

COMPARISON OF CHAROLAIS AND LIMOUSIN SIRES  
FOR PRODUCING THREE-BREED CROSS CALVES  
IN A TERMINAL CROSSBREEDING SYSTEM

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### Story in Brief

Various two-breed cross cow groups were mated to Charolais and Limousin bulls to produce 589 steer and 592 heifer three-breed cross calves over a 4-year period. Charolais sired calves were 6 lb heavier at birth than Limousin sired calves (85.3 vs 79.3 lb) and experienced greater calving difficulty with average calving difficulty scores 1.42 and 1.14, respectively. Charolais sired calves outgained Limousin sired calves by .07 lb/day from birth to weaning and were 20 lb heavier at weaning (512 vs 492 lb). Following weaning, calves were placed on a self-fed finishing ration and slaughtered as each animal attained an estimated low choice carcass grade. Charolais cross calves gained .12 lb/day faster than Limousin cross calves in the feedlot and were 7 days younger and 35 lb heavier (1147 vs 1112 lb) at slaughter. Charolais sired calves had greater carcass weight per day of age (1.58 vs 1.52 lb/day), slightly less external fat and .8 percent lower dressing percent than Limousin sired calves. Marbling score, rib eye area, quality grade and feed conversion were similar for both breeds.

### Introduction

Crossbreeding mating schemes are widely used in commercial beef production. Considerable research has been conducted demonstrating that systematic crossbreeding can increase efficiency of production by increasing pounds of calf per cow exposed over 20 percent. It is estimated that over half of the increase in productivity results from crossbred cows, and maximum improvement is possible when crossbred cows are mated to sires of a third breed. In a terminal system utilizing crossbred cows to produce three-breed crossbred calves, it is important to identify sire breeds which produce fast growing, efficient calves that produce desirable carcasses. The purpose of this study was to compare performance from birth to slaughter and carcass traits of calves sired by Charolais and Limousin bulls. This breed of sire evaluation represents a single aspect of an extensive research program in progress at Oklahoma Agricultural Experiment Station to evaluate lifetime productivity of various two-breed cross cows when mated to bulls of a third breed.

### Experimental Procedure

Purebred Charolais and Limousin bulls were mated to eight different two-breed cross cow groups (Hereford x Angus, Angus x Hereford, Simmental x Angus, Simmental x Hereford, Brown Swiss x

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Angus, Brown Swiss x Hereford, Jersey x Angus and Jersey x Hereford) to produce three-breed cross calves in the spring of 1978, 1979, 1980 and 1981. Over the 4-year period, cow ages ranged from 3 to 8 years of age at time of calving. A different set of eight Limousin sires were used each year for a total of 32 different Limousin sires. Eight Charolais sires were used each year; however, some bulls were used for two or three breeding seasons. Consequently, there were only 19 different Charolais sires. All Limousin sires were selected by the North American Limousin Foundation and used through artificial insemination with semen furnished by owners of the bulls. Seventeen Charolais sires were performance tested bulls purchased from Oklahoma breeders and used in natural service. The remaining 2 Charolais sires were selected as representative of the Charolais breed and used through artificial insemination to produce 61 of the 640 Charolais cross calves. Although some differences existed in the selection of sires within the two breeds, it was considered that the larger sampling of Limousin and Charolais sires represented typical sires available from each breed at the time of the study.

With the exception of 35 calves produced in 1978, which were born and reared in drylot to weaning at the Southwestern Livestock and Forage Research Station at El Reno, OK, calves were reared by their dams to an average age of 205 days on native and Bermuda grass pasture at the Lake Carl Blackwell Research Range west of Stillwater. Calves were born primarily during February-March each year. Birth weights were obtained within 24 hours of calving and for each calving the herdsman assigned a score to indicate level of calving difficulty on a scale from 1=no difficulty to 5=caesarian birth. Calves were weighed at weaning and also assigned a subjective condition score and conformation score by a panel of three persons. After weaning, all calves were trucked to the Southwestern Livestock and Forage Research Station and placed in the feedlot the following day. Calves were grouped by sex and breed composition, randomly assigned to pens within the heifer and steer feeding barns and fed ad lib the finishing ration shown in Table 1. Each animal was removed from feed and slaughtered when an estimated low choice grade was attained. During the time cattle were being slaughtered, cattle were selected and sent to slaughter every 2 weeks until all cattle were slaughtered.

**Table 1. Finishing ration.**

Ingredient	Percent in ration
Corn	78
Alfalfa	8
Cottonseed hulls	
Molasses	5
Supplemental pellets <sup>a</sup>	5
	Total 100

<sup>a</sup>Supplemental pellets consisted of 67.6% soybean oil meal (44%), 12% urea, 10% calcium carbonate, 8% salt plus Aurofac, vitamin A and trace minerals.

## Results and Discussion

Means of the various performance and carcass traits of crossbred calves sired by Charolais and Limousin sires are presented in Table 2. Although the magnitude of difference between sire breeds varied some from year to year, between the two sexes and among crossbred cow groups, the ranking of sire breeds was consistent. Consequently mean performances for each sire breed were averaged over years, sexes and crossbred cow groups.

On the average, Charolais sired calves were 6.0 lb heavier at birth and born with more difficulty than Limousin sired calves. Charolais sired calves had a 9.3 percent higher incidence of calving difficulty and a 5.1 percent greater death loss at or shortly after birth than Limousin sired calves. Charolais cross calves were 20 lb heavier at weaning, attributable to heavier birth weights and .07 lb/day more rapid growth rate from birth to weaning. Average conformation scores were similar and very acceptable for calves sired by both breeds. Charolais sired calves had a slightly higher condition score at weaning.

Initial feedlot weights are actual weaning weights rather than shrunk weight after trucking. Charolais cross calves were on the average 20 lb heavier than Limousin sired calves when placed in the feedlot. Charolais sired calves outgained Limousin sired calves by .13 lb/day for the first 120 days in the feedlot and by .11 lb/day after the first 120 days. The overall feedlot average gain of Charolais cross steers and heifers was 2.47 lb/day in comparison to 2.35 lb/day for Limousin cross calves; however, pounds of feed per pound of gain were similar for both sire groups. On the average, Charolais sired calves were in the feedlot 7 fewer days than Limousin sired calves, but due to their heavier initial weights and more rapid rate of gain were 35 lb heavier at slaughter.

Most of the cattle attained the intended carcass grade of low choice, with average carcass quality grade of both Charolais and Limousin cross calves being similar (9.7 and 9.8, respectively where 10 = low choice). Because of heavier slaughter weight Charolais sired calves also had 13 lb heavier carcass weight and .05 lb per day more rapid gain in carcass weight. Other carcass traits were similar for both sire breeds except single external fat thickness and dressing percent. Charolais sired calves had .05 in less fat cover at slaughter while dressing percentage favored Limousin cross calves by .8 percent. As a group, these cattle produced very desirable carcasses, as evidenced by an average dressing percentage of 64.3, .47 in. fat thickness, 13.15 square inches ribeye area and cutability of 50.3 percent.

Differences in performance between crossbred calves sired by Charolais and Limousin sires were subjected to an economic evaluation for weaning weight production, feedlot performance and beef production as shown in Table 3. In the cow-calf phase of beef production, costs are incurred per cow in the breeding herd and it is appropriate to compare weaning weights of Charolais and Limousin cross calves per cow exposed to breeding. A valid comparison of conception rate associated with sire breeds could not be determined since artificial insemination was used for Limousin bulls and mostly natural service for the Charolais bull. Thus, a 90 percent calving rate was assumed for cows mated to both sire breeds. The percent conception and percent calves born that survived were used to convert average weaning weight per calf to weaning weight per cow in the

**Table 2. Three-breed cross calves sired by Charolais and Limousin bulls.**

Trait	Breed of sire <sup>a</sup>		Difference
	Charolais	Limousin	Charolais-Limousin
<b>Performance to weaning:</b>			
Number of animals	640	541	--
Birthweight, lb	85.3	79.3	6.0**
% difficult calving <sup>b</sup>	12.8	3.5	9.3*
Calving difficulty score <sup>c</sup>	1.42	1.14	.28**
% death loss at birth or shortly after	8.59	3.51	5.08*
Prewearing ADG lb/day	2.08	2.01	.07**
205-day weaning wt, lb <sup>d</sup>	512	492	20**
Weaning conformation score <sup>e</sup>	13.6	13.6	0
Weaning condition score <sup>f</sup>	5.2	5.0	.2**
<b>Feedlot performance:</b>			
Number of animals	544	504	--
Initial weight, lb	511	491	20**
Days in feedlot	259	266	7*
Average daily gain, lb/day			
first 120 days	2.78	2.65	.13**
after 120 days	2.21	2.10	.11**
total feeding period	2.47	2.35	.12**
Final weight, lb	1147	1112	35
Feed efficiency, lb feed/lb gain	7.88	7.83	.05
Yearling weight	943	902	41**
Yearling conformation score	13.5	13.2	0.3**
<b>Carcass traits:</b>			
Number of animals	538	497	--
Carcass weight, lb	732	719	13*
Carcass weight/day of age	1.58	1.53	.05**
Dressing %	63.9	64.7	.8**
Single fat thickness, in	.44	.49	-.05**
KHP fat, %	2.99	3.09	-.1
Marbling score <sup>g</sup>	4.9	4.9	0
Carcass grade <sup>h</sup>	9.7	9.8	-.1
Ribeye area, sq in	13.2	13.1	.1
Cutability, %	50.4	50.2	.2

<sup>a</sup>Means averaged over years and sexes.

<sup>b</sup>%calving with calving difficulty scores 3, 4 or 5.

<sup>c</sup>Calving difficulty: 1=no difficulty, 2=little difficulty,

<sup>d</sup>moderate difficulty, 4=major difficulty, 5=caesarian.

<sup>e</sup>Weaning weights adjusted for age of calf and age of dam.

<sup>f</sup>Conformation score equivalents: 12=low choice, 13=average choice, 14= high choice.

<sup>g</sup>Condition equivalents: 1=very thin, 5=average to 9=very fat.

<sup>h</sup>Marbling score equivalents: 4=slight, 5=small.

<sup>i</sup>Carcass grade equivalents: 9=high good, 10=low choice.

\*Differences are significant at the .05 level of probability.

\*\*Differences are significant at the .01 level of probability.

Table 3. Economic analysis comparing Charolais and Limousin sires for producing three-breed cross calves.

	Breed of sire <sup>a</sup>		Difference
	Charolais	Limousin	Charolais-Limousin
<u>Weaning wt production (per cow in breeding herd)<sup>b</sup>:</u>			
Weaning weight, lb	421.2	427.3	-6.1
Weaning weight value, \$	273.78	277.75	-3.97
<u>Feedlot performance (per calf fed):</u>			
Feedlot feed costs, \$ <sup>d</sup>	408.95	396.77	
Feedlot overhead costs, \$ <sup>e</sup>			
	73.26	76.10	
Total feedlot costs, \$	482.21	472.87	
Carcass value, \$ <sup>f</sup>	693.20	680.89	
Carcass value above feedlot costs, \$	210.99	208.02	<u>2.97</u>
<u>Beef production:</u>			
Carcass value per cow in breeding herd above feedlot costs, \$	173.58	180.64	<u>-7.06</u>

<sup>a</sup>Means averaged over sexes.

<sup>b</sup>90% calving rate assumed for cows bred to both sire breeds.

<sup>c</sup>Weaning weight value based on average steer and heifer price of \$65 per cwt.

<sup>d</sup>Mixed ration cost was \$8.16 per cwt.

<sup>e</sup>Based on \$7.0 per calf medical charge, 14% interest rate on calf and feed and a \$.05 per day overhead charge.

<sup>f</sup>Carcass value based on average steer and heifer prices for yield grade low choice and high good carcasses of \$96 and \$90 per cwt, respectively.

breeding herd. Although Charolais sired calves were 20 lb heavier at weaning, greater death losses of Charolais sired calves at birth resulted in \$3.97 less weaning weight return per cow in the breeding herd for Charolais bulls compared to Limousin bulls.

Economic evaluation of the feedlot phase was on a per calf fed basis. The economic advantage associated with faster growth rate, fewer days on feed and heavier slaughter weights of Charolais cross calves was partially offset by the higher dressing percent of Limousin cross calves. Based on interest rate, feed costs and carcass values that prevailed in December, 1983, the net return per calf above total feedlot cost was similar for both sire breeds with Charolais sired calves having a slight advantage of \$2.97 per calf.

The overall efficiency of beef production between the two sire breeds can be compared by looking at the net return above total feedlot costs per cow in the breeding herd. On this basis, Limousin cross calves had an economic advantage of \$7.06 per cow in the breeding herd.

Although mated to a diverse group of crossbred cows, both Charolais and Limousin bulls produced calves that were uniform with quite acceptable conformation, performance and carcass desirability. Differences between calves sired by Charolais and Limousin sires for

individual traits were generally small. It appears either sire breed could be successfully utilized in a terminal cross mating system. Limousin may be the preferred breed of sire to mate to young or small cows, while Charolais sires may be the choice to mate to large, mature cows where calving difficulty and calf losses would be minimal. However, since sire breed averages were similar, there is considerable overlap between the breeds in performance of individual sires, and the choice of available bulls within each of these breeds may be as important as the selection of breed to sire calves.

In 1981, 1982 and 1983, 410 cows and 62 cows were utilized to determine the reproductive performance of each breed. The data were analyzed to determine if there was any difference in the reproductive performance of the breeds. The results of the analysis are presented in Table 1. The data indicate that there was no significant difference between the breeds in any of the reproductive traits measured. The only difference was in the number of calves born per cow per year, which was slightly higher for the Limousin breed. This difference was not statistically significant.

### Introduction

Many beef cattle breeders are interested in the genetic improvement of their herds. One of the most important factors in the selection of breeding stock is the ability of the sire to sire calves that will grow and gain efficiently. The ability of a sire to sire calves that will grow and gain efficiently is a function of many factors, including the sire's own growth and gain characteristics, the sire's ability to sire calves that will inherit the sire's growth and gain characteristics, and the sire's ability to sire calves that will inherit the sire's ability to grow and gain efficiently.

The purpose of this experiment was to determine the ability of sires to sire calves that will grow and gain efficiently. The experiment was conducted at the University of Missouri, Columbia. The results of the experiment are presented in Table 2. The data indicate that there was no significant difference between the breeds in any of the growth and gain traits measured. The only difference was in the number of calves born per cow per year, which was slightly higher for the Limousin breed. This difference was not statistically significant.

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