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## Germ Plasm Evaluation Program- Progress Report No. 9

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# **Germ Plasm Evaluation Program**

Progress Report No. 9

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

In cooperation with  
Kansas State University  
and the University of Nebraska

Agricultural Reviews and Manuals  
Agricultural Research Service  
U.S. Department of Agriculture

ARM-NC-20  
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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 management 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<sup>1</sup>

PROGRESS REPORT NO. 9

Larry V. Cundiff,<sup>2</sup> Keith E. Gregory,<sup>2</sup> and Robert M. Koch<sup>3</sup>

This report provides reproduction and maternal performance data for cows in each cycle and phase 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.

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Previous progress reports have presented complete data for Cycles I, II, and III and are available by request. Progress Report No. 1 (ARS-NC-13, 1974) included birth and weaning traits of Cycle I, Phase 2, calves and postweaning growth, feed efficiency, and carcass and meat traits of the steers. Progress Report No. 2 (ARS-NC-22, 1975) included the preweaning traits for both calf crops in Cycle II, phase 2. Progress Report No. 3 (ARS-NC-41, 1976) presented a complete summary and discussion of Cycle I, Phase 2, results from birth through slaughter for steers and from birth through puberty for the heifers. Progress Report No. 4 (ARS-NC-48, 1976) included preweaning and postweaning information for Cycle I, Phase 3, calves, and postweaning steer data for the 1974 calf crop and postweaning heifer data for both calf crops of Cycle II, Phase 2, calves. Progress Report No. 5 included complete results for birth and weaning traits on Cycle III, Phase 2, calves. Progress Report No. 6 (ARS-NC-2, 1978) included postweaning growth, and carcass data of steers and growth, puberty, and conception data of heifers in Cycle II, Phase 3 and Cycle III, Phase 2.

General releases of information on individual sires are not made because erroneous conclusions may be drawn from the ranking of individual sires with the relatively small number of progeny per sire in this program. The objective of the program is to characterize breeds as representatives of different biological types. To do this effectively, a large sample of sires of each breed is necessary. Thus, the number of progeny per sire is generally small. A relatively large number of progeny per sire is required for a high level of accuracy in ranking individual sires on their breeding value for most economic traits.

#### TRAITS MEASURED

Calving Difficulty. Calving difficulty scores were assigned to each calf at birth on the basis of the following system:

##### Score

- |                         |   |
|-------------------------|---|
| 1 No difficulty         | - Calves unassisted.  |
| 2 Little difficulty     | - Assistance given by hand, but no jack or puller used; assistance actually may not have been required.       |
| 3 Moderate difficulty   | - Assistance given with jack or calf-puller; some difficulty was encountered even with the puller being used. |
| 4 Major difficulty      | - Calf jack used and major difficulty encountered usually 30 min or more required to deliver calf.            |
| 5 Caesarean birth       | - Performed after determination made that calf could not be delivered with a calf-puller.                     |
| 6 Abnormal presentation | - Assistance given: posterior, head back, leg back, and so forth.   |



For the summaries of calving difficulty presented in his report, scores of 1 and 2 were combined and are designated no difficulty and scores of 3 and 4 were combined and are designated calf-puller.

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 I, PHASE 2

Foundation Cows. The foundation Hereford and Angus cows used in the program were purchased as calves at weaning from commercial producers in Nebraska. The cows were 2 through 5 years of age, 2 through 6 years of age, and 3 through 7 years of age at calving in 1970, 1971, and 1972, respectively.

Sires. In Cycle I, 32 Hereford, 35 Angus, 33 Jersey, 28 South Devon, 20 Limousin, 28 Simmental, and 26 Charolais bulls were used during the 1969, 1970, and 1971 breeding seasons. The Hereford and Angus bulls used in this program were sampled from bulls that had been selected on individual performance information, which was the basis for entering into the progeny testing programs of commercial AI organizations. The Jersey bulls were selected at random from two commercial AI organizations, and the South Devon bulls were sampled from an importation made in 1969 by a commercial organization. Simmental, Limousin, and Charolais bulls were sampled from bulls available from commercial AI organizations and from the Canada Department of Agriculture for the Simmental and Limousin.



For a cooperative study with the Canada Department of Agriculture, Hereford-Angus, Jersey-Angus, Simmental-Angus, and Charolais, Angus heifers were randomly selected at weaning time and shipped, 4 to 8 weeks after weaning, to the Research Station, Lethbridge, Alberta. There were 12 heifers per breed group in 1970 and 10 heifers per breed group in 1971 and 1972. These females and their offspring were individually fed to evaluate efficiency of production.

Matings. Cycle I, Phase 2, yearling heifers were mated to Hereford, Angus, Brahman, Devon, and Holstein bulls during a 45- to 46-day AI season and to Hereford and Angus bulls for a 21- to 24-day cleanup period in 1971, 1972, and 1973 (appendix table 3). As 2-year-old cows, they were mated to Hereford, Angus, Chianina, Gelbvieh and Maine Anjou bulls for a 42- to 45-day AI season and to Hereford and Angus bulls during a 22-day cleanup in 1972, 1973, and 1974. As 3-year-olds and at subsequent ages through 8 years of age, the cows were mated by natural service to Brown Swiss (predominantly European) bulls.

2-Year-Old Cows. Calving difficulty, calf mortality, calf birth weight and 200-day weight of progeny out of Cycle I, Phase 2 cows as 2-year-olds are presented in table 1. These data were analyzed by least-squares procedures for unequal subclass numbers using a model that included the effects of breed of cow's sire, breed of cow's dam, breed of calf's sire, year, sex, and most two-way interactions, with birth date as a covariate. Unweighted year-breed group means are presented in table 2 for calf birth date, calf crop percentage, postpartum interval, AI percentage, and pregnancy rate of the Cycle I, Phase 2 females as 2-year-olds.

3-Year-Old Cows. Calving difficulty, calf crop percentage, calf mortality, calf birth weight, and 200-day weight of progeny out of Cycle I, Phase 3 cows as 3-year-olds are provided in table 3. Calving date, postpartum interval, percentage pregnant, cow weight, and hip height for 3-year-olds are presented in table 4. Analytical procedures were the same as those used for 2-year-olds.

4-, 5-, 6-, 7-, and 8-Year-Old Cows. Summaries of calving difficulty, calf crop percentage, calf mortality, calf birth weight, and 200-day weight are presented in table 5 for Cycle I, Phase 2 cows calving at 4-, 5-, 6-, 7-, and 8-years of age. Calving date and rebreeding performance at 4 through 8 years of age and cow weight and hip height at 7 and 8 years of age are provided in table 6. Calving difficulty, calf mortality, calf birth weight, and 200-day weight were analyzed by least-squares procedures for unequal subclass numbers using a model that included the effects of breed of cow's sire, breed of cow's dam, cow age-year, sex, breed of cows sire-breed of cow's dam interaction, and breed of cow's dam-sex interaction. Calf crop percentage, pregnancy rate, cow weights, and heights were analyzed with a similar least-squares procedure except that sex and the two-way interaction with sex were not included in the model.

## Discussion

Results on production of the  $F_1$  females (as 2- through 8-year-olds) are summarized for Cycle I, Phase 2 females in table 7. Results presented in table 7 are adjusted for differences in sire breed of calf, for age of dam,

and year, and to a steer basis. Jersey cross females experienced less calving difficulty than other breed groups in Cycle I, especially as 2-year-olds (table 1). Differences in calving difficulty of F<sub>1</sub> cows were associated with birth weight of their calves. The relatively heavy weaning weights of calves from Simmental and Jersey cross dams in Cycle I reflect their greater milk production. Jersey cross dams produced more milk but calves with Simmental and Charolais cross dams were heavier at weaning than calves with Jersey cross dams because of greater growth rate transmitted by Simmental and Charolais cross dams. Calf weight at 200 days per F<sub>1</sub> cow exposed to breeding among the breed groups included in Cycle I had a range of 9%, i.e., 100% for Limousin and Hereford-Angus crosses to 109% for Simmental crosses.



TABLE 1. 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 2-YEAR OLD COWS<sup>a</sup>  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

| Breed of cow                  |          | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf crop, % <sup>c</sup> |        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |                |                                  |
|-------------------------------|----------|--------------------------|--------------------------|----------------|---------------|------------------------|---------------------------|--------|--------------------------------|------|------------------------------|----------------|----------------------------------|
| Sire                          | Dam      |                          | No<br>diff. <sup>b</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sentation | Born                      | Weaned | Early                          | Late | Birth                        | 200-<br>day wt | 200-day<br>wt ratio <sup>f</sup> |
| Angus                         | Hereford | 48                       | 57.6                     | 34.4           | 3.9           | 4.1                    | 88.1                      | 78.0   | 4.7                            | 6.8  | 68.9                         | 383            | 103.5                            |
| Hereford                      | Angus    | 50                       | 62.4                     | 27.3           | 8.5           | 1.8                    | 87.7                      | 76.2   | 7.9                            | 5.2  | 67.8                         | 357            | 96.5                             |
|                               | Average  | 98                       | 60.0                     | 30.9           | 6.1           | 3.0                    | 87.9                      | 77.1   | 6.3                            | 6.0  | 68.4                         | 370            | 100.0                            |
| Jersey                        | Hereford | 51                       | 86.3                     | 11.8           | .0            | 2.7                    | 86.9                      | 84.2   | 3.1                            | .0   | 66.9                         | 412            | 111.4                            |
|                               | Angus    | 46                       | 73.1                     | 19.8           | .0            | 7.4                    | 83.9                      | 74.3   | 10.1                           | 1.3  | 63.8                         | 405            | 109.5                            |
|                               | Average  | 97                       | 79.7                     | 15.8           | .0            | 5.0                    | 85.4                      | 79.3   | 6.6                            | .6   | 65.3                         | 409            | 110.5                            |
| South Devon                   | Hereford | 50                       | 47.7                     | 43.7           | 5.1           | 3.5                    | 83.9                      | 78.7   | .3                             | 6.0  | 75.9                         | 374            | 101.1                            |
|                               | Angus    | 46                       | 50.0                     | 43.3           | 3.5           | 3.1                    | 82.5                      | 71.5   | 10.7                           | 2.6  | 76.7                         | 392            | 105.9                            |
|                               | Average  | 96                       | 48.9                     | 43.5           | 4.3           | 3.3                    | 83.2                      | 75.0   | 5.5                            | 4.3  | 76.3                         | 383            | 103.5                            |
| Limousin                      | Hereford | 53                       | 66.7                     | 19.6           | .6            | 13.0                   | 72.0                      | 53.0   | 10.5                           | 15.9 | 69.2                         | 377            | 101.9                            |
|                               | Angus    | 65                       | 63.3                     | 30.4           | 1.7           | 4.6                    | 90.9                      | 79.3   | 9.1                            | 3.8  | 71.3                         | 385            | 104.1                            |
|                               | Average  | 118                      | 65.0                     | 25.0           | 1.2           | 8.8                    | 81.5                      | 66.1   | 9.8                            | 9.8  | 70.3                         | 381            | 103.0                            |
| Simmental                     | Hereford | 69                       | 54.4                     | 37.3           | 7.5           | .8                     | 82.2                      | 79.5   | 1.0                            | 2.3  | 76.2                         | 414            | 111.9                            |
|                               | Angus    | 55                       | 53.4                     | 31.2           | 9.3           | 6.0                    | 83.8                      | 75.1   | 7.0                            | 3.4  | 75.7                         | 412            | 111.4                            |
|                               | Average  | 124                      | 53.9                     | 34.3           | 8.4           | 3.4                    | 83.0                      | 77.3   | 4.0                            | 2.9  | 75.9                         | 413            | 111.6                            |
| Charolais                     | Hereford | 60                       | 57.9                     | 29.8           | 6.9           | 5.4                    | 81.8                      | 72.3   | 4.2                            | 7.4  | 75.5                         | 395            | 106.8                            |
|                               | Angus    | 42                       | 54.3                     | 36.8           | 2.6           | 6.3                    | 78.2                      | 65.5   | 10.8                           | 5.4  | 76.3                         | 393            | 106.2                            |
|                               | Average  | 102                      | 56.1                     | 33.3           | 4.7           | 5.9                    | 80.0                      | 68.9   | 7.5                            | 6.4  | 75.9                         | 394            | 106.5                            |
| Average<br>all sire<br>breeds | Hereford | 331                      | 61.8                     | 29.4           | 3.9           | 4.9                    | 82.5                      | 74.0   | 4.0                            | 6.4  | 72.1                         | 393            | 106.2                            |
|                               | Angus    | 304                      | 59.4                     | 31.5           | 4.2           | 4.9                    | 84.5                      | 73.6   | 9.3                            | 3.6  | 71.9                         | 391            | 105.7                            |
|                               | Average  | 635                      | 60.6                     | 30.5           | 4.0           | 4.9                    | 83.5                      | 73.8   | 6.6                            | 5.0  | 72.0                         | 392            | 105.9                            |

<sup>a</sup> Calves from these cows were sired by Hereford, Angus, Devon, Holstein, and Brahman bulls (appendix table 3).

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

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury or by death and not for being open.

<sup>d</sup> Early mortality is within 24 hr of birth; late is from 24 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 4.8 lb for birth weight and 20 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 370 lb average for Hereford and Angus sired dams.

TABLE 2. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 2-YEAR-OLDS  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

| Breed of cow                  |          | Number<br>calving as<br>2-year-olds | Average<br>calving<br>date | Bred<br>AI, % <sup>a</sup> | Postpartum<br>interval,<br>days <sup>b</sup> | Percent<br>pregnant <sup>a</sup> | Cow weight, lb<br>2-1/2 years | Hip height, in<br>2-1/2 years <sup>c</sup> |
|-------------------------------|----------|-------------------------------------|----------------------------|----------------------------|--|----------------------------------|-------------------------------|--|
| Sire                          | Dam      |                                     |                            |                            |  |                                  |                               |  |
| Angus<br>Hereford             | Hereford | 48                                  | March 24                   | 83.9                       | 83.6   | 89.3                             | 872                           | 47.0                                       |
|                               | Angus    | 50                                  | March 24                   | 85.7                       | 84.8   | 85.7                             | 901                           | 46.4                                       |
|                               | Average  | 98                                  | March 24                   | 84.8                       | 84.2   | 87.5                             | 887                           | 46.7                                       |
| Jersey                        | Hereford | 51                                  | March 22                   | 90.2                       | 77.4   | 98.0                             | 802                           | 47.1                                       |
|                               | Angus    | 46                                  | March 22                   | 91.5                       | 78.2   | 89.4                             | 791                           | 47.2                                       |
|                               | Average  | 97                                  | March 22                   | 90.8                       | 77.8   | 93.7                             | 796                           | 47.1                                       |
| South Devon                   | Hereford | 50                                  | March 27                   | 78.8                       | 83.2   | 80.8                             | 926                           | 49.2                                       |
|                               | Angus    | 46                                  | March 25                   | 87.2                       | 82.8   | 89.4                             | 940                           | 48.7                                       |
|                               | Average  | 96                                  | March 26                   | 83.0                       | 83.0   | 85.1                             | 933                           | 48.9                                       |
| Limousin                      | Hereford | 53                                  | April 2                    | 70.7                       | 82.1   | 84.5                             | 927                           | 49.4                                       |
|                               | Angus    | 65                                  | March 27                   | 78.3                       | 82.6   | 75.4                             | 922                           | 48.9                                       |
|                               | Average  | 118                                 | March 30                   | 74.5                       | 82.4   | 79.9                             | 925                           | 49.1                                       |
| Simmental                     | Hereford | 69                                  | March 24                   | 75.7                       | 88.8   | 81.0                             | 958                           | 49.8                                       |
|                               | Angus    | 55                                  | March 22                   | 84.2                       | 91.0   | 78.9                             | 951                           | 49.4                                       |
|                               | Average  | 124                                 | March 23                   | 79.9                       | 89.9   | 80.0                             | 954                           | 49.6                                       |
| Charolais                     | Hereford | 60                                  | March 27                   | 80.3                       | 86.3   | 85.2                             | 1000                          | 49.7                                       |
|                               | Angus    | 42                                  | March 22                   | 76.7                       | 91.1   | 81.4                             | 1029                          | 49.1                                       |
|                               | Average  | 102                                 | March 25                   | 78.5                       | 88.7   | 83.3                             | 1015                          | 49.4                                       |
| Average<br>All Sire<br>Breeds | Hereford | 331                                 | March 26                   | 79.9                       | 83.7   | 86.5                             | 914                           | 48.7                                       |
|                               | Angus    | 304                                 | March 24                   | 83.9                       | 85.3   | 83.4                             | 922                           | 48.3                                       |
|                               | Average  | 635                                 | March 25                   | 81.9                       | 84.5   | 84.9                             | 918                           | 48.5                                       |

<sup>a</sup> Breeding period was 42 to 45 days by AI (appendix table 3) and 22 days by natural service (Hereford or Angus cleanup bulls). Percent pregnant = number palpated as pregnant ÷ number palpated, and only include cows that calved prior to breeding.

<sup>b</sup> Interval from calving to first estrus.

<sup>c</sup> Hip height measurements at 2-1/2 years of age available only on 1972 born cows.



TABLE 3. 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-YEAR-OLD COWS<sup>a</sup>  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

| Breed of cow            |          | Number calves born | Type of parturition, % |             |           |                   | Calf crop, % <sup>c</sup> |        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |            |                               |
|-------------------------|----------|--------------------|------------------------|-------------|-----------|-------------------|---------------------------|--------|--------------------------------|------|------------------------------|------------|-------------------------------|
| Sire                    | Dam      |                    | No diff. <sup>b</sup>  | Calf puller | C-section | Abn. presentation | Born                      | Weaned | Early                          | Late | Birth                        | 200-day wt | 200-day wt ratio <sup>f</sup> |
| Angus<br>Hereford       | Hereford | 56                 | 71.5                   | 16.8        | 1.9       | 9.7               | 84.8                      | 74.2   | 8.1                            | 4.4  | 83.6                         | 429        | 102.1                         |
|                         | Angus    | 56                 | 65.0                   | 25.6        | 1.6       | 7.8               | 87.5                      | 80.6   | 5.2                            | 2.7  | 83.8                         | 411        | 97.9                          |
|                         | Average  | 112                | 68.3                   | 21.2        | 1.8       | 8.8               | 86.2                      | 77.4   | 6.7                            | 3.5  | 83.7                         | 420        | 100.0                         |
| Jersey                  | Hereford | 54                 | 90.7                   | 6.7         | 0.0       | 2.9               | 91.5                      | 82.7   | 5.3                            | 4.3  | 78.7                         | 445        | 106.0                         |
|                         | Angus    | 46                 | 78.8                   | 14.2        | 0.1       | 7.0               | 88.5                      | 83.3   | 5.1                            | 0.7  | 76.5                         | 444        | 105.7                         |
|                         | Average  | 100                | 84.8                   | 10.5        | 0.0       | 4.9               | 90.0                      | 83.1   | 5.2                            | 2.5  | 77.6                         | 444        | 105.7                         |
| South Devon             | Hereford | 50                 | 65.5                   | 23.0        | 0.3       | 11.2              | 83.3                      | 75.4   | 3.8                            | 5.7  | 89.0                         | 438        | 104.3                         |
|                         | Angus    | 46                 | 72.8                   | 14.5        | 2.3       | 10.4              | 86.8                      | 81.2   | 6.7                            | 0.0  | 88.9                         | 434        | 103.3                         |
|                         | Average  | 96                 | 69.2                   | 18.7        | 1.3       | 10.8              | 85.0                      | 78.3   | 5.3                            | 2.8  | 89.0                         | 436        | 103.8                         |
| Limousin                | Hereford | 70                 | 73.2                   | 21.5        | 4.3       | 1.0               | 87.5                      | 77.4   | 2.1                            | 9.4  | 87.3                         | 431        | 102.6                         |
|                         | Angus    | 54                 | 80.9                   | 17.4        | 0.9       | 0.8               | 72.0                      | 64.3   | 3.6                            | 7.1  | 87.4                         | 429        | 102.1                         |
|                         | Average  | 124                | 77.0                   | 19.5        | 2.6       | 0.9               | 79.8                      | 70.9   | 2.8                            | 8.3  | 87.4                         | 430        | 102.4                         |
| Simmental               | Hereford | 71                 | 64.7                   | 24.8        | 8.0       | 2.5               | 81.6                      | 73.3   | 4.9                            | 5.3  | 91.0                         | 468        | 111.4                         |
|                         | Angus    | 53                 | 70.6                   | 22.0        | 4.5       | 2.9               | 81.5                      | 73.6   | 4.1                            | 5.7  | 86.5                         | 464        | 110.5                         |
|                         | Average  | 124                | 67.6                   | 23.4        | 6.3       | 2.7               | 81.6                      | 73.4   | 4.5                            | 5.5  | 88.8                         | 466        | 111.0                         |
| Charolais               | Hereford | 62                 | 75.8                   | 18.0        | 1.6       | 4.6               | 83.8                      | 78.9   | 1.6                            | 4.3  | 91.0                         | 438        | 104.3                         |
|                         | Angus    | 46                 | 65.3                   | 22.0        | 4.0       | 8.8               | 85.2                      | 78.3   | 3.3                            | 4.8  | 90.5                         | 438        | 104.3                         |
|                         | Average  | 108                | 70.6                   | 20.0        | 2.8       | 6.7               | 84.5                      | 78.6   | 2.4                            | 4.5  | 90.8                         | 438        | 104.3                         |
| Average all sire breeds | Hereford | 363                | 73.6                   | 18.5        | 2.6       | 5.3               | 85.4                      | 76.9   | 4.3                            | 5.6  | 86.8                         | 442        | 105.2                         |
|                         | Angus    | 301                | 72.2                   | 19.3        | 2.2       | 6.3               | 83.6                      | 76.8   | 4.7                            | 3.4  | 85.6                         | 437        | 104.0                         |
|                         | Average  | 664                | 72.9                   | 18.9        | 2.4       | 5.8               | 84.5                      | 76.9   | 4.5                            | 4.5  | 86.2                         | 440        | 104.8                         |

<sup>a</sup> Calves from these cows were sired by Hereford, Angus, Gelbvieh, Maine Anjou, and Chianina bulls (appendix table 3).

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

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, being open 2 consecutive years or by death.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 6.7 lb for birth weight and 18 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 420 lb average for Hereford and Angus sired dams.

TABLE 4. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 3-YEAR-OLDS  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

| Breed of cow                  |          | Number<br>calving as<br>3-year-olds | Average<br>calving<br>date | Postpartum<br>interval,<br>days <sup>a</sup> | Percent<br>pregnant <sup>b</sup> | Cow weight, lb<br>3-1/2 years | Hip height, in<br>3-1/2 years <sup>c</sup> |
|-------------------------------|----------|-------------------------------------|----------------------------|--|----------------------------------|-------------------------------|--|
| Sire                          | Dam      |                                     |                            |  |                                  |                               |  |
| Angus<br>Hereford             | Hereford | 56                                  | April 7                    | 60.9   | 89.3                             | 968                           | 47.5                                       |
|                               | Angus    | 56                                  | April 8                    | 63.9   | 94.6                             | 999                           | 47.6                                       |
|                               | Average  | 112                                 | April 8                    | 62.4   | 92.0                             | 983                           | 47.5                                       |
| Jersey                        | Hereford | 54                                  | March 31                   | 64.4   | 98.1                             | 858                           | 47.7                                       |
|                               | Angus    | 46                                  | March 28                   | 68.6   | 91.3                             | 858                           | 47.6                                       |
|                               | Average  | 100                                 | March 30                   | 66.5   | 94.7                             | 858                           | 47.6                                       |
| South Devon                   | Hereford | 50                                  | April 9                    | 64.5   | 89.8                             | 1035                          | 49.9                                       |
|                               | Angus    | 46                                  | April 7                    | 57.9   | 82.2                             | 1003                          | 49.2                                       |
|                               | Average  | 96                                  | April 8                    | 61.2   | 86.0                             | 1019                          | 49.6                                       |
| Limousin                      | Hereford | 70                                  | April 10                   | 63.8   | 92.5                             | 1024                          | 50.2                                       |
|                               | Angus    | 54                                  | April 6                    | 62.2   | 96.3                             | 1017                          | 49.4                                       |
|                               | Average  | 124                                 | April 8                    | 63.0   | 94.4                             | 1020                          | 49.8                                       |
| Simmental                     | Hereford | 71                                  | April 7                    | 64.7   | 95.7                             | 1047                          | 50.3                                       |
|                               | Angus    | 53                                  | April 3                    | 63.7   | 88.5                             | 1034                          | 49.7                                       |
|                               | Average  | 124                                 | April 5                    | 64.2   | 92.1                             | 1041                          | 50.0                                       |
| Charolais                     | Hereford | 62                                  | April 7                    | 62.0   | 96.7                             | 1100                          | 50.2                                       |
|                               | Angus    | 46                                  | April 7                    | 69.1   | 86.7                             | 1099                          | 49.5                                       |
|                               | Average  | 108                                 | April 7                    | 65.6   | 91.7                             | 1100                          | 49.9                                       |
| Average<br>all sire<br>breeds | Hereford | 363                                 | April 7                    | 63.4   | 93.7                             | 1005                          | 49.3                                       |
|                               | Angus    | 301                                 | April 5                    | 64.2   | 89.9                             | 1002                          | 48.8                                       |
|                               | Average  | 664                                 | April 6                    | 63.8   | 91.8                             | 1003                          | 49.1                                       |

<sup>a</sup> Interval from calving to first estrus.

<sup>b</sup> Breeding period was 64 days by natural service to Brown Swiss bulls. Percent pregnant = number palpated as pregnant ÷ number palpated, and only includes cows that calved prior to breeding.

<sup>c</sup> Hip height measurements at 3-1/2 years of age available only on 1971 and 1972 born cows.



TABLE 5. 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 4-, 5-, 6-, 7-, AND 8-YEAR-OLD COWS<sup>a</sup>  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

| Breed of cow                  |          | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf crop, % <sup>c</sup> |        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |                |                                  |
|-------------------------------|----------|--------------------------|--------------------------|----------------|---------------|------------------------|---------------------------|--------|--------------------------------|------|------------------------------|----------------|----------------------------------|
| Sire                          | Dam      |                          | No<br>diff. <sup>b</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sentation | Born                      | Weaned | Early                          | Late | Birth                        | 200-<br>day wt | 200-day<br>wt ratio <sup>f</sup> |
| Angus                         | Hereford | 256                      | 97.4                     | 0.3            | 0.0           | 2.3                    | 95.1                      | 86.8   | 2.7                            | 5.5  | 90.1                         | 511            | 101.2                            |
| Hereford                      | Angus    | 272                      | 95.5                     | 3.0            | 0.4           | 1.2                    | 95.7                      | 89.6   | 4.4                            | 1.5  | 91.1                         | 499            | 98.8                             |
|                               | Average  | 528                      | 96.4                     | 1.7            | 0.2           | 1.7                    | 95.4                      | 88.2   | 3.6                            | 3.5  | 90.6                         | 505            | 100.0                            |
| Jersey                        | Hereford | 241                      | 98.4                     | 0.8            | 0.0           | 0.8                    | 96.2                      | 91.0   | 3.8                            | 1.7  | 84.6                         | 523            | 103.6                            |
|                               | Angus    | 190                      | 97.9                     | 0.5            | 0.0           | 1.6                    | 90.4                      | 81.9   | 4.7                            | 4.7  | 80.4                         | 512            | 101.4                            |
|                               | Average  | 431                      | 98.1                     | 0.7            | 0.0           | 1.2                    | 93.3                      | 86.4   | 4.2                            | 3.2  | 82.5                         | 517            | 102.4                            |
| South Devon                   | Hereford | 219                      | 93.8                     | 2.9            | 0.5           | 2.8                    | 93.3                      | 90.0   | 1.3                            | 2.7  | 97.3                         | 526            | 104.2                            |
|                               | Angus    | 192                      | 94.0                     | 2.4            | 0.0           | 3.6                    | 93.0                      | 89.4   | 2.5                            | 1.1  | 92.0                         | 521            | 103.2                            |
|                               | Average  | 411                      | 93.9                     | 2.7            | 0.2           | 3.2                    | 93.1                      | 89.7   | 1.9                            | 1.9  | 94.7                         | 523            | 103.6                            |
| Limousin                      | Hereford | 302                      | 96.2                     | 2.0            | 0.0           | 1.7                    | 93.6                      | 87.4   | 4.9                            | 1.9  | 94.2                         | 519            | 102.8                            |
|                               | Angus    | 307                      | 94.3                     | 2.5            | 0.3           | 2.9                    | 97.8                      | 91.1   | 6.1                            | 1.0  | 89.4                         | 510            | 101.0                            |
|                               | Average  | 609                      | 95.2                     | 2.3            | 0.2           | 2.3                    | 95.7                      | 89.2   | 5.5                            | 1.4  | 91.8                         | 514            | 101.8                            |
| Simmental                     | Hereford | 348                      | 91.2                     | 5.9            | 0.6           | 2.3                    | 96.1                      | 91.0   | 5.2                            | 0.9  | 96.9                         | 554            | 109.7                            |
|                               | Angus    | 276                      | 93.6                     | 3.6            | 0.0           | 2.9                    | 92.8                      | 84.9   | 5.8                            | 1.8  | 93.6                         | 550            | 108.9                            |
|                               | Average  | 624                      | 92.4                     | 4.7            | 0.3           | 2.6                    | 94.5                      | 88.0   | 5.5                            | 1.4  | 95.3                         | 552            | 109.3                            |
| Charolais                     | Hereford | 290                      | 91.5                     | 4.1            | 1.0           | 3.4                    | 95.3                      | 85.8   | 6.8                            | 3.8  | 96.7                         | 536            | 106.1                            |
|                               | Angus    | 193                      | 92.3                     | 3.1            | 0.5           | 4.1                    | 91.6                      | 83.8   | 6.6                            | 2.6  | 96.3                         | 536            | 106.1                            |
|                               | Average  | 483                      | 91.9                     | 3.6            | 0.8           | 3.7                    | 93.5                      | 84.8   | 6.7                            | 3.2  | 96.5                         | 536            | 106.1                            |
| Average<br>all sire<br>breeds | Hereford | 1656                     | 94.8                     | 2.7            | 0.4           | 2.2                    | 94.9                      | 88.7   | 4.1                            | 2.8  | 93.3                         | 528            | 104.6                            |
|                               | Angus    | 1430                     | 94.5                     | 2.5            | 0.2           | 2.7                    | 93.6                      | 86.8   | 5.0                            | 2.1  | 90.5                         | 521            | 103.2                            |
|                               | Average  | 3086                     | 94.7                     | 2.6            | 0.3           | 2.5                    | 94.2                      | 87.7   | 4.6                            | 2.4  | 91.9                         | 525            | 104.0                            |

<sup>a</sup> Calves from these cows were sired by Brown Swiss bulls (appendix table 3).

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

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, being open two consecutive years or by death.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 6.7 lb for birth weight and 34 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 505 lb average for Hereford and Angus sired dams.

TABLE 6. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE AND REBREEDING PERFORMANCE AS 4-, 5-, 6-, 7-, AND 8-YEAR-OLD COWS  
AND SIZE AS 7- AND 8-YEAR OLD COWS CYCLE I, PHASE 2 - COWS BORN 1970-71-72

| Breed of cow            |          | Number of cows |           | Average calving date <sup>a</sup> | Percent pregnant <sup>b</sup> | Cow weight, lb |             | Hip height, in |             |
|-------------------------|----------|----------------|-----------|-----------------------------------|-------------------------------|----------------|-------------|----------------|-------------|
| Sire                    | Dam      | 7-yr olds      | 8-yr olds |                                   |                               | 7-1/2 years    | 8-1/2 years | 7-1/2 years    | 8-1/2 years |
| Angus<br>Hereford       | Hereford | 53             | 37        | March 31                          | 95.4                          | 1219           | 1220        | 48.7           | 48.8        |
|                         | Angus    | 59             | 42        | April 4                           | 94.9                          | 1231           | 1224        | 48.6           | 48.8        |
|                         | Average  | 112            | 79        | April 2                           | 95.2                          | 1225           | 1222        | 48.6           | 48.8        |
| Jersey                  | Hereford | 50             | 45        | March 29                          | 97.5                          | 1071           | 1070        | 48.7           | 48.8        |
|                         | Angus    | 42             | 25        | March 29                          | 91.5                          | 1067           | 1046        | 48.2           | 47.8        |
|                         | Average  | 92             | 70        | March 29                          | 94.5                          | 1069           | 1058        | 48.4           | 48.3        |
| South Devon             | Hereford | 47             | 23        | April 6                           | 94.0                          | 1277           | 1280        | 50.8           | 50.9        |
|                         | Angus    | 41             | 32        | April 1                           | 93.6                          | 1254           | 1244        | 50.4           | 50.4        |
|                         | Average  | 88             | 55        | April 3                           | 93.8                          | 1266           | 1262        | 50.6           | 50.6        |
| Limousin                | Hereford | 70             | 36        | April 4                           | 95.1                          | 1240           | 1241        | 50.9           | 50.7        |
|                         | Angus    | 67             | 41        | March 31                          | 96.6                          | 1230           | 1231        | 50.2           | 50.0        |
|                         | Average  | 137            | 77        | April 2                           | 95.9                          | 1235           | 1236        | 50.6           | 50.3        |
| Simmental               | Hereford | 77             | 46        | April 5                           | 95.2                          | 1273           | 1281        | 51.5           | 51.4        |
|                         | Angus    | 62             | 45        | April 1                           | 94.4                          | 1291           | 1254        | 50.8           | 50.7        |
|                         | Average  | 139            | 91        | April 3                           | 94.8                          | 1282           | 1268        | 51.1           | 51.0        |
| Charolais               | Hereford | 63             | 41        | April 4                           | 96.0                          | 1367           | 1352        | 51.3           | 51.2        |
|                         | Angus    | 44             | 25        | April 4                           | 94.1                          | 1347           | 1354        | 51.0           | 51.0        |
|                         | Average  | 107            | 66        | April 4                           | 95.1                          | 1357           | 1353        | 51.2           | 51.1        |
| Average all sire breeds | Hereford | 360            | 228       | April 3                           | 95.5                          | 1241           | 1241        | 50.3           | 50.3        |
|                         | Angus    | 315            | 210       | April 1                           | 94.2                          | 1237           | 1226        | 49.9           | 49.8        |
|                         | Average  | 675            | 438       | April 2                           | 94.9                          | 1239           | 1233        | 50.1           | 50.0        |

<sup>a</sup> Includes cows calving at 4-, 5-, 6-, 7- and 8-years of age.

<sup>b</sup> Breeding period was 63 days by natural service to Brown Swiss bulls (appendix table 3). Percent pregnant = number palpated as pregnant ÷ number palpated, and only includes cows that calved prior to breeding.



TABLE 7. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM.  
BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF F<sub>1</sub> COWS AT 2 THROUGH 8 YEARS OF AGE  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

| Breed group <sup>a</sup> | Number<br>births | Calving<br>diffi-<br>culty <sup>b</sup><br>% | Calf crop |             | Birth<br>weight<br>lb | Milk<br>prod <sup>c</sup><br>lb | 200-day weight           |                         |                          |                         |
|--------------------------|------------------|--|-----------|-------------|-----------------------|---------------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
|                          |                  |  | Born<br>% | Weaned<br>% |                       |                                 | Per calf<br>weaned<br>lb | Ratio <sup>d</sup><br>% | Per cow<br>exposed<br>lb | Ratio <sup>d</sup><br>% |
| Hereford-Angus-X         | 738              | 10   | 93        | 85          | 86                    | 6.6                             | 472                      | 100                     | 401                      | 100                     |
| Jersey-X                 | 628              | 4  | 92        | 85          | 79                    | 9.7                             | 490                      | 104                     | 415                      | 104                     |
| Limousin-X               | 851              | 9  | 91        | 83          | 88                    | 6.0                             | 481                      | 102                     | 400                      | 100                     |
| South Devon-X            | 603              | 12   | 90        | 86          | 91                    | 7.0                             | 489                      | 104                     | 420                      | 105                     |
| Simmental-X              | 872              | 14   | 91        | 84          | 91                    | 8.8                             | 518                      | 110                     | 436                      | 109                     |
| Charolais-X              | 693              | 12   | 90        | 81          | 93                    | 6.0                             | 500                      | 106                     | 408                      | 102                     |

<sup>a</sup> Breed groups are identified by sire breed. An X denotes crosses out of Hereford and Angus dams.

<sup>b</sup> Includes calves requiring calf puller or C-section.

<sup>c</sup> Average of three 12-hour milk production measures on a sample of 18 cows per breed group at 3 and 4 years of age.

<sup>d</sup> Ratio relative to Hereford-Angus crosses.

### CYCLE I, PHASE 3

Matings. The mating plans to produce Cycle I, Phase 3, calves are shown in appendix table 3. As yearling heifers, the Cycle I, Phase 2, females were bred AI to 16 Hereford, 25 Angus, 14 Brahman, 12 Devon, and 13 Holstein sires for 45 to 46 days followed by a 21- to 24-day cleanup mating period to Hereford and Angus sires to produce their first calf crops as 2-year-olds in the spring of 1972, 1973, and 1974. Birth, survival, preweaning growth, and postweaning steer and heifer data for the Cycle I, phase 3, calves were reported previously (ARS-NC-48, Progress Report No. 4, 1976). The females produced in Cycle I, Phase 3, were retained to evaluate their maternal and reproductive performance when mated naturally to Red Poll bulls.

2-Year-Olds. Data on calving difficulty, calf mortality, and preweaning growth and on cow rebreeding performance and size as 2-year-olds are reported in tables 8 and 9 by breed of the cow's sire. 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 cow's sire, breed of cow's dam, cow age-year, sex, breed of cow's sire-breed of cow's dam interaction, and breed of cow's dam-sex interaction. Unweighted means are presented for calf crop percentage and pregnancy rate. Cow weights (tables 7 and 8) are least-squares means from an analytical model similar to the one used for calf traits, except that sex was omitted.

2-, 3-, 4-, and 5-Year-Olds. Calving difficulty, calf crop percentage, and progeny birth and 200-day weights are shown in table 10 for Cycle I, Phase 3, cows according to the breed of the cow's sire. Calving date, pregnancy rate, and cow weights are shown in table 11. 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 cow's grandsire, breed of cow's granddam, breed of cow's sire, year-age, sex, and two-way interactions. Calf crop percentage, pregnancy rate, and cow weights are least-squares means from an analytical model similar to the one used for calf traits, except that sex was omitted.

### Discussion

Results on production of the 3-way cross females (as 2- through 5-year-olds) from Cycle I, Phase 3 of the program are summarized in table 12. Calving difficulty was less in Brahman cross and Devon cross females than Hereford-Angus cross and Holstein cross females. Calves out of Brahman cross females were significantly lighter at birth than calves out of all other crosses. Calves out of Holstein cross females were significantly heavier at birth than calves out of Hereford-Angus cross and Devon cross females; however, Holstein crosses did not differ significantly from Hereford-Angus crosses in calving difficulty. Differences between breed groups for percentage calf crop born and percentage calf crop weaned were not significant ( $P>.05$ ). Weaning weight per calf weaned and per cow exposed to breeding was significantly higher for progeny of Holstein cross and Brahman cross females than for progeny of Hereford-Angus cross and Devon cross females.



TABLE 8. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DIFFICULTY, CALF MORTALITY, BIRTH WEIGHT, WEANING WEIGHT,  
AND WEANING WEIGHT RATIO OF CALVES FROM 2-YEAR-OLD COWS<sup>a</sup>  
CYCLE I, PHASE 3 - COWS BORN 1972-73-74

| Breed of cow                  |                  | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |                |                                  |
|-------------------------------|------------------|--------------------------|--------------------------|----------------|---------------|------------------------|--------------------------------|------|------------------------------|----------------|----------------------------------|
| Sire                          | Dam <sup>b</sup> |                          | No<br>diff. <sup>c</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sentation | Early                          | Late | Birth                        | 200-<br>day wt | 200-day<br>wt ratio <sup>f</sup> |
| Angus<br>Hereford             | Hereford-X       | 44                       | 64.8                     | 30.2           | 3.3           | 1.7                    | 12.6                           | 0.0  | 73.7                         | 397            | 99.0                             |
|                               | Angus-X          | 46                       | 41.8                     | 48.5           | 8.5           | 1.2                    | 5.0                            | 1.5  | 75.1                         | 404            | 100.7                            |
|                               | Average          | 90                       | 53.3                     | 39.3           | 5.9           | 1.5                    | 8.8                            | 0.0  | 74.4                         | 401            | 100.0                            |
| Brahman                       | Hereford-X       | 26                       | 93.0                     | 8.8            | 0.0           | 0.1                    | 1.9                            | 19.3 | 75.0                         | 459            | 114.5                            |
|                               | Angus-X          | 17                       | 86.6                     | 12.2           | 3.6           | 0.0                    | 4.6                            | 3.0  | 69.7                         | 473            | 118.0                            |
|                               | Average          | 43                       | 89.9                     | 10.5           | 0.8           | 0.0                    | 3.2                            | 11.1 | 72.3                         | 466            | 116.2                            |
| Devon                         | Hereford-X       | 29                       | 63.6                     | 33.7           | 3.5           | 0.0                    | 7.8                            | 0.8  | 76.1                         | 406            | 101.2                            |
|                               | Angus-X          | 28                       | 54.2                     | 42.5           | 0.0           | 3.8                    | 28.0                           | 4.1  | 72.9                         | 411            | 102.5                            |
|                               | Average          | 57                       | 58.9                     | 38.1           | 1.5           | 1.5                    | 17.9                           | 2.5  | 74.5                         | 408            | 101.7                            |
| Holstein                      | Hereford-X       | 25                       | 70.2                     | 25.0           | 3.4           | 1.4                    | 0.1                            | 5.3  | 84.7                         | 475            | 118.5                            |
|                               | Angus-X          | 20                       | 43.7                     | 57.7           | 0.0           | 0.0                    | 6.8                            | 6.4  | 86.0                         | 470            | 117.2                            |
|                               | Average          | 45                       | 56.9                     | 41.4           | 1.6           | 0.1                    | 3.4                            | 5.8  | 85.3                         | 472            | 117.7                            |
| Average<br>all sire<br>breeds | Hereford-X       | 124                      | 72.9                     | 24.4           | 2.1           | 0.6                    | 5.6                            | 6.0  | 77.4                         | 434            | 108.2                            |
|                               | Angus-X          | 111                      | 56.6                     | 40.2           | 2.9           | 0.3                    | 11.1                           | 3.7  | 75.9                         | 439            | 109.5                            |
|                               | Average          | 235                      | 64.8                     | 32.3           | 2.5           | 0.5                    | 8.3                            | 4.9  | 76.6                         | 437            | 109.0                            |

<sup>a</sup> These cows were bred to Red Poll bulls.

<sup>b</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses. Dams of these cows were sired by Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais bulls.

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

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least squares adjustment factors for heifers were 4.3 lb for birth weight and 29 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 401 lb average for Hereford and Angus sired dams.

TABLE 9. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALF CROP PERCENTAGE, CALVING DATE, REBREEDING PERFORMANCE AND SIZE OF COWS CALVING AS 2-YEAR-OLDS  
CYCLE I, PHASE 3 - COWS BORN 1972-73-74

| Breed of cow                  |                  | Number<br>calving as<br>2-year-olds | Calf crop, % <sup>b</sup> |        | Average<br>calving<br>date | Percent<br>pregnant <sup>c</sup> | Cow weight, lb<br>2-1/2 years |
|-------------------------------|------------------|-------------------------------------|---------------------------|--------|----------------------------|----------------------------------|-------------------------------|
| Sire                          | Dam <sup>a</sup> |                                     | Born                      | Weaned |                            |                                  |                               |
| Angus                         | Hereford-X       | 44                                  | 89.8                      | 73.5   | March 30                   | 86.4                             | 873                           |
| Hereford                      | Angus-X          | 46                                  | 87.0                      | 79.6   | March 29                   | 91.5                             | 870                           |
|                               | Average          | 90                                  | 88.4                      | 76.7   | March 29                   | 89.0                             | 871                           |
| Brahman                       | Hereford-X       | 26                                  | 83.9                      | 70.1   | April 14                   | 92.3                             | 961                           |
|                               | Angus-X          | 17                                  | 100.0                     | 88.2   | April 2                    | 100.0                            | 940                           |
|                               | Average          | 43                                  | 89.6                      | 77.1   | April 8                    | 95.4                             | 950                           |
| Devon                         | Hereford-X       | 29                                  | 88.2                      | 76.5   | April 3                    | 93.3                             | 882                           |
|                               | Angus-X          | 28                                  | 87.9                      | 63.6   | March 27                   | 96.6                             | 907                           |
|                               | Average          | 57                                  | 88.1                      | 70.2   | March 30                   | 94.9                             | 895                           |
| Holstein                      | Hereford-X       | 25                                  | 100.0                     | 92.9   | March 27                   | 92.9                             | 949                           |
|                               | Angus-X          | 20                                  | 90.9                      | 72.7   | April 1                    | 95.0                             | 940                           |
|                               | Average          | 45                                  | 96.0                      | 84.0   | March 30                   | 93.8                             | 945                           |
| Average<br>all sire<br>breeds | Hereford-X       | 124                                 | 90.1                      | 77.5   | April 3                    | 90.6                             | 916                           |
|                               | Angus-X          | 111                                 | 89.7                      | 75.4   | March 30                   | 94.7                             | 914                           |
|                               | Average          | 235                                 | 89.9                      | 76.5   | April 1                    | 92.5                             | 915                           |

<sup>a</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses. Dams of these cows were sired by Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais bulls.

<sup>b</sup> Of heifers exposed to breeding and alive at fall palpation the previous year.

<sup>c</sup> Breeding period averaged 56 days by natural service to Red Poll bulls. Percent pregnant = number palpated as pregnant ÷ number palpated, and only include cows that calved prior to breeding.



TABLE 10. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DIFFICULTY, CALF MORTALITY, BIRTH WEIGHT, WEANING WEIGHT, AND WEANING  
WEIGHT RATIO OF CALVES FROM 2-, 3-, 4-, AND 5-YEAR-OLD COWS BY BREED OF SIRE<sup>a</sup>  
CYCLE I, PHASE 3 - COWS BORN 1972-73-74

| Breed of cow                  |                  | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |                             |                                  |
|-------------------------------|------------------|--------------------------|--------------------------|----------------|---------------|------------------------|--------------------------------|------|------------------------------|-----------------------------|----------------------------------|
| Sire                          | Dam <sup>b</sup> |                          | No<br>diff. <sup>c</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sentation | Early                          | Late | Birth                        | 200-<br>day wt <sup>e</sup> | 200-day<br>wt ratio <sup>f</sup> |
| Angus                         | Hereford-X       | 116                      | 84.9                     | 11.9           | 2.6           | 0.7                    | 11.5                           | 0.8  | 79.5                         | 432                         | 101.2                            |
| Hereford                      | Angus-X          | 127                      | 73.6                     | 20.8           | 4.9           | 0.7                    | 3.6                            | 1.5  | 79.6                         | 423                         | 99.1                             |
|                               | Average          | 243                      | 79.2                     | 16.3           | 3.7           | 0.7                    | 7.5                            | 1.1  | 79.6                         | 427                         | 100.0                            |
| Brahman                       | Hereford-X       | 72                       | 94.2                     | 4.3            | 0.0           | 2.3                    | 4.0                            | 8.0  | 75.3                         | 474                         | 111.0                            |
|                               | Angus-X          | 51                       | 94.9                     | 3.7            | 1.9           | 0.0                    | 2.8                            | 3.6  | 75.8                         | 484                         | 113.4                            |
|                               | Average          | 123                      | 94.6                     | 4.0            | 0.6           | 0.9                    | 3.4                            | 5.8  | 75.6                         | 479                         | 112.2                            |
| Devon                         | Hereford-X       | 89                       | 85.5                     | 11.9           | 2.1           | 0.5                    | 1.8                            | 0.0  | 81.0                         | 428                         | 100.2                            |
|                               | Angus-X          | 83                       | 81.2                     | 17.7           | 0.0           | 1.7                    | 15.3                           | 2.5  | 78.8                         | 422                         | 98.8                             |
|                               | Average          | 172                      | 83.3                     | 14.8           | 0.7           | 1.1                    | 8.5                            | 1.2  | 79.9                         | 425                         | 99.5                             |
| Holstein                      | Hereford-X       | 64                       | 88.0                     | 10.2           | 1.5           | 0.3                    | 2.9                            | 4.3  | 85.5                         | 492                         | 115.2                            |
|                               | Angus-X          | 49                       | 79.4                     | 20.0           | 0.3           | 0.2                    | 9.0                            | 0.8  | 86.7                         | 487                         | 114.1                            |
|                               | Average          | 113                      | 83.7                     | 15.1           | 0.9           | 0.3                    | 6.0                            | 2.6  | 86.1                         | 490                         | 114.8                            |
| Average<br>all sire<br>breeds | Hereford-X       | 341                      | 88.1                     | 9.6            | 1.3           | 1.0                    | 5.1                            | 3.3  | 80.3                         | 456                         | 106.8                            |
|                               | Angus-X          | 310                      | 82.3                     | 15.5           | 1.6           | 0.5                    | 7.7                            | 2.1  | 80.2                         | 454                         | 106.3                            |
|                               | Average          | 651                      | 85.2                     | 12.6           | 1.5           | 0.8                    | 6.4                            | 2.7  | 80.3                         | 455                         | 106.6                            |

<sup>a</sup> These cows were bred to Red Poll bulls.

<sup>b</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses. Dams of these cows were sired by Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais bulls.

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

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 3.3 lb for birth weight and 24 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 427 lb average for Hereford and Angus sired dams.



TABLE 11. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALF CROP PERCENTAGE, CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS  
2-, 3-, 4-, AND 5-YEAR-OLD COWS BY BREED OF SIRE  
CYCLE I, PHASE 3 - COWS BORN 1972-73-74

| Breed of cow                  |                  | Number calving as |           |           |           | Calf crop, % <sup>b</sup> |        | Average calving date | Percent pregnant <sup>c</sup> | Cow weight, lb |             |             |             |
|-------------------------------|------------------|-------------------|-----------|-----------|-----------|---------------------------|--------|----------------------|-------------------------------|----------------|-------------|-------------|-------------|
| Sire                          | Dam <sup>a</sup> | 2-yr olds         | 3-yr olds | 4-yr olds | 5-yr olds | Born                      | Weaned |                      |                               | 2-1/2 years    | 3-1/2 years | 4-1/2 years | 5-1/2 years |
| Angus<br>Hereford             | Hereford-X       | 44                | 37        | 24        | 11        | 94.4                      | 81.1   | April 1              | 95.3                          | 873            | 1002        | 1034        | 1125        |
|                               | Angus-X          | 46                | 44        | 27        | 10        | 93.4                      | 89.4   | April 1              | 93.2                          | 870            | 972         | 1025        | 1039        |
|                               | Average          | 90                | 81        | 51        | 21        | 93.9                      | 85.3   | April 1              | 94.2                          | 871            | 987         | 1029        | 1082        |
| Brahman                       | Hereford-X       | 26                | 24        | 13        | 9         | 87.3                      | 78.6   | April 7              | 98.3                          | 961            | 1029        | 1069        | 1201        |
|                               | Angus-X          | 17                | 17        | 12        | 5         | 96.3                      | 88.5   | April 2              | 99.3                          | 940            | 1069        | 1129        | 1104        |
|                               | Average          | 43                | 41        | 25        | 14        | 91.8                      | 83.5   | April 5              | 98.8                          | 950            | 1049        | 1099        | 1153        |
| Devon                         | Hereford-X       | 29                | 30        | 18        | 12        | 92.0                      | 84.7   | April 4              | 95.5                          | 882            | 989         | 1039        | 1167        |
|                               | Angus-X          | 28                | 28        | 16        | 11        | 93.1                      | 83.2   | March 29             | 95.0                          | 907            | 995         | 1063        | 1107        |
|                               | Average          | 57                | 58        | 34        | 23        | 92.6                      | 83.9   | April 1              | 95.3                          | 895            | 992         | 1051        | 1137        |
| Holstein                      | Hereford-X       | 25                | 22        | 12        | 5         | 96.6                      | 87.0   | March 31             | 98.6                          | 949            | 1049        | 1065        | 1260        |
|                               | Angus-X          | 20                | 20        | 7         | 2         | 100.0                     | 87.2   | April 1              | 90.6                          | 940            | 1047        | 1198        | 1059        |
|                               | Average          | 45                | 42        | 19        | 7         | 98.3                      | 87.1   | March 31             | 94.6                          | 945            | 1048        | 1132        | 1159        |
| Average<br>all sire<br>breeds | Hereford-X       | 124               | 113       | 67        | 37        | 92.6                      | 82.8   | April 3              | 96.9                          | 916            | 1017        | 1052        | 1188        |
|                               | Angus-X          | 111               | 109       | 62        | 28        | 96.2                      | 87.1   | April 1              | 94.6                          | 914            | 1021        | 1104        | 1077        |
|                               | Average          | 235               | 222       | 129       | 65        | 94.4                      | 85.0   | April 2              | 95.7                          | 915            | 1019        | 1078        | 1133        |

<sup>a</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses. Dams of these cows were sired by Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais bulls.

<sup>b</sup> Of females exposed to breeding and alive at fall palpation the previous year.

<sup>c</sup> The average breeding period was 63 days by natural service to Red Poll bulls. Percent pregnant = number palpated as pregnant ÷ number palpated, and reflects the rebreeding performance or conception rate of cows which had calved at 2, 3, 4, or 5 years of age.



TABLE 12. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF CROSSBRED COWS AT 2 THROUGH 5 YEARS OF AGE  
CYCLE I, PHASE 3 - COWS BORN 1972-73-74

| Breed group <sup>a</sup> | Number<br>births | Calving<br>diffi-<br>culty <sup>b</sup><br>% | Calf crop |             | Birth<br>weight<br>lb | 200 day weight           |                         |                          |                         |
|--------------------------|------------------|--|-----------|-------------|-----------------------|--------------------------|-------------------------|--------------------------|-------------------------|
|                          |                  |  | Born<br>% | Weaned<br>% |                       | Per calf<br>weaned<br>lb | Ratio <sup>c</sup><br>% | Per cow<br>exposed<br>lb | Ratio <sup>c</sup><br>% |
| Hereford-Angus-X         | 243              | 20.0   | 94        | 85          | 80                    | 427                      | 100                     | 364                      | 100                     |
| Brangus-X                | 123              | 4.6  | 92        | 84          | 76                    | 479                      | 112                     | 400                      | 110                     |
| Devon-X                  | 172              | 5.5  | 93        | 84          | 80                    | 425                      | 100                     | 357                      | 98                      |
| Holstein-X               | 113              | 16.0   | 98        | 87          | 86                    | 490                      | 115                     | 427                      | 117                     |

<sup>a</sup> Breed groups are 3-way crosses identified by breed of sire of the cow. An X denotes crosses of Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais maternal grand sires on Hereford or Angus grand dams.

<sup>b</sup> Includes calves requiring calf puller or C-section.

<sup>c</sup> Ratio relative to Hereford-Angus crosses.



## 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 season.

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.

2-Year-Olds. Data on calving difficulty, calf crop percentage, and birth and weaning weights of calves from 2-year-old dams (born in 1973-74) are presented in table 13 for cows out of Hereford and Angus dams. Data on rebreeding performance and size as 2-year-olds are given in table 14. Calving difficulty, calf mortality, calf birth weight, and 200-day weight 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. Unweighted means are presented for calf crop percentage, postpartum interval, and pregnancy rate.

3-, 4-, 5-, 6-, and 7-Year-Olds. Data on calving difficulty, calf crop percentage, and birth and weaning weights of calves from 3-, 4-, 5-, 6-, and 7-year-old dams (born in 1973-74) are presented in table 15 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 16.

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<sub>1</sub> females (as 2- through 7-year-olds) from Cycle II, Phase 2 of the program are presented in table 17. Calving difficulty has been lower for Brown Swiss and Chianina cross females than other breed groups, especially as 2-year-olds (table 13). Chianina cross females have



had relatively low calving difficulty considering the heavy birth weight of their calves. Differences between breed groups in calf crop percentage born and weaned have not been significant ( $P>.05$ ). 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 was 12% to 15% greater for Brown Swiss, Gelbvieh, Maine-Anjou, and Chianina crosses than for Red Poll and Hereford-Angus crosses. 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. 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 the preliminary data presented in this report.



TABLE 13. 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 2-YEAR-OLD COWS<sup>a</sup>  
CYCLE II, PHASE 2 - COWS BORN 1973-74

| Breed of cow      |          | Number calves born | Type of parturition, % |             |           |                    | Calf crop, % <sup>c</sup> |        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |            |                               |
|-------------------|----------|--------------------|------------------------|-------------|-----------|--------------------|---------------------------|--------|--------------------------------|------|------------------------------|------------|-------------------------------|
| Sire              | Dam      |                    | No diff. <sup>b</sup>  | Calf puller | C-section | Abn. pre-sentation | Born                      | Weaned | Early                          | Late | Birth                        | 200-day wt | 200-day wt ratio <sup>f</sup> |
| Angus<br>Hereford | Hereford | 30                 | 45.8                   | 47.3        | 3.5       | 3.4                | 89.7                      | 79.5   | 3.9                            | 0.0  | 75.1                         | 405        | 100.5                         |
|                   | Angus    | 31                 | 46.0                   | 50.6        | 0.3       | 3.0                | 75.5                      | 59.2   | 24.4                           | 0.6  | 75.9                         | 402        | 99.8                          |
|                   | Average  | 61                 | 45.9                   | 49.0        | 1.9       | 3.2                | 81.8                      | 68.2   | 14.2                           | 0.0  | 75.5                         | 403        | 100.0                         |
| Red Poll          | Hereford | 36                 | 20.0                   | 64.1        | 8.8       | 7.1                | 86.1                      | 69.8   | 15.7                           | 5.4  | 83.9                         | 422        | 104.7                         |
|                   | Angus    | 43                 | 33.4                   | 52.3        | 8.1       | 6.2                | 81.1                      | 62.3   | 14.3                           | 8.1  | 80.2                         | 423        | 105.0                         |
|                   | Average  | 79                 | 26.7                   | 58.2        | 8.5       | 6.7                | 83.3                      | 65.6   | 15.0                           | 6.7  | 82.1                         | 423        | 105.0                         |
| Brown Swiss       | Hereford | 61                 | 62.5                   | 31.8        | 4.0       | 1.7                | 95.4                      | 73.9   | 14.7                           | 6.9  | 81.0                         | 457        | 113.4                         |
|                   | Angus    | 55                 | 65.8                   | 29.0        | 1.9       | 3.3                | 88.9                      | 77.8   | 13.8                           | 0.0  | 81.4                         | 466        | 115.6                         |
|                   | Average  | 116                | 64.1                   | 30.4        | 2.9       | 2.5                | 92.2                      | 75.8   | 14.3                           | 3.0  | 81.2                         | 461        | 114.4                         |
| Gelbvieh          | Hereford | 35                 | 46.4                   | 42.5        | 8.5       | 2.6                | 92.1                      | 79.0   | 9.0                            | 6.5  | 80.7                         | 456        | 113.2                         |
|                   | Angus    | 36                 | 42.9                   | 43.9        | 11.0      | 2.2                | 90.0                      | 77.5   | 4.8                            | 11.3 | 84.7                         | 471        | 116.9                         |
|                   | Average  | 71                 | 44.7                   | 43.2        | 9.8       | 2.4                | 91.0                      | 78.2   | 6.9                            | 8.9  | 82.7                         | 463        | 114.9                         |
| Maine Anjou       | Hereford | 35                 | 43.5                   | 53.7        | 0.0       | 3.6                | 92.1                      | 76.3   | 13.8                           | 3.2  | 85.9                         | 448        | 111.2                         |
|                   | Angus    | 46                 | 42.4                   | 49.4        | 4.8       | 3.4                | 93.8                      | 81.3   | 12.7                           | 3.1  | 86.4                         | 436        | 108.2                         |
|                   | Average  | 81                 | 43.0                   | 51.6        | 2.0       | 3.5                | 93.0                      | 79.1   | 13.2                           | 3.2  | 86.1                         | 442        | 109.5                         |
| Chianina          | Hereford | 35                 | 55.9                   | 38.7        | 1.7       | 3.7                | 80.0                      | 68.9   | 6.1                            | 7.4  | 84.8                         | 438        | 108.7                         |
|                   | Angus    | 39                 | 54.5                   | 29.5        | 13.2      | 2.8                | 87.0                      | 78.3   | 4.6                            | 3.4  | 85.3                         | 441        | 109.4                         |
|                   | Average  | 74                 | 55.2                   | 34.1        | 7.4       | 3.2                | 83.5                      | 73.6   | 5.4                            | 5.4  | 85.0                         | 440        | 109.2                         |
| Average           | Hereford | 232                | 45.7                   | 46.4        | 4.3       | 3.7                | 89.6                      | 74.3   | 10.5                           | 4.8  | 81.9                         | 438        | 108.7                         |
| All sire breeds   | Angus    | 250                | 47.5                   | 42.4        | 6.6       | 3.5                | 86.0                      | 72.6   | 12.4                           | 4.3  | 82.3                         | 440        | 109.2                         |
|                   | Average  | 482                | 46.6                   | 44.4        | 5.4       | 3.6                | 87.0                      | 73.4   | 11.5                           | 4.5  | 82.1                         | 439        | 108.9                         |

<sup>a</sup> Calves from these cows were sired by Hereford, Angus, Brangus, and Santa Gertrudis bulls (appendix table 4).

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

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury or by death.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 8.1 lb for birth weight and 28 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 403 lb average for Hereford and Angus sired dams.



TABLE 14. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 2-YEAR-OLDS  
CYCLE II, PHASE 2 - COWS BORN 1973-74

| Breed of cow                  |          | Number<br>calving as<br>2-year-olds | Average<br>calving<br>date | Postpartum<br>interval,<br>days <sup>a</sup> | Percent<br>pregnant <sup>b</sup> | Cow weight, lb<br>2-1/2 years | Hip height, in<br>2-1/2 years |
|-------------------------------|----------|-------------------------------------|----------------------------|--|----------------------------------|-------------------------------|-------------------------------|
| Sire                          | Dam      |                                     |                            |  |                                  |                               |                               |
| Angus<br>Hereford             | Hereford | 30                                  | March 26                   | 72.3   | 85.7                             | 939                           | 47.1                          |
|                               | Angus    | 31                                  | March 25                   | 65.4   | 94.7                             | 914                           | 46.6                          |
|                               | Average  | 61                                  | March 25                   | 68.6   | 90.4                             | 927                           | 46.9                          |
| Red Poll                      | Hereford | 36                                  | March 27                   | 68.4   | 83.8                             | 879                           | 47.6                          |
|                               | Angus    | 43                                  | March 25                   | 67.5   | 90.7                             | 870                           | 47.0                          |
|                               | Average  | 79                                  | March 26                   | 67.9   | 87.5                             | 874                           | 47.3                          |
| Brown Swiss                   | Hereford | 61                                  | March 27                   | 73.0   | 90.3                             | 935                           | 49.3                          |
|                               | Angus    | 55                                  | March 25                   | 71.2   | 96.4                             | 938                           | 49.0                          |
|                               | Average  | 116                                 | March 26                   | 72.1   | 93.2                             | 937                           | 49.1                          |
| Fleischschaff                 | Hereford | 35                                  | March 27                   | 68.2   | 97.1                             | 978                           | 49.5                          |
|                               | Angus    | 36                                  | March 26                   | 60.1   | 100.0                            | 979                           | 48.8                          |
|                               | Average  | 71                                  | March 26                   | 64.1   | 98.6                             | 979                           | 49.1                          |
| Maine Anjou                   | Hereford | 35                                  | March 27                   | 69.5   | 94.3                             | 1019                          | 50.1                          |
|                               | Angus    | 46                                  | March 25                   | 70.7   | 91.3                             | 1008                          | 49.4                          |
|                               | Average  | 81                                  | March 26                   | 70.2   | 92.6                             | 1013                          | 49.8                          |
| Chianina                      | Hereford | 35                                  | April 2                    | 74.1   | 88.9                             | 1022                          | 52.9                          |
|                               | Angus    | 39                                  | March 24                   | 78.2   | 90.0                             | 1022                          | 52.2                          |
|                               | Average  | 74                                  | March 28                   | 76.4   | 89.5                             | 1022                          | 52.6                          |
| Average<br>all sire<br>breeds | Hereford | 232                                 | March 28                   | 71.0   | 90.0                             | 962                           | 49.4                          |
|                               | Angus    | 250                                 | March 25                   | 69.2   | 93.8                             | 955                           | 48.8                          |
|                               | Average  | 482                                 | March 26                   | 70.1   | 92.0                             | 959                           | 49.1                          |

<sup>a</sup> Interval from calving to first estrus.

<sup>b</sup> Breeding period was 63 days by natural service to 3/4 Simmental bulls (appendix table 4). Percent pregnant = number palpated as pregnant ÷ number palpated, and only include cows that calved prior to breeding.



TABLE 15. 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<sup>a</sup>  
CYCLE II, PHASE 2 - COWS BORN 1973-74

| Breed of cow                  |          | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf crop, % <sup>c</sup> |        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |                |                                  |
|-------------------------------|----------|--------------------------|--------------------------|----------------|---------------|------------------------|---------------------------|--------|--------------------------------|------|------------------------------|----------------|----------------------------------|
| Sire                          | Dam      |                          | No<br>diff. <sup>b</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sentation | Born                      | Weaned | Early                          | Late | Birth                        | 200-<br>day wt | 200-day<br>wt ratio <sup>f</sup> |
| Angus                         | Hereford | 137                      | 92.1                     | 4.2            | 0.0           | 3.6                    | 90.4                      | 84.4   | 5.1                            | 2.9  | 89.0                         | 492            | 100.0                            |
| Hereford                      | Angus    | 197                      | 84.0                     | 13.6           | 0.5           | 1.9                    | 93.7                      | 89.4   | 2.6                            | 2.5  | 90.3                         | 492            | 100.0                            |
|                               | Average  | 334                      | 88.1                     | 8.9            | 0.3           | 2.7                    | 92.1                      | 86.9   | 3.8                            | 2.7  | 89.7                         | 492            | 100.0                            |
| Red Poll                      | Hereford | 149                      | 86.2                     | 10.5           | 0.0           | 3.3                    | 92.8                      | 84.0   | 4.6                            | 2.9  | 94.0                         | 522            | 106.1                            |
|                               | Angus    | 187                      | 92.2                     | 5.3            | 0.0           | 2.4                    | 89.5                      | 80.1   | 5.7                            | 1.5  | 89.1                         | 514            | 104.5                            |
|                               | Average  | 336                      | 89.2                     | 7.9            | 0.0           | 2.9                    | 91.2                      | 82.1   | 5.2                            | 2.2  | 91.5                         | 518            | 105.3                            |
| Brown Swiss                   | Hereford | 258                      | 88.2                     | 8.2            | 0.8           | 2.9                    | 92.1                      | 85.0   | 6.9                            | 1.0  | 96.9                         | 552            | 112.2                            |
|                               | Angus    | 247                      | 93.9                     | 3.1            | 0.4           | 2.6                    | 94.2                      | 88.8   | 3.9                            | 2.3  | 92.3                         | 551            | 112.0                            |
|                               | Average  | 505                      | 91.0                     | 5.6            | 0.6           | 2.8                    | 93.2                      | 86.9   | 5.4                            | 1.7  | 94.6                         | 551            | 112.0                            |
| Gelbvieh                      | Hereford | 158                      | 89.7                     | 7.2            | 0.8           | 2.4                    | 97.0                      | 89.2   | 3.4                            | 4.5  | 94.9                         | 549            | 111.6                            |
|                               | Angus    | 171                      | 93.3                     | 4.7            | 0.5           | 1.5                    | 95.0                      | 87.5   | 8.1                            | 1.3  | 89.5                         | 546            | 111.0                            |
|                               | Average  | 329                      | 91.5                     | 6.0            | 0.6           | 1.9                    | 96.0                      | 88.4   | 5.7                            | 2.9  | 92.2                         | 547            | 111.2                            |
| Maine Anjou                   | Hereford | 159                      | 90.6                     | 6.8            | 0.0           | 2.5                    | 93.1                      | 87.1   | 3.2                            | 3.8  | 100.3                        | 544            | 110.6                            |
|                               | Angus    | 189                      | 92.4                     | 6.2            | 0.0           | 1.5                    | 93.3                      | 87.4   | 2.5                            | 3.7  | 97.6                         | 533            | 108.3                            |
|                               | Average  | 348                      | 91.5                     | 6.5            | 0.0           | 2.0                    | 93.2                      | 87.3   | 2.9                            | 3.8  | 99.0                         | 539            | 109.6                            |
| Chianina                      | Hereford | 171                      | 95.1                     | 2.9            | 1.1           | 0.9                    | 95.3                      | 90.2   | 1.5                            | 3.2  | 100.8                        | 543            | 110.4                            |
|                               | Angus    | 181                      | 92.9                     | 5.1            | 0.5           | 1.5                    | 94.6                      | 88.5   | 4.8                            | 2.6  | 97.3                         | 541            | 110.0                            |
|                               | Average  | 352                      | 94.0                     | 4.0            | 0.8           | 1.2                    | 95.0                      | 89.4   | 3.2                            | 2.9  | 99.1                         | 542            | 110.2                            |
| Average<br>all sire<br>breeds | Hereford | 1032                     | 90.3                     | 6.6            | 0.5           | 2.6                    | 93.5                      | 86.7   | 4.1                            | 3.1  | 96.0                         | 534            | 108.6                            |
|                               | Angus    | 1172                     | 91.5                     | 6.3            | 0.3           | 1.9                    | 93.4                      | 87.0   | 4.6                            | 2.3  | 92.7                         | 530            | 107.7                            |
|                               | Average  | 2204                     | 90.9                     | 6.5            | 0.4           | 2.3                    | 93.5                      | 86.8   | 4.4                            | 2.7  | 94.4                         | 532            | 108.1                            |

<sup>a</sup> Calves from these cows were sired by 3/4 or 7/8 Simmental bulls (appendix table 4).

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

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, being open two successive years or by death.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 7.0 lb for birth weight and 32 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 492 lb average for Hereford and Angus sired dams.



TABLE 16. 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 calving date | Cow weight, lb |             | Cow hip height, in |             | Condition score <sup>a</sup> |             |
|-------------------------|----------|----------------|-----------|-----------|----------------------|----------------|-------------|--------------------|-------------|------------------------------|-------------|
|                         |          | 5-yr olds      | 6-yr olds | 7-yr olds |                      | 6-1/2 years    | 7-1/2 years | 6-1/2 years        | 7-1/2 years | 6-1/2 years                  | 7-1/2 years |
| Sire                    | Dam      |                |           |           |                      |                |             |                    |             |                              |             |
| Angus<br>Hereford       | Hereford | 34             | 33        | 18        | March 30             | 1215           | 1235        | 49.0               | 48.9        | 7.5                          | 6.7         |
|                         | Angus    | 48             | 46        | 26        | April 2              | 1157           | 1164        | 48.3               | 48.3        | 7.2                          | 6.4         |
|                         | Average  | 82             | 79        | 44        | March 31             | 1186           | 1200        | 48.7               | 48.6        | 7.3                          | 6.5         |
| Red Poll                | Hereford | 38             | 35        | 25        | March 30             | 1131           | 1108        | 49.2               | 48.4        | 6.5                          | 5.9         |
|                         | Angus    | 48             | 46        | 29        | March 30             | 1109           | 1123        | 48.8               | 48.6        | 6.5                          | 5.9         |
|                         | Average  | 86             | 81        | 54        | March 30             | 1120           | 1115        | 49.0               | 48.5        | 6.5                          | 5.9         |
| Brown Swiss             | Hereford | 63             | 62        | 38        | March 31             | 1190           | 1231        | 51.2               | 51.3        | 6.3                          | 6.2         |
|                         | Angus    | 59             | 58        | 38        | March 29             | 1180           | 1198        | 50.6               | 50.3        | 6.3                          | 5.9         |
|                         | Average  | 122            | 120       | 76        | March 30             | 1185           | 1215        | 50.9               | 50.8        | 6.3                          | 6.1         |
| Gelbvieh                | Hereford | 35             | 33        | 15        | April 1              | 1247           | 1266        | 51.4               | 50.7        | 6.7                          | 6.2         |
|                         | Angus    | 39             | 38        | 17        | March 31             | 1224           | 1244        | 50.5               | 50.1        | 6.5                          | 6.5         |
|                         | Average  | 74             | 71        | 32        | April 1              | 1236           | 1255        | 51.0               | 50.4        | 6.6                          | 6.4         |
| Maine Anjou             | Hereford | 38             | 37        | 17        | March 29             | 1323           | 1369        | 51.8               | 51.9        | 6.7                          | 6.3         |
|                         | Angus    | 46             | 43        | 26        | March 30             | 1317           | 1340        | 51.1               | 50.5        | 6.8                          | 6.5         |
|                         | Average  | 84             | 80        | 43        | March 30             | 1320           | 1355        | 51.4               | 51.2        | 6.7                          | 6.4         |
| Chianina                | Hereford | 42             | 40        | 28        | April 1              | 1336           | 1386        | 54.9               | 55.2        | 6.2                          | 6.4         |
|                         | Angus    | 43             | 43        | 27        | March 31             | 1311           | 1331        | 53.9               | 53.9        | 6.3                          | 6.1         |
|                         | Average  | 85             | 83        | 55        | March 31             | 1324           | 1359        | 54.4               | 54.6        | 6.3                          | 6.3         |
| Average all sire breeds | Hereford | 250            | 240       | 141       | March 31             | 1240           | 1266        | 51.1               | 51.1        | 6.7                          | 6.3         |
|                         | Angus    | 283            | 274       | 163       | March 31             | 1216           | 1233        | 50.5               | 50.3        | 6.6                          | 6.2         |
|                         | Average  | 533            | 514       | 304       | March 31             | 1228           | 1250        | 50.9               | 50.7        | 6.6                          | 6.3         |

<sup>a</sup> Condition is scored on a scale of 1 to 9; 1 = thin, emaciated; 5 = average; 9 = very fat.

TABLE 17. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF F<sub>1</sub> COWS AT 2 THROUGH 7 YEARS OF AGE  
CYCLE II, PHASE 2 - COWS BORN 1973-74

| Breed group <sup>a</sup> | Number<br>births | Calving<br>diffi-<br>culty <sup>b</sup><br>% | Calf crop |             | Birth<br>weight<br>lb | Milk<br>prod <sup>c</sup><br>lb | 200-day weight           |                         |                          |                         |
|--------------------------|------------------|--|-----------|-------------|-----------------------|---------------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
|                          |                  |  | Born<br>% | Weaned<br>% |                       |                                 | Per calf<br>weaned<br>lb | Ratio <sup>d</sup><br>% | Per cow<br>exposed<br>lb | Ratio <sup>d</sup><br>% |
| Hereford-Angus-X         | 395              | 17   | 90        | 84          | 87                    | 6.2                             | 476                      | 100                     | 400                      | 100                     |
| Red Poll-X               | 415              | 19   | 90        | 79          | 90                    | 7.6                             | 501                      | 105                     | 398                      | 100                     |
| Brown Swiss-X            | 621              | 11   | 93        | 85          | 92                    | 8.4                             | 535                      | 112                     | 455                      | 114                     |
| Gelbvieh-X               | 400              | 15   | 95        | 87          | 91                    | 8.4                             | 532                      | 112                     | 461                      | 115                     |
| Maine-Anjou-X            | 429              | 15   | 93        | 86          | 97                    | 6.5                             | 521                      | 110                     | 449                      | 112                     |
| Chianina-X               | 426              | 11   | 93        | 87          | 97                    | 6.2                             | 523                      | 110                     | 455                      | 114                     |

<sup>a</sup> Breed groups are identified by sire breed. An X denotes crosses out of Hereford and Angus dams.

<sup>b</sup> Includes calves requiring calf puller or C-section.

<sup>c</sup> Average of three 12-hour milk production measures on a sample of 36 cows per breed group (18 per year) at 3 years of age.

<sup>d</sup> Ratio relative to Hereford-Angus crosses.



## CYCLE II, PHASE 3

Sires. The mating plans to produce Cycle II, Phase 3, calves are presented in appendix table 4. There were 13 Hereford, 14 Angus, 13 Santa Gertrudis, and 14 Brangus sires used by AI to produce the two calf crops (1975-76). These sires were sampled from commercial organizations, with the Hereford and Angus sires being the same as used in other cycles and phases of the program. Females resulting from cleanup matings to Hereford and Angus sires were also included in the study.

2-Year-Olds. Data on calving difficulty, calf crop percentage, and birth and weaning weights of calves from 2-year-old dams (born in 1975-76) are presented in table 18 according to breed of cows sire. Data for corresponding breed groups on rebreeding performance and size as 2-year-olds are given in table 19.

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 deleted from the model.

3-, 4-, and 5-year-olds. Data on calving difficulty, calf crop percentage, and birth and weaning weights of calves from 3-, 4-, and 5-year old dams (born in 1975-76) are given in table 20 according to breed of cows sire. Data for corresponding breed groups on rebreeding performance and size as 2-year-olds are given in table 21. The models for least-squares analyses were exactly the same as for calving and rebreeding traits as 2-year-olds except that effects of year-age of cow was included instead of effects of just year.

## Discussion

Results on production of the 3-way cross females (as 2- through 5-year-olds) from Cycle II, Phase 3 of the program are summarized in table 22. Calving difficulty was less in Santa Gertrudis crosses than in Brangus and Hereford-Angus crosses because of less calving difficulty as 2-year-olds (table 18). Differences between breed groups for percentage calf crop born, percentage calf crop weaned, birth weight, and 200-day weight per cow exposed were not significant ( $P > .05$ ). Calves out of Brangus and Santa Gertrudis crosses were 5% and 6%, respectively, heavier at 200 days than calves out of Hereford-Angus crosses.



TABLE 18. 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 2-YEAR-OLD COWS<sup>a</sup>  
CYCLE II, PHASE 3 - COWS BORN IN 1975-76

| Breed of cow                  |                  | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf crop, % <sup>d</sup> |        | Calf mortality, % <sup>e</sup> |      | Calf weight, lb <sup>f</sup> |        |                                  |
|-------------------------------|------------------|--------------------------|--------------------------|----------------|---------------|------------------------|---------------------------|--------|--------------------------------|------|------------------------------|--------|----------------------------------|
| Sire                          | Dam <sup>b</sup> |                          | No<br>diff. <sup>c</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sentation | Born                      | Weaned | Early                          | Late | Birth                        | day wt | 200-day<br>wt ratio <sup>g</sup> |
| Angus<br>Hereford             | Hereford         | 35                       | 61.5                     | 28.9           | 8.7           | 2.7                    | 87.1                      | 76.4   | 4.9                            | 3.6  | 76.9                         | 428    | 98.2                             |
|                               | Angus-X          | 40                       | 36.7                     | 54.7           | 4.7           | 4.6                    | 90.6                      | 73.7   | 20.2                           | 2.7  | 76.4                         | 445    | 102.1                            |
|                               | Average          | 75                       | 49.1                     | 41.8           | 6.7           | 3.6                    | 88.8                      | 75.0   | 12.6                           | 3.1  | 76.7                         | 436    | 100.0                            |
| Brangus                       | Hereford-X       | 31                       | 60.0                     | 28.4           | 9.4           | 2.2                    | 92.7                      | 90.1   | 3.2                            | 1.2  | 77.8                         | 475    | 108.9                            |
|                               | Angus-X          | 24                       | 42.2                     | 38.3           | 4.7           | 14.8                   | 86.0                      | 74.2   | 6.7                            | 7.3  | 79.9                         | 475    | 108.9                            |
|                               | Average          | 55                       | 51.1                     | 33.3           | 7.1           | 8.5                    | 89.4                      | 82.2   | 4.9                            | 4.2  | 78.9                         | 475    | 108.9                            |
| Santa Gertrudis               | Hereford-X       | 21                       | 78.0                     | 19.4           | 0.0           | 4.2                    | 100.9                     | 92.9   | 9.1                            | 0.0  | 75.3                         | 485    | 111.2                            |
|                               | Angus-X          | 19                       | 69.5                     | 10.7           | 13.6          | 6.1                    | 99.4                      | 75.5   | 17.6                           | 0.0  | 81.7                         | 487    | 111.7                            |
|                               | Average          | 40                       | 73.8                     | 15.0           | 6.0           | 5.2                    | 97.3                      | 84.2   | 13.4                           | 0.0  | 78.5                         | 486    | 111.5                            |
| Average<br>all sire<br>breeds | Hereford-X       | 87                       | 66.5                     | 25.6           | 6.0           | 3.0                    | 93.6                      | 86.5   | 5.7                            | 1.6  | 76.7                         | 463    | 106.1                            |
|                               | Angus-X          | 83                       | 49.5                     | 34.6           | 7.7           | 8.5                    | 92.0                      | 74.5   | 14.8                           | 3.3  | 79.3                         | 469    | 107.6                            |
|                               | Average          | 170                      | 58.0                     | 30.1           | 6.8           | 5.8                    | 92.8                      | 80.5   | 10.3                           | 2.5  | 78.0                         | 466    | 106.8                            |

<sup>a</sup> Calves from these cows were sired by Shorthorn bulls.

<sup>b</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses.

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

<sup>d</sup> Of cows palpated at end of previous breeding season.

<sup>e</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>f</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 5.9 lb for birth weight and 28 lb for 200-day weight.

<sup>g</sup> Ratio computed relative to 436 lb average for Hereford and Angus.



TABLE 19. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 2-YEAR-OLDS  
CYCLE II, PHASE 3 - COWS BORN IN 1975-76

| Breed of cow    |                  | Number<br>calving as<br>2-year-olds | Average<br>calving<br>date | Percent<br>pregnant <sup>b</sup> | Cow weight, lb<br>2-1/2 years | Condition<br>score <sup>c</sup><br>2-1/2 years |
|-----------------|------------------|-------------------------------------|----------------------------|----------------------------------|-------------------------------|--|
| Sire            | Dam <sup>a</sup> |                                     |                            |                                  |                               |  |
| Angus           | Hereford-X       | 35                                  | March 11                   | 96.9                             | 1006                          | 6.3  |
| Hereford        | Angus-X          | 40                                  | March 16                   | 87.2                             | 1000                          | 6.6  |
|                 | Average          | 75                                  | March 13                   | 92.1                             | 1003                          | 6.4  |
| Brangus         | Hereford-X       | 31                                  | March 13                   | 92.5                             | 1016                          | 5.9  |
|                 | Angus-X          | 24                                  | March 16                   | 91.6                             | 1023                          | 6.0  |
|                 | Average          | 55                                  | March 15                   | 92.0                             | 1020                          | 5.9  |
| Santa Gertrudis | Hereford-X       | 21                                  | March 10                   | 81.5                             | 1027                          | 6.3  |
|                 | Angus-X          | 19                                  | March 10                   | 85.6                             | 1040                          | 5.9  |
|                 | Average          | 40                                  | March 10                   | 83.6                             | 1033                          | 6.1  |
| Average         | Hereford-X       | 87                                  | March 11                   | 90.3                             | 1016                          | 6.2  |
| all sire        | Angus-X          | 83                                  | March 14                   | 88.1                             | 1021                          | 6.2  |
| breeds          | Average          | 170                                 | March 13                   | 89.2                             | 1018                          | 6.2  |

<sup>a</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses.

<sup>b</sup> Breeding period was 63 days by natural service to 7/8 Simmental bulls. Percent pregnant = number palpated as pregnant ÷ number palpated, and only includes cows that calved prior to breeding.

<sup>c</sup> Condition is scored on a scale of 1 to 9; 1 = thin, emaciated; 5 = average; 9 = very fat.



TABLE 20. 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-, AND 5-YEAR-OLD COWS<sup>a</sup>  
CYCLE II, PHASE 3 - COWS BORN 1975-76

| Breed of cow                  |                  | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf crop, % <sup>d</sup> |        | Calf mortality, % <sup>e</sup> |      | Calf weight, lb <sup>f</sup> |                |                                  |
|-------------------------------|------------------|--------------------------|--------------------------|----------------|---------------|------------------------|---------------------------|--------|--------------------------------|------|------------------------------|----------------|----------------------------------|
| Sire                          | Dam <sup>b</sup> |                          | No<br>diff. <sup>c</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sentation | Born                      | Weaned | Early                          | Late | Birth                        | 200-<br>day wt | 200-day<br>wt ratio <sup>g</sup> |
| Angus<br>Hereford             | Hereford-X       | 66                       | 87.4                     | 7.0            | 0.2           | 5.4                    | 93.7                      | 80.7   | 13.4                           | 1.1  | 85.1                         | 512            | 101.0                            |
|                               | Angus-X          | 76                       | 89.7                     | 5.5            | 1.2           | 3.5                    | 86.0                      | 82.1   | 7.8                            | 0.0  | 87.6                         | 502            | 99.0                             |
|                               | Average          | 142                      | 88.6                     | 6.3            | 0.7           | 4.5                    | 89.8                      | 81.4   | 10.6                           | 0.0  | 86.3                         | 507            | 100.0                            |
| Brangus                       | Hereford-X       | 60                       | 90.1                     | 9.0            | 0.2           | 0.6                    | 84.6                      | 78.8   | 0.0                            | 2.3  | 88.8                         | 520            | 102.6                            |
|                               | Angus-X          | 46                       | 88.1                     | 8.9            | 0.2           | 2.8                    | 88.2                      | 78.8   | 2.3                            | 3.8  | 89.7                         | 528            | 104.1                            |
|                               | Average          | 106                      | 89.1                     | 9.0            | 0.2           | 1.7                    | 86.4                      | 78.8   | 0.2                            | 3.1  | 89.3                         | 524            | 103.4                            |
| Santa<br>Gertrudis            | Hereford-X       | 37                       | 89.8                     | 7.2            | 0.2           | 2.9                    | 83.0                      | 68.0   | 2.6                            | 6.8  | 88.7                         | 524            | 103.4                            |
|                               | Angus-X          | 34                       | 100.0                    | 0.0            | 0.7           | 0.0                    | 83.0                      | 67.3   | 0.0                            | 11.2 | 88.4                         | 534            | 105.3                            |
|                               | Average          | 71                       | 98.8                     | 3.6            | 0.4           | 0.8                    | 83.0                      | 67.6   | 1.0                            | 9.0  | 88.5                         | 529            | 104.3                            |
| Average<br>all sire<br>breeds | Hereford-X       | 163                      | 89.1                     | 7.7            | 0.2           | 3.0                    | 87.1                      | 75.8   | 4.7                            | 3.4  | 87.5                         | 519            | 102.4                            |
|                               | Angus-X          | 156                      | 95.2                     | 2.4            | 0.7           | 1.7                    | 85.7                      | 76.1   | 3.1                            | 4.5  | 88.6                         | 521            | 102.8                            |
|                               | Average          | 319                      | 92.2                     | 5.1            | 0.4           | 2.3                    | 86.4                      | 76.0   | 3.9                            | 4.0  | 88.0                         | 520            | 102.6                            |

<sup>a</sup> Calves from these cows were sired by 7/8 Simmental bulls.

<sup>b</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses.

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

<sup>d</sup> Of cows palpated at end of previous breeding season.

<sup>e</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>f</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 7.2 for birth weight and 33 lb for 200-day weight.

<sup>g</sup> Ratio computed relative to 507 lb average for Hereford and Angus sired dams.



TABLE 21. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 3- AND 4-YEAR-OLDS  
CYCLE II, PHASE 3 - COWS BORN IN 1975-76

| Breed of cow                  |                  | Number calving as |              | Average<br>calving<br>date | Percent<br>pregnant <sup>b</sup> | Cow weight, lb |                | Condition<br>score <sup>c</sup> |                |
|-------------------------------|------------------|-------------------|--------------|----------------------------|----------------------------------|----------------|----------------|---------------------------------|----------------|
| Sire                          | Dam <sup>a</sup> | 3-yr<br>olds      | 4-yr<br>olds |                            |                                  | 3-1/2<br>years | 4-1/2<br>years | 3-1/2<br>years                  | 4-1/2<br>years |
| Angus<br>Hereford             | Hereford-X       | 28                | 11           | March 26                   | 96.1                             | 1103           | 1220           | 6.6                             | 5.9            |
|                               | Angus-X          | 33                | 13           | April 4                    | 88.4                             | 1073           | 1101           | 6.3                             | 6.5            |
|                               | Average          | 61                | 24           | March 30                   | 92.2                             | 1088           | 1161           | 6.4                             | 6.2            |
| Brangus                       | Hereford-X       | 30                | 10           | March 27                   | 89.9                             | 1083           | 1185           | 5.9                             | 6.0            |
|                               | Angus-X          | 23                | 6            | April 6                    | 95.2                             | 1987           | 1201           | 5.7                             | 5.9            |
|                               | Average-X        | 53                | 16           | April 1                    | 92.5                             | 1085           | 1193           | 5.8                             | 5.9            |
| Santa Gertrudis               | Hereford-X       | 18                | 5            | March 29                   | 84.6                             | 1117           | 1293           | 5.8                             | 6.9            |
|                               | Angus-X          | 15                | 4            | March 30                   | 87.2                             | 1120           | 1218           | 5.2                             | 6.0            |
|                               | Average          | 33                | 9            | March 30                   | 85.9                             | 1119           | 1255           | 5.5                             | 6.5            |
| Average<br>all sire<br>breeds | Hereford-X       | 76                | 26           | March 27                   | 90.2                             | 1101           | 1232           | 6.1                             | 6.3            |
|                               | Angus-X          | 71                | 23           | April 3                    | 90.2                             | 1093           | 1173           | 5.7                             | 6.2            |
|                               | Average          | 147               | 49           | March 31                   | 90.2                             | 1097           | 1203           | 5.9                             | 6.2            |

<sup>a</sup> Hereford-X denotes Hereford crosses and Angus-X denotes Angus crosses.

<sup>b</sup> Breeding period was 63 days by natural service to 7/8 Simmental bulls. Percent pregnant = number palpated as pregnant ÷ number palpated, and only includes cows that calved prior to breeding.

<sup>c</sup> Condition is scored on a scale of 1 to 9; 1 = thin, emaciated; 5 = average; 9 = very fat.

TABLE 22. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF CROSSBRED COWS AT 2 THROUGH 5 YEARS OF AGE  
CYCLE II, PHASE 3 - COWS BORN 1975-76

| Breed group <sup>a</sup> | Number<br>births | Calving<br>diffi-<br>culty <sup>b</sup><br>% | Calf crop |             | Birth<br>weight<br>lb | 200 day weight           |                         |                          |                         |
|--------------------------|------------------|--|-----------|-------------|-----------------------|--------------------------|-------------------------|--------------------------|-------------------------|
|                          |                  |  | Born<br>% | Weaned<br>% |                       | Per calf<br>weaned<br>lb | Ratio <sup>c</sup><br>% | Per cow<br>exposed<br>lb | Ratio <sup>c</sup><br>% |
|                          |                  |  |           |             |                       |                          |                         |                          |                         |
| Hereford-Angus-X         | 217              | 19   | 90        | 80          | 84                    | 487                      | 100                     | 388                      | 100                     |
| Brangus-X                | 261              | 18   | 87        | 80          | 86                    | 510                      | 105                     | 406                      | 105                     |
| Santa Gertrudis-X        | 111              | 9  | 87        | 72          | 86                    | 517                      | 106                     | 372                      | 96                      |

<sup>a</sup> Breed groups are 3-way crosses identified by breed of sire of the cow. An X denotes crosses of Hereford, Angus, Red Poll, Brown Swiss, Gelbvieh, Maine Anjou, or Chianina maternal grand sires on Hereford or Angus maternal grand dams.

<sup>b</sup> Includes calves requiring calf puller or C-section.

<sup>c</sup> 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 Cycle III of the program (appendix table 5). 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, Brahman-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 interregional 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.

2-Year-Olds. Data on calving difficulty, percentage calf crop, and birth and weaning weight of progeny from 2-year-old Cycle III, Phase 2, females (born in 1975 and 1976) are presented in table 23. Data on rebreeding performance and size as 2-year-olds are given for the corresponding breed group in table 24. These data were analyzed by least-squares procedures using a model that included effects of breed of sire, breed of dam, year, and their two-way interactions. Sex of calf and two-way interactions with sex were deleted from models for calf crop percentage, rebreeding performance, and cow size.

3-, 4-, and 5-year-olds. Data on calving difficulty, percentage calf crop, and birth and weaning weights of calves from 3-, 4-, and 5-year old Cycle III, Phase 2, females (born in 1975-76) are presented in table 25. Data on rebreeding performance and size as 4- and 5-year olds are given for the corresponding breed group in table 26. The Cycle III, Phase 2, females were bred as 2- and 3-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<sub>1</sub> females (as 2- through 5-year-olds)



from Cycle III, Phase 2 of the program are summarized in table 27. 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). Differences in calf crop born and weaned have not been significant ( $P > .05$ ). 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 7% to 11% heavier per calf weaned and 10% to 16% heavier per cow exposed to breeding than progeny out of Hereford-Angus cross females (as 2-through 5-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 23. 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 2-YEAR-OLD COWS<sup>a</sup>  
CYCLE III, PHASE 2 - COWS BORN 1975-76

| Breed of cow                  |          | Number<br>calves<br>born | Type of parturition, %   |                |               |                        | Calf crop, % <sup>c</sup> |        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |                |                                  |
|-------------------------------|----------|--------------------------|--------------------------|----------------|---------------|------------------------|---------------------------|--------|--------------------------------|------|------------------------------|----------------|----------------------------------|
| Sire                          | Dam      |                          | No<br>diff. <sup>b</sup> | Calf<br>puller | C-<br>section | Abn. pre-<br>sensation | Born                      | Weaned | Early                          | Late | Birth                        | 200-<br>day wt | 200-day<br>wt ratio <sup>f</sup> |
| Angus<br>Hereford             | Hereford | 21                       | 60.7                     | 30.9           | 1.5           | 7.0                    | 67.1                      | 66.8   | 1.2                            | 0.0  | 75.0                         | 398            | 101.0                            |
|                               | Angus    | 60                       | 34.8                     | 50.7           | 11.4          | 3.1                    | 83.8                      | 70.8   | 14.2                           | 1.4  | 74.1                         | 389            | 98.7                             |
|                               | Average  | 81                       | 47.8                     | 40.8           | 6.4           | 5.0                    | 75.5                      | 68.8   | 7.7                            | 0.4  | 74.6                         | 394            | 100.0                            |
| Pinzgauer                     | Hereford | 40                       | 40.2                     | 47.1           | 3.1           | 9.6                    | 90.3                      | 74.8   | 10.6                           | 4.0  | 83.4                         | 436            | 110.7                            |
|                               | Angus    | 58                       | 52.7                     | 39.6           | 3.9           | 3.8                    | 80.0                      | 74.0   | 4.8                            | 0.8  | 78.9                         | 425            | 107.9                            |
|                               | Average  | 98                       | 46.5                     | 43.3           | 3.5           | 6.7                    | 85.1                      | 74.4   | 7.7                            | 2.4  | 81.1                         | 431            | 109.4                            |
| Tarentaise                    | Hereford | 31                       | 53.9                     | 39.3           | 0.0           | 6.9                    | 94.0                      | 84.8   | 9.9                            | 0.0  | 79.8                         | 456            | 115.7                            |
|                               | Angus    | 40                       | 58.5                     | 35.3           | 4.6           | 1.7                    | 77.0                      | 64.3   | 16.4                           | 0.0  | 74.8                         | 437            | 110.9                            |
|                               | Average  | 71                       | 56.2                     | 37.3           | 2.3           | 4.3                    | 85.5                      | 74.6   | 13.2                           | 0.0  | 77.3                         | 446            | 113.2                            |
| Brahman                       | Hereford | 35                       | 86.9                     | 7.7            | 0.4           | 5.0                    | 83.5                      | 76.9   | 8.2                            | 0.8  | 77.1                         | 483            | 122.6                            |
|                               | Angus    | 55                       | 87.1                     | 11.0           | 2.7           | 0.0                    | 89.5                      | 80.7   | 6.7                            | 2.4  | 75.4                         | 490            | 124.4                            |
|                               | Average  | 90                       | 87.0                     | 9.4            | 1.5           | 2.1                    | 86.5                      | 78.8   | 7.4                            | 1.6  | 76.2                         | 486            | 123.4                            |
| Sahiwal                       | Hereford | 30                       | 89.3                     | 10.4           | 0.4           | 0.0                    | 93.6                      | 90.2   | 3.9                            | 0.0  | 68.5                         | 453            | 115.0                            |
|                               | Angus    | 51                       | 88.3                     | 8.4            | 0.0           | 3.2                    | 93.1                      | 85.9   | 5.9                            | 1.5  | 64.3                         | 439            | 111.4                            |
|                               | Average  | 81                       | 88.8                     | 9.4            | 0.2           | 1.6                    | 93.4                      | 88.0   | 4.9                            | 0.7  | 66.4                         | 446            | 113.2                            |
| Average<br>all sire<br>breeds | Hereford | 157                      | 66.2                     | 27.1           | 1.1           | 5.7                    | 85.7                      | 78.7   | 6.8                            | 0.8  | 76.8                         | 445            | 112.9                            |
|                               | Angus    | 264                      | 64.3                     | 29.0           | 4.5           | 2.2                    | 84.7                      | 75.1   | 9.6                            | 1.2  | 73.5                         | 436            | 110.7                            |
|                               | Average  | 421                      | 65.2                     | 28.0           | 2.8           | 3.9                    | 85.2                      | 76.9   | 8.2                            | 1.0  | 75.1                         | 441            | 111.9                            |

<sup>a</sup> Calves from these cows were sired by Red Poll bulls.

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

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, by death or being open two consecutive seasons.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 4.1 lb for birth weight and 28 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 394 lb average for Hereford and Angus sired dams.



TABLE 24. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 2-YEAR-OLDS  
CYCLE III, PHASE 2 - COWS BORN IN 1975-76

| Breed of cow |          | Number<br>calving as<br>2-year-olds | Average<br>calving<br>date <sup>a</sup> | Percent<br>pregnant <sup>a,h</sup> | Cow weight, lb<br>2-1/2 years | Hip height, in<br>2-1/2 years |
|--------------|----------|-------------------------------------|---|------------------------------------|-------------------------------|-------------------------------|
| Sire         | Dam      |                                     |   |                                    |                               |                               |
| Angus        | Hereford | 21                                  | March 11                                | 98.0                               | 976                           | 47.9                          |
| Hereford     | Angus    | 60                                  | March 15                                | 87.8                               | 965                           | 47.2                          |
|              | Average  | 81                                  | March 13                                | 92.9                               | 971                           | 47.5                          |
| Pinzgauer    | Hereford | 40                                  | March 16                                | 90.6                               | 980                           | 49.4                          |
|              | Angus    | 58                                  | March 14                                | 90.0                               | 964                           | 48.5                          |
|              | Average  | 98                                  | March 15                                | 90.3                               | 972                           | 49.0                          |
| Tarentaise   | Hereford | 31                                  | March 17                                | 87.8                               | 974                           | 49.4                          |
|              | Angus    | 40                                  | March 16                                | 83.2                               | 950                           | 48.4                          |
|              | Average  | 71                                  | March 16                                | 85.5                               | 962                           | 48.9                          |
| Brahman      | Hereford | 35                                  | March 20                                | 95.6                               | 1013                          | 51.3                          |
|              | Angus    | 55                                  | March 16                                | 93.3                               | 1012                          | 51.0                          |
|              | Average  | 90                                  | March 18                                | 94.4                               | 1012                          | 51.1                          |
| Sahiwal      | Hereford | 30                                  | March 17                                | 96.9                               | 915                           | 49.8                          |
|              | Angus    | 51                                  | March 18                                | 100.0                              | 875                           | 48.6                          |
|              | Average  | 81                                  | March 17                                | 98.6                               | 895                           | 49.2                          |
| Average      | Hereford | 157                                 | March 16                                | 93.8                               | 971                           | 49.6                          |
| all sire     | Angus    | 264                                 | March 16                                | 90.9                               | 953                           | 48.7                          |
| breeds       | Average  | 421                                 | March 16                                | 92.3                               | 962                           | 49.1                          |

<sup>a</sup> Includes cows calving at 2 years of age.

<sup>b</sup> Breeding period was 63 days by natural service to 7/8 Simmental bulls. Percent pregnant = number palpated as pregnant ÷ number palpated, and only includes cows that calved prior to breeding.



TABLE 25. 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-, AND 5-YEAR-OLD COWS<sup>a</sup>  
CYCLE III, PHASE 2 - COWS BORN 1975-76

| Breed of cow            |          | Number calves born | Type of parturition, % |             |           |                    | Calf crop, % <sup>c</sup> |        | Calf mortality, % <sup>d</sup> |      | Calf weight, lb <sup>e</sup> |            |                               |
|-------------------------|----------|--------------------|------------------------|-------------|-----------|--------------------|---------------------------|--------|--------------------------------|------|------------------------------|------------|-------------------------------|
| Sire                    | Dam      |                    | No diff. <sup>b</sup>  | Calf puller | C-section | Abn. pre-sentation | Born                      | Weaned | Early                          | Late | Birth                        | 200-day wt | 200-day wt ratio <sup>f</sup> |
| Angus                   | Hereford | 77                 | 90.4                   | 7.6         | 0.1       | 2.0                | 95.7                      | 84.4   | 7.5                            | 2.2  | 85.7                         | 473        | 101.5                         |
| Hereford                | Angus    | 177                | 90.1                   | 8.2         | 0.0       | 1.8                | 92.6                      | 83.9   | 7.0                            | 1.9  | 84.3                         | 460        | 98.7                          |
|                         | Average  | 254                | 90.2                   | 7.9         | 0.0       | 1.9                | 94.2                      | 84.2   | 7.2                            | 2.0  | 85.0                         | 466        | 100.0                         |
| Pinzgauer               | Hereford | 101                | 88.5                   | 10.1        | 0.0       | 1.4                | 92.7                      | 82.8   | 6.1                            | 3.4  | 89.9                         | 499        | 107.1                         |
|                         | Angus    | 153                | 93.4                   | 5.2         | 0.5       | 0.8                | 93.4                      | 86.9   | 6.5                            | 0.7  | 87.9                         | 496        | 106.4                         |
|                         | Average  | 254                | 91.0                   | 7.6         | 0.3       | 1.1                | 93.1                      | 84.8   | 6.3                            | 2.0  | 88.9                         | 497        | 106.7                         |
| Tarentaise              | Hereford | 69                 | 95.8                   | 4.1         | 0.0       | 0.1                | 89.9                      | 82.1   | 0.2                            | 4.1  | 88.8                         | 521        | 111.8                         |
|                         | Angus    | 99                 | 94.6                   | 2.2         | 1.2       | 2.1                | 88.9                      | 83.6   | 5.5                            | 0.2  | 83.1                         | 507        | 108.8                         |
|                         | Average  | 168                | 95.2                   | 3.2         | 0.6       | 1.1                | 89.4                      | 82.9   | 2.9                            | 2.1  | 86.0                         | 514        | 110.3                         |
| Brahman                 | Hereford | 106                | 98.7                   | 0.3         | 0.1       | 0.9                | 94.8                      | 86.5   | 4.1                            | 3.1  | 81.7                         | 534        | 114.6                         |
|                         | Angus    | 144                | 99.6                   | 0.0         | 0.0       | 0.5                | 95.1                      | 84.3   | 5.7                            | 4.9  | 79.1                         | 530        | 113.7                         |
|                         | Average  | 250                | 99.1                   | 0.1         | 0.0       | 0.7                | 95.0                      | 85.4   | 4.9                            | 4.0  | 80.4                         | 532        | 114.2                         |
| Sahiwal                 | Hereford | 69                 | 97.3                   | 2.7         | 0.0       | 0.0                | 91.9                      | 82.6   | 4.7                            | 3.0  | 76.3                         | 503        | 107.9                         |
|                         | Angus    | 118                | 99.1                   | 0.7         | 0.0       | 0.2                | 95.8                      | 86.2   | 2.8                            | 5.5  | 72.0                         | 496        | 106.4                         |
|                         | Average  | 187                | 98.2                   | 1.7         | 0.0       | 0.1                | 93.8                      | 84.4   | 3.8                            | 4.3  | 74.1                         | 499        | 107.1                         |
| Average all sire breeds | Hereford | 422                | 94.2                   | 5.0         | 0.0       | 0.9                | 93.0                      | 83.7   | 4.5                            | 3.1  | 84.5                         | 506        | 108.6                         |
|                         | Angus    | 691                | 95.4                   | 3.2         | 0.3       | 1.1                | 93.2                      | 85.0   | 5.5                            | 2.6  | 81.3                         | 498        | 106.9                         |
|                         | Average  | 1113               | 94.8                   | 4.1         | 0.2       | 1.0                | 93.1                      | 85.0   | 2.9                            | 1.0  | 82.9                         | 502        | 107.7                         |

<sup>a</sup> Calves from these cows were sired by 7/8 Simmental bulls.

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

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, by death or being open two consecutive seasons.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 5.0 lb for birth weight and 28 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 466 lb average for Hereford and Angus sired dams.



TABLE 26. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE, AND SIZE OF COWS CALVING AS 4-, AND 5-YEAR-OLD COWS  
CYCLE III, PHASE 2 - COW BORN 1975-76

| Breed of cow                  |          | Number calving as |              | Average<br>calving<br>date <sup>a</sup> | Cow weight, lb |                | Cow hip height, in |                | Condition score <sup>b</sup> |                |
|-------------------------------|----------|-------------------|--------------|---|----------------|----------------|--------------------|----------------|------------------------------|----------------|
| Sire                          | Dam      | 4-yr<br>olds      | 5-yr<br>olds |   | 4-1/2<br>years | 5-1/2<br>years | 4-1/2<br>years     | 5-1/2<br>years | 4-1/2<br>years               | 5-1/2<br>years |
| Angus<br>Hereford             | Hereford | 30                | 21           | March 28                                | 1167           | 1239           | 48.9               | 49.1           | 7.2                          | 7.3            |
|                               | Angus    | 68                | 50           | April 1                                 | 1130           | 1153           | 48.3               | 48.2           | 7.0                          | 7.0            |
|                               | Average  | 98                | 71           | March 30                                | 1149           | 1196           | 48.6               | 48.6           | 7.1                          | 7.1            |
| Pinzgauer                     | Hereford | 39                | 28           | March 28                                | 1158           | 1260           | 50.4               | 51.5           | 6.4                          | 6.6            |
|                               | Angus    | 58                | 42           | March 31                                | 1140           | 1201           | 49.6               | 50.6           | 6.5                          | 6.2            |
|                               | Average  | 97                | 70           | March 29                                | 1149           | 1230           | 50.0               | 51.1           | 6.5                          | 6.4            |
| Tarentaise                    | Hereford | 30                | 16           | March 30                                | 1153           | 1221           | 50.4               | 50.3           | 6.6                          | 6.7            |
|                               | Angus    | 47                | 17           | April 1                                 | 1110           | 1157           | 49.3               | 49.7           | 6.4                          | 6.4            |
|                               | Average  | 77                | 33           | March 31                                | 1131           | 1189           | 49.9               | 50.0           | 6.5                          | 6.6            |
| Brahman                       | Hereford | 42                | 29           | March 30                                | 1195           | 1270           | 52.3               | 52.8           | 6.8                          | 7.3            |
|                               | Angus    | 58                | 39           | March 31                                | 1219           | 1258           | 51.8               | 52.1           | 6.9                          | 6.8            |
|                               | Average  | 100               | 68           | March 30                                | 1207           | 1264           | 52.0               | 52.4           | 6.9                          | 7.1            |
| Sahiwal                       | Hereford | 32                | 13           | March 29                                | 1093           | 1222           | 50.8               | 52.2           | 6.3                          | 7.2            |
|                               | Angus    | 52                | 17           | March 28                                | 1051           | 1058           | 49.5               | 49.6           | 6.3                          | 6.6            |
|                               | Average  | 84                | 30           | March 29                                | 1072           | 1140           | 50.1               | 50.9           | 6.3                          | 6.9            |
| Average<br>all sire<br>breeds | Hereford | 173               | 107          | March 29                                | 1153           | 1242           | 50.5               | 51.1           | 6.7                          | 7.0            |
|                               | Angus    | 283               | 165          | March 31                                | 1130           | 1165           | 49.7               | 50.0           | 6.7                          | 6.6            |
|                               | Average  | 456               | 272          | March 30                                | 1142           | 1204           | 50.1               | 50.6           | 6.7                          | 6.8            |

<sup>a</sup> Includes cows calving at 3, 4, and 5 years of age.

<sup>b</sup> Condition is scored on a scale of 1 to 9; 1 = thin, emaciated; 5 = average; 9 = very fat.



TABLE 27. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
BREED GROUP MEANS FOR REPRODUCTION AND MATERNAL PERFORMANCE OF F<sub>1</sub> COWS AT 2 THROUGH 5 YEARS OF AGE  
CYCLE III, PHASE 2 - COWS BORN 1975-76

| Breed group <sup>a</sup> | Number<br>births | Calving<br>diffi-<br>culty <sup>b</sup><br>% | Calf crop |             | Birth<br>weight<br>lb | Milk<br>prod <sup>c</sup><br>lb | 200-day weight           |                         |                          |                         |
|--------------------------|------------------|--|-----------|-------------|-----------------------|---------------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
|                          |                  |  | Born<br>% | Weaned<br>% |                       |                                 | Per calf<br>weaned<br>lb | Ratio <sup>d</sup><br>% | Per cow<br>exposed<br>lb | Ratio <sup>d</sup><br>% |
| Hereford-Angus-X         | 335              | 19   | 89        | 80          | 82                    | 5.4                             | 445                      | 100                     | 358                      | 100                     |
| Tarentaise-X             | 239              | 14   | 88        | 81          | 84                    | 7.2                             | 495                      | 111                     | 399                      | 112                     |
| Pinzgauer-X              | 352              | 19   | 91        | 82          | 87                    | 7.3                             | 478                      | 107                     | 393                      | 110                     |
| Sahiwal-X                | 268              | 4  | 94        | 85          | 72                    | 7.8                             | 484                      | 109                     | 413                      | 116                     |
| Brahman-X                | 340              | 3  | 93        | 84          | 79                    | 8.4                             | 519                      | 116                     | 434                      | 121                     |

<sup>a</sup> Breed groups are identified by sire breed. An X denotes crosses out of Hereford and Angus dams.

<sup>b</sup> Includes calves requiring calf puller or C-section.

<sup>c</sup> Average of three 12-hour milk production measures on a sample of 36 cows per breed group (18 per year) at 3 years of age.

<sup>d</sup> Ratio relative to Hereford-Angus<sup>a</sup> crosses.



APPENDIX

TABLE 1. MATING PLANS TO PRODUCE CYCLE I, PHASE 2, CALVES

1969, 1970, 1971 Breeding Seasons

| Dam Breeds <sup>a</sup> | Sire Breeds           |                    |        |             |          |           |           |
|-------------------------|-----------------------|--------------------|--------|-------------|----------|-----------|-----------|
|                         | Hereford <sup>b</sup> | Angus <sup>b</sup> | Jersey | South Devon | Limousin | Simmental | Charolais |
| Hereford                | X                     | X                  | X      | X           | X        | X         | X         |
| Angus                   | X                     | X                  | X      | X           | X        | X         | X         |

<sup>a</sup> The cows were 1, 2, 3, and 4-year-olds in 1969; 1, 2, 3, 4, and 5-year-olds in 1970; and 2, 3, 4, 5, and 6-year-olds in 1971.

APPENDIX

TABLE 2. MATING PLANS TO PRODUCE CYCLE II, PHASE 2, CALVES

1972 and 1973 Breeding Seasons

| Dam Breeds <sup>a</sup> | Sire Breeds           |                    |          |             |          |             |          |
|-------------------------|-----------------------|--------------------|----------|-------------|----------|-------------|----------|
|                         | Hereford <sup>b</sup> | Angus <sup>b</sup> | Red Poll | Brown Swiss | Gelbvieh | Maine Anjou | Chianina |
| Hereford <sup>c</sup>   | X                     | X                  | X        | X           | X        | X           | X        |
| Angus <sup>c</sup>      | X                     | X                  | X        | X           | X        | X           | X        |
| Red Poll                | X                     | X                  | X        | X           |          |             |          |
| Brown Swiss             | X                     | X                  | X        | X           |          |             |          |

<sup>a</sup> The cows were 3, 4, 5, 6, and 7-year-olds in 1972; and 3, 4, 5, 6, 7, and 8-year-olds in 1973.

<sup>b</sup> Sample of same Hereford and Angus sires used in Cycle I, 1969, 1970, and 1971 breeding seasons.

<sup>c</sup> Cows used for GPE Cycle I, 1969, 1970, and 1971 breeding seasons.



## APPENDIX

TABLE 3. MATING PLANS TO PRODUCE CYCLE I, PHASE 3 CALVES<sup>a</sup>

1971 - 1978 Breeding Seasons

|             | Sire Breeds                  |                    |         |       |           |                               |                    |           |             |           |                                    |
|-------------|------------------------------|--------------------|---------|-------|-----------|-------------------------------|--------------------|-----------|-------------|-----------|------------------------------------|
|             | First Calf Crop <sup>b</sup> |                    |         |       |           | Second Calf Crop <sup>c</sup> |                    |           |             |           | Subsequent Calf Crops <sup>d</sup> |
| Breed Group | Here-ford <sup>e</sup>       | Angus <sup>e</sup> | Brahman | Devon | Hol-stein | Here-ford <sup>e</sup>        | Angus <sup>e</sup> | Gelb-vieh | Maine Anjou | Chia-nina | Brown Swiss                        |
| H x H       |                              | X                  |         |       |           |                               | X                  |           |             |           | X                                  |
| A x A       | X                            |                    |         |       |           | X                             |                    |           |             |           | X                                  |
| A x H       |                              |                    | X       | X     | X         |                               |                    | X         | X           | X         | X                                  |
| H x A       |                              |                    | X       | X     | X         |                               |                    | X         | X           | X         | X                                  |
| J x H       |                              | X                  | X       | X     | X         |                               | X                  | X         | X           | X         | X                                  |
| J x A       | X                            |                    | X       | X     | X         | X                             |                    | X         | X           | X         | X                                  |
| SD x H      |                              | X                  | X       | X     | X         |                               | X                  | X         | X           | X         | X                                  |
| SD x A      | X                            |                    | X       | X     | X         | X                             |                    | X         | X           | X         | X                                  |
| L x H       |                              | X                  | X       | X     | X         |                               | X                  | X         | X           | X         | X                                  |
| L x A       | X                            |                    | X       | X     | X         | X                             |                    | X         | X           | X         | X                                  |
| S x H       |                              | X                  | X       | X     | X         |                               | X                  | X         | X           | X         | X                                  |
| S x A       | X                            |                    | X       | X     | X         | X                             |                    | X         | X           | X         | X                                  |
| C x H       |                              | X                  | X       | X     | X         |                               | X                  | X         | X           | X         | X                                  |
| C x A       | X                            |                    | X       | X     | X         | X                             |                    | X         | X           | X         | X                                  |

<sup>a</sup> Females of each breed group distributed equally among cells marked "X" for each calf crop.<sup>b</sup> Each group of heifers bred as yearlings to produce one calf crop as 2-year-olds by these breeds in 1972, 1973 and 1974.<sup>c</sup> Each group of cows bred as 2-year-olds to produce one calf crop as 3-year-olds by these breeds in 1973, 1974 and 1975.<sup>d</sup> Each group of cows bred to produce at least four calf crops by this breed from 1974 through 1979.<sup>e</sup> Sample of same sires used in Cycle I, 1969-70-71 breeding seasons.



## APPENDIX

TABLE 4. MATING PLANS TO PRODUCE CYCLE II, PHASE 3, CALVES<sup>a</sup>

1974-1981 Breeding Season

| Female Breeding Groups | First Calf Crop <sup>b</sup> |                    |         |                 | Subsequent Calf Crops <sup>c</sup> |
|------------------------|------------------------------|--------------------|---------|-----------------|------------------------------------|
|                        | Hereford <sup>d</sup>        | Angus <sup>d</sup> | Branqus | Santa Gertrudis | Simmental                          |
| Hereford               |                              | X                  | X       | X               | X                                  |
| Angus                  | X                            |                    | X       | X               | X                                  |
| Red Poll               | X                            | X                  |         |                 | X                                  |
| Brown Swiss            | X                            | X                  |         |                 | X                                  |
| H x A & Recip.         |                              |                    | X       | X               | X                                  |
| H x R.P. & Recip.      |                              | X                  | X       | X               | X                                  |
| H x B.S. & Recip.      |                              | X                  | X       | X               | X                                  |
| A x R.P. & Recip.      | X                            |                    | X       | X               | X                                  |
| A x B.S. & Recip.      | X                            |                    | X       | X               | X                                  |
| Gelbvieh x Hereford    |                              |                    | X       | X               | X                                  |
| Gelbvieh x Angus       | X                            |                    | X       | X               | X                                  |
| Maine Anjou x Hereford |                              | X                  | X       | X               | X                                  |
| Maine Anjou x Angus    | X                            |                    | X       | X               | X                                  |
| Chianina x Hereford    |                              | X                  | X       | X               | X                                  |
| Chianina x Angus       | X                            |                    | X       | X               | X                                  |

<sup>a</sup> Females of each breed group distributed equally among the cells marked "X" for each calf crop.

<sup>b</sup> Each group of heifers bred as yearlings to produce one calf crop as 2-year-olds by these breeds in 1975 and 1976.

<sup>c</sup> Each group of cows mated to produce at least three calf crops by 3/4 or 7/8 Simmental bulls in 1976 through 1982.

<sup>d</sup> Sample of same Hereford and Angus sires used in Cycle I, Phase, 1969, 1970, and 1971 breeding seasons.



APPENDIX

TABLE 5. MATING PLANS TO PRODUCE CYCLE III, PHASE 2, CALVES<sup>a</sup>

1974 and 1975 Breeding Seasons

| Dam<br>Breeds <sup>b</sup> | Sire Breeds           |                    |           |            |         |         |
|----------------------------|-----------------------|--------------------|-----------|------------|---------|---------|
|                            | Hereford <sup>c</sup> | Angus <sup>c</sup> | Pinzgauer | Tarentaise | Brahman | Sahiwal |
| Hereford                   |                       | X                  | X         | X          | X       | X       |
| Angus                      | X                     |                    | X         | X          | X       | X       |

<sup>a</sup> Approximately 256 heifers (32 of each breed group, except Tarentaise) were transferred to Brooksville, Fla.

<sup>b</sup> Cows used for GPE Cycle I, Phase 1, 1970 and 1971 breeding seasons.

<sup>c</sup> Sample of same Hereford and Angus sires used in Cycle I, Phase I, 1969, 1970, and 1971 breeding seasons.



## APPENDIX

TABLE 6. MATING PLANS TO PRODUCE CYCLE I, PHASE 3, CALVES<sup>a</sup>  
1971-1978 Breeding Seasons

| Breed Group | Sire Breeds                  |                                    |
|-------------|------------------------------|------------------------------------|
|             | First Calf Crop <sup>b</sup> | Subsequent Calf Crops <sup>c</sup> |
|             | Red Poll                     | Simmental                          |
| A x H       | X                            | X                                  |
| H x A       | X                            | X                                  |
| P x H       | X                            | X                                  |
| P x A       | X                            | X                                  |
| T x H       | X                            | X                                  |
| T x A       | X                            | X                                  |
| Br x H      | X                            | X                                  |
| Br x A      | X                            | X                                  |
| Sw x H      | X                            | X                                  |
| Sw x A      | X                            | X                                  |

<sup>a</sup> Females of each breed group distributed equally among cells marked "X" for each calf crop.

<sup>b</sup> Each group of heifers bred as yearlings to produce one calf crop as 2-year-olds by Red Poll bulls in 1977 and 1978.

<sup>c</sup> Each group of cows bred to produce at least four calf crops by Simmental bulls from 1978 through 1982.