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# HETEROISIS AND BREED MATERNAL AND TRANSMITTED EFFECTS IN BEEF CATTLE

Keith E. Gregory,<sup>1</sup> Larry V. Cundiff, and Robert M. Koch

## Introduction

Heterosis has been shown to have important effects on most economic traits of beef cattle. This is a report of the results from the first phase of an experiment designed to evaluate heterosis and breed maternal and transmitted effects on economic traits of beef cattle and involves some combinations of breeds not previously included in crossbreeding experiments. Results are reported on preweaning traits, growth rate and puberty in females, growth traits in steers, and carcass traits of steers produced in an experimental design that included the straightbreds and all possible crosses of the Red Poll, Brown Swiss (European and domestic), Hereford, and Angus breeds.

## Preweaning Traits

Preweaning traits were analyzed on 1,207 calves born and 1,151 calves weaned. Effects of heterosis were significant for birth weight, calf crop weaned, preweaned average daily gain, and 200-day weight. Cows producing crossbred calves weaned 7.4% more weight per cow calving than cows producing straightbred calves. The four breeds did not differ in breed mean heterosis for the traits analyzed. Calves with Red Poll and Brown Swiss dams averaged 5 lb heavier at birth and 77 lb heavier at 200 days than their reciprocal crosses with Hereford and Angus dams. Breed maternal effects favored the Brown Swiss and Red Poll breeds over the Hereford and Angus breeds for traits associated with growth rate.

Breed transmitted effects showed the four breeds ranking in order (high to low) of Brown Swiss, Angus, Hereford, and Red Poll for traits associated with growth rate. The four breeds in crosses ranked in order (high to low) of Brown Swiss, Red Poll, Angus, and Hereford for traits associated with growth rate. The four breeds in crosses did not differ significantly from each other in perinatal mortality and calf crop weaned.

## Growth Rate And Puberty In Females

Postweaning growth rate and puberty data were analyzed on 536 females. Effects of heterosis on growth rate were expressed on average daily gain from 200 to 400 days, 400-day weight, and 550-day weight. Most of the effects of heterosis on

growth rate were expressed on average daily gain from 200 to 400 days. Crossbreds were 15 lb heavier and 9.4 days younger than straightbreds when puberty was observed.

Reciprocal cross differences averaged 74, 69, and 61 lb for 200-, 400-, and 550-day weight, respectively, in favor of females with Red Poll and Brown Swiss dams in crosses with Hereford and Angus. Breed maternal effects showed Brown Swiss and Red Poll breeds generally superior to Hereford and Angus breeds in most traits evaluated.

The Brown Swiss breed showed significantly higher breed transmitted effects than the other breeds for growth traits. Red Poll, Hereford, and Angus breeds did not differ greatly from each other in breed transmitted effects for growth traits; differences generally favored the Angus breed. Breed transmitted effects for weight at puberty showed the Red Poll breed reaching puberty at significantly lighter weight than the three other breeds.

The Brown Swiss breed in crosses was significantly heavier at 200, 400, and 550 days than crosses of the three other breeds, and the Red Poll, Hereford, and Angus breeds in crosses did not differ significantly from each other in 550-day weight. The Red Poll, Hereford, and Angus breeds in crosses did not differ in weight at puberty, but the Red Poll and Angus breeds reached puberty at significantly younger ages than the Hereford breed in crosses. The Brown Swiss breed in crosses reached puberty at a significantly younger age than the three other breeds, and it was significantly heavier than the Hereford and Red Poll breeds in crosses when puberty was observed.

## Postweaning Growth Traits Of Steers

Data on growth traits were analyzed on 584 steers. Effects of heterosis were significant for weight at 200, 312, and 424 days. Effects of heterosis on average daily gain decreased with increasing age; most of the heterosis observed on growth rate was expressed on preweaning average daily gain. Breed mean heterosis for growth traits of steers was highest in the Brown Swiss and Red Poll breeds and lowest in the Hereford breed.

Average reciprocal effect on weight in favor of steers with Red Poll and Brown Swiss dams was 78, 82, and 85 lb at 200, 312, and 424 days, respectively. The Brown Swiss and Red Poll breeds were superior in breed maternal effects to the Hereford and Angus breeds for weight at 200, 312, and 424 days.

The rank for breeds (high to low) in breed transmitted effects for 424-day weight was Brown Swiss, Angus, Hereford, and Red Poll.

The Brown Swiss breed in crosses was superior to the three other breeds for weight at 200, 312, and 424 days. The relative superiority of the Red Poll to Hereford and Angus in breed maternal effects and breed mean heterosis compensated for its relatively low level of breed transmitted effects and resulted in the Red Poll breed in crosses being equal to the Angus breed and significantly superior to the Hereford breed in crosses for weight at 424 days.

## Carcass Traits Of Steers

Data were analyzed on 537 carcasses from steers on an age constant basis. Heterosis effects were significant for most of the carcass traits associated with growth rate, including slaughter weight, carcass weight, adjusted fat thickness, estimated retail product weight, estimated fat trim weight, and estimated bone weight. Differences in breed mean heterosis were not generally important.

Reciprocal differences were significant in favor of the Red Poll and Brown Swiss dams for most of the carcass traits associated with weight. Breed maternal effects were greatest in Red Poll and Brown Swiss breeds for carcass traits associated with weight.

The Brown Swiss breed ranked first and the Red Poll breed last in breed transmitted effects for carcass traits associated with weight. The Angus breed ranked first in breed transmitted effects for carcass quality grade and for other carcass traits associated with carcass fatness.

The Brown Swiss breed in crosses ranked significantly higher than crosses of the three other breeds for most carcass traits associated with weight. Also crosses of the Brown Swiss breed had a higher lean-to-fat ratio.

When carcass traits were adjusted to a constant carcass weight of 597 lb, heterosis effects, reciprocal differences, and breed maternal effects were not important. Thus the heterosis, reciprocal effects, and breed maternal effects were associated with growth rate.

Breed transmitted effects were important for traits associated with carcass composition after adjustments were made for the effects of weight. This observation shows that there are important breed differences on carcass traits independent of carcass weight.

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