



USDA QUALITY GRADES and YIELD GRADES

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Inside virtually every commercial beef processing plant there are graders and inspectors. Both are employed by the US Department of Agriculture (USDA); however, they play very different roles. USDA inspectors are part of the Food Safety Inspection Service (FSIS) and inspect live cattle, carcasses, internal organs and the head (including the glands, nervous system, lymph nodes, etc.). They evaluate the beef and by-products and the plant they are processed in for safety, cleanliness and wholesomeness ensuring that the product sold is safe and free of contaminants and disease. All beef products sold across state lines must be USDA inspected. Even small locker plants must be inspected by state inspectors for safety.

USDA graders evaluate and then rate, or rank, beef carcasses for quality (quality grades) and cutability (yield grades). They also certify beef for various USDA Certified programs like Certified Angus Beef™ or Certified Farmland Black Angus Beef™. Grading is voluntary and an individual carcass can be graded for quality, cutability or both or neither. It is not mandatory.

Brief History:

The US Standards for Grades of Carcass Beef were originally formulated in 1916 as a basis of uniformly reporting dressed beef markets and then later were used in the selection of beef for the Armed Forces during World War I. They were first published in 1924 in a bulletin and then officially released in 1926, shortly before the voluntary beef grading and stamping service began in May 1927. Grades were established for steer, heifer, cow, bullock and stag beef. Since then, grades have been renamed, adjusted and readjusted.

A dual system for separate identification of differences in quality and cutability was officially implemented in 1965. Hence, the yield grading system was born. In 1975, conformation was eliminated as a factor in determining quality grade. The name of the US Good grade was changed to US Select to use in the marketing of this grade as an alternative to Choice. Most recently, in 1997, the standards were revised to restrict the Select grade to A maturity only and to raise the marbling required for Choice to modest throughout B maturity. These changes were made to improve the uniformity and

consistency of the Choice and Select grades since research has shown that carcasses of B maturity are more variable in overall palatability.

Quality Grades:

Quality grades are determined by marbling and overall maturity. They predict the palatability of the lean. There are eight quality grade designations: Prime, Choice, Select, Standard, Commercial, Utility, Cutter and Canner. Prime, Choice, Select and Standard are classified as young beef (maturity level A and B) and must be less than 42 months of age, physiologically. Commercial, Utility, Cutter and Canner are cow grades from carcasses greater than 42 months of skeletal maturity. Marbling, or intramuscular fat, is the flecks of fat dispersed within the lean. The USDA grader evaluates marbling within the longissimus dorsi (ribeye) muscle that has been cut, or ribbed, between the twelfth and thirteenth ribs. See Figure 1.

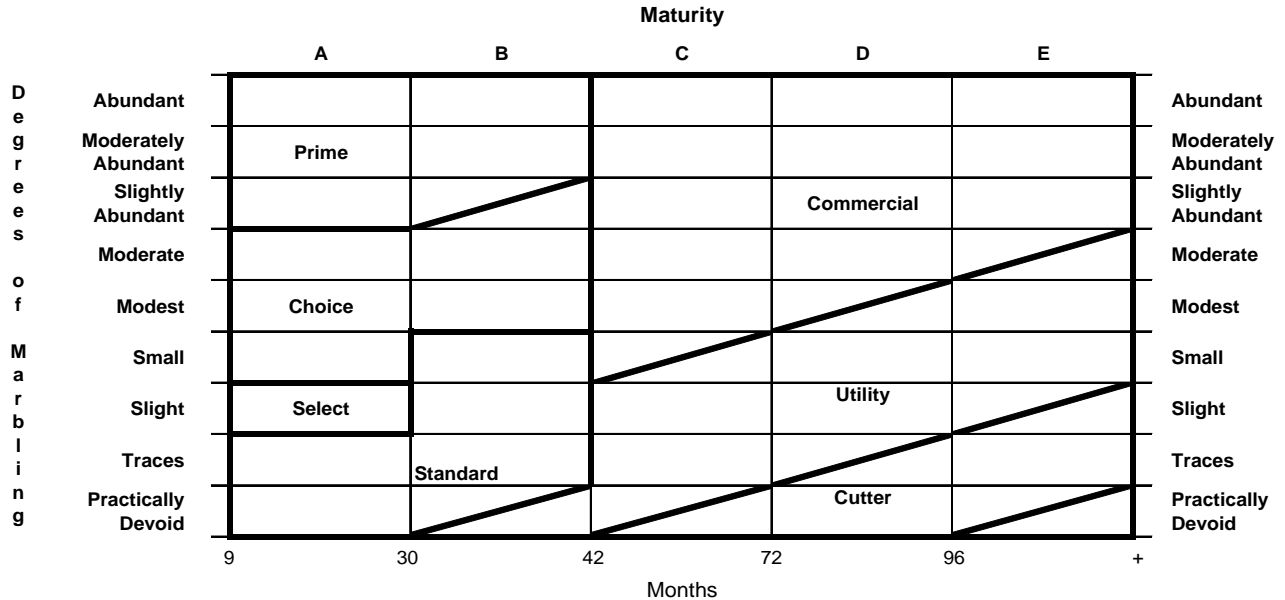
Maturity is determined by evaluating (1.) the degree of ossification (changing of cartilage to bone) in the split chine bones of the vertebral column of a split carcass, (2.) size and shape of the rib bones, (3.) the color and firmness (texture) of the lean in the longissimus dorsi. As animals mature, cartilage in the spinal column vertebrae gradually changes to bone, or ossifies. This change occurs first in the sacral vertebrae (the hip region), then in the lumbar vertebrae (sirloin and loin region) and still later in the thoracic vertebrae (rib area) as an animal gets progressively older. Also, as animals age, the chine bones lose their red color and gradually become whiter as they ossify. Younger animals' rib bones tend to be round and red. Older animals' ribs flatten and become whiter.

Skeletal maturity (also called physiological maturity) is an *estimate* of chronological age (actual days from birth). Generally, they correspond very well. However, animals that have been stressed nutritionally or from poor health can tend to have advanced *skeletal* maturity relative to their actual age in days. Heifers that have been pregnant during some period of their life tend to ossify earlier. Cattle that were sick or have been deficient in vitamins or trace minerals are associated with greater than expected skeletal maturity.

The skeletal maturity can be adjusted after evaluating the color and texture of the lean within the ribeye to achieve overall maturity. Lean color and texture can only be used to reduce, or improve the overall maturity from skeletal. Younger carcasses will tend to be very fine in texture and lighter red in color. Older beef will tend to be coarse textured and darker red. This adjustment can be no more than one full maturity group. Each maturity group is subdivided by degrees (from 0 to 100). In other words, if the grader feels that a carcass has a skeletal maturity of B⁸⁰ but feels the color and texture is more typical of a much younger animal, then he could adjust it back to an overall maturity of B²⁰ perhaps. However, the most that he could adjust would be down to A⁸⁰ (one full maturity group).

Figure 1 shows the relationship between maturity, marbling and USDA quality grades. Maturity groups are listed across the top (A through E). Degrees of marbling are listed on the left and right axes. Inside the chart are the quality grades.

Figure 1. Relationship between Marbling, Maturity and Quality Grade¹



¹Assumes that firmness of lean is comparably developed with the degree of marbling and that the carcass is not a dark cutter

Ungraded Carcasses:

As mentioned earlier, it is not mandatory that a beef packer have every single carcass graded for either quality or yield or both. It is common for a packer to not have outlier cattle like hardbones, dark cutters, stags, etc. quality graded by the USDA. People in the packing industry tend to use the term “no-roll” referring to these outlier carcasses. Whether they were actually graded by the USDA or not, they are carcasses that after processing, will not be sold as Select, Choice or Prime. Instead they will be sold as “no-roll” or ungraded boxed beef.

Currently, on the USPB grid, Ungraded cattle are defined as Standards, Dark Cutters and Bloodshot. Standard is the USDA quality grade below Choice and Select (see Figure 1).

Dark Cutters are carcasses that have a dark lean color. Animals who are advanced in their maturity tend to have darker lean color. Also, young animals that are slaughtered with low levels of glycogen (blood sugar) will tend to have a darker color of lean. You may notice carcasses on your grade detail reports that have an “X” in the dark cutter column (See “Understanding the Grade Detail Report” in the USPB section of this manual).

Dark Cutters tend to show up more often in the fall months. To date, no research has shown why this tends to occur. Extreme heat can also tend to increase their incidence. Mixing or commingling cattle from different pens onto the truck during delivery has been



associated with slightly higher levels of dark cutters. A heifer that is cycling during slaughter will have a greater chance of being dark. A typical example of a live steer that is likely to produce a dark cutting carcass is one from the 4-H carcass show. He is very wild and excited. He was mixed in with a bunch of strange cattle on the truck and in the holding pen at the plant. Then by the time he is slaughtered, he has depleted his glycogen.

Bloodshots occur very rarely. Occasionally, when an animal is stunned during slaughter, the blood vessels rupture and blood is “shot” throughout the lean. Like dark cutters, this meat would be much less desirable in a retailer’s meatcase.

What Happens in the plant:

At National Beef, like most major processing plants, carcasses exit the kill floor and are weighed to record their hot carcass weight. They are then electrically stimulated to encourage tenderness and enter the “hot box”, or cooler. The hot boxes are simply large refrigerators. Each room is filled with warm carcasses and then the temperature is reduced slowly to minimize shrinkage. At National Beef carcasses are held in the hot boxes for approximately 36 hours. In recent years the packing industry has been moving towards a longer chill. Previously, most packers graded carcasses only 24 hours after slaughter. Extra chill time makes the marbling more visible and encourages quality grade.

The carcasses exit the hot box and are ribbed between the 12th and 13th ribs. Then they move along the chain for about twenty minutes. This is what’s called the “blooming line”. This gives the ribeye time to react with oxygen in the air making the marbling more visible. USDA graders then evaluate carcasses for quality grade and yield grade.

A National Beef employee is positioned immediately down the line behind the grader. He is called a carcass merchandiser. He sorts the carcasses by stamping them so they can be sorted onto rails for later fabrication. Carcasses are sorted by quality grade, yield grade, carcass weight and candidates for branded programs like Certified Angus Beef™. After carcasses are sorted into the “staging area” the carcass merchandiser asks the grader to certify carcasses that are candidates for branded programs. He can also ask that carcasses that are “on the line” between choice and select be regraded. In other words, if he doesn’t agree with the grader, he can ask for a re-grade.

Yield Grades:

USDA Yield Grades are an indication of cutability or yield of boneless, closely trimmed, retail cuts. The yield grade of a carcass is determined by (1) external fat, (2) kidney, heart and pelvic fat, (3) ribeye area and (4) hot carcass weight. Remember that yield grades measure the combination of fat and muscle, not just fat. Yield grades can be determined by using the following formula: **$2.50 + (2.5 \times \text{adjusted fat thickness in inches}) + (0.2 \times \text{percent kidney, heart and pelvic fat}) + (0.0038 \times \text{hot carcass weight}) - (0.32 \times \text{ribeye area in square inches})$** . Or, yield grades can be determined by a “shortcut method”. USDA yield grades are expressed as a whole number. They range from 1 (lean and heavy muscled) to 5 (fat and light muscled). The fractional part of the yield grade is always dropped. For example, if a calculated yield grade is 2.8, the final yield grade is 2.

External fat is measured in terms of thickness of fat over the ribeye muscle, measured three-fourths of the length of the ribeye from its chine bone end. The fat thickness may be adjusted to reflect unusual amounts of fat (or leanness) on other parts of the carcass. Using the shortcut method, this fat measurement is converted to a preliminary yield grade (PYG). The grader looks at the amount of external fat over the round, cod or udder, flank, plate and brisket. If the carcass is leaner in these locations, he will adjust down. If these areas are fatter, he can adjust up. As external fat increases, the percent of retail cuts decreases. Each one-tenth inch in adjusted external fat changes the yield grade by 25% of a yield grade.

Kidney, heart and pelvic fat, or internal fat, is evaluated subjectively and expressed as a percent of the carcass weight. As internal fat increases, the percent of retail cuts decreases. Each one percent of internal fat changes the yield grade by 20% of a yield grade.

Ribeye area is measured between the 12th and 13th rib (where marbling is also evaluated). Graders usually estimate the area subjectively; however, they may use a grid calibrated in tenths of a square inch. An increase in the ribeye area increases the percent of retail cuts. A change of one square inch in ribeye area changes the yield grade by approximately 30% of a yield grade.

Hot carcass weight is taken into consideration when determining the final yield grade. As carcass weight increases, the percent of retail cuts decreases. A change of 100 pounds in carcass weight changes the yield grade by approximately 40 percent of a yield grade.

As mentioned earlier, the official USDA yield grade equation may be used to calculate the exact yield grade number or the following short cut method may be used:

1. Determine a preliminary yield grade from the external fat measurement according to the schedule below in Table 1.

Table 1.

Adjusted Fat Thickness (inches)	PYG
0.0	2.0
0.2	2.5
0.4	3.0
0.6	3.5
0.8	4.0
1.0	4.5
1.2	5.0
1.4	5.5

The fat thickness may be adjusted, either upward or downward, as necessary to reflect unusual amounts of fat on other parts of the carcass.

2. Determine the final yield grade by adjusting the PYG for ribeye area and internal fat.

A. Ribeye area adjustment in relation to hot carcass weight.

Each carcass weight has a ribeye area that results in no adjustment to the final yield grade. This is often referred to as “required ribeye area”. Those are listed in the table 2 below.

Table 2.

Hot Carcass Weight (lbs.)	Required Ribeye Area (sq. in.)
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
850	14.0
875	14.3
900	14.6
925	14.9
950	15.2

For each square inch more than the area indicated in the weight-area schedule, subtract 0.3 of a grade from the PYG. For each square inch less than the area indicated in the weight-area schedule, add 0.3 of a grade to the PYG.

If the deviation of ribeye area from the required ribeye area is a fraction of an inch(es), the deviation is multiplied by 0.3, rounded to the nearest tenth, and that adjustment is made to the PYG. For example, a 1250 pound steer produces an 800 pound carcass. From the table above, it’s required ribeye area is 13.4 square inches. If it’s actual ribeye area is 14 square inches, we take $14 - 13.4 = 0.6$ to get the difference in ribeye area. Then, we multiply that $0.6 \times 0.3 = 0.18$. And we would then deduct 0.18 (or 2/10ths) from the PYG because he was heavier muscled than average.

B. Internal fat adjustment. See table 3.

For each 0.5 percent of internal fat greater than 3.5 percent, add 0.1 to the PYG.

For each 0.5 percent of internal fat less than 3.5 percent, subtract 0.1 from the PYG.

Table 3.

KPH Fat (%)	PYG adjustment
0.5	-0.6
1.0	-0.5
1.5	-0.4
2.0	-0.3
2.5	-0.2
3.0	-0.1
3.5	None
4.0	+0.1
4.5	+0.2
5.0	+0.3

Table 4 lists some Yield Grade examples (all assume no adjustment to PYG for external fat elsewhere on the carcass).

Table 4.

External Fat	PYG	HCW	Required REA	Actual REA	REA adjustment	% KPH	KPH adjustment	Final YG
0.32	2.8	717	12.4	12.6	-0.1	3.5	0.0	2.7
0.24	2.6	842	13.9	16.9	-0.9	2.0	-0.3	1.4
1.28	5.2	662	11.7	10.0	+0.5	4.5	+0.2	5.9
0.84	4.1	811	13.5	14.0	-0.2	1.5	-0.4	3.5