BEEF CARCASS EVALUATION

Circular 615
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UNIVERSITY OF KENTUCKY
COOPERATIVE EXTENSION SERVICE
AGRICULTURE AND HOME ECONOMICS

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The "ideal" in market cattle has changed tremendously during the past few years and will continue to change according to consumer demands. Not only is the wasty, overfinished animal undesirable, often it is unacceptable until it is discounted in price. It has been replaced by a much trimmer and more heavily muscled animal.

Meat from the trimmer cattle compares very favorably in palatability with that from overfinished cattle. Tenderness, juciness, and flavor are due almost entirely to characteristics of the lean meat; therefore, excessive finish is not needed.

A much higher yield of saleable meat is realized from the trimmer cattle. It's a simple matter of percentage or ratio. As the percent of fat in an animal or carcass goes up, the percent of lean goes down and vice versa. Excessive finish must be trimmed by the retailer. This increases the price per pound of retail cuts and damages the competitive position of beef with other food items. This can, and often does, decrease the market value of live cattle.

Strains of cattle have been found that produce high quality meat and thus their carcasses grade well without excessive finish. Assuming that at least a thin covering of fat is present, outside finish is not considered in beef carcass grading. Instead, emphasis is placed on the quality of the lean meat along with muscle development.

The poor image that has been created for fat has caused consumers to demand leaner meat. A large percentage of consumers are diet conscious because of obesity or they are concerned about the connection between a high-fat diet and health. In many cases, they are concerned about both problems.

Trimmer and meatier cattle can be produced more economically than wasty ones. Fat has 2¼ times the energy value of protein, so it is logical that more feed is required to produce a pound of fat than is required to produce a pound of lean meat.

In keeping with the trend for trimmer, more heavily muscled beef cattle, the following minimum standards or goals seem quite feasible:

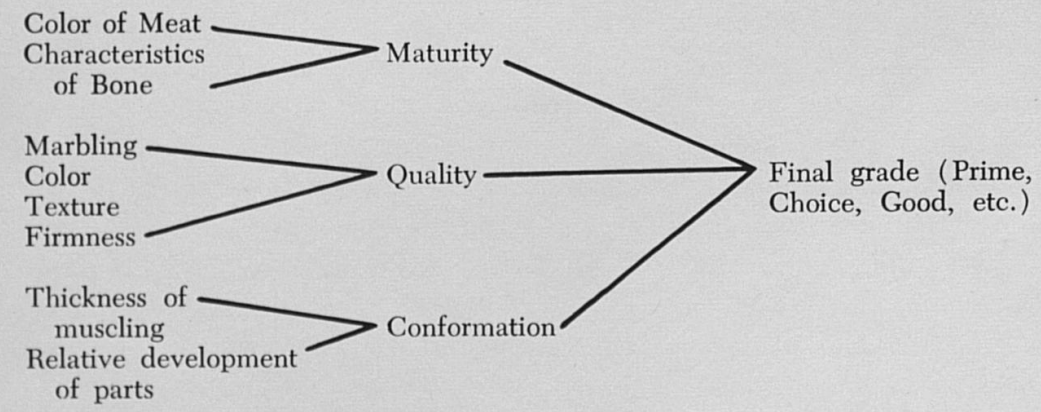
1. A carcass grade of at least low choice.
2. At least 50 percent of the carcass weight in boneless, closely trimmed retail cuts from the round, loin, rib, and chuck.
3. At least 2 square inches of ribeye per 100 pounds of carcass.
4. No more than 1/10 inch fat thickness over the ribeye per 100 pounds of carcass.

RELATIVE CARCASS VALUES

Two primary factors that affect relative carcass values are the quality of the meat and the weight of trimmed retail cuts.

Quality—juciness, tenderness, and flavor—is judged on the basis of marbling, firmness, color, and texture of the lean, all of which are in relation to the maturity of the animal from which the carcass was derived. These factors together with an assessment of conformation are used to determine a USDA grade.

This is the general scheme used.



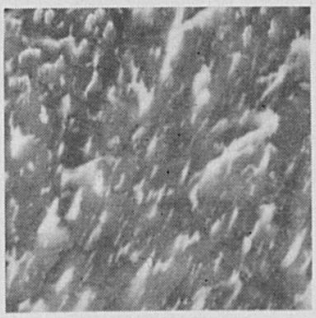
Grade is one of the primary factors that is considered in determining the sale price of a given carcass or cut of beef. It is not feasible to cover grading in detail here but explanation of some of the major points may be helpful.

Marbling. This is fat within a muscle, as seen on the cross-cut surface of a ribeye muscle. Various degrees of marbling are designated by descriptive terms as indicated in Fig. 1.

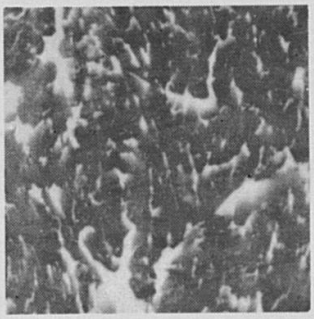
Color. Bright red is the optimum color in high-quality beef. The color tends to become darker as the animal ages.

Texture. A fine texture is desirable. This is generally associated with a youthful animal and high-quality meat.

Firmness. Generally speaking, the firmer the meat, the higher the quality is considered to be.



Very Abundant



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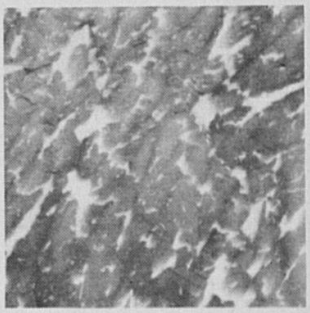
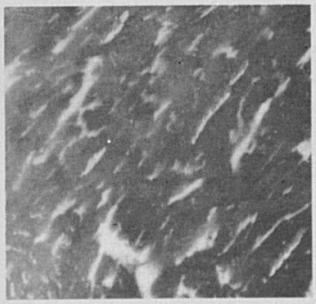
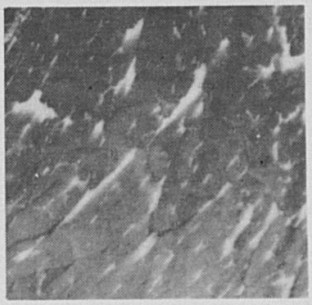


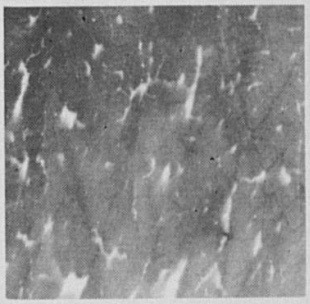
Moderately Abundant



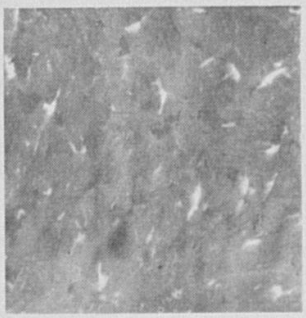
Slightly Abundant



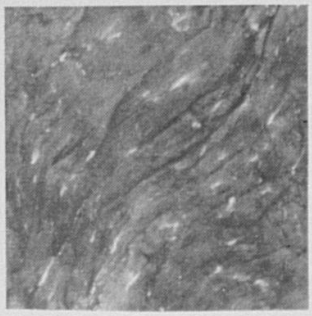
Moderate



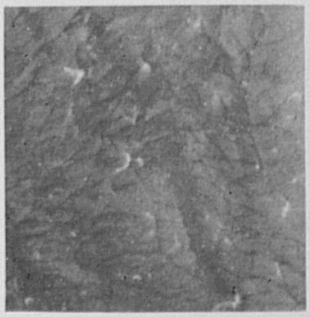
Modest



Small



Slight



Traces

Fig. 1 — Degrees of marbling

Maturity. This refers to the relative age of the animal from which the carcass was derived. The designations for stage of maturity are A, B, C, D, and E, with "A" being the youngest and "E" the oldest. Probably 90 percent or more of the block beef is within the "A" stage with the remainder being "B." More marbling is required for a given grade with advancement in maturity.

Conformation. This refers to the manner of formation of the carcass as to the thickness of muscling and to an overall degree of thickness and fullness of the carcass and its various parts.

Examples of some combinations of maturity, marbling, and the resulting USDA grades are given here. In each case, it is assumed that the conformation grade is at least equivalent to the quality grade.

Maturity	*Marbling*	*Grade*
A	Slight	Good
B	Slight	Standard
A	Small	Low Choice
B	Small	Good
A	Modest	Average Choice
B	Modest	Low Choice
A	Moderate	High Choice
B	Moderate	Average Choice
A	Slightly abundant	Low Prime
B	Slightly abundant	High Choice

These examples over-simplify the matter to some degree, but they should be helpful. As indicated earlier, the final quality grade of a carcass is based on a composite evaluation of its conformation and quality. Since relatively few carcasses have an identical development of conformation and quality, it is obvious that each grade will include various combinations of development of these two characteristics.

Within the Prime and Choice grades, a development of quality superior to that specified as minimum for the grade may compensate, without limit, for a development of conformation inferior to that specified as minimum for the grade at an equal rate, as indicated in the following example: A carcass which has midpoint Choice quality may have conformation equal to the midpoint of the Good grade and remain eligible for Choice. However, regardless of the extent to which the conformation of a carcass exceeds the minimum of the grade, a carcass must have minimum

Prime quality to be eligible for the Prime grade or minimum Choice quality to be eligible for the Choice grade.

Within the Good grade, a development of quality superior to that specified as minimum for the Good grade may compensate, without limit, for a development of conformation inferior to that specified as minimum for Good at an equal rate, as indicated in the following example: A carcass which has mid-point Good grade quality may have conformation equivalent to the mid-point of the Standard grade and remain eligible for Good. Also, a carcass which has at least one-third of a grade superior conformation to that specified as minimum for the grade may qualify for Good with a development of quality equivalent to the lower limit of the upper third of the Standard grade. Compensation of superior conformation for inferior quality is limited to one-third of a quality grade.

Situation Examples

Quality grade	*Conformation grade*	*Final grade*
Average Choice	Average Choice	Average Choice
Average Choice	Average Prime	Average Choice
Average Choice	Average Good	Low Choice
Average Good	Average Good	Average Good
High Standard	Average Good	Low Good
Average Good	Average Standard	Low Good

Cutability

The term "cutability" is used to define the relative meatiness of a beef carcass and, hence, its relative value when compared to another carcass of equal weight and grade.

Research workers have demonstrated that a combination of four factors may be used to very closely estimate the percent of the carcass weight that is represented in boneless and closely trimmed retail cuts from the round, loin, rib, and chuck. This is referred to as determining the "cutability grade" or "cutability group." Numbers are assigned as follows:

Cutability group	*Percent cutability*
1	52.4 and above
2	50.1 - 52.3
3	47.8 - 50.0
4	45.5 - 47.7
5	45.4 and below

The cutability group into which a beef carcass is placed is determined by considering the following characteristics:

1. The amount of external fat.
2. The amount of kidney, pelvic, and heart fat.
3. The area of the ribeye muscle.
4. The warm carcass weight.

The amount of external fat on a carcass is determined by measuring the fat thickness over the ribeye muscle. This measurement is taken perpendicular to the outside surface at a point three-fourths of the length of the ribeye from its chine bone end (Fig. 2). The measurement may be adjusted, as necessary, to reflect unusual amounts of fat on other parts of the carcass. The adjustment may be either upward or downward.

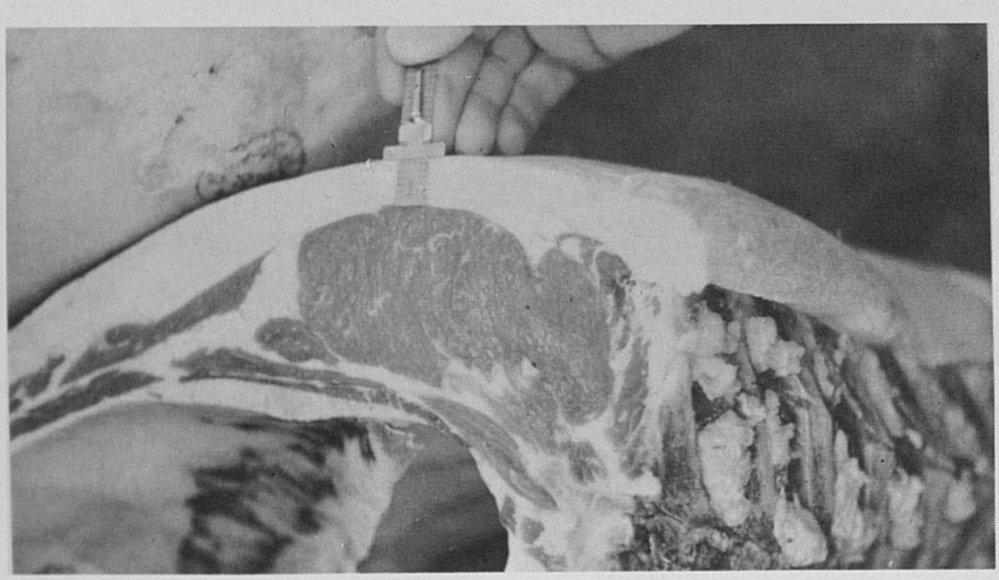


Fig. 2 — Fat thickness measurement

The amount of kidney, pelvic, and heart fat considered in determining the cutability group includes the kidney knob (kidney and surrounding fat), the lumbar and pelvic fat in the loin and round, and the heart fat in the chuck and brisket area which are removed in making closely trimmed retail cuts. The amount of these fats is evaluated subjectively and expressed as a percent of the carcass weight. Three percent of the carcass weight is considered a normal amount. Very meaty carcasses may have as little as 2 percent while extremely wasty carcasses may have 5 percent or more.

The area of the ribeye is determined where this muscle is exposed by ribbing. A tracing of the single ribeye muscle may be

made on transparent paper (Fig. 3) and the area measured by use of a compensating polar planimeter (Fig. 4). Another method is to place a plastic grid directly over the ribeye muscle and count the squares (Fig. 5). Each square on the grid represents 0.1 square inch.

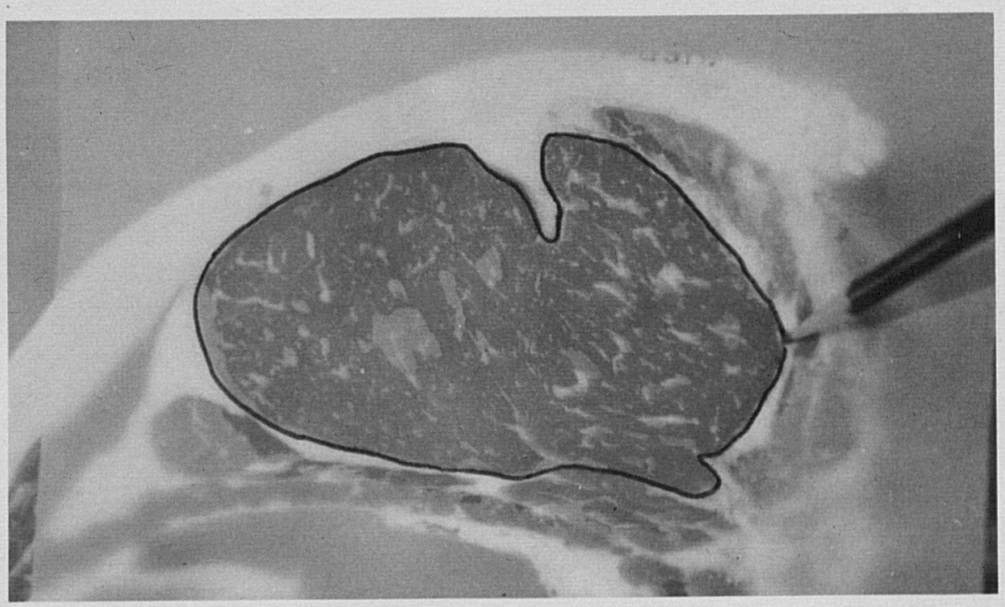


Fig. 3 — Ribeye tracing

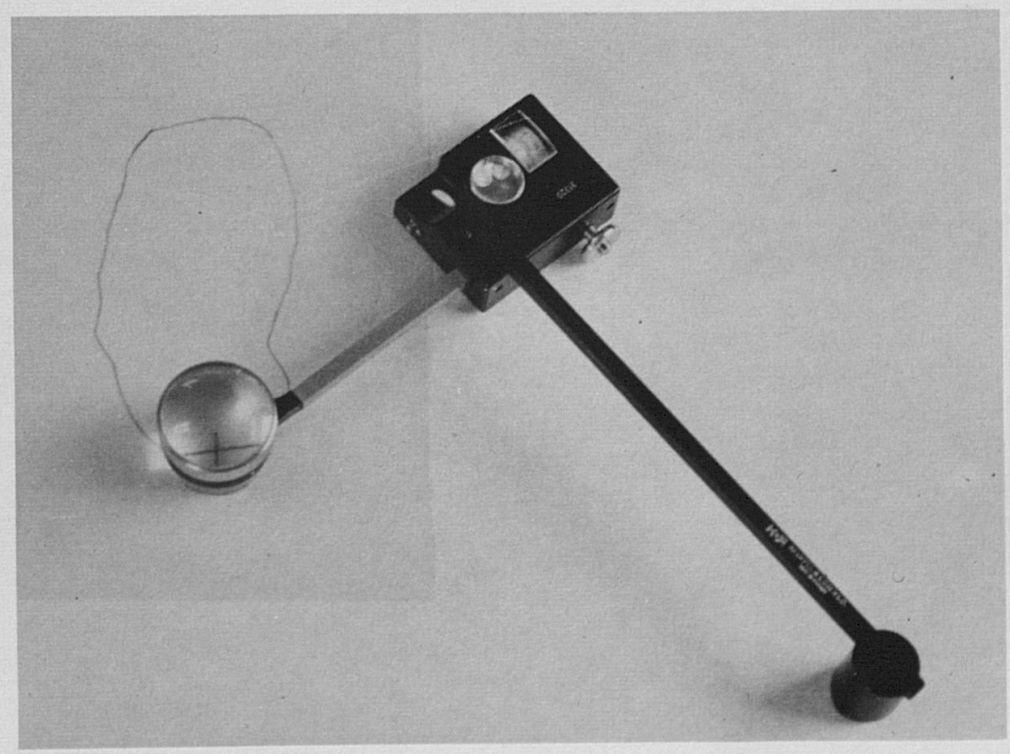


Fig. 4 — Planimeter

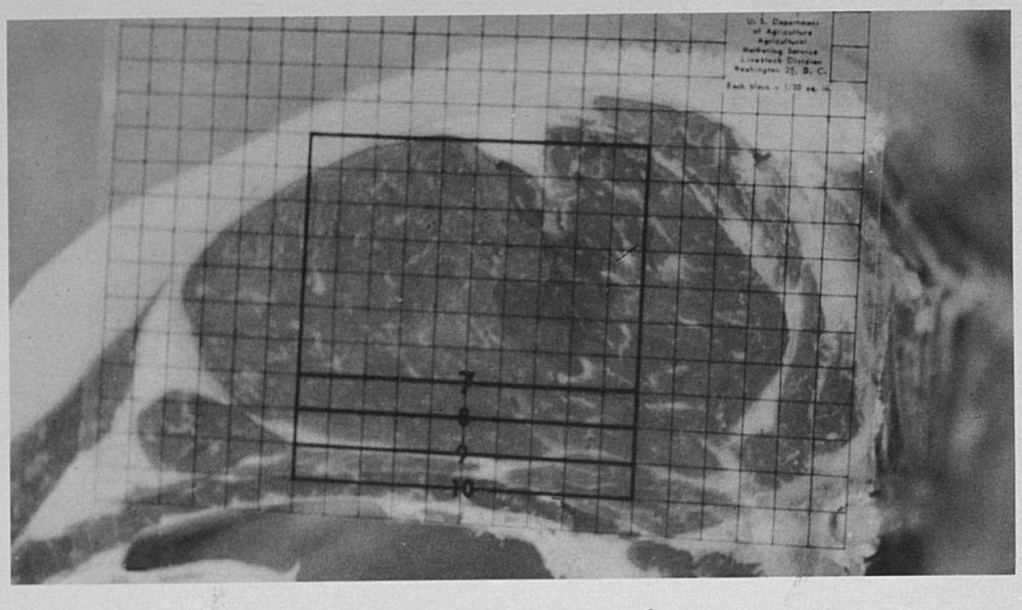


Fig. 5 — Grid over ribeye

The percentage of cutability of a beef carcass may be determined by use of this formula:

Percent cutability = 51.34 – (inches of fat thickness x 5.78) – (percentage kidney, pelvic and heart fat x .462) + (sq. in. of ribeye area x .740) – (warm carcass weight x .0093).

A beef carcass exhibiting the following characteristics would be considered quite desirable from the standpoint of cutability:

Fat thicknes over ribeye	–	0.6 in.
Kidney, pelvic and heart fat	–	2.5%
Ribeye area	–	12.0 sq. in.
Warm carcass weight	–	600 lbs.

Substituting the data from this carcass into the above formula, the percent cutability is determined, as follows:

Percent cutability = 51.34 – (.6 x 5.78) – (2.5 x .462) + (12 x .740) – (600 x .0093) = 50.92 percent.

(Note that the hypothetical carcass has one-tenth of an inch fat thickness per hundred pounds of carcass weight and 2 square inches of ribeye area per hundred pounds of carcass weight).

Percent cutability may also be estimated by use of a "Beef Carcass Yield Grade Finder" (Fig. 6). This instrument was developed by the USDA and can be simply and rapidly operated. It was developed from the formula and is close enough for practical purposes.

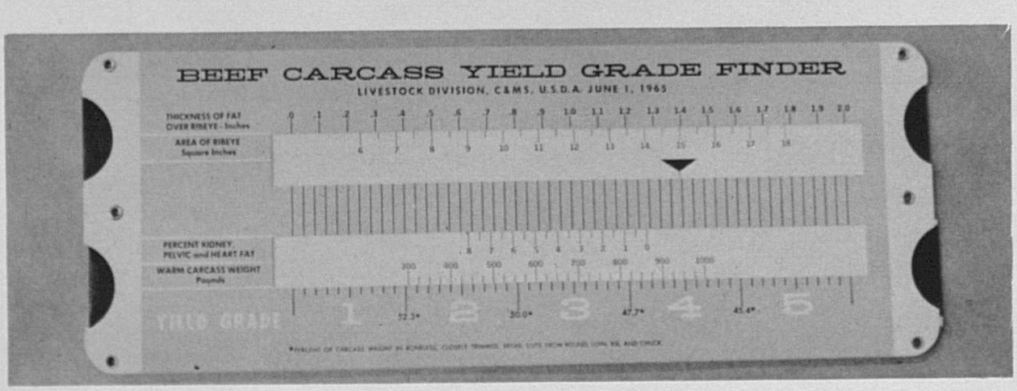


Fig. 6 — Beef Carcass Yield Grade Finder

The scheme given below shows the effect of varying each of the factors of fat thickness over the ribeye; kidney, pelvic, and heart fat; ribeye area; and carcass weight. Hypothetical carcass "A" is held constant in each comparison while B, C, D, E, and F are varied as indicated. All carcasses are assumed to grade USDA Choice.

	Fat thickness (in.)	Kidney, pelvic, and heart fat (%)	Ribeye area (sq. in.)	Carcass weight (lbs.)	Cutability (%)	Value differences per hundred weight of carcass
A	0.6	3.0	12.0	600	50.0	$2.25
B	*0.9	3.0	12.0	600	48.2	
A	0.6	3.0	12.0	600	50.0	$0.88
C	0.6	*4.5	12.0	600	49.3	
A	0.6	3.0	12.0	600	50.0	$2.88
D	0.6	3.0	*9.0	600	47.7	
A	0.6	3.0	12.0	600	50.0	$1.63
E	0.6	3.0	12.0	*750	48.7	
A	0.6	3.0	12.0	600	50.0	$5.88
F	*0.9	*4.5	*9.0	*750	45.3	

* Factor varied

Difference in the value per hundred weight of two USDA Choice carcasses is estimated by multiplying the difference in estimated cutability by the factor of $1.25. For example, the estimated differences in value per hundred weight of carcasses A and B was obtained as follows:

$$50.0 - 48.2 = 1.8$$
$$1.8 \times \$1.25 = \$2.25$$

Some differences between two carcasses in each of the three grades of Prime, Choice, and Good are shown in Figs. 7, 8, and 9.

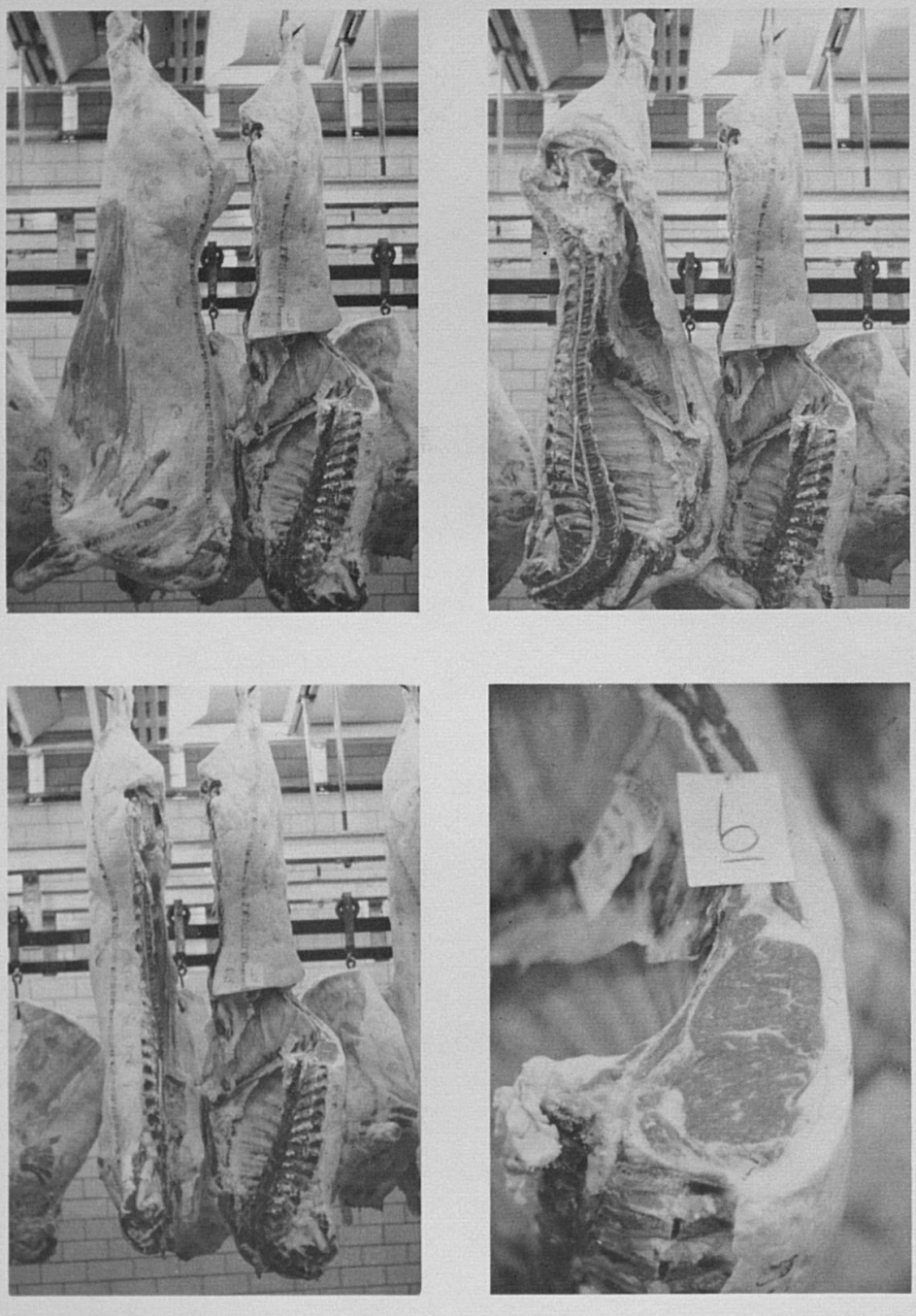
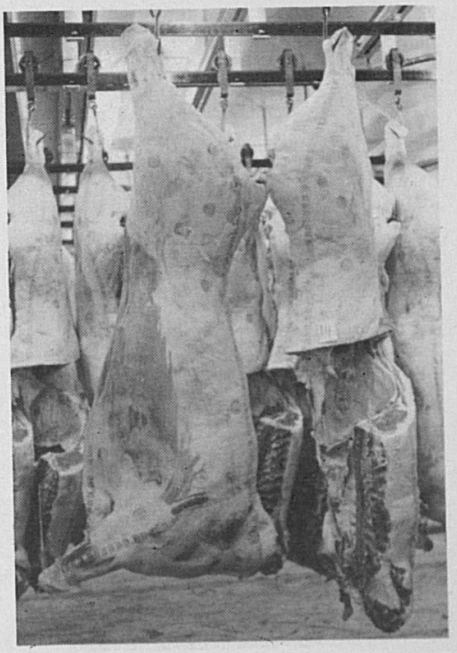
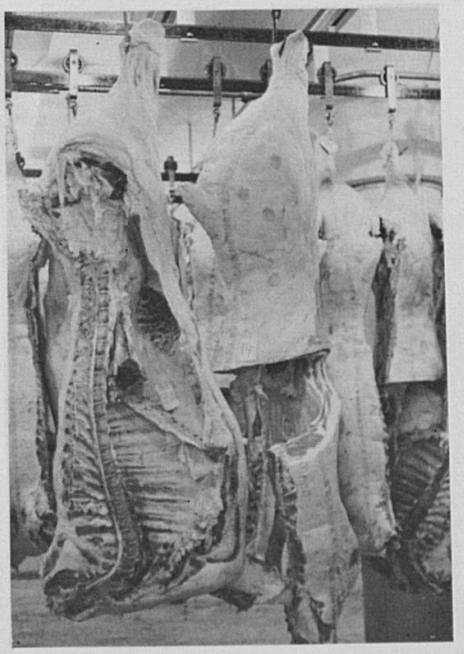
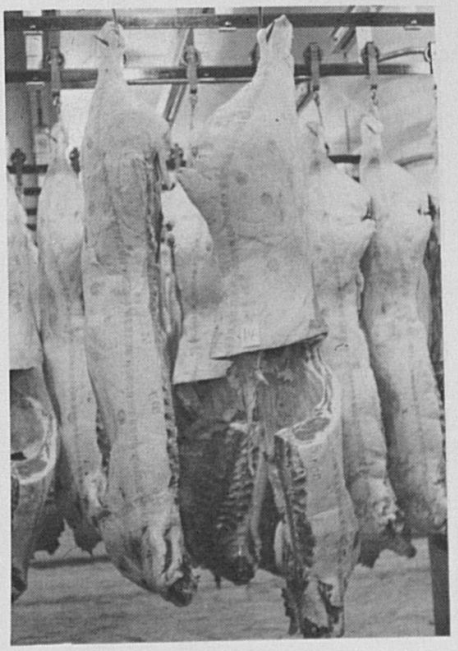


Fig. 7

Carcass number	6
Warm carcass weight	520 lb
Stage of maturity	A–
Conformation	Low prime
Degree of marbling	Slightly abundant
USDA grade	Low prime
Area of ribeye	12.5 sq. in.
Kidney, pelvic, and heart fat	2.5%
Thickness of fat over ribeye	0.6 in.
Cutability	51.2%







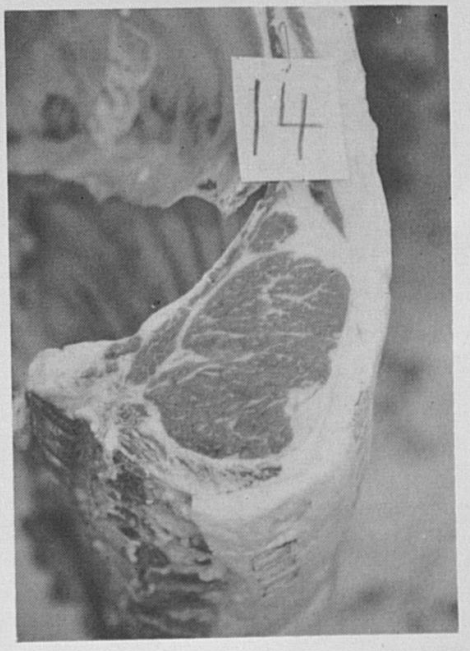


Fig. 8

Carcass number	14
Warm carcass weight	612 lb
Stage of maturity	A—
Conformation	High choice
Degree of marbling	Slightly abundant
USDA grade	Low prime
Area of ribeye	12.3 sq. in.
Kidney, pelvic, and heart fat	3.5%
Thickness of fat over ribeye	0.9 in.
Cutability	48.1%
Estimated difference in value per hundredweight of carcasses 6 and 14	$3.88

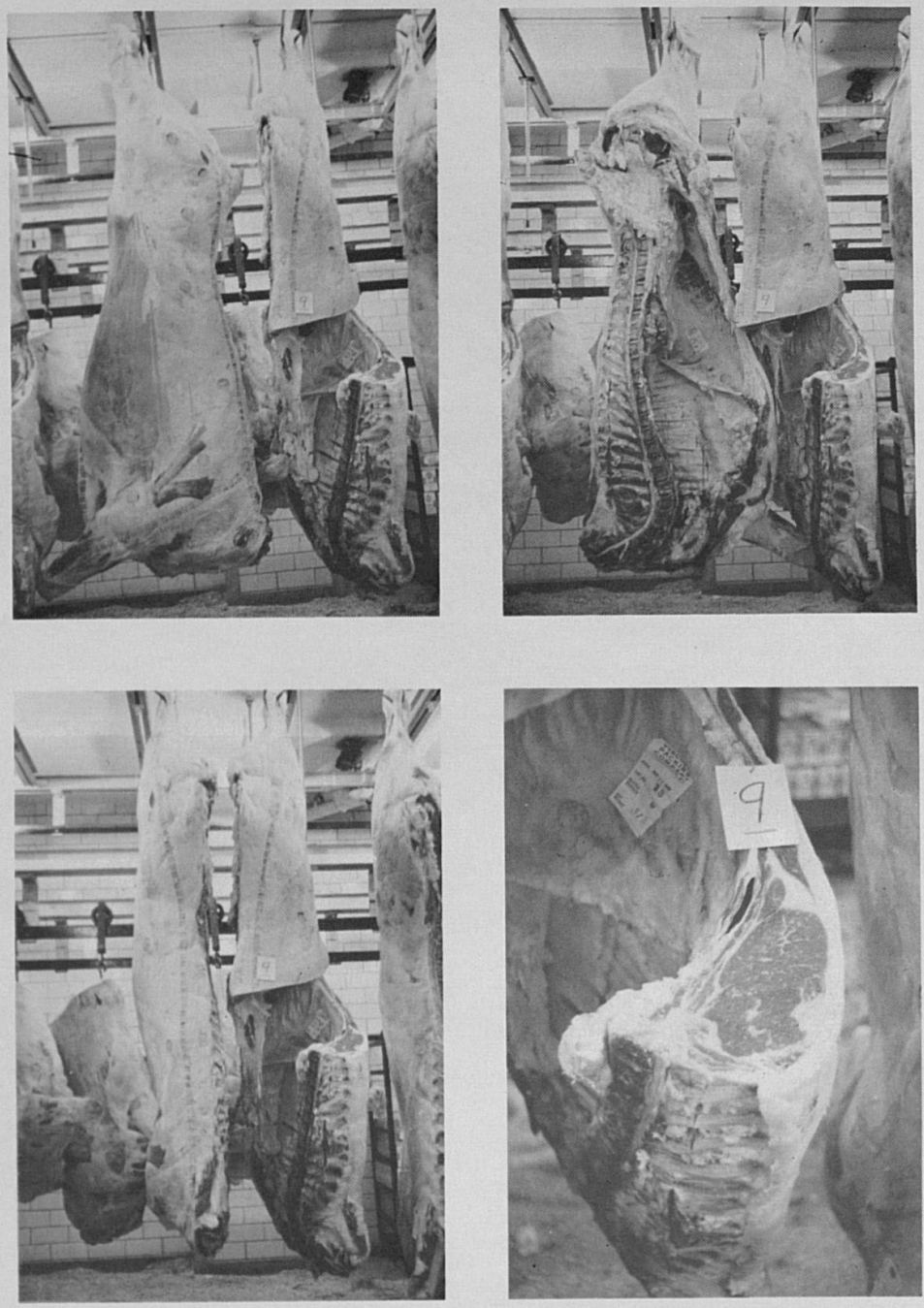


Fig. 9

Carcass number	9
Warm carcass weight	622 lb
Stage of maturity	A—
Conformation	High choice
Degree of marbling	Modest
USDA grade	Choice
Area of ribeye	12.7 sq. in.
Kidney, pelvic, and heart fat	3.0%
Thickness of fat over ribeye	0.5 in.
Cutability	51.0%

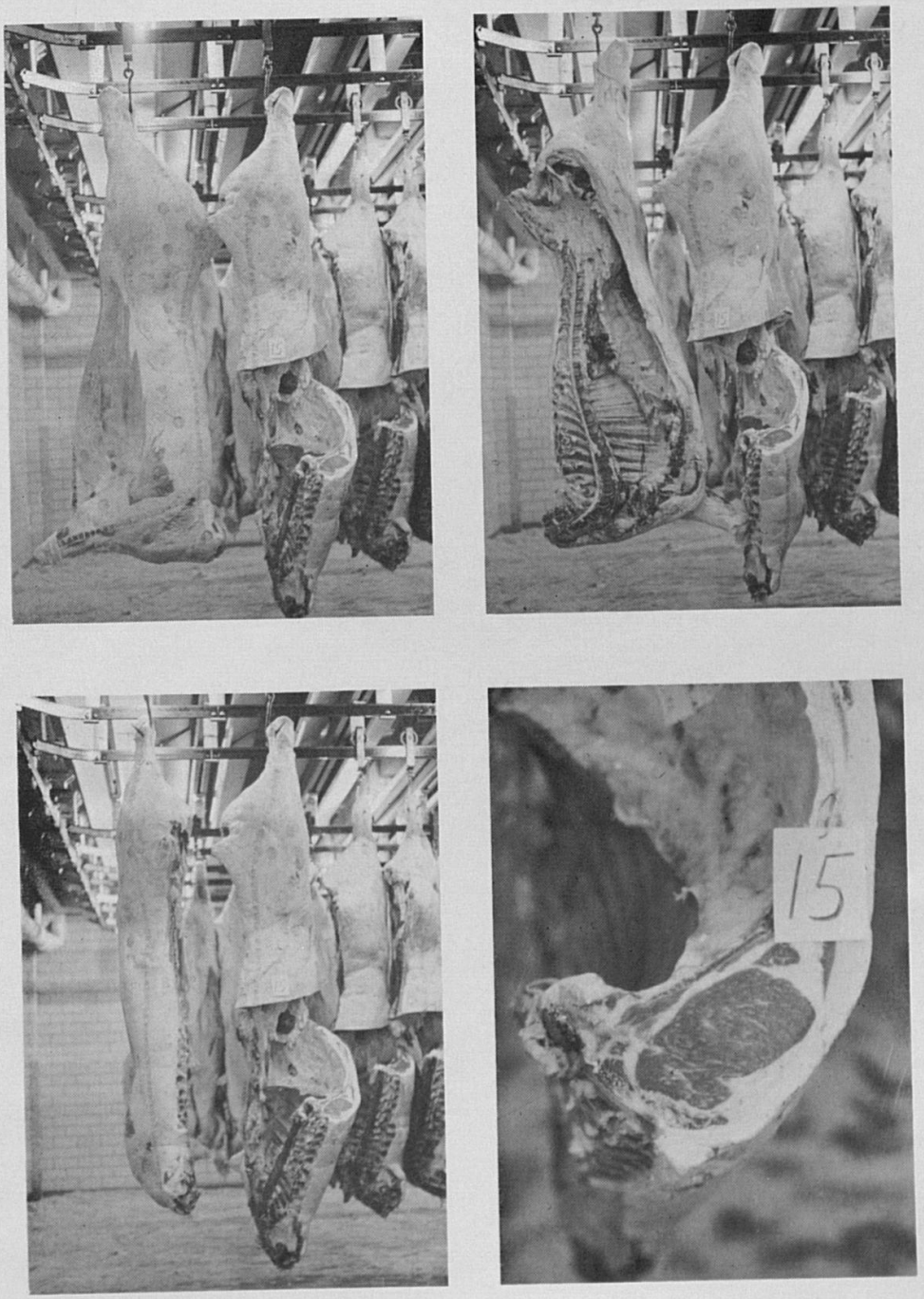
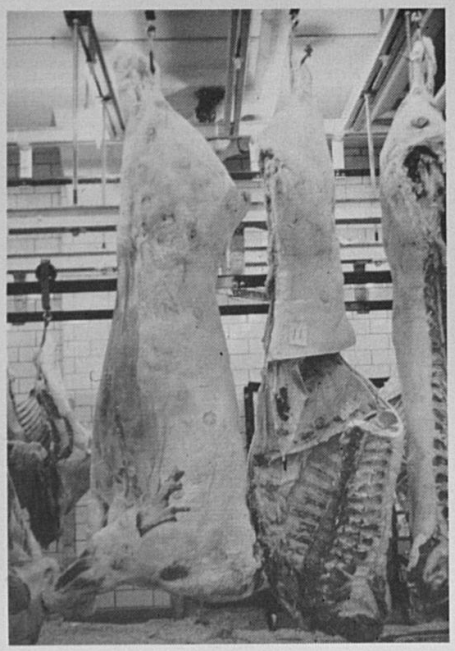
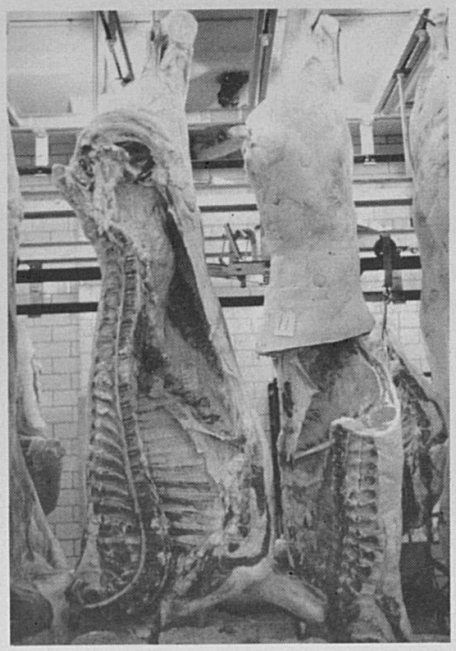
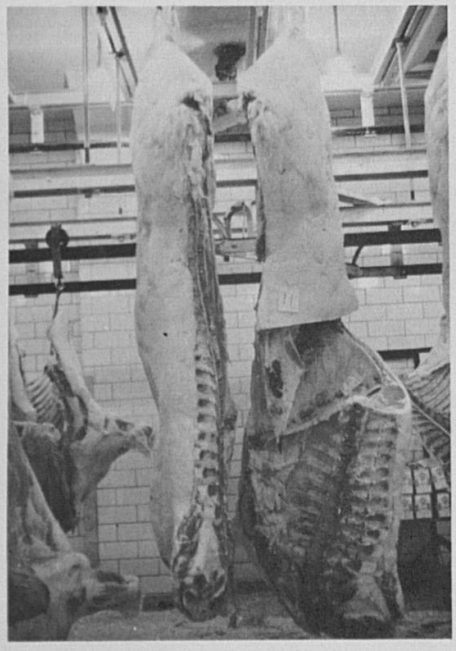


Fig. 10	
Carcass number	15
Warm carcass weight	594 lb
Stage of maturity	A
Conformation	Choice
Degree of marbling	Modest
USDA grade	Choice
Area of ribeye	11.2 sq. in.
Kidney, pelvic, and heart fat	3.5%
Thickness of fat over ribeye	0.9 in.
Cutability	47.4%
Estimated difference in value per hundredweight of carcasses 9 and 15	$4.50







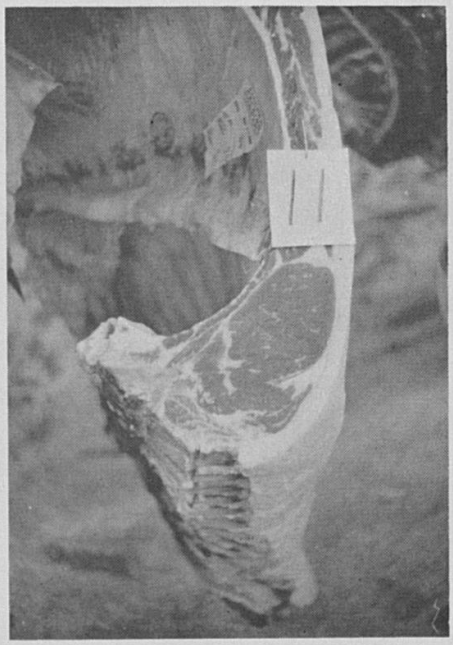
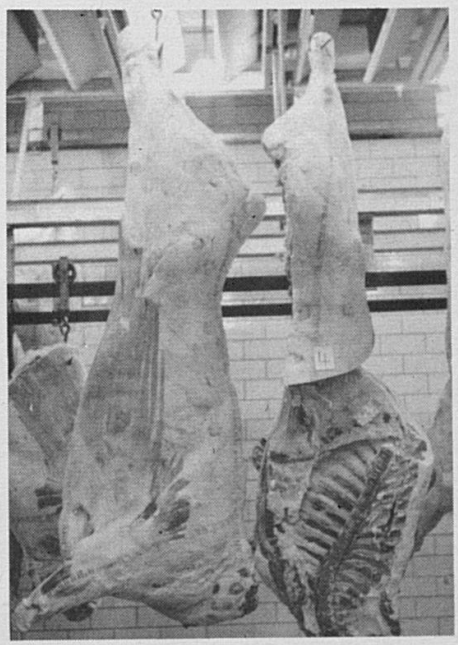
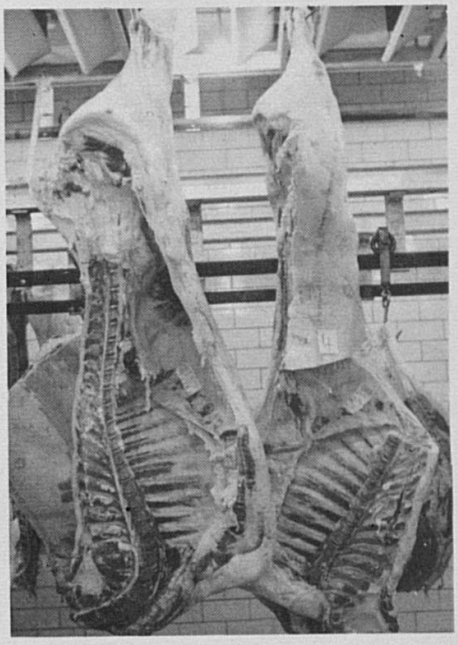
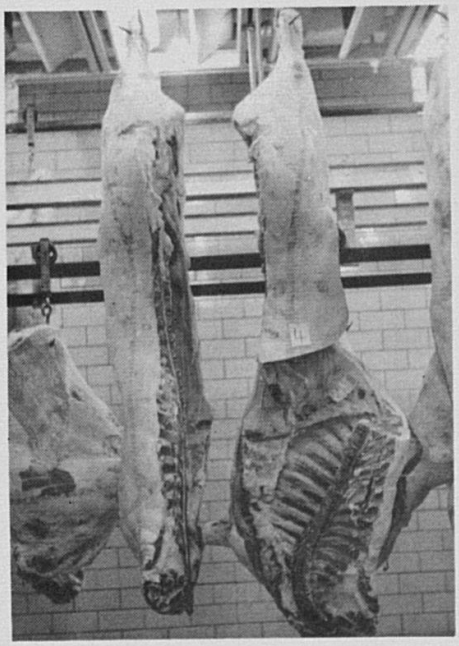


Fig. 11

Carcass number	11
Warm carcass weight	626 lb
Stage of maturity	A—
Conformation	Choice
Degree of marbling	Slight
USDA grade	High good
Area of ribeye	12.1 sq. in.
Kidney, pelvic, and heart fat	3.0%
Thickness of fat over ribeye	0.4 in.
Cutability	51.1%







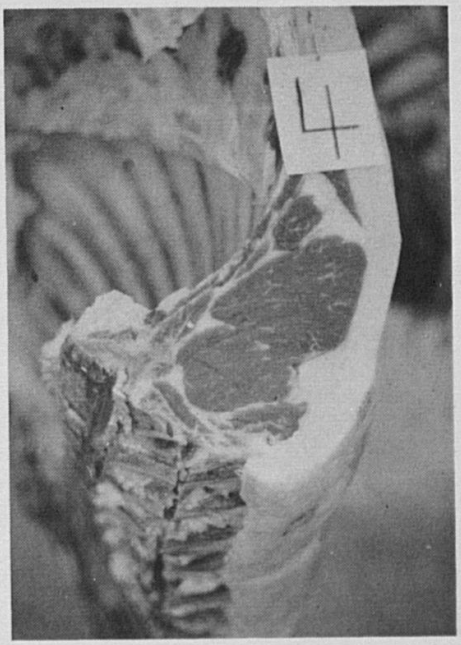


Fig. 12

Carcass number	4
Warm carcass weight	620 lb
Stage of maturity	A
Conformation	Good
Degree of marbling	Slight
USDA grade	Good
Area of ribeye	11.2 sq. in.
Kidney, pelvic, and heart fat	3.0%
Thickness of fat over ribeye	0.7 in.
Cutability	48.7%
Estimated difference in value per hundredweight of carcasses 11 and 4	$3.00

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