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Michigan State University Extension Service

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MICHIGAN BEEF PRODUCTION

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Beef Grades: What They Represent and How They Are Determined¹

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The market value of a beef carcass is determined primarily by two factors: (1) the *quality* of the meat (palatability) and (2) the *quantity* or amount of lean meat available.

The USDA established grades to represent the differences in both the quality and quantity of edible meat in a beef carcass. The differences in quality of the meat are represented by the USDA quality grades and differences in quantity of salable lean are represented by the USDA yield grades. The USDA grader must now determine both USDA grades if the carcasses are to be graded. On certain beef types, the packer may choose to use a "house grade" or "packer brand" in place of the USDA grades. Carcasses that meet requirements for prime and choice quality grades are usually stamped with the USDA grades and those carcasses that fail to grade USDA choice often receive one of the packer's house grades.

Beef quality grades are important in determining carcass value because they serve as guides to the eating characteristics of the final product. The eating characteristics are measured by the palatability of the cooked product — its tenderness, juiciness and flavor. Yield grades identify the proportion of trimmed, retail cuts that can be obtained from the carcass. This fact sheet discusses the determination of these grades and the effect of the revision in grading standards implemented in 1976.

Development of Present Grade Standards

The USDA beef quality grades — Prime, Choice, Good, Standard, Commercial, Utility, Cutter and Canner — have been used since 1927 to identify differences in the palatability

of beef. The major factors used to determine quality grades have been (1) marbling, (2) maturity and (3) conformation.

Since 1965, USDA yield grades have been available for identifying differences in proportion of trimmed retail cuts. Until 1976, a packer could choose to have the USDA grader determine one or both of these grades.

On February 23, 1976 several revisions in the grading standards went into effect. The changes were:

1. All beef graded will be graded for both quality and yield, not just one or the other. This was implemented to properly identify differences in trimmed retail cuts and to discourage production of overfat cattle.

This should result in premiums for those cattle with a minimum of fat trim and a discount for those with excess fat trim. This should encourage the industry to produce leaner cattle, reducing the cost of producing beef.

2. The marbling requirements have been reduced for cattle between 9 and 30 months of age. Old standards assumed that as an animal increased in age, more marbling was required to insure palatability. According to the USDA, recent research shows no significant differences in the eating quality of beef from cattle ranging in age from 9 to 30 months ("A" maturity group). Further, they felt that since a much higher proportion of fed beef cattle now reach market weight at less than 24 months of age, the previous increase in marbling requirement was considered to be unnecessary and wasteful.

This change will result in some of the older cattle that didn't grade choice because of marbling now grading choice. For example, a 2 year old steer with a small amount of marbling previously would have graded good rather than choice because it needed a modest amount of marbling for choice. However, a 12 month old steer with a small amount of marbling would have graded choice. Both grade choice under the new standards.

¹Part of the information for this fact sheet was taken from Great Plains Beef Cattle Feeding Handbook, fact sheet 1903, "Quality and Yield Grades for Beef" by Dan H. Gee, South Dakota State University.

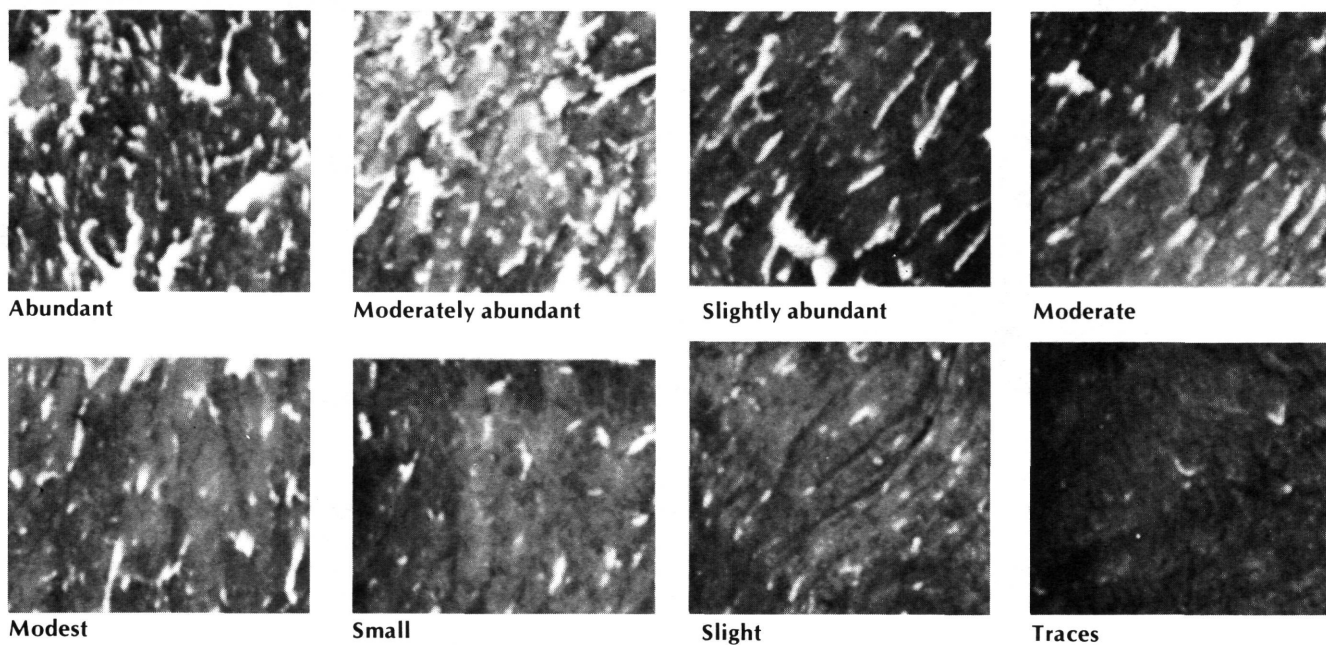


Figure 1. These are the lower limits of typical degrees of marbling referred to in grading carcass beef.

3. Conformation (shape of carcass) has been eliminated as a factor in determining carcass grade. Research has shown that shape of the carcass has little influence on the proportion of high priced cuts or the quality of the meat.

USDA compared how our steer and heifer beef grade under the old and new systems, assuming no changes in feeding practices:

	Old Standards	New Standards
	----- % of total -----	
Prime	4.5	6.5
Choice	54	68.5
Good	40	21
Standard	1.5	4

The reason for the dramatic drop in the proportion grading good is the ability of older cattle with a small amount of marbling, and more angular cattle with a small or higher amount of marbling, to grade choice under the new standards. Also, some cattle that had inadequate marbling for the good grade but had choice conformation could grade good because of their conformation. Those types will grade standard. Thus the good grade is now more uniform.

Determination of Quality Grades

Marbling, the amount and distribution of small flecks of fat within a muscle system, is the most important factor in determining quality grades. The evaluation of marbling is made on the cut surface of the rib eye by partially separating the hind from the forequarter between the twelfth and thirteenth ribs. Marbling contributes to the overall juiciness and flavor of beef. Several degrees of marbling have been established and are used as guides in grading beef carcasses. Figure 1 illustrates the lower limits of eight of the nine degrees of marbling (Practically devoid not shown).

Maturity is also an important factor in determining beef quality grades. The primary indicators of maturity are color, size and shape of the rib bones, ossification of cartilage, particularly the "buttons" on the vertebrae, and the color and texture of the lean. Advanced maturity is often associated with decreased tenderness. Five maturity groups, A through E, have been established for ease of reference. Group A is carcasses from very young animals and group E is carcasses from animals with evidences of advanced maturity or old age. The approximate age ranges of these maturity groups are as follows:

A - 9 to 30 months	D - over 60 months
B - 30 to 48 months	E - over 60 months
C - 48 to 60 months	

After the maturity group and degree of marbling have been evaluated, the two values are combined, with the use of the chart in Figure 2, into a single quality evaluation. The chart shows the minimum amount of marbling permitted for each of the quality grades and indicates that within each grade with increases in maturity there is an increase in the marbling requirement. For example, the minimum marbling requirement for choice varies from a small amount for the young carcasses to a modest amount for carcasses having the maximum maturity permitted in the choice grade. The chart also shows that cattle in the C, D and E maturity groups are not eligible for the prime, choice, good and standard grades. For example, a steer with a typical slight amount of marbling and a typical A maturity would fall into the average good grade. The majority of market steers and heifers that fail to make the choice grade lack the degree of marbling necessary.

Each grade is associated with a specific degree of quality, thus allowing consumers to use the meat most efficiently by preparing it in the manner for which it is best suited.

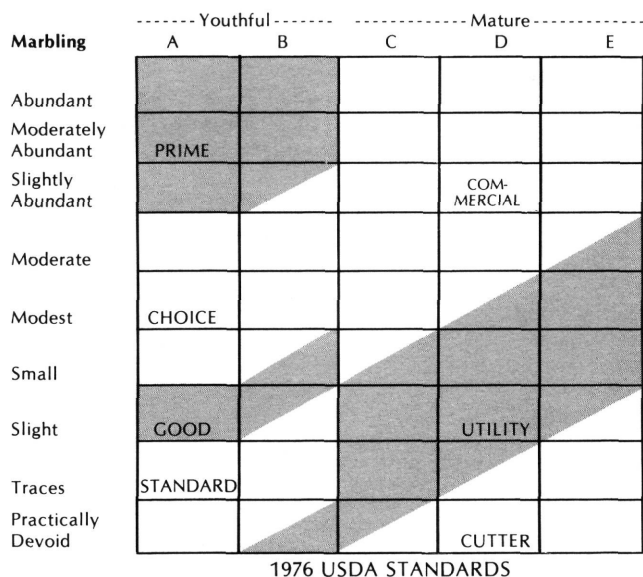


Figure 2. Relationship between Marbling, Maturity and Quality

Beef Yield Grades

Since 1965, USDA yield grades (also referred to as cutability grades) have provided an additional marketing tool for use by all who buy or sell cattle and beef carcasses. Yield grades identify the most important value-determining characteristic — the amount of trimmed retail cuts that can be obtained from a beef carcass. Specifically, yield grades are based on the percentage of boneless, closely trimmed retail cuts from the round, loin, rib and chuck. These four wholesale cuts account for more than 80% of the carcass value. There are five USDA yield grades numbered 1 through 5. Carcasses with yield grade 1 have the highest yield of retail cuts, while carcasses with a yield grade of 5 have the lowest yield of retail cuts. Yield grades for beef carcasses are applied without regard to sex or quality grade. Table 1 shows the percent of boneless, closely trimmed retail cuts that can be cut from the round, loin, rib and chuck for each of the five yield grades.

Table 1. Percent of Boneless Retail Cuts from Round, Loin, Rib and Chuck

Yield grades	
1	52.6% and above
2	52.3% to 50.3%
3	50.0% to 48.0%
4	47.7% to 45.7%
5	45.4% and below

Yield grades are determined by using the following four factors: (1) fat thickness, in.; (2) rib eye area, sq. in.; (3) percent kidney, heart and pelvic fat and (4) carcass weight, lb.

The amount of fat over the outside of a carcass is the most important factor in determining yield grade because it is a good indication of the amount of fat that is trimmed in making retail cuts. The measurement is made between the twelfth and thirteenth ribs over the rib eye at a point three-fourths of the rib eyes length from its chine bone end. This measurement may be adjusted to reflect unusual amounts of fat on other carcass parts.

The rib eye is the largest muscle in the carcass, lying on each side of the backbone, running the full length of the back. When the carcass is separated into a fore and hind-quarter between the twelfth and thirteenth ribs, a cross-section of the rib eye is exposed. The area of the rib eye is used in determining the yield grade because it indicates the total amount of muscle in a carcass. Among carcasses of the same fatness and weight, an increase in the rib eye area indicates an increase in the yield of retail cuts.

The amount of fat around the kidneys and in the pelvic and heart areas also affects carcass yields. Because this fat is removed in trimming, increases in these fats decrease the yields of retail cuts. The amount of kidney, pelvic and heart fat is estimated and expressed as a percent of the carcass weight. The average amount of kidney, heart and pelvic fat is 3.5 percent of the carcass weight.

The following method is used to determine yield grade in beef carcasses. These factors can also be estimated in live cattle to determine their potential yield or cutability grade.

I. Determine a preliminary yield grade from the following schedule:

Thickness of fat over rib eye	Preliminary yield grade
.2 inch	2.5
.4	3.0
.6	3.5
.8	4.0
1.0	4.5

II. Determine the final yield grade (1 to 5) by adjusting the preliminary yield grade as necessary for variations in kidney fat from 3.5% and for variations in area of rib eye Table 2. These adjustments are made as follows:

- A. Rate of adjustment for area of rib eye in relation to warm carcass weight.
 1. For each square inch of rib eye area *more* than the area indicated in Table 2, subtract .3 from the preliminary yield grade.
 2. For each square inch of rib eye area *less* than the area indicated in Table 2, add .3 to the preliminary yield grade.
- B. Rate of adjustment for percent of kidney, pelvic and heart fat.
 1. For each percent of kidney, pelvic and heart fat *more* than 3.5% add .2 to the preliminary yield grade.
 2. For each percent of kidney, pelvic and heart fat *less* than 3.5% subtract .2 from the preliminary yield grade.

Table 2. Minimum Rib Eye Area Needed for Various Carcass Weights (Carcass weight — area of rib eye table)

Warm carcass wt.	Minimum area of rib eye
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

Example: Determination of yield grade given the following data: .6 in. fat thickness, 12.5 sq. in. of rib eye area, 625 lb. carcass and 2.0 percent estimated kidney, heart and pelvic fat.

- I. Preliminary yield grade: .6 in. fat = 3.5 preliminary yield grade.
- II. Rate of adjustment for rib eye area, percent kidney, heart and pelvic fat.
 - A. 625 lb. carcass should have 11.3 sq. in. (from Table 2).
 - 12.5 (sq. in.) actual data
 - 11.3 (sq. in.) from Table 2
 - 1.2 sq. in. rib eye area more than indicated in Table 2.
 - 1.2 x .3 (rate of adjustment) = .36 yield grade adjustment
 - 3.5 preliminary yield grade — .36 = 3.14 after adjustment for rib eye area.
 - B. 3.5% normal percent kidney, heart and pelvic fat
 - 2.0% actual data
 - 1.5% difference
 - 1.5 x .2 (rate of adjustment) = .3
 - 3.14 adjusted yield grade — .3 = 2.84 or
 - 2.8 final yield grade.

Note: When used in the meat trade, fractional parts of the final yield grade are dropped. For the above example, the yield grade is a 2.

Table 3 shows the expected pounds of fat trim, bone and trimmed retail cuts per hundredweight of carcass for each of the five yield grades.

	Yield Grades				
	1	2	3	4	5
Fat trim	7.6	12.7	17.8	22.9	28.0
Bone and shrink	10.4	9.9	9.4	8.9	8.4
Trimmed retail cuts	82.0	77.4	72.8	68.2	63.6

The values indicate that as pounds of fat increase from yield grades 1 to 5, the pounds of trimmed retail cuts decrease.

Value differences of \$5 to \$15 per hundredweight between adjacent yield grades (2 and 3, 3 and 4, etc.) are quite common. With the use of yield grades, retailers can order beef of

a specific yield grade and carcass weight, knowing approximately how many pounds of edible lean will be available for sale.

Estimating Yield Grades in Live Cattle

Evaluating live cattle as well as their carcasses in terms of their yield grade is very useful in appraising their value. Cattle with a desirable yield grade (high yield of retail cuts; yield grade 1 or 2) are heavily muscled and have little outside fat cover. Cattle that are fat, wasty and poorly muscled have a less desirable yield of retail cuts (yield grades 4 or 5). Differences in both fat thickness and muscling affect the appearance of the live animal and, because fatness and muscling have opposite effects on yields of retail cuts, evaluating live animals for yield grade requires an ability to make separate and accurate evaluations of these two factors.

Cattle can vary a great deal in external fat thickness at slaughter time. Therefore, estimating fat thickness correctly is very important in determining yield grade. Differences in fat thickness can be best estimated by observing areas where fat is deposited most rapidly; the brisket, flanks, twist, over the back and around the tailhead. As cattle increase in fatness, these areas become progressively fuller, thicker and deeper in appearance. In general, the deeper the animal, relative to its length, the more fat it will carry.

The muscular development of an animal is best evaluated by observing those body parts that are the least affected by fatness; the round and forearm area. The thickness and fullness of the round and forearm are largely due to thickness of muscling.

In doing a good job of marketing cattle, it is necessary to know how to accurately estimate quality and yield grades. To become more skillful in estimating yield grades in live cattle, it is helpful to evaluate a group of cattle individually and then observe their carcasses in the cooler. In the cooler, it is important to compare the visual estimates with the final quality and yield grades as well as the actual degree of marbling, fat thickness, rib eye area, etc.

Yield grades provide an indirect means for reflecting consumer preferences for beef with a high ratio of lean to fat. Thus, they can be effective in bringing about changes which eliminate much of the waste now present in the production and marketing of beef. When used in conjunction with quality grades, yield grades provide a means of identifying strains of cattle and production methods which produce high quality beef with a minimum of waste fat and should lead to better values for consumers and greater returns for producers.



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