EFFECTS OF POSTWEANING MANAGEMENT SYSTEM AND BREED ON GROWTH AND CARCASS TRAITS

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Summary

Data from 5 years of a long-term, rotational, crossbreeding project were used to calculate heritabilities and correlations and to make breed comparisons for growth rate and carcass traits in two different postweaning management systems. The traits studied were weight per day of age, hot carcass weight, ribeye area, marbling score, and days of age at slaughter. One group was placed on full feed after weaning. A second group underwent a backgrounding phase for 7 months at Louisiana State University before being placed on feed at KSU. The breeds involved were Angus, Brahman, Charolais, Hereford, Simmental, and Gelbvieh. Differences in heritabilities between management systems were generally small, indicating similar genetic expression across management systems. Genetic correlations also were high except for marbling score, which indicates some difference in genetic expression between management systems for this trait. Some changes in rank of breeds occurred between management systems, but they generally were not significant.

(Key Words: Breeds, Management, Carcass Traits, Genetics, Growth.)

Introduction

With the increased use of retained ownership of calves and increased growth potential of some biological types of calves, many producers are changing from a conventional management system that utilizes backgrounding on forage followed by feedlot finishing to one in which calves are placed directly on feed after weaning. Differences in some carcass traits have been related to increased days on feed and differences in age of calves. Also, increased efficiency of gain has been reported for calves placed directly in the feedlot at weaning. Various breeds also may perform differently under different management systems. Our objectives were to determine the heritabilities and genetic and phenotypic correlations between measurements of the same trait in two postweaning management systems and to compare breeds in the two management systems.

Experimental Procedures

Records from 488 crossbred steers were available for analysis of growth rate and carcass traits between two postweaning management systems. The traits studied were weight per day of age, hot carcass weight, ribeye area, marbling score, and slaughter age. This project was conducted in cooperation with Louisiana State University (LSU). All steers were produced at LSU in the fifth generation of a rotational crossbreeding project involving Angus, Brahman, Charolais, and Hereford. All possible F_1, two-, three-, and four-breed rotational crosses were produced with the restriction that Brahman be included in all crosses. All F_1 dams and half of each rotational dam line were mated to terminal sires. Gelbvieh was used for the first 3 years and Simmental for the last 2 years as the terminal sire breeds. Angus Hereford F_1 cross calves also were produced.

Calves were born between mid-January and mid-April. Bull calves were dehorned and

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castrated in July. Calves were weaned and vaccinated in the first week of September. Approximately 60% of the steers within each breed group were assigned randomly 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% of the steers 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 steers were produced at LSU.

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 starter period. Steers were slaughtered at IBP, Inc., Emporia, Kansas, when ultrasound-measured fat thickness was between .3 and .5 inches. Carcass data were collected by members of the KSU faculty. Marbling scores were converted to a numeric value for analysis.

The data were analyzed by considering each trait separately in the two management systems. A multiple-traits DFREML procedure in a full-animal model was used. Two- trait models were used, with the two management systems being analyzed together for each measured trait. The model included the fixed effect of year of birth. Heterosis was adjusted for by regression procedures. All traits were analyzed to a constant adjusted backfat end point (.42 in.). Breed differences were adjusted for by use of regression procedures in the calculation of heritabilities and correlations. The pedigree file contained information from all five generations of the breeding project. The breeds were included as genetic groups in the pedigree file for calculation of breed effects. Solutions for the breed effects were contrasted to determine differences between breeds for each trait within a management systems.

Results and Discussion

A total of 488 steers was shipped from LSU to KSU as part of this study. The calf management group totaled 289 (59.2%), and the yearling management group, 199 (40.8%). Because of missing data, only 261 steers from the calf group and 176 from the yearling group were available for analysis of all traits. The calf management group had an average weight per day of age of 2.75 lb/day and averaged 463 days of age at slaughter. The yearling management group averaged 2.18 lb/day and a slaughter age of 564 days. Both management systems produced acceptable average carcass weights; 693 lb for calves and 756 lb for yearlings. Ribeye area also were very acceptable, being 12.6 in^2 and 13.4 in^2 for calf and yearling groups, respectively. The calf management group had a higher average marbling score than the yearling management group (small ^{18} vs slight ^{92}, respectively). A marbling score of small ^{00} is necessary to be graded Choice.

Heritabilities and correlations are presented in Table 1. Differences in heritability between management systems were generally small, indicating that genetics were expressed equally. The greatest difference was for marbling, with .28 for calf vs .12 for yearling management. This may indicate greater expression of genetic potential for marbling in the calf management group.

All genetic correlations were extremely high, except for weight per day of age and marbling. High genetic correlations for a trait for both calves and yearlings indicates that the same genes affect traits at both ages. The lower correlations for weight per day of age may have been due to differences in rate of maturity. The base used is the average of the breeds. The earlier maturing breeds (Gelbvieh and Simmental) had the greatest weight per day of age as calves, whereas the later maturing breeds (Brahman and Charolais) had the greatest weight per day of age as yearlings (Table 2). Simmental was significantly higher than Angus, Brahman,

and Hereford in the calf management group for weight per day of age. The rankings of breeds for all traits, except weight per day of age, were very similar between the calf and yearling management groups.

These results indicate that steers in different management systems showed similar genetic expression of traits, except for weight per day of age and marbling score. For these two traits, the calf management group had higher heritabilities, indicating greater expression of genetic potential. The breed comparisons indicate that breeds perform similarly under different managements, except for weight per day of age.

Table 1. Heritabilities and Genetic and Phenotypic Correlations within Management System[a]

	Heritability		Correlations	
Traits	Calf	Yearling	Genetic	Phenotypic
Weight/day of age	.61	.54	.69	.82
Hot carcass weight	.24	.24	1.0	1.0
Ribeye area	.17	.23	1.0	.28
Marbling	.28	.12	.22	.84
Age at slaughter	.19	.22	1.0	1.0

[a]Calf is calf management and yearling is yearling management.

Table 2. Breed Comparisons for Growth Rate and Carcass Traits within Management System[a]

	Breeds					
Traits[b]	Angus	Brahman	Charolais	Hereford	Simmental	Gelbvieh
WDA, Calf (lb)	.097 ^{z}	.207 ^{z}	.035^{yz}	.066 ^{z}	.282^{y}	.053^{yz}
WDA, Year (lb)	.007^{yz}	.035^{yz}	.128^{z}	.097 ^{y}	.015 ^{yz}	.053 ^{yz}
HCW, Calf (lb)	16.89 ^{z}	16.89 ^{z}	66.13^{y}	102.64 ^{x}	38.17^{yz}	32.17^{yz}
HCW, Year (lb)	51.98 ^{xz}	51.98 ^{xz}	112.19^{y}	99.62 ^{x}	81.28^{yz}	10.10^{z}
REA, Calf (in^2)	.65 ^{z}	.58 ^{z}	.99^{z}	1.13 ^{z}	.78^{z}	.60^{z}
REA, Year (in^2)	1.23 ^{z}	.64 ^{yz}	.43^{xy}	1.93 ^{z}	2.48^{x}	.90^{xy}
MAR, Calf (%)	9.10^{yz}	53.50 ^{z}	14.66^{yz}	2.00^{yz}	75.60^{y}	47.87 ^{z}
MAR, Year (%)	37.82^{z}	128.94 ^{y}	68.29^{z}	30.07 ^{x}	82.04^{z}	29.10 ^{x}
DOA, Calf (d)	18.54 ^{z}	18.54 ^{z}	30.27^{y}	18.54 ^{z}	8.87^{yz}	16.48^{yz}
DOA, Year (d)	15.64 ^{z}	15.64 ^{z}	15.64 ^{z}	15.64 ^{z}	37.71^{y}	24.85^{y}

[a]The base is the average of the breed groups.
[b]Calf is calf management group, Year is yearling management group, WDA = weight per day of age (lb/day), HCW = hot carcass weight (lb), REA = ribeye area (in ^{2}), MAR = marbling score (% of score), DOA = days of age at slaughter (day).
[x,y,z]Values in the same row with different superscripts differ significantly.