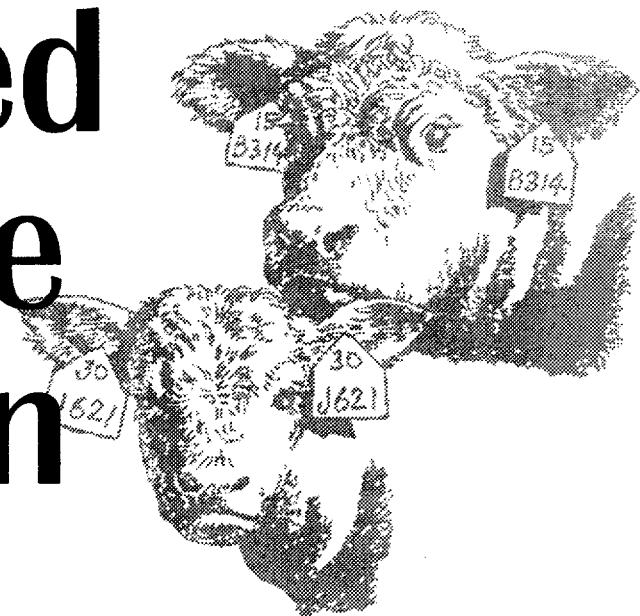




Value-Based Beef Cattle Production



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Today's beef industry is evolving toward a concept of value-based marketing which prices cattle and carcasses on individual merit rather than averages.

Recognizing that consumer's wants and needs drive beef demand, those who contribute to the added value of superior products should be rewarded. Likewise, the market should penalize those responsible for producing an inferior product.

Whether you are feeding a 4-H steer, an FFA beef project or are a commercial beef producer, this publication is designed to help you learn about the concepts of value-based beef cattle production and marketing. It consists of information you can use to help you take market beef animals from weaning (preconditioning) to finish. The major focus centers around producing a high quality beef end product for the consumer while adding profitability to the beef cattle enterprise.



NDSU EXTENSION SERVICE

North Dakota State University, Fargo, ND 58105

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Value-Based Beef Cattle Production Goals

I. Determine frame scores, beginning weights, desired end weights and calculations needed for average-daily-gains

1. Measure hip-height and weigh beef cattle
2. Calculate frame score, desired end weight and estimated average daily gain needed to reach desired end weight.

II. Building ratios to meet goals

1. Develop ratios utilizing locally grown feeds to meet the goals for average daily gain and end weight set above.

III. Learn about carcass quality characteristics — what are they, how are they measured and how do they influence value on a live-weight basis?

1. Develop an understanding of carcass quality characteristics, how they are measured and how they relate to both carcass value and live animal value.
2. Develop an awareness of Beef Quality Assurance techniques and issues.

provide an indication of composition, and characterize performance potential and nutritional requirements of an animal.

Low frame scores are descriptive of cattle which are short in stature for their age, tend to be early maturing, and finish for slaughter and mature at lighter body weights. High frame scores indicate cattle that are tall for their age, have a slower rate of maturity, and finish and mature at relatively heavy body weights. Rate of gain is usually higher for larger framed cattle; however, large differences in rate and efficiency of gain exist in cattle of similar size.

For cattle developed under a consistent and adequate plane of nutrition for normal growth, a calculated frame score should be similar regardless of when the animal was measured. Theoretically an animal should have the same frame score throughout its life. Inconsistent environmental factors and management can alter skeletal growth rate, which may result in cattle developing slightly faster or slower than anticipated. As a result, animals may increase or decrease a frame score over time depending on rate of growth.

The Beef Improvement Federation has recommended in its "Guidelines for Uniform Beef Improvement Programs" that height measurements for the calculation of frame score be taken at the hip directly over the hock bones as illustrated in Figure 1.

Height measurements can be collected with hip height measuring sticks marked specifically for that purpose. Such height sticks are constructed with a sliding arm containing a bubble level on a pole scaled in height increments. To make a measurement, the pole is held vertically alongside the animal's hip with the sliding arm positioned level and directly over the hock bones and a measurement read from the pole where the arm attaches. For accurate height measurements it is necessary for the animal to have its legs set squarely and head in a normal position.

An alternative to using a height stick where the accuracy of individual measurements is not as critical is to place a grid marked in height increments inside a scale or working chute. As cattle are being worked, a height can be read off the grid by sighting across the animal's hip.

Beef Cattle Frame Scores

Frame scores are an objective, numerical description of cattle skeletal size which reflect the growth pattern and potential mature size of an animal. Frame score values typically range from 2 to 9 and are calculated from hip height and age. Frame scores are frequently reported as supplementary information to weight and other performance data. They can be used to predict mature size,

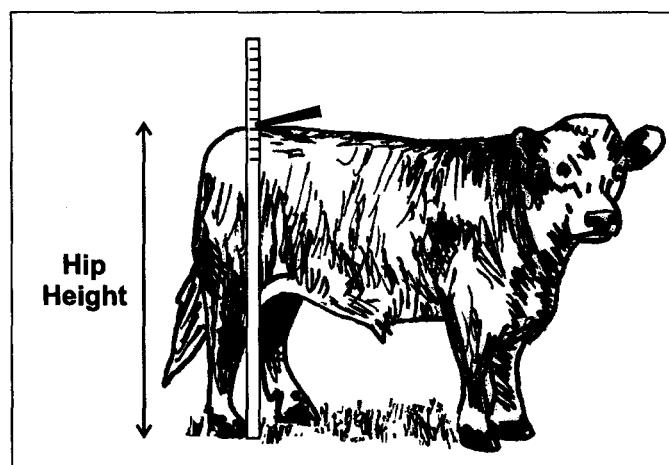


Figure 1. Proper position for correctly measuring hip height.

Source: BIF Guidelines for Uniform Beef Improvement Programs, 1990

Modifications can also be made to equip cattle handling chutes with a moveable front to back pull-down measuring device calibrated to obtain height measurements.

Beef Improvement Federation recommended procedures are available to adjust actual height measurements to standard performance testing 205-day weaning and 365-day yearling stages. Hip heights adjusted to 205 days should be collected between 160 and 250 days of age similar to the range for calculating adjusted weaning weights. Cattle should be at least 330 days of age for predicting yearling height measurements that are adjusted to 365 days.

A hip height measurement can be converted to a frame score if the animal's age is known. Frame scores can be approximated from "height for age" frame score tables. There are separate charts for bulls and heifers because of differing rates of skeletal growth between sexes. Beef Improvement Federation frame score charts are presented in Table 1.

As an example of determining a frame score, a bull measuring 48 inches at 330 days of age would be estimated to be about a frame score 5 from the chart. Several beef cattle breed associations have developed their own frame score formulas and charts based on average growth and development within their specific breed. These vary slightly from BIF calculations.

Frame score provides an indication of an animal's growth curve, which can be used to project expected finishing weight for slaughter cattle. Table 2 provides an estimate of expected slaughter weight at finish for steers and heifers by frame score.

Table 1. Frame score charts for bulls, steers and heifers. Values within the tables are reported in inches.

Age in Months	Frame Score								
	1	2	3	4	5	6	7	8	9
Bulls and Steers									
5	33.5	35.5	37.5	39.5	41.6	43.6	45.6	47.7	49.7
6	34.8	36.8	38.8	40.8	42.9	44.9	46.9	48.9	51.0
7	36.0	38.0	40.0	42.1	44.1	46.1	48.1	50.1	52.2
8	37.2	39.2	41.2	43.2	45.2	47.2	49.3	51.3	53.3
9	38.2	40.2	42.3	44.3	46.3	48.3	50.3	52.3	54.3
10	39.2	41.2	43.3	45.3	47.3	49.3	51.3	53.3	55.3
11	40.2	42.2	44.2	46.2	48.2	50.2	52.2	54.2	56.2
12	41.0	43.0	45.0	47.0	49.0	51.0	53.0	55.0	57.0
13	41.8	43.8	45.8	47.8	49.8	51.8	53.8	55.8	57.7
14	42.5	44.5	46.5	48.5	50.4	52.4	54.4	56.4	58.4
15	43.1	45.1	47.1	49.1	51.1	53.0	55.0	57.0	59.0
16	43.6	45.6	47.6	49.6	51.6	53.6	55.6	57.5	59.5
17	44.1	46.1	48.1	50.1	52.0	54.0	56.0	58.0	60.0
18	44.5	46.5	48.5	50.5	52.4	54.4	56.4	58.4	60.3
19	44.9	46.8	48.8	50.8	52.7	54.7	56.7	58.7	60.6
20	45.1	47.1	49.1	51.0	53.0	55.0	56.9	58.9	60.9
21	45.3	47.3	49.2	51.2	53.2	55.1	57.1	59.1	61.0
Heifers									
5	33.1	35.1	37.2	39.3	41.3	43.4	45.5	47.5	49.6
6	34.1	36.2	38.2	40.3	42.3	44.4	46.5	48.5	50.6
7	35.1	37.1	39.2	41.2	43.3	45.3	47.4	49.4	51.5
8	36.0	38.0	40.1	42.1	44.1	46.2	48.2	50.2	52.3
9	36.8	38.9	40.9	42.9	44.9	47.0	49.0	51.0	53.0
10	37.6	39.6	41.6	43.7	45.7	47.7	49.7	51.7	53.8
11	38.3	40.3	42.3	44.3	46.4	48.4	50.4	52.4	54.4
12	39.0	41.0	43.0	45.0	47.0	49.0	51.0	53.0	55.0
13	39.6	41.6	43.6	45.5	47.5	49.5	51.5	53.5	55.5
14	40.1	42.1	44.1	46.1	48.0	50.0	52.0	54.0	56.0
15	40.6	42.6	44.5	46.5	48.5	50.5	52.4	54.4	56.4
16	41.0	43.0	44.9	46.9	48.9	50.8	52.8	54.8	56.7
17	41.4	43.3	45.3	47.2	49.2	51.1	53.1	55.1	57.0
18	41.7	43.6	45.6	47.5	49.5	51.4	53.4	55.3	57.3
19	41.9	43.9	45.8	47.7	49.7	51.6	53.6	55.5	57.4
20	42.1	44.1	46.0	47.9	49.8	51.8	53.7	55.6	57.6
21	42.3	44.2	46.1	48.0	50.0	51.9	53.8	55.7	57.7

Table 2. Relationship of frame size to projected mature cow weight and slaughter weight at Choice Quality Grade.

BIF Numerical Frame Score	USDA Feeder Calf Frame Score	Mature Cow Weight	Steer Slaughter Weight	Heifer Slaughter Weight
2	Small	955	850	700
3		1030	950	800
4	Medium	1100	1050	900
5		1175	1150	1000
6	Large	1250	1250	1100
7		1320	1350	1200
8		1395	1450	1300
9		1470	1550	1400

Source: Adapted from Boggs, South Dakota State University, 1991

These projections are for average cattle; actual weights will also vary due to differences in muscling, body length, condition and other factors.

Large frame size is associated with greater growth potential, longer finishing periods and heavier slaughter weights. The generally preferred range for carcass weights of 650 to 850 pounds suggests the need to produce feeder cattle with a frame score between 5 and 7.

The current USDA feeder cattle grading system is based on the factors of frame size and muscle thickness. Three frame score designations are included: large, medium, and small, which relate to an evaluation by appearance of an animal's skeletal height in relation to its age and the weight at which an animal will produce a choice quality carcass with about 0.5 inches external fat at the 12th rib.

Large frame steers and heifers would not be expected to produce choice carcasses until their live weight exceeds 1250 and 1100 pounds, respectively. Medium frame steers would be expected to produce choice carcasses at live weights of 1050 to 1150 pounds and heifers at 900 to 1000 pounds. Small frame steers and heifers would produce choice carcasses at live weights of less than 950 and 800 pounds, respectively.

An indication of frame score is very important when estimating growing and finishing cattle nutrient requirements and projected feed intake. Although larger framed cattle will generally have increased intakes, energy concentration in the feed that is used for gain (NEg) is lower than that of medium framed cattle. Furthermore, protein requirements for large framed steers have been

based on medium framed steers that weigh 15% less. This results in a greater protein requirement for large compared to medium framed cattle.

Frame score measurements are descriptive of animal type and growth patterns in beef cattle. They are useful in evaluating animal nutritional requirements, characterizing target market weights, and aid in selection decisions.

Example

An April-born calf measured 45 inches at the hip and weighed 625 pounds in December. From April to December is 8 months, and using the bull and steer chart from Table 1, an 8-month-old calf with a hip-height of 45 inches has a frame score of 5. From Table 2, a frame score 5 steer should finish at about 1150 pounds. 1150 minus 625 equals 525 pounds of gain needed to finish.

Assuming an August target date, there are approximately 240 days from December to August. Therefore we need an average daily gain (ADG) of 525 divided by 240 days, which equals 2.2 pounds of gain per day. We can now develop a ration, and adjust it periodically as the steer grows, to meet our goal of an 1150 pound finished steer in August.

$$\begin{aligned} \text{ADG Needed} &= (\text{Finish Weight} - \text{Starting Weight}) \div \text{Number of Days} \\ 2.2 &= (1150 - 635) \div 240 \end{aligned}$$

Note:

For show steers, reduce the number of days by about 20 to account for weight losses or reduced weight gain associated with washing, training and hauling prior to the show. In the above sample, 220 days should be used rather than 240.

Diets for Growing/Finishing Steers

Diets in Tables 3 through 8 were formulated using the following assumptions: Angus steers, with an initial age of 9 months, fed to finish. All steers were assumed to be implanted (e.g. Ralgro, Synovex)¹ and fed an ionophore (e.g. Rumensin, Bovatec).²

Environmental conditions included a dry pen, 20 F and a 5 mph wind speed. Steers were acclimated to cold weather. Dry matter intakes were estimated. Feedstuffs were limited to barley or corn grain, high or medium quality hay and corn silage. Protein supplement and limestone as a source of calcium were included in some diets (see chart on page 5).

Based upon these assumptions, cattle should perform as expected. Steers should gain better than expected if intake is greater than indicated in the following tables or if the average temperature exceeds 20 F. Performance could be depressed if intakes are not maintained or during long periods of extremely cold weather.

For example, you have a frame score 5.5 steer weighing 500 pounds and wish to feed corn grain and alfalfa hay. Example rations for this situation are found in the middle of Table 3. If you desire an average daily gain of 2.0 pounds, you would expect the steer to eat 15.0 pounds of feed daily. To meet the steer's nutritional needs, 4.2 pounds of corn, 10.8 pounds of alfalfa hay and no (0) additional protein or limestone supplemented is needed. If feeding is going to occur more than once per day, the feed should be equally distributed between feedings.

¹ Expected gains will be reduced 1/4 pound per day if not implanting.

² Expected gains will be reduced 1/4 pound per day if not feeding an ionophore.

Nutrient composition (percent on a dry matter basis).

Feed	Dry Matter (DM)	Total Digestible Nutrients (TDN)	Crude Protein (CP)	Calcium (Ca)	Phosphorous (P)
Barley	88.0	84.0	13.2	0.05	0.35
Corn	88.0	88.0	9.8	0.03	0.31
Prot. suppl.	92.0	69.0	40.9	0.70	1.20
Alfalfa hay	91.0	60.0	17.0	1.39	0.24
Grass hay	88.0	56.0	10.0	0.29	0.28
Corn silage	33.0	66.0	7.8	0.31	0.27
Limestone	100.0	0.0	0.0	34.0	0.02

Table 3. Corn grain and high quality hay.

Weight	Average Daily Gain	Intake	Grain	Hay	Corn Silage	Protein Supplement	Lime-stone
----- Frame Score = 4.0; Slaughter Weight = 1050 pounds -----							
500	2.0	14.9	5.3	9.6	0.0	0.0	0.00
	2.5	14.3	8.7	4.2	0.0	1.4	0.06
700							
	2.0	19.1	6.8	12.3	0.0	0.0	0.00
	2.5	18.5	11.2	5.4	0.0	1.8	0.08
900	2.0	19.9	12.1	5.9	0.0	1.9	0.00
	2.5	—	—	—	—	—	—
----- Frame Score = 5.5; Slaughter Weight = 1200 pounds -----							
500	2.0	15.0	4.2	10.8	0.0	0.0	0.00
	2.5	14.5	7.2	6.7	0.0	0.6	0.00
	3.0	14.3	10.0	1.4	0.0	2.7	0.19
700	2.0	19.1	5.9	13.2	0.0	0.0	0.00
	2.5	18.8	9.5	8.3	0.0	0.9	0.00
	3.0	17.7	13.8	1.2	0.0	2.5	0.16
900	2.0	22.4	7.3	15.1	0.0	0.0	0.00
	2.5	21.7	12.1	7.7	0.0	1.9	0.00
	3.0	20.5	17.4	1.0	0.0	2.0	0.18
1100	2.0	23.9	10.9	12.9	0.0	0.0	0.00
	2.5	22.5	18.1	2.2	0.0	2.2	0.10
	3.0	—	—	—	—	—	—
----- Frame Score = 7.0; Slaughter Weight = 1350 pounds -----							
600	2.0	17.1	3.5	13.6	0.0	0.0	0.00
	2.5	16.9	6.9	10.0	0.0	0.0	0.00
	3.0	16.3	10.6	4.0	0.0	1.6	0.14
800	2.0	21.4	4.4	17.0	0.0	0.0	0.00
	2.5	21.1	8.6	12.5	0.0	0.0	0.00
	3.0	20.3	13.2	4.9	0.0	1.9	0.18
1000	2.0	24.4	6.3	18.1	0.0	0.0	0.00
	2.5	26.4	11.0	15.4	0.0	0.0	0.00
	3.0	23.0	16.1	4.5	0.0	2.2	0.20
1200	2.0	25.6	10.5	15.2	0.0	0.0	0.00
	2.5	24.8	15.1	7.3	0.0	2.4	0.00
	3.0	—	—	—	—	—	—

Table 4. Corn grain and medium quality hay.

Weight	Average Daily Gain	Intake	Grain	Hay	Corn Silage	Protein Supplement	Lime-stone
----- Frame Score = 4.0; Slaughter Weight = 1050 pounds -----							
500	2.0	15.2	6.0	7.6	0.0	1.4	0.13
	2.5	14.5	8.7	2.9	0.0	2.8	0.19
700							
	2.0	19.6	7.8	9.8	0.0	1.9	0.17
	2.5	18.7	11.2	3.7	0.0	3.6	0.25
900	2.0	20.2	12.1	4.0	0.0	3.9	0.18
	2.5	—	—	—	—	—	—
----- Frame Score = 5.5; Slaughter Weight = 1200 pounds -----							
500	2.0	15.3	4.9	8.9	0.0	1.5	0.00
	2.5	14.9	7.3	5.4	0.0	2.1	0.13
	3.0	13.9	10.4	0.7	0.0	2.7	0.12
700	2.0	19.7	6.3	11.4	0.0	1.9	0.09
	2.5	19.1	9.4	6.9	0.0	2.7	0.17
	3.0	17.9	13.9	1.3	0.0	2.4	0.31
900	2.0	22.9	8.5	11.5	0.0	2.9	0.10
	2.5	22.0	12.1	5.5	0.0	4.2	0.10
	3.0	21.0	16.7	1.0	0.0	3.0	0.18
1100	2.0	24.2	10.9	9.7	0.0	3.5	0.00
	2.5	22.5	17.9	1.6	0.0	2.8	0.20
	3.0	—	—	—	—	—	—
----- Frame Score = 7.0; Slaughter Weight = 1350 pounds -----							
600	2.0	17.7	4.8	11.4	0.0	1.3	0.16
	2.5	17.3	6.9	7.8	0.0	2.5	0.15
	3.0	16.7	10.0	3.3	0.0	3.2	0.22
800	2.0	22.0	5.9	14.3	0.0	1.7	0.19
	2.5	21.5	8.6	9.7	0.0	3.1	0.19
	3.0	20.7	12.3	4.1	0.0	3.9	0.27
1000	2.0	25.1	7.5	15.0	0.0	2.4	0.22
	2.5	24.6	11.0	9.8	0.0	3.5	0.22
	3.0	23.2	16.2	3.5	0.0	3.3	0.20
1200	2.0	26.5	10.5	13.2	0.0	2.5	0.23
	2.5	25.1	15.1	5.0	0.0	4.8	0.22
	3.0	—	—	—	—	—	—

Table 5. Corn grain, medium quality hay and corn silage.

Weight	Average Daily Gain	Intake	Grain	Hay	Corn Silage	Protein Supplement	Lime-stone
----- Frame Score = 4.0; Slaughter Weight = 1050 pounds -----							
500	2.0	25.4	3.8	3.4	16.2	1.8	0.13
	2.5	18.1	7.9	1.4	5.8	2.8	0.19
----- Frame Score = 5.5; Slaughter Weight = 1200 pounds -----							
500	2.0	21.8	3.8	6.1	10.2	1.5	0.14
	2.5	22.4	6.0	2.2	11.9	2.1	0.13
	3.0	16.6	9.2	0.0	3.8	3.4	0.19
700	2.0	27.7	4.9	7.8	13.0	1.9	0.09
	2.5	28.7	7.6	2.9	15.3	2.7	0.17
	3.0	22.5	12.6	0.0	7.2	2.6	0.20
900	2.0	32.3	6.9	8.0	15.2	2.2	0.00
	2.5	33.4	10.0	2.2	17.8	3.2	0.10
	3.0	24.2	16.5	0.0	5.5	2.0	0.18
1100	2.0	36.1	9.6	3.6	19.3	3.5	0.11
	2.5	28.6	16.0	0.0	9.1	3.3	0.20
	3.0	—	—	—	—	—	—
----- Frame Score = 7.0; Slaughter Weight = 1350 pounds -----							
600	2.0	29.4	2.6	6.2	18.8	1.7	0.16
	2.5	24.5	6.0	4.3	11.5	2.5	0.15
	3.0	22.0	9.1	0.8	8.8	3.2	0.15
800	2.0	36.5	3.3	7.6	23.3	2.1	0.19
	2.5	30.3	7.5	5.3	14.2	3.1	0.19
	3.0	27.3	11.3	1.0	10.9	3.9	0.18
1000	2.0	42.0	3.8	8.8	26.8	2.4	0.22
	2.5	34.5	9.7	4.9	16.2	3.5	0.21
	3.0	26.6	15.9	1.1	6.1	3.3	0.20
1200	2.0	39.7	7.9	7.9	21.1	2.5	0.23
	2.5	35.5	13.8	1.3	16.7	3.6	0.22
	3.0	—	—	—	—	—	—

Table 6. Barley grain and high quality hay.

Weight	Average Daily Gain	Intake	Grain	Hay	Corn Silage	Protein Supplement	Lime-stone
----- Frame Score = 4.0; Slaughter Weight = 1050 pounds -----							
500	2.0	14.9	6.1	8.8	0.0	0.0	0.00
	2.5	14.4	10.1	3.5	0.0	0.7	0.13
----- Frame Score = 5.5; Slaughter Weight = 1200 pounds -----							
500	2.0	15.0	4.6	10.4	0.0	0.0	0.00
	2.5	14.7	8.2	6.5	0.0	0.0	0.00
	3.0	—	—	—	—	—	—
700	2.0	19.2	7.8	11.3	0.0	0.0	0.00
	2.5	18.6	13.1	5.4	0.0	0.0	0.00
900	2.0	20.3	13.4	7.0	0.0	0.0	0.00
	2.5	—	—	—	—	—	—
----- Frame Score = 7.0; Slaughter Weight = 1350 pounds -----							
600	2.0	17.1	3.5	13.6	0.0	0.0	0.00
	2.5	16.9	6.9	10.0	0.0	0.0	0.00
	3.0	16.5	10.0	4.8	0.0	1.6	0.15
800	2.0	21.4	4.4	17.0	0.0	0.0	0.00
	2.5	21.1	8.6	12.5	0.0	0.0	0.00
	3.0	20.5	12.3	6.0	0.0	2.0	0.18
1000	2.0	24.3	6.2	18.0	0.0	0.0	0.00
	2.5	24.0	11.0	13.0	0.0	0.0	0.00
	3.0	23.0	16.1	4.5	0.0	2.2	0.20
1200	2.0	25.6	10.5	15.2	0.0	0.0	0.00
	2.5	24.5	16.1	6.0	0.0	2.4	0.00
	3.0	—	—	—	—	—	—

Table 7. Barley grain and medium quality hay.

Weight	Average Daily Gain	Intake	Grain	Hay	Corn Silage	Protein Supplement	Lime-stone
----- Frame Score = 4.0; Slaughter Weight = 1050 pounds -----							
500	2.0	15.3	6.9	7.6	0.0	0.7	0.13
	2.5	14.4	10.7	2.1	0.0	1.4	0.19
700	2.0	19.7	9.8	9.8	0.0	0.0	0.17
	2.5	18.8	14.0	3.7	0.0	0.9	0.16
900	2.0	20.6	14.3	5.1	0.0	1.0	0.18
	2.5	—	—	—	—	—	—
----- Frame Score = 5.5; Slaughter Weight = 1200 pounds -----							
500	2.0	15.6	3.9	11.6	0.0	0.0	0.14
	2.5	15.1	8.9	5.2	0.0	0.7	0.20
	3.0	—	—	—	—	—	—
700	2.0	19.9	7.9	11.9	0.0	0.0	0.17
	2.5	19.4	11.5	6.7	0.0	0.9	0.25
	3.0	18.2	15.4	0.9	0.0	1.7	0.24
900	2.0	23.2	10.3	12.6	0.0	0.0	0.20
	2.5	22.2	15.4	5.5	0.0	1.1	0.19
	3.0	—	—	—	—	—	—
1100	2.0	24.3	15.7	8.4	0.0	0.0	0.21
	2.5	22.7	21.4	1.1	0.0	0.0	0.20
	3.0	—	—	—	—	—	—
----- Frame Score = 7.0; Slaughter Weight = 1350 pounds -----							
600	2.0	17.7	4.4	11.4	0.0	1.7	0.16
	2.5	17.3	6.9	7.8	0.0	2.5	0.15
	3.0	16.7	10.0	3.3	0.0	3.2	0.22
800	2.0	22.0	5.5	14.3	0.0	2.1	0.19
	2.5	21.5	8.6	9.7	0.0	3.1	0.19
	3.0	20.8	12.4	4.1	0.0	4.0	0.27
1000	2.0	25.1	7.5	15.0	0.0	2.4	0.22
	2.5	24.3	11.6	9.0	0.0	3.5	0.21
	3.0	23.1	16.1	3.5	0.0	3.3	0.20
1200	2.0	26.3	11.8	11.8	0.0	2.5	0.23
	2.5	24.9	16.2	5.0	0.0	3.6	0.22
	3.0	—	—	—	—	—	—

Table 8. Barley grain, medium quality hay and corn silage.

Weight	Average Daily Gain	Intake	Grain	Hay	Corn Silage	Protein Supplement	Lime-stone
----- Frame Score = 4.0; Slaughter Weight = 1050 pounds -----							
500	2.0	25.3	4.5	3.0	16.1	1.4	0.13
	2.5	19.5	8.7	0.7	7.8	2.1	0.19
700	2.0	32.7	5.9	3.9	20.8	1.9	0.17
	2.5	26.5	12.1	0.9	12.4	0.9	0.16
900	2.0	27.4	12.3	2.0	10.9	2.0	0.18
	2.5	—	—	—	—	—	—
----- Frame Score = 5.5; Slaughter Weight = 1200 pounds -----							
500	2.0	24.4	3.8	5.4	14.3	0.7	0.14
	2.5	26.7	5.9	0.0	18.9	1.7	0.20
	3.0	15.9	11.5	0.0	2.8	1.3	0.25
700	2.0	31.3	4.9	6.9	18.3	0.9	0.17
	2.5	34.6	7.7	0.0	24.6	2.2	0.17
	3.0	20.5	14.9	0.0	3.6	1.7	0.24
900	2.0	36.2	6.9	6.9	21.3	1.1	0.10
	2.5	36.9	12.1	0.0	23.5	1.1	0.19
	3.0	—	—	—	—	—	—
1100	2.0	40.4	10.9	2.4	25.8	1.2	0.11
	2.5	26.7	20.5	0.0	6.1	0.0	0.20
	3.0	—	—	—	—	—	—
----- Frame Score = 7.0; Slaughter Weight = 1350 pounds -----							
600	2.0	28.9	2.6	6.7	17.8	1.5	0.16
	2.5	24.5	6.0	4.3	11.5	2.5	0.15
	3.0	20.5	9.8	0.8	6.5	3.1	0.22
800	2.0	35.7	3.3	8.3	22.1	1.9	0.19
	2.5	30.3	7.5	5.3	14.2	3.1	0.19
	3.0	25.4	12.1	1.0	8.1	3.9	0.27
1000	2.0	39.9	3.8	10.0	23.4	2.4	0.22
	2.5	34.5	9.7	4.9	16.2	3.5	0.21
	3.0	26.9	16.1	1.1	6.1	3.3	0.30
1200	2.0	41.7	7.9	6.6	24.5	2.5	0.23
	2.5	31.2	14.9	2.5	10.0	3.6	0.22
	3.0	—	—	—	—	—	—

Beef Quality Assurance

Consumers today are more concerned than ever about the food they eat. Cattle producers must take responsibility that the beef they produce is a healthy, wholesome, and quality product and their management meets regulatory standards. Assuring quality beef begins with an attitude to do things in the production process that enhance quality and safety and minimize defects or risks. A number of good management practices have been identified to guide producers in assuring beef quality.

Good beef begins with good feed. Several regulations exist concerning feed used in cattle rations. For example, pesticides used on crops for feed must have U.S. government agency approval. Also, no ruminant-derived protein sources can now be fed to cattle as a precaution against the transmission of bovine spongiform encephalomyelitis. A wide variety of feed additives and medications are given to cattle to enhance performance and health. It is important that only government approved products are used in accordance with label directions.

Guidelines and directions for use are attached to the product container. Included are instructions for dosage, how to administer, precautions, and the length of withdrawal period necessary from when the animal receives the product and when it is safe to slaughter it to avoid product residues in the meat. It is advisable to develop a relationship with a veterinarian to help you find the most effective and safe treatments and products. Take care to handle vaccines and antibiotics properly with regard to storage temperature, sunlight exposure, and mixing

according to label instructions to avoid diminishing their effectiveness.

Good records of products, medications, and treatments fed or administered to either a group of animals or individual animals should be kept. Uniquely numbered ear tags placed at birth or purchase provide a means to keep track of individual animals. Records should include the date used, product used, dosage given, where or how it was administered, and the withdrawal time assigned to the product(s).

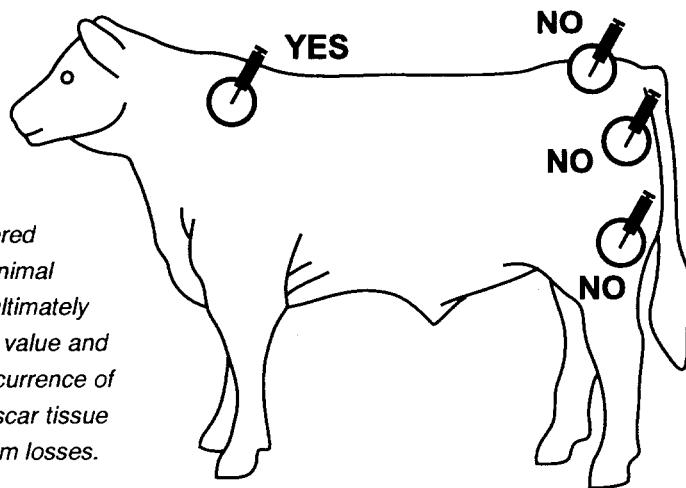
Site and technique for administering injections as either vaccinations or treatments is of special concern. Improperly administered injections increase animal tissue damage that ultimately reduces the animal's value and quality due to the occurrence of lesions, abscesses, scar tissue in the muscle, and trim losses. Whenever possible, medications should be given sub-cutaneous (sub-Q), intravenously (IV) or orally. Intra-muscular (IM) injections should be given in the neck and never exceed 10 cc per injection site. Never give injections in the back leg or rump, as it may cause defects or blemishes in valuable meat cuts. Avoid injecting cattle during wet weather and take care to see that the injection site is free of manure and dirt.

Proper equipment is also important for reducing injection site defects. Use clean sharp needles of the smallest practical size. Generally 16 or 18 gauge needles $\frac{1}{2}$ to $\frac{3}{4}$ inch long for sub-Q and 1 to $1\frac{1}{2}$ inch long for IM are recommended. If a needle bends, loses its sharpness or gets contaminated with dirt or manure, replace it. Dull and dirty needles increase tissue damage and injection site infections and abscesses. Likewise, keep syringes clean using hot water for cleaning guns to administer modified live vaccines and hot water or a mild disinfectant for guns used to administer bacterin.

Animal performance and carcass quality is optimized when people managing animals treat them with patience and care. Handling cattle in ways to minimize stress enhances both immune and rumen functions. Rough handling and poor facilities contribute to bruising and carcass defects.

Providing a good environment which protects animals from severe weather, minimizes mud, and furnishes adequate water is an issue of animal well being and vital to good performance and a quality product. Castrating and dehorning calves

Improperly administered injections increase animal tissue damage that ultimately reduces the animal's value and quality due to the occurrence of lesions, abscesses, scar tissue in the muscle, and trim losses.



early in life, preferably prior to weaning, is generally recognized as minimizing stress in the feeding period. Feeding high grain rations for at least 100 days prior to slaughter is generally needed to obtain desired carcass finish and grade. To avoid digestive problems, reduce liver abscesses, and avoid founder, cattle need to be gradually stepped up on grain rations and then fed multiple and consistent feedings per day.

Everyone involved in the beef business needs to strive in all aspects to produce the best product possible that will exceed beef consumers' expectations for safe, wholesome, and quality meat.

Beef Grading

How to calculate quality and yield grades

The grade of a beef cut sold at retail can be an important selection factor for many consumers. Likewise, the grade of a beef carcass is critical to the beef producer, since the dollar value received is directly dependent on the grade. Yet consumers and producers alike often are confused as to what grades mean and how they are determined.

Determining USDA quality grade

Beef quality refers to the expected eating characteristics (tenderness, juiciness and flavor) of the cooked product. USDA quality grades are used to reflect differences in expected eating quality among slaughter cattle and their carcasses. There are eight USDA quality grades for beef:

Prime	Commercial
Choice	Utility
Select	Cutter
Standard	Canner

Eating quality generally is most desirable for "Prime beef" and least desirable for "Canner beef." The quality grade of a beef carcass is determined by evaluating carcass indicators of physiological maturity and marbling, as reflected in the Official USDA Grading Chart (Figure 2). For example, a carcass in the A maturity group with a small degree of marbling would be graded USDA Choice.

Physiological Maturity

As animals mature, the lean tends to become darker and less tender. Most cattle are slaughtered at less than 30 months of age which places them in the A maturity class. When chronological age is not known, the beef grader will examine the bone and cartilage of the animal to estimate age. As maturity (or age) increases beyond 30 months, an increase in

marbling is required in order to maintain quality grade levels.

Marbling

Within a maturity group, marbling (the amount and distribution of intramuscular fat) within the ribeye is the primary determinant of USDA quality grade. Visual evaluations of marbling in the ribeye (at the 12th rib cross-section) are related to differences in eating quality of beef. Beef cuts with high levels of marbling are more likely to be tender, juicy and flavorful than cuts with very low levels of marbling. Studies suggest that beef from carcasses grading at least USDA Select is likely to be acceptable in eating quality for most consumers.

Ten marbling scores are used to determine USDA Quality Grades for beef, seven of which are shown in Figure 2. Color photograph standards for USDA marbling scores are available from the National Cattlemen's Beef Association.

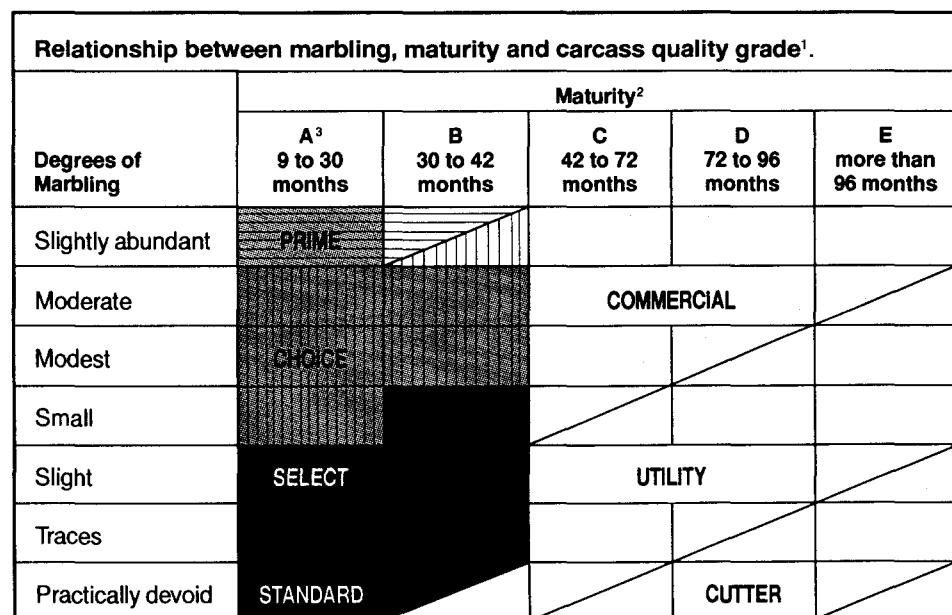


Figure 2: USDA Beef Grading chart.

- Assumes that firmness of lean is comparably developed with the degrees 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.

Determining USDA Yield Grade

USDA yield grades estimate beef carcass cutability, which is defined as the combined yield of closely trimmed, boneless retail cuts (% CTBRC) from the round, loin, rib and chuck. This is an estimate of the relative amount of lean, edible meat from a carcass. The five yield grades for slaughter cattle and beef carcasses are:

- Yield Grade 1
- Yield Grade 2
- Yield Grade 3
- Yield Grade 4
- Yield Grade 5

The lower the numerical value of the USDA yield grade, the higher the yield of closely trimmed, boneless retail cuts (Table 9).

The yield grade of a beef carcass is determined by evaluating the following factors: (1) external fat thickness over the ribeye area, (2) ribeye area, (3) estimating percentage of kidney, pelvic and heart fat (% KPH), and (4) hot carcass weight.

Table 9. Expected yields of closely trimmed boneless retail cuts (%CTBRC) for each USDA yield grade.

Yield Grade	%CTBRC
1	>52.3%
2	50.0 to 52.3%
3	47.7 to 50.0%
4	45.4 to 47.7%
5	<45.4%

Fat thickness

Fat thickness is measured at a point three-fourths of the distance of the length of the ribeye from its chine bone side (Figure 3). This single measurement is a reasonably accurate predictor of overall carcass fatness; however, to improve the accuracy of the predictions of overall carcass fatness, the fat thickness measurement usually is adjusted up or down by the grader to account for visible differences in the distribution of external fat in the other areas of the carcass.

Ribeye Area and Carcass Weight

The relationship between ribeye area and carcass weight is used in yield grading beef carcasses to reflect differences in cutability stemming from carcass muscularity. This measurement is taken between the 12th and 13th ribs of the carcass.

Ribeye area can range from about 9 to 17 square inches; however, a preferred range will be between 12 and 15 square inches among carcasses of common weights. Typical beef cattle at finished slaughter weights will have approximately 1.6 square inches of ribeye per 100 pounds of carcass weight. Ribeye area can be measured by using a plastic grid (Figure 4).

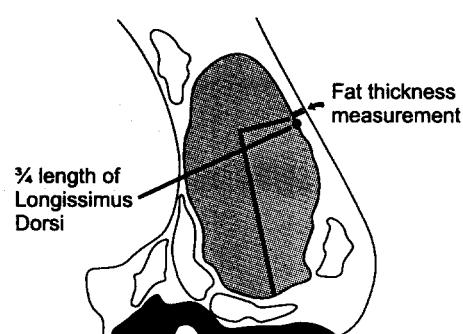


Figure 3. The location where fat thickness over the ribeye is measured.

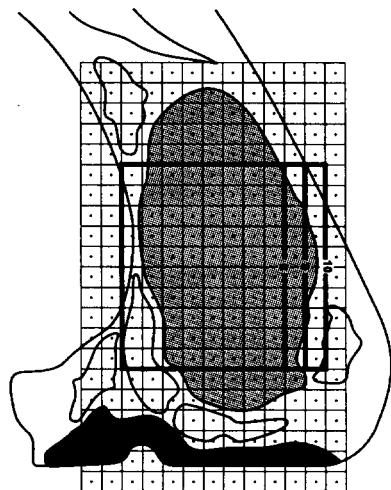


Figure 4. Method of measuring ribeye area. In using the grid to measure a ribeye, place it on the cut surface of the ribeye and count all squares in which lean surrounds a dot. Divide the number of square counted by 10. The resulting number is the area of the ribeye in square inches.

Kidney, Pelvic and Heart Fat Percentage (% KPH)

Fat deposits around the kidney and heart and in the pelvic cavity typically are left in the carcass during the slaughter process and affect carcass cutability. Most carcasses have 1 to 4 percent of the carcass weight represented as kidney, pelvic and heart fat.

Calculating USDA Yield Grades

The formula for calculating yield grade is:

$$\begin{aligned} \text{YG} = & 2.5 + (2.5 \times \text{adjusted fat thickness, in.}) \\ & + (0.2 \times \text{KPH \%}) \\ & + (.0038 \times \text{hot carcass weight, lbs.}) \\ & - (0.32 \times \text{ribeye area, sq. in.}) \end{aligned}$$

While the USDA grader may use this equation occasionally, most determinations are based upon the grader's experience and training, checking occasionally with the formula when requested to do so. The same holds true for the grader's determination of the USDA quality grade.

Determining Carcass and Live Animal Value

Consumers and producers often do not have a clear understanding of beef grading. Beef grades are two types, quality grades and yield grades. Most consumers are familiar with the names of several quality grades and may use them as a selection criterion when purchasing at retail. However, yield grades have less direct impact on consumer selection decisions. Producers, on the other hand, depend greatly on both quality and yield grades as a marketing tool for beef cattle and carcasses.

USDA quality grades are used to predict the palatability of meat from a beef animal or carcass, using carcass physiological maturity and marbling to determine the USDA grade. USDA yield grades are used to estimate the expected edible lean meat, with a USDA YG 1 being the leanest and a USDA YG 5 being the fattest.

Beef producers need to utilize the USDA quality grades and yield grades to determine the value of a carcass and of the live animal based on carcass merits.

Many companies in the wholesale and retail meat industry have developed pricing grids that assign premiums or discounts based on carcass quality grades and yield grades.

For example, a base price is established and premiums for prime or choice quality and yield grades #1 and #2 are established. These premiums are added to the base price. An example of one such grid is listed on Table 10. Using this grid

Table 10. Example value-based carcass price grid.

Value based price grid	
Base price = \$103.00	
Weight range 535-950	
USDA Quality Grade	\$/cwt
Prime	6.00
Choice	2.00
Select	-3.00
Standard	-13.00
USDA Yield Grade	\$/cwt
YG 1	3.00
YG 2	1.00
YG 3	-1.00
YG 4	-20.00
YG 5	-20.00

and the base carcass price of \$103 per hundredweight (cwt), a choice, yield grade 2 carcass would bring a premium of \$2.00 for choice and \$1.00 for yield grade 2, making the total carcass price received \$106 per cwt.

Retailers then utilize a formula to account for retail product available for sale (which is related to yield grade), current carcass prices and a percentage markup (normally 30%) to determine the retail value (or what they will charge consumers, on average, for the beef contained in the carcass).

Table 11 illustrates how all these components of quality grade, yield grade, carcass prices and retail marketing can and do influence the retail value of a live beef animal.

Table 11. Examples of quality, yield, price and overall value.*

Live Weight	Carcass Weight	Dress	KPH	Fat	REA	Marbling	Quality Grade	Yield Grade	Whole Sale Carcass Price	Live Weight Value
1348	757	56.2	1.5	0.40	12.3	Small	Choice	2.7	1.06	0.60
1358	831	61.2	2.0	0.55	13.0	Modest	Choice	3.3	1.04	0.64
1001	595	59.4	1.5	0.20	10.4	Slight	Select	2.2	1.01	0.60
1180	727	61.6	2.0	0.55	12.8	Modest	Choice	2.9	1.06	0.65
1350	810	60.0	2.0	0.30	13.5	Slight	Select	2.4	1.01	0.61
1131	705	62.3	1.5	0.15	10.0	Slight	Select	2.7	1.01	0.63
1271	827	65.0	2.0	0.45	12.8	Modest	Choice	3.1	1.04	0.68
1051	663	63.1	1.5	0.50	10.0	Small	Choice	3.4	1.04	0.66
1201	752	62.6	2.0	0.70	10.6	Modest	Choice	4.1	0.85	0.53

* Based upon the price grid listed in Table 10.

Value-Based Beef Cattle Production Goals

- ✓ Determine frame scores, beginning weights, desired end weights and calculations needed for average-daily-gains
- ✓ Building rations to meet goals
- ✓ Learn about carcass quality characteristics — what are they, how are they measured and how do they influence value on a live-weight basis?



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