

1975

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Recommended Citation

Smith, W. L.; Parker, W. R.; and Dinkel, C. A., "Crossbreeding Effects on Growth and Carcass Traits of Beef Calves" (1975). *South Dakota Cow-Calf Field Day Proceedings, 1975*. Paper 9.
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Crossbreeding Effects on Growth and Carcass Traits
of Beef Calves

W. L. Smith, W. R. Parker and C. A. Dinkel

Introduction

Crossbreeding offers producers an opportunity to utilize heterosis in lowly heritable traits and breed differences in highly heritable traits. Heterosis is defined as the difference between the average of crossbreds and the average of the straightbred parents making up the crosses. Thus, if the crossbred average is intermediate between the two parents, there is no heterosis for that particular trait. Lowly heritable traits (those most apt to show heterosis) do not respond well to selection. Thus, crossbreeding is the primary tool for improvement. Reproductive traits are a good example.

Highly heritable traits that do respond to selection offer producers the opportunity to make improvement through selection of individuals and breeds outstanding in these traits.

The cow-calf efficiency project described elsewhere in this bulletin (A.S. Series 75-42) required the production of straightbred and crossbred heifers sired by two bulls, one each from the Angus and Charolais breeds. The purpose of this study was to summarize growth and carcass data from these first crosses. Because the breeds are represented by only one sire, breed comparisons should not be made from these data.

Procedures

The crossbreeding experiment was initiated in 1968 with the purchase of Angus and three-quarter Charolais weaning heifer calves from 59 ranchers in South Dakota. The heifers were bred artificially to an Angus or Charolais bull to produce straightbred Angus, seven-eighths Charolais, Angus-Charolais and Charolais-Angus calves in the years 1970, 1971 and 1972. (Crosses are denoted with breed of sire first.) The same two bulls were used each year. All calves were under one management system until weaning, but after weaning the heifers were divided into two groups. One group was wintered in drylot and put on pasture during the summer, while the second group was individually fed in drylot throughout the year. Steers were fed in a private feedlot following weaning.

Prepared for Cow-Calf Field Day, Aberdeen, South Dakota, November 13, 1975.

Results and Discussion

Average gestation length and birth weight of the bulls and heifers of each breed group are given in table 1. Heterosis for gestation length was negative but essentially zero. Charolais had a longer gestation length (286 days) than Angus (282), while the average of crossbreds was near the average of Angus and Charolais straightbreds. Birth weight of bulls also showed little heterosis, but there was 3% heterosis for birth weight of heifers. This sex difference in heterosis has been reported in other experiments.

Table 1. Breed Group Averages and Heterosis Estimates

| | | Breed group | | | | Heterosis |
|------------------------------------|------|-------------|-----|-----|-----|-----------|
| | | AA | AC | CA | CC | (%) |
| Gestation length (days) | | | | | | |
| Bull | Avg. | 282 | 283 | 284 | 286 | 0 |
| | No. | 51 | 43 | 48 | 41 | |
| Heifer | Avg. | 280 | 279 | 283 | 284 | 0 |
| | No. | 49 | 43 | 47 | 35 | |
| Birth weight (lb) | | | | | | |
| Bull | Avg. | 66 | 78 | 78 | 89 | 0 |
| | No. | 51 | 43 | 48 | 41 | |
| Heifer | Avg. | 63 | 72 | 75 | 81 | 3 |
| | No. | 49 | 43 | 47 | 35 | |
| Weaning weight (lb) | | | | | | |
| Bull | Avg. | 376 | 424 | 404 | 410 | 5 |
| | No. | 47 | 37 | 47 | 38 | |
| Heifer | Avg. | 368 | 403 | 394 | 413 | 2 |
| | No. | 48 | 40 | 47 | 34 | |
| Yearling weight (lb) | | | | | | |
| Heifer | Avg. | 568 | 616 | 620 | 631 | 3 |
| | No. | 48 | 39 | 46 | 34 | |
| 550 day weight (lb) | | | | | | |
| Heifer | Avg. | 743 | 818 | 820 | 836 | 4 |
| | No. | 48 | 39 | 46 | 34 | |
| Heifer feed efficiency (feed/gain) | | | | | | |
| W-550 | Avg. | 7.9 | 7.9 | 8.0 | 8.0 | 0 |
| | No. | 27 | 22 | 23 | 21 | |
| Y-550 | Avg. | 9.5 | 9.7 | 9.9 | 9.4 | -4 |
| | No. | 27 | 22 | 23 | 21 | |
| Weaning-Yearling | Avg. | 6.4 | 6.3 | 6.3 | 6.8 | 4 |
| | No. | 36 | 29 | 31 | 24 | |

At weaning, the effects of heterosis were greater than at birth for bulls, with crossbred bulls showing 5% and crossbred heifers 2% heterosis in weaning weight (table 1). Crossbred bulls were larger than Charolais bulls. Crossbred calves from Charolais cows weaned 14.5 pounds heavier than crossbreds from Angus cows.

Heterosis for postweaning traits of heifers increased slightly and were about 3% for yearling weight and 4% for 550-day weight (table 1). There was no heterotic effect on feed efficiency of the heifers following weaning, and there were no real differences between any of the breed groups (table 1). The heifers were raised for breeding purposes and thus were not fed for maximum gains.

There was evidence of heterosis in feedlot growth and certain carcass traits of steers (table 2). Crossbreds gained 6% faster and weighed 5% more at slaughter than the average of Angus and Charolais. There was no real difference in feedlot gain and slaughter weight between crossbred and Charolais steers, but the crossbreds gained faster and weighed more at slaughter than the Angus.

Table 2. Breed Group Averages and Heterosis Estimates for Steers Postweaning

| | Breed group | | | | Heterosis (%) |
|----------------------|-------------|-------|-------|-------|---------------|
| | AA | AC | CA | CC | |
| Number of animals | 42 | 34 | 44 | 31 | |
| ADG/feedlot (lb/day) | 2.09 | 2.40 | 2.49 | 2.51 | 6 |
| Slaughter wt. (lb) | 915 | 1039 | 1050 | 1075 | 5 |
| Carcass wt. (lb) | 556 | 637 | 648 | 668 | 5 |
| Dressing percent | 60.93 | 61.36 | 61.39 | 61.73 | 0 |
| Retail cuts (lb) | 276 | 319 | 332 | 347 | 4 |
| Cutability (%) | 50 | 50 | 51 | 52 | 0 |
| Grade ^a | 19 | 18 | 18 | 17 | 0 |

^aUSDA grades. 19 = low Choice, 18 = high Good, 17 = average Good.

As might be expected, heterosis was more important for those carcass traits affected by growth, namely, pounds of retail cuts (4%) and carcass weight (5%) than for carcass quality traits. Dressing percent, carcass grade and cutability did not display heterosis, a finding confirmed in other experiments.

Summary

In summary, these results indicate little heterosis for birth weight or gestation length. At weaning heterosis was important and crossbreds of the Angus and Charolais breeds were similar to the Charolais in weaning weight. Heterosis for growth rate after weaning is important for both feedlot steers and breeding heifers. In this study heterosis was greatest at slaughter weight for steers and at 550 days of age for heifers.

There were no important differences between breed groups of heifers for feed efficiency nor was there any heterotic effect.

Carcass traits associated with growth showed 4 to 5% heterosis, but carcass quality traits did not differ between straightbred and crossbred.