



Quick Facts

- Linear measurements are more objective than visual appraisal.
- Most simple correlations between skeletal size and such performance traits as birth weight, weaning weight, post-weaning gain, yearling weight and mature size range from .40 to .70.
- Hip height is recommended by the Beef Improvement Federation as the height measure of preference.
- Hip height can be adjusted for age and sex of the cattle being measured.

For the past 10 to 15 years the beef cattle industry has had an acute interest in linear measurements as measures of skeletal size. A great deal of use and misuse has been made by the industry in interpreting such measurements. It is a foregone conclusion that the industry is going to use various procedures in measuring and reporting skeletal size. Therefore, it would be helpful if the industry became unified in using these measurements.

Such states as Missouri have made linear measurements an essential part of their state beef cattle performance testing program. Other states have used measurements of skeletal size, particularly in central bull test stations. The primary reason for using linear measurements is to predict future performance. Numerous research studies have reported positive and reasonably high correlations between measures of skeletal size and performance traits, including weaning weight, post-weaning gain, average daily gain, final weight, adjusted 365-day weight, birth weight, and mature size. Most simple correlations between skeletal size and these performance traits range from .40 to .70.

Evaluation of live animals takes into consideration any measurements or subjective evaluations that help describe a particular animal. For example, evaluation can involve physical examination of the bull's penis, rectum and scrotum. Other common measurements of cattle include backfat, pelvic size, height at the

shoulder, height at the hip, length of body and heart girth.

In recent years, measurements for height have become a descriptive supplement to many herd testing programs. Adjusted height, weight and weight ratios accompanied by linear measurements of height have added another dimension to evaluating the fat-to-lean ratio of an individual animal in a performance measure program.

Linear measurements are more objective than visual appraisal. They supplement comprehensive performance testing. How much emphasis breeders should place on linear measurement information should depend on their goals concerning shape and growth patterns, the extent to which certain shape relationships are important to them and any advantage these shape relationships give them in marketing beef cattle.

A linear measurement should never be interpreted as a replacement for the weight of an animal at a given age. Instead, linear measurements should be used for growth information as a supplement to selection. No single frame size will be optimum for all feed resources, breeding systems, feed costs and management. Reproduction efficiency and market weight will determine the optimum frame size range within a given set of feed resource, breeding system, production cost and management factors.

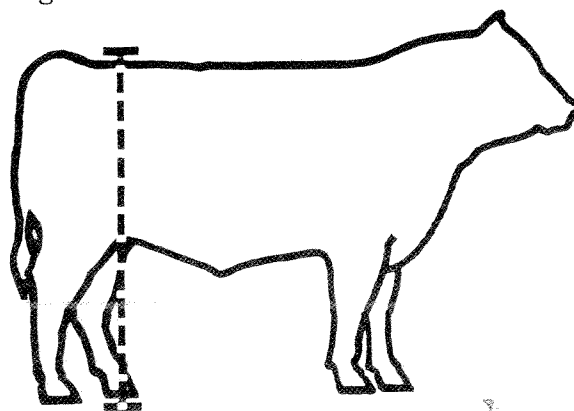


Figure 1: Height measurement.

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Measuring Hip Height

The recommended point for linear measurement for height is over the hip, halfway between the hook and the pin (see Figure 1). This measurement is adjusted to logical production end points at 205 days and 365 days according to the 1981 Beef Improvement Federation guidelines. The adjustments for age and sex are given in the following examples:

Adjusted weaning heights*.

The sex adjustment factor for heights at weaning are

Bulls: 0.033 inch
Heifers: 0.025 inch

Age-of-dam adjustment factors for heights at weaning are:

Age of dam (years)	Bulls (weaning height)	Heifers (weaning height)
2 and 13 or older	1.02	1.02
3 and 12	1.015	1.015
4 and 11	1.01	1.01
5 through 10	— (no adjustment) —	— (no adjustment) —

To adjust heights to 205 days for sex, 1) multiply the number of days **under** 205 by 0.033 for bulls or 0.025 for heifers, and **add** to the actual height; or 2) multiply the number of days **over** 205 by 0.033 for bulls or 0.025 for heifers and **subtract** the result from the actual height. To adjust for age of dam, multiply the adjusted height for sex by the age-of-dam factor.

Example: (heifer).

Actual data: Born Jan. 1, 1979; birth weight 70 pounds; weaned July 21, 1979; weight 470 pounds; height 38 inches; 201 days old; dam 3 years old; adjusted 205-day weight is 496 pounds.

205 days - 201 days = 4 days

38 inches + (4 x 0.025) + 38.1 inches x 1.015 = 38.67 inches = 205-day height adjusted for age of dam and sex of calf.

Adjusted postweaning heights*.

1. Bulls—Daily adjustment may be made as follows:

a. Adjustment for bulls **under** 365 days:
Actual height + (number of days under 365 x 0.033) = adjusted height.

b. Adjustment for bulls **over** 365 days:
Actual height - (number of days over 365 x 0.025) = adjusted height.

2. Heifers—Remember that the great variation in nutritional levels of rations that heifers are fed between weaning and 1 year old can vary their growth rate slightly. The following daily adjustments, however, are fairly accurate for all heifers fed to gain in a range from 0.75 to 2.0 pounds per day:

a. Adjustment for heifers **under** 365 days:
Actual height + (number of days under 365 x 0.025) = adjusted height.

b. Adjustment for heifers **over** 365 days:
Actual height - (number of days over 365 x 0.025) = adjusted height.

Example: (bull).

Actual data: 359 days old; height 49.5 inches; adjusted 365-day weight is 1,050 pounds.

365 days - 359 days = 6 days

49.5 inches + (6 x 0.033) = 49.7 inches = adjusted postweaning height.

Hip heights and corresponding frame scores of bulls, heifers and steers are presented in Tables 1, 2 and 3, respectively.

Table 1: Bulls—hip height chart in inches*.

Months of age	Frame scores						
	1	2	3	4	5	6	7
5	34	36	38	40	42	44	46
6	35	37	39	41	43	45	47
7	36	38	40	42	44	46	48
8	37	39	41	43	45	47	49
9	38	40	42	44	46	48	50
10	39	41	43	45	47	49	51
11	40	42	44	46	48	50	52
12	41	43	45	47	49	51	53
13	41.75	43.75	45.75	47.75	49.75	51.75	53.75
14	42.5	44.5	46.5	48.5	50.5	52.5	54.5
15	43	45	47	49	51	53	55
16	43.5	45.5	47.5	49.5	51.5	53.5	55.5
17	44	46	48	50	52	54	56
18	44.5	46.5	48.5	50.5	52.5	54.5	56.5

Table 2: Heifers—hip height chart in inches*.

Months of age	Frame scores						
	1	2	3	4	5	6	7
5	33.75	35.75	37.75	39.75	41.75	43.75	45.75
6	34.5	36.5	38.5	40.5	42.5	44.5	46.5
7	35.25	37.25	39.25	41.25	43.25	45.25	47.25
8	36	38	40	42	44	46	48
9	36.75	38.75	40.75	42.75	44.75	46.75	48.75
10	37.5	39.5	41.5	43.5	45.5	47.5	49.5
11	38.25	40.25	42.25	44.25	46.25	48.25	50.25
12	39	41	43	45	47	49	51
13	39.75	41.75	43.75	45.75	47.75	49.75	51.75
14	40.25	42.25	44.25	46.25	48.25	50.25	52.25
15	40.75	42.75	44.75	46.75	48.75	50.75	52.75
16	41.25	43.25	45.25	47.25	49.25	51.25	53.25
17	41.75	43.75	45.75	47.75	49.75	51.75	53.75
18	42.25	44.25	46.25	48.25	50.25	52.25	54.25

What to Measure

It appears that the industry is converging on height as the linear measurement to use for describing skeletal size. Much of the research reported and much of the practice to date has been with wither (shoulder) height. More recently, hip height has become the measurement that appears to be most easily obtained. In fact, the Beef Improvement Federation recommends that hip height be the height measure to use. There are several ways to measure hip height, but most cattle will be measured in the chute either with a measuring stick or looking across the animal to a graduated board on the offside of a single animal scale, which in many instances is the most practical manner of measuring height.

Currently, the only standardized system across the United States is the University of Missouri frame scoring system presented in Tables 1 through 3. Some breed associations have expanded those tables to include higher frame scores. It is questionable, however, whether data are available to support the extension of this frame score system.

Summary

Linear measurements, particularly hip height, have served as a means of describing the total animal. There is, apparently, a definite and strong relationship among weight, skeletal size and fatness. Linear measurements also provide a basis for selection. As mentioned previously, skeletal size is heritable near the same level as postweaning average daily gain and final feedlot weight. Therefore, breeders may select for or against skeletal size as they desire.

Hip heights can be useful, but they must be used primarily as a descriptive measure and not as a comparative one. Measures of skeletal size are another tool to refine performance records of beef cattle. Skeletal size measurements should be kept in the proper context.

**To convert to metrics, use the following conversions: 1 inch = 2.5 centimeters; 1 pound = .45 kilogram.*

Table 3: Steers—hip height chart in inches*.

Frame scores							
Months of age	1	2	3	4	5	6	7
5	33	35	37	39	41	43	45
6	34	36	38	40	42	44	46
7	35	37	39	41	43	45	47
8	36	38	40	42	44	46	48
9	37	39	41	43	45	47	49
10	38	40	42	44	46	48	50
11	39	41	43	45	47	49	51
12	40	42	44	46	48	50	52
13	40.75	42.75	44.75	46.75	48.75	50.75	52.75
14	41.5	43.5	45.5	47.5	49.5	51.5	53.5
15	42	44	46	48	50	52	54
16	42.5	44.5	46.5	48.5	50.5	52.5	54.5
17	43	45	47	49	51	53	55
18	43.5	45.5	47.5	49.5	51.5	53.5	55.5