

season, cows grazing native grasses may be consuming a diet deficient in protein. In this respect, the introduced grasses demonstrated a marked advantage over the native grass mixture.

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A Preliminary Report of Performance to Weaning of Certain Two-Breed Cross Calves

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Story in Brief

The purpose of this study was to present data concerning birth and weaning traits of two-breed cross calves produced by 363 Hereford and Angus cows that were bred to Simmental, Brown Swiss, Jersey, Hereford and Angus bulls. Results indicate that use of Simmental and Brown Swiss bulls can improve preweaning growth potential relative to Hereford, Angus and Jersey crosses. However, increased calving problems were encountered with Simmental and Brown Swiss crossbreds, especially when bulls of these breeds were used on first calf heifers. Jersey crosses in general were not comparable in growth performance to the other crossbreds. However, essentially no calving problems were encountered with Jersey crosses.

Considerable calving problems were encountered with first calf heifers bred to Simmental and Brown Swiss bulls. Less than half of the

Simmental (49 percent) and Brown Swiss (47 percent) calves produced by first calf heifers were born without some assistance from herdsmen. Calving problems were not as great when bulls of these breeds were mated to mature cows.

Simmental-Angus calves were heaviest at birth (79.5 lbs.) and Jersey-Angus calves were lightest (61.9 lbs.). Jersey-Hereford and Angus-Hereford calves were about three lbs. heavier than Jersey-Angus calves. Brown Swiss-Hereford, Brown Swiss-Angus, Hereford-Angus and Simmental-Hereford calves had similar birthweights, (ranging from 74.9 to 76.9 lbs.) and averaged four lbs. lighter than Simmental-Angus calves.

Average 205-day weaning weights adjusted for age of dam ranged from a high of 525 lbs. for Simmental-Angus calves to a low of 451 lbs. for the Jersey cross calves. Brown Swiss-Angus and Simmental-Hereford calves were similar in weight (497 and 493 lbs., respectively) and averaged 18 lbs. heavier than Brown Swiss-Hereford and Hereford-Angus calves that averaged 477 pounds. Simmental-Angus calves received conformation scores which averaged high choice. Jersey sired calves received conformation scores of average good while all other breed groups had similar conformation scores that were in the low to average choice grade.

Introduction

Considerable research from several different experiment stations in the U.S. has shown that production, as measured by pounds of calf weaned per cow exposed for breeding, was increased on the average by 20 percent or more by systematically crossing various cattle breeds. Increased production is possible through crossbreeding because the breeder has the opportunity of combining the desirable characteristics of two or more breeds and also because of heterosis for many of the important production traits.

Most research to date has dealt with estimating heterosis from crosses involving the British breeds of cattle. Some heterosis estimates have also been obtained for various Brahman crosses in the southern regions of the U.S. which has yielded similar results. It seems likely that similar amounts of heterosis as indicated by these studies for various productivity traits would result from crossing other breeds as well.

In order to help cattlemen maximize their production efficiency, additional research is needed to determine how available breeds can be best utilized to take advantage of the improved reproductive efficiency and maternal performance of the crossbred cow and the increased growth potential of crossbred calves. In particular, research is urgently needed to evaluate the potential usefulness of the recently imported "exotic"

breeds of cattle to the efficient production of beef under the various climatic and management systems found in the U.S. Also, it is important that efforts be made to evaluate the dairy breeds as a potential source of germ plasm for producing crossbred cows capable of producing sufficient milk to allow full realization of the increased genetic growth potential of crossbred calves.

The purpose of this report is to present data concerning birth and weaning traits of two-breed cross calves produced by Hereford and Angus cows that were bred to Hereford, Angus, Simmental, Brown Swiss and Jersey bulls.

Materials and Methods

Data analyzed in this study were collected from a crossbreeding study initiated in 1972 at the Lake Carl Blackwell research range. The specific purpose of the project is to compare lifetime productivity under range conditions of eight different two-breed cross cow groups (Angus-Hereford, Hereford-Angus, Simmental-Angus, Simmental-Hereford, Brown Swiss-Angus, Brown Swiss-Hereford, Jersey-Angus, Jersey-Hereford) when mated to terminal cross sires of a third breed. A more complete description of this project was presented in Okla. Agr. Res. Sta. Misc. Pub. 87: 180.

A foundation herd of approximately 200 Angus cows and 200 Hereford cows typical of good commercial Oklahoma cattle were assembled at the Lake Carl Blackwell research range near Stillwater in 1972. They were bred to bulls of the respective sire breeds during the 1972 breeding season to initiate production of the crossbred females to be used in the study. The data presented here were collected on the two-breed cross calves produced from these matings.

The calves were born from February through April, 1973. Herdsmen closely observed the herd during the calving season and obtained birth weights and determined calving difficulty scores, ranging from 1 through 6, for each calf born. Unassisted births were scored 1 and births requiring minor hand assistance were scored 2. Scores of 3 or 4, depending on degree of difficulty, were given births requiring use of a calf-puller. Caesarean births were scored 5 and a score of 6 was given to posterior presentations.

The calves remained with the cow herd without creep feed until they were weaned September 25, 1973 at an average age of 205 days. All calves were weighed and a panel of three observers determined conformation and condition scores for each calf.

Individual calf weaning weights were adjusted to a 205-day mature dam basis using the recommended industry age of dam correction factors of 1.15, 1.10 and 1.05 for calves from 2, 3 and 4 year old cows, respectively. The birth weight and weaning performance data (including the adjusted weaning weights) were statistically analyzed by least-squares procedures. The least squares breed group means presented in this report have been adjusted for unequal numbers of calves of the two sexes and also for different numbers of calves from each of the four sires used in producing the calves in each breed group. In other words, the means presented here are what would be expected if there were an equal number of calves of each sex for each of the four bulls that produced calves in a particular breed group.

After weaning, the steer calves were shipped to the Fort Reno Livestock Research Station where feedlot and carcass data will be collected. The heifer calves are being grown out to be used as breeding stock to provide data for the primary objective of the study.

Results and Discussion

Calving Difficulty.

Calving difficulty scores were determined, as described previously, for each of the 363 calves born. These calving difficulty scores are summarized in Table 1. All full term calves were included whether born dead or alive. The number of calves as well as the percentage of total calves classified in each calving difficulty category are shown for each breed group. Probably the most meaningful comparison of breed differences is the percentage of calves that had calving scores of either 1 or 2, since these two categories represent calves that in all probability would have been born without any assistance from the herdsman.

Due to differences in age and maturity of the Angus and Hereford cow herds, comparison and interpretation of these calving results should be made on a within breed of dam basis. Most of the Hereford cows were 30 to 36 month old heifers calving for the first time. In the Angus herd, however, all of the cows had produced at least one calf and most were mature cows.

On the Angus cows, about 85 percent of the calves sired by Simmental bulls were born unassisted which represents a 7 to 8 percent increase in the number of calves requiring some degree of assistance as compared to Brown Swiss and Hereford sired calves. All of the calves sired by Jersey bulls were born without assistance.

Use of the larger breeds on the young Hereford cows resulted in considerable calving difficulty. Less than half of the Simmental (49 per-

Table 1. Calving Difficulty Summary for Two-Breed Cross Calves.

Sire Breed	Total Calves	Live Calves	Calving Difficulty Categories ^{1,2}						Avg. Score ³	Calving Unassisted ⁴
			1	2	3	4	5	6		
Angus Cows:										
Hereford	49	45	45	----	3	1	----	----	1.18	91.8
		91.8	91.8	----	6.1	2.0	----	----		
Simmental	52	46	43	1	6	----	2	----	1.40	84.6
		88.4	82.7	2.0	11.5	----	3.8	----		
Brown Swiss	44	43	40	1	2	1	----	----	1.18	93.2
		97.7	90.9	2.3	4.6	2.3	----	----		
Jersey	43	43	43	----	----	----	----	----	1.00	100
Total	188	100	100	----	----	----	----	----	1.19	92.0
		177	171	2	11	2	2	----		
Hereford Cows:										
Angus	53	50	42	5	4	1	----	1	1.31	88.7
		94.3	79.2	9.4	7.5	1.9	----	1.9		
Simmental	41	38	17	4	14	4	2	1	2.27	48.8
		92.7	41.5	7.3	34.2	9.8	4.9	2.4		
Brown Swiss	43	40	19	1	12	5	3	3	2.30	46.5
		93.0	44.2	2.3	27.9	11.6	7.0	7.0		
Jersey	38	35	35	3	----	----	----	----	1.08	100
		92.1	92.1	7.9	----	----	----	----		
Total	175	163	113	12	30	10	5	5	1.72	71.4
		93.1	64.6	6.9	17.1	5.7	2.9	2.9		

¹ Calving difficulty categories: 1 = No difficulty, 2 = Little difficulty, 3 = Moderate difficulty, 4 = Major difficulty, 5 = Caesarean birth, and 6 = Posterior presentation.

² Top number is number of calves and lower number is percentage of total calves.

³ Average score based on categories 1 - 5.

⁴ Percentage of the calves receiving a calving score of either 1 or 2.

cent) and Brown Swiss (47 percent) sired calves were born without some assistance. Relatively little difficulty was encountered with Angus sired calves with only 11 percent of the calves requiring some assistance. Essentially no difficulty was encountered with Jersey sired calves.

These results are quite similar to results reported by the U.S. Meat Animal Research Center (USMARC), Clay Center, Nebraska. In general, researchers there found that significantly more calving difficulty was encountered with calves sired by bulls from the larger breeds (Simmental, Limousin, South Devon and Charolais) than with calves sired by Hereford, Angus or Jersey bulls. Hereford and Angus sired calves experienced somewhat more difficulty at birth than Jersey sired calves. In addition, first and second calf heifers encountered considerably more calving difficulty than mature cows.

These results indicate that it is not generally advisable to use bulls of the larger breeds on first calf heifers. And even with mature cows, an effort should be made to closely observe the cow herd during the calving season. This, of course, is a good management practice regardless of the breed of sire used. These results support the practice of using bulls from smaller breeds, such as Jersey, to reduce calving problems with first calf heifers.

Birth Weight.

Average birth weights are presented in Table 2. Simmental-Angus calves were the heaviest at birth (79.5 lbs.), and this was significantly heavier than calves of all other breed combinations except Brown Swiss-Hereford calves. Birth weights of Brown Swiss-Hereford, Brown Swiss-Angus, Hereford-Angus and Simmental-Hereford calves were not significantly different (ranging from 74.9 to 76.9 lbs.). Jersey-Hereford, Angus-Hereford and Jersey-Angus calves were significantly lighter at birth than

Table 2. Least-Squares Means and Standard Errors for Birth Weight of Two-Breed Cross Calves.

Breed of Site	Angus Cows		Hereford Cows	
	No. of Calves	Birth Weight (lbs.)	No. of Calves	Birth Weight (lbs.)
Hereford	46	75.4 ^a ±1.22	50	64.4 ^a ±1.71
Angus	—	—	38	74.9 ^b ±1.35
Simmental	49	79.5 ^c ±1.23	42	76.9 ^{b,c} ±1.36
Brown Swiss	43	75.8 ^b ±1.30	36	64.6 ^b ±1.52
Jersey	43	61.9 ^d ±1.29		

^{1,2,3} Means with different superscripts are significantly different (P<.05).

calves sired by Simmental, Brown Swiss and Hereford bulls, averaging about 18 lbs. lighter.

Growth Performance to Weaning.

Growth performance to weaning for the various breed groups is summarized in Table 3. Simmental-Angus and Brown Swiss-Angus calves grew faster prior to weaning than any other breed group, gaining on the average 0.3 lbs. more per day than Brown Swiss-Hereford, Angus-Hereford and Jersey-Hereford calves and 0.2 lbs. more per day than Hereford-Angus, Jersey-Angus and Simmental-Hereford calves.

Preweaning average daily gain is affected by numerous factors, including breed of sire, breed of dam and age of dam. Thus, breed differences need to be interpreted with these factors in mind. These results indicate that on a within breed of cow basis Simmental and Brown Swiss sired calves grow faster prior to weaning than calves sired by Angus, Hereford and Jersey bulls. Simmental crossbreds gained significantly faster than the Brown Swiss crosses. It is apparent that calves produced by Angus cows grow more rapidly prior to weaning than calves produced by Hereford cows; however, the magnitude of the differences probably would not be quite as large if age distribution would have been the same in both groups.

Weaning weight is a very important economic trait for the cow-calf producer. Because of a heavier birth weight and a more rapid rate of gain from birth to weaning, the Simmental-Angus calves were significantly heavier at weaning than calves of any other breed group. Jersey sired calves were significantly lighter than all other calves except Angus-Hereford calves. Brown Swiss-Angus and Simmental-Hereford calves had similar weights (497 and 493 lbs., respectively) and were on the average 18 lbs. heavier than Hereford-Angus and Brown Swiss-Hereford calves. Although not significantly different from either group, Angus-Hereford calves averaged 15 lbs. lighter than Hereford-Angus and Brown Swiss-Hereford calves and 10 lbs. heavier than Jersey sired calves. Some specific comparisons such as Brown Swiss-Angus *vs.* Hereford-Angus (19 lbs. different), Simmental-Hereford *vs.* Brown Swiss-Hereford (17 lbs. different) and Hereford-Angus *vs.* Angus-Hereford (15 lbs. different) were not significantly different but were approaching significance ($P < .10$) and probably reflect some real biological differences.

Simmental-Angus calves received an average conformation score of high choice while all other breed groups, except Jersey crosses, received conformation scores of average to low choice. As expected, the Jersey crosses received lower conformation scores due to a general lack of muscling. There were no extreme differences in condition among the

Table 3. Least-Squares Means and Standard Errors for 205-Day Weaning Performance of Two-Breed Cross Calves

Breed Group	No. of Calves	Prewaning ADG (lbs./day)	Weaning Weight (lbs.)	Conformation Score ¹	Condition Score ²
Hereford-Angus	45	1.85 ^a ±0.03	479 ^{a,6,6} ±6.7	13.0 ⁴ ±0.10	5.4 ³ ±0.08
Angus-Hereford	49	1.69 ^a ±0.03	463 ^{6,7} ±6.4	12.3 ⁵ ±0.10	5.0 ^{4,6} ±0.07
Simmental-Angus	46	2.05 ^b ±0.03	525 ³ ±6.8	13.9 ² ±0.11	5.2 ^{3,4} ±0.08
Simmental-Hereford	37	1.79 ^a ±0.03	493 ^{4,5} ±7.5	13.2 ⁴ ±0.12	5.0 ^{4,6} ±0.08
Brown Swiss-Angus	43	1.94 ^a ±0.03	497 ⁴ ±7.1	12.4 ⁵ ±0.11	5.1 ^{4,6} ±0.08
Brown Swiss-Hereford	41	1.69 ^a ±0.03	476 ^{5,6} ±7.4	12.2 ⁵ ±0.12	4.8 ^{4,6} ±0.08
Jersey-Angus	43	1.79 ^a ±0.03	452 ⁷ ±7.0	10.4 ⁶ ±0.11	5.0 ^{4,6} ±0.08
Jersey-Hereford	34	1.64 ^a ±0.04	451 ⁷ ±8.6	10.4 ⁶ ±0.13	4.9 ⁵ ±0.10

¹ 14 = high choice, 13 = average choice, 12 = low choice, 11 = high good, 10 = average.

² Condition scores range from 1 = very thin to 9 = very fat.

^{3,4,5,6,7} Means in the same column with different superscripts are significantly different ($P < .05$).

various breed groups although some differences were statistically significant.

These data indicate that, relative to crosses involving Angus and Hereford, considerable improvement in growth potential can be realized by using Simmental bulls on Hereford and Angus cows. This conclusion is made assuming that the sires sampled in this study were representative of those being used across the industry. The same comment can be made relative to Brown Swiss crosses, also, except that the magnitude of the increases in weaning weight was not as great as with Simmental crosses, and the Brown Swiss-Hereford calves showed no advantage over Hereford-Angus calves. Although Jersey crosses had respectable weaning weights (451 lbs.), they generally were not comparable in performance to the other breed combinations. The birthweight and growth performance data presented here follow the same general pattern as data reported on similar breed groups by USMARC.

Total Productivity.

To maximize production efficiency and economic returns, producers must wean as many pounds of calf as possible per cow in the herd. Table 4 summarizes total productivity of the various breed groups in terms of pounds of calf weaned per pregnant cow in the herd. Calculations of this nature depend not only on growth rate but also on the number of calves weaned as compared to the number of cows that conceived. Thus, this calculation reflects not only differences in growth rate but also calf losses during gestation, at birth (calving difficulty losses) and calf mortality from birth to weaning.

On the basis of productivity per pregnant cow, Brown Swiss-Angus calves showed a distinct advantage, weaning about 44 more pounds of calf per cow than any other group. On the other hand Jersey-Hereford

Table 4. Total Calf Production to Weaning of Two-Breed Cross Calves.

Breed Group	No. of Preg. Cows ¹	No. of Calves Weaned	Percent Calf Crop	205-Day Wean. Wt. (lbs.)	Lbs. of Calf Weaned/Pregnant Cow
Hereford-Angus	51	45	88.2	478	422
Angus-Hereford	54	49	90.7	463	420
Simmental-Angus	55	46	83.6	525	439
Simmental-Hereford	43	37	86.0	493	424
Brown Swiss-Angus	44	43	97.9	497	486
Brown Swiss-Hereford	46	41	89.1	476	424
Jersey-Angus	44	43	97.7	452	442
Jersey-Hereford	42	34	81.0	451	365

¹ Based on pregnancy diagnosis in the fall.

calves weaned approximately 54 lbs. less per pregnant cow than any other group. This low value for the Jersey-Hereford group was due to the combined effect of low average weaning weights and a high mortality rate among the Jersey-Hereford calves after birth. This may simply be due to chance rather than indicative of the survival ability of this particular breed combination. It is apparent from these data, however, that it is possible for a particular breed combination that has a lighter weaning weight to rank somewhat better in lbs. of calf weaned per pregnant cow if there is less death loss due to calving difficulties (e.g., the Jersey-Angus). Reflecting total production on a per breeding cow basis appears to be a very important and realistic basis for comparing the productivity of different breed groups. It will be of interest to further compare these breed groups on this basis as additional data become available.

Literature Cited

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Influence of Harvest Date and N and K Fertility Levels on Soluble Carbohydrate and Nitrogen Fractions in Winter Wheat Pasture

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Story in Brief

Previous studies had demonstrated the existence of high levels of soluble carbohydrates, total-N and nonprotein-N in winter wheat pasture samples. This past year, these fractions were measured in samples harvested at various intervals from early January to early May. Four fer-

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