Abstract W37

Effect of breed composition, temperament, and ELISA scores for paratuberculosis on phenotypic residual feed intake and growth in an Angus-Brahman multibreed herd

M. A. Elzo*[1], D. G. Riley[2], G. R. Hansen[3], D. D. Johnson[1], R. O. Myer[4], D. O. Rae[1], J. G. Wasdin[1], and J. D. Driver[1]

[1]Department of Animal Sciences, University of Florida, Gainesville, FL 32611-0910; [2]ARS-USDA, STARS. Brooksville, FL 34601-4672
[3]North Carolina State University, Plymouth, NC 27962; [4]North Florida Research and Education Center, Marianna, FL 32446-7906

SUMMARY

The effects of additive and nonadditive genetic effects, temperament, and dam ELISA scores for paratuberculosis (ES) on five postweaning feed intake and growth traits were evaluated in a group of 335 bull, heifer, and steer calves of breed compositions ranging from 100% Angus (A) to 100% Brahman (B). Calves were born in Gainesville, FL (2006 and 2007), and moved to a *GrowSafe automated feeding facility* in Marianna, FL, after weaning. Calves were randomly allocated to pens by sire group (1 = A, 2 = ¾ A ¼ B, 3 = Brangus, 4 = ½ A ½ B, 5 = ¼ A ¾ B, and 6 = B) and sex (bull, heifer, and steer). Calves were fed concentrate during the 21-d adjustment and the *70-d trial* periods. Individual daily feed intake, byweekly weights, chute score, and exit velocity were recorded. Dam ES were obtained preweaning. Phenotypic RFI was computed as the difference between the actual and the expected feed intakes. Traits were analyzed using mixed linear models. Fixed effects were contemporary group (year-pen), RFI group (except when trait was RFI), age of dam, sex of calf, age of calf, B fraction of calf, heterozygosity of calf, mean CS, mean EV, and ES. Random effects were sire and residual. Calves were assigned to 3 RFI groups: high (RFI > mean + 0.5 SD), low (RFI < mean - 0.5 SD), and medium (RFI between mean ± 0.5 SD; SD = 5.4 kg). *Feed efficiency tended to increase with higher Brahman fractions, and to decrease with higher levels of heterozygosity. Average daily gain was similar across B fractions and heterozygosities. Postweaning gain tended to decrease as Brahman fraction increased. Temperament traits were unimportant for all traits, except exit velocity for average daily gain. Dam ELISA scores for paratuberculosis was immaterial for postweaning feed efficiency or growth.*

INTRODUCTION

Breed composition, temperament, and subclinical paratuberculosis in dams are factors that may have an effect on growth and feed efficiency in beef cattle. Residual feed intake (RFI; Koch et al., 1963) has become a common way to measure feed efficiency. The RFI is computed as the difference between actual feed intake and expected feed intake (function of average daily gain and metabolic mid-weight). Two of the breeds most frequently found in the Southern region of the US are Angus (A) and Brahman (B). These breeds usually exist as crossbreds of various A and B fractions as well as purebreds. Thus, *the objective of this research was to assess the effect of breed group (Angus (A), Brahman (B), Brangus, ¾ A ¼ B, ½ A ½ B, and ¼ A ¾ B), chute score (CS), exit velocity (EV), and ELISA scores for paratuberculosis in dams of calves (ES) on 5 feed intake and growth traits in bulls, heifers, and steers (n = 461) ranging from 100% Angus to 100% Brahman.*

MATERIALS AND METHODS

Animals and preweaning management and nutrition. Animals were from the Angus-Brahman multibreed herd of the University of Florida (UF). There were 335 calves born in 2006 and 2007 (bulls = 21, heifers = 149, steers = 165) from 6 breed groups (1 = Angus, 2 = ¾ A ¼ B, 3 = Brangus, 4 = ½ A ½ B, 5 = ¼ A ¾ B, and 6 = Brahman). Calves were produced by a diallel mating 21 sires and 200 dams of all 6 breed groups per year. Table 1 shows numbers of calves per breed-group-of-sire x breed-group-of-dam combination. Cows were synchronized in March with a progesterone-releasing device (CIDR®, Pfizer Animal Health) for 7 d, followed by an injection of $PGF_{2\alpha}$ (5 ml of LUTALYSE®, Pfizer Animal Health), artificially inseminated twice, then assigned to a cleanup sire group for a period of 60 d. There was one cleanup sire group per breed group of sire, for a total of six breeding groups. Calves were kept at the UF Beef Research Unit (BRU) until weaning (August), and moved to the Marianna GrowSafe automated feeding facility (September). Calves were pre-conditioned at the BRU for 3 wk using concentrate (1.6 kg to 3.6 kg; 488 Pellet, Medicated Weaning Ration, Lakeland Animal Nutrition, Lakeland, Florida; and soy hull pellets), hay, pasture, and free choice mineral (UF University Special Hi-Cu Mineral, University of Florida, Animal Science Department, Gainesville).

Table 1. Number of calves by breed group of sire x breed group of dam combination

Breed group of dam	Breed group of sire						
	Angus	¾ A ¼ B	Brangus	½ A ½ B	¼ A ¾ B	Brahman	All
Angus	29	7	9	7	8	14	74
¾ A ¼ B	18	5	13	9	9	9	63
Brangus	2	2	28	2	3	2	39
½ A ½ B	16	16	15	11	15	17	90
¼ A ¾ B	4	3	6	8	4	5	30
Brahman	0	0	0	0	0	39	39
All	69	33	71	37	39	86	335

Management, nutrition, and data collection at the feed efficiency facility. Calves were randomly allocated to 10 pens in 2006 (20 calves/pen) and to 14 pens in 2007 (14 calves/pen) in the UF-IFAS Feed Efficiency Facility (FEF) by sire group (1 = A, 2 = ¾ A ¼ B, 3 = Brangus, 4 = ½ A ½ B, 5 = ¼ A ¾ B, and 6 = B) and sex (bull, heifer, and steer).The FEF is located at the North Florida Research and Education Center (NFREC), Marianna, FL. It has 24 pens (108 m^2/pen) equipped with 2 GrowSafe feed nodes. Animals were fed a concentrate diet composed of whole corn, soybean hulls, corn gluten feed, cottonseed hulls, and a protein, vitamin, and mineral supplement in 2006. The 2007 diet had higher fiber content (chopped bermudagrass instead of soybean hulls) The concentrate had a DM, CP, NEm, and NEg of 91.2%,17.3%, 1.7 mcal/kg, and 1.2 mcal/kg in 2006, and 90.0%,14.1%, 1.5 mcal/kg, and 0.9 mcal/kg in 2007. Pre-trial adjustment period = 21 d; trial period = 70 d. Software recorded individual feed intake in real-time. Weights and temperament traits were taken every 2 weeks.

Temperament, Feed Efficiency, and Subclinical Paratuberculosis. *Temperament traits* were: 1) *chute score* (BIF, 2002; CS = 1 = docile; 2 = restless; 3 = nervous; 4 = flighty; 5 = aggressive; 6 = very aggressive); and 2) *exit velocity* (EV) out of the chute (m/sec). *Residual feed intake* was computed as the difference between actual feed intake and expected feed intake (Koch et al., 1963; Arthur et al., 2001; Archer et al., 2007) during the 70-d post-weaning feeding trial. Expected feed intake was a function of average daily gain and metabolic mid-weight. Average daily gain was computed as the regression of weight on days on test. Metabolic mid-weight was equal to estimated mid-weight (estimated initial weight plus average daily gain times 35 d) to the power of 0.75. *Subclinical paratuberculosis* was evaluated using ELISA scores (ES) obtained from dams of calves: 1 = negative, 2 = suspect, 3 = weak positive, and 4 = positive.

Statistical analysis. Traits were RFI, daily feed intake (DFI), feed conversion ratio (FCR), average daily gain (ADG), and postweaning gain (PWG). Traits were analyzed using mixed models. Fixed effects were contemporary group (year*pen; year = 2006, 2007; pen = 1 to 14), RFI group (except when trait was RFI), age of dam (1 = 3 yr, 2 = 4 yr, and 3 = 5 yr and older), sex of calf (1 = bull, 2 = heifer, and 3 = steer), age of calf, Brahman fraction of calf, probability of A and B alleles at 1 locus in the calf, mean CS, mean EV, and ES. *Brahman fraction and heterozygosity of calf were nested within sex of calf for RFI, and within RFI group for the other traits.* Random effects were sire and residual. Sire and residual effects were assumed to have mean zero and to be uncorrelated. The RFI groups (Nkrumah et al., 2004) were: high (calf RFI > mean + 0.5 SD), low (calf RFI < mean - 0.5 SD), and medium (calf RFI between mean ± 0.5 SD; SD = 5.4 kg). Mixed model analyses were carried out using SAS Proc MIXED. Least squares means by sex of calf for RFI, and by RFI group for DFI, FCR, ADG, and PWG were plotted against breed group of calf using SAS Proc GPLOT.

RESULTS AND DISCUSSION

Breed Composition. The largest fraction of calves belonging to the low RFI group (most efficient) was that of Brahman, whereas Brangus had the largest fraction of calves in the high RFI group (least efficient). There was a negative trend for additive genetic RFI effects (*higher feed efficiency*) from Angus to Brahman (significant only for heifers: -1.4 ± 0.7 kg, P < 0.04), and a positive nonadditive genetic trend (*lower feed efficiency*) towards high levels of heterosis (significant only for steers: 2.0 ± 0.8 kg, P < 0.02). Similar trends existed for additive and nonadditive genetic effects for DFI (significant only for medium RFI group, additive = -1.4 ± 0.5 kg, P < 0.007, and nonadditive = 1.2 ± 0.6 kg, P < 0.05). The RFI group was important only for DFI (P < 0.0001). *The negative regressions of PWG on RFI group indicated that PWG decreased as the B fraction increased (-38.1 ± 9.0 kg, P < 0.0001, for calves in the least efficient group, and -19.3 ± 6.2 kg, P < 0.002, for calves in the most efficient group). Neither additive nor nonadditive genetic effects were important for FCR and ADG.*

Temperament and ELISA score for paratuberculosis. *Neither chute score nor exit velocity was significant for any of the traits except for ADG (Table 3). Similarly, ELISA score for paratuberculosis was not important for any of the feed efficiency or growth traits.*

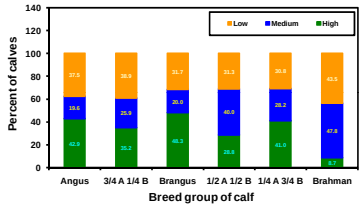
Table 2. Significance (P > F) of Regression of Brahman fraction and Heterozygosity of calf on traits

Trait	Brahman fraction	Heterozygosity
Residual Feed Intake	0.04	0.03
Daily Feed Intake	0.05	0.05
Feed Conversion Ratio	0.98	1.00
Average Daily Gain	0.42	0.82
Postweaning Gain	< 0.0001	0.43

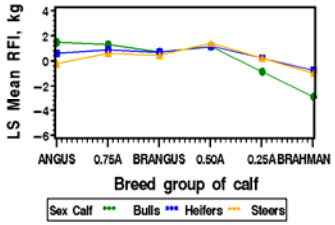
Table 3. Significance (P > F) of Temperament and ELISA scores for paraTBC

Trait	Chute Score	Exit Velocity	ELISA Score
Residual Feed Intake	0.78	0.49	0.39
Daily Feed Intake	0.20	0.45	0.16
Feed Conversion Ratio	0.40	0.10	0.47
Average Daily Gain	0.71	0.02	0.29
Postweaning Gain	0.39	0.89	0.98

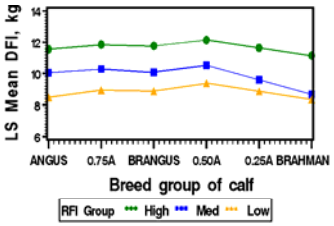
Residual Feed Intake



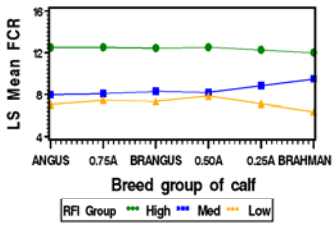
Residual Feed Intake



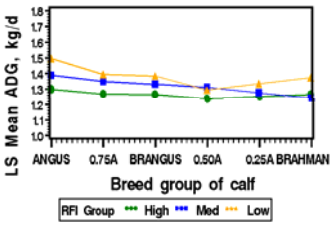
Daily Feed intake



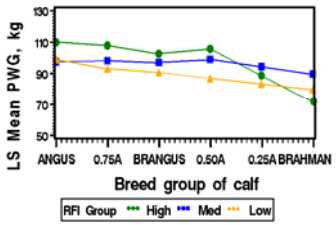
Feed Conversion Ratio



Average Daily Gain



Postweaning Gain (70 d)



FINAL REMARKS

Feed efficiency tended to increase with higher Brahman fractions.
Feed efficiency tended to decrease with higher levels of heterozygosity.
Average daily gain was similar across B fractions and heterozygosities.
Postweaning gain tended to decrease as Brahman fraction increased.
Temperament traits were unimportant for all traits, except EV for ADG.
Dam ELISA scores for paratuberculosis did not affect postweaning feed efficiency or growth.

LITERATURE CITED

Archer, J. A., P. F. Arthur, R. M. Herd, P. F. Parnell, and W. S. Pitchford. 2007. Optimum postweaning test for measurement of growth rate, feed intake, and feed efficiency in British breed cattle. J. Anim. Sci.75:2024-2032.

Arthur, P. F., G. Rennard, and D. Krauss. 2001. Genetic and phenotypic relationships among different measures of growth and feed efficiency in young Charolais bulls. Livest. Prod. Sci. 68:131-139.

BIF. 2002. Guidelines for uniform beef improvement programs. 8th Ed. http://www.beefimprovement.org/library/06guidelines.pdf.

Koch, R. M., L. A. Swiger, D. Chambers, and K. E. Gregory. 1963. Efficiency of feed use in beef cattle. J. Anim. Sci. 22:486-494.

Nkrumah, J. D., J. A. Basarab, M. A. Price, E. K. Okine, A. Ammoura, S. Guercio, C. Hansen, C. Li, B. Benkel, B. Murdoch, and S. S. Moore. 2004. Different measures of energetic efficiency and their phenotypic relationships with growth, feed intake, and ultrasound and carcass merit in hybrid cattle. J. Anim. Sci. 82:2451-2459.