A Quantitative Comparison of Growth and Carcass Traits from Crossbred Calves Sired by a Modern Phenotype Paternal Breed Versus Calves Sired by a Multi-Generational Maternal Breed

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Corresponding Author: Dr. Matthew D Garcia, Assistant Professor, Louisiana State University/School of Animal Sciences, 105 jb francioni, 70803 - United States of America

Submitting Author: Dr. Matthew D Garcia, Assistant Professor, Louisiana State University/School of Animal Sciences, 105 jb francioni, 70803 - United States of America

Other Authors: Ms. Jennifer Bailey, First Author, Louisiana State University - United States of America
Dr. Glen Gentry, Collaborator, Louisiana State University/AgCenter - United States of America
Dr. Timothy Page, Collaborator, Louisiana State University/Agcenter - United States of America

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Author(s): Bailey J, Gentry G, Page T, Garcia MD

Introduction

Dramatic improvements in the beef cattle industry have been made over the last five decades. Specifically, the Angus breed has evolved from a small framed maternal breed to a breed with greater muscling and growth characteristics. Major increases have been observed in traits such as birth weight, weaning weight, yearling weight, and average daily gain. Genetic trends show a 3.8 pound increase in birth weight and a 54 pound increase in weaning weight (http://www.angus.org/Nce/GeneticTrends.aspx). Likewise, the Charolais breed, classified as a paternal breed, has also seen dramatic improvements in production traits. The Charolais breed has reported a five pound decrease in birth weight over the last 21 years and a 32 pound increase in weaning weight (http://www.charolaisusa.com/pdf/2012/09.07/PhenotypicTrendTables.pdf).

A study conducted by Williams et al. (2010) utilized production and carcass trait data reported in studies from 1976 to 1996. It was observed that the Charolais breed consistently had higher birth weights, weaning weights and post-weaning gains when compared to maternal breeds of cattle (Williams et al, 2010). Specifically, studies evaluating economically important production traits have reported that the Charolais sired calves had heavier birth weights (Cundiff et al., 1998), weaning weights (Cundiff et al., 1998; Thallman et al., 1999), hip heights (Arango et al., 2002; Thallman et al., 1999), and average daily gains (Gregory et al., 1994) than Angus sired animals. Previous studies evaluating carcass traits have reported that Charolais animals have higher average daily gain (Gregory et al., 1994), heavier hot carcass weights (Gregory et al., 1994; DeRouen et al., 1992), larger rib eye areas, lower back fat thickness (DeRouen et al., 1992), and lower marbling scores (Gregory et al., 1994; DeRouen et al., 1992) when compared to other Bos Taurus breeds of cattle.

The objective of this study was to test the effect of sire breed type on growth, performance, and carcass characteristics on a population consisting of Charolais sired calves and multigenerational Angus sired calves.

Materials and Methods

Experimental Animals

The population utilized in the current study consisted of one hundred thirty-two animals sired by purebred multi-generational Angus or modern phenotype Charolais sires mated to crossbred dams. The dam lines were comprised of one of four crossbred lines from the Germplasm Evaluation VIII population and have been previously described (Wheeler et al., 2005). The Angus sires utilized in the current study consisted of multigenerational sires born between 1960 and 2006. Dams had estrous synchronized via a previously described procedure (Wilson et al., 2010) and multigenerational Angus bulls were mated to the GPE VIII female population via artificial insemination. Upon completion of artificial insemination, Charolais sires were utilized as cleanup bulls for 67 days to increase pregnancy rates in the GPE VIII cows. The Charolais bulls were modern in their phenotype and contained modern EPD’s typically utilized for a terminal herd sire.

All calves were born between January 15 and April 23, 2010 at the LSU AgCenter Central Research Station in Baton Rouge, LA. Calves were managed and maintained at this facility until weaning, or approximately six months of age. Specifically, the calf population consisted of 86 multigenerational Angus sired animals and 46 Charolais sired animals. Animals were nominated for the Louisiana calf to carcass program after a 45 day preconditioning program and vaccination program that was pre-established by the Louisiana calf to carcass program. Animals were then shipped to a commercial feedlot and maintained there until a suitable harvest weight was attained. After a suitable harvest weight was reached all animals were shipped to a commercial packing plant for harvest and collection of carcass quality and composition data.
Growth and Carcass Characteristics

Growth and performance traits were collected at the Central Research Stations in Baton Rouge, LA and included birth weight (BW), weaning weight (WW), and hip height (HH). However, upon leaving the research station data was collected by the calf to carcass program included weight post shipping (shrinkage), days on feed, finishing weight and average daily gain (ADG). Animals were finished at either Hitch feedlot or Buffalo feedlot until a desired harvest weight of over 1200 lbs was reached. All animals were then transported to a commercial packing plant for harvest and subsequent carcass quality and composition trait measurement recording. Carcass quality and composition measurements that were collected included hot carcass weight (HCW), yield grade (YG), rib eye area (REA), back fat thickness (BF), marbling score (MARB) and quality grade (QG).

Statistical Analysis

The analyses conducted in this study were performed using the mixed model procedure of SAS as previously described by White and associates (2005). Fixed effects include sire breed and sex. Random effects included the traits of birth weight, weaning weight, hip height, average daily gain, hot carcass weight, back fat thickness, rib eye area, and marbling score. The LSMEANS function of SAS was utilized to conduct means separation analyses to detect potential differences in performance for growth and carcass traits between the multigenerational Angus sired calves and the Charolais sired calves.

Results

When analyzing the trait birth weight, Charolais sired calves had a mean of 43,0025 kg ± 0.9359 kg which was significantly (p < 0.05) heavier than the Angus sired calves mean birth weight of 37.8011 kg ± 0.6845 kg (Illustration 1.1). A significant difference (p = 0.05) was detected for weaning weight in which Angus sired calves had a mean weaning weight of 260.90 kg ± 3.8752 kg which was significantly heavier than the mean weaning weight of 247.97 kg ± 5.3573 kg for the Charolais sired calves (Illustration 1.2). Rib eye area measurements were significantly (p = 0.05) different between the two groups with Charolais sired animals having a mean rib eye area of 88.1353 cm² ± 1.3606 cm² which was significantly larger than the Angus sired animals mean rib eye area of 84.7934 cm² ± 1.0129 cm² (Illustration 1.6). When analyzing the trait of back fat thickness, Angus sired animals had a mean back fat thickness of 0.5159 in ± 0.01985 in which was significantly (p < 0.05) more than the Charolais sired animals mean back fat thickness of 0.3757 in ± 0.02667 in (Illustration 1.7). A significant difference (p < 0.05) was detected for marbling scores in which Angus sired animals had a mean marbling score of 414.17 ± 7.9944 which was significantly higher than the Charolais sired animals mean marbling score of 380 ± 10.3208 (Illustration 1.8). Although multiple differences were identified for both groups when evaluating growth and carcass traits, no significant differences were detected for the traits hip height (Illustration 1.3), average daily gain (Illustration 1.4), and hot carcass weight, (Illustration 1.5).

Discussion

The objective of this study was to test the effect of sire breed type on growth, performance, and carcass characteristics on a population consisting of modern Charolais sired calves and multigenerational Angus sired calves. Results indicated that Charolais sired animals had significantly greater birth weights than multigenerational Angus sired animals and have been validated by both Cundiff et al. (1998) and Williams et al. (2010). However, the significantly heavier weaning weights observed in the multigenerational Angus sired calves contradict the results reported by Cundiff and et al. (1998) and Williams et al. (2010). These studies reported that Charolais sired animals displayed higher weaning weights than maternal breeds of cattle indicating the multigenerational Angus sires utilized herein were more paternal than the base average of the breed.

When evaluating carcass quality and composition traits, the current study reported that the Charolais sired calves had a larger rib eye area than their multigenerational Angus sired counterparts. An association between Charolais animals and larger rib eye areas was also observed by Williams et al. (2010) and DeRouen et al. (1992). Results also indicate multigenerational Angus sired animals had significantly higher amounts of marbling in the longissimus muscle and greater back fat thickness measurements than Charolais sired animals. These results have been observed as well in previous studies conducted by Gregory et al. (1994), DeRouen (1992), and Williams et al. (2010). Furthermore, previous studies conducted by Williams et al. (2010) and DeRouen et al. (1992) reported an correlation between Angus sired animals and larger back fat thickness measurements when compared to Charolais sired animals.

The implications of this study are the potential benefits
of incorporating multigenerational animals into current
production schemes in order to improve traits which
have been inadvertently selected against. Incorporation of such genetics could improve traits such as fertility without hindering improvements made on other economically important traits. Integrating multigenerational genetics also has the potential benefit of improving carcass quality traits without decreasing carcass size. In conclusion, incorporating traditional breed genetics properly has the potential to improve traits in the beef industry that producers have unintentionally selected against over many decades to meet current standards dictated by the marked. However, modern genetics may prove to be more beneficial to incorporate into breeding herds as these phenotypes are more in line with current market demands in the beef industry.

References


Illustrations

Illustration 1

Illustration 1.1: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of birth weight. a, b Superscript indicates significance at p < 0.05

Illustration 2

Illustration 1.2: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of weaning weight. a Superscript indicates no significance at p < 0.05
Illustration 3

Illustration 1.3: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of hip height. A Superscript indicates no significance at p < 0.05.

Illustration 4

Illustration 1.4: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of average daily gain in the feedlot. A Superscript indicates no significance at p < 0.05.
Illustration 5

Illustration 1.5: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of hot carcass weight. a Superscript indicates no significance at $p < 0.05$

Illustration 6

Illustration 1.6: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of rib eye area. a Superscript indicates no significance at $p < 0.05$
Illustration 7

Illustration 1.7: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of back fat. a, b Superscript indicates significance at p < 0.05

Illustration 8

Illustration 1.8: Means separation analysis comparing multigenerational Angus sired calves and Charolais sired calves for the trait of marbling score. a, b Superscript indicates significance at p < 0.05