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Breed and management comparisons and genetic parameters for carcass traits (1995)

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BREED AND MANAGEMENT COMPARISONS AND GENETIC PARAMETERS FOR CARCASS TRAITS

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Summary

Carcass data from 5 years of a long-term, rotational, crossbreeding project were used to calculate heritabilities, genetic and phenotypic correlations, and management effects and to compare breeds for marbling, ribeye area, and hot carcass weight. Angus, Brahman, Charolais, Hereford, Polled Hereford, Gelbvieh, and Simmental breeds were involved. Sixty percent of the steer calves were fed as calves and 40% as yearlings. Heritabilities were .40 for marbling, .46 for ribeye area, and .51 for carcass weight. Genetic and phenotypic correlations were high between carcass weight and ribeye area but low between marbling and the other traits. Steers fed as calves had more marbling and lighter carcasses than steers fed as yearlings. Higher percentages of Gelbvieh or Brahman breeding resulted in lower (P<.05) marbling. Increased percentage of Charolais and Simmental breeding increased (P<.05) ribeye area and tended to increase carcass weight without reducing marbling

(Key Words: Postweaning Management, Genetic Parameters, Carcass Traits, Breeds, Beef Cattle.)

Introduction

Marbling score, ribeye area, and carcass weight determine carcass value, but profit is determined by the difference between carcass value and the cost of production. One major factor effecting cost of production is length of time the cattle must be maintained before slaughter. Our objectives were to 1) determine the heritabilities and genetic correlations among marbling, ribeye area, and carcass weight; 2) determine the influence of postweaning management on these traits; and 3) compare additive genetic breed differences for these traits.

Experimental Procedures

Records from 445 steer carcasses were analyzed for marbling, ribeye area, and hot carcass weight. Steers were produced at Louisiana State University as the fifth generation of a rotational crossbreeding project carried out in cooperation with KSU. Breeds were Angus, Brahman, Charolais, and Hereford (both horned and polled). All F_1 and two-, three-, and four-breed rotational crosses were represented with the restriction that Brahman be included in each cross. Terminal cross sires were mated to F_1 dams and half of each rotational-cross dam group. Gelbvieh was used for the first 3 years and Simmental for the last 2 years as the terminal sire breeds. Angus × Hereford F_1 also were produced.

Calves were born between mid January and mid April. Bull calves were dehorned and castrated in July. Calves were weaned and vaccinated in the first week of September. Approximately 60% of the steers were randomly assigned to the calf management group and shipped to KSU during the first week of October at an average age of 8 months. The remaining 40% made up the yearling management group and were backgrounded on ryegrass pasture at LSU before being shipped to KSU in early May at an average age of 15 months. In 1993, only a calf management group was available because fewer steer calves were produced at LSU.

[1]Louisiana State University, Baton Rouge.

Upon arrival at KSU, steers were weighed, sorted into pens, and placed on feed. The ration consisted of sorghum silage and cracked corn plus a soybean meal, urea, and mineral supplement. Silage was reduced from 75 to 15% of the diet dry matter over a 4-week starting period. Steers were slaughtered at IBP, Inc., Emporia, Kansas, when the ultrasound-measured fat thickness was between .3 and .5 inch. Carcass data (hot carcass weight, marbling score, ribeye area, and adjusted fat thickness) were collected by members of the KSU faculty. USDA yield grades were calculated, and marbling scores were converted to a numeric value for analysis.

The data were analyzed using a multiple-trait DFREML procedure in a full-animal model. The model included pedigree information from all five generations of the project and the fixed effects of year of birth and management group. Differences in heterosis were adjusted for using regression procedures. All data were adjusted to a constant adjusted fat thickness endpoint for analysis. Breeding values obtained from the animal model were used to compare breeds, and Least Squares Means were used to compare management groups.

Results and Discussion

The carcasses averaged 717 lb, small^{07} marbling, and 13.1 in^2 ribeye area. The heritability estimates were .40 for marbling, .46 for ribeye area, and .51 for carcass weight (Table 1). These estimates for ribeye area and marbling are lower than some estimates using REML procedures, probably because the between-breed variation was included in our analysis.

Genetic and phenotypic correlations between marbling and the other traits were low. The correlation between marbling and ribeye area was negative, whereas that between marbling and carcass weight was positive. The correlations between ribeye area and caracas weight were high (.75 for genetic and .57 for phenotypic). These results agree with earlier reports that indicate a high relationship between weight-related traits and ribeye area, but small correlations between weight-related traits and marbling.

Marbling was higher (P=.03) in carcasses of steers fed as calves than in steers fed as yearlings (Table 2). Steers fed as yearlings had heavier (P<.01) carcasses and tended to have larger (P=.07) ribeye areas than the steers fed as calves. These results indicate that steers fed as calves could have higher quality grades at lighter weights compared to steers placed on feed as yearlings.

All breeds were compared to an Angus base (Table 3). As the percentage Gelbvieh and Brahman breeding increased, marbling decreased (P<.05) relative to Angus. Increasing the percentage of Simmental or Charolais breeding resulted in larger (P<.01) ribeye areas, whereas increased percentage of Hereford tended (P=.06) to decrease ribeye area relative to Angus. As the amount of Charolais breeding increased, carcass weight increased (P<.01). As the percentage of Hereford breeding increased, carcass weight tended to decrease.

Our results indicate that carcass traits can be improved through selection. At a constant adjusted-fat thickness, feeding steers beginning at weaning will result in lighter carcasses with more marbling compared to steers that are grazed before being placed on feed.

Table 1. Heritability and Genetic and Phenotypic Correlations [a]

Trait[b]	MARB	REA	HCW
MARB	**.40**	-.001	.17
REA	-.19	**.46**	.57
HCW	.14	.75	**.51**

[a]Heritabilities are on the diagonal, genetic correlations below the diagonal, and phenotypic correlations above the diagonal.
[b]MARB = marbling score, REA = ribeye area, and HCW = hot carcass weight.

Table 2. Least Squares Means by Management Group [a]

Management	MARB	REA (in^2)	HCW (lb)
Calf	small[08 x]	12.7[z]	695[x]
Yearling	slight[90 z]	13.0[z]	752[z]

[a]MARB = marbling score, REA = ribeye area, and HCW = hot carcass weight.
[x,z]Means in the same column with different superscripts differ significantly (P<.05).

Table 3. Regression Coefficients and Standard Errors for Breed Comparisons [a]

Breeds	MARB (%)	REA (in^2)	HCW (lb)
Gelbvieh	-.182±.072	.002±.001	-.082±.094
Simmental	.075±.081	.006±.002	.200±.105
Brahman	-.589±.105	.002±.002	.020±.137
Charolais	.043±.072	.013±.002	.838±.103
Hereford[b]	-.088±.214	-.003±.001	-.280±.092
Angus	.000±.080	.000±.001	.000±.092

[a]For each one percentage change in the breed composition, the traits changed by this amount. MARB = percent of a marbling score, REA = ribeye area, and HCW = hot carcass weight.
[b]Hereford and Polled Hereford.