ECRONICON OPEN ACCESS

VETERINARY SCIENCE
Research Article

A Comparison of F1 Steers Sired by One of Three Paternal Breed Types for Growth and Carcass Traits

S Mizell[1], S Miller[1], K Bondioli[1, 2], M Garcia[1, 2]*

[1]School of Animal Science, Louisiana State University, Baton Rouge, Louisiana 70803, USA
[2]Louisiana State AgCenter, Baton Rouge, Louisiana 70803, USA

***Corresponding Author:** M Garcia, Louisiana State University, Baton Rouge, USA.

Received: December 18, 2015; **Published:** February 11, 2016

Abstract

The objective of the current study was to evaluate the growth and carcass characteristics for a crossbred calf crop sired by three different paternal breeds of sires. The sire breeds consisted of Braunvieh, Charolais, and Simmental cattle that all originated from herds in the southeastern United States. The three sire types were selected to be mated to a population of crossbred cattle that are classified by the breed types comprising the MARC germplasm cycle 8 dams. A total of 60 Simmental steer calves, 133 Charolais steer calves, and 46 Braunvieh steer calves were calved at the LSU AgCenter Central Research Station. All steer calves had birth weights, weaning weights, and hip height measurements collected on the farm. Steers were then shipped to commercial feedlots to complete the finishing process and upon completion of the finishing process were shipped to commercial packing plants for final carcass quality and composition data collection. Carcass quality and composition traits that were evaluated included hot carcass weight, yield grade, marbling score rib eye area, and back fat thickness. Analyses revealed that there were no significant differences ($P < 0.05$) between sire groups for growth traits and virtually all carcass traits. However, the Charolais breed had significantly larger rib eye areas than both the Braunvieh and Simmental sires steer calves, which were not significantly different from one another. Although no significant results for growth traits and most carcass traits were observed in the current study it may prove useful if the study can be expanded. If the experimental population size is increased to include more animals, more sire breeds and more production environments the results may provide vital insight to improve crossbreeding schemes both in the Southeastern United States, but also to other production environments as well.

Keywords: *Growth; Carcass quality; Carcass composition; Crossbreeding*

Introduction

The cattle industry as a whole is a diverse market with a major emphasis on decreasing input cost and maximizing profit. Producers are faced with task of increasing productivity in traits of economic importance and increasing the accuracy of selection to remain profitable. Greiner., *et al*. (2009) reported that reproduction, growth, maternal ability, and carcass composition are traits that influence productivity and profitability of the beef enterprise (Greiner, 2009). Crossbreeding is a fundamental beef production practice that has held producers reach these goals. The breeding of two separate breeds of cattle or crossbreeding offers two primary advantages, hybrid vigor and the increased performance of the offspring when compared to their purebred parents in traits of economic importance and environmental adaptability (Greiner, 2009). Coleman & associates (2012) reported that roughly 30% of the cow herd in the United States is located in the Gulf Coast region, but cattle in subtropical regions are exposed to problems associated with heat, parasite and disease exposure, and a seasonally impacted feed supply. Breed differences in performance characteristics are important genetic resources for improving the efficiency of beef production (Casas., *et al*. 2011). As such, knowledge of breed composition can be a beneficial tool when selecting cattle for various areas of production (Kuehn., *et al*. 2011).

The use of paternal sire breeds in a terminal based cow-herd is common practice for producers not retaining ownership of calves. Arango & associates (2002) reported that paternal breeds of cattle have been reported to sire calves with increased post weaning gains and frame size, which are two highly valued traits in the cattle feeding industry. Paternal breeds have also been reported to increase hot carcass weight but variable quality grades which can influence pricing systems have also been reported (Williams and Bennett, 1995). Diverse sire breed selection could potentially exploit heterosis and breed complementarity affects through crossbreeding to meet diverse market demands (Wheeler., *et al*. 2011). The objective of the current study was to evaluate growth, performance and carcass traits from a group of spring born calves sired by Charolais, Braunvieh, or Simmental bulls.

Materials and Methods

All animals were treated and maintained in accordance with the principles and guidelines outlined in the Guide for the Care and Use of Agricultural Animals in Research and Teaching (Protocol # AE2009-21). The population of animals utilized in the current study was comprised of 239 crossbred calves born from 2010-2013 at the Louisiana State University Central Research Station crossbred unit in Baton Rouge, La. Calves in the current study were sired by Charolais, Simmental or Braunvieh bulls (Table 1). The breed type of the dams has been previously described during the characterization of the Germplasm Evaluation VIII studies (Wheeler., *et al*. 2011). All animals were handled while following the IACUC procedures put in place by the LSU AgCenter. Prior to breeding season the GPE VIII females were divided into three breeding groups ranging from 30-40 cows per group with two bulls per sired breed placed with them for the entire 75 day breeding season (April 15th– July 1st). The spring calving season typically started on January 15th, and ended April 1st. Data was collected at Central Research Station throughout the calves' production cycle at the farm and consisted of sex, birth weight, weaning weight, and hip height. Ear notches were collected at birth when calf birth weight was collected and were subsequently used for DNA extraction. All calves were weighed within 24 hours of birth and color, sex, and sire breed was recorded. All bull calves were castrated at birth in conjunction with all previously described data collection procedures. The cow-calf pairs were then moved to rye grass pastures, and were maintained throughout spring. At approximately 205 days the calves from the spring calving group were weaned and weaning weight and hip height measurements were recorded. Steers that met shipping standard criteria of weighing above 225 kg were vaccinated and shipped to commercial feedlots in Oklahoma to complete the finishing process. Carcass quality and composition measurements were collected after completion of the finishing process at commercial packing plants.

Year	Charolais	Braunvieh	Simmental	Total
2010	63	0	0	63
2011	24	16	25	61
2012	26	15	17	60
2013	20	15	18	55

Table 1: *Total number of steers per breed by year utilized in the current study.*

Statistical Analysis

The Mixed Model procedure of SAS (version 9.4, SAS Institute, Cary, NC) was utilized to test for significant differences in growth, and carcass traits in the Charolais, Braunvieh, or Simmental calf groups. Birth weight (BW), weaning weight (WW), hip height (HH), ribeye area (REA), marbling score (MS), hot carcass weight (HCW), back fat thickness (BF), and yield grade (YG) were fit as dependent variables in the model. Sire breed and birth year were fit into the model as fixed variables. A random nested variable of Sire breed (birth year) was fit into the model to account for possible confounding effects from utilizing similar sires across years. The LSMEANS procedure and the pre-planned pairwise comparisons function were utilized to evaluated significant differences in performance between calves sired by one of the previously described sire breeds. Statistical significance was set at $P < 0.05$ for the current study.

Results

A total of 239 steer calves born from Bruanvieh, Charolais and Simmental sires were evaluated for growth and carcass traits in the current study. When evaluating growth and carcass traits of birth weight, weaning weight and hip height, BF, HCW, YG and MS no significant differences were detected in the current population (Table 2 and Table 3). Thus, all animals regardless of sire breed performed

similarly for the all growth traits and the vast majority of carcass quality and composition traits. The only trait that exhibited a significant difference in performance between different sire breed groups was REA. Charolais sired animals had significantly ($P < 0.05$) larger REA than Braunvieh and Simmental sired animals. However, the Braunvieh and Simmental sired animals were not significantly different from one another when evaluating REA.

Trait/Sire Breed	Braunvieh	Charolais	Simmental
Birth weight kg	39.24 + 1.85[a]	40.95 + 1.04[a]	40.72 + 1.78[a]
Weaning weight kg	261.55 + 18.72[a]	272.51 + 10.66[a]	269.25 + 18.41[a]
Hip Height cm	113.77 + 1.83[a]	114.05 + 1.04[a]	114.20 + 1.78[a]

Table 2: *LSMEANS Comparison of growth traits from steers sired by three paternal sire breeds. Differing superscripts indicate a difference of means at $P < 0.05$ within rows.*

Trait/Sire Breed	Braunvieh	Charolais	Simmental
HCW kg[1]	342.99 + 9.67[a]	377.13 + 5.24[a]	348.65 + 9.28[a]
REA cm[2]	33.62 + 0.82[a]	36.62 + 0.40[b]	33.84 + 0.73[a]
BF cm[3]	0.16 + 0.02[a]	0.18 + 0.01[a]	0.14 + 0.02[a]
Marbling Score	438.55 + 26.04[a]	407.81 + 14.64[a]	425.76 + 25.14[a]
Yield Grade	1.97 + 0.22[a]	2.08 + 0.13[a]	1.97 + 0.22[a]

[1]*Hot carcass weight*

[2]*Rib eye area*

[3]*Back fat thickness*

Table 3: *LSMEANS Comparison of growth traits from steers sired by three paternal sire breeds. Differing superscripts indicate a difference of means at $P<0.05$ within rows.*

Discussion

While limited differences were detected in the current study for growth and carcass traits, the United States Department of Agriculture Meat Animal Research Center (MARC) in Clay Center, Nebraska has routinely conducted studies where the objective is to do comprehensive research on specific cattle breed performances. These studies evaluated several breeds and analyzed cattle at various stages of the production scheme (Thallman., *et a*l. 1999). Research evaluating the performance of crossbred animals throughout the production period is important to producers as it provides information about breed complementarity and the benefit of heterosis for growth and carcass traits various production settings (Kim., *et al*. 2003; Kuehn., *et al*. 2011). In the southeast region of the United States many producers have traditionally utilized crossbred cattle herds with predominantly Anus or Charolais sires (Coleman., *et al*. 2012). The current study provides evidence that while the Charolais breed is a very functional paternal breed in the Southeastern United States, there are also other viable paternal sire breed options (Braunvieh and Simmental) that will produce very similar high performing calves. Evidence of similar performance levels was presented in the current study as there was no significant difference observed between all breeds for growth traits, and only a single carcass trait being significantly different among all the sire breed calves (Table 3). Thus the current study reports that performance due to heterosis would be similar among all the sire breed calves and would agree with previous research that crossbred calves with good breed complimentarity will exhibit high levels of heterosis (Greiner., *et al*. 2009)

Although no significant differences were detected for birth weight in the current study between sire breeds, previous research has reported that Simmental sired calves have been shown to have higher birth weights when compared to other breeds. Lawlor and associates (1984) reported similar results in which Simmental sired calves were significantly heavier at birth when compared to Hereford and Angus sired calves. The previously reported increased birth weight in the Simmental breed could possibly a precursor for future

increased carcass yield and larger mature size. This is not in agreement with the current study as no significant differences were observed between calves sired by any of the sire breeds utilized herein. Carcass traits that were evaluated among calves sired by Charolais, Bruanvieh and Simmental bulls in the current study included hot carcass weight, ribeye area, backfat thickness, marbling score, and yield grade. Although no statistical difference was detected for growth and virtually all carcass traits when evaluating calves sired by different paternal cattle breeds, a significant difference was detected for REA. When evaluating the trait of REA, Charolais sired calves in the current study had significantly ($P < 0.05$) larger REA than their Braunvieh or Simmental sired counterparts. These results are not in agreement with previous research conducted by Wheeler., *et al*. (1996) in which paternal breed calves were evaluated for carcass traits and Charlolais sired calves did not have significantly larger REA when compared to other breeds. Furthermore, previous research has reported breed differences when evaluating carcass and growth traits (Arango., *et al*. 2002). However, Arango and associated utilized maternal breeds in which have been reported to be significantly different in their growth patterns from paternal breed sired calves (Wheeler., *et al*. 2005; Wheeler., *et al*. 2004).

Conclusion

The current study provides more information to the knowledge base that is necessary to evaluate breed complimentarity in a crossbreeding system. While limited significance was identified in the current study the information is still very valuable for producers in the Southeastern United States. The data presented herein provides evidence to producers that there are multiple sire breed alternatives that can be utilized in a rotational crossbreeding scheme that will generate high performing calves in the Southeastern United State beef production system. However, the authors would suggest that future studies be conducted utilizing larger experimental populations, an expansion of quantitative traits evaluated, and the evaluation of breeds in multiple production environments to provide more accurate conclusions with regards to specific sire breeds being utilized in specific production environments.

Bibliography

1. Arango JA., *et al*. "Breed comparisons of Angus, Brahman, Hereford, Pinzgauer, Sahiwal, and Tarentaise for weight, weight adjusted for condition score, height, and body condition score". *Journal of Animal Science* 80.12 (2002): 3142-3149.
2. Arango JA., *et al*. "Breed comparisons of Angus, Charolais, Hereford, Jersey, Limousin, Simmental, and South Devon for weight, weight adjusted for body condition score, height, and body condition score of cows". *Journal of Animal Science* 80.12 (2002): 3123-3132.
3. Bourdon R.M and J.S. Brinks. "Genetic, environmental and phenotypic relationships among gestation length, birth weight, growth traits and age at first calving in beef cattle". *Journal of Animal Science* 55.3 (1982): 543–553.
4. Brandt H., *et al*. "Animal Genetics – Quantitative Genetics: Estimation of genetic and crossbreeding parameters for preweaning traits in German Angus and Simmental beef cattle and the reciprocal crosses". *Journal of Animal Science* 88 (2010): 80-86.
5. Casas E., *et al*. "Birth and weaning traits in crossbred cattle from Hereford, Angus, Brahman, Boran, Tuli, and Belgian Blue sires". *Journal of Animal Science* 89.4 (2011): 979-987.
6. Coleman SW., *et al*. "Evaluation of tropically adapted straightbred and crossbred cattle: Postweaning BW gain and feed efficiency when finished in a temperate climate". *Journal of Animal Science* 90 (2012): 1955-1965.
7. Greiner S., "Crossbreeding beef cattle". Virginia Cooperative Extension. Pub. 400- 805.
8. Kim JJ., *et al*. "Detection of quantitative trait loci for growth and beef carcass fatness in a cross between Bos taurs (Angus) and Bos indicus (Brahman) cattle". *Journal of Animal Science* 81.8 (2003):1933-1942.
9. Kuehn LA., *et al*. "Predicting breed composition using breed frequencies of 50,000 markers from the US Meat Animal Research Center 2,000 Bull Project". *Journal of Animal Science* 89.6 (2011):1742-1750.
10. Lawlor TJ., *et al*. "Performance of crosses among Hereford, Angus, and Simmental cattle with different levels of Simmental breeding. I. Preweaing growth and survival". *Journal of Animal Science* 58.6 (1984): 1321- 1328.
11. Meyer K. "Estimates of genetic parameters for mature weight of Australian beef cows and its relationship to early growth and skeletal measures". *Livestock Production Science* 44.2 (1995): 125– 137.

12. Thallman RM., *et al*. "Germplasm Evaluation in Beef Cattle—Cycle IV: Postweaning Growth and Puberty of Heifers1,2,3". *Journal of Animal Science* 77 (1999):2651–2659.
13. Wheeler TL., *et al*. "Characterization of biological types of cattle (Cycle IV): carcass traits and longissimus palatability". *Journal of Animal Science* 74.5 (1996): 1023-1035.
14. Wheeler TL., *et al*. "Characterization of biological types of cattle (Cycle V): carcass traits and longissimus palatability". *Journal of Animal Science* 79.5 (2001): 1209-1222.
15. Wheeler TL., *et al*. "Characterization of biological types of cattle (Cycle VI): Carcass, yield, and longissimus palatability traits". *Journal of Animal Science* 82:1177-1189.
16. Wheeler TL., et al. "Characterization of biological types of cattle (Cycle VII): Carcass, yield, and longissimus palatability traits". *Journal of Animal Science* 83.1 (2005): 196-207.
17. Wheeler TL., *et al*. "Characterization of biological types of cattle (Cycle VIII): Carcass, yield, and longissimus palatability traits". *Journal of Animal Science* 88.9 (2010): 3070-3083.

Volume 2 Issue 4 February 2016