The Professional Animal Scientist 33:334–341
https://doi.org/10.15232/pas.2016-01586

Genetic evaluation of postweaning performance traits in Brahman and Brahman-influenced stockers grazing rye–ryegrass or bermudagrass pastures

M. R. Woolfolk,* J. O. Sanders,* F. M. Rouquette Jr.,† PAS, R. D. Randel,† and D. G. Riley*[1]
*Department of Animal Science, Texas A&M University, College Station 77843; and †Texas A&M AgriLife Research, Overton 75684

ABSTRACT

Growth of young cattle on forages and pastures has a major effect on the profitability of the stocker cattle industry. The objectives of this study were to estimate heritability of performance traits and additive genetic correlations of pairs of traits in Brahman and Brahman-influenced (0.25 or 0.5 Brahman) stocker cattle on rye (*Secale cereale*) + ryegrass (*Lolium multiflorum*) (RRG; n = 2,031) or bermudagrass [*Cynodon dactylon* (L.) Pers.] (BER; n = 1,322). Data from 1986 to 2014 at Overton, Texas, for BW, ADG, and BCS were analyzed for each stocking season. Main effects included stocking rate (3 levels), proportion of Brahman inheritance (3 levels on RRG: 0.25, 0.5, 1; 2 levels on BER: 0.25 and 1), supplementation status, and contemporary groups. Stockers receiving supplement were heavier ($P < 0.001$) from both RRG (365.3 ± 4.2 kg) and BER (363.8 ± 3.0 kg) compared with nonsupplemented stockers (348.1 ± 2.5 and 343.9 ± 2.7 kg, respectively). Within each breed group, BW and ADG means were greater ($P < 0.003$) for low stocking rates. Heritability estimates for BW and ADG were 0.56 ± 0.05 and 0.1 ± 0.06, respectively, on RRG. Estimates of additive genetic and phenotypic correlations were 0.69 ± 0.13 and 0.59 ± 0.02, respectively. Heritability estimates for BW, ADG, and BCS of stockers on BER were 0.5 ± 0.1, 0.11 ± 0.09, and 0.27 ± 0.1, respectively. Additive genetic correlation of BW and BCS during BER was large (0.61 ± 0.17), but estimates for the other pairs of traits did not differ from zero.

Key words: average daily gain, Brahman, genetic parameters, stocker cattle, pasture

INTRODUCTION

Bos indicus cattle and Brahman-influenced cattle maintain a prominent position in the beef cattle industry in the Southwest and Gulf Coast regions of the United States. Adaptation to semitropical environmental conditions, including resistance to parasites and disease, allows these cattle to thrive in conditions in which non-*Bos indicus* breeds of beef cattle do not perform as well (Hammond et al., 1998). The mating of Brahman with *Bos taurus* breeds of cattle has resulted in crossbred cattle that combine the growth and carcass characteristics of *Bos taurus* cattle with the heat tolerance and hardiness of *Bos indicus* breeds. The use of available pastures for backgrounding has become a viable and economic method of adding postweaning BW gains to stocker calves before feedlot entry (Brown et al., 1999). The most common measure of performance in stocker cattle is ADG, and appropriate management strategies are required for enhanced BW gains on low nutritive value forages such as bermudagrass (Rouquette, 2015). Genetic parameters for these types of traits may be unique for different seasons in the tropics (de Alencar et al., 2005; Mascioli et al., 2006). Genetic parameters for postweaning BW gain on pasture have been primarily investigated and estimated in the tropics with *Bos indicus* cattle in Australia (Seifert, 1975; Barwick et al., 2009a) and South America (Cardoso and Templeman, 2004; Toral et al., 2011; Caetano et al., 2013; Lima et al., 2013; Raidan et al., 2015; Martínez et al., 2016). In confined feeding, genetic parameters for growth traits have been estimated in *Bos indicus* cattle in the United States (Warwick and Cartwright, 1955; Riley et al., 2002; Smith et al., 2007; Lancaster et al., 2009); however, no estimates of genetic parameters for performance on pastures have been reported for Brahman cattle under any temperate or subtropical United States conditions. The objectives of this study were to estimate h^2 of postweaning growth traits, including ADG, BCS, and BW, and genetic correlations of pairs of traits in Brahman and Brahman-influenced stocker calves by season of grazing.

MATERIALS AND METHODS

Cattle and Management

All animal procedures were approved by the Texas A&M University Institutional Animal Care and Use Committee. Brahman and Brahman crossbred calves were born in the spring or fall at the Texas A&M AgriLife Research and

[1] Corresponding author: david-riley@tamu.edu

Extension Center at Overton, Texas, from 1986 to 2014. Brahman cows were mated to Brahman bulls to produce purebred calves. Brahman cows were mated to Angus, Hereford, Romosinuano, and Tuli bulls in different years to produce contemporary, crossbred offspring. Contemporary stockers of 0.25 Brahman resulted from matings of crossbred (F_1) Brahman females and Simmental, Angus, Hereford, Bonsmara, and Romosinuano bulls. Pedigree information was available for all calves. Numbers of steer and heifer records during each grazing season by breed type are shown in Table 1.

Calves were weaned at approximately 5 to 7 mo of age depending upon the year and allocated randomly by BW and BCS onto grazing experiments. Experiments were classified by forage type and season (Gaertner et al., 1992). Cool-season annual grass pastures (September 1 to March 15) consisted primarily of Elbon or Maton rye (*Secale cereal* L.) and Gulf or TAM-90 annual ryegrass (*Lolium multiflorum* L.). Bermudagrass (*Cynodon* sp.) pastures (March 16 to August 31) were primarily Coastal, common, or Tifton 85. Calves born in spring were weaned in fall and stockered on cool-season pastures. Calves born in the fall were weaned in May and stockered on bermudagrass pastures. Performance data collected on stockers at the conclusion of grazing periods included BW, ADG, and BCS. Body condition scores were based on the 1-to-9 scale used in beef cattle, with 1 indicating emaciated and 9 indicating obese (Herd and Sprott, 1986). Variable stocking rates were based on forage mass as described by Roth et al. (1990) and Rouquette (2015). Low-stocked pastures maintained greater than 2,400 kg/ha of forage, medium between 1,600 and 2,000 kg/ha, and high-stocking-rate pastures had less than 800 kg/ha of forage mass. During the cool season, average stocking rates ranged from 3.5 animals/ha (low), to 5 animals/ha (medium), to 7 animals/ha (high) with 250 kg = 1 stocker calf. During the summer, average stocking rates (250 kg = 1 stocker calf) on bermudagrass pastures ranged from 12 animals/ha (low), to 16 animals/ha (medium), to 19 animals/ha (high).

Depending on the experimental protocol, some grazing seasons included supplementation treatments that were energy-based or protein-based rations (Huston et al., 2002). The amount and type of supplement varied with the experimental design and objectives for backgrounding stockers. Feedstuffs included fishmeal, cottonseed meal, soybean meal, feather meal, corn gluten meal, cracked corn, and molasses blocks, with or without the addition of Rumensin (Elanco, Greenfield, IN). For this study, type and amount of supplementation were not uniquely separated.

Statistical Analyses

Although some breed effects were confounded with fraction of Brahman (e.g., most 0.25 Brahman were 0.5 Simmental), numbers of some groups were too low to model distinctly. Consequently, fraction of Brahman was modeled as 3 levels (0.25, 0.5, and 1; n = 1,259, 199, and 573, respectively, in cool-season data; n = 832 and 490 for 0.25 Brahman and Brahman in warm-season data; Table 1). All animals that received any supplementation (all supplementations were designed evaluations) were classified as supplemented, and others were classified as not supplemented. This was modeled as a 2-level fixed effect. Age in days was investigated as a covariate across and within groups representing fraction of Brahman. Data were analyzed using animal models with ASReml (Gilmour et al., 2009). Effects investigated in models were sex, year, stocking rate, supplementation status, fraction of Brahman inheritance, and interactions. Preliminary analyses were conducted to assess possible combinations of main effects into contemporary groups. Random effects investigated included additive genetic, maternal additive genetic, the covariance of additive genetic with maternal additive genetic, and maternal permanent environmental effects. Log-likelihood values of nested models were compared and, where appropriate, tested with likelihood ratio tests to determine final model random components. Estimates of heritability were obtained from single-trait analyses; estimates of genetic and phenotypic correlations were from 2-trait analyses of each trait in each season. Descriptive statistics for traits by season are shown in Table 2.

RESULTS AND DISCUSSION

Contemporary groups were constructed as combinations of sex and year, and this was a highly significant effect in the analyses of all traits in both seasons. Average ages of animals at trial end were 435 and 419.6 d for cool- and warm-season trials, respectively. Probability values for the F-statistics of fixed effects for final models of all traits in both seasons are shown in Table 3.

Rye + Ryegrass Pastures

Supplemented calves were heavier at the end of grazing experiments compared with those with no supplementa-

Table 1. Distribution of BW records by breed type, sex, and grazing season

Breed type, no.	Cool season	Warm season
0.25 Brahman		
Steers	678	404
Heifers	581	428
0.5 Brahman		
Steers	161	
Heifers	38	
Brahman		
Steers	404	431
Heifers	169	59
Total	2,031	1,322