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Performance and Carcass Characteristics of  
Different Cattles Types--A Preliminary Report

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This report contains results from the U.S. Meat Animal Research Center Cattle Germ Plasm Evaluation Program. Dr. Keith Gregory and Dr. Hudson Glimp, U.S. Meat Animal Research Center, Clay Center, Nebraska, initiated and designed the cattle germ plasm evaluation program. Dr. Dan Laster and Dr. John Crouse are currently working on the project from the Research Center. Kansas State University and the Livestock Division, C&MS, U.S.D.A. are cooperating on the project.

The project was designed to characterize breeds from different cattle types regarding economic traits that relate to reproduction, maternal ability, growth, feed efficiency, and carcass and meat traits. Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais breeds are represented as different biological types.

This report includes data on calving difficulty and preweaning growth from three calf crops (1970, 1971, and 1972 spring dropped calves). Data on postweaning growth, feed efficiency, and carcass and meat traits are presented for the 1971 calf crop, along with postweaning growth, puberty, and conception data for heifers from the 1971 calf crop. In addition, calving and rebreeding information (Phase II) obtained in 1972 on the two year old heifers born in 1970 are presented.

Postweaning growth, feed efficiency, and carcass and meat data on the 1970 calf crop were presented in the 1972 Cattlemen's Day report.

A complete analysis of the data and interpretation of the results will be made and published after all data from each segment of the study have been obtained.

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## Experimental Procedure

### Phase I

Commercial Hereford and Angus females were bred artificially to seven breeds of sires. The females were purchased as weaning calves in Nebraska and were two, three, four, and five years old at calving in 1970, two, three, four, five, and six years old at calving in 1971, and three, four, five, six, and seven years old in 1972. The calves were born in late March, April and early May, and were creep fed a ration of whole oats beginning in mid-July.

Thirty-four Hereford, 35 Angus, 33 Jersey, 36 South Devon, 30 Limousin, 37 Simmental, and 38 Charolais sires were used in 1969, 1970, and 1971. The Hereford and Angus bulls had been selected on individual performance information as a basis to be accepted for progeny testing by an artificial insemination organization. The Charolais breed included domestic and French bulls. The Simmental bulls were those available commercially, and some that the Canada Department of Agriculture had imported for research. The Limousin bulls were those available commercially. The South Devon bulls were sampled from a commercial importation, and the Jersey bulls were selected at random from two artificial insemination organizations.

Because the number of progeny per sire is relatively low, information on individual sires is not released.

Calving difficulty scores were obtained on 2,595 births in 1970, 1971, and 1972. Scores were assigned to each calf at birth using this scoring system:

#### Score

- |                           |   |   |
|---------------------------|---|---|
| 1. No difficulty          | - | Calves unassisted   |
| 2. Little difficulty      | - | Assistance by hand, but no jack or puller used;   |
| 3. Moderate difficulty    | - | Assistance with jack or calf puller; some difficulty encountered even then.                           |
| 4. Major difficulty       | - | Calf jack used and major difficulty encountered; usually 30 minutes or more required to deliver calf. |
| 5. Caesarean birth        |   |   |
| 6. Posterior presentation |   |   |

Table 1 shows the calving difficulty summary for cows calving at two years of age, and table 2, the summary for cows calving at three to seven years of age. In the summaries, scores of 1 and 2 were combined and designated "no difficulty" and scores of 3 and 4 were combined and designated "calf puller." No females were bred in 1971 to calve as two year olds in 1972.

Preweaning growth information on 2,264 calves for the 1970, 1971, and 1972 calf crops were combined (table 3). Weaning weights were adjusted to a steer basis and to a five, six, and seven-year-old basis. The adjustment factors, developed from the combined calf crops, were as follows:

	<u>Birth</u> <u>wt., lb.</u>	<u>Preweaning</u> <u>A.D.G., lb.</u>	<u>200-day</u> <u>wt., lb.</u>
Heifer calf adjustment	+5.4	+0.103	+26
Steer calf adjustment	0	0	0
2-year old dam	+8.0	+0.396	+87
3-year old dam	+6.3	+0.191	+44
4-year old dam	+2.5	+0.066	+16
5-6-7-year old dam	0	0	0

Steer calves with adjusted weaning weights more than three standard deviations below the mean were removed from the study. The remaining steers were placed in the feedlot by breed of sire group (replicated with two lots per sire breed) to obtain data on growth rate and feed efficiency. Feedlot rations are presented in table 4 for the 1971 calf crop. Postweaning average daily gains (table 5) are based on actual weaning weights and final weights at slaughter. Final weights at slaughter were the average of two weights (on feed and water) taken on different days to reduce errors from differences in fill. Adjusted final weight was obtained by adding postweaning average daily gain x days on feed to weaning weight adjusted to 200 days of age, and to a four, five, or six-year-old dam basis. Average daily gains and adjusted final weights (400 days, 442 days, 484 days of age) for each of the three slaughter groups are for steers slaughtered in that group only. Feed efficiency for each breeding group was obtained by dividing the cumulative average daily TDN consumption per steer by the average daily gain of the steers.

Approximately one-third of the steers in each breed of sire by breed of dam group was slaughtered at each of three slaughter dates (200, 242 and 284 days on feed after weaning). Steers to be slaughtered from each breeding group at each of the three times were identified at random across all birth dates. The steers averaged 42 days between slaughter groups 1 and 2 and between slaughter groups 2 and 3. However, differences in conception date and gestation length kept birth dates from averaging the same for all breeding groups.

Steers were transported to a commercial slaughter plant approximately 12 hours before slaughter, and their carcasses were allowed to chill 24 hours after slaughter before carcass data were obtained. Carcasses were evaluated for conformation, maturity, marbling, color, texture, and firmness. U.S.D.A. Quality Grade was determined by representatives of the Livestock Division, C&MS, U.S.D.A., and Kansas State University (table 6). Loin eye area and external fat thickness were measured and U.S.D.A. Yield Grade determined (table 7). Additional selected linear carcass measurements and other data were obtained but not included in this report.

The right side of each carcass was transported to Kansas State University approximately 56 hours after slaughter to obtain detailed cut-out and meat quality data. Each side was separated into wholesale cuts, which were then processed into closely trimmed, boneless cuts with no more than 0.30 in. of fat on any surface. Amounts of retail product, fat trim, and bone were determined for each wholesale cut (table 8).

One steak was removed from each carcass at the 11th rib for Warner-Bratzler shear determination. The steaks were cooked at 350°F to an internal temperature of 150°F. After cooling for approximately 30 minutes at room temperature, one-half inch cores were removed for shear determination. Steaks were removed at the 10th rib from four representative carcasses per breed group per slaughter date (168 carcasses), cooked at 350°F to an internal temperature of 150°F, and subjected to taste panel evaluation for tenderness, flavor, juiciness, and overall acceptability by experienced taste panelists (table 9).

Additional carcass information obtained on the 1971 calf crop included chemical analyses (water, protein, and fat) of the 9-10-11 rib section from the left side of the carcass. Total chemical composition was also determined on the left side of the carcass from three representative steers of the Hereford x Angus, Simmental x Angus, and Limousin x Angus breeding groups per slaughter group (total of 27 carcass sides, nine per breeding group). Those data are not reported here.

Data for carcass and meat traits were analyzed by least squares procedures for unequal subclass numbers using a model that included effects of age of dam (two, three, four, five, and six-year-olds); breed of sire (straightbred Hereford and Angus, Hereford-Angus reciprocal crosses Jersey, South Devon, Limousin, Simmental, and Charolais; breed of dam (Hereford, Angus); time of slaughter, and breed of sire-breed of dam-time of slaughter; and birth date was included as a covariate to adjust for differences in age of calf within slaughter groups. Thus, the least-squares means for the carcass and meat traits are adjusted for age of dam and to 400, 422, and 484 days of age for the three slaughter groups.

Postweaning average daily gain and adjusted final weight for both steers and heifers were analyzed by least squares procedures using the same model except the birth date was not included as a covariate.

Postweaning growth, puberty, and pregnancy data on the heifers in the 1971 calf crop are presented in table 10. The heifers were kept in drylot from weaning through the artificial insemination breeding period (early July). Their postweaning ration was 50% corn silage and 50% grass silage fed ad libitum or a grass silage and grain mixture to provide an equivalent energy intake. The adjusted 400-day weight is based on a full weight; the adjusted 550-day weight is based on a shrunk weight.

Date of puberty, defined as date of first observed standing estrus, was determined by checking animals for estrus twice daily. Body weights were taken every 28 days from weaning to the breeding period and again when the breeding period terminated. Heifers were inseminated only after standing for vasectomized bulls or other heifers. Following the 45-day artificial insemination breeding season, heifers were placed on pasture for a 24-day natural service breeding period. The percentage of heifers reaching puberty by 15 months and the average age of those that reached puberty are for heifers observed in estrus up to the end of the artificial insemination breeding season only; the percentage pregnant includes heifers that may have reached puberty and bred during the 24-day natural service breeding period.

## Phase II

Data on calving and rebreeding as two year olds for heifers born in 1970 are presented in tables 11 and 12. They were bred in 1971 by artificial insemination to Hereford, Angus, Brahman, Devon and Holstein bulls and to Hereford and Angus bulls during the cleanup period.

Because numbers of calves by each sire breed group were disproportionate among the cow breeding groups and because calves in some of the sire breed-dam breed subgroups were so few, weaning weights of the calves are not given and data in tables 11 and 12 were not statistically analyzed. That will be done with results published after data from three calf crops are available. Data presented here should be considered preliminary.

Females in phase II will be bred as two year olds (to Hereford, Angus, Gelbvieh, Maine Anjou and Chianina bulls) to calve as three year olds. Then these cows will be bred naturally to Brown Swiss bulls for their third and fourth calves.

## Results and Discussion

Calving difficulty and preweaning growth information presented here include data from three calf crops. Although mean differences have not been statistically interpreted, certain differences are great enough for valid conclusions. Postweaning growth, feed efficiency, and carcass and meat data presented here are for the 1971 calf crop only. Future data will be needed for final conclusions.

Calving difficulty scores on two-year-old females indicate calving difficulty in all crossbred combinations. However, more difficulty occurred with Limousin, Simmental, and Charolais sired calves. The latter two breeds sired more calves that had to be delivered by caesarean than any other breeds. So those three breeds should not be bred to heifers. Jersey calves caused the least difficulty in calving, as expected. More difficulty was encountered with Hereford than with Angus two-year-old females.

Many fewer calving problems occurred in the three, four, five, six, and seven-year-old females than in two-year old females. There were slightly fewer problems with Angus than with Hereford cows. However, South Devon, Limousin, Simmental, and Charolais calves still caused some problems in calving.

Simmental and Charolais calves were somewhat heavier at birth than calves from other breeds. South Devon and Limousin calves were intermediate in birth weights, and Jersey calves were lightest. Calves out of Angus dams were slightly lighter at birth than those out of Hereford dams.

Adjusted weaning weights were higher for Simmental and Charolais calves than for any other calves. Limousin and South Devon calves were heavier than Angus, Hereford, or Jersey calves. Jersey calves were the lightest. There was an approximate 15 lb. weaning weight advantage in the Angus-Hereford reciprocal crosses over the straightbred Angus or Hereford calves. Calves out of Angus females weighed somewhat heavier at weaning than those out of Hereford females.

All steers averaged 2.73 lb. gain per day during the feedlot period, about 0.30 lb. per day more than the steers from the 1970 calf crop, undoubtedly due to a harsher 1971-72 winter. Simmental and Charolais steers averaged about 0.20 lb. gain per day more than any other breed. South Devon and Limousin steers were about average in daily gain while Jersey steers were somewhat lower than other breeds. There appeared to be a slight advantage in daily gain of Angus-Hereford reciprocal crosses over straight bred Angus or Herefords.

Charolais and Limousin calves used feed somewhat more efficiently than any other breed. Charolais and Angus-Hereford reciprocally crossed steers were about average in feed efficiency; Jersey steers appeared to be less efficient than the other breeds.

Simmental and Charolais steers were heavier than other breeds at slaughter because of their heavier weaning weights and higher average daily gains. South Devon, Limousin, and Angus-Hereford reciprocally crossed steers were all three similar in slaughter weights.

Dressing percentage differences were not large, but Limousins dressed somewhat higher than other breeds and Jerseys dressed somewhat lower.

All steers averaged between high Good and low Choice on the rail. On a scoring system of 9 for high Good, 10 for low Choice, all steers averaged 9.5. The average grade and the percentage of all steers grading low Choice or better were lower for the 1971 calf crop than for the 1970 calf crop. The 1971 steers averaged slightly younger than the 1970 steers, which could partially explain why the grades were lower. Also, some grading personnel changed between the two years, which may partially explain lower grades for the 1971 steers. Steers out of Angus cows graded somewhat higher than steers out of Hereford cows. The average quality grade increased from the first to the last slaughter group, as expected.

Limousin and Charolais steers had lower Yield Grade scores than other breeds with Simmental steers running close third. Larger rib eye areas and less external fat covering gave those three breeds the more desirable Yield Grade scores. Angus and Hereford straightbreds, Jersey crosses, and South Devon crosses were similar in Yield Grades while Angus-Hereford reciprocally crossed steers tended to have the least desirable Yield Grades. Jersey steers had higher percentages of kidney and pelvic fat than other breeds did.

Actual cutability and retail product percentages were definitely higher for Charolais steers followed closely by Limousins and then by Simmentals. South Devon Crosses and straightbred Angus and Herefords had cutability percentages about 3% below those of the first three breeds. Jersey and Angus-Hereford reciprocal crosses were similar in cut-out percentages. Steers out of Hereford dams had slightly higher cutability percentages than those out of Angus dams.

Bone percentage differences were small between breeds. Charolais and Simmental steers had slightly higher bone percentages than other breeds, and steers out of Hereford cows tended to have higher bone percentages than steers out of Angus cows.

Warner-Bratzler shear data suggest little variation among breeds and that all breeds had steaks with desirable tenderness. Simmental and Limousin crosses, however, had slightly higher shear values (slightly less tender). Taste panel data show steaks from all breeds "moderately" desirable in all palatability traits with very small differences among breeds.

Preliminary data for growth of heifers indicate that there was no difference between heifers out of Angus cows and those out of Hereford cows in weight at 550 days. Heifers and those out of Hereford cows in weight at 550 days. Heifers by Charolais and Simmental bulls were heavier than heifers from other sire breeds. Heifers out of Angus cows reached puberty younger and a higher percentage was pregnant at the end of the breeding season than heifers out of Hereford cows.

#### Reproduction of $F_1$ Females

Of the two-year-old females born in 1970 and calving in 1972, all breed crosses had some difficulty in calving but Jersey crossbred heifers had the fewest problems. Birth weights of calves dropped from the various breeds of heifers differed little.

A larger percentage of females out of Angus dams exposed to breeding in 1971 calved in 1972 than females out of Hereford dams. The percentage of females from Angus dams detected in estrus after calving was similar to the percentage from Hereford dams. However, a greater percentage of females out of Hereford dams conceived postpartum.

More data are needed before conclusions can be made on calving and rebreeding of  $F_1$  two-year-old heifers.



Table 1. Calving difficulty summary, 1970-71 calf crops, 2-year old females.

Breed of sire	Breed of dam	No. calves	Type of parturition, %				Dead at or shortly after birth
			No calving difficulty <sup>a</sup>	Calf-puller	Caesarean	Posterior presentation	
Hereford Angus	Hereford	81	46.9	45.7	4.9	2.5	7.4
	Angus	83	62.7	36.1	1.2	0.0	8.4
	Average <sup>b</sup>	164	54.8	40.9	3.1	1.3	7.9
Angus Hereford	Hereford	77	54.5	41.6	1.3	2.6	7.8
	Angus	86	61.6	37.2	1.2	0.0	3.5
	Average <sup>b</sup>	163	58.1	39.4	1.3	1.3	5.7
Jersey	Hereford	61	80.3	19.7	0.0	0.0	1.6
	Angus	76	85.5	13.2	1.3	0.0	5.3
	Average <sup>b</sup>	137	82.9	16.5	0.7	0.0	3.5
South Devon	Hereford	28	53.6	42.9	3.6	0.0	7.1
	Angus	45	35.6	62.2	2.2	0.0	13.3
	Average <sup>b</sup>	73	44.6	52.6	2.9	0.0	10.2
Limousin	Hereford	63	17.5	74.6	6.3	1.6	11.1
	Angus	58	32.8	65.5	1.7	0.0	6.9
	Average <sup>b</sup>	121	25.2	70.1	4.0	0.8	9.0
Simmental	Hereford	27	11.1	63.0	25.9	0.0	14.8
	Angus	37	40.5	51.4	5.4	2.7	10.8
	Average <sup>b</sup>	64	25.8	57.2	15.7	1.4	12.8
Charolais	Hereford	37	21.6	54.1	21.6	2.7	16.2
	Angus	34	23.5	67.6	8.8	0.0	11.8
	Average <sup>b</sup>	71	22.6	60.9	15.2	1.4	14.0
Average of all sire breeds	Hereford	374	44.4	47.3	6.7	1.6	8.6
	Angus	419	54.4	43.0	2.4	0.2	7.6
	Average <sup>b</sup>	793	49.4	45.2	4.6	0.9	8.1

<sup>a</sup> No assistance or minor hand assistance.

<sup>b</sup> Unweighted means.

Table 2. Calving difficulty summary, 1970-71-72 calf crops, 3-, 4-, 5-, 6-, 7-year-old females.

Breed of sire	Breed of dam	No. calves	Type of parturition, %				Deat at or shortly after birth
			No calving difficulty <sup>a</sup>	Calf-puller	Caesarean	Posterior presentation	
Hereford Angus	Hereford	118	92.4	3.4	0.0	4.2	
	Angus <sup>b</sup>	94	94.7	4.3	1.1	0.0	2.5
	Average <sup>b</sup>	212	93.6	3.9	0.6	2.1	2.1
Angus Hereford	Hereford	112	91.1	1.8	0.0	7.1	0.9
	Angus <sup>b</sup>	150	95.3	2.7	0.0	2.0	0.0
	Average <sup>b</sup>	262	93.2	2.3	0.0	4.6	0.5
Jersey	Hereford	67	98.5	1.5	0.0	0.0	3.0
	Angus <sup>b</sup>	108	99.1	0.0	0.0	0.9	1.9
	Average <sup>b</sup>	175	98.8	0.8	0.0	0.5	2.5
South Devon	Hereford	92	77.2	16.3	1.1	5.4	4.3
	Angus <sup>b</sup>	76	88.2	7.9	0.0	3.9	3.9
	Average <sup>b</sup>	168	82.7	12.1	0.6	4.7	4.1
Limousin	Hereford	140	85.0	11.4	0.0	3.6	5.7
	Angus <sup>b</sup>	127	89.8	6.3	0.0	3.9	2.4
	Average <sup>b</sup>	267	87.4	8.9	0.0	3.8	4.1
Simmental	Hereford	178	80.9	15.2	0.6	3.4	7.9
	Angus <sup>b</sup>	186	84.4	12.4	0.0	3.2	3.8
	Average <sup>b</sup>	364	82.7	13.8	0.3	3.3	5.9
Charolais	Hereford	164	70.7	24.4	0.0	4.9	11.0
	Angus <sup>b</sup>	190	81.1	13.7	0.0	5.3	6.3
	Average <sup>b</sup>	354	75.9	19.1	0.0	5.1	8.7
Average of all sire breeds	Hereford	871	83.5	12.1	0.2	4.2	5.7
	Angus <sup>b</sup>	931	89.3	7.6	0.1	3.0	3.1
	Average <sup>b</sup>	1802	86.4	9.9	0.2	3.6	4.4

<sup>a</sup> No assistance or minor hand assistance.

<sup>b</sup> Unweighted means.

Table 3. Preweaning summary, 1970-71-72 calf-crops.

Breed of sire	Breed of dam	Nb. calves <sup>a</sup>	birth date	Birth wt., lb. <sup>b</sup>	Preweaning A.D.G., lb. <sup>b</sup>	Adjusted 200-day wt., lb. <sup>b</sup>	200-day wt. ratio
Hereford Angus	Hereford	132	Apr. 1	83.5	1.83	450	95.7 c
	Angus	203	Mar. 27	76.0	1.96	469	95.9 d
	Average	335	Mar. 29	79.8	1.90	459	95.8 e
Angus Hereford	Hereford	179	Mar. 31	82.0	1.91	464	98.7 c
	Angus	157	Mar. 28	81.1	2.03	487	99.6 d
	Average	336	Mar. 30	81.6	1.97	475	99.2 e
Jersey	Hereford	116	Mar. 31	74.8	1.87	449	95.5 c
	Angus	167	Mar. 24	71.1	1.92	455	93.0 d
	Average	283	Mar. 28	73.0	1.90	452	94.4 e
South Devon	Hereford	107	Apr. 2	88.1	1.89	467	99.4 c
	Angus	108	Mar. 31	83.3	2.03	490	100.2 d
	Average	215	Apr. 1	85.7	1.96	478	99.8 e
Limousin	Hereford	179	Apr. 11	88.4	1.93	473	100.6 c
	Angus	174	Apr. 7	84.7	2.06	498	101.8 d
	Average	353	Apr. 9	86.5	1.99	485	101.3 e
Simmental	Hereford	182	Apr. 6	93.5	<b>1.99</b>	492	104.7 c
	Angus	202	Apr. 1	88.6	2.10	510	104.3 d
	Average	384	Apr. 3	91.1	2.05	501	104.6 e
Charolais	Hereford	163	Apr. 4	93.9	2.00	493	104.9 c
	Angus	195	Mar. 31	90.0	2.13	516	105.5 d
	Average	358	Apr. 2	91.9	2.06	505	105.4 e
Average of all sire breeds	Hereford	1058	Apr. 3	86.3	1.92	470	100.0
	Angus	1206	Mar. 31	82.1	2.03	489	100.0
	Average	2264	Apr. 1	84.2	1.98	479	100.0

<sup>a</sup> Includes all steer and heifer calves weaned.

<sup>b</sup> Adjusted to a steer and a 5-, 6, and 7-year-old **cow** bases.

<sup>c</sup> Ratio computed relative to average for Hereford cows, adjusted to a steer calf and a 5-, 6-, and 7-year-old cow bases.

<sup>d</sup> Ratio computed relative to average for Angus cows, adjusted to a steer calf and a 5-, 6-, and 7-year-old cow bases.

<sup>e</sup> Ratio computed relative to overall average adjusted to a steer calf and a 5-, 6-, and 7-year-old cow bases.

Table 4. Postweaning steer feedlot rations, 1971 calf crop.

Ingredient	Oct. 25- Nov. 22	Nov. 23- Dec. 21	Dec. 22- Feb. 15	Feb. 16- Slaughter
Corn silage	% 85.0	% 75.0	% 60.0	% 60.0
Concentrate <sup>a</sup>	7.5	18.5	32.0	33.0
Supplement, 38% crude protein <sup>b</sup>	7.5	6.5	8.0	7.0
Ration analyses, 90% dry matter basis <sup>c</sup>				
Crude protein, %	13.4	12.6	13.1	12.6
Digestible protein, %	9.8	9.1	9.5	9.1
Total digestible nutrients, %	64.9	68.2	70.0	71.0

<sup>a</sup> Concentrate portion included varying amounts of ground shelled corn, ground sorghum grain, and ground wheat.

<sup>b</sup> Composition of supplement: 1600 lb. soybean meal; 150 lb. salt; 60 lb. dicalcium phosphate; 172 lb. ground limestone; 14.0 lb. Vitamine A premix (2,000,000 I.U. Vitamin A/lb.); 1.4 lb. Aureomycin (50 grams/lb.); 2 lb. trace mineral premix; 60 lb. ammonium chloride from April 12 to slaughter.

<sup>c</sup> Dry matter and crude protein based on proximate analyses.

Table 5. Least squares means for postweaning average daily gains, adjusted final weights and TDN efficiencies, 1971 calf crop.

Breed of sire	Breed of dam	No. steers <sup>a</sup>				Postweaning average daily gain <sup>b</sup>				Adjusted final weight <sup>c</sup>				TDN efficiency <sup>d</sup>			
		200	242	284	Total	200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.
Hereford Angus	Hereford	9	9	9	27	2.87	2.54	2.40	2.60	1075	1069	1093	1079	5.56	6.09	7.00	6.22
	Angus	8	9	9	26	2.77	2.74	2.33	2.61	1060	1172	1080	1104				
	Average	17	18	18	53	2.82	2.64	2.37	2.61	1068	1121	1087	1092				
Angus Hereford	Hereford	12	13	12	37	2.91	2.71	2.65	2.76	1095	1130	1195	1140	5.59	6.10	6.51	6.07
	Angus	10	10	11	31	2.89	2.58	2.51	2.66	1110	1123	1183	1139				
	Average	22	23	23	68	2.90	2.65	2.58	2.71	1103	1127	1189	1140				
Jersey	Hereford	8	7	8	23	2.82	2.51	2.43	2.59	1043	1059	1104	1069	5.70	6.29	6.73	6.24
	Angus	7	7	8	22	2.63	2.48	2.25	2.45	1038	1073	1062	1058				
	Average	15	14	16	45	2.73	2.50	2.34	2.52	1041	1066	1083	1063				
South Devon	Hereford	5	7	5	18	2.87	2.79	2.52	2.73	1046	1158	1129	1111	5.92	6.31	6.89	6.37
	Angus	6	5	6	17	2.96	2.72	2.50	2.73	1104	1143	1158	1135				
	Average	11	12	12	35	2.92	2.76	2.51	2.73	1075	1151	1144	1123				
Limousin	Hereford	5	5	5	15	2.64	2.79	2.63	2.69	1074	1164	1137	1125	5.17	5.62	6.20	5.66
	Angus	7	6	6	19	2.75	2.69	2.51	2.65	1099	1142	1170	1137				
	Average	12	11	11	34	2.70	2.74	2.57	2.67	1087	1153	1154	1131				
Simmental	Hereford	9	9	8	26	3.32	3.12	2.93	3.12	1217	1254	1278	1250	5.57	6.04	6.67	6.09
	Angus	9	9	9	27	2.89	2.86	2.71	2.82	1137	1222	1246	1202				
	Average	18	18	17	53	3.11	2.99	2.82	2.97	1177	1238	1262	1226				
Charolais	Hereford	9	9	9	27	3.24	2.98	2.83	3.02	1167	1207	1250	1208	5.21	5.68	6.12	5.67
	Angus	5	7	7	19	3.01	2.86	2.67	2.85	1176	1179	1229	1195				
	Average	14	16	16	46	3.13	2.92	2.75	2.93	1172	1193	1240	1202				
Average of all sire breeds	Hereford	57	59	57	173	2.95	2.78	2.63	2.79	1102	1149	1169	1140	5.53	6.02	6.59	6.05
	Angus	52	53	56	161	2.84	2.70	2.50	2.68	1103	1151	1161	1138				
	Average	109	112	113	334	2.90	2.74	2.56	2.73	1103	1150	1165	1139				

<sup>a</sup> Number of steers slaughtered after 200, 242 and 284 days on feed.

<sup>b</sup> Average daily gain = (final weight - actual weaning weight) ÷ days on feed.

<sup>c</sup> Adjusted final weight = adjusted 200-day weight + (postweaning average daily gain x days on feed postweaning).

<sup>d</sup> TDN efficiency = lb. TDN consumed per lb. gain; 90% dry matter basis for feed consumed.

Table 6. Least squares means for adjusted hot carcass weight, dressing percent, U.S.D.A. quality grade and marbling score<sup>a</sup>, 1971 calf crop.

Breed of sire	Breed of dam	Adjusted hot carcass weight, lb.				Dressing %				U.S.D.A. Quality Grade <sup>b</sup>				Marbling score <sup>c</sup>			
		200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.
Hereford Angus	Hereford	595	642	678	638	60.3	62.1	62.1	61.5	9.0	8.4	10.0	9.1	9.9	8.8	12.3	10.3
	Angus	600	710	676	662	61.1	62.8	62.5	62.1	10.2	10.5	11.5	10.7	12.2	14.1	17.4	14.6
	Average	598	676	677	650	60.7	62.5	62.3	61.8	9.6	9.5	10.8	9.9	11.1	11.5	14.9	12.5
Angus Hereford	Hereford	608	674	740	674	60.4	62.0	62.3	61.6	9.7	9.6	10.8	10.0	11.2	11.1	15.4	12.6
	Angus	627	675	744	682	61.4	62.1	62.9	62.1	9.9	10.0	10.3	10.1	12.0	12.1	14.0	12.7
	Average	618	675	742	678	60.9	62.1	62.6	61.9	9.8	9.8	10.6	10.1	11.6	11.6	14.7	12.6
Jersey	Hereford	565	612	680	619	59.2	59.9	61.6	60.2	8.6	9.5	10.2	9.4	9.8	13.9	16.0	13.2
	Angus	581	625	639	615	60.3	59.8	60.7	60.3	9.5	10.0	10.4	10.0	12.6	14.6	17.4	14.9
	Average	573	619	660	617	59.8	59.9	61.2	60.2	9.1	9.8	10.3	9.7	11.2	14.3	16.7	14.1
South Devon	Hereford	568	692	703	654	59.7	62.3	62.6	61.5	8.7	9.8	9.3	9.3	9.3	11.9	12.1	11.1
	Angus	613	693	723	676	60.9	63.2	62.7	62.3	9.5	10.6	10.7	10.3	10.6	12.9	15.0	12.8
	Average	591	693	713	665	60.3	62.8	62.7	61.9	9.1	10.2	10.0	9.8	10.0	12.4	13.6	12.0
Limousin	Hereford	628	698	687	671	63.1	62.5	60.9	62.2	8.6	8.8	9.0	8.8	8.7	9.5	9.6	9.3
	Angus	638	693	748	693	62.8	63.0	64.1	63.3	8.1	9.2	9.5	8.9	8.3	11.0	12.0	10.4
	Average	632	696	718	682	63.0	62.8	62.5	62.8	8.4	9.0	9.3	8.9	8.5	10.3	10.8	9.9
Simmental	Hereford	666	736	772	725	60.0	61.4	60.7	60.7	9.1	9.0	9.1	9.1	9.7	9.7	11.4	10.3
	Angus	643	731	774	716	61.3	62.2	62.4	61.9	9.1	9.2	9.7	9.3	10.1	10.3	13.0	11.1
	Average	654	734	773	720	60.6	61.8	61.6	61.3	9.1	9.1	9.4	9.2	9.9	10.0	12.2	10.7
Charolais	Hereford	649	711	760	707	61.2	61.4	61.3	61.3	7.8	8.6	10.2	8.9	7.8	9.1	12.9	9.9
	Angus	678	693	767	713	62.2	61.5	62.7	62.1	9.5	9.3	10.0	9.6	10.2	10.0	11.7	10.6
	Average	664	702	764	710	61.7	61.5	62.0	61.7	8.7	9.0	10.1	9.3	9.0	9.6	12.3	10.3
Average of all sire breeds	Hereford	611	681	717	670	60.6	61.7	61.6	61.3	8.8	9.1	9.8	9.2	9.5	10.6	12.8	11.0
	Angus	626	689	724	680	61.4	62.0	62.6	62.0	9.4	9.8	10.3	9.8	10.8	12.2	14.4	12.4
	Average	619	685	721	675	61.0	61.9	62.1	61.7	9.1	9.5	10.1	9.5	10.2	11.4	13.6	11.7

<sup>a</sup> Data for all carcass traits adjusted by regression on birth date to the average age of each slaughter group, adjusted for age of dam.

<sup>b</sup> U.S.D.A. Quality Grade: 9=high good; (10=low) choice; 11=average choice; 12=high choice; etc.

<sup>c</sup> Marbling Score: 9=slight+; 10=small-; ..... 27=abundant+.

Table 7. Least squares means for yield grade, rib eye area, fat thickness and percentages of kidney, pelvic, and heart fat<sup>a</sup>, 1971 calf crop.

Breed of sire	Breed of dam	U.S.D.A. Yield Grade				Ribeye area, sq. in.				Fat thickness, in.				Estimated kidney, pelvic and heart fat, %			
		200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.
Hereford Angus	Hereford	3.0	3.1	3.4	3.2	11.0	11.9	11.7	11.5	.45	.66	.63	.58	2.7	2.2	2.4	2.4
	Angus	3.6	4.0	3.8	3.8	10.9	12.0	11.6	11.5	.71	.91	.83	.82	3.1	3.8	2.8	3.2
	Average	3.3	3.6	3.6	3.5	11.0	12.0	11.6	11.5	.58	.79	.73	.70	2.9	3.0	2.6	2.8
Angus Hereford	Hereford	3.5	3.8	4.0	3.8	10.9	11.5	12.1	11.5	.66	.72	.87	.75	2.8	3.3	2.6	2.9
	Angus	3.3	3.7	4.1	3.7	11.7	11.8	12.7	12.1	.67	.77	.90	.78	2.6	2.7	3.0	2.8
	Average	3.4	3.8	4.1	3.8	11.3	11.7	12.4	11.8	.67	.75	.89	.77	2.7	3.0	2.8	2.8
Jersey	Hereford	3.0	3.4	3.7	3.4	11.4	11.1	11.6	11.4	.35	.40	.58	.44	5.2	5.0	4.3	4.8
	Angus	3.3	3.6	3.6	3.5	11.5	11.1	11.6	11.4	.53	.54	.60	.56	5.0	4.9	4.9	4.9
	Average	3.2	3.5	3.7	3.5	11.5	11.1	11.6	11.4	.44	.47	.59	.50	5.1	5.0	4.6	4.9
South Devon	Hereford	3.0	3.7	3.7	3.5	11.1	12.1	11.5	11.6	.41	.66	.53	.53	4.2	3.8	3.4	3.8
	Angus	2.7	3.9	3.5	3.4	11.8	11.7	12.5	12.0	.40	.70	.68	.59	3.1	4.5	3.7	3.8
	Average	2.9	3.8	3.6	3.4	11.5	11.9	12.0	11.8	.41	.68	.61	.57	3.7	4.2	3.6	3.8
Limousin	Hereford	2.0	2.5	2.6	2.4	13.3	13.6	13.2	13.4	.38	.48	.47	.44	2.7	3.2	3.0	3.0
	Angus	2.4	2.8	3.1	2.8	13.1	13.0	13.8	13.3	.43	.60	.62	.55	3.6	3.4	4.0	3.7
	Average	2.2	2.7	2.9	2.6	13.2	13.3	13.5	13.3	.41	.54	.55	.50	3.2	3.3	3.5	3.3
Simmental	Hereford	2.5	2.6	2.7	2.6	12.6	13.0	13.2	12.9	.41	.39	.38	.39	2.9	3.0	2.7	2.9
	Angus	2.9	2.9	3.5	3.1	12.2	13.1	12.6	12.6	.47	.54	.64	.55	3.7	3.5	3.3	3.5
	Average	2.7	2.8	3.1	2.9	12.4	13.1	12.9	12.8	.44	.47	.51	.47	3.3	3.3	3.0	3.2
Charolais	Hereford	1.9	2.3	2.6	2.3	13.2	13.4	13.8	13.5	.28	.39	.50	.39	2.6	2.3	2.6	2.5
	Angus	2.7	2.5	3.2	2.8	13.0	13.4	13.4	13.3	.45	.47	.73	.55	3.5	3.4	3.1	3.3
	Average	2.3	2.4	2.9	2.5	13.1	13.4	13.6	13.4	.37	.43	.62	.47	3.1	2.9	2.9	3.0
Average of all sire breeds	Hereford	2.7	3.1	3.2	3.0	11.9	12.4	12.4	12.2	.42	.53	.57	.50	3.3	3.3	3.0	3.2
	Angus	3.0	3.3	3.5	3.3	12.0	12.3	12.5	12.3	.52	.65	.71	.63	3.5	3.7	3.5	3.6
	Average	2.8	3.2	3.4	3.1	12.0	12.3	12.5	12.3	.47	.59	.64	.57	3.4	3.5	3.3	3.4

<sup>a</sup> Data for all carcass traits adjusted by regression on birth date to the average age of each slaughter group, and adjusted for age of dam.

Table 8. <sup>a</sup>  
Least squares means for actual percentages of cutability, retail product, fat trim and bone,  
1971 calf crop.

Breed of sire	Breed of dam	Cutability, % <sup>b</sup>				Retail product, % <sup>c</sup>				Fat trim, %				Bone, %			
		200	242	284	Avg.	200	242	284	Avg.	200	242	-284	Avg.	200	242	284	Avg.
Hereford Angus	Hereford	54.3	54.3	54.1	54.2	67.2	66.8	66.1	66.7	20.0	21.4	22.4	21.3	12.8	11.8	11.5	12.0
	Angus	53.5	50.2	52.2	52.0	66.9	63.1	64.5	64.8	21.4	26.4	24.9	24.2	11.7	10.4	10.6	10.9
	Average	53.9	52.3	52.3	53.1	67.1	65.0	65.3	65.8	20.7	23.9	23.7	22.8	12.3	11.1	11.1	11.5
Angus Hereford	Hereford	51.9	51.5	51.8	51.7	64.7	64.2	63.7	64.2	23.1	24.7	25.1	24.3	12.1	11.0	11.2	11.4
	Angus	53.2	51.8	51.2	52.1	65.9	64.3	63.0	64.4	22.2	24.7	26.4	24.4	11.9	10.9	10.6	11.1
	Average	52.6	51.7	51.5	51.9	65.3	64.3	63.4	64.3	22.7	24.7	25.8	24.4	12.0	11.0	10.9	11.3
Jersey	Hereford	52.6	51.7	52.2	52.2	66.0	64.4	64.1	64.8	21.5	23.1	24.4	23.0	12.6	12.4	11.6	12.2
	Angus	51.6	51.2	52.4	51.7	64.1	64.5	65.1	64.6	23.9	23.8	23.6	23.8	11.9	11.7	11.3	11.6
	Average	52.1	51.5	52.3	52.0	65.1	64.5	64.6	64.7	22.7	23.5	24.0	23.4	12.3	12.1	11.5	12.0
South Devon	Hereford	54.0	51.9	53.1	53.0	67.3	65.1	64.8	65.7	19.6	23.1	23.9	22.2	13.0	11.7	11.3	12.0
	Angus	54.2	49.7	53.5	52.5	68.1	62.2	65.9	65.4	19.9	27.1	22.9	23.3	12.0	10.8	11.2	11.3
	Average	54.1	50.8	53.3	52.7	67.7	63.7	65.4	65.6	19.8	25.1	23.4	22.8	12.5	11.3	11.3	11.7
Limousin	Hereford	55.7	54.0	56.0	55.2	68.4	67.3	68.8	68.2	20.0	21.0	19.2	20.1	11.6	11.6	12.0	11.7
	Angus	56.0	55.7	55.4	55.7	69.3	68.4	67.4	68.4	18.8	20.5	21.7	20.3	11.9	11.1	10.9	11.3
	Average	55.9	54.9	55.7	55.5	68.9	67.9	68.1	68.3	19.4	20.8	20.5	20.2	11.8	11.4	11.5	11.5
Simmental	Hereford	55.4	56.2	56.3	56.0	67.9	69.2	68.6	68.6	18.4	18.3	18.6	18.4	13.8	12.5	12.8	13.0
	Angus	54.2	54.5	54.4	54.4	67.0	67.3	66.6	67.0	20.2	20.6	21.4	20.7	12.8	12.1	12.0	12.3
	Average	54.8	55.4	55.4	55.2	67.5	68.3	67.6	67.8	19.3	19.5	20.0	19.6	13.3	12.3	12.4	12.7
Charolais	Hereford	58.3	56.7	56.8	57.3	71.1	69.9	68.8	69.9	15.9	17.3	18.9	17.4	13.0	12.8	12.2	12.7
	Angus	55.6	55.9	54.8	55.4	68.8	68.9	67.0	68.2	18.8	19.3	21.4	19.8	12.4	11.8	11.6	11.9
	Average	57.0	56.3	55.8	56.4	70.0	69.4	67.9	69.1	17.4	18.3	20.2	18.6	12.7	12.3	11.9	12.3
Average of all sirebreeds	Hereford	54.6	53.8	54.3	54.2	67.5	66.7	66.4	66.9	19.8	21.3	21.8	21.0	12.7	12.0	11.8	12.2
	Angus	54.0	52.7	53.4	53.4	67.2	65.5	65.6	66.1	20.7	23.2	23.2	22.4	12.1	11.3	11.2	11.5
	Average	54.3	53.2	53.9	53.8	67.3	66.1	66.0	66.5	20.3	22.3	22.5	21.7	12.4	11.6	11.5	11.8

<sup>a</sup> Data for all carcass traits adjusted by regression on birth date to the average age of each slaughter group, and adjusted for age of dam.

<sup>b</sup> Cutability. % = Actual yield of boneless, closely trimmed beef from the round, loin, rib, and chuck.

<sup>c</sup> Retail Product. % = Actual yield of boneless, closely trimmed beef from the carcass.



Table 9.  
Least squares means for Warner-Bratzler shear and taste panel evaluation of cooked steaks<sup>a</sup>,  
1971 calf crop.

Breed of sire	Breed of dam	Warner-Bratzler shear, lb. b				Taste panel tenderness <sup>c</sup>				Taste panel flavor <sup>c</sup>				Taste panel juiciness <sup>c</sup>				Taste panel acceptability <sup>c</sup>				
		200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.	200	242	284	Avg.	
Hereford Angus	Hereford	7.1	6.7	7.0	6.9	7.3	8.4	8.1	7.9	7.5	7.8	7.7	7.7	7.0	8.0	7.8	7.6	7.2	8.1	7.9	7.7	7.7
	Angus	7.2	7.8	7.7	7.6	7.7	6.6	7.4	7.2	7.7	7.3	7.6	7.5	7.3	6.8	7.6	7.2	7.5	6.8	7.5	7.3	7.3
	Average	7.2	7.3	7.4	7.3	7.5	7.5	7.8	7.6	7.6	7.6	7.7	7.6	7.2	7.4	7.7	7.4	7.4	7.5	7.7	7.5	7.5
Angus Hereford	Hereford	6.5	8.4	6.9	7.3	7.6	7.1	7.7	7.5	7.4	7.4	7.8	7.5	7.5	7.2	7.8	7.5	7.5	7.2	7.8	7.5	7.5
	Angus	7.7	7.0	6.9	7.2	7.5	7.6	7.2	7.4	7.1	7.4	7.6	7.4	7.1	7.3	7.4	7.3	7.2	7.5	7.4	7.4	7.4
	Average	7.1	7.7	6.9	7.2	7.6	7.4	7.5	7.5	7.3	7.4	7.7	7.5	7.3	7.3	7.6	7.4	7.4	7.4	7.6	7.5	7.5
Jersey	Hereford	7.2	7.9	7.4	7.5	7.1	6.8	8.0	7.3	7.9	7.5	7.2	7.5	7.7	7.0	7.8	7.5	7.5	7.1	7.5	7.4	7.4
	Angus	6.5	6.5	6.7	6.6	7.6	7.3	6.5	7.1	8.0	7.4	7.7	7.7	7.6	7.3	7.4	7.4	7.7	7.3	7.1	7.4	7.4
	Average	6.9	7.2	7.1	7.1	7.4	7.1	7.3	7.2	8.0	7.5	7.5	7.6	7.7	7.2	7.6	7.5	7.6	7.2	7.3	7.3	7.4
South Devon	Hereford	8.2	8.1	7.7	8.0	7.3	7.0	7.3	7.2	7.6	7.5	7.4	7.5	7.1	7.0	7.6	7.2	7.3	7.2	7.2	7.2	7.2
	Angus	7.1	6.4	6.8	6.8	7.1	7.4	7.3	7.3	7.2	7.3	7.6	7.3	7.6	7.1	7.4	7.4	6.9	7.3	7.4	7.2	7.2
	Average	7.7	7.3	7.3	7.4	7.2	7.2	7.3	7.2	7.4	7.4	7.5	7.4	7.3	7.1	7.5	7.3	7.1	7.3	7.3	7.2	7.2
Limousin	Hereford	8.2	7.7	8.4	8.1	6.8	7.1	6.2	6.7	7.4	7.4	7.6	7.5	7.6	6.8	7.4	7.2	6.8	7.0	6.6	6.8	6.8
	Angus	7.7	7.4	9.1	8.1	7.2	7.6	6.4	7.1	7.6	7.7	7.6	7.6	6.6	7.2	7.3	7.0	7.1	7.5	7.2	7.3	7.3
	Average	8.0	7.6	8.8	8.1	7.0	7.4	6.3	6.9	7.5	7.6	7.6	7.6	6.9	7.0	7.4	7.1	7.0	7.3	6.9	7.1	7.1
Simmental	Hereford	8.3	8.0	8.1	8.1	6.9	7.0	7.4	7.1	7.4	7.6	7.4	7.5	7.5*	6.9	7.1	7.2	7.3	7.1	7.3	7.2	7.2
	Angus	8.0	7.8	8.4	8.1	7.1	7.7	6.4	7.1	7.3	7.7	7.5	7.5	7.0	7.7	7.3	7.3	6.9	7.7	6.9	7.2	7.2
	Average	8.2	7.9	8.3	8.1	7.0	7.4	6.9	7.1	7.4	7.7	7.5	7.5	7.3	7.3	7.2	7.3	7.1	7.4	7.1	7.2	7.2
Charolais	Hereford	6.6	7.8	7.9	7.4	6.0	6.8	7.2	6.7	7.6	7.4	7.8	7.6	6.3	7.2	7.5	7.0	6.2	7.1	7.4	6.9	6.9
	Angus	7.4	7.1	8.1	7.5	7.1	6.6	6.9	6.9	7.4	7.4	7.3	7.4	7.0	6.8	7.0	6.9	7.3	6.9	7.1	7.1	7.1
	Average	7.0	7.5	8.0	7.5	6.6	6.7	7.1	6.8	7.5	7.4	7.6	7.5	6.7	7.0	7.3	7.0	6.8	7.0	7.3	7.0	7.0
Average of all sire breeds	Hereford	7.4	7.8	7.6	7.6	7.0	7.2	7.4	7.2	7.5	7.5	7.6	7.5	7.2	7.2	7.6	7.3	7.1	7.3	7.4	7.3	7.3
	Angus	7.4	7.1	7.8	7.4	7.3	7.3	6.9	7.2	7.5	7.5	7.6	7.5	7.2	7.2	7.4	7.3	7.2	7.3	7.2	7.2	7.2
	Average	7.4	7.5	7.7	7.5	7.2	7.3	7.2	7.2	7.5	7.5	7.6	7.5	7.2	7.2	7.5	7.3	7.2	7.3	7.3	7.3	7.3

<sup>a</sup>Data for all carcass traits adjusted by regression on birth date to the average age of each slaughter group, and adjusted for age of dam.

<sup>b</sup>Pounds of force required to shear one-half inch cores of steaks cooked at 350°F to 150°F internal temperature and cooled 30 minutes at room temperature. Warner-Bratzler shear values obtained on steaks from all 334 steers.

<sup>c</sup>Taste panel scores based on a 9-point scale; higher scores indicate greater acceptability. Taste panel traits measured on steaks from 4 steers per breed group per slaughter date (168).

Table 10. Postweaning growth and reproductive performance of yearling heifers, 1971 calf crop.

Breed of sire	Breed of dam	No. heifers	200-day postweaning avg. daily gain, lb.	Adj. 400-day a wt., lb.	Adj. 550-day b wt., lb.	% reaching puberty by 15 mos.	Avg. age at puberty days	% pregnant <sup>d</sup>
Hereford Angus	Hereford	16	0.99	616	742	81	415	88
	Angus	21	1.07	653	764	100	370	90
	Average	37	1.03	635	754	92	393	89
Angus Hereford	Hereford	27	1.18	665	783	96	394	89
	Angus	24	1.13	681	782	96	385	92
	Average	51	1.16	674	783	96	390	90
Jersey	Hereford	27	1.01	609	723	100	348	93
	Angus	21	0.99	620	736	100	326	76
	Average	48	1.00	614	729	100	337	85
South Devon	Hereford	20	1.21	664	788	100	381	95
	Angus	23	1.16	680	778	100	345	91
	Average	43	1.19	673	784	100	363	93
Limousin	Hereford	14	1.11	656	763	64	427	57
	Angus	28	1.08	678	769	100	383	96
	Average	42	1.10	668	767	88	405	83
Simmental	Hereford	31	1.16	681	836	97	376	94
	Angus	28	1.22	720	829	100	362	86
	Average	59	1.19	700	832	98	369	90
Charolais	Hereford	20	1.17	679	826	85	422	70
	Angus	12	1.18	704	813	100	393	92
	Average	32	1.18	693	821	91	408	78
Average of all sire breeds	Hereford	155	1.12	653	781	92	395	86
	Angus	157	1.12	677	782	99	366	89
	Average	312	1.12	665	781	96	380	88

<sup>a</sup>Adjusted 400-day weight = Adjusted 200-day weight + (200-day postweaning average daily gain x 200 days).

<sup>b</sup>Adjusted 550-day weight = Adjusted 200-day weight + (350-day postweaning average daily gain x 350 days).

<sup>c</sup>Includes only heifers reaching puberty by 15 months and should be interpreted in relation to the percentage reaching puberty by 15 months.

<sup>d</sup>Breeding period was 46 days by artificial insemination and 24 days by natural service.

Table 11. Calving difficulty for the first calf crop of F<sub>1</sub> 2-year-old females calving during 1972<sup>a</sup>.

Cow genotype		No. of calves			Birth wt., lb. <sup>b</sup>	No difficulty <sup>c</sup>	Type of parturition, %			Dead at or shortly after birth (No.)
Breed of sire	Breed of dam	Total	Males	Females			Calf-puller	Caesarean	Abnormal presentation	
Hereford Angus	Hereford	17 <sup>c</sup>	10	6	63.3	50.0	25.0	6.3	18.8	1
	Angus	18 <sup>d</sup>	11	6	63.2	52.9	35.3	0.0	5.9	0
	Average	35	21	12	63.3	51.5	30.3	3.0	12.1	1
Angus Hereford	Hereford	18	7	11	70.3	55.6	38.9	5.6	0.0	0
	Angus	23	10	13	67.3	65.2	30.4	4.3	0.0	2
	Average	41	17	24	68.8	61.0	34.1	4.9	0.0	2
Jersey	Hereford	27	12	15	65.3	85.2	14.8	0.0	0.0	
	Angus	14	8	6	59.7	78.6	21.4	0.0	0.0	1
	Average	41	20	21	62.5	82.9	17.1	0.0	0.0	
South Devon	Hereford	11	7	4	71.5	36.4	63.6	0.0	0.0	0
	Angus	13	8	5	73.6	38.5	53.8	7.7	0.0	2
	Average	24	15	9	72.6	37.5	58.3	4.2	0.0	2
Limousin	Hereford	22	14	8	67.7	59.1	36.4	0.0	4.5	1
	Angus	23	9	14	70.1	52.2	43.4	4.3	0.0	2
	Average	45	23	22	68.9	55.6	40.0	2.2	2.2	3
Simmental	Hereford	20	10	10	70.9	45.0	50.0	5.0	0.0	0
	Angus	19	14	5	71.5	52.6	36.8	10.5	0.0	1
	Average	39	24	15	71.2	48.7	43.6	7.7	0.0	1
Charolais	Hereford	27	14	13	73.8	63.0	25.9	7.4	3.7	0
	Angus	12 <sup>d</sup>	7	4	77.2	45.5	45.5	0.0	9.1	1
	Average	39	21	17	75.5	57.9	31.6	5.3	5.3	1
Average of all sire breeds	Hereford	142	74	67	69.0	59.6	33.3	3.5	3.5	2
	Angus	122	67	53	68.9	56.3	37.8	4.2	1.7	9
	Average	264	141	120	69.0	58.1	35.4	3.8	2.7	11

<sup>a</sup> Calves from these cows sired by Hereford, Angus, Devon, Holstein and Brahman bulls.  
<sup>b</sup> Unweighted for calf sex.  
<sup>c</sup> No assistance or minor hand assistance.  
<sup>d</sup> One premature birth.

Table 12. Calving and breeding of 2-year-old females during 1972<sup>a</sup>.

Breed of sire	Cow genotype Breed of dam	No. exposed to breeding in 1971	Calving in 1972		% detected in estrus <sup>b</sup>	% bred by AI <sup>b</sup>	Postpartum interval, Days	% pregnant <sup>b</sup>	Cow wt. at 2½ yrs., lb.
			No.	%					
Hereford Angus	Hereford	26	17	65.4	94.1	76.5	80.6	94.1	853
	Angus	23	18	78.3	100.0	88.9	86.4	83.3	834
	Average <sup>c</sup>	49	35	71.9	97.1	82.7	83.5	88.7	844
Angus Hereford	Hereford	22	18	81.8	94.4	83.3	89.4	88.9	874
	Angus	24	23	95.8	95.7	95.7	75.3	87.0	914
	Average <sup>c</sup>	46	41	88.8	95.1	89.5	82.4	88.0	894
Jersey	Hereford	29	27	93.1	100.0	88.9	82.9	96.3	800
	Angus	16	14	87.5	100.0	100.0	76.4	85.7	755
	Average <sup>c</sup>	45	41	90.3	100.0	94.5	79.7	91.0	778
South Devon	Hereford	18	11	61.1	90.9	90.9	75.8	81.8	912
	Angus	17	13	76.5	100.0	92.3	80.8	100.0	930
	Average <sup>c</sup>	35	24	68.8	95.5	91.6	78.3	90.9	921
Limousin	Hereford	30	22	73.3	90.9	63.6	73.2	86.4	899
	Angus	26	23	88.5	95.7	91.3	73.0	69.6	911
	Average <sup>c</sup>	56	45	80.9	93.3	77.5	73.1	78.0	905
Simmental	Hereford	27	20	74.1	90.0	85.0	86.4	75.0	948
	Angus	22	19	86.4	94.7	89.5	89.2	73.7	933
	Average <sup>c</sup>	49	39	80.3	92.4	87.3	87.8	74.4	941
Charolais	Hereford	34	27	79.4	100.0	81.5	86.4	88.9	970
	Angus	16	12	75.0	91.7	91.7	93.0	66.7	1076
	Average <sup>c</sup>	50	39	77.2	95.9	86.6	89.7	77.8	1023
Average of all sire breeds	Hereford	186	142	76.3	94.3	81.4	82.1	87.3	894
	Angus	144	122	84.7	96.8	92.8	82.0	80.9	908
	Average <sup>c</sup>	330	264	80.5	95.6	87.1	82.1	84.1	901

<sup>a</sup> Calves from these cows sired by Hereford, Angus, Devon, Holstein and Brahman bulls.

<sup>b</sup> Percentage of those that calved.

<sup>c</sup> Unweighted means.