Wt. Shank	Wt. Brisket	Wt. Plate	Wt. Flank	Wt. K. K.	Wt. of Untrmd. Primal Cuts	Wt. of Belly Cuts + K. K.	Trmd. Primal Cuts	Ext. Fat Trim
Group V .26 to .50 in.									
1	10.20	15.30	33.90	30.20	14.40	269.40	118.40	256.40	13.00
2	10.00	13.00	33.50	23.70	17.40	262.60	115.00	251.80	10.80
3	12.90	14.80	30.90	27.10	21.20	267.50	128.10	257.10	9.80
4	11.80	14.60	31.30	26.60	10.50	265.60	105.30	256.70	8.90
5	11.00	9.80	28.40	24.30	8.90	263.60	91.30	251.30	12.30
6	10.10	13.80	32.40	27.70	13.50	276.50	111.00	263.90	12.20
7	10.10	12.10	34.20	27.10	9.10	256.90	101.70	246.90	9.80
8	9.70	15.80	33.90	29.00	16.30	268.80	121.00	252.40	16.40
9	10.60	11.70	32.60	25.20	14.00	264.80	108.10	255.30	9.50
10	12.40	15.50	32.60	21.10	10.10	278.40	101.80	269.60	10.80
11	11.80	12.90	30.50	20.80	14.30	270.50	104.60	265.00	5.50
12	10.70	14.50	37.30	29.80	19.30	255.80	130.90	249.90	5.90
13	9.00	12.20	35.80	28.30	15.40	248.50	116.10	241.20	7.30
14	11.00	14.20	29.30	21.10	11.90	251.70	99.40	244.70	7.00
15	10.90	11.90	28.80	20.70	13.90	270.70	100.10	265.40	5.30
Eng. Mean	10.80	13.50	32.40	25.50	14.00	264.80	110.00	255.20	9.60
Metric Mean	4.90	6.10	14.70	11.60	6.40	120.10	49.90	115.80	4.40
Group VI .51 to .75 in.									
1	10.80	13.90	32.30	25.60	14.00	253.10	110.60	240.50	12.60
2	9.80	12.60	31.10	24.50	19.80	255.20	117.60	242.40	11.80
3	10.60	12.10	34.60	23.50	16.40	263.50	113.60	251.50	12.00
4	9.60	13.10	32.10	24.70	17.00	262.30	113.50	247.40	14.90
5	9.70	18.50	33.80	26.10	13.90	249.70	115.90	227.40	22.30
6	10.60	16.50	33.90	29.60	16.90	260.60	124.40	241.50	19.10
7	10.20	15.70	33.10	27.20	14.90	269.10	116.00	254.80	14.30
8	9.50	15.90	32.40	28.70	14.70	254.90	115.90	242.50	12.40
9	10.50	14.90	34.60	28.10	19.70	255.60	127.50	245.60	10.00
10	9.80	11.60	31.80	26.00	18.50	252.70	116.20	238.90	13.80
11	11.30	17.10	31.10	26.60	12.60	275.40	111.30	260.80	14.60
12	10.60	14.30	30.40	24.90	12.10	259.10	104.40	247.20	11.90
13	9.30	11.40	32.20	26.90	14.30	263.00	108.40	252.40	10.60
14	9.50	11.90	32.20	20.10	13.20	262.40	100.10	252.60	9.80
15	10.80	13.30	28.00	23.60	9.40	261.60	94.50	248.00	13.60
Eng. Mean	10.20	14.20	32.20	25.70	15.20	259.90	112.70	246.20	13.60
Metric Mean	4.60	6.40	14.60	11.70	6.90	117.90	51.10	111.70	6.20

Steer No.	Wt. Shank	Wt. Brisket	Wt. Plate	Wt. Flank	Wt. K. K.	Wt. of Untrmd. Primal Cuts	Wt. of Belly Cuts + K. K.	Trmd. Primal Cuts	Ext. Fat Trim
Group VII .76 to 1.00 in.									
1	9.90	15.00	30.60	26.20	14.30	253.50	110.30	238.10	15.30
2	9.50	13.70	33.60	25.30	12.10	275.90	106.30	254.60	21.30
3	9.70	13.00	31.20	25.40	13.70	250.80	106.70	238.90	11.90
4	10.50	14.10	32.60	29.20	17.00	249.50	120.40	232.90	16.60
5	9.80	18.30	33.90	33.10	22.50	247.20	140.10	223.20	24.00
6	9.70	9.50	32.80	29.50	17.50	257.70	116.50	242.60	15.10
7	9.00	13.50	35.40	28.40	15.60	246.70	117.50	228.50	18.20
8	8.90	14.60	35.10	26.20	15.70	254.00	116.20	234.90	19.10
9	9.30	13.70	32.60	27.50	12.90	257.80	108.90	244.60	13.20
10	10.00	12.40	32.30	25.20	13.70	268.00	107.30	254.40	13.60
11	10.10	13.80	33.80	28.80	19.20	250.20	124.90	233.30	16.90
12	10.40	16.20	31.90	29.60	13.40	255.70	114.90	238.00	17.70
13	11.60	15.70	29.80	24.50	15.50	255.20	112.60	235.80	19.40
14	10.30	14.00	29.40	29.60	13.10	247.00	109.50	225.40	21.60
15	10.10	17.10	36.00	28.60	15.70	240.40	123.20	225.20	15.20
Eng. Mean	9.90	14.30	32.70	27.80	15.50	254.00	115.70	236.70	17.10
Metric Mean	4.50	6.50	14.90	12.60	7.00	115.20	52.50	107.40	7.70
Group VIII 1.01 to 1.25 in.									
1	9.00	12.60	35.10	30.30	17.10	247.60	121.20	218.70	28.90
2	9.30	13.00	33.90	29.00	14.20	265.50	113.60	248.10	17.40
3	10.00	14.80	36.20	32.20	21.10	252.80	135.40	219.30	33.50
4	9.30	16.50	31.80	30.50	14.60	253.10	117.30	219.50	33.60
5	8.90	10.70	27.90	28.20	14.10	252.70	103.90	233.80	18.90
6	10.30	16.10	37.40	32.70	15.90	260.40	128.30	229.80	30.60
7	10.30	14.90	29.40	28.80	9.90	256.00	103.20	228.30	28.70
8	8.50	16.70	37.90	31.40	15.70	240.40	125.90	218.20	22.20
9	8.50	14.40	33.40	28.30	18.10	247.80	120.80	227.30	20.50
10	10.90	14.50	23.70	27.90	12.00	262.70	101.00	241.90	20.80
11	8.50	13.80	33.30	29.60	12.00	260.70	109.20	229.00	31.70
12	9.90	15.00	34.30	31.60	15.20	252.70	121.20	226.50	26.20
13	8.90	16.40	34.30	30.20	14.30	236.20	118.40	206.90	29.30
14	9.80	14.30	38.20	33.10	17.70	256.80	130.80	231.40	25.40
15	10.00	13.30	31.00	27.90	18.00	262.00	118.20	236.00	26.00
Eng. Mean	9.50	14.50	33.20	30.10	15.30	253.80	117.90	227.70	26.30
Metric Mean	4.30	6.60	15.10	13.70	7.00	115.10	53.50	103.30	11.90



APPENDIX II B RETAIL CUTOUT

Steer No.	Round Yield	Round Fat	Round Bone	Loin Yield	Loin Fat	Loin Bone	Rib Yield	Rib Fat	Rib Bone	Chuck Yield	Chuck Fat	Chuck Bone
Group I .26 to .50 in.												
1	52.10	1.40	9.90	33.20	1.90	5.90	16.50	2.40	3.90	60.30	7.80	11.10
2	47.30	1.30	11.20	29.50	1.30	5.60	14.20	0.40	3.40	63.40	6.40	12.20
3	49.30	1.10	11.30	31.10	1.50	6.40	17.30	0.40	3.80	56.90	6.70	11.70
4	50.20	1.80	10.80	31.20	2.10	5.30	14.80	0.20	4.50	59.20	6.20	12.60
5	46.00	3.50	9.30	27.00	1.80	5.40	16.10	0.40	4.30	54.30	7.40	11.50
6	44.60	1.40	9.00	30.60	2.70	4.60	14.90	1.30	3.40	54.90	8.10	10.00
7	43.60	2.90	8.40	26.50	3.10	4.20	14.90	1.00	3.10	52.50	8.40	9.70
8	47.70	1.30	9.80	32.50	2.20	5.20	13.90	1.10	4.40	52.00	7.00	11.00
9	43.90	2.30	8.70	29.70	4.00	5.80	16.20	1.40	3.60	59.00	7.80	10.30
10	47.30	3.10	9.10	30.40	4.50	4.40	15.50	0.90	3.20	53.40	9.40	9.60
11	50.30	3.70	9.00	27.60	3.50	3.90	16.50	0.90	3.20	54.80	8.30	9.40
12	47.50	4.60	10.50	31.30	4.30	5.00	14.80	0.40	3.00	49.60	9.30	9.80
13	47.70	3.40	9.00	29.30	4.10	4.40	16.50	1.00	3.40	56.40	10.80	9.90
14	45.60	4.00	8.40	29.00	4.60	4.70	16.40	1.40	3.50	51.70	8.10	10.20
15	50.60	4.10	8.70	29.10	4.80	4.80	17.10	1.40	3.40	57.80	8.60	9.80
Eng. Mean	47.60	2.70	9.50	29.90	3.10	5.00	15.70	1.00	3.60	55.75	8.00	10.60
Metric Mean	21.60	1.20	4.30	13.50	1.40	2.30	7.10	0.45	1.65	25.30	3.60	4.80
Group II .51 to .75 in.												
1	43.00	3.40	8.90	26.60	4.30	5.20	15.40	2.20	4.20	51.70	10.40	9.90
2	43.00	3.00	8.80	25.30	2.40	5.20	13.90	1.30	4.10	50.50	8.30	11.10
3	44.00	1.50	9.30	28.10	2.90	4.60	14.50	1.00	3.60	56.30	9.00	10.30
4	39.00	3.80	7.50	27.10	3.10	4.10	13.80	2.50	3.00	51.00	11.00	9.60
5	45.10	3.10	8.50	29.70	3.00	4.70	16.20	1.60	3.70	49.50	11.50	9.10
6	43.80	3.80	8.50	29.20	1.60	5.60	15.40	1.30	3.90	50.90	7.00	9.70
7	41.00	4.00	9.00	26.50	2.60	4.20	15.80	1.60	3.10	49.60	11.20	9.90
8	39.80	4.20	8.80	27.10	3.20	4.80	15.50	3.10	3.80	49.90	10.90	9.20
9	38.90	1.30	7.20	28.90	2.90	3.90	12.80	5.00	3.10	49.20	11.00	8.30
10	40.00	1.50	7.20	29.30	2.80	4.80	16.10	1.70	3.10	51.80	11.00	8.30
11	44.10	5.70	9.90	32.30	2.60	4.20	14.70	1.00	3.60	54.30	7.90	10.80
12	41.40	5.50	8.10	28.30	3.90	3.50	16.00	2.70	3.40	49.40	11.70	9.30
13	44.20	3.50	8.60	30.50	2.60	5.20	14.50	2.20	3.20	54.70	9.60	9.90
14	46.00	5.60	9.40	29.90	2.00	4.60	16.00	1.50	3.60	57.00	9.10	11.50
15	41.70	5.00	9.30	28.50	3.00	4.60	14.50	2.00	2.90	50.80	9.70	9.40
Eng. Mean	42.30	3.70	8.60	28.59	2.90	4.60	15.00	2.10	3.50	51.80	9.90	9.80
Metric Mean	19.20	1.65	3.90	12.90	1.30	2.10	6.80	0.90	1.60	23.50	4.50	4.40

APPENDIX II B (CONTINUED)

Steer No.	Round Yield	Round Fat	Round Bone	Loin Yield	Loin Fat	Loin Bone	Rib Yield	Rib Fat	Rib Bone	Chuck Yield	Chuck Fat	Chuck Bone
Group III .76 to 1.00 in.												
1	37.20	5.20	7.50	27.70	2.70	5.30	15.10	2.00	3.50	47.40	10.40	9.80
2	38.70	5.90	8.20	26.50	3.40	4.10	14.00	2.70	3.50	53.00	11.60	10.50
3	39.90	4.30	8.30	26.20	3.90	4.40	15.70	2.90	3.50	46.40	10.80	8.90
4	37.70	5.20	7.90	25.30	3.60	4.00	13.60	3.80	3.50	50.40	11.40	9.50
5	40.70	5.20	8.00	30.50	3.00	4.50	15.30	2.60	3.00	52.10	11.90	8.70
6	39.90	5.30	9.00	27.50	2.80	4.40	15.10	1.80	3.50	48.90	10.50	9.10
7	40.30	5.30	8.90	27.70	3.60	5.00	14.30	2.50	3.40	49.90	10.80	9.10
8	39.80	3.40	7.70	24.70	3.20	4.30	15.40	1.20	3.50	47.10	9.90	8.70
9	38.50	4.50	7.50	27.10	4.00	4.40	14.00	2.50	3.50	48.50	12.50	8.90
10	41.90	3.60	8.30	28.70	2.90	4.40	15.70	2.20	3.40	50.10	10.70	8.40
11	37.60	3.20	8.00	28.80	3.20	4.00	14.10	2.20	3.40	52.50	12.00	8.40
12	41.20	2.90	8.30	30.10	3.20	4.80	15.90	2.90	3.50	49.80	10.40	9.20
13	44.50	3.20	7.90	31.30	3.40	4.10	16.00	2.20	3.50	50.90	9.10	8.70
14	38.70	5.40	7.50	23.70	4.00	3.10	16.00	3.00	3.30	45.10	10.40	7.60
15	37.50	6.50	7.40	26.30	6.00	3.70	14.10	3.30	3.10	49.40	11.70	8.10
Eng. Mean	39.60	4.60	8.00	27.50	3.50	4.30	15.00	2.50	3.40	49.40	10.90	8.90
Metric Mean	18.00	2.10	3.75	12.45	1.60	1.95	6.80	1.15	1.55	22.40	4.95	4.05
Group IV 1.01 to 1.25in.												
1	33.90	6.60	7.70	26.10	3.60	4.10	14.40	3.80	3.50	49.40	11.80	9.40
2	35.90	5.50	7.30	25.00	5.60	4.00	13.70	3.50	2.70	47.60	10.20	8.30
3	35.30	6.10	7.00	23.90	6.00	3.20	15.60	3.80	2.80	44.30	11.30	7.70
4	37.20	6.20	8.10	24.80	3.40	3.60	13.20	2.70	2.80	44.00	10.50	7.80
5	39.50	6.60	7.40	24.10	5.20	4.30	15.40	2.90	3.20	48.00	13.60	8.60
6	35.50	6.00	7.90	23.10	5.20	4.00	14.90	3.00	3.20	48.90	12.40	8.80
7	37.40	7.10	7.10	26.60	5.80	3.40	13.90	3.40	2.70	49.10	14.70	7.80
8	35.50	5.60	6.90	23.50	6.20	3.20	12.60	4.10	2.50	43.80	13.60	7.00
9	33.90	6.90	6.30	23.30	5.50	3.20	13.80	4.40	2.70	44.80	12.30	7.30
10	41.90	5.80	7.60	26.60	4.90	3.50	14.00	3.20	2.90	52.00	14.10	7.60
11	34.70	6.40	6.70	25.40	5.60	3.10	13.80	3.30	2.40	50.00	11.10	7.90
12	37.50	6.40	7.00	27.10	4.90	3.40	16.20	4.20	3.20	51.00	9.90	8.20
13	33.70	4.90	7.30	21.00	6.90	3.40	12.40	3.90	2.60	41.80	12.20	6.40
14	41.40	4.90	6.80	25.60	4.30	3.50	14.80	3.20	2.40	51.80	8.70	7.00
15	33.20	6.20	6.50	22.80	6.10	3.20	13.60	3.90	2.60	47.00	11.80	7.30
Eng. Mean	36.40	6.10	7.20	24.60	5.30	3.50	14.20	3.60	2.80	47.60	11.90	7.80
Metric Mean	16.50	2.75	3.25	11.15	2.40	1.60	6.40	1.60	1.30	21.60	53.90	3.55

APPENDIX II B (CONTINUED)

Steer No.	Round Yield	Round Fat	Round Bone	Loin Yield	Loin Fat	Loin Bone	Rib Yield	Rib Fat	Rib Bone	Chuck Yield	Chuck Fat	Chuck Bone
Group V .26 to .50 in.												
1	56.40	8.20	10.90	36.70	4.80	6.90	19.00	4.40	5.10	78.60	11.70	19.30
2	58.60	7.70	12.80	36.00	5.00	6.10	17.80	4.80	4.00	70.20	14.30	13.70
3	59.20	7.90	13.20	35.50	6.60	5.90	17.60	3.80	4.10	75.90	11.80	14.10
4	62.20	7.30	12.40	37.70	5.70	6.30	18.50	3.50	4.30	74.60	10.30	12.70
5	57.70	8.30	13.00	36.50	6.20	6.40	17.10	4.70	4.80	71.40	11.30	12.80
6	61.70	6.30	10.40	39.10	7.40	5.00	20.60	4.10	3.80	77.90	14.80	11.80
7	55.20	7.20	11.50	34.60	8.20	6.60	17.30	4.50	4.20	70.80	13.30	12.90
8	56.10	8.40	10.00	35.10	8.00	5.60	18.40	4.90	3.70	73.90	14.90	11.90
9	58.80	8.00	13.50	36.90	6.80	6.60	15.20	4.20	4.00	72.70	15.30	13.10
10	61.60	7.80	12.90	40.90	7.00	6.00	18.90	3.50	4.20	79.20	9.90	13.30
11	64.50	5.90	14.30	40.70	6.10	6.80	18.20	3.90	4.00	75.20	10.90	14.70
12	55.70	7.20	12.30	32.70	7.80	4.90	17.40	4.70	4.10	73.20	14.80	11.90
13	51.30	6.40	9.70	34.30	8.50	5.00	18.00	4.90	4.00	74.30	12.20	11.40
14	56.30	6.70	11.60	38.40	6.60	6.00	19.60	4.60	4.00	68.20	9.80	11.20
15	59.70	6.20	13.00	41.60	7.60	6.30	16.10	4.40	4.00	80.60	11.50	14.00
Eng. Mean	58.30	7.30	12.10	37.10	6.80	6.00	18.00	4.30	4.15	74.40	12.50	13.30
Metric Mean	26.45	3.30	5.50	16.80	3.10	2.75	8.15	1.95	1.90	33.80	5.65	6.00
Group VI .51 to .75 in.												
1	51.20	6.40	14.10	33.70	4.80	7.50	15.60	3.20	6.10	73.20	9.70	14.50
2	53.40	7.70	12.00	35.20	5.60	6.10	18.10	3.20	4.70	71.20	11.00	13.30
3	57.70	7.20	12.60	36.50	4.20	6.20	17.00	3.60	4.50	76.20	10.00	13.50
4	56.50	7.40	11.20	35.40	5.20	6.70	17.50	4.10	4.20	74.20	11.00	12.40
5	49.90	9.10	11.20	31.80	5.40	5.80	15.20	5.90	4.10	62.60	12.70	12.00
6	51.50	8.10	11.70	34.40	4.50	6.10	16.40	4.20	4.20	72.60	13.90	13.00
7	59.30	7.20	11.10	40.00	5.50	6.40	20.20	4.90	4.60	70.40	12.60	11.40
8	53.00	7.20	9.20	40.20	6.10	5.00	16.50	5.50	3.50	71.00	14.70	10.40
9	54.00	5.90	10.80	38.50	4.10	5.70	17.40	4.30	3.90	73.80	14.20	12.30
10	51.90	8.50	11.30	34.10	6.70	6.30	15.60	5.30	3.90	68.90	14.30	12.60
11	57.80	7.70	12.10	44.90	4.30	8.40	19.80	5.30	4.70	72.20	11.30	12.00
12	52.60	6.00	10.80	37.00	6.00	6.20	16.40	4.20	3.80	75.90	15.10	12.30
13	53.80	8.30	11.00	37.90	9.20	5.70	17.00	4.40	4.20	69.50	12.00	13.80
14	57.10	8.40	11.80	36.30	7.80	6.20	18.00	5.80	4.50	71.30	11.90	13.70
15	54.90	7.90	12.90	38.00	4.90	6.60	16.90	4.80	4.20	70.90	10.90	13.30
Eng. Mean	54.30	7.50	11.60	36.90	5.60	6.30	17.20	4.60	4.40	71.60	12.40	12.70
Metric Mean	24.60	3.40	5.25	16.75	2.55	2.90	7.80	2.10	2.00	32.50	5.60	5.75

APPENDIX II B (CONTINUED)

Steer No.	Round Yield	Round Fat	Round Bone	Loin Yield	Loin Fat	Loin Bone	Rib Yield	Rib Fat	Rib Bone	Chuck Yield	Chuck Fat	Chuck Bone
Group VII .76 to 1.00 in.												
1	49.60	8.10	11.00	36.00	5.10	6.50	14.70	4.40	4.80	69.10	14.40	13.30
2	55.20	8.90	10.90	35.90	4.60	6.50	18.50	5.30	4.80	76.60	13.40	12.70
3	53.40	8.30	10.50	34.20	4.00	6.20	17.20	5.40	4.40	69.40	12.60	12.30
4	46.90	8.60	10.80	33.60	5.50	5.80	15.80	5.00	4.20	69.30	13.30	13.60
5	47.80	9.40	9.20	33.10	6.70	4.40	18.40	4.20	4.10	59.90	16.10	9.90
6	53.90	7.90	11.30	35.60	4.90	5.70	16.20	5.80	4.30	70.90	12.80	13.60
7	45.30	9.70	9.50	32.80	7.10	5.70	16.90	6.30	4.10	62.60	16.80	11.00
8	50.80	5.80	11.40	36.80	5.10	5.60	17.20	6.30	3.70	65.10	16.60	9.20
9	50.60	8.10	10.30	34.70	8.20	7.10	17.70	5.10	3.90	71.60	13.70	12.30
10	54.30	8.60	12.10	35.60	9.00	6.50	17.00	4.80	4.00	74.30	12.40	13.80
11	53.00	6.90	9.80	35.10	5.30	5.80	18.50	4.00	4.00	66.30	13.90	11.10
12	50.40	8.90	10.50	31.80	7.30	5.40	16.80	5.50	4.10	68.40	15.30	12.20
13	53.20	8.80	11.60	35.50	7.80	6.30	16.40	3.90	4.10	62.70	12.10	11.90
14	47.70	7.80	10.40	35.10	5.90	6.30	17.30	4.40	3.90	62.20	11.20	11.30
15	48.40	8.90	9.40	30.10	7.30	4.30	18.60	6.70	3.60	63.50	13.80	8.70
Eng. Mean	50.70	8.30	10.60	34.40	6.30	5.90	17.20	5.10	4.10	67.50	13.90	11.80
Metric Mean	23.00	3.80	4.80	15.60	2.85	2.65	7.80	2.30	1.90	30.60	6.20	5.35
Group VIII 1.01 to 1.25 in.												
1	44.90	7.50	9.90	36.20	5.10	6.00	16.20	6.00	4.80	62.30	12.90	11.90
2	52.70	8.10	10.90	35.00	5.30	6.30	20.40	5.40	4.20	70.90	15.80	12.70
3	44.10	10.40	11.00	31.80	5.10	5.60	15.40	5.40	4.00	59.00	14.10	11.60
4	47.00	8.80	8.90	31.90	5.60	4.00	17.20	6.00	3.50	59.80	17.00	9.30
5	49.80	7.60	10.60	34.40	7.50	5.90	18.70	4.70	4.00	64.30	12.50	11.40
6	47.60	9.40	9.30	32.10	7.50	4.50	15.40	6.40	3.80	66.00	16.70	10.10
7	50.20	8.80	9.70	32.60	6.80	4.70	18.50	5.46	3.40	65.60	12.30	11.20
8	43.30	8.10	8.60	33.40	5.60	4.50	16.90	6.90	3.30	60.50	17.00	10.30
9	48.10	6.50	9.50	32.60	6.60	5.20	15.70	6.20	3.70	63.40	18.00	10.60
10	54.90	10.40	11.00	34.50	7.60	6.60	17.30	4.40	4.00	66.00	11.00	12.10
11	49.50	7.90	8.70	34.10	6.70	5.20	17.40	6.10	3.20	61.60	17.80	9.70
12	47.10	7.50	8.90	31.90	7.30	5.00	17.30	5.50	3.50	64.20	16.90	10.70
13	45.00	7.80	9.60	28.60	6.70	5.20	15.70	5.50	3.90	60.50	14.70	10.40
14	49.20	9.60	10.10	33.00	8.30	5.50	17.80	6.40	3.70	59.80	15.50	10.70
15	51.30	7.80	10.30	33.00	7.80	5.00	18.70	5.00	4.40	67.30	13.70	10.80
Eng. Mean	48.30	8.40	9.80	32.60	6.60	5.30	17.20	5.70	3.80	63.40	15.10	10.90
Metric Mean	21.90	3.80	4.45	14.80	3.00	2.40	7.80	2.60	1.70	28.75	6.80	4.95

APPENDIX II B (CONTINUED)

Steer No.	Shank Yield	Fat Shank	Bone Shank	Brisket Yield	Fat Brisket	Bone Brisket	Plate Yield	Fat Plate	Bone Plate	Flank Yield	Fat Flank	Bone Flank
Group I .26 to .50 in.												
1	4.80	0.40	3.70	6.40	2.70	1.20	13.70	6.60	2.70	10.50	6.80	0.10
2	4.40	0.30	3.60	6.50	3.30	1.60	14.60	4.90	2.80	7.70	5.50	0.10
3	4.70	0.20	3.90	6.80	3.00	1.60	11.90	4.70	2.50	7.10	5.80	0.10
4	4.80	0.30	3.60	6.80	3.40	1.60	12.80	6.70	3.00	9.10	7.10	0.10
5	5.00	0.20	3.20	5.70	3.00	1.20	10.50	4.40	2.80	7.70	7.00	0.10
6	5.50	0.20	3.40	6.90	4.10	1.80	11.80	7.50	2.70	7.70	11.60	0.10
7	4.20	0.20	3.00	5.30	2.40	1.00	10.80	7.90	2.30	8.60	9.30	0.10
8	5.30	0.40	3.70	5.60	3.10	1.10	10.50	5.60	2.70	7.50	7.30	0.10
9	4.10	0.20	3.20	6.70	3.50	1.20	11.10	9.50	2.60	9.00	10.10	0.10
10	4.90	0.80	3.20	5.30	2.80	1.80	11.70	7.40	2.20	9.70	7.30	0.10
11	4.70	0.80	3.00	5.90	4.00	1.00	11.70	8.50	2.20	9.40	9.00	0.10
12	4.70	0.40	3.60	5.50	3.60	1.20	9.40	7.60	2.30	8.50	9.40	0.10
13	3.90	0.80	3.20	5.80	3.10	0.70	12.20	9.20	2.60	10.00	8.40	0.10
14	4.50	0.40	3.20	5.00	2.40	0.90	11.70	9.40	2.30	8.40	8.50	0.10
15	5.00	0.80	3.40	6.30	3.30	0.80	12.00	8.10	2.10	8.00	8.50	0.10
Eng. Mean	4.70	0.40	3.40	6.00	3.20	1.20	11.80	7.20	2.50	8.60	8.10	0.10
Metric Mean	2.10	0.20	1.50	2.70	1.40	0.50	5.30	3.30	1.10	3.90	3.70	0.05
Group II .51 to .75 in.												
1	4.00	0.70	3.20	5.80	4.40	1.30	11.00	9.30	2.80	7.80	8.60	0.10
2	3.90	0.60	3.20	5.50	4.00	1.00	10.30	9.10	2.70	7.20	10.40	0.10
3	3.90	0.40	3.20	4.10	3.00	0.90	9.80	7.30	2.30	8.20	11.30	0.10
4	3.90	0.40	2.50	4.30	3.00	0.70	10.40	9.10	2.20	7.00	10.70	0.10
5	4.10	0.40	3.30	5.40	4.80	0.90	11.60	8.60	2.30	8.10	10.40	0.10
6	4.20	0.40	3.00	4.80	4.00	1.10	10.50	7.20	1.90	6.30	9.00	0.10
7	3.80	0.40	2.90	6.00	4.20	1.00	8.90	10.20	2.00	8.10	13.10	0.10
8	4.80	0.60	3.20	5.90	5.10	1.10	10.10	10.70	2.20	6.50	9.50	0.10
9	4.20	0.70	2.70	5.80	4.80	0.90	10.60	13.40	2.20	7.40	10.50	0.10
10	4.00	0.60	2.80	5.90	5.10	1.10	10.00	9.30	2.20	6.80	8.00	0.10
11	4.10	0.30	3.50	4.90	4.50	1.00	11.50	8.50	2.20	8.00	9.30	0.10
12	4.20	0.70	3.00	3.70	4.40	0.90	8.30	10.80	2.10	6.40	11.10	0.10
13	4.90	0.40	3.50	5.80	4.90	1.30	10.70	9.00	2.20	7.40	8.80	0.10
14	4.60	0.60	3.10	5.00	3.60	1.10	10.90	6.80	2.20	8.80	9.30	0.10
15	4.20	0.70	3.20	5.90	4.70	1.30	9.20	8.20	2.30	8.20	12.10	0.10
Eng. Mean	4.20	0.50	3.00	5.30	4.30	1.00	10.20	9.20	2.20	7.50	10.20	0.10
Metric Mean	1.90	0.25	1.40	2.40	1.95	0.50	4.65	4.15	1.00	3.40	4.60	0.05

Group III .76 to 1.00

Steer No.	Shank Yield	Fat Shank	Bone Shank	Brisket Yield	Fat Brisket	Bone Brisket	Plate Yield	Fat Plate	Bone Plate	Flank Yield	Fat Flank	Bone Flank
Group III .76 to 1.00 in.												
1	3.40	0.60	2.90	3.80	4.00	0.80	9.90	10.30	2.30	7.40	14.60	0.10
2	3.90	0.60	2.80	4.10	4.40	0.90	9.70	12.90	2.20	6.60	13.40	0.10
3	4.20	0.60	3.00	5.00	7.30	1.20	10.30	10.60	2.20	9.10	15.40	0.10
4	3.60	0.70	2.60	4.50	5.70	1.00	9.90	11.60	2.30	7.60	13.70	0.10
5	4.30	0.50	2.80	5.50	5.50	1.20	10.60	9.20	1.90	8.00	12.20	0.10
6	4.20	0.60	3.20	5.10	5.00	1.00	8.50	9.90	2.00	7.30	11.00	0.10
7	4.20	0.70	3.20	4.80	5.60	1.00	10.10	12.20	2.00	7.50	13.90	0.10
8	3.90	0.40	2.90	5.30	5.00	1.00	11.10	7.80	1.80	8.50	12.10	0.10
9	3.70	0.80	2.80	4.60	5.60	0.80	9.80	12.60	2.50	7.20	12.40	0.10
10	4.30	1.00	3.10	4.80	6.00	0.90	10.80	11.80	2.40	7.60	12.30	0.10
11	4.40	0.60	3.00	4.50	4.70	0.90	9.70	10.60	2.10	6.40	11.90	0.10
12	4.20	0.60	3.10	4.30	4.30	0.90	9.80	11.90	2.20	7.50	12.20	0.10
13	4.20	0.50	2.90	5.20	5.60	1.20	10.20	9.30	2.00	6.80	9.90	0.10
14	4.00	0.70	2.90	5.30	7.70	1.10	11.10	12.50	2.10	7.30	14.00	0.10
15	3.60	1.50	2.80	4.90	5.70	0.90	10.10	14.20	2.30	8.20	16.00	0.10
Eng. Mean	4.00	0.70	2.90	4.80	5.50	1.00	10.10	11.20	2.20	7.50	13.00	0.10
Metric Mean	1.80	0.30	1.30	2.20	2.50	0.45	4.60	5.05	1.00	3.40	5.90	0.05
Group IV 1.01 to 1.25 in.												
1	3.10	0.80	2.60	3.90	6.30	0.80	9.60	14.80	2.20	7.30	16.50	0.10
2	3.20	1.00	2.60	4.30	5.60	0.80	10.00	11.50	2.10	8.80	15.00	0.10
3	4.30	0.70	2.70	5.10	7.20	0.60	10.80	14.40	2.10	8.10	15.50	0.10
4	4.20	1.90	3.20	6.20	8.20	1.00	8.40	11.80	1.80	5.70	11.70	0.10
5	3.00	1.30	2.50	4.20	4.90	0.70	9.90	12.30	1.90	8.70	15.40	0.10
6	3.20	1.30	2.80	7.50	4.50	1.20	10.50	15.40	2.20	7.30	15.50	0.10
7	3.40	1.50	2.70	4.70	6.10	0.70	9.90	12.20	2.10	8.50	15.00	0.10
8	3.30	1.70	2.70	5.10	7.60	0.90	7.30	14.70	1.60	7.20	20.70	0.10
9	2.50	1.60	2.40	3.50	6.00	0.60	6.50	17.40	1.70	5.30	15.80	0.10
10	3.80	1.40	2.70	4.70	7.30	0.90	10.60	13.50	2.00	8.20	13.40	0.10
11	3.20	0.90	2.50	3.90	4.50	0.60	9.50	11.00	2.10	6.20	15.30	0.10
12	3.50	1.30	2.70	5.00	8.50	1.10	9.30	14.00	1.90	7.60	15.20	0.10
13	2.10	1.00	2.30	4.20	6.10	0.70	7.10	13.30	2.00	6.10	12.30	0.10
14	3.20	0.90	2.30	5.10	5.60	0.80	9.10	12.30	1.70	7.40	12.70	0.10
15	3.00	1.20	2.50	3.80	6.10	0.50	10.10	18.70	1.80	6.80	15.40	0.10
Eng. Mean	3.30	1.20	2.60	4.80	6.30	0.80	9.20	13.80	2.00	7.30	15.00	0.10
Metric Mean	1.70	0.55	1.20	2.15	2.85	0.35	4.20	6.30	0.90	3.30	6.80	0.05

	Shank Yield	Shank Bone	Brisket Yield	Brisket Fat	Brisket Bone	Plate Yield	Plate Fat	Plate Bone	Flank Yield	Flank Fat	Flank Bone
Group V .26 to .50 in.											
1	4.80	1.40	3.90	6.90	6.80	1.50	17.00	12.80	3.90	12.10	17.90	0.20
2	4.50	1.20	4.20	6.30	5.40	1.20	16.40	13.40	3.50	8.30	15.20	0.10
3	6.50	1.40	4.90	7.10	5.80	1.70	16.10	10.80	3.80	11.50	15.40	0.10
4	6.30	1.20	4.20	8.60	4.30	1.70	17.00	10.30	3.80	11.80	13.80	0.20
5	5.00	1.80	4.20	4.80	4.20	.80	14.10	10.70	3.30	10.50	13.70	0.10
6	5.10	1.40	3.50	7.30	5.20	1.30	15.70	13.70	3.00	11.90	15.60	0.10
7	4.80	1.20	4.00	5.50	5.10	1.40	16.10	14.30	3.60	11.60	15.60	0.10
8	4.30	1.90	3.60	6.50	8.20	1.00	14.20	16.80	2.80	12.80	16.20	0.10
9	4.90	1.40	4.30	4.90	5.60	1.20	13.30	15.40	3.70	8.80	16.20	0.10
10	5.80	1.30	4.90	8.20	5.60	1.50	15.50	12.70	3.80	8.90	11.80	0.10
11	5.30	1.70	4.80	6.70	4.70	1.50	16.20	10.50	3.60	8.60	12.00	0.10
12	4.90	1.50	4.20	6.30	6.60	1.50	17.10	16.10	3.70	12.00	17.40	0.10
13	4.30	1.10	3.60	6.00	4.90	1.20	15.80	15.60	4.30	12.70	15.10	0.10
14	5.60	1.40	3.90	7.20	5.70	1.00	13.10	12.70	3.30	8 .20	12.90	0.10
15	5.00	1.30	4.60	5.20	5.50	1.20	12.30	12.90	3.50	8.00	12.50	0.10
Eng. Mean	5.10	1.40	4.20	6.50	5.60	1.30	15.30	13.25	3.60	10.50	14.80	0.10
Metric Mean	2.30	0.65	1.90	2.95	2.55	0.60	6.95	6.00	1.60	4.80	6.70	0.05
Group VI .51 to .75 in.												
1	5.30	0.60	4.90	6.30	6.30	1.30	15.50	12.90	3.80	9.30	14.10	0.20
2	4.80	1.10	4.10	6.60	4.50	1.40	16.20	11.00	3.80	10.10	14.30	0.10
3	5.00	0.90	4.50	6.40	4.40	1.20	17.50	12.70	4.30	10.10	13.20	0.20
4	4.70	0.80	4.00	6.60	5.00	1.40	16.40	12.50	2.80	11.10	13.90	0.10
5	4.50	1.40	3.90	7.10	9.50	1.80	13.60	16.90	3.00	8.00	18.00	0.10
6	4.60	1.80	4.10	6.60	8.50	1.20	13.90	16.30	3.30	9.80	19.50	0.10
7	4.90	1.40	3.90	7.30	7.20	1.20	15.00	14.60	3.00	10.20	16.70	0.10
8	4.50	1.40	3.50	7.90	6.60	1.20	14.60	14.90	2.60	9.30	19.20	0.10
9	5.30	1.20	4.00	7.10	6.60	1.00	17.60	13.80	3.10	12.60	15.30	0.10
10	4.40	1.40	3.90	4.60	5.90	0.90	14.40	14.20	2.90	9.00	16.90	0.10
11	5.50	1.60	4.10	7.60	8.30	1.20	14.10	14.10	2.70	10.40	16.10	0.10
12	5.20	1.50	3.70	6.20	6.60	1.30	13.80	13.20	3.00	10.40	14.20	0.10
13	4.40	1.20	3.80	5.60	5.00	0.70	14.30	15.80	3.50	9.10	17.80	0.20
14	4.50	1.00	4.00	5.80	5.70	0.80	15.00	13.70	3.40	12.00	8.00	0.10
15	5.00	1.70	4.10	6.30	5.60	1.30	13.80	10.80	3.30	8.90	14.70	0.10
Eng. Mean	4.80	1.30	4.00	6.50	6.40	1.20	15.10	13.80	3.20	10.00	15.50	0.10
Metric Mean	2.20	0.60	1.80	2.95	2.90	0.55	6.80	6.30	1.50	4.55	7.00	0.05

	Yield	Fat Shank	Bone Shank	Brisket Yield	Fat Brisket	Bone Brisket	Plate Yield	Fat Plate	Bone Plate	Flank Yield	Fat Flank	Bone Flank
Group VII .76 to 1.00 in.												
1	4.70	1.10	4.00	5.60	8.00	1.40	12.40	14.40	3.60	9.20	16.80	0.10
2	4.10	1.50	3.70	7.10	5.10	1.30	17.10	13.00	3.30	10.10	15.00	0.10
3	4.60	1.20	3.90	6.50	5.00	1.00	15.70	11.70	3.40	10.60	14.60	0.10
4	4.60	1.70	4.10	6.50	6.50	1.10	14.00	15.10	3.40	9.50	19.40	0.20
5	4.20	1.90	3.40	7.50	9.60	1.10	12.10	18.70	2.60	9.80	23.00	0.10
6	4.30	1.50	3.80	4.50	3.70	1.10	14.60	14.40	3.40	10.50	18.70	0.10
7	4.00	1.50	3.40	5.50	6.90	1.00	13.20	19.30	2.80	8.40	19.90	0.10
8	4.20	1.30	3.20	6.90	6.50	0.90	15.00	17.10	2.70	8.30	17.80	0.10
9	4.30	1.30	3.60	7.50	5.40	0.80	13.90	15.60	3.10	9.20	18.20	0.10
10	4.40	1.70	4.00	5.70	6.00	1.80	14.90	14.10	3.30	9.40	15.60	0.10
11	4.80	1.40	3.80	5.60	6.80	1.40	15.40	15.10	3.20	8.90	19.90	0.20
12	4.90	1.80	3.70	7.50	8.10	0.90	14.40	14.20	3.20	10.60	18.60	0.20
13	5.70	1.70	4.30	7.20	7.10	1.40	14.10	12.40	3.20	8.60	15.90	0.10
14	4.90	1.40	3.90	6.70	6.00	1.20	13.30	13.00	2.90	10.20	19.30	0.10
15	5.00	1.60	3.60	7.30	8.60	1.30	15.30	17.60	1.90	9.50	18.90	0.10
Eng. Mean	4.60	1.50	3.80	6.50	6.60	1.20	14.40	15.10	3.10	9.50	18.10	0.10
Metric Mean	2.10	0.69	1.70	2.95	3.00	0.55	6.50	6.80	1.40	4.30	8.20	0.05
Group VIII 1.01 to 1.25 in.												
1	3.90	1.40	3.60	5.30	6.00	1.20	15.80	16.00	3.10	10.30	19.90	0.10
2	4.20	1.30	3.60	5.60	6.20	1.00	14.80	15.70	3.10	10.00	18.70	0.20
3	3.80	2.10	4.10	5.20	8.50	1.00	15.10	17.80	2.90	9.40	22.60	0.10
4	3.80	2.10	3.30	5.80	9.50	1.10	11.70	17.50	2.30	8.10	22.10	0.10
5	3.90	1.40	3.60	4.30	5.80	0.80	11.70	13.60	2.50	10.20	18.00	0.10
6	4.40	2.30	3.60	6.50	8.30	1.30	13.70	20.90	2.60	9.60	23.30	0.10
7	4.20	2.40	3.50	6.70	7.10	1.00	12.70	13.90	2.70	9.50	19.20	0.10
8	3.70	1.50	3.20	5.40	9.90	1.20	15.10	19.80	3.70	9.70	21.50	0.10
9	3.80	1.20	3.40	5.40	8.00	0.80	13.50	16.80	2.70	9.90	18.30	0.10
10	5.20	1.70	4.10	7.00	6.20	1.30	10.90	10.20	2.60	10.20	17.50	0.10
11	3.60	1.60	3.10	5.00	7.80	0.80	11.50	19.10	2.50	9.10	20.30	0.10
12	4.70	1.70	3.60	5.90	8.20	0.90	13.30	18.10	2.80	9.20	22.40	0.10
13	3.70	1.80	3.40	6.30	9.20	0.90	13.10	18.60	2.30	9.50	20.60	0.10
14	4.60	1.50	3.70	5.60	7.40	1.10	15.00	19.90	3.00	10.10	22.90	0.10
15	4.60	1.70	3.60	5.40	7.10	0.80	12.90	14.30	2.80	8.80	18.90	0.20
Eng. Mean	4.10	1.70	3.60	5.70	7.70	1.00	13.40	16.80	2.80	9.60	20.40	0.10
Metric Mean	1.90	0.80	1.60	2.60	3.50	0.45	6.10	7.60	1.25	4.35	9.25	0.05

	Loin	Steaks Rib	Steaks Chuck	Roasts & Steaks RLRC	Retail Yield RLRC	Carcass Retail Yield	Internal Fat Trim	Total Bone
Group I .26 to .50 in.								
1	44.4	30.4	12.7	56.0	143.5	162.1	197.5	30.0	38.5
2	39.4	25.6	9.7	57.4	132.1	154.4	187.6	23.4	40.5
3	41.5	27.4	11.2	52.3	132.4	154.6	185.1	23.4	41.3
4	40.5	25.9	10.8	55.0	132.2	155.4	186.9	27.8	41.5
5	40.2	21.7	11.8	42.5	116.2	143.4	172.3	27.7	37.8
6	37.9	25.2	10.6	44.3	118.0	145.0	176.9	36.9	35.0
7	36.6	22.1	11.3	41.4	111.4	137.5	166.4	35.2	31.8
8	38.6	26.3	8.6	42.0	115.5	146.1	175.0	28.0	38.0
9	37.5	24.4	11.7	50.6	124.2	148.8	179.7	38.8	35.5
10	40.2	25.0	10.9	43.5	119.6	146.6	178.2	36.2	35.6
11	43.7	22.0	11.5	44.9	122.1	149.2	180.9	38.7	31.8
12	39.2	25.6	10.4	41.2	116.4	143.2	171.3	39.3	35.5
13	40.6	24.6	12.0	45.5	122.7	149.9	181.8	40.8	32.9
14	38.8	24.3	9.0	40.4	112.5	142.7	172.3	38.8	33.3
15	42.6	23.7	11.6	48.0	125.9	154.6	185.9	39.0	33.1
Eng. Mean	40.10	24.90	10.90	47.00	122.90	148.90	179.90	33.60	36.10
Metric Mean	18.20	11.30	4.95	21.30	55.75	67.55	81.60	15.25	16.40
Group II .51 to .75 in.								
1	36.7	22.7	10.6	46.5	116.5	136.7	165.3	43.3	35.6
2	38.1	20.2	9.5	41.4	109.2	132.7	159.6	37.6	36.2
3	36.8	23.9	10.1	51.3	122.1	142.9	168.9	36.4	34.3
4	34.3	22.6	9.1	42.0	108.0	130.9	156.5	43.6	29.7
5	38.0	24.0	10.4	37.2	109.6	140.5	169.7	43.4	32.6
6	37.7	24.6	10.0	40.0	112.3	139.3	164.9	34.3	33.8
7	35.0	21.5	12.6	38.4	107.5	132.9	159.7	46.3	32.2
8	34.7	22.3	11.2	39.7	107.9	132.3	159.6	47.3	33.2
9	33.7	24.4	8.6	35.5	102.2	129.8	157.8	49.6	28.4
10	33.3	24.3	12.0	41.5	111.1	137.2	163.9	40.0	29.6
11	37.5	25.5	10.7	42.7	116.4	145.4	173.9	39.8	35.3
12	33.8	22.7	11.6	38.6	106.7	135.1	159.5	50.8	30.4
13	37.7	23.7	9.5	44.1	115.0	143.9	172.7	40.3	34.0
14	39.3	24.4	11.1	45.4	120.2	148.9	178.2	38.5	35.6
15	35.9	23.1	10.7	37.6	107.3	135.5	163.0	51.7	33.1
Eng. Mean	36.20	23.30	10.50	41.60	111.50	137.60	164.90	42.90	32.90
Metric Mean	16.40	10.55	4.75	18.85	50.60	62.40	74.80	19.45	14.90

Steer No.	Roasts & Steaks Round	Roasts & Steaks Loin	Roasts & Steaks Rib	Roasts & Steaks Chuck	Roasts & Steaks RLRC	Retail Yield RLRC	Retail Yield	Fat Trim	Total Bone
Group III .76 to 1.00 in.									
1	33.0	23.2	10.6	39.8	106.6	127.4	151.9	55.3	32.2
2	34.3	22.0	9.8	43.7	109.8	132.2	156.5	54.9	32.3
3	35.0	21.9	10.8	36.6	104.3	128.2	156.8	55.8	31.6
4	33.3	21.8	9.4	43.2	107.7	127.0	152.6	51.0	30.9
5	34.6	25.4	10.7	41.2	111.9	138.6	167.0	50.1	30.2
6	34.7	23.2	11.1	38.5	107.5	131.4	156.5	46.9	32.3
7	35.1	23.7	10.3	39.3	108.4	132.2	158.8	54.6	32.7
8	35.3	20.8	10.9	39.1	106.1	127.0	155.8	43.0	30.0
9	32.6	22.7	9.9	39.8	105.0	128.1	153.4	54.9	30.5
10	35.6	23.5	10.8	41.3	111.2	136.4	163.9	50.5	31.0
11	30.7	24.0	10.8	44.3	109.8	132.2	157.2	48.4	29.9
12	35.0	24.6	10.0	39.7	109.3	137.0	162.8	48.4	32.1
13	37.7	26.0	11.2	42.0	116.9	142.7	169.1	43.2	30.4
14	33.2	19.1	11.7	38.8	102.8	123.5	151.2	57.7	27.7
15	31.7	21.8	10.5	40.4	104.4	127.3	154.1	64.9	28.4
Eng. Mean	34.10	22.90	10.60	40.50	108.10	131.40	157.80	51.90	30.80
Metric Mean	15.45	10.40	4.80	18.40	49.00	59.60	71.60	23.55	14.00
Group IV 1.01 to 1.25 in.									
1	29.2	21.4	9.7	38.7	99.0	123.8	147.7	64.2	30.4
2	29.7	20.7	9.8	40.0	100.2	122.2	148.5	57.9	27.9
3	30.0	19.6	11.1	35.5	96.2	119.1	147.4	65.0	26.2
4	32.6	20.3	9.2	34.8	96.9	119.2	143.7	56.4	28.4
5	35.1	19.9	11.4	39.5	105.9	127.0	152.8	75.2	28.7
6	30.3	19.1	11.1	41.5	102.0	122.4	150.9	63.3	30.2
7	32.2	21.3	9.5	40.2	103.2	127.0	153.5	65.8	26.6
8	31.1	19.5	9.2	36.9	96.7	115.4	138.3	74.2	24.9
9	29.4	20.2	10.9	36.3	96.8	115.8	133.6	59.4	24.3
10	36.4	22.6	10.0	40.7	109.7	134.5	161.8	63.6	27.3
11	30.0	21.1	10.0	39.1	100.2	123.9	146.7	58.1	25.4
12	32.9	24.0	12.1	41.3	110.3	131.8	157.2	64.4	27.6
13	29.4	17.5	9.4	33.6	89.9	108.9	128.4	60.6	24.8
14	35.4	20.8	11.2	43.6	111.0	133.6	158.4	52.6	24.6
15	28.8	20.2	10.1	37.6	96.7	116.6	140.3	69.4	24.5
Eng. Mean	31.50	20.50	10.30	38.60	100.90	122.70	147.30	63.30	26.80
Metric Mean	14.30	9.30	4.70	17.50	45.80	55.65	66.80	28.70	12.15

APPENDIX II B (CONTINUED)

Steer No.	Roasts & Steaks Round	Roasts & Steaks Loin	Roasts & Steaks Rib	Roasts & Steaks Chuck	Roasts & Steaks RLRC	Retail Yield RLRC	Carcass Retail Yield	Internal Fat Trim	Total Bone
Group V .26 to .50 in.									
1	49.3	31.2	13.6	64.7	158.8	190.7	231.5	68.0	51.7
2	52.6	29.6	12.5	52.4	147.1	182.6	218.1	67.0	45.6
3	49.7	29.4	12.9	64.8	156.8	188.2	229.4	63.5	47.8
4	52.7	32.1	12.7	62.2	159.7	193.0	236.7	56.4	45.6
5	48.1	29.7	11.7	59.3	148.8	182.7	217.1	60.9	45.4
6	53.4	33.2	14.6	64.5	165.7	199.3	239.3	68.5	38.9
7	47.8	29.0	13.0	58.6	148.4	177.9	215.9	69.4	44.3
8	49.8	29.9	13.6	58.3	151.6	183.5	221.3	79.3	38.7
9	50.3	31.9	11.4	57.0	150.6	183.6	215.5	72.9	46.5
10	51.5	34.7	14.5	63.1	163.8	200.6	239.0	59.6	46.7
11	53.4	36.7	14.5	61.8	166.4	198.6	235.4	55.7	49.8
12	47.7	27.9	13.0	57.4	146.0	179.0	219.3	76.1	42.7
13	45.7	29.0	13.2	58.6	146.5	177.9	216.7	68.7	39.3
14	48.7	32.7	15.9	56.1	153.4	182.5	216.6	60.4	41.1
15	50.9	37.2	11.4	61.8	161.3	198.0	228.5	61.9	46.7
Eng. Mean	50.10	31.60	13.20	60.00	155.00	187.90	225.40	65.90	44.70
Metric Mean	22.70	14.30	6.00	27.20	70.30	85.20	102.45	29.90	20.30
Group VI .51 to .75 in.									
1	43.6	28.6	10.6	63.8	146.6	173.7	210.1	58.0	52.4
2	41.8	29.6	13.3	62.4	147.1	177.9	215.6	58.4	45.5
3	46.0	30.3	11.0	66.8	154.1	187.4	226.4	56.2	47.0
4	49.1	29.4	11.5	63.8	153.7	183.6	222.4	59.9	42.8
5	43.7	27.3	10.1	52.7	133.8	159.5	192.7	78.9	41.9
6	45.4	30.0	11.6	57.4	144.4	174.9	209.8	76.8	43.7
7	52.1	34.7	14.2	57.2	158.2	189.9	227.3	70.1	41.7
8	45.9	33.1	10.6	58.4	148.0	180.7	217.0	75.6	35.5
9	45.4	32.9	12.8	59.1	150.20	183.7	226.3	65.4	40.9
10	44.6	29.6	10.4	54.3	138.9	170.5	202.9	73.2	41.9
11	48.8	38.8	13.2	58.7	159.5	194.7	232.3	68.7	45.3
12	44.8	31.5	11.2	60.4	147.9	181.9	217.5	66.8	41.2
13	46.6	31.3	12.1	58.8	148.8	178.2	211.6	73.7	42.9
14	48.4	29.9	12.4	58.0	148.7	182.7	220.0	62.3	44.5
15	45.4	33.0	12.3	61.9	152.6	180.7	214.7	61.3	45.8
Eng. Mean	46.10	31.30	11.80	59.60	148.80	180.00	216.40	67.00	43.50
Metric Mean	20.90	14.20	5.35	27.00	67.50	81.65	98.15	30.40	19.70

APPENDIX II B (CONTINUED)

Steer No.	Roasts & Steaks Round	Roasts & Steaks Loin	Roasts & Steaks Rib	Roasts & Steaks Chuck	Roasts & Steaks RLRC	Retail Yield RLRC	Carcass Retail Yield	Internal Fat Trim	Total Bone
Group VII .76 to 1.00 in.									
1	43.7	31.2	9.3	55.0	139.2	169.4	201.3	72.3	44.7
2	48.2	31.3	11.7	65.5	156.7	186.2	224.6	66.8	43.3
3	47.5	28.3	11.7	55.8	143.3	174.2	211.6	62.8	41.8
4	40.3	27.6	10.8	52.7	131.4	165.6	200.2	75.15	43.2
5	42.6	28.0	14.6	46.6	131.8	159.2	192.8	89.6	34.8
6	47.3	29.5	11.0	54.6	142.4	176.6	210.5	69.7	43.3
7	39.4	28.6	13.0	48.9	129.9	157.6	188.7	87.5	37.6
8	42.8	32.1	12.1	53.5	140.5	169.9	204.3	76.5	36.8
9	43.7	28.8	13.8	61.2	147.5	174.6	209.5	75.6	41.2
10	46.0	29.1	13.2	64.1	152.4	181.2	215.6	72.2	45.6
11	46.1	29.2	14.3	46.9	136.5	172.9	207.6	73.3	39.2
12	42.1	26.1	12.2	55.0	135.4	167.4	204.8	79.7	40.2
13	43.1	29.2	12.3	53.1	137.7	167.8	203.4	69.7	42.9
14	38.8	29.9	11.9	53.7	134.3	162.3	197.4	69.0	40.0
15	39.5	24.7	12.6	54.9	131.7	160.6	197.7	83.4	32.9
Eng. Mean	43.40	28.90	12.30	54.80	139.40	169.70	204.70	74.90	40.50
Metric Mean	19.70	13.10	5.60	24.85	63.20	77.00	92.85	34.00	18.40
Group VIII 1.01 to 1.25 in.									
1	36.30	26.0	11.1	55.6	129.0	153.6	188.9	74.8	40.7
2	47.2	30.1	15.4	57.3	148.0	179.0	213.6	76.5	41.1
3	39.2	26.9	10.4	45.9	122.4	150.3	183.8	86.0	40.3
4	41.4	27.8	12.4	47.7	129.3	155.9	185.3	88.6	32.5
5	42.1	28.0	14.0	54.4	138.5	167.2	197.3	71.1	38.9
6	40.4	26.8	10.7	56.1	134.0	161.1	195.3	94.8	35.3
7	42.3	27.0	12.7	56.2	138.2	166.9	200.0	75.9	36.3
8	37.9	28.5	12.6	49.0	128.0	154.1	188.0	90.3	34.9
9	41.1	28.3	10.9	52.8	133.1	159.8	192.4	81.6	36.00
10	45.9	28.5	13.1	53.8	141.3	172.7	206.0	69.0	41.8
11	43.6	28.8	12.1	49.5	134.0	162.6	191.8	87.3	33.3
12	39.9	25.9	13.2	52.3	131.3	160.5	193.6	87.6	35.5
13	37.2	24.0	11.8	49.1	122.1	149.8	182.4	84.9	35.8
14	41.9	27.8	13.0	49.4	132.1	159.8	195.1	91.5	37.9
15	43.3	27.2	14.0	58.1	142.6	170.3	202.0	76.3	37.9
Eng. Mean	41.30	27.40	12.50	52.50	133.60	161.60	194.40	82.40	37.20
Metric Mean	18.70	12.40	5.70	23.80	60.60	73.30	88.20	37.40	16.90

APPENDIX II C BONE WEIGHTS

Steer No.	Radius + Ulna	Femur	Tibia Fibia	Scapula	Humerus
Group I .26 to .50 in.					
1	2.90	3.70	2.90	2.00	3.00
2	3.00	4.10	3.10	2.10	3.40
3	3.10	4.30	3.20	2.00	3.40
4	2.90	4.00	3.20	2.20	3.20
5	2.70	3.50	2.50	2.10	3.00
6	2.60	3.20	2.80	1.90	2.90
7	2.40	3.90	2.50	1.80	2.60
8	2.80	3.30	2.90	2.20	3.10
9	2.60	3.60	2.60	1.80	2.60
10	2.40	3.40	2.80	1.70	2.70
11	2.30	4.10	2.60	1.80	2.70
12	2.70	3.40	3.30	1.20	2.90
13	2.60	3.40	2.50	1.90	2.50
14	2.50	3.40	2.50	1.90	2.60
15	2.70	3.40	2.50	1.80	2.80
Eng. Mean	2.70	3.70	2.80	1.90	2.90
Metric Mean	1.20	1.70	1.30	0.90	1.30
Group II .51 to .75 in.					
1	2.50	3.40	2.60	1.90	2.70
2	2.50	3.40	2.60	2.00	2.90
3	2.60	3.60	2.70	1.80	2.70
4	2.00	3.10	2.00	1.60	2.10
5	2.70	3.30	2.60	2.80	2.50
6	2.30	3.10	2.30	1.80	2.60
7	2.50	3.30	2.60	1.80	2.60
8	2.50	3.20	2.70	1.80	2.70
9	2.10	2.70	2.10	1.70	2.40
10	2.20	2.90	2.20	1.70	2.50
11	2.80	3.70	2.90	1.70	3.00
12	2.30	3.20	2.30	1.70	2.50
13	2.70	3.40	2.60	1.80	2.90
14	2.60	3.80	2.70	2.10	2.90
15	2.50	3.50	2.60	1.60	2.90
Eng. Mean	2.50	3.30	2.50	1.90	2.60
Metric Mean	1.10	1.50	1.10	0.80	1.20

APPENDIX II C (CONTINUED)

Steer No.	Radius + Ulna	Femur	Tibia Fibia	Scapula	Humerus
Group III .76 to 1.00 in.					
1	2.40	2.80	2.20	1.80	2.50
2	2.20	3.10	2.30	1.80	2.70
3	2.40	3.20	2.10	1.60	2.60
4	2.10	3.00	2.50	1.70	2.10
5	2.20	3.00	2.30	1.50	2.50
6	2.50	3.40	2.70	1.80	2.70
7	2.50	3.50	2.60	1.80	2.50
8	2.30	2.90	2.40	1.50	2.30
9	2.20	3.10	2.20	1.90	2.40
10	2.50	3.20	2.50	1.60	2.60
11	2.40	3.00	2.50	1.60	2.50
12	2.40	3.30	2.40	1.80	2.80
13	2.30	3.10	2.40	1.70	2.50
14	2.50	2.90	2.40	1.30	2.60
15	2.20	2.80	2.20	1.70	2.20
Eng. Mean	2.30	3.10	2.40	1.70	2.50
Metric Mean	1.10	1.40	1.10	0.80	1.10
Group IV 1.01 to 1.25 in.					
1	2.10	2.80	2.20	1.70	2.40
2	2.10	2.70	2.10	1.70	2.20
3	2.00	2.60	2.00	1.50	2.10
4	2.40	3.30	2.40	1.50	2.50
5	2.00	2.90	1.90	1.80	2.30
6	2.20	2.90	2.40	1.70	2.40
7	2.10	2.90	1.90	1.60	2.10
8	2.10	2.60	2.00	1.40	2.10
9	1.90	2.50	1.70	1.40	2.00
10	2.10	2.30	2.30	1.60	2.30
11	2.20	2.60	2.00	1.50	2.00
12	2.10	2.50	2.10	1.50	2.40
13	1.80	2.70	2.10	1.30	1.90
14	1.70	2.60	1.80	1.40	1.60
15	2.00	2.50	1.80	1.40	2.10
Eng. Mean	2.10	2.70	2.10	1.50	2.20
Metric Mean	0.90	1.20	0.90	0.70	1.00

Rat No.	Radius & Ulna	Femur	Tibia Fibia	Scapula	Humerus
Group V .26 to .50 in.					
1	3.30	4.30	3.00	2.30	3.30
2	3.50	5.00	3.60	2.40	3.60
3	3.80	5.20	3.90	2.50	4.30
4	3.40	4.80	3.50	2.50	3.40
5	3.50	4.90	3.80	2.50	3.80
6	2.70	3.60	3.70	2.30	3.10
7	3.10	4.40	3.30	2.50	3.30
8	2.90	4.00	2.80	2.20	2.30
9	3.20	5.00	3.50	2.40	3.60
10	3.90	5.00	3.90	2.40	3.90
11	3.80	5.70	3.90	2.60	3.60
12	3.40	3.50	3.50	2.20	3.50
13	3.00	3.70	3.90	2.60	4.60
14	3.20	4.60	3.10	2.30	3.50
15	3.70	5.10	3.70	2.60	4.10
Eng. Mean	3.40	4.60	3.50	2.40	3.60
Metric Mean	1.50	2.10	1.60	1.10	1.60
Group VI .51 to .75 in.					
1	4.00	5.40	4.20	2.80	4.20
2	3.20	4.50	3.50	2.30	3.60
3	3.70	4.80	3.70	2.60	3.90
4	3.30	4.30	3.10	2.10	3.50
5	3.10	4.30	3.00	2.30	3.30
6	3.40	4.40	3.40	2.40	3.60
7	3.00	4.30	3.10	2.20	3.30
8	2.70	3.60	2.70	2.00	2.80
9	3.10	4.00	3.20	2.40	3.40
10	3.10	4.30	3.20	2.30	3.50
11	3.60	4.80	3.40	2.50	3.30
12	3.00	4.10	2.90	2.20	3.20
13	3.10	4.40	3.10	2.50	3.40
14	3.20	4.80	4.70	2.70	3.60
15	3.20	4.80	3.50	2.50	3.60
Eng. Mean	3.30	4.50	3.40	2.40	3.50
Metric Mean	1.50	2.00	1.50	1.10	1.60

APPENDIX II C (CONTINUED)

Steer No.	Radius + Ulna	Femur	Tibia Fibia	Scapula	Humerus
Group VII .76 to 1.00 in.					
1	3.30	4.20	3.00	1.40	3.70
2	3.00	4.40	3.00	2.40	3.30
3	3.20	4.00	2.90	2.30	3.60
4	3.40	4.10	3.00	2.40	3.60
5	2.60	3.50	2.60	1.80	2.90
6	3.30	4.30	3.20	2.50	3.50
7	2.70	3.70	2.70	2.10	2.90
8	2.60	3.90	2.60	1.90	2.60
9	3.00	3.80	3.00	2.40	3.20
10	3.30	4.70	3.40	2.40	3.50
11	3.10	3.80	3.00	2.10	3.10
12	2.90	4.00	2.90	2.90	3.10
13	3.40	4.50	3.20	2.50	3.50
14	3.10	4.10	2.90	2.40	3.40
15	2.80	3.60	2.70	1.90	3.00
Eng. Mean	3.10	4.00	2.90	2.20	3.30
Metric Mean	1.40	1.80	1.30	1.00	1.50
Group VIII 1.01 to 1.25 in.					
1	3.00	3.80	2.90	2.30	3.20
2	3.00	4.20	3.00	2.20	3.50
3	3.30	4.40	3.10	2.00	3.50
4	2.90	4.20	3.20	2.10	3.20
5	2.90	4.20	3.20	2.10	3.20
6	2.90	3.60	2.80	2.10	3.00
7	2.80	3.80	2.80	2.00	2.90
8	2.60	3.50	2.50	1.80	2.80
9	2.70	3.80	2.60	2.00	3.20
10	3.20	4.30	3.20	2.40	3.40
11	2.50	3.30	2.50	1.90	2.70
12	2.90	3.50	2.50	2.00	2.90
13	2.80	3.60	2.70	2.00	2.80
14	2.90	3.90	2.90	2.00	3.30
15	2.80	3.80	2.60	2.10	3.00
Eng. Mean	2.90	3.90	2.80	2.10	3.10
Metric Mean	1.30	1.80	1.30	0.90	1.40

APPENDIX III A HOLSTEIN CARCASS EVALUATION - SUBJECTIVE SCORES

Steer No.	Breed	Round Score	Overall Conformation	Hindquarter Conformation	Forequarter Conformation	Maturity Score	Marbling Score	Final Score
Group IX Holsteins .26 to .50 in.								
1	4	02	03	03	03	3	10	03
2	4	04	04	04	04	2	17	05
3	4	03	03	03	02	2	12	03
4	4	03	03	03	03	3	16	05
5	4	02	02	02	01	3	11	03
6	4	01	02	02	03	3	14	04
7	4	03	03	03	02	3	14	04
8	4	02	02	02	02	3	10	03
9	4	03	03	03	03	3	12	03
10	4	02	02	02	02	5	14	03
11	4	02	02	02	02	4	13	03
12	4	04	04	04	04	3	11	04
13	4	04	04	04	04	3	12	04
14	4	02	02	02	02	3	07	01
15	4	03	03	03	03	3	11	03
Eng. Mean		2.7	2.8	2.8	2.7	3.1	12.3	3.4
Metric Mean		2.7	2.8	2.8	2.7	3.1	12.3	3.4

APPENDIX III B HOLSTEIN CARCASS EVALUATION - OBJECTIVE FAT MEASURES

Steer No.	Carc. Wt.	5th Thor. 4 in.	5th Thor. 8 in.	5th Thor. 12 in.	5th Thor. Avg.	8th Thor. 4 in.	8th Thor. 8 in.	8th Thor. 12 in.	8th Thor. Avg.	11th Thor. 4 in.	11th Thor. 8 in.
Group IX Holsteins .26 to .50 in.											
1	735	02	09	06	5.67	01	05	05	3.67	04	06
2	728	03	06	11	6.67	03	06	04	4.33	05	07
3	695	02	08	06	5.33	02	06	05	4.33	03	04
4	718	05	06	08	6.33	02	07	04	4.33	04	06
5	690	05	11	07	7.67	09	05	06	6.67	05	07
6	712	04	09	07	6.67	05	07	06	6.00	05	05
7	716	05	09	06	6.67	05	08	06	6.33	06	05
8	709	03	09	03	5.00	03	06	04	4.33	03	08
9	711	05	09	07	7.00	07	08	06	7.00	07	09
10	715	05	10	01	5.33	04	06	06	5.33	08	06
11	745	07	12	11	10.00	07	10	08	8.33	06	06
12	738	05	14	10	9.67	04	07	05	5.33	06	08
13	701	05	14	10	9.67	06	08	10	8.00	08	10
14	716	07	12	11	10.00	05	11	09	8.33	07	07
15	711	06	08	12	8.67	05	08	07	6.67	05	07
Eng. Mean	716.0	.18	.38	.30	.29	.18	.28	.24	.23	.22	.26
Metric Mean	324.8	4.6	9.7	7.7	7.4	4.5	7.2	6.1	5.9	5.5	6.7

	12 in.	Avg.	4 in.	8 in.	12 in.	1st Lumb. Avg.	4th Lumb. 4 in.	4th Lumb. 8 in.	4th Lumb. 12 in.	4th Lumb. Avg.	6th Lumb. 4 in.
Group IX Holsteins .26 to .50 in.											
1	05	5.00	06	08	08	7.33	07	15	12	11.33	04
2	04	5.33	06	09	10	8.33	07	05	09	7.00	02
3	05	4.00	03	07	08	6.00	05	10	06	7.00	02
4	07	5.67	07	13	11	10.33	08	09	08	8.33	03
5	07	6.33	06	08	09	7.67	09	10	09	9.33	03
6	06	5.33	05	13	07	8.33	05	08	08	7.00	05
7	06	5.67	05	07	07	6.33	08	10	06	8.00	04
8	05	5.33	03	08	06	5.67	05	10	11	8.67	02
9	05	7.00	07	14	14	11.67	09	12	11	10.67	06
10	05	6.33	06	10	06	7.33	06	07	11	8.00	06
11	05	5.67	05	11	10	8.67	05	05	12	7.33	06
12	08	7.33	05	09	06	6.67	06	06	07	6.33	06
13	09	9.00	06	24	15	15.00	08	18	14	13.33	06
14	08	7.33	06	10	09	8.33	07	12	10	9.67	06
15	07	6.33	07	08	10	8.33	06	13	12	10.33	05
Eng. Mean	.24	.24	.22	.42	.36	.33	.26	.39	.38	.35	.17
Metric Mean	6.1	6.1	5.5	10.6	9.1	8.4	6.7	10.0	9.7	8.8	4.4

APPENDIX III B (CONTINUED)

Steer No.	6th Lumb. 8 in.	6th Lumb. 12 in.	6th Lumb. Avg.	3rd Sacral 4 in.	3rd Sacral 8 in.	3rd Sacral 12 in.	3rd Sacral Avg.	5th Sacral 4 in.	5th Sacral 8 in.	5th Sacral 12 in.	5th Sacral Avg.
Group IX Holsteins .26 to .50 in.											
1	06	07	5.67	06	01	04	3.67	15	09	05	9.67
2	06	05	4.33	06	03	03	4.00	10	05	05	6.67
3	03	05	3.33	04	02	02	2.67	07	03	04	4.67
4	07	06	5.33	05	05	03	4.33	09	04	03	5.33
5	06	04	4.33	05	02	02	3.00	11	02	02	5.00
6	04	07	5.33	05	05	04	4.67	07	05	01	4.33
7	02	07	4.33	03	02	03	2.67	06	03	04	4.33
8	03	07	4.00	05	02	04	3.67	10	04	05	6.33
9	04	07	5.67	05	05	04	4.67	08	06	05	6.33
10	07	14	9.00	06	02	06	4.67	07	03	05	5.00
11	07	13	8.67	06	04	02	4.00	12	05	06	7.67
12	07	09	7.33	07	06	05	6.00	15	05	08	9.33
13	08	10	8.00	08	09	09	8.67	15	09	06	10.00
14	07	13	8.67	04	03	03	3.33	08	03	04	5.00
15	05	07	5.67	07	06	06	6.33	09	06	06	7.00
Eng. Mean	.22	.32	.24	.22	.15	.16	.17	.39	.19	.18	.25
Metric Mean	5.5	8.1	6.0	5.5	3.8	4.0	4.4	9.9	4.8	4.6	6.4

[redacted]

Group IX Holsteins .26 to .50 in.								
1	08	08	04	05	07	07	06	6.67
2	07	15	06	06	08	08	12	9.33
3	04	13	04	04	04	03	09	7.00
4	03	14	04	05	05	05	13	7.00
5	14	07	04	07	05	05	04	8.33
6	06	16	03	04	05	03	04	8.33
7	07	07	06	06	06	05	06	6.67
8	12	07	02	05	05	04	05	7.00
9	10	19	08	08	09	07	06	12.33
10	11	14	04	04	06	04	07	9.67
11	15	06	03	06	05	05	07	8.00
12	05	15	04	05	06	07	06	8.00
13	09	08	06	09	13	16	17	7.67
14	07	12	03	07	07	05	14	7.33
15	12	08	05	08	08	09	13	8.33
Eng. Mean	.34	.44	.17	.23	.26	.24	.34	.32
Metric Mean	8.6	11.3	4.4	5.9	6.6	6.2	8.6	8.1

APPENDIX III C CARCASS EVALUATION - OBJECTIVE MEASUREMENTS

Steer No.	L. dorsi area	Carc. Length	Round Length	Round Circumference	Brisket Depth
Group IX Holsteins .26 to .50 in.					
1	10.70	54.3	34.9	32.6	4.10
2	11.50	53.9	33.9	34.3	4.80
3	10.55	52.5	35.1	34.4	4.20
4	12.60	52.6	33.4	32.2	4.30
5	9.65	55.3	35.4	31.4	4.50
6	11.05	53.6	34.5	32.5	4.00
7	11.80	53.2	35.0	32.6	4.20
8	10.45	53.3	35.2	33.2	4.70
9	9.85	54.3	34.0	32.8	4.40
10	13.90	52.9	34.0	31.2	3.60
11	12.20	54.7	36.0	31.8	4.80
12	11.55	52.4	35.1	33.3	4.30
13	11.90	51.3	32.7	34.9	4.00
14	13.40	54.4	33.9	35.8	4.20
15	11.65	52.3	33.3	33.5	4.60
Eng. Mean	11.52	53.4	33.8	33.1	4.3
Metric Mean	74.32	135.6	85.9	84.1	10.9

APPENDIX IV A WHOLESALE CUT YIELD

Steer No.	Rt. Side Wt.	Wt. Untrmd. Round	Wt. Trmd. Round	Wt. Untrmd. Loin	Wt. Trmd. Loin	Wt. Untrmd. Rib	Wt. Trmd. Rib	Wt. Untrmd. Chuck	Wt. Trmd. Chuck
Group IX Holsteins .26 to .50 in.									
1	367.30	87.80	86.20	51.00	50.80	25.60	25.10	100.70	109.90
2	363.70	85.40	83.10	50.70	49.70	27.70	27.10	106.60	105.40
3	346.80	86.70	85.70	49.80	49.60	22.70	22.60	102.90	102.50
4	358.70	81.90	79.70	53.80	53.10	26.50	26.20	103.50	102.10
5	344.60	73.00	71.00	51.40	50.90	23.80	23.50	105.10	103.60
6	355.80	81.80	79.50	49.70	49.30	27.50	26.50	102.00	100.80
7	357.70	84.30	82.60	51.30	50.80	24.80	24.40	107.70	107.00
8	354.10	86.70	85.70	49.60	49.20	23.50	23.20	105.70	105.20
9	355.30	81.70	79.90	52.50	51.30	25.70	25.00	102.70	101.70
10	357.10	80.30	79.00	50.70	49.90	26.50	25.80	108.40	107.60
11	371.90	86.00	84.50	52.60	51.90	24.50	23.80	114.90	113.70
12	368.60	87.60	85.70	55.10	54.40	22.80	22.50	110.40	109.50
13	349.50	82.40	78.80	49.20	47.70	22.60	21.90	96.50	94.90
14	357.60	88.00	86.70	54.30	53.70	26.80	26.40	104.10	103.50
15	355.20	78.90	77.50	52.60	51.30	25.30	24.90	108.70	107.60
Eng. Mean	357.60	83.50	81.70	51.60	50.90	25.10	24.60	106.00	105.00
Metric Mean	162.20	37.90	37.10	23.40	23.10	11.40	11.20	48.10	47.60

APPENDIX IV A (CONTINUED)

Steer No.	Wt. Shank	Wt. Brisket	Wt. Plate	Wt. Flank	Wt. K.K.	Wt. of Untrmd. Primal Cuts	Wt. of Belly Cuts + K.K.	Trmd. Primal Cuts	Ext. Fat Trim
Group IX Holsteins .26 to .50 in.									
1	13.00	13.70	32.60	23.30	9.60	275.10	92.2	272.00	3.10
2	13.20	11.60	31.00	21.30	16.20	270.40	93.3	265.30	5.10
3	12.50	11.60	28.70	18.00	13.90	262.10	84.7	260.40	1.70
4	12.00	11.50	29.90	25.00	14.60	265.70	93.0	261.10	4.60
5	13.80	12.60	31.10	20.30	13.50	253.30	91.3	249.00	4.30
6	11.80	8.80	33.60	22.00	18.60	261.00	94.8	256.10	4.90
7	12.90	14.10	31.70	20.00	10.90	268.10	89.6	264.80	3.30
8	12.90	13.40	32.10	18.40	11.80	265.50	88.6	263.30	2.20
9	12.60	12.70	32.70	21.60	13.10	262.60	92.7	257.90	4.70
10	11.90	10.60	32.80	21.20	14.70	265.90	91.2	262.30	3.60
11	13.30	13.40	33.60	22.10	11.50	278.00	93.9	273.90	4.10
12	12.60	12.10	32.40	20.80	14.80	275.90	92.7	272.10	3.80
13	11.50	12.60	31.10	26.40	17.20	250.70	98.8	243.30	7.40
14	12.90	12.90	29.40	19.90	9.30	273.20	84.4	270.30	2.90
15	12.50	13.90	30.00	21.90	11.40	265.50	89.7	261.30	4.20
Eng. Mean	12.60	12.40	31.50	21.50	12.90	266.20	91.40	262.20	4.00
Metric Mean	5.70	5.60	14.30	9.80	5.90	120.70	41.50	118.90	1.80

APPENDIX IV B RETAIL CUTOUT

Steer No.	Round Yield	Round Fat	Round Bone	Loin Yield	Loin Fat	Loin Bone	Rib Yield	Rib Fat	Rib Bone	Chuck Yield	Chuck Fat	Chuck Bone
Group IX Holsteins .26 to .50 in.												
1	62.60	7.20	16.10	35.80	6.10	8.40	17.10	2.60	5.20	80.20	10.40	17.60
2	60.10	7.30	15.10	36.10	6.70	6.60	18.50	3.50	4.80	77.30	12.30	15.40
3	64.20	5.40	15.70	37.50	5.90	5.80	15.80	2.10	4.50	77.40	9.10	15.20
4	57.40	7.60	14.20	37.20	8.20	7.20	17.50	4.00	4.60	73.90	13.00	14.80
5	47.60	7.50	15.40	36.60	6.10	7.80	15.50	3.10	4.60	74.30	11.00	17.60
6	58.00	6.30	15.00	37.20	4.90	6.90	18.40	3.20	4.70	74.60	9.90	15.70
7	59.50	7.30	15.20	36.40	6.40	7.40	17.00	2.70	4.60	78.70	10.60	17.10
8	62.40	7.80	15.00	36.80	5.40	6.70	16.30	2.50	4.30	78.50	9.00	16.70
9	57.50	6.20	16.30	36.10	6.90	7.60	16.40	2.90	4.50	74.00	10.50	17.50
10	58.60	6.30	13.80	34.70	6.80	8.10	18.40	3.00	4.40	80.20	11.60	15.40
11	62.50	6.60	15.00	36.40	7.10	7.90	15.30	3.30	4.90	83.00	12.70	17.50
12	63.50	7.20	14.70	38.30	7.70	8.00	14.50	3.50	4.20	82.00	10.30	16.90
13	57.30	7.80	13.30	36.00	6.00	5.30	15.00	2.90	3.60	71.10	10.60	13.10
14	62.80	7.20	15.20	38.50	6.80	7.90	19.10	2.70	4.40	77.70	9.80	15.40
15	54.50	8.20	14.30	36.30	7.00	7.10	16.90	3.40	4.50	80.20	11.20	16.00
Eng. Mean	59.20	7.10	15.00	36.70	6.50	7.20	16.80	3.00	4.50	77.50	10.80	16.10
Metric Mean	26.90	3.20	6.80	16.60	2.90	3.30	7.60	1.40	2.00	35.20	4.90	7.30

APPENDIX IV B (CONTINUED)

Steer No.	Shank Yield	Fat Shank	Bone Shank	Brisket Yield	Fat Brisket	Bone Brisket	Plate Yield	Fat Plate	Bone Plate	Flank Yield	Fat Flank	Bone Flank
Group IX Holsteins .26 to .50 in.												
1	6.30	1.40	5.30	6.90	4.60	1.90	19.10	8.60	4.80	11.70	11.40	0.10
2	6.20	1.30	5.60	5.80	4.10	1.60	16.00	10.70	4.00	10.20	11.00	0.10
3	6.10	1.10	5.40	6.60	3.10	1.90	16.40	7.50	4.60	9.40	8.40	0.20
4	5.70	1.60	4.70	5.70	4.40	1.50	15.40	10.30	3.90	11.10	13.90	0.10
5	6.20	1.80	5.60	5.90	4.50	2.10	15.50	10.20	5.30	9.10	11.10	0.20
6	5.50	1.50	4.90	4.80	3.00	1.00	18.40	10.50	4.30	10.90	11.00	0.20
7	6.20	1.50	5.20	7.70	4.40	2.00	18.00	8.60	4.90	10.20	9.80	0.10
8	6.60	1.40	4.90	6.80	4.50	2.00	18.60	8.60	4.80	9.20	9.00	0.10
9	5.50	1.60	5.40	6.20	4.80	1.60	17.00	10.70	4.60	9.60	11.60	0.10
10	5.70	1.70	4.50	5.70	3.60	1.30	16.80	11.20	4.80	10.10	10.80	0.20
11	6.40	1.90	5.00	6.90	4.70	1.80	16.10	12.00	5.30	10.00	11.80	0.20
12	5.90	1.40	5.20	6.00	4.50	1.70	18.10	9.90	4.20	10.20	10.50	0.10
13	5.50	1.50	4.50	6.20	5.00	1.40	15.50	11.60	3.80	10.20	16.00	0.20
14	6.20	1.20	5.40	7.20	3.70	1.90	17.00	8.00	4.20	10.40	9.30	0.20
15	5.30	1.70	5.60	7.50	4.50	1.80	15.60	10.00	4.00	10.60	11.00	0.10
Eng. Mean	6.00	1.50	5.10	6.40	4.20	1.70	16.90	9.90	4.50	10.20	11.10	0.10
Metric Mean	2.70	0.70	2.30	2.90	1.90	0.80	7.70	4.50	2.00	4.60	5.00	0.05

APPENDIX IV B (CONTINUED)

Steer No.	Roasts & Steaks Round	Roasts & Steaks Loin	Roasts & Steaks Rib	Roasts & Steaks Chuck	Roasts & Steaks RLRC	Retail Yield RLRC	Carcass Retail Yield	Internal Fat Trim	Total Bone
Group IX Holsteins .26 to .50 in.									
1	51.60	29.60	12.40	67.50	161.10	195.70	239.70	26.30	59.40
2	50.20	29.80	13.40	63.70	157.10	192.00	230.20	29.90	53.20
3	53.30	30.20	11.00	60.80	155.30	194.90	233.40	22.50	53.30
4	47.70	30.30	11.50	55.50	145.00	186.00	223.90	32.80	51.00
5	35.30	29.40	11.50	59.30	135.50	174.00	210.70	27.70	58.60
6	48.60	31.90	12.40	60.10	153.00	188.20	227.80	24.30	52.70
7	50.10	30.00	11.90	67.10	159.10	191.60	233.70	27.00	56.50
8	52.80	31.10	11.70	65.90	161.50	194.00	235.20	24.70	54.50
9	48.60	29.90	11.90	58.10	148.50	184.00	222.30	26.50	57.60
10	49.10	28.80	14.40	63.20	155.50	191.90	230.20	27.70	52.50
11	53.50	31.10	10.90	64.60	160.10	197.20	236.60	29.70	57.60
12	51.40	32.70	9.50	65.60	159.20	198.30	238.50	28.70	55.00
13	47.60	30.10	11.60	55.20	144.50	179.40	216.80	27.30	45.20
14	53.50	31.90	13.50	61.20	160.10	198.10	238.90	26.50	54.60
15	45.60	30.90	12.40	65.00	153.90	187.90	226.90	29.80	53.40
Eng. Mean	49.30	30.50	12.00	62.20	154.00	190.20	229.70	27.40	54.30
Metric Mean	22.3	13.80	5.40	28.20	69.80	86.30	104.20	12.40	24.60

APPENDIX IV C BONE WEIGHTS

Steer No.	Radius + Ulna	Femur	Tibia Fibia	Scapula	Humerus
Group IX Holsteins .26 to .50 in.					
1	3.60	6.20	4.40	3.20	4.70
2	4.50	5.80	4.50	2.40	4.70
3	4.70	6.10	4.30	2.80	4.90
4	3.80	5.50	4.10	2.40	4.20
5	4.50	5.60	4.60	2.80	4.80
6	4.00	5.90	4.30	2.70	4.50
7	4.00	5.90	4.40	2.70	5.10
8	3.90	5.90	4.30	3.10	4.30
9	4.30	6.00	4.70	2.70	5.00
10	3.70	5.30	3.80	2.80	4.10
11	4.00	5.90	4.20	3.20	4.40
12	4.30	5.60	4.20	3.00	4.50
13	3.70	5.40	4.00	2.50	4.00
14	4.30	6.10	4.40	2.50	4.80
15	4.40	5.60	4.10	2.90	4.90
Eng. Mean	4.10	5.80	4.30	2.80	4.60
Metric Mean	1.90	2.60	2.00	1.30	2.10