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1988

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Koch, Robert M.; Crouse, John D.; and Seideman, Steven C., "Bison, Hereford, and Brahman Growth and Carcass Characteristics" (1988). *Roman L. Hruska U.S. Meat Animal Research Center*. 75.
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Bison, Hereford, and Brahman Growth and Carcass Characteristics

Robert M. Koch, John D. Crouse, and Steven C. Seideman¹

Introduction

Bison, Hereford, and Brahman represent three species of the bovine family that evolved under different environmental conditions. There has been much interest in these species and hybrids among them to find animal types that are better adapted to the climatic conditions of the U.S. northern temperate zones down to the subtropical areas. There has been considerable research on growth and carcass characteristics of crosses among British, European, and Brahman cattle types, such as studies at MARC. However, there is little experimental documentation of the growth and carcass merit of Bison or their crosses. The three species differ distinctly in conformation, and Bison normally have 14 ribs instead of 13. The experiment described here addresses the differences in growth and carcass characteristics between Bison and two cattle types.

Procedure

Brahman calves, born in January and February, were obtained from the Subtropical Agricultural Research Station, Brooksville, Florida. The Hereford calves, born in March and April, were from the MARC herd. Bison calves, born in May, June, and July were obtained from the Fort Niobrara Wildlife Refuge, Valentine, Nebraska. The period from late September until January 28 was used to adjust the Bison, Hereford, and Brahman groups to the pens and diet to be used during a 224-day feeding trial. Animals

were placed in pens of 5 or 6 animals and fed the following diet: corn silage (66%), corn (22%), and a soybean and mineral supplement (12%), on a dry matter basis. All animals were castrated and dehorned.

The Hereford and Brahman groups were slaughtered in two groups based on the time when Hereford reached an avg wt of 1,150 lb. The Bison were younger, smaller, and varied greatly in wt and rate of gain when placed on feed so were slaughtered when the pen groups attained an avg wt of 900 lb. This wt was thought to be comparable in stage of maturity to the Hereford and Brahman groups.

Detailed carcass evaluation, retail cutout, and taste panel (sensory) evaluations were obtained on all carcasses. The right side was broken into wholesale cuts. Primal cuts were trimmed to an avg of .3 in fat cover and boned out. After aging 7 days, loins were frozen and, at a later date, cut into steaks for sensory evaluation. A trained taste panel of 10 persons evaluated three samples from each loin for variation in juiciness, ease of fragmentation, amount of connective tissue, tenderness, and flavor. The 9-10-11 rib cut was removed from the left side and separated into bone and soft tissue for chemical analysis of the soft tissue. The left loins were used for chemical analysis, fiber type analysis, and shear force determination.

Results

Growth and carcass characteristics are presented in Table 1. Rate of gain for the 224-day test period indicate Hereford > Brahman > Bison. Daily feed intake followed the same pattern. Feed intake as a percentage of avg body wt on test was lowest for Brahman and highest for Hereford with Bison not significantly lower than Hereford. Feed per unit of gain was lowest for Bison and highest for Brahman. Part of the low feed requirement

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Table 1—Growth and carcass characteristics of Bison, Hereford, and Brahman

Item	Bison	Hereford	Brahman
Number	10	12	10
Initial wt, lb	408	550	672
Range in initial wt	266-494	490-642	547-804
Wt after 224 days on feed	787	1,093	1,110
Avg daily gain, 224 days, lb	1.7	2.5	1.9
Feed/day, lb	14.0	21.6	19.4
Feed/avg wt, %	2.4	2.6	2.2
Feed/gain, lb	8.2	8.6	10.3
Avg days to slaughter	336	239	239
Slaughter wt, lb	903	1,149	1,114
Carcass wt, lb	561	701	697
Dressing percentage	62.2	61.0	62.5
Forequarter percentage	53.5	51.4	50.4
Retail product ^a , %	70.6	62.1	63.4
Total fat trim ^b , %	13.3	22.2	21.3
Bone, %	16.1	15.7	15.3
Fat thickness, in	.87	.53	.46
Fat, 9-10-11 rib cut, %	38.8	40.5	37.6

^aRetail product is amount of trimmed, boneless lean relative to side wt.

^bFat in excess of .3 in was trimmed from the surface of cuts and added to the kidney and pelvic fat.

of Bison was associated with a lower avg wt during the 224-day period. When adjusted for differences in avg wt on test, Bison and Hereford were similar (8.1 and 8.2) and lower than Brahman (11.3). The increased efficiency of gain of Bison, in spite of a lower rate of gain, may have been due to a lower basal metabolic rate and maintenance requirement. Growth contrasts in these data should be interpreted with caution, even though a long adjustment period was used before starting the test. Confinement to pens and a moderate density diet is an abnormal situation for Bison, which are not domesticated animals. The Brahman cattle came from Florida and may not have adapted well to the cold winter but should have had a compensating advantage during the hot summer months.

Brahman and Bison had similar dressing percentages and exceeded Hereford. The forequarter percentage differed significantly among all species with Bison the highest and Brahman the lowest. The amount of trimmed, boneless retail product was higher and fat trim was lower for Bison than Brahman and Hereford. Surprisingly, the Bison had more fat over the rib than Hereford or Brahman (Fig 1). This was due to an unusual distribution of the subcutaneous fat with a disproportionate amount being concentrated over the rib portion of the carcass (Fig. 2). The percentage of fat in the 9-10-11 rib cut has often been used as a good indicator of total fat in the carcass of British breeds. Hereford had the highest percentage of fat in the 9-10-11 rib cut and the highest percentage of fat trim. However, the relative discrepancy of 9-10-11 rib fat and total fat trim for Bison and Brahman suggests a differential pattern of fat distribution among the three species.

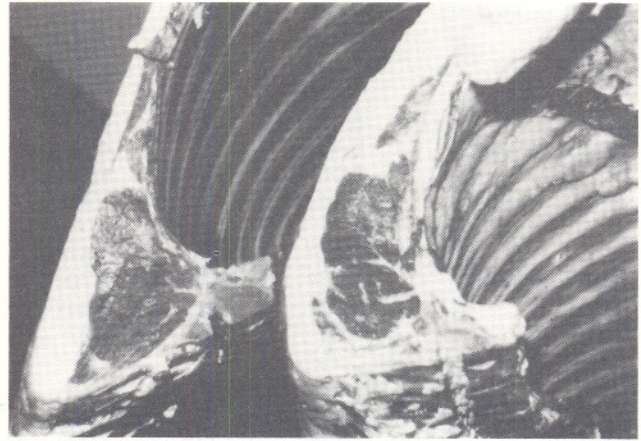


Figure 1—Rib section of Bison (left) and Hereford (right) showing increased fat thickness of Bison vs Hereford.

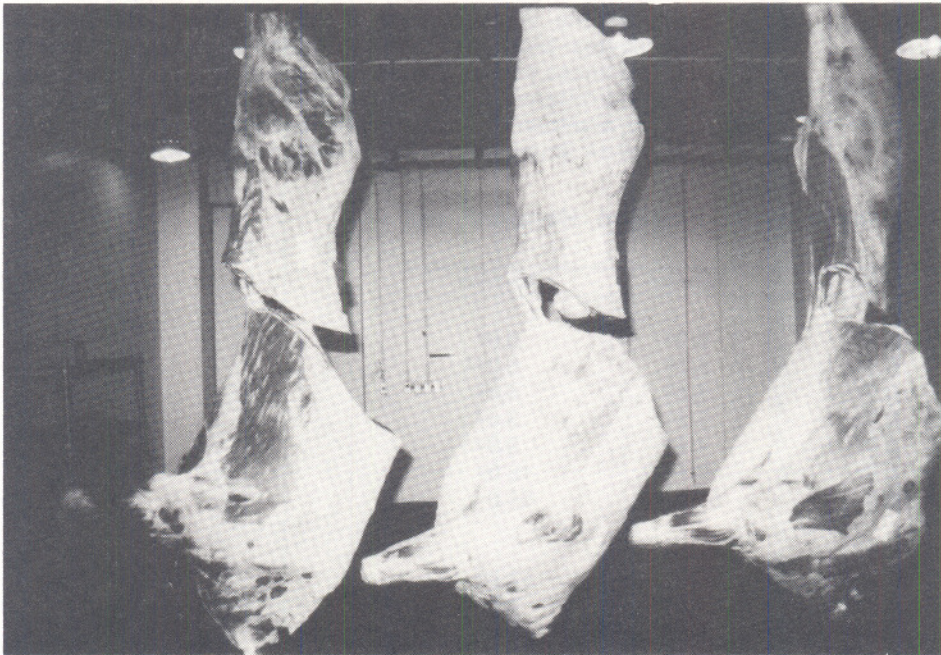


Figure 2—Side of Bison (left), Hereford (middle) and Brahman (right) showing relative fat cover.

Wholesale cut composition as a percentage of side wt is shown in Table 2. Bison had more chuck than Brahman or Hereford. Part of the difference in chuck retail product among species was associated with the hump (rhomboid muscle) of Bison (.54%) and Brahman (1.11%).

Table 2—Wholesale cut composition, as a percentage of side weight

Item	Bison	Hereford	Brahman
Chuck	30.82 ^b	26.80 ^c	27.36 ^c
Retail product	23.39 ^b	18.59 ^d	20.26 ^c
Fat trim	2.83 ^b	4.26 ^c	3.09 ^b
Bone	4.60 ^b	3.94 ^c	4.01 ^c
Rib	8.93 ^b	7.86 ^c	7.40 ^c
Retail product	5.43 ^b	7.82 ^c	4.57 ^c
Fat trim	2.06 ^b	1.54 ^c	1.38 ^c
Bone	1.44	1.49	1.45
Loin	13.95 ^b	15.33 ^c	14.57 ^d
Retail product	10.55 ^b	9.90 ^c	9.70 ^c
Fat trim	1.41 ^b	3.46 ^d	2.94 ^c
Bone	1.99	1.97	1.93
Round	24.19	23.56	24.23
Retail product	19.23 ^b	16.71 ^d	17.65 ^c
Fat trim	.82 ^b	2.77 ^c	2.55 ^c
Bone	4.13	4.08	4.03
Minor cuts ^a	18.95 ^b	23.51 ^d	22.32 ^c
Retail product	11.99 ^b	12.06 ^b	11.20 ^c
Fat trim	2.98 ^b	7.22 ^c	7.22 ^c
Bone	3.98 ^c	4.23 ^c	3.90 ^b
Kidney knob	3.17 ^b	2.94 ^b	4.12 ^c

^aMinor cuts include flank, shank, brisket, and plate.

^{b,c,d}Values with superscripts that do not have a common letter differ (probability < .05).

Bison had a higher percentage of retail product and fat trim in the rib cut than Brahman or Hereford, but, in all other cuts, Bison had less fat trim. Bison may have evolved this extra fat over the rib as an energy storage depot or as protection from a cold environment. Hereford had the largest loin percentage, but this was due to more fat trim. Bison, with the lowest percentage of whole loin, had the highest percentage of loin retail product. The whole round did not differ significantly across species, but it did differ in percentages of retail product and fat trim. Bison had more round retail product and less fat trim than Brahman or Hereford, which might not be expected from a casual appraisal of their conformation. The percentage of minor cuts was lowest in Bison due to low fat trim percentage. The lower percentage of minor cuts for Brahman compared to Hereford was due to less retail product and bone. Hereford had the lowest and Brahman the highest percentage of kidney knob.

Meat and sensory panel characteristics of Bison, Hereford, and Brahman are presented in Table 3. Bison meat had a darker and coarser texture than Hereford or Brahman. The ranking of species for intramuscular fat (marbling score and longissimus muscle fat) was Hereford > Brahman > Bison. Bison also had less total and soluble collagen in the loin than Hereford or Brahman. Brahman had more soluble collagen than Hereford. The cholesterol content of the longissimus muscle, trimmed of all external fat, did not differ significantly among species. Most of the observed differences could be accounted for by intramuscular fat.

Even though Bison had the least amount of intramuscular fat, their shear force values and sensory panel scores for tenderness, ease of fragmentation, and amount of connective tissue were similar to Hereford. Shear force is inversely related to tenderness. Brahman had the highest shear force and lowest tenderness scores. Bison had the highest and Brahman the lowest juiciness scores. The sensory panel detected a stronger and different flavor for Bison as compared to Hereford or Brahman. The taste panel described this as a more intense ammonia, metallic, and gamey flavor.

Table 3—Meat and sensory panel characteristics of Bison, Hereford, and Brahman

Item	Bison	Hereford	Brahman
Meat characteristics^a			
Color score	4.8 ^c	6.0 ^d	5.6 ^d
Texture score	5.7 ^c	6.7 ^d	6.2 ^{cd}
Marbling	3.2 ^c	5.4 ^d	4.4 ^e
Longissimus fat, %	2.7 ^d	5.3 ^c	3.4 ^d
Collagen, mg/g	3.0 ^c	4.1 ^d	3.9 ^d
Soluble collagen, %	8.6 ^c	10.1 ^d	12.0 ^e
Cholesterol (lean), mg/100g	50.6	51.9	51.0
Sensory characteristics^b			
Shear force, lb	11.0 ^{cd}	10.1 ^c	12.8 ^d
Tenderness	5.4 ^d	5.4 ^d	5.0 ^c
Ease of fragmentation	5.4 ^d	5.3 ^d	5.0 ^c
Amount of connective tissue	5.3 ^{de}	5.1 ^d	4.9 ^c
Juiciness	5.3 ^{de}	5.1 ^d	4.9 ^c
Flavor	2.3 ^c	3.0 ^d	3.1 ^d

^aColor scores: 1 = dark, 8 = light; texture scores: 1 = coarse, 8 = fine; marbling scores: 1 = devoid, 5 = small, 10 = abundant.

^bTenderness scores: 1 = extremely tough, 8 = extremely tender; ease of fragmentation: 1 = extremely difficult, 8 = extremely easy; amount of connective tissue: 1 = abundant, 8 = none; juiciness scores: 1 = extremely dry, 8 = extremely juicy; flavor scores: 1 = intense, 4 = none.

^{c,d}Values with superscripts that do not have a common letter differ (probability < .05).