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RP 357 Quality and Yield Grades for Beef Carcasses

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Quality and Yield Grades for Beef Carcasses

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There are two types of beef grades in the United States--quality grades and yield grades. Beef carcasses may carry a quality grade, a yield grade or both a quality and yield grade.

Quality grades indicate expected palatability or eating satisfaction of the meat; yield grades are estimates of the percentage of boneless, closely trimmed retail cuts from the round, Join, rib and chuck.

Federal meat grading is a voluntary service packers request and pay for on an hourly fee basis. Meat grading should not be confused with meat inspection, which is mandatory and ensures the safety and wholesomeness of our meat supply.

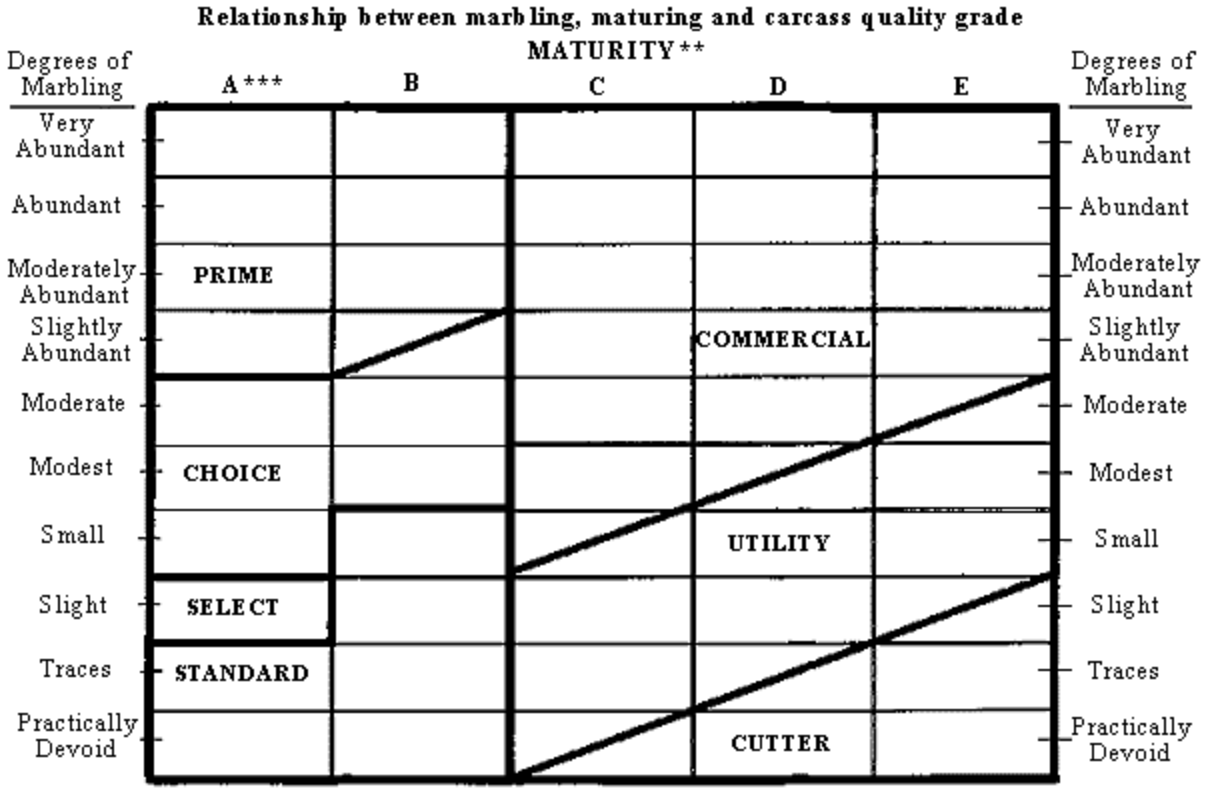
Quality Grading

USDA beef quality grades are *Prime, Choice, Select, Standard, Commercial, Utility, Cutter* and *Canner*. Since quality grading is voluntary, not all carcasses are quality graded. Packers may apply their own "house brand" to merchandise their beef. Carcasses merchandised as ungraded beef usually are those that do not grade Choice or Prime. They generally are termed "No Roll" beef by the industry, because a grade stamp has not been rolled on the carcass.

Maturity and marbling are the major considerations in beef quality grading.

Maturity is an estimation of the physiological age of the carcass. There are five degrees of maturity--*A, B, C, D* and *E*.

The quality grading chart (*Figure 1*) shows that carcasses of *A* and *B* maturity are eligible for the *Prime, Choice, Select, Standard* and *Utility* quality grades. Older carcasses of *C, D* and *E* maturity qualify only for the *Commercial, Utility, Cutter* and *Canner* grades.



*Assumes that firmness of lean is comparably developed with the degree of marbling and that 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.

Figure 1. Relationship between marbling, maturing and carcass quality grade*.

Degree of maturity, or physiological age as determined from bone and lean maturity, may not be the same as the actual age of the animal in months or years. However, approximate chronological age groupings for maturity degrees are as follows:

Maturity	Age
A	9 - 30 months
B	30 - 42 months (2 1/2-3 1/2 years)
C	42 - 72 months (3 1/2-6 years)
D	72 - 96 months (6 - 8 years)
E	over 96 months (over 8 years)

Maturity is estimated visually by cartilage ossification (hardening of cartilage into bone), rib bone shapes, and lean color and texture. Cartilage ossification of the split backbone is useful in determining carcass maturity (*Figure 2*).

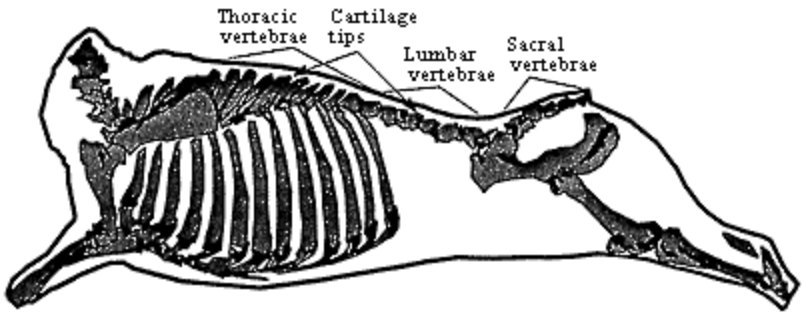


Figure 2. Location of cartilage and vertebrae for determination of maturity.

During the early stages of growth, more ossification occurs in the hind portion of the backbone (sacral and lumbar vertebrae), progressing with advancing maturity toward the forequarter (thoracic vertebrae). As animals advance from A to E maturity, there is fusion of the sacral vertebrae, more ossification of the cartilage tips of the lumbar and thoracic vertebrae occurs, and rib bones become wider and flatter (*Table I*).

Table I. Guidelines for Determining Skeletal Maturity

Maturity	Sacral Vertebrae	Lumbar Vertebrae	Thoracic Vertebrae
A	Distinct separation to completely fused	Cartilage evident to nearly completely ossified	No ossification to slight evidence of ossification
B	Completely fused completely ossified	Nearly completed ossified to ossified (10-25% ossified)	Partially ossified to moderately
C	Completely fused	Completely ossified	Moderately ossified to considerable ossification with cartilage outline plainly visible (30-70%)
D	Completely fused	Completely ossified	Considerable ossification with cartilage outlines plainly visible to barely visible (70-100%)
E	Completely fused	Completely ossified	Cartilage outline barely visible to completely ossified

In young beef carcasses the lean flesh is light cherry red in color and fine in texture. With advancing maturity the lean becomes progressively darker in color and more coarsely textured. Mature carcasses (*D* and *E*) may have lean that is dark red and coarse textured.

Carcass maturity is determined initially from the skeletal characteristics and adjustments made according to the lean characteristics. The final maturity of the carcass cannot be adjusted more than one full maturity group from the maturity indicated by its bones and cartilages.

Marbling, the flecks of fat in the lean, is the other major consideration in quality grading. Marbling is evaluated visually in the rib eye muscle between the 12th and 13th ribs. Although it contributes only slightly to meat tenderness, marbling probably contributes to the palatability traits of juiciness and flavor. Ten degrees of marbling range from *Very Abundant* to *Practically Devoid* (In *Figure 3*, *Practically Devoid* is not shown).

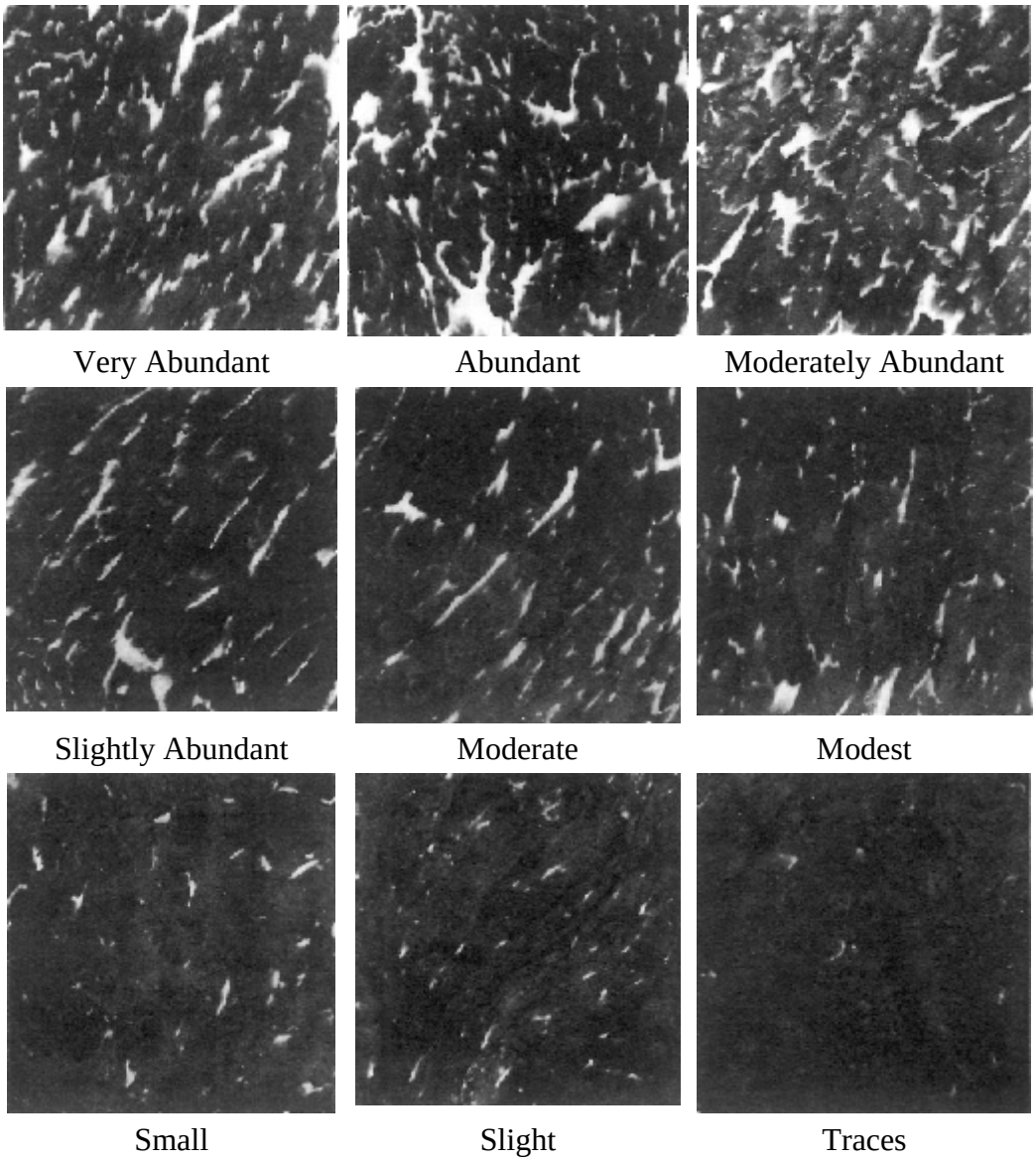


Figure 3. Lower limits of some marbling degrees used in quality grading.

Using the chart illustrated in *Figure 1*, quality grades are determined by combining maturity and marbling characteristics. For example, *A* maturity carcasses (typical of most feedlot cattle) require at least a *Small* degree of marbling to make the *Choice* grade, whereas a *Slightly Abundant* amount of marbling is required for *Prime*. Carcasses of *B* maturity require a *Modest* degree of marbling to grade *Choice*. Also, *B* maturity carcasses cannot grade *Select*, but will grade *Standard* with a small degree of marbling or less. Carcasses of *C* maturity with *Modest* marbling will grade *Commercial*.

If necessary, adjustments are made in the final quality grade for other quality characteristics, such as lean color, texture and firmness.

Bullock carcasses are *A* maturity carcasses of male animals that exhibit masculine characteristics such as a noticeable crest over thick shoulders and a prominent "jump muscle" in front of the hip bone. They often display a slightly darker red lean color and a more coarsely textured lean. Bullock carcasses can be quality and/or yield graded, and must be identified as bullock if either grade is applied. Bull carcasses (*B*, *C*, *D* and *E* maturity) are only yield graded.

"Dark cutters" are carcasses that produce a lean that is dark red to almost black in color and has a sticky or gummy texture. This condition often results in cattle that have been stressed for a relatively long period of time.

"Dark cutters" are safe to eat and their palatability is normally not affected, but consumer acceptability and carcass value are reduced. Dark cutting carcasses that normally would qualify for the *Prime*, *Choice* or *Select* grades may be reduced as much as a full quality grade.

In review, USDA quality grades are a subjective measure of the meat palatability traits of flavor, juiciness and tenderness. Other factors such as genetics, processing methods, types of retail cut, and, especially, cooking methods, also influence meat palatability.

Yield Grades

USDA yield grades identify the "quantity" or "cutability" differences among carcasses. Yield grades are *1, 2, 3, 4* and *5*, and are a numerical representation of the expected percentage of closely trimmed, boneless retail cuts from the round, loin, rib and chuck. This percentage of retail cuts is the carcass cutability (*Table II*).

Table II. Relationship of Yield Grades and Cutability

Yield Grade	% Boneless, Closely Trimmed Retail Cuts From the Round, Loin, Rib and Chuck
1	52.6 - 54.6
2	50.3 - 52.3
3	48.0 - 50.0
4	45.7 - 47.7
5	43.3 - 45.4

The terms "yield" and "yield grade" should not be confused. "Yield" alone means dressing percentage (carcass weight divided by live weight multiplied by 100), and is not directly related to yield grades or cutability.

Carcass factors used to calculate yield grade are:

1. **Adjusted fat thickness.** External fat is measured at the 12th rib perpendicular to the outside fat at a point 3/4 the length of the rib eye (longissimus) muscle (*Figure 4*). This measurement may be adjusted by the grader to reflect unusual fat distribution in the carcass. Special attention is given to fat deposition in the cod or udder, rump, inside round, flank, lower rib, plate and brisket areas. External fat is the most important yield grade factor. As external fat increases, the percentage of retail cuts decreases.

2. **Percentage of Kidney, Pelvic and Heart Fat (KPH).** This is a subjective estimate of the amount of fat surrounding the kidney knob, and fat in the pelvic and thoracic (heart) areas as a percentage of the carcass weight. As the percentage of KPH fat increases, the percentage of retail cuts decreases. Percentage KPH fat normally ranges from 1.0 to 4.0 percent.

3. **Rib Eye Area.** The longissimus muscle is measured at the 12th rib by using a grid expressed in square inches (*Figure 5*), or a compensating polar planimeter, which measures a rib eye tracing. Rib eye area is an indicator of carcass muscling; as rib eye area increases, retail cut yield increases.

4. **Hot Carcass Weight.** Generally, as carcass weight increases, the percentage of retail cuts decreases slightly due to increased fat deposition. If only chilled carcass weight is available, it can be adjusted to hot carcass weight by multiplying by 1.02 to correct for the evaporative weight loss of the carcass in the cooler.

Yield grades are calculated by using the following formula:

YG = 2.50 + (2.50 × Adjusted Fat Thickness, inches)
+ (0.20 × Kidney, Pelvic and Heart Fat %)
+ (0.0038 × Hot Carcass Weight, lb)
- (0.32 × Rib eye area, sq. in.)

For example, a carcass has 0.40 inch of fat, 2.5 percent KPH, 12.8 sq. inches of rib eye and a hot carcass weight of 750 lbs. Substitute these variables into the yield grade equation to calculate a final yield grade of 2.75:

YG = 2.50 + (2.50 × 0.4 in.)
+ (0.20 × 2.5 percent)
+ (0.0038 × 750 lbs.)
- (0.32 × 12.8 sq. in.)
YG = 2.75

In the official USDA grading program the decimals are dropped and the yield grade is reported as 2.

In review, USDA yield grades estimate the quantity of edible meat from the major wholesale cuts--round, loin, rib and chuck.

Additional information regarding USDA quality and yield grades may be obtained by requesting Official United States Standards for Grades of Carcass Beef from the United States Department of Agriculture, Agricultural Marketing Service, Livestock and Seed Division, Standardization Branch, Room 2603 South Bldg., P.O. Box 96456, Washington, D.C. 20090-6456.

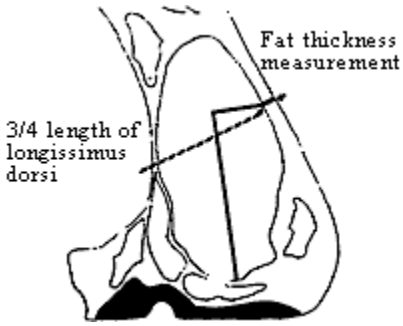


Figure 4. Location of fat thickness measurement

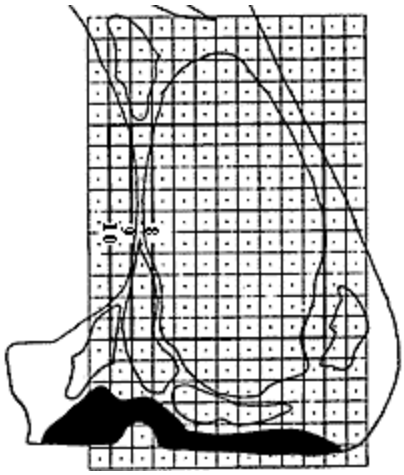


Figure 5. Measurement of rib eye area by grid method

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