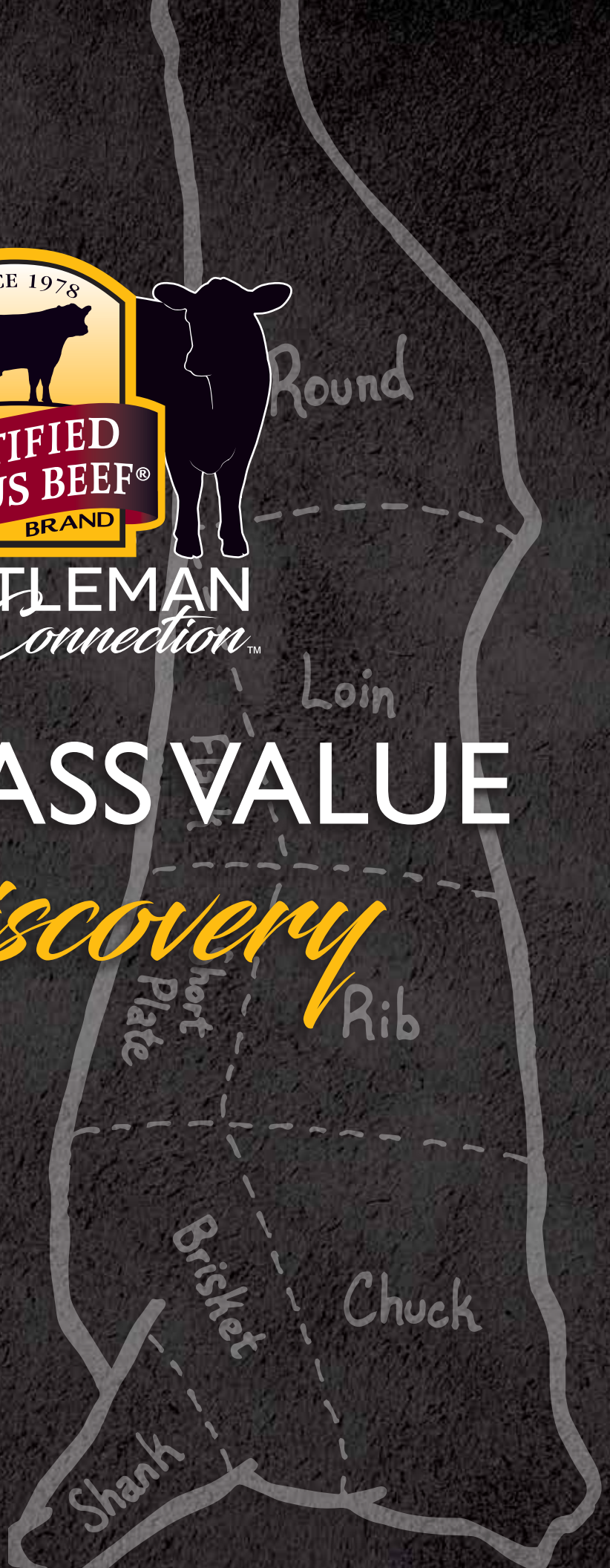




CATTLEMAN
Connection™

CARCASS VALUE

Discovery



MEASURING BEEF VALUE WITH CARCASS GRADING

Carcass grading to measure yield and quality serves as a series of dividing lines for beef value assessment and consumer acceptance. A consistent beef eating experience hinges on accurate carcass grading by the USDA Agricultural Marketing Service (AMS) and occurs at the packing plant. Quality grades provide a reasonable guarantee of beef's tenderness, juiciness and flavor. The grading system also influences value of cattle after harvest by acting as report card for beef producers.

Purpose and Procedure

Carcass grading began in 1916 to offer uniformity for livestock market reporting. Unlike meat inspection – a mandatory, tax-funded government process performed by the USDA Food Safety Inspection Service (FSIS) to ensure wholesomeness – carcass grading is a voluntary government service. Packing companies pay AMS to assign value to individual carcasses.

The process was tested when the government ordered meat for the army during World War I. After that war, the beef trade used quality grades as a product-purchasing tool. Yield grading of carcasses was added to the system in 1965 to predict red-meat yield. Adjustments have been made since then, but the basic two-tiered system remains.



At harvest, carcasses on trolley hooks are “dressed” by removing hide and internal organs, split into right and left halves or sides, and chilled. After 24-48 hours in the cooler, the halves are “ribbed” with a cut between the 12th and 13th rib to expose the ribeye muscle. After ribbing, carcass halves make their way along the rail towards the USDA grading stand.

USDA graders, often in concert with vision grading technology, objectively evaluate carcasses as they pass by in the plant grading cooler and assign the grade with an ink stamp applied to a specific area of the carcass. In a matter of 10 to 15 seconds, carcasses receive a quality grade and yield grade while evaluated for branded programs.

QUALITY GRADING

USDA quality grades are used to indicate the differences in expected eating quality and palatability. Each grade is determined by examining the marbling, or intramuscular fat and maturity of a carcass.

Eight quality grades differentiate desirability, most grain-fed beef is either Choice or Select. Prime beef is designated as the highest eating quality and Canner is the least desirable:

Prime
Choice
Select
Standard

Commercial
Utility
Cutter
Canner



Marbling

The amount of marbling (small flecks of intramuscular fat within muscle tissue) is the primary determinant of quality grade. Increases in marbling lessen the density of lean muscle, provide more lubrication or juiciness, increase beef flavor and better protect beef from overcooking.

This intramuscular fat is quantified using marbling scores assigned after a visual appraisal of the quantity, texture and distribution of marbling at the 12th-13th rib cross section.

Higher marbling scores result in higher quality grades. The scores are based on nine degrees of marbling, which are further subdivided into increments from 00 to 99. A marbling score is typically listed with its degree of marbling and numeric score. The USDA Choice category includes small, modest and moderate degrees of marbling. The lowest degree of marbling a carcass must have to earn the *Certified Angus Beef*® brand is a Modest 00 in the Choice grade.



Degree of Marbling	Carcass Maturity Score Over 30 Months of Age								
	A	B	C	D	E				
Abundant	Prime			Commercial					
Moderately Abundant									
Slightly Abundant									
Moderate	Choice			Utility					
Modest									
Small									
Slight	Select	Standard			Cutter				
Trace									
Practically Devoid									
					Canner				

Maturity

Dentition and skeletal characteristics as well as color, firmness and texture of lean muscle change as cattle mature. Tenderness decreases as cattle develop, making age a valuable component of quality grade.

Due to the complex structure of the beef industry, only a small number of cattle are harvested with a traceable birth record. However, the physiological age of the carcass can be assessed.

Historically, carcasses have been evaluated for maturity by assessing the quantity of ossification, or cartilage turning into bone, along the vertebral column. Today, overall carcass maturity is estimated by objectively determining age through dentition and ossification. Data show a correlation between the age of the animal and the amount of permanent teeth (incisors) they have. At the plant, trained Quality Assurance staff check the mouth of every animal to evaluate how many, if any, permanent incisors an animal has. If there are less than three permanent teeth, it is considered less than 30 months of age.

If an animal is identified as being greater than 30 months of age, the USDA grader will utilize the graph and bone ossification to assess what maturity score the animal should receive. Marbling and maturity scores are then used to determine quality grade.

The youngest and most prominent category of fed cattle is "A" maturity, representing estimated ages of 9 to 30 months. Only animals identified as less than 30 months of age through dentition are eligible for the *Certified Angus Beef*® brand.

The USDA classifies maturity in five categories from A to E:



A MATURITY:

9 to 30 months of age



Full set of eight temporary teeth.

B MATURITY:

30 to 42 months of age

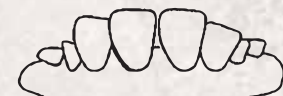
First set permanent incisors



Erupted third permanent incisor, top of tooth above gum line.

C MATURITY:

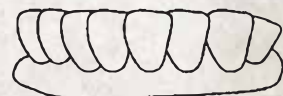
42 to 72 months of age



Four permanent incisors (with top corners of the second set above the gum).

D MATURITY:

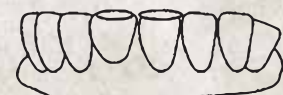
72 to 96 months of age



Full set of permanent incisors.

E MATURITY:

more than 96 months of age



Medial incisors showing wear and leveled tops.

YIELD GRADING

USDA yield grades estimate beef cutability – defined as the percent of closely trimmed, boneless retail cuts from the round, loin, rib and chuck. A yield grade ranging from 1 to 5 is assigned based on the amount of lean, edible meat from a carcass. Numerically smaller yield grades indicate a higher yield.

USDA Yield Grade	% Closely trimmed, boneless retail cuts
1	>52.3
2	50.0 to 52.3
3	47.7 to 50.0
4	45.4 to 47.7
5	<45.4

Yield grades are assigned based on a calculation that includes external fat thickness, carcass weight, ribeye area, and estimated percentage of kidney, pelvic and heart fat (KPH).

External Fat Thickness

Meat graders use a ribeye fat-thickness measurement as an indicator of overall carcass fat cover. The measurement is made three-fourths of the total length of the ribeye around the outside of the ribeye muscle, starting from the chine or backbone.

Graders may adjust the external fat thickness measurement based on visual appraisal of external fat distribution. Such flexibility improves measurement accuracy by accounting for fat in other areas of the carcass.



Hot Carcass Weight (pounds)	Ribeye area (square inches)
600	11.0
650	11.6
700	12.2
750	12.8
800	13.4
850	14.0
900	14.6
950	15.2
1000	15.8

Carcass Weight and Ribeye Area

A higher ratio of ribeye area to carcass weight indicates a more muscular carcass.

The relationship between these two factors is considered linear. Cattle with average muscling and similar weight should have a reasonably predictable ribeye area based on hot carcass weight.



Carcass weight is measured “hot,” rather than in the cooler, and the number is fixed to a carcass tag.

Ribeye area is measured at the 12th-13th-rib cross section, traditionally using a grid transparency. With this tool over the ribeye, dots surrounded by lean muscle are counted. The total number of dots divided by 10 equals the area in square inches.

Kidney, Pelvic and Heart Fat

The fat deposits in the kidney, pelvic and heart (KPH) cavities are typically left in the carcass after internal organs are removed. KPH fat accounts for 1% to 4% of carcass weight and has some effect on carcass cutability.

There is no objective standard to evaluate KPH, so graders must estimate the percentage, but the measurement has the least influence of the four yield grade factors.

Calculating Yield Grade

Yield grade is calculated by using the above measurements in a formula:

$$\begin{aligned}\text{USDA Yield Grade} = & 2.5 + (2.5 \times \text{adjusted fat thickness, inches}) \\ & + (0.20 \times \text{KPH, percent}) \\ & - (0.32 \times \text{ribeye area, square inches}) \\ & + (0.0038 \times \text{hot carcass weight, pounds})\end{aligned}$$

Official USDA yield grades are calculated to the nearest tenth, but carcasses are only assigned a whole number. For example, the equation above could generate a value of 2.77. The calculated yield grade would be 2.8, and the carcass would be stamped as a USDA Yield Grade 2. The decimal is dropped, not rounded.

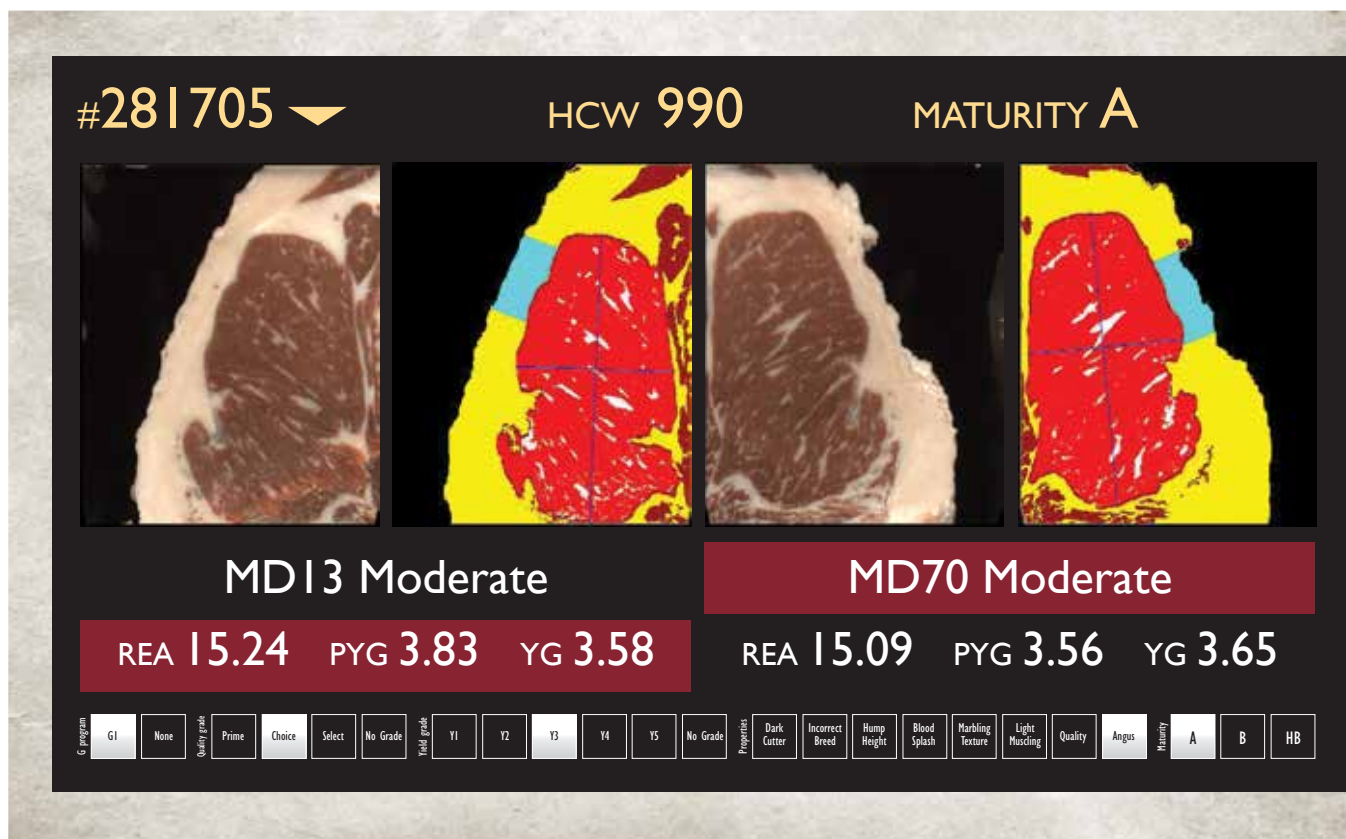
The equation serves as the guide and checkpoint for determining yield grade. Quality and yield grades can be assigned by an experienced grader’s visual appraisal in a matter of 10 to 12 seconds. He or she may use this equation to make close decisions or verify a grade when asked. Instrument grading is also used to help USDA graders make accurate calls.

CAMERA GRADING

For many years, the tasks of quality and yield grading were entirely the responsibility of the USDA grader. Technological advances have allowed the industry to become more efficient and consistent in determining quality and yield grades using camera grading.

Today, many commercial plants use a camera system to capture ribbed carcass components for grading. The camera system is operated by trained plant personnel and is calibrated at the beginning of each operational shift. Calibration and camera operation is performed in front of the USDA grader.

The USDA grader has the authority to override camera grading calls based on poor image capture or when they disagree with camera results by a margin greater than thresholds outlined in USDA instructions. Camera grading creates a consistent model for carcass grading, regardless of plant. Although not mandated, camera grading is heavily favored by the industry to help bring more consistency to carcass grade assessment.



In a matter of seconds, the camera takes a photograph of the ribeye, assigns a marbling score for quality grade, evaluates the lean color, measures the ribeye area, and measures the back fat thickness. The camera system can then analyze the data and assign an overall quality and yield grade.

CARCASS DEFECTS

Some imperfections can decrease carcass value. There are four common defects, although varying in frequency and severity: bruising, dark-cutting beef, blood splash and calloused ribeyes.

Bruises

Deep tissue bruises and abscesses are the most common beef carcass defects. Poor cattle handling, accidents or improper needle injections may cause these defects, which must be trimmed out at the packing plant. These defects directly impact dressed yield and overall carcass value, especially when the affected area is the rib or loin.



Dark Cutter



Capillary Rupture

Dark Cutters

A variety of preharvest-stress factors can produce dark-cutting beef. Extreme changes in weather, feed withdrawal, temperament and long transport are a few scenarios that can create a lack of energy stores within the muscle. This energy depletion in the post-mortem muscle inhibits a pH decline in the meat and keeps it from reaching the ideal cherry-red color when exposed to oxygen during grading. Although it is safe to eat, consumers falsely associate the dark color with a lack of freshness and quality, making it difficult to sell at retail.

Capillary Rupture

Internal hemorrhages in the muscles can cause capillary ruptures or “blood splash.” Often due to a breakdown in plant logistics, this occurs when an unconscious animal (post immobilization) is not exsanguinated, or bled, in a timely fashion, pulmonary pressure can build rapidly. This scenario can result in the capillaries within the muscle tissue erupting. The resulting product is safe for consumption, but may promote a metallic taste and is not visually appealing to consumers.

Calloused Ribeyes

Ribeyes and other muscles can become calloused when a pre-harvest injury causes severe nerve damage. The damaged area develops a callous, or an area of heavily deposited connective and fat tissue within the muscle.

CERTIFIED PROGRAM EVALUATION

The beef industry has evolved in the last 40 years to include a variety of beef brands, each differentiated by a unique set of animal and carcass characteristics and production methods.

These brands can be determined by packing companies and marketed as house brands, or USDA graders can evaluate carcasses for government certified programs.

Certification alone doesn't guarantee a higher level of quality. Current certified programs use carcasses from each maturity group and quality grade. It is important to look at a brand's specifications to judge its quality.

Each program's carcass specifications are outlined in a "G schedule," with corresponding carcass stamps to apply in the packing plant to denote acceptance into the program. USDA graders evaluate carcasses for their potential to be certified for G schedules. After the certification is stamped on carcasses, plant personnel sort the sides of beef into their respective programs so that the final products may be sold under the qualifying brands.



In 1978, the *Certified Angus Beef*® brand became the first USDA certified beef program. Today, there are more than 80 certified programs, and nearly three-fourths have Angus in the name.

The G-1 schedule number and stamp represent the *Certified Angus Beef*® brand. Angus-influenced cattle with a predominately solid black hair coat are identified with an "A" stamped on the carcass, or some other mark of recognition specific to the packing plant after the hide is removed. These must then pass 10 carcass specifications to qualify for the brand.

MARBLING

1. Modest or higher marbling
2. Medium or fine marbling texture

MATURITY

3. "A" maturity, under 30 months of age

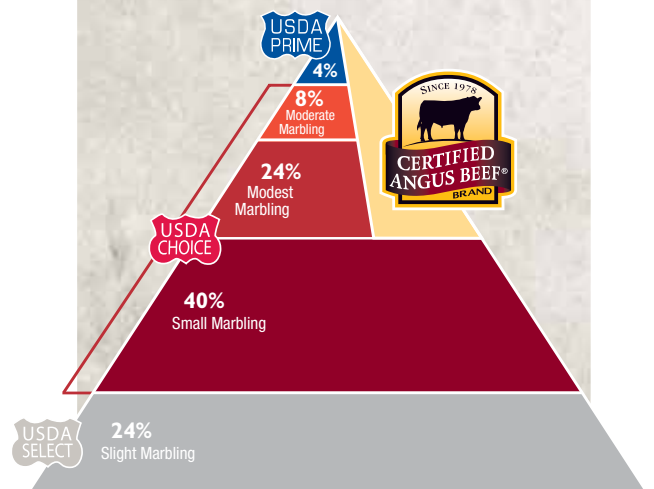
CONSISTENT SIZING

4. 10 to 16 square-inch ribeye area
5. 1,050 pound or less hot carcass weight
6. Less than 1 inch fat thickness

QUALITY APPEARANCE AND TENDERNESS

7. Superior muscling (restricts dairy influence)
8. Practically free of capillary rupture
9. No dark cutters
10. No neck hump exceeding 2 inches (restricts bos indicus influence)

The 10 science-based specifications are so strict that only about 3 in 10 Angus cattle qualify. As the original Angus brand, the *Certified Angus Beef*® brand excels in product quality and availability.



GRID-BASED VALUE DETERMINATION

One primary selling tool cattlemen use today is grid-based marketing – selling fed cattle based on their carcass merit. Within grid marketing, there are a variety of options, and individual sellers may have negotiated differences. This example explores individual carcass grading as it relates to premiums and discounts.

How does a grid work?

First, start with the live price. Suppose other cattle are selling for the cash or “live cattle” price of \$125/cwt. For those marketing on a grid, the seller retains ownership through grading. During this process, a dressing percentage for each carcass is calculated from the difference between live and carcass weight. In this example, the animal had a live weight of 1378 lb, a dressing percentage of 63.5% and a hot carcass weight of 875 lb. Next, divide the live price by the dressing percentage to discover the carcass base price.

$$1,378 \text{ lb Live Weight} \times .635 \text{ Dressing Percentage} = 875 \text{ lb. HCW}$$

$$\frac{\$125/\text{cwt Live Price}}{.635 \text{ Dressing Percentage}} = \$196.85/\text{cwt Carcass Base Price}$$

Determine the Base Carcass Value by multiplying the hot carcass weight by the carcass base price and dividing by 100 to convert from prices noted as cwt.

$$875 \text{ lb.} \times \$196.85/\text{cwt Carcass Base Price}/100 = \$1,722.44 \text{ Base Carcass Value}$$

If the seller were selling “In the Meat” or just pounds of hot carcass, this would be the paid price for the animal; however, selling on a grid requires applying the value results of carcass grading. After grading, this example carcass qualifies for the *Certified Angus Beef*® (CAB®) brand and is a USDA Yield Grade (YG) 3. CAB has a premium of \$3.55/cwt and a YG 3 offers no premium or discount. Next, apply the premium to the carcass base price.

$$\$196.85/\text{cwt Carcass Base Price} + \$3.55/\text{cwt Quality Premium} = \$200.40/\text{cwt Adjusted Carcass Price}$$

Finally, multiply the hot carcass weight by the adjusted carcass base price and divide by 100.

$$875 \text{ lb.} \times \$200.40/\text{cwt Adjusted Carcass Base Price}/100 = \$1,753.50 \text{ Net Carcass Value}$$

HOT CARCASS WEIGHT	
500-550	\$(20.56)
550-600	\$(8.00)
600-900	\$ -
>1050	\$(23.71)
QUALITY GRADE	
Prime	\$13.15
<i>Certified Angus Beef</i> ® brand	\$3.55
Choice	\$ -
Select	\$(11.46)
Standard	\$(28.68)
YIELD GRADE	
1.0-1.9	\$3.69
2.0-2.9	\$1.81
3.0-3.9	\$ -
4.0-4.9	\$(11.60)
>5.0	\$(16.89)
ADJUSTMENTS	
Natural	\$30.45
NHTC	\$17.55
Dairy	\$(2.84)
Bullock	\$(34.44)
Hardbone	\$(34.79)
30+	\$(16.59)
Dark Cutter	\$(35.62)

The above price grid shows national average price premiums and discounts for 2017 as reported by the USDA Agricultural Marketing Service for fed beef steers and heifers.

A USDA Choice, YG 3 carcass is the average in most grid-based cattle marketing systems. There are no premiums or discounts based upon this range of values; however, any deviation from this line may result in a discount or a premium.

Animal	1378 lb. Live, 875 HCW	1378 lb. Live, 875 HCW
Quality & Yield	CAB YG 3	SELECT YG 2
Live Value	\$1,722.50	\$1,722.50
In the Beef Value	\$1,722.44	\$1,722.44
875 x Quality Premium or Discount/100	\$31.06	-\$100.28
875 x Yield Premium or Discount/100	-	\$15.84
875 x Age & Appearance Adjustments/100	-	-
875 x HCW Discount/100	-	-
Grid Value	\$1,753.50	\$1,638.00

If we take this example further, we can see a comparison of the *Certified Angus Beef*® brand carcass from the example and an industry average USDA Select YG 2 carcass. In this example, the two animals are identical with regards to live weight and dressing percentage. As shown above, if both animals were sold on a “Live” basis, they would be worth \$1,722.50. If ownership was retained further, and the carcasses were sold on a dressed basis or “In the Meat”, the carcasses would both be worth \$1722.44; still no difference in price. However, if the two carcasses were marketed on the grid, we begin to see separation in value based upon the quality of the individual animal. The Select animal received a discount for lacking quality that totaled \$100.28 while the CAB carcass received a premium totaling \$31.06; a difference of \$131.34. Finally, the Select carcass received a premium for having a higher yielding carcass totaling \$15.84.

It is important to note, that as a producer feeds higher quality cattle, real value is obtained when cattle are sold in a manner that best rewards their performance.

Grid marketing is a great tool to use when marketing quality cattle. It benefited the example producer who raised the CAB qualifying carcass by rewarding them for superior carcass merits. On the other hand, it negatively influenced the producer of a below average carcass by discounting their sale of a Select animal. In this example, although the two carcasses weighed the same, the difference in the final price was more than \$115.

Grid performance can either increase profitability for quality-focused cattlemen or signal necessary management or genetic changes required to produce high-quality beef. Most importantly, it is necessary to remember that all grids are negotiated with the packer. If you are interested in selling your cattle on a grid based marketing system, begin by starting a conversation with your feedyard manager or cattle buyer.

**References available upon request.
For more information visit CABcattle.com.**



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