

Feeder Cattle Grades, Carcass Grades, & Meat Palatability

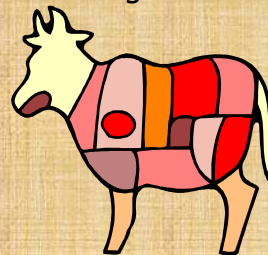
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August 2012

Purpose

- Review the USDA "standards", which reflect the value of cattle and meat
 - Grades of Feeder Cattle and Grades of Meat
- Review "Tenderness" of meat
- Consider how these affect your production goals.
- Focus points
 - **Muscle Thickness & Frame Sizes**
 - **Yield Grades & Quality Grades**
 - **Factors which affect tenderness**



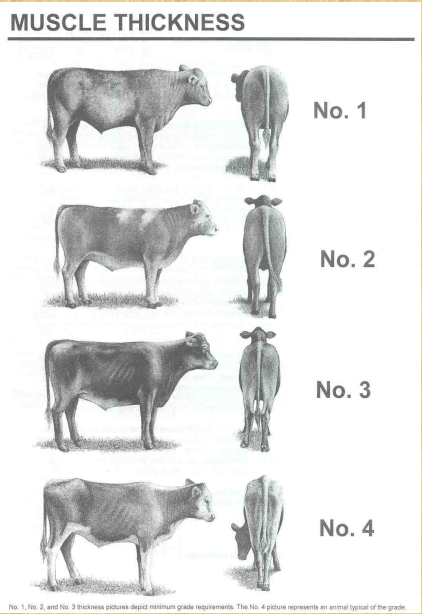
Feeder Cattle Grades

- Muscle Thickness (four categories)
- Frame Score (three categories)



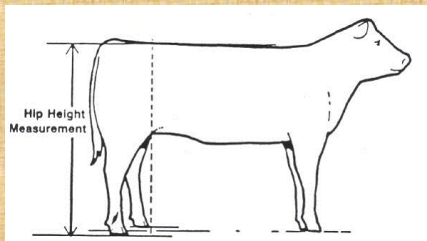
Muscle Thickness (1-4)

- #1 Moderately Thick
- #2 Tends to be slightly thick
- #3 Thin
- #4 Less thickness than minimum for #3



Frame Size

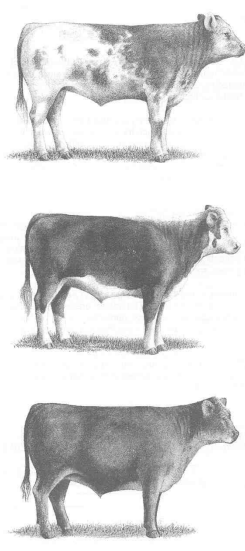
- Two scales
 - ❑ 1 to 9 scale for BIF (Beef Improvement Federation)
 - ❑ Small, medium and large frame (USDA scale)



Tables convert
Hip height for age → frame score

See Frame Score and Feeder
Cattle Grades (CL775) at the end
of these slides.

FRAME SIZE



Large

Medium

Small

Related to the weight an animal will produce a carcass of grade "Choice"

Large and Medium frame pictures depict minimum grade requirements. The small frame picture represents an animal typical of the grade.

Feeder Cattle Grades

- Muscle Thickness (four categories)
- Frame Score (three categories)
 - 12 Combinations of grades for thrifty cattle (3 frame size and 4 muscle thickness)
For example:
medium frame, #2 steer
large frame, #1 steer
 - Inferior Grade for unthrifty animals

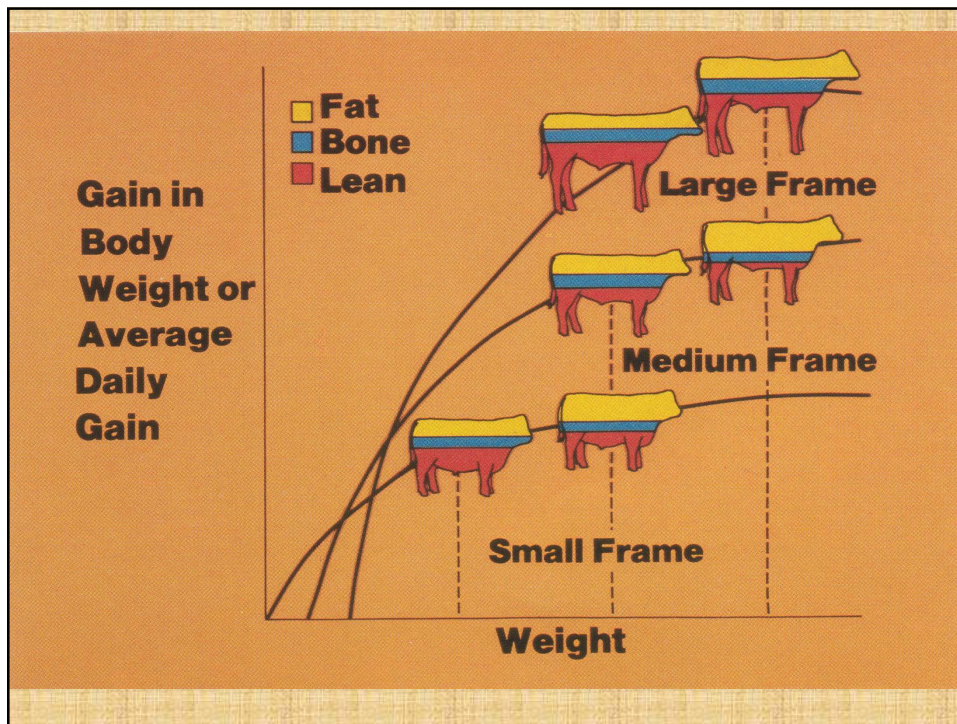
Frame Size & Expected Weight to Grade Choice

<u>FRAME</u>	<u>STEERS</u>	<u>HEIFERS</u>
Large +	↑	↑
Large	↑	↑
Large -	1250#	1150#
Medium +	↑	↑
Medium	↑	↑
Medium -	1100#	1000#
Small +	1100#	1000#
Small	↓	↓
Small -	↓	↓



Small, medium, and large frame steers.

To yield high and grade choice, each size must be fed to a different weight.



If cattle are fed to the weight represented by the middle line, the small-framed cattle are overdone, the medium-framed cattle are about the right finish, and the larger-framed cattle are underfinished.

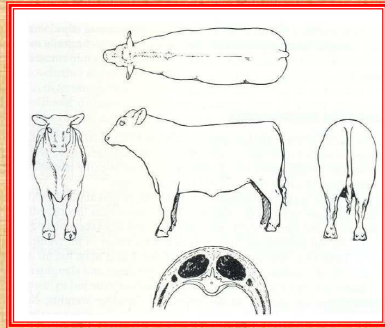
Small, medium, and large frame steers. To yield high and grade choice, each size must be fed to a different weight.

CARCASS

GRADES

Yield Grade (YG)

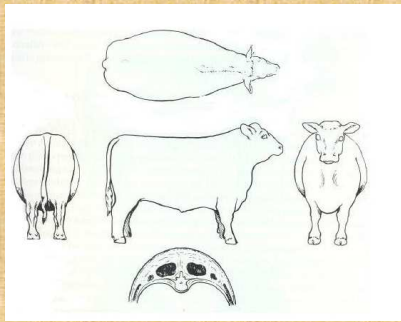
- YG = yield (cutability)
 - Percent of boneless, closely trimmed retail cuts
 - Greatly affected by amount of excess trimmable fat and muscling
- Scores range from 1 to 5
- 1 is the highest YG, 5 is the lowest YG



Yield Grade 1 & 2:

Desirable

All grades are possible on grain and/or grass rations, depending on feed quality, amount fed, and time on feed.



Yield Grade 4 or 5:

Over-Finished

Yield Grade From Carcass Measurements

- Amount of fat, measured in tenths of inches, over the rib-eye muscle (back fat or BF).
- Kidney, pelvic, & heart (KPH) fat, which is estimated as a percentage of carcass weight.
- Area of the rib-eye muscle, which is measured in square inches (REA).
- Hot carcass weight. Carcass weight reflects the amount of inter-muscular fat.

Yield Grade =

= 2.50 + 2.50 (inches of fat at 12th & 13th rib)
+ 0.20 (% kidney, heart & pelvic fat)
+ 0.0038 (lb hot carcass weight)
- 0.32 (square inches of rib eye muscle)

Carcass Measurements

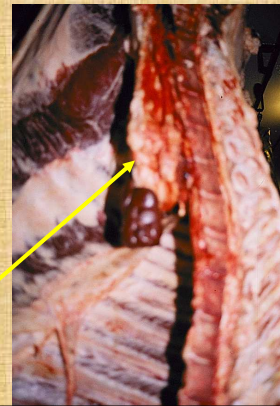




BF = Back fat measured at the 12th & 13th rib (tenths of an inch)



Rib-eye area = REA (sq. in.)



KPH = % kidney, pelvic, and heart fat

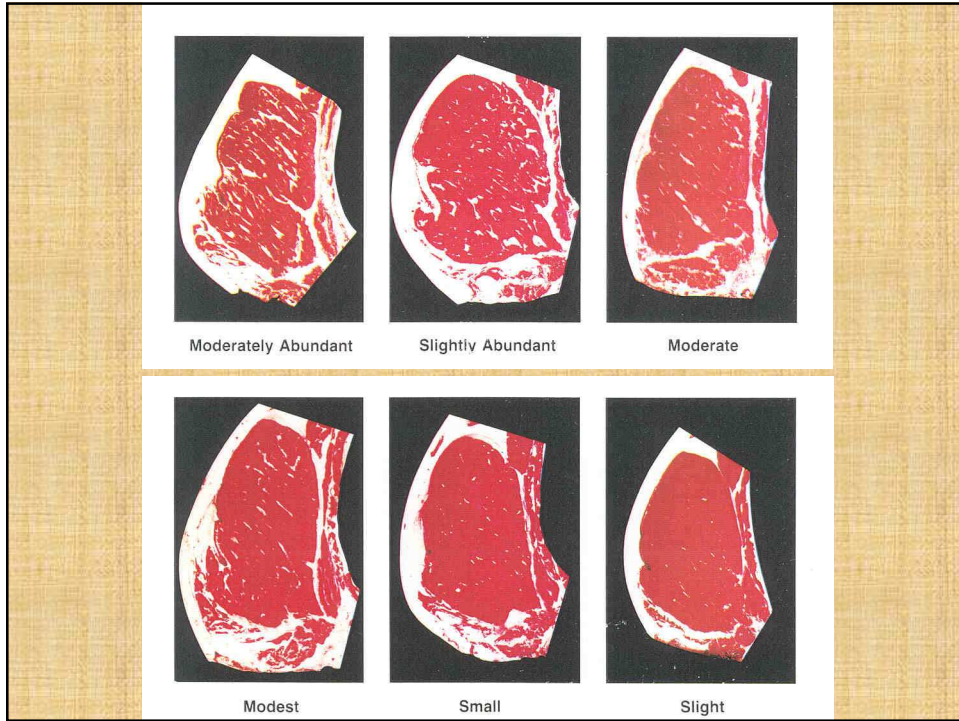
Quality Grades

- Prime
- Choice
- Select
- Standard
- Utility

Quality Grades

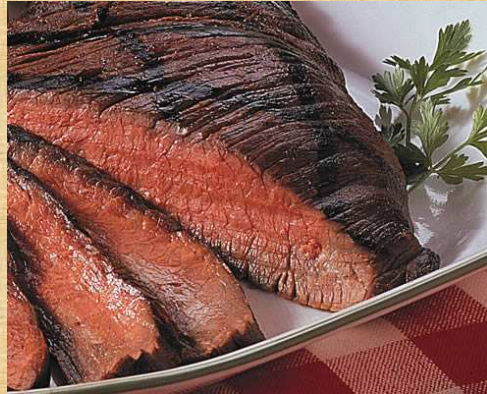
Indicating characteristics are

- Maturity
 - A < 30 months of age
 - B from 30-42 months of age
- Marbling
- Texture of the lean
- Firmness of the lean & fat
- Color of the lean & fat



Quality Grading Chart

Degrees of Marbling	Maturity**					Degrees of Marbling
	A***	B	C	D	E	
Slightly Abundant	Prime					Slightly Abundant
Moderate			Commercial			Moderate
Modest	Choice					Modest
Small						Small
Slight	Select			Utility		Slight
Traces					Cutter	Traces
Practically Devoid	Standard					Practically Devoid



Palatability of Meat

(not in official grade)

- Tenderness, juiciness, and flavor (eating quality)
- Tenderness has the most variability among steaks
- Amount and solubility of connective tissue, and amount of intramuscular fat (marbling), have been associated with meat tenderness.

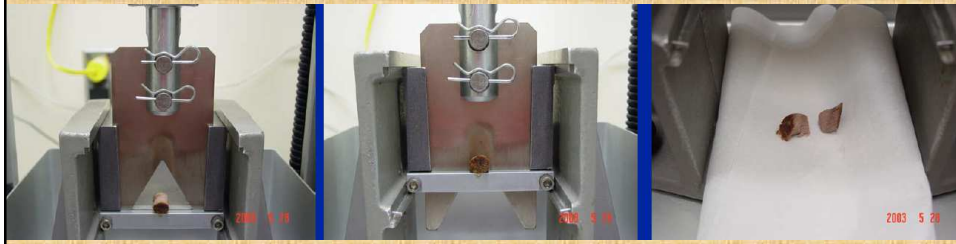
Richard J. Epley (Univ. of Mn);
D. Koohmaraie (USDA MARC)

Meat tenderness - factors

- Genetics ($h^2 \sim 45\%$ of the variation) ★★
- Age of the animal
 - collagen ↑ complexity and strength with age
 - > 30 mo, more pronounced
- Not a function of feed type
 - grain vs. grass
 - indirect effect of age at harvest

Measuring Meat Tenderness

- Warner-Bratzler Shear force
 - Core and shear cooked meat
 - Measure force to shear
- Trained panels



Meat tenderness - factors

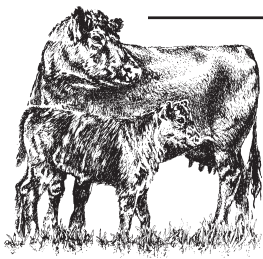
- Location of the cut
 - Tenderloin vs. fore shank
 - Connective tissue needed for locomotion
- Processing
 - Tenderness improves with postmortem storage
 - Amount of stretch or tension upon hanging
 - Hind leg, pelvic or hip bone methods
 - Electrical stimulation
 - Chilling rate

Meat tenderness - factors

- Chill Rate
 - tender beef → rigor mortis meat (6 – 12 hr)
 - “cold shortening” - chill to < 60° F before rigor
 - “thaw rigor” - frozen before rigor
 - <0.5” back fat – problems with chill rate
- Aging
 - Done after rigor mortis, natural enzymatic process, improves tenderness
 - Complete at 35°, for 7 – 10 days post slaughter

Meat tenderness - factors

- Pre-cooking and Cooking
 - Dissolves/degrades collagen and elastin (connective tissue proteins)
 - Slow thawing, grinding, chemicals (salting, marinating, vegetable enzymes), etc...
- Method of cooking and Degree of doneness
 - Quality grades (marbling) and cuts of meat need to be considered.



Cattle Producer's Library

Frame Scores and Feeder Cattle Grades

*Ron Torell and Ben Bruce, University of Nevada, Reno
J. Don Dansie, Ricks College Livestock Center, Rexburg, Idaho*

For an efficient cow-calf operation, estimates of cow performance can help plan management strategies. Frame scores are one way that producers can predict performance of their cattle. Frame scores project mature size, indicate carcass composition, and estimate performance potential and feed requirements.

Frame scores are classifications of skeletal size. Skeletal size indicates mature proportions and subsequently cattle growth patterns. Frame scores are objective number scores that typically range from 1 to 9. Hip height measurements adjusted for age are used to calculate the numbers.

With proper age adjustment, the frame score for the animal should be the same its entire life. This should hold true no matter at what age the measurements are taken. This assumes that there will be proper nutrition and management for that animal.

In real life situations, management or nutrition may not be consistent. Because of this, sometimes animals will change frame scores (usually no more or less than 1) in their lifetime.



Fig. 1. Three different frame scores.

Cattle with low frame scores are smaller and shorter. Cattle with this type of frame usually mature earlier and at lighter body weights. They finish for slaughter earlier and at lighter weights in the feedlot. Cattle with high numbered frame scores are taller and usually later maturing. They weigh more at maturity. They finish at higher weights in the feedlot and tend to convert feed to gain more efficiently. They may not carry as much marbling, lowering carcass value.

Which frame size is more desirable depends upon environmental conditions that the cattle are in as well as management goals and objectives. Fig. 1 is an example of various frame sizes of similar body condition.

Hip height is measured at a point directly over the hook bones (Fig. 2). A specially designed device measures hip height. It has a bubble level on a sliding arm on a pole with scaled measurements. You can also use other methods. It is important, however, that the animal is standing squarely and its head held in a normal position for any measuring technique used.

Adjustments when frame scoring at 205 and 365 days of age must be made for age of calf and age of dam. For the 205-day weights, take hip height measurements

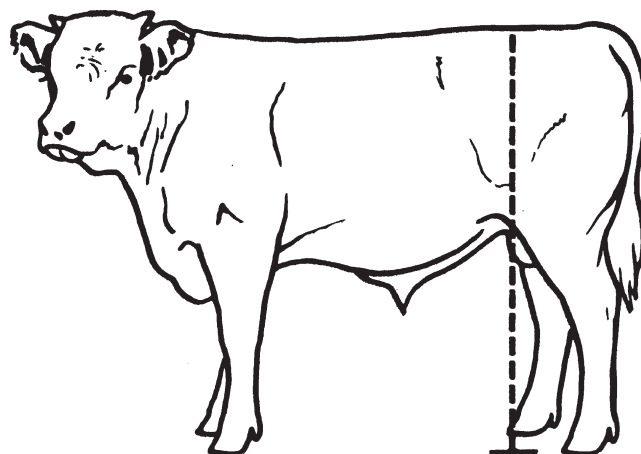


Fig. 2. Proper measurement location for hip heights.

Table 1. 205-day and 365-day height adjustment factors and formulas.

Formula for 205-day height:

$$\text{Adjusted height} = \{ \text{actual height} + [(205 - \text{actual age}) \times \text{age of calf adjustment}] \} \times \text{age of dam adjustment}$$

Formula for 365-day height:

$$\text{Adjusted height} = \text{actual height} + [(365 - \text{actual age}) \times \text{age of calf adjustment}]$$

Factors for adjusting weaning height:

	Bulls	Heifers
Age of calf	0.033	0.025
Age of dam		
2 and 13 or older	1.020	1.020
3 and 12	1.015	1.015
4 and 11	1.010	1.010
5 through 10	1.000	1.000

Factors for adjusting yearling height:

	Bulls	Heifers
Age of calf		
under 365 days	0.033	0.025
over 365 days	0.025	0.025

Source: BIF Guidelines for Uniform Beef Improvement Programs 1990.

between 160 and 250 days of age. For the 365-day weight, cattle should be at least 330 days of age to take the measurements. Table 1 shows the proper adjustment factors for calf age and age of dam. For an example, a bull calf born on March 1 and weaned on October 20 with a 2-year-old dam that measured 43 inches would have an adjusted reading of:

$$\begin{aligned} \text{Adjusted height} &= \{ \text{actual height} + [(205 - \text{actual age}) \times \text{calf age adjustment}] \} \times \text{dam adjustment} \\ &= \{ 43 + [(205 - 234) \times .033] \} \times 1.02 \\ &= [43 + (-.0957)] = 42.043 \times 1.02 \\ &= 42.9 \end{aligned}$$

Calculations are similar when adjusting for yearling heights with the exception the age of the dam factor is not used. The actual frame score is derived from the adjusted hip height and the animal's age. The frame score can be derived from a chart (see Tables 2 and 3 on next page). Charts are different for bulls and heifers. Values for steers are not available; however, bull height estimates may be used as an approximation for steers.

Some breed associations have developed charts that they consider more accurate for their respective breeds. For example, a bull measuring 50 inches (adjusted) at 345 days of age, from the chart, would be approximately a frame score 6.

Frame scores can predict mature cow size. Large frame heifers will grow into large frame cows. The

larger the frame score, the higher the mature weight. The larger the size of the cow, the greater the nutrient demands.

When sufficient nutrients are available, reproductive rates are similar between frame sizes. If nutrition is short, such as in arid regions, a more moderate frame sized cow will be more likely to have its nutrient needs met. This is important in heifer development programs, since moderate frame sizes will reach puberty at an earlier age. Refer to fact sheets CL413, CL446, CL720, and CL733 for additional information on selecting the proper frame size that matches your ranch resources.

Feeder Cattle Grades

Frame scores combined with muscle scores can indicate feedlot finish weights. Large framed animals grow faster but take longer to finish and have heavier slaughter weights. The USDA feeder cattle grading system is based on frame scores and muscle thickness. For feeder cattle, instead of using BIF frame scores, designations of large, medium, and small frames are used (Table 4).

Large-frame feeder cattle (frame scores 6, 7, 8, and 9) have large skeletons, being tall and long bodied. Large-frame steers produce a choice carcass between 1,250 to 1,500 pounds and heifers between 1,150 to 1,400 pounds. Medium-frames (frame scores 4 and 5) are smaller than large frames, but frames are still called a slightly large frame and produce a choice carcass at 1,100 to 1,250 pounds for steers and 1,000 to 1,150 pounds for heifers. Small-frame cattle (frame scores 2 and 3) are shorter, and steers produce choice carcasses at 1,100 pounds or less and heifers at 1,000 or less.

Muscle Scores—Four muscle scores are used (1, 2, 3, and 4) to describe muscle thickness of feeder cattle:

Number 1: Feeder cattle that possess minimum qualifications for this grade usually display predominate beef breeding. They must be thrifty and moderately thick throughout. They are moderately thick and full in the forearm and gaskin, showing a rounded appearance through the back and loin with moderate width between the legs, both front and rear. Cattle show this thickness with a slightly thin covering of fat. Cattle eligible for this grade may carry varying degrees of fat.



Number 2: Feeder cattle that possess minimum qualifications for this grade usually show a high proportion of beef breeding, and slight dairy breeding may be detected. They must be thrifty and tend to be slightly thick throughout. They tend to be slightly thick and full in the forearm and gaskin, showing a rounded appearance through the back and loin with slight width between the



Table 2. Frame score formulas and charts (in inches) for bulls.

Age in months	Frame score								
	1	2	3	4	5	6	7	8	9
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	54.1	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

Source: BIF Guidelines for Uniform Beef Improvement Programs, 1990.

Table 3. Frame score formulas and charts (in inches) for heifers.

Age in months	Frame score								
	1	2	3	4	5	6	7	8	9
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

Source: BIF Guidelines for Uniform Beef Improvement Programs, 1990.

Table 4. Relationship of frame size to projected mature cow weight and slaughter weight at choice quality grade.

Feeder cattle frame size (USDA)	Small		Medium			Large			
	2	3	4	5	6	7	8	9	
Mature cow weight, lb	955	1,030	1,100	1,175	1,250	1,320	1,400	1,470	
Steer slaughter weight, lb	850	1,100	1,100	1,250	1,250	1,350	1,450	1,500	
Heifer slaughter weight, lb	700	1,000	1,000	1,150	1,150	1,200	1,300	1,400	

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

legs, both front and rear. Cattle show this thickness with a slightly thin covering of fat. Cattle eligible for this grade may carry varying degrees of fat.

Number 3: Feeder cattle that possess minimum qualifications for this grade are thrifty and thin through the forequarter and the middle part of the rounds. The forearm and gaskin are thin, and the back and loin have a sunken appearance. The legs are set close together, both front and rear. Cattle show this narrowness with a slightly thin covering of fat. Cattle eligible for this grade may carry varying degrees of fat.



Number 4: Feeder cattle included in this grade are thrifty animals that have less thickness than the minimum requirements specified for the frame score 3 grade.

By combining frame score (small, medium, large) with muscle score (1, 2, 3, 4) classifications, this gives a possibility of classifications 1 to 12. For example, L-1 is a large framed, heavier muscled animal, and S-12 is a small framed, lighter muscled animal (Table 5).



One more feeder cattle grade is called inferior. It is used for cattle that will not perform normally and includes unthrifty animals because of mismanagement (disease, parasites, poor nutrition, etc.) and double muscled cattle.

The purpose of USDA Feeder Cattle Grades is to sort feeder cattle into similar groups that will facilitate their selling and buying. These grades also sort feeder cattle into similar outcome groups in a feedlot. An indication of frame size is important when estimating growing and finishing cattle nutrient requirements, and projected feed intake.

Summary

Frame score is considered to be moderately heritable to highly heritable. As such, selection can significantly change frame scores, primarily achieved through sire selection. With a heritability estimate of .40, about 40 percent of a bull's difference in frame score from herd average will appear in the progeny.

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.

References

- Guidelines for Uniform Beef Improvement Programs. 1996. Beef Improvement Federation. Northwest Research Extension Center, 105 Experiment Farm Rd., KS 67701. Seventh Edition. pg. 18.
- U.S. Standards for Grades of Feeder Cattle. October 2000. USDA. AMS-586.

Table 5. Frame scores and muscle scores combined.

Frame size	Muscle scores			
	1	2	3	4
Large frames (6 to 9)	L-1	L-2	L-3	L-4
Medium frames (4 & 5)	M-5	M-6	M-7	M-8
Small frames (2 & 3)	S-9	S-10	S-11	S-12

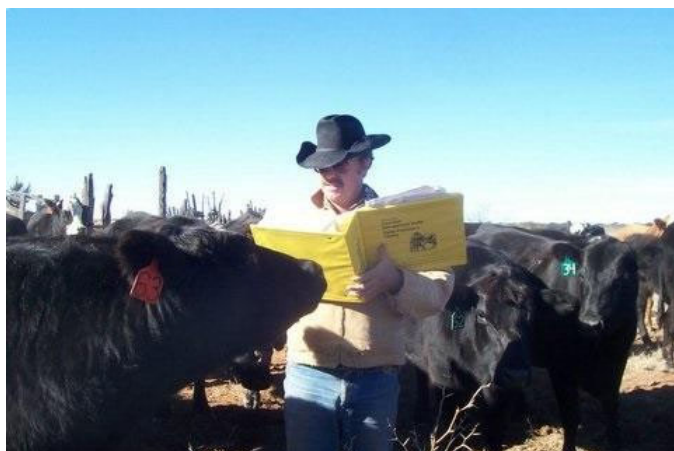


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Cattle Producer's Library



Ron Torell, Univ. of Nevada

Prepared by the Western Beef Resource Committee, which consists of extension specialists in 12 western states, this publication contains 250 fact sheets for cattle producers and is revised/updated annually. Included are sections on quality assurance, nutrition, reproduction, range and pasture, animal health, management, marketing, finance, genetics, and other natural disasters.

The link included here is to a demonstration version (page 1 only) of the fact sheets. Go to site (<http://blogs.oregonstate.edu/beefcattle/cattle-producers-handbook-third-edition-2012/>)

You may order the complete handbook from the following:
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