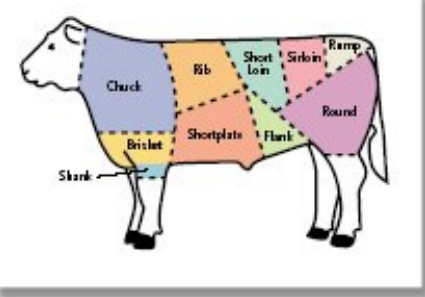


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# Understanding Beef Carcass Evaluation



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To understand beef carcass evaluations, it is necessary to know what the various carcass measurements mean. The following is an explanation of the terminology used and how it relates to the carcass and its final quality and yield grade.

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The value of a beef carcass is determined primarily by two factors: Its predicted palatability or quality and its expected yield of boneless retail cuts.

The USDA established tentative standards in 1916 to provide a basis for reporting beef carcass markets according to grades. Since that time there have been revisions in these standards to reflect changes in the industry, the most recent occurring in January 1997.

**USDA QUALITY GRADES**  
Quality grades are important in determining car-

cass value because they serve as guides to "eating characteristics" of the final product. The USDA quality grades (Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner) have been in use since 1927 to identify differences in the palatability of steer, heifer, and cow beef.

There have been revisions in the USDA grading system over the years as there have been changes in the beef industry. The revisions of January 1997 now restrict the Select grade to carcasses of younger cattle only. Also those carcasses with B maturity would be re-

quired to have minimum degree of marbling of minimum modest to grade Choice. This revision was implemented to improve the uniformity and consistency of the carcasses within the Choice and Select grades. This change can be seen in Figure 2.

Maturity and marbling are the principal factors involved in determining the quality grade, but texture, firmness, and color of lean are involved in this determination.



## Factors Used in Determining Quality Grades

**1. Maturity**  
The primary indicators of maturity are size, shape, and ossification of cartilage and bone, and the color and texture of the lean.  
Five maturity groups, A

through E, have been established with Group A indicating carcasses from very young animals, and Group E indicating carcasses from animals of advanced maturity.  
Maturity groups under the USDA grading system are

determined by observing the bone structure at the points shown in Figure 1, and to some extent the color of lean, and can be described as follows.

# Maturity Groups

- A. Chine bones soft, red, porous. Cartilage tips on thoracic vertebrae, soft and white. Rib bones small and tend to be round. Sacral vertebrae only partially fused. Cartilage tips on lumbar vertebrae only moderately ossified (hardened into bone).
- B. Slightly hard chine bones only tinged with red. Cartilage tips on thoracic vertebrae slightly ossified. Sacral vertebrae completely fused. Cartilages on lumbar vertebrae completely ossified.
- C. Rather white chine

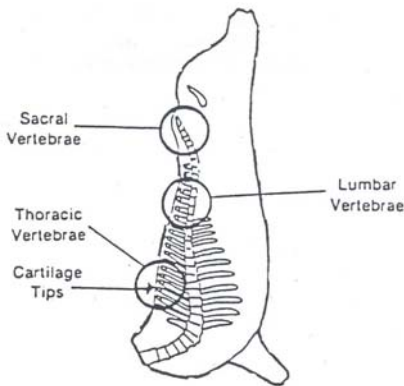


Figure 1. Location of vertebrae

- bones. Cartilage tips on thoracic vertebrae almost completely ossified. Lean is usually somewhat darker in color.
- D. Rib bones flat, white and quite wide. Chine bones white and flinty. Cartilage tips on thoracic vertebrae are completely ossified, and only an outline of these cartilage tips remains.
- E. These very mature carcasses have hard, white, flinty bones. Cartilages on thoracic vertebrae completely ossified, and the outlines of these tips not visible.

Lean has a dark red color.

While there can be a difference in the chronological age of an animal when compared to its physiological age, the approximate age ranges from the maturity groups are as follows:

- A - 9 to 30 months
- B - 30 to 42 months
- C - 42 to 72 months
- D - 72 to 96 months
- E - over 96 months

The maturity groups are divided into thirds and are expressed in the following sequence:

- A -, A, A +,
- B -, B, B + ▶ advancing maturity

## 2. Marbling

This refers to the amount of distribution of small flecks of fat within a muscle system. It is a subjective measurement evaluated when the rib eye muscle is exposed between the 12th and 13th rib. The degrees of marbling and their abbreviations are as follows:

- Abundant - A

- Moderately Abundant - MdA
- Slightly Abundant - SIA
- Moderate - Md
- Modest - Mt
- Small - Sm
- Slight - SI
- Traces - T
- Practically Devoid - PD
- Devoid - D

Using the chart in Figure 2, the relationship between marbling and maturity and the determination of the final quality grade of a beef carcass can be seen.

Figure 2. Relationship between Marbling, Maturity, and Carcass Quality Grade\*

Degrees of Marbling	Maturity **					Degrees of Marbling
	A ***	B	C	D	E	
Slightly Abundant	Prime					Slightly Abundant
Moderate			Commercial			Moderate
Modest	Choice					Modest
Small						Small
Slight	Select			Utility		Slight
Traces					Cutter	Traces
Practically Devoid	Standard					Practically Devoid

\* Assumes that firmness of lean is comparably developed with the degree of marbling, and the carcass is not a "dark cutter."  
 \*\* Maturity increases from left to right (A through E).  
 \*\*\* The A maturity portion of the Figure is the only portion applicable to bullock carcasses.

### 3. Dark Cutting Beef

Another factor involved in determining final grade is the condition known as a "dark cutter." When this condition occurs, it will cause the exposed rib eye muscle to look much darker than the physiological maturity the carcass would indicate. This color is ac-

companied by a soft, gummy, sticky feeling of the muscle to the touch.

This does not affect palatability, but it does lower its acceptance at the retail level due to its decrease in eye appeal. Depending on the degree, this condition

can lower the final grade up to one full grade.

This condition is thought to be associated with stress prior to slaughtering, but it is not known why this reaction in the pigment of the muscle fiber occurs.

## USDA YIELD GRADES

Yield grades are a means of identifying "quantity or cutability" differences among beef carcasses. They are based on the percentage yields of boneless, closely trimmed retail cuts from the high-value parts of the carcass - the round, loin, rib, and chuck.

There are five yield grades, numbers 1 through 5. Carcasses in Yield Grade 1 have the highest cutability, while carcasses in Yield Grade 5 have lowest cutability. These grades are applied without regard to sex or the quality grade. The yield grade of beef car-

casses is determined by four factors.

## FACTORS USED TO DETERMINE YIELD GRADE

### 1. Amount of External Fat

Fat thickness is measured at the 12th rib as seen in Figure 3. The point of measurement is at three-fourths of the length of the rib eye muscle from the chine bone end and perpendicular to the outside surface of the fat. The amount of fat over the outside of the carcass is the most important factor in determining yield grade because it indicates the amount of fat that may have to be trimmed from the retail cuts. Four-tenths of an inch variation in fat thickness results in a full yield grade change.

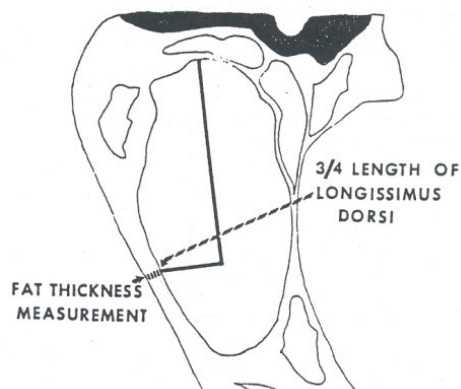
### 2. Amount of Kidney, Pelvic and Heart Fat

The amount of kidney, pelvic and heart fat is evalu-

Figure 3.

#### Measuring Fat Thickness over the Rib Eye

This diagram illustrates the location where fat thickness over the ribeye is measured.



ated subjectively and is expressed as a percent of the carcass weight. This affects carcass yield because all of this fat is removed in trimming. Fat accumulation in these regions decreases the

yields in retail cuts. The average amount of kidney, pelvic and heart fat is considered to be 3.5 percent.

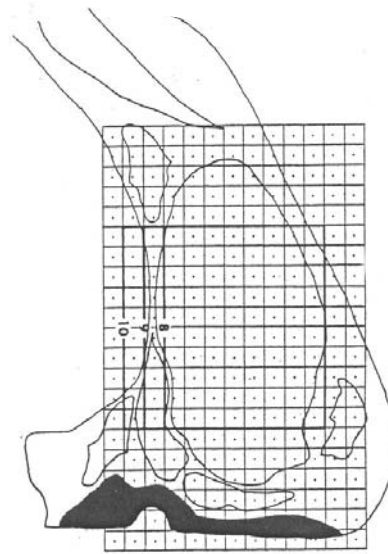
### 3. Area of Rib Eye Muscle

The area of rib eye is determined when this muscle is exposed by ribbing at the 12th rib in a manner for our purpose as seen in Figure 4. The rib eye is one of the largest muscles of the carcass, lying on each side of the backbone and running the full length of the back. The area of rib eye is used in determining the yield grade because it is an indicator of the total amount of muscle in the carcass since all muscles are proportional to one another within the carcass. Among carcasses of the same degree of finish and weight, an increase in the rib eye area indicates an increase in yield of retail cuts,

Figure 4.

**Measuring Rib Eye Area**

In using the dot grid to measure a rib eye, place it on the cut surface of the rib eye and count all squares in which lean touches a dot. Divide the number of squares counted by 10. The resulting number is the area of rib eye in square inches. The heavy black lines outlining blocks labeled 8, 9 and 10, enclosing 80, 90 and 100 squares, respectively, increase the ease and rapidity of counting. In the



accompanying example, the rib eye area includes 102 squares or 10.2 square inches.

**4. Hot Carcass Weight**

The hot carcass weight is the weight of the carcass taken immediately after slaughter.

**PROCEDURE USED TO DETERMINE YIELD GRADE**

1. Determine a “preliminary yield grade” by tenths (2.1, 3.3, 3.5, etc.) using the following schedule:

Thickness of Fat over Rib Eye	Preliminary Yield Grades
.2 inch	2.5
.4 inch	3.0
.6 inch	3.5
.8 inch	4.0
1.0 inch	4.5
1.2 inch	5.0

2. Determine the final yield grade (1 to 5) by adjusting the preliminary yield grade, as necessary, for variations in kidney fat from 3.5 percent, and for variations in the required rib eye area using Table 1. Hot Carcass Weight/Area of Rib Eye for specific carcass weights.

Table 1. REQUIRED RIB EYE AREA FOR SPECIFIC CARCASS WEIGHTS

Hot Carcass	Are of Rib Eye
450	9.2
475	9.5
500	9.8
525	10.1
550	10.4
575	10.7
600	11.0
625	11.3
650	11.6
675	11.9
700	12.2
725	12.5
750	12.8
775	13.1
800	13.4
825	13.7

Rate of adjustment for area of rib eye in relation to carcass weight:

1. For each square inch more than the area indicated, subtract 0.3 of a grade from the preliminary grade.
2. For each square inch less than the area indicated, add 0.3 of a grade to the preliminary grade.

Rate of adjustment for percent of kidney, pelvis and heart fat:

1. For each percent of kidney, pelvic and heart fat less than 3.5%, subtract 0.2 of a grade from the preliminary yield grade.
2. For each percent of kidney, pelvic and heart fat more than 3.5%, add 0.2 of a grade to the preliminary yield grade.

The following is an example of determining yield grade of a carcass using the following information:

- A. Thickness of external fat - 0.6"
- B. Percent kidney, pelvic and heart fat - 2.0%
- C. Area of rib eye - 12.5 square inches
- D. Hot carcass weight - 625 lbs.
- 1. A 0.6 inch fat thickness results in preliminary yield grade of 3.5.
- 2. 2.0% is 1.5% less than the average of 3.5% kidney, pelvic

- and heart fat (1.5 x .2=.3 to be subtracted from the preliminary yield grade).
- 3. A carcass that weighs 625 lbs. Requires an 11.3 sq. inch rib eye (12.5 - 11.3 + 1.2 sq. inches more than required. 1.2 x .3 to be subtracted from the preliminary yield grade).
- 4. The final yield grade is determined in this instance by

subtracting the adjustments from the preliminary yield grade.

Preliminary yield grade	3.50
Less adjustment for rib eye	<u>.36</u>
Subtotal	3.14
Less adjustment for Kidney, pelvic and heart fat	<u>.30</u>
	2.84

In the official USDA Grading Program, all fractional parts of the yield grade are dropped. In this case the final yield grade would be 2.

## Methodology for Determining Carcass Class Placings

A carcass index is used to combine both the quality and cutability to evaluate the overall merit of the carcass in order to determine a winner of the carcass class sponsored by the Santa Barbara County Cattleman's Association.

The procedure to determine the carcass index is as follows:

1. Determine the yield grade to the nearest one-tenth of a grade and convert this value to a percent of carcass weight in boneless, closely trimmed retail cuts from the round, loin, rib, and chuck. Table 2 represents the percent of carcass weight in boneless retail cuts from round, loin, rib, and chuck for corresponding yield grades.

Table 2. COMPARISON BETWEEN YIELD GRADE AND PERCENTAGE OF CLOSELY TRIMMED RETAIL CUTS FROM RIB, LOIN, CHUCK, AND ROUND

Yield Grade	Yield of Cuts
1.0	54.6
1.5	53.5
2.0	52.3
2.5	51.2

3.0	50.0
3.5	48.9
4.0	47.7
4.5	46.6
5.0	45.4

2. Determine the Quality Grade in terms of thirds of USDA Quality Grades.
3. Subtract 0.8 percent from the estimated yield of retail cuts for each one-third quality grade below Prime Plus (P+).
4. The difference between the cutability and adjustment for quality is now the carcass index.

**Example of determining the carcass index of a carcass that has a USDA Quality Grade of Choice minus and a Yield Grade of 3.0:**

Estimated Yield of Cuts	50.0
3.0 Yield Grade	
Choice minus* quality	<u>- 4.0</u>
.8 x 5	
Index	46.0

\*Choice minus is one and two-thirds quality grades below Prime Plus.

### OTHER CARCASS INFORMATION INCLUDED IN THE EVALUATION

#### Yield or Dressing Percentage

While this figure is not involved in determining either the Quality or Yield Grades, it is important to the individual or firm who buys the live animal. This yield reflects the weight of the carcass compared to the live animal. The packer who buys the live animal sells it as a carcass or boxed beef. His product is pounds, just as is the producer's of the live animal. Therefore, pounds of saleable product are very important. For example, if a choice 1,100-pound steer dresses 62% instead of 60%, the difference of 2% is 22 pounds. This amount can represent quite a dollar value difference between two carcasses of equal quality and cutability.

The weighing conditions of the live animal are important in this calculation. An animal that is shrunk (feed or water withheld or not available) prior to weighing will have a higher yield. As a means of comparison with the yield percent found with the carcass evaluation summary, it is generally recognized that fed cattle will normally yield from 59% to 62% of their live weight as carcass weight.



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