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Germ Plasm Evaluation Program- Progress Report No. 10

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Roman L. Hruska U.S. Meat Animal Research Center

Germ Plasm Evaluation Program

Progress Report No. 10

Roman L. Hruska
U.S. Meat Animal Research Center

In cooperation with
Kansas State University
and the University of Nebraska

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The cattle Germ Plasm Evaluation Program at the Roman L. Hruska U.S. Meat Animal Research Center is designed to characterize different biological types represented by breeds varying widely in characteristics such as milk production, growth, mature size, and carcass composition. A major objective is to characterize breeds representing different biological types in different feed environments and production situations for the full spectrum of biological traits relating to economic beef production.

A coordinated research effort is employed involving scientists from the disciplines of animal breeding, reproductive physiology, nutrition, meats, and production systems. The program was initiated in 1969. Progress reports have been published annually summarizing current results from each cycle and phase of the program for traits of principal economic importance to the beef cattle industry.

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ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER

CATTLE GERM PLASM EVALUATION PROGRAM[1]

PROGRESS REPORT NO. 10

Larry V. Cundiff,[2] Keith E. Gregory,[2] and Robert M. Koch[3]

This report updates reproduction and maternal performance data for cows in Cycle II, Phase 2 and Cycle III, Phase 2 of the Germ Plasm Evaluation Program.

The cattle Germ Plasm Evaluation Program has been conducted in three cycles. Cycle I involved breeding Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais bulls by artificial insemination (AI) to Hereford and Angus cows to produce three calf crops (Cycle I, Phase 2) in the spring of 1970, 1971 and 1972.

Cycle II, initiated with the 1972 breeding season, involved the Hereford and Angus cows used in the first cycle. These cows were bred by AI to Hereford, Angus, Red Poll, Brown Swiss, Gelbvieh, Maine Anjou, and Chianina sires to produce two calf crops (Cycle II, Phase 2) in the spring of 1973 and 1974. In addition, in Cycle II, Phase 2, Red Poll and Brown Swiss cows were added to the program and mated to Hereford, Angus, Red Poll, and Brown Swiss sires in a four-breed diallel crossbreeding experiment.

Cycle III was initiated during the 1974 breeding season. In Cycle III, the Hereford and Angus cows used to initiate Cycles I and II were mated by AI to Hereford, Angus, Pinzgauer, Tarentaise, Brahman, and Sahiwal sires to produce two calf crops (Cycle III, Phase 2) in the spring of 1975 and 1976.

Fifteen of the Hereford and 16 of the Angus sires used in Cycle I were also used in Cycle II and Cycle III to insure a stable control population of Hereford and Angus reciprocal crosses that are used as a basis for comparison between different cycles and phases of the program. Within each cycle of sire breeds, foundation cows (Hereford and Angus, in Cycles I, II, and III, plus Red Poll and Brown Swiss in Cycle II) are referred to as Phase 1. Their calves are called Phase 2, and the calves from Phase 2 cows are designated Phase 3. Specific mating plans for each cycle and phase of the program are provided in the appendix of Progress Report No. 9.

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Previous progress reports have presented data for Cycles I, II and III and are available upon request. Progress Report No. 9 (ARS-NC-2), October 1981) presented results on reproduction and maternal performance of F_1 two-way cross cows (Cycle I, Phase 2; Cycle II, Phase 2; and Cycle III, Phase 2) and three-way cross cows (Cycle I, Phase 3; Cycle II, Phase 3). This report is provided as a supplement to Progress Report No. 9 to update information on reproduction and maternal performance of F_1 cows in Cycle II, Phase 2 and Cycle III, Phase 2.

TRAITS MEASURED

Calving Difficulty. Calving difficulty scores were assigned to each calf at birth.

Calf Crop. Calf crop percentages reflect the percentage of cows giving birth to or weaning a calf relative to all cows alive at calving time. Since cows were removed from the experiment only for serious injury, for being open 2 successive years or by death, percentage calf crop relative to all cows calving is virtually the same as percentage calf crop relative to all cows exposed to breeding.

Calf Mortality. Calf mortality is expressed as the percentage of all calves born that died early (within 72 hr of birth) or late (from 72 hr after birth until weaning) in the period from birth to weaning.

Calf Weights. Calf birth weights and 200-day weights reported are adjusted to a steer basis by adjustment factors calculated from the data and shown in the table footnotes. The 200-day weights were computed as ((actual weaning weight - birth weight)/weaning age) X 200 + birth weight.

Postpartum Interval. Postpartum interval, the number of days from calving to first estrus, is reported for certain groups in which it was recorded.

Percent Pregnant. Percent pregnant is the number palpated as pregnant divided by the number palpated (X 100) in the fall about 3 months after the breeding season. The data reported for percent pregnant only includes cows that calved prior to the breeding season.

Cow Weights and Hip Heights. Cow weights and hip heights reported were obtained on the cows in the fall at weaning time.

CYCLE II, PHASE 2

Foundation Cows. The foundation Hereford and Angus cows used in Cycle I were continued in Cycle II of the program. The cows calving in 1973 were 4 to 8 years of age and in 1974 were 4 to 9 years of age. As previously indicated, mature Brown Swiss and Red Poll cows were added to these herds for the 1972 and 1973 breeding seasons.

Sires. In Cycle II, 15 Hereford, 16 Angus, 16 Red Poll, 11 Brown Swiss, 11 Gelbvieh, 18 Maine Anjou, and 20 Chianina bulls were used during the 1972 and 1973 breeding seasons. The Hereford and Angus sires had also been used in Cycle I of the program, and the other bulls were sampled from commercial organizations. The Brown Swiss sires included four domestic bulls and seven bulls imported into Canada from Switzerland and Germany.

Matings. Cycle II, Phase 2 yearling heifers were mated to Hereford, Angus, Brangus, and Santa Gertrudis by AI to produce their first calves as 2-year-olds in 1975 and 1976. The Cycle II, Phase 2 cows were bred by natural service to 3/4 Simmental bulls in 1975, 1976, and 1977 and to 7/8 Simmental bulls in 1978, 1979, and 1980.

3-, 4-, 5-, 6-, and 7-Year-Olds. Data on calving difficulty, calf crop percentage, and birth weaning weights of calves from 3-, 4-, 5-, 6-, and 7-year-old dams (born in 1973-74) are presented in table 15S (replaces table 15 in Progress Report No. 9) for cows out of Hereford and Angus dams. Data on rebreeding performance and size as 3-, 4-, 5-, 6-, and 7-year-olds are given in table 16S (replaces table 16 in Progress Report No. 9).

Calving difficulty, calf mortality, calf birth weight, and preweaning growth were analyzed by least-squares procedures for unequal subclass numbers using a model that included the effects of breed of dam's sire, breed of dam's dam, breed of sire, year, sex, and two-way interactions. Calf crop percentage, pregnancy rate, cow weight, and cow height were analyzed by similar least-squares procedures, except that sex and interactions with sex were not included in the model.

Discussion

Results to date on production of the F_1 females (as 2- through 7-year-olds from Cycle II, Phase 2 of the program are presented in table 17S. (replaces table 17 in Progress Report No. 9). Calving difficulty has been lower for Brown Swiss and Chianina cross females than other breed groups, especially as 2-year-olds (table 13, Progress Report No. 9). Chianina cross females have had relatively low calving difficulty considering the heavy birth weight of their calves. Brown Swiss cross and Gelbvieh cross females milked at the highest level and produced calves that were 12% heavier at 200 days than Hereford-Angus cross females. Maine-Anjou cross and Chianina cross females were comparable to Hereford-Angus crosses in milk production but produced calves that were 10% heavier in 200-day weight. Red Poll cross females were intermediate in the range among breed groups for milk production and 200-day weight of progeny. Calf weight weaned per cow exposed was 12% to 16% greater for Brown Swiss, Gelbvieh, Maine-Anjou, and Chianina crosses than for Red Poll and Hereford-Angus crosses.

TABLE 15S. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM
CALVING DIFFICULTY, CALF CROP PERCENTAGE, CALF MORTALITY, BIRTH WEIGHT,
WEANING WEIGHT, AND WEANING WEIGHT RATIO OF CALVES FROM 3-, 4-, 5-, 6- AND 7-YEAR-OLD COWS[a]
CYCLE II, PHASE 2 - COWS BORN 1973-74

Breed of cow		Number calves born	Type of parturition, %				Calf crop, %[c]		Calf mortality, %[d]		Calf weight, lb[e]		
Sire	Dam		No diff.[b]	Calf puller	C-section	Abn. presentation	Born	Weaned	Early	Late	Birth	200-day wt	200-day wt ratio[f]
Angus	Hereford	155	93.2	3.7	0.0	3.2	91.4	85.5	5.1	2.6	89.9	497	100.0
Hereford	Angus	222	84.1	12.9	0.9	2.1	93.9	89.3	3.2	2.2	91.2	498	100.2
	Average	377	88.6	8.3	0.5	2.6	92.6	87.4	4.1	2.4	90.5	497	100.0
Red Poll	Hereford	169	88.1	9.2	0.0	2.8	92.0	83.0	5.2	2.7	95.2	529	106.4
	Angus	213	92.7	5.2	0.0	2.1	89.9	81.1	5.4	1.4	90.1	520	104.6
	Average	382	90.4	7.2	0.0	2.4	91.0	82.1	5.3	2.0	92.6	525	105.6
Brown Swiss	Hereford	288	88.8	7.3	0.7	3.3	91.4	84.7	6.5	0.9	97.4	556	111.9
	Angus	277	93.3	3.6	0.7	2.3	93.4	88.2	3.9	2.1	93.6	556	111.9
	Average	565	91.1	5.4	0.7	2.8	92.4	86.5	5.2	1.5	95.5	556	111.9
Gelbvieh	Hereford	172	90.1	7.0	0.7	2.2	97.2	89.6	3.6	4.1	96.4	556	111.9
	Angus	186	93.4	4.2	0.5	1.9	94.3	87.5	8.0	1.2	90.6	553	111.3
	Average	358	91.8	5.6	0.6	2.1	95.7	88.5	5.8	2.6	93.5	554	111.5
Maine Anjou	Hereford	174	90.9	6.8	0.0	2.3	93.7	87.7	3.5	3.5	101.3	551	110.9
	Angus	213	91.9	6.4	0.0	1.7	93.6	86.6	3.6	3.3	98.4	539	108.5
	Average	387	91.4	6.6	0.0	2.0	93.7	87.1	3.5	3.4	99.9	545	109.7
Chianina	Hereford	198	95.7	2.6	1.0	0.7	95.7	91.2	1.3	2.8	101.2	547	110.1
	Angus	203	93.2	4.5	0.4	1.8	93.2	86.4	4.7	3.3	98.0	546	109.9
	Average	401	94.4	3.6	0.7	1.3	94.4	88.8	3.0	3.1	99.6	547	110.1
Average	Hereford	1156	91.1	6.1	0.4	2.4	93.6	87.0	4.2	2.8	96.9	539	108.5
all sire	Angus	1314	91.4	6.1	0.4	2.0	93.1	86.5	4.8	2.3	93.7	535	107.7
breeds	Average	2470	91.3	6.1	0.4	2.2	93.4	86.8	4.5	2.6	95.3	537	108.1

[a] Calves from these cows were sired by 3/4 or 7/8 Simmental bulls (appendix table 4).
[b] No assistance or minor hand assistance.
[c] Of cows alive at calving; cows removed from experiment only for serious injury, being open 2 successive years or by death.
[d] Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.
[e] Adjusted to a steer basis. Least-squares adjustment factors for heifers were 7.1 lb for birth weight and 32 lb for 200-day weight.
[f] Ratio computed relative to 497 lb average for Hereford and Angus sired dams.

TABLE 16S. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM
CALVING DATE, AND SIZE OF COWS CALVING AS 3-, 4-, 5-, 6-, AND 7-YEAR-OLD COWS
CYCLE II, PHASE 2 - COW BORN 1973-74

Breed of cow		Number of cows		Average	Cow weight, lb		Cow hip height, in		Condition score[a]	
Sire	Dam	6-yr olds	7-yr olds	calving date	6-1/2 years	7-1/2 years	6-1/2 years	7-1/2 years	6-1/2 years	7-1/2 years
Angus	Hereford	33	32	March 30	1215	1273	49.0	48.9	7.5	7.4
Hereford	Angus	46	45	April 1	1157	1200	48.3	48.2	7.2	7.2
	Average	79	77	March 31	1186	1236	48.7	48.6	7.3	7.3
Red Poll	Hereford	35	33	March 30	1131	1187	49.2	48.9	6.5	6.5
	Angus	46	45	March 30	1109	1179	48.8	48.8	6.5	6.5
	Average	81	78	March 30	1120	1183	49.0	48.9	6.5	6.5
Brown Swiss	Hereford	62	58	March 30	1190	1265	51.2	51.1	6.3	6.7
	Angus	58	54	March 29	1180	1243	50.6	50.4	6.3	6.5
	Average	120	112	March 29	1185	1254	50.9	50.8	6.3	6.6
Gelbvieh	Hereford	33	32	April 1	1247	1313	51.4	51.3	6.7	6.8
	Angus	38	37	March 30	1224	1280	50.5	50.4	6.5	6.8
	Average	71	69	March 31	1236	1297	51.0	50.8	6.8	6.8
Maine Anjou	Hereford	37	35	March 29	1323	1389	51.8	51.8	6.7	6.9
	Angus	43	42	March 30	1317	1365	51.1	51.0	6.8	6.9
	Average	80	77	March 30	1320	1377	51.4	51.4	6.7	6.9
Chianina	Hereford	40	40	April 1	1336	1392	54.9	54.3	6.2	7.0
	Angus	43	43	March 30	1311	1370	53.9	53.7	6.3	6.8
	Average	83	83	March 31	1324	1381	54.4	54.0	6.3	6.9
Average	Hereford	240	230	March 31	1240	1303	51.1	51.1	6.7	6.9
all sire	Angus	274	266	March 30	1216	1273	50.5	50.4	6.6	6.8
breeds	Average	514	496	March 31	1228	1288	50.9	50.8	6.6	6.9

[a] Condition is scored on a scale of 1 to 9; 1 = thin, emaciated; 5 = average; 9 = very fat.

TABLE 17S. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM
BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF F_1 COWS AT 2 THROUGH 7 YEARS OF AGE
CYCLE II, PHASE 2 - COWS BORN 1973-74

Breed group[a]	Number births	Calving difficulty[b] %	Calf crop		Birth weight lb	Milk prod[c] lb	200-day weight			
			Born %	Weaned %			Per calf weaned lb	Ratio[d] %	Per cow exposed lb	Ratio[d] %
Hereford-Angus-X	438	16	91	84	88	6.2	481	100	404	100
Red Poll-X	461	17	90	79	91	7.6	508	106	401	99
Brown Swiss-X	681	11	92	85	93	8.4	540	112	459	114
Gelbvieh-X	429	14	95	87	92	8.4	539	112	469	116
Maine-Anjou-X	468	14	94	86	98	6.5	528	110	454	112
Chianina-X	475	11	93	86	97	6.2	529	110	455	113

[a] Breed groups are identified by sire breed. An X denotes crosses out of Hereford and Angus dams.
[b] Includes calves requiring calf puller or C-section.
[c] Average of three 12-hr milk production measures on a sample of 36 cows per breed group (18 per year) at 3 years of age.
[d] Ratio relative to Hereford-Angus crosses.

CYCLE III, PHASE 2

Cows. The foundation Hereford and Angus cows used to produce Phase 2 calves in Cycles I and II were continued in Cyle III of the program. The two calf crops in Cycle III, Phase 2, were produced in 1975 and 1976.

Sires. There were 13 Hereford, 14 Angus, 17 Brahman, 6 Sahiwal, 9 Pinzgauer, and 7 Tarentaise sires used during the 1974 and 1975 breeding seasons. The Hereford and Angus bulls had also been used in Cycle I and Cycle II of the program, and the Brahman bulls were sampled from commercial AI organizations or purebred Brahman herds. Semen was available from only two Sahiwal bulls (imported from Australia) and one Tarentaise bull for the 1974 breeding season. Semen was available on four additional Sahiwal bulls and six additional Tarentaise bulls for the 1975 breeding season to produce the Cycle III, Phase 2, calf crop in 1976.

A sample of about 32 heifers from each of the Angus-Hereford, Hereford-Angus, Brahman-Hereford, Brahám-Angus, Sahiwal-Hereford, Sahiwal-Angus, Pinzgauer-Hereford, and Pinzgauer-Angus breed groups were transferred to the U.S. Department of Agriculture Station at Brooksville, Fla., for an inter-regional study cooperative with the Florida Agricultural Experiment Station to evaluate genotype-environment interactions involving maternal traits. These heifers and those remaining at the Roman L. Hruska U.S. Meat Animal Research Center were mated by natural service to bulls sampled from the same population of Red Poll to produce their first calf crop and to 7/8 Simmental bulls to produce their second through fourth calf crops.

3-, 4-, 5- and 6-year-olds. Data on calving difficulty, percentage calf crop, and birth and weaning weights of calves from 3-, 4-, 5- and 6-year-old Cycle III, Phase 2, females (born in 1975-76) are presented in table 25S (replaces table 25 in Progress Report No. 9). Data on rebreeding performance and size as 5- and 6-year-olds are given for the corresponding breed-group in table 26S (replaces table 26 in Progress Report No. 9). The Cycle III, Phase 2, females were bred as 2- through 5-year-olds to 7/8 Simmental sires. These data were analyzed by least-squares procedures using a model that included effects of breed of dam's sire, breed of dam's dam, year-age of cow, and two-way interactions. Effects of sex of calf and two-way interaction of breed of dam's sire, breed of dam's dam, and year-age with sex were also included in models for calving difficulty and birth and weaning weight of progeny.

Discussion

Results to-date on production of the F_1 females (as 2- through 6-year-olds) from Cycle III, Phase 2 of the program are summarized in table 27S (replaces table 27 in Progress Report No. 9). Sahiwal and Brahman cross females experienced significantly less calving difficulty than the other breed groups in Cycle III. This difference in calving difficulty in favor of Sahiwal and Brahman crosses was of greatest magnitude for the first parturition as 2-year-olds (table 23, Progress Report No. 9). Birth weight of calves out of Pinzgauer and Tarentaise crosses have been heavier than calves out of

Hereford-Angus crosses while birth weight of calves out of Sahiwal and Brahman crosses have been lighter than Hereford-Angus crosses. Differences in milk production between Tarentaise, Pinzgauer, Sahiwal, and Brahman cross females were not large; all exceeded Hereford-Angus cross females. Brahman crosses exceeded all crosses in 200-day weight weaned per calf and per cow exposed to breeding. Weaning weights of progeny out of Pinzgauer, Tarentaise, and Sahiwal cross females were 6% to 11% heavier per calf weaned and 10% to 13% heavier per cow exposed to breeding than progeny out of Hereford-Angus cross females (as 2-through 6-year-olds).

Differences between breed groups in calving difficulty, calf crop percentage, and calf weights at birth and 200 days have decreased as cows have advanced in age and as the number of records have increased. Thus, inference should not be drawn to breed groups in other cycles and phases of the program using deviations from Hereford-Angus crosses based on preliminary data presented in this report.

TABLE 25S. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM
CALVING DIFFICULTY, CALF CROP PERCENTAGE, CALF MORTALITY, BIRTH WEIGHT,
WEANING WEIGHT, AND WEANING WEIGHT RATIO OF CALVES FROM 3-, 4-, 5-, AND 6-YEAR-OLD COWS[a]
CYCLE III, PHASE 2 - COWS BORN 1975-76

Breed of cow		Number calves	Type of parturition, %				Calf crop, %[c]		Calf mortality, %[d]		Calf weight, lb[e]		
Sire	Dam	born	No diff.[b]	Calf puller	C-section	Abn. presentation	Born	Weaned	Early	Late	Birth	200-day wt	200-day wt ratio[f]
Angus	Hereford	106	92.1	6.5	0.0	1.5	95.0	85.8	6.7	1.4	87.7	494	101.9
Hereford	Angus	235	91.7	6.7	0.3	1.3	91.4	84.6	5.2	1.7	85.9	476	98.1
	Average	341	91.9	6.6	0.2	1.4	93.2	85.2	6.0	1.6	86.8	485	100.0
Pinzgauer	Hereford	137	89.3	9.7	0.0	1.0	93.6	85.2	6.2	3.1	91.9	521	107.4
	Angus	201	94.1	4.9	0.4	0.6	92.4	88.0	4.8	0.4	90.4	514	106.0
	Average	338	91.7	7.3	0.2	0.8	93.0	86.6	5.5	1.8	91.2	518	106.8
Tarentaise	Hereford	92	94.5	5.5	0.0	0.0	88.6	83.0	0.3	3.0	91.7	541	111.6
	Angus	143	95.5	1.4	0.8	2.2	91.4	86.2	4.5	1.0	83.8	525	108.3
	Average	235	95.0	3.5	0.4	1.1	90.0	84.6	2.4	2.0	87.7	533	109.9
Brahman	Hereford	141	98.1	1.2	0.1	0.7	93.8	85.1	3.1	3.6	83.3	548	113.0
	Angus	199	99.9	0.0	0.0	0.4	95.1	87.4	4.0	3.4	80.9	544	112.2
	Average	340	99.0	0.5	0.0	0.5	94.5	86.2	3.5	3.5	82.1	546	112.6
Sahiwal	Hereford	100	98.4	1.6	0.0	0.0	94.4	85.9	3.2	2.2	78.1	514	106.0
	Angus	169	99.2	0.7	0.0	0.1	94.8	87.9	2.1	3.9	73.1	505	104.1
	Average	269	98.8	1.1	0.0	0.1	94.6	86.9	2.6	3.1	75.6	509	105.0
Average	Hereford	576	94.5	4.9	0.0	0.6	93.1	85.0	3.9	2.7	86.6	523	107.8
all sire	Angus	947	96.1	2.7	0.3	0.9	93.0	86.8	4.1	2.1	82.8	513	105.8
breeds	Average	1523	95.3	3.8	0.2	0.8	93.1	85.9	4.0	2.4	84.7	518	106.8

[a] Calves from these cows were sired by 7/8 Simmental bulls.
[b] No assistance or minor hand assistance.
[c] Of cows alive at calving; cows removed from experiment only for serious injury, by death or being open two consecutive seasons.
[d] Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.
[e] Adjusted to a steer basis. Least-squares adjustment factors for heifers were 5.4 lb for birth weight and 32 lb for 200-day weight.
[f] Ratio computed relative to 485 lb average for Hereford and Angus sired dams.

TABLE 26S. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 5-, AND 6-YEAR-OLD COWS
CYCLE III, PHASE 2 - COW BORN 1975-76

Breed of cow		Number calving as		Average	Cow weight, lb		Cow hip height, in		Condition score[b]	
Sire	Dam	5-yr olds	6-yr olds	calving date[a]	5-1/2 years	6-1/2 years	5-1/2 years	6-1/2 years	5-1/2 years	6-1/2 years
Angus	Hereford	30	21	March 27	1246	1272	48.9	48.6	7.1	7.6
Hereford	Angus	66	48	March 30	1212	1217	48.5	48.0	7.2	7.6
	Average	96	69	March 29	1229	1244	48.7	48.3	7.2	7.6
Pinzgauer	Hereford	38	27	March 27	1224	1289	50.6	50.7	6.6	6.8
	Angus	56	39	March 29	1192	1272	49.9	50.3	6.4	6.8
	Average	94	66	March 28	1208	1281	50.2	50.5	6.5	6.8
Tarentaise	Hereford	29	14	March 29	1260	1240	50.6	50.0	6.9	7.0
	Angus	46	17	March 30	1164	1211	49.5	49.4	6.6	6.9
	Average	75	31	March 30	1212	1225	50.1	49.7	6.7	6.9
Brahman	Hereford	40	27	March 29	1281	1320	52.6	52.4	7.3	7.6
	Angus	58	39	March 29	1271	1302	51.9	51.8	7.0	7.2
	Average	98	66	March 29	1276	1311	52.2	52.1	7.2	7.4
Sahiwal	Hereford	32	12	March 29	1163	1254	51.2	51.7	6.9	7.3
	Angus	52	18	March 27	1091	1110	49.7	49.3	6.8	7.1
	Average	84	30	March 28	1127	1182	50.4	50.5	6.9	7.2
Average	Hereford	169	101	March 28	1235	1275	50.8	50.7	7.0	7.3
all sire	Angus	278	161	March 29	1186	1223	49.9	49.8	6.8	7.1
breeds	Average	447	262	March 29	1210	1249	50.3	50.2	6.9	7.2

[a] Includes cows calving at 3, 4, 5, and 6 years of age.
[b] Condition is scored on a scale of 1 to 9; 1 = thin, emaciated; 5 = average; 9 = very fat.

TABLE 27S. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM
BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF F_1 COWS AT 2 THROUGH 6 YEARS OF AGE
CYCLE III, PHASE 2 - COWS BORN 1975-76

Breed group[a]	Number births	Calving difficulty[b] %	Calf crop		Birth weight lb	Milk prod[c] lb	200-day weight			
			Born %	Weaned %			Per calf weaned lb	Ratio[d] %	Per cow exposed lb	Ratio[d] %
Hereford-Angus-X	422	16	89	82	84	5.4	465	100	381	100
Pinzgauer-X	436	16	91	84	89	7.3	499	107	419	110
Tarentaise-X	306	12	89	82	85	7.2	514	111	421	111
Brahman-X	430	3	93	85	81	8.4	533	115	453	119
Sahiwal-X	350	3	94	87	74	7.8	495	106	431	113

[a] Breed groups are identified by sire breed. An X denotes crosses out of Hereford and Angus dams.
[b] Includes calves requiring calf puller or C-section.
[c] Average of three 12-hr milk production measures on a sample of 36 cows per breed group (18 per year) at 3 years of age.
[d] Ratio relative to Hereford-Angus crosses.

EFFICIENCY OF COWS OF DIFFERENT SIZE AND MILK PRODUCTION

C. L. Ferrell[1] and T. G. Jenkins[1]

Research was initiated in 1979 at the Roman L. Hruska U.S. Meat Animal Research Center to evaluate the energy requirements of cows differing in genetic potential for mature size and milk production during varying physiological states. Energy requirements for maintenance, gestation and latation were to be evaluated. Assuming requirements for gestation and lactation are additive to those of maintenance, annual energy requirements can be estimated as the summation of requirements for each of these functions.

Energy requirements have been estimated for a sample of randomly selected cows produced in Cycle I, phase 2. Angus X Hereford, Hereford X Angus (AHX); Charolais X Angus, Charolais X Hereford (CX); Jersey X Angus, Jersey X Hereford (JX); and Simmental X Angus, Simmental X Hereford (SX) were chosen. The AHX and CX cows have been characterized as having moderate milk production potential while the JX and SX cows represent cows with higher milk production potential. The AHX and JX cows have been characterized as having a medium mature size while the CX and SX have a large mature size. Table 1 provides further characterization for the production traits of these cow types and progeny of the cows through slaughter as previously reported in the series of Germ Plasm Evaluation Program progress reports (See Progress Report No. 9).

Metabolizable energy (ME) requirements for maintenance were estimated from regressions of energy gain (kcal/kg$\cdot^{75}$/day) on ME intake (kcal/kg$\cdot^{75}$/day; figure 1) as the ME intake at which energy gain was equal to zero. Maintenance requirements were 131, 136, 147 and 163 kcal ME/kg$\cdot^{75}$/day for AHX, CX, JX and SX cows, respectively. These results suggest that cows having higher milk production potential had higher maintenance requirements per unit metabolic body size (kg$\cdot^{75}$) than those having lower milk production potential. Size per se had little influence on maintenance requirements, when they were expressed in this manner. Daily maintenance requirements of each cow type (obtained by multiplying the estimates reported above by the appropriate average metabolic body size) were 14.1, 15.9, 14.4 and 18.2 mcal/day. These results indicate that, on a daily basis, AHX and JX cows had similar maintenance requirements; the smaller size of the JX cows compensated for their higher requirements per unit size. The daily maintenance requirements of CX cows were intermediate as a result of their relatively low requirements per unit size, but large size. The SX cows were large and had a high maintenance requirement per unit size and as a result had the highest daily maintenance requirement.

Data relating to the ME requirements for gestation have not been fully analyzed. As a result, requirements for gestation have been calculated from previously reported values by adjusting for calf birth weight (table 1).

Lactation curves for each of the cow types (figure 2) were estimated from data obtained by weigh-suckle-weigh procedures. Total milk yield (table 1) was obtained, for each cow type, by integration of the lactation curves. Estimates of the ME required for lactation were calculated from total milk yields, assuming .48 mcal ME was required per pound of milk produced.

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Estimates of annual ME requirements of cows of different types are summarized in figure 3. For ease of comparison, total annual ME requirements of the AHX cows were set at 100% and all other values were expressed in relation to that value. Total annual ME requirements of the SX, JX and CX cows were 30, 4 and 11% greater than those of the AHX cows. Maintenance accounted for 70 to 75% of the total annual ME requirements of each cow type. Differences in gestation and lactation requirements were evident, but requirements for these functions represented relatively small proportions of the total.

Estimates of efficiency for the four cow types through weaning were calculated as calf weight weaned per cow exposed (table 1) divided by total annual ME requirements of the cow. The values obtained were .066, .061, .064 and .056 lb/Mcal for AHX, CX, JX and SX cows, respectively. These values suggest differences exist in the efficiency of the different cow types. The primary factors affecting these estimates were 1) cow ME requirements, 2) weaning percentages and 3) calf weaning weight. These results suggest all of these factors should be considered when different types of cows are to be compared. Feed consumed by calves preweaning, other than milk, were not included in these calculations; thus, the results may be somewhat biased.

Total ME consumed by weaned progeny during a 217-day postweaning feeding period or to low choice quality grade were added to annual cow requirements. These results are summarized in figures 4 and 5, respectively. Again, the total feed requirements of the AHX cows and their progeny were set at 100% and all other values were expressed relative to that value. Of the total ME consumed by the cow and calf, to slaughter of the calf, 43% or less of the total was consumed by the calf postweaning, regardless of cow type or calf slaughter endpoint. These calculations assumed all calves weaned were fed to slaughter. The proportion of the total ME consumed during the feedlot phase of production would obviously have been less if heifers for cow replacement had been deducted from the feedlot phase and included as part of the costs of maintenance of the cow herd.

Differences in overall efficiency were noted among the cow types. Efficiencies of production of retail product (lb retail product divided by total ME consumed by the calf postweaning and cow) were .0369, .0368, .0344 and .0336 for AHX, CX, JX and SX type cows and their progeny, if evaluated to an age constant endpoint, and .0380, .0360, .0365 and .0309 if evaluated to a low choice quality grade endpoint. Cow and calf feed costs and weight of retail product had substantial influences on these estimates.

These data and calculations, although preliminary, serve to demonstrate that input as well as output of a beef production enterprise should be considered when efficiency is to be evaluated. Misleading conclusions may be drawn if any component is ignored.

TABLE 1. PRODUCTION CHARACTERISTICS OF BREED TYPES DIFFERING IN MATURE SIZE AND MILK PRODUCTION POTENTIAL

Item	Breed type[a]			
	AHX	CX	JX	SX
Cow production traits				
Weight, lb	1131	1258	993	1187
Calf birth weight, lb[b]	91.4	97.7	83.4	92.7
Milk yield, lb[c]	2685	2682	3314	3448
Weaning percentage	88.2	84.8	86.4	88.0
Average weaning weight, lb	507	538	518	553
Weaning weight per cow exposed, lb	447	456	448	487
Calf postweaning performance[b]				
Average daily gain, lb/d, 217 d	2.52	2.55	2.25	2.50
Estimated weight at choice, lb	1098	1204	1020	1269
Estimated weight at 455 d of age, lb	1140	1174	1096	1181
Estimated retail product at choice, lb	476	532	449	514
Estimated retail product at 455 days, lb	477	519	454	512

[a] AHX - Angus X Hereford, Hereford X Angus; CX - Charolais X Angus, Charolais X Hereford; JX - Jersey X Angus, Jersey X Hereford; SX - Simmental X Angus, Simmental x Hereford.

[b] Average of Brown Swiss sired male and female calves.

[c] Based on a 165-day lactation period.

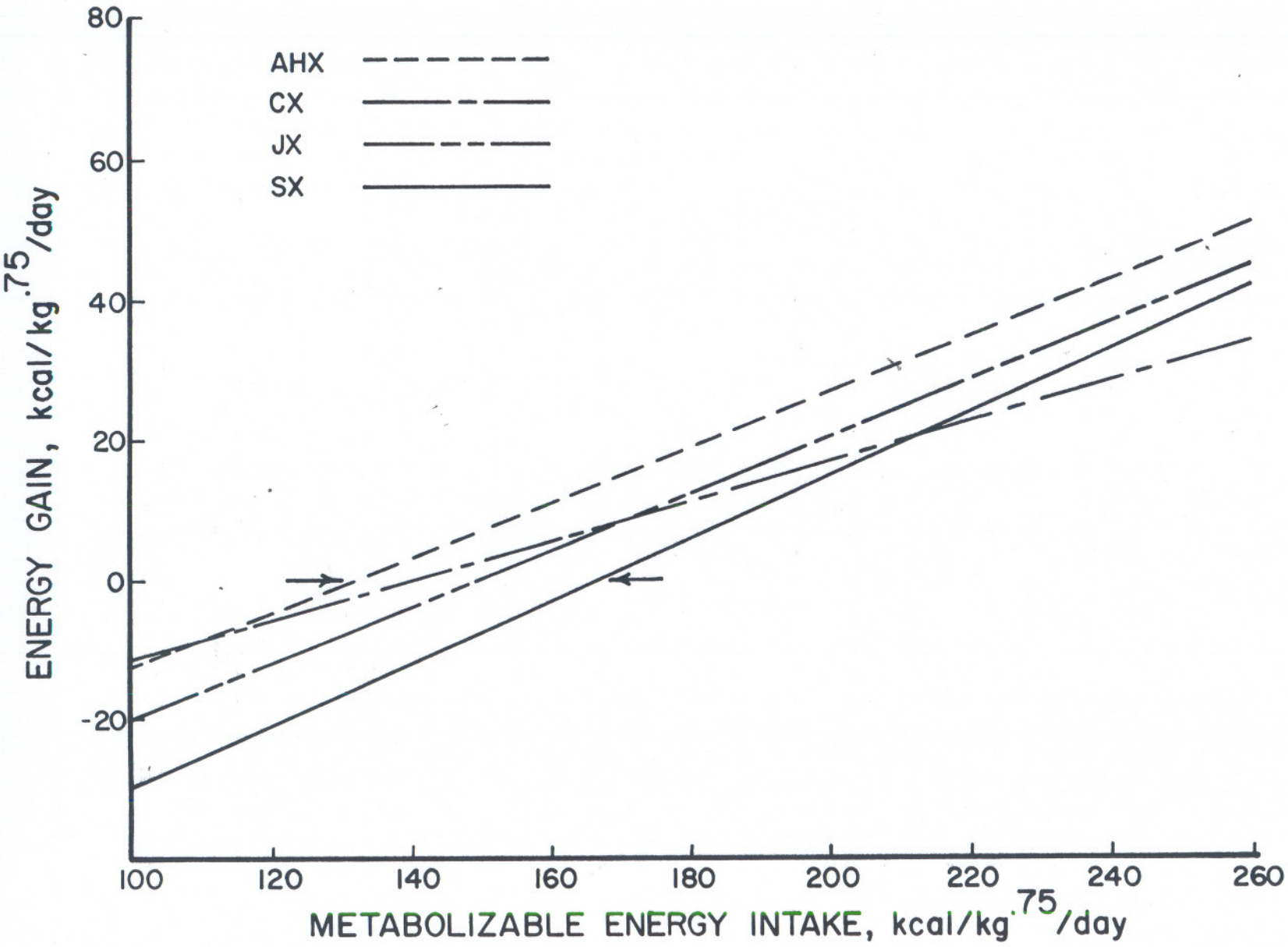

Figure 1. Relationships between energy gain and metabolizable energy intake for different types of cows.

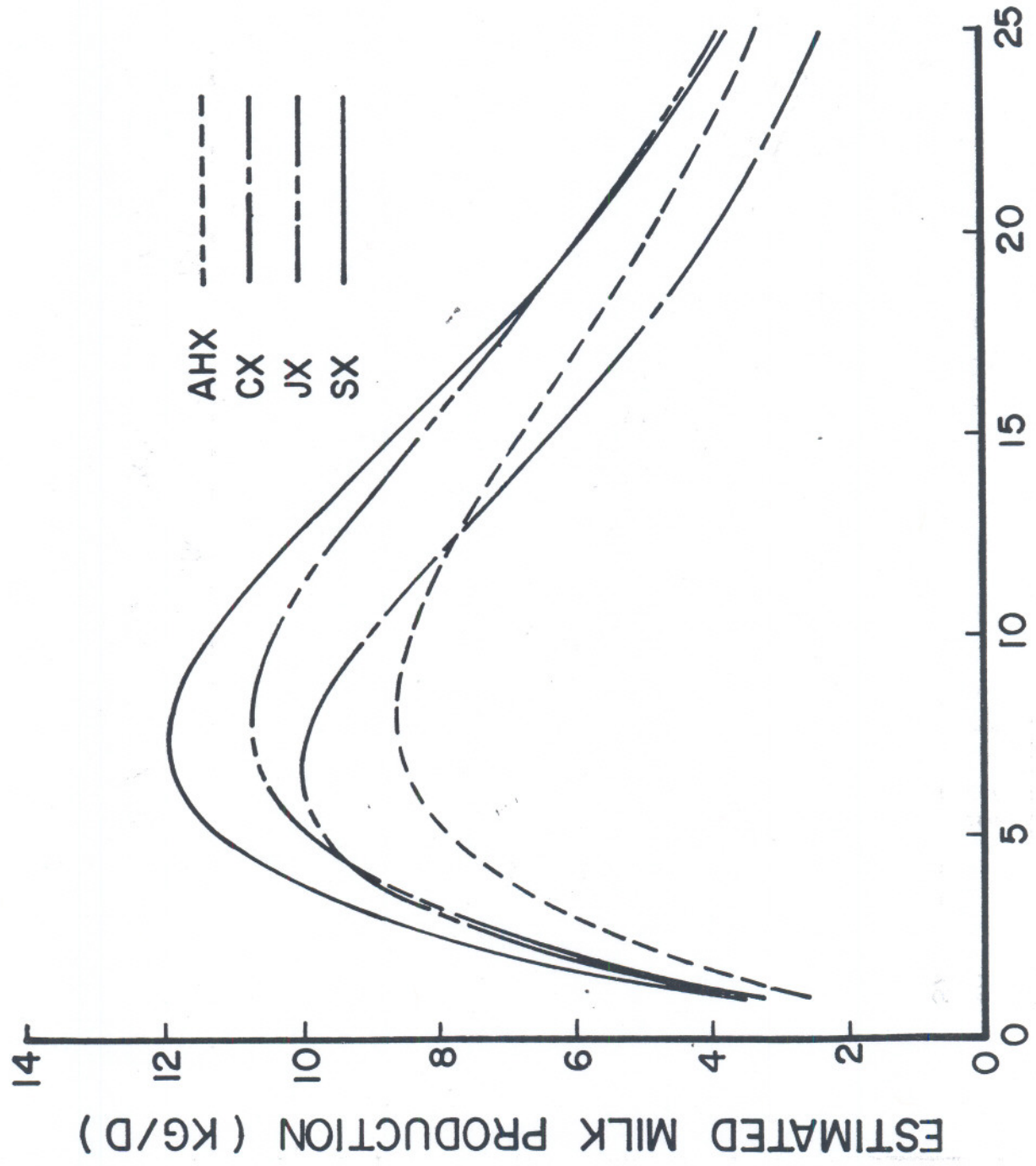

Figure 2. Lactation curves of mature crossbred cows.

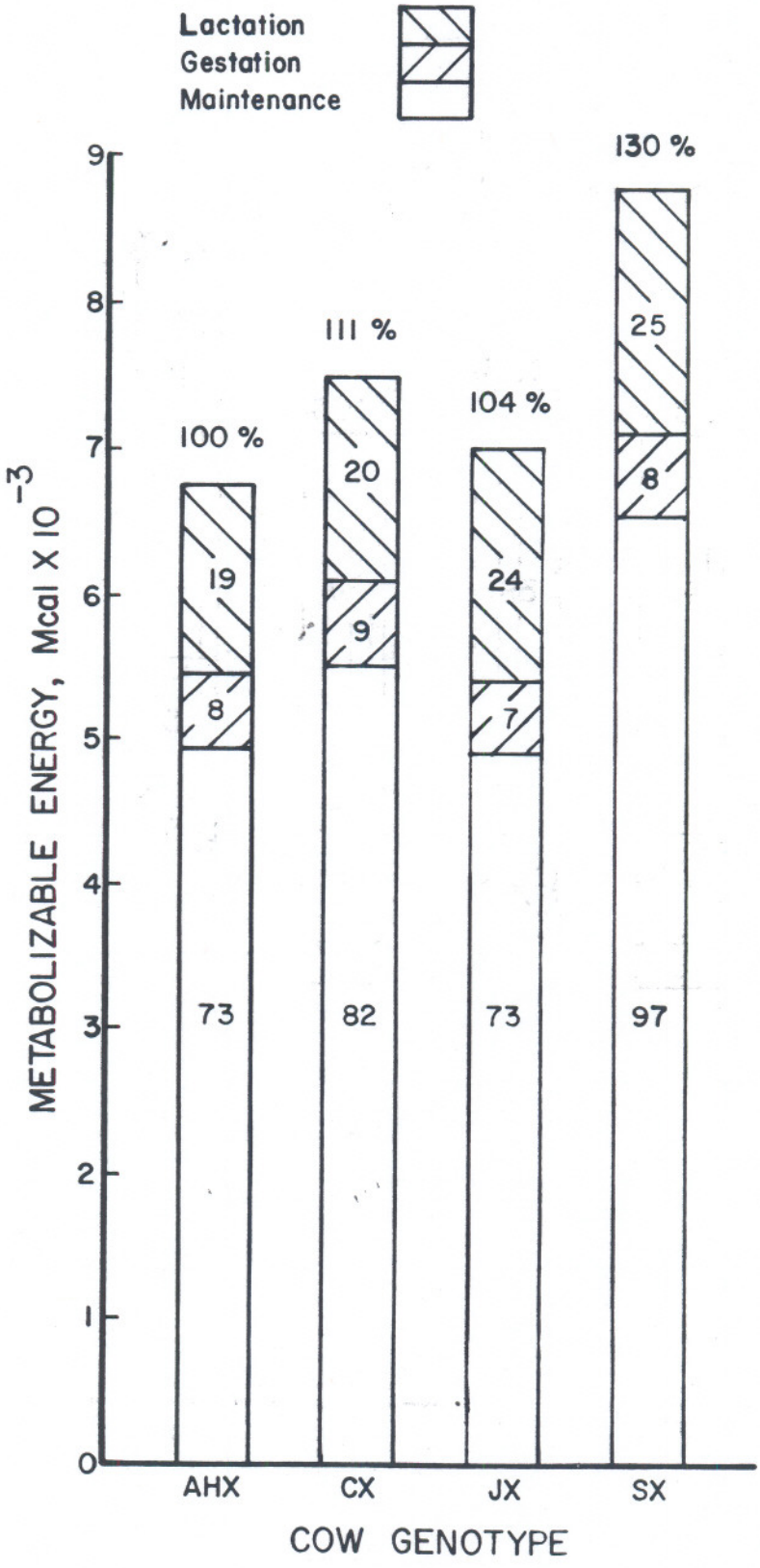

Figure 3. Estimated annual metabolizable energy requirements of cows of different biological genotypes.

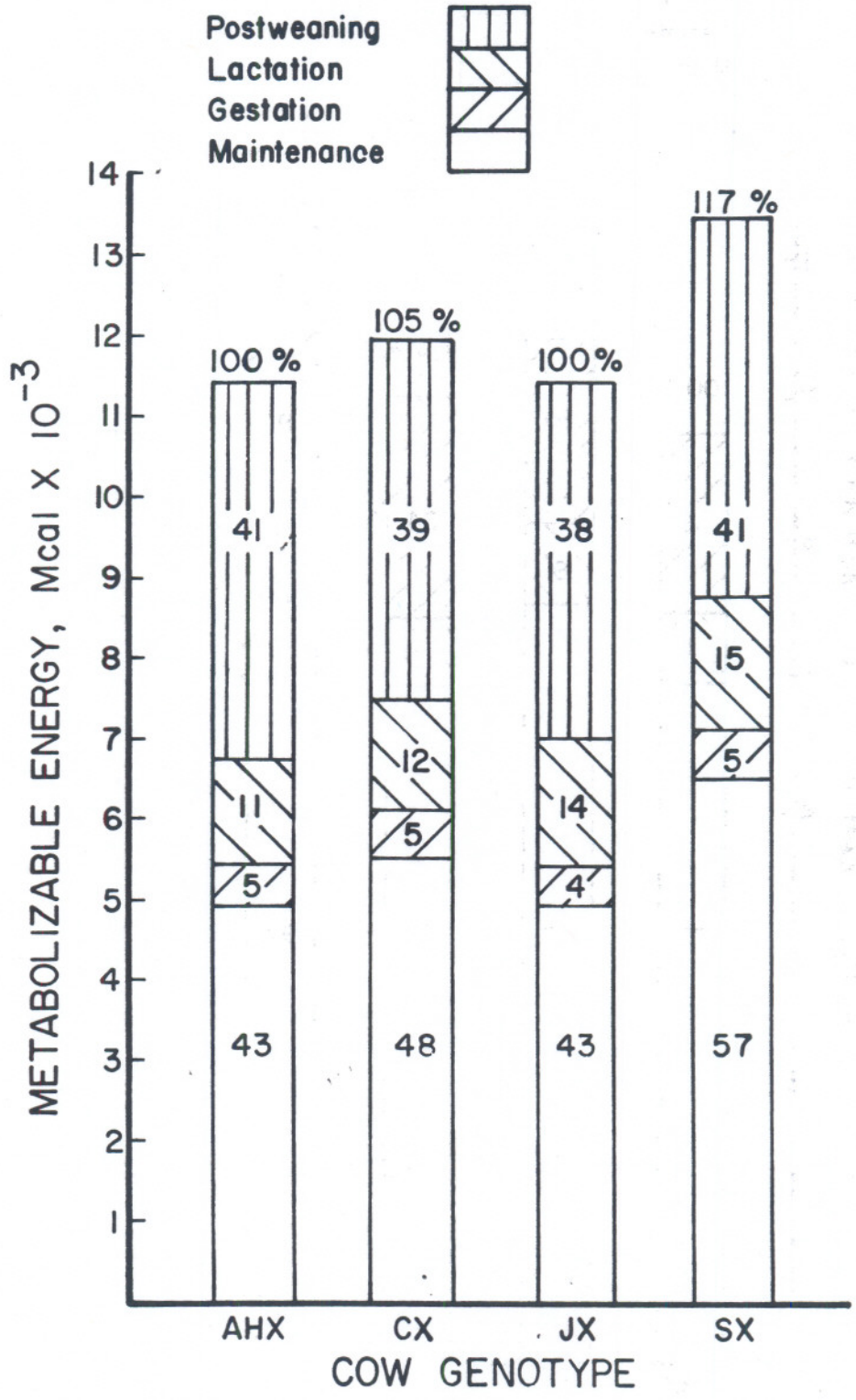

Figure 4. Estimated total metabolizable energy required for the production of calves to 455 days of age.

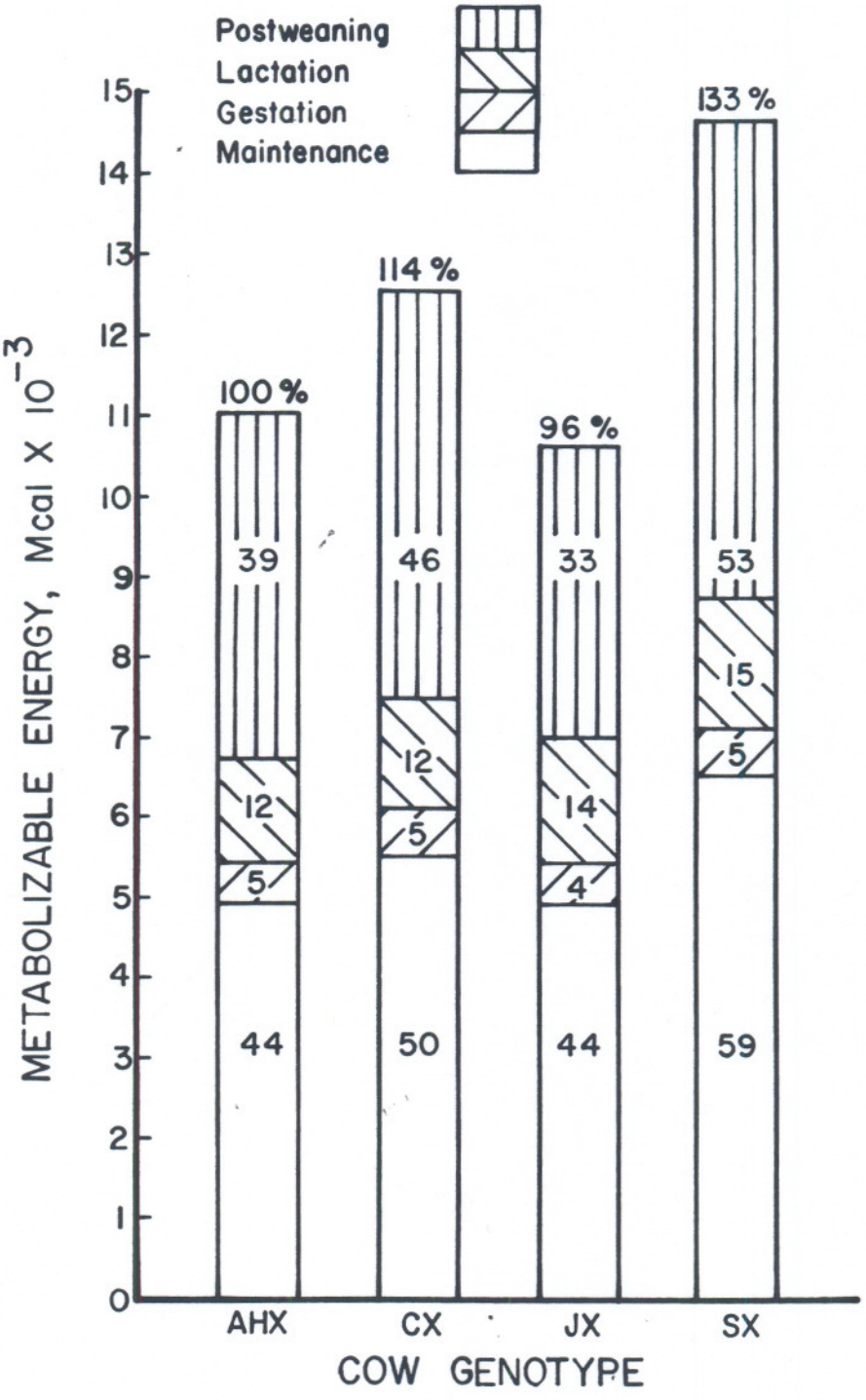

Figure 5. Estimated total metabolizable energy required for the production of calves to a constant degree of marbling end point.