Abstract T181

Genetic parameters and genetic trends for preweaning growth in an Angus-Brahman cattle population in the Colombian tropics

O. D. Vergara[1], M. A. Elzo[*2], R. M. Patiño[3], A. Calderón[1], R. Almanza[4]

University of Cordoba, Monteria, Colombia[1], University of Florida, Gainesville, FL, USA[2], University of Sucre, Sincelejo, Colombia[3], Gencaribe, Hacienda Abastecedora de Carnes SA, Planeta Rica, Colombia[4]

SUMMARY

The objective of this research was to estimate genetic parameters and trends for birth weight (BW) and weaning weight adjusted to 270 d of age (WW270) in a beef cattle population composed of Angus and Brahman straightbred and crossbred animals located in a Colombian premontane humid forest. Data were from 561 calves born from 1999 to 2010. The 2-trait model included the fixed effects of contemporary group (year-season-sex), age of dam, breed direct genetic effects, breed maternal genetic effects, individual heterosis, and maternal heterosis. Random effects were calf direct genetic, dam maternal genetic, permanent environmental maternal, and residual. Variance components and genetic parameters were estimated by Restricted Maximum Likelihood. Program AIREML was used to perform computations. Heritabilities estimates for additive direct genetic effects were 0.08 ± 0.005 for BW and 0.10 ± 0.006 for WW270. Maternal heritability was 0.04 ± 0.002 for BW and 0.08 ± 0.005 for WW270. Low direct and maternal preweaning heritabilities suggested that nutrition should be improved to allow fuller expressions of calf direct growth and cow maternal ability. The correlation between additive direct genetic effects for BW and WW270 (0.18 ± 0.03) indicated that genes that increased BW also augmented WW270. The genetic correlations between direct and maternal additive effects were negative for BW (-0.51 ± 0.02) and for WW270 (-0.21 ± 0.03) suggesting that genes increasing weight would lower maternal ability. Calf weighted yearly means showed near zero trends during these years for direct and maternal effects for BW and WW270. This indicated that the intensity of selection applied to this multibreed population was insufficient to influence direct and maternal genetic yearly EBV means during this 12-yr period. To make genetic progress for direct and maternal growth traits in this population, a selection program that utilizes direct and maternal animal EBV to select replacement sires and dams will need to be implemented.

INTRODUCTION

Beef cattle production in tropical and subtropical regions must utilize cattle that can not only survive and reproduce, but also produce good quality meat under hot and humid climatic conditions. This has led cattle producers in these regions to make widespread use of crossbreeding of *Bos indicus* breeds, primarily Brahman, with *Bos taurus* breeds to generate crossbred cattle that are able to thrive in under such harsh environmental conditions. This mating strategy has produced a large *Bos taurus* × *Bos indicus* multibreed cattle population in the Southern region of the US, where Angus has the largest representation among *Bos taurus* breeds (Elzo et al 2012). Similarly, most systems of beef and dairy cattle in Colombia have a multibreed structure primarily due to the importation of semen, embryos and live animals of various *Bos taurus* and *Bos indicus* breeds. In addition, Colombia has a great diversity of animals of Criollo breeds, which added to the availability of animals of foreign breeds has created a national cattle population of tremendous genetic diversity. Thus, there is a need for research on genetic evaluation systems that can evaluate all animals in populations composed of purebred and crossbred animals (Vergara et al, 2010). Thus, **the objective of this research was to estimate genetic parameters and trends for birth weight (BW) and weaning weight adjusted to 270 d of age (WW270) in a beef cattle population composed of Angus and Brahman straightbred and crossbred animals located in a Colombian premontane humid forest.**

MATERIALS AND METHODS

Animals and Data. Data were collected by a private cattle company (Gencaribe, Medellin, Colombia) from 1999 to 2010. Data consisted of 561 birth weights (BW) and weaning weights (WW270). Weaning weights were adjusted to 270-d of age.

Management and Feeding. Calves were born and raised until weaning in a single farm (La Abastecedora, Planeta Rica, Colombia) owned by the Gencaribe company. Cows and preweaning calves at La Abastecedora were maintained in a rotational grazing system. Pastures were composed of Brachiaria (*Brachiaria decumbens*), Braquiaria humidicola (*Decumbens humidicola*), Angleton (*Dichanthium aristatum*), Estrella Africana (*Cynodon nlemfuensis*), Admirable (*Brachiaria mutica*), and dictoneura Brachiaria (*Brachiaria dictyoneura*). In addition, animals received salt and water ad libitum. During the dry season, cattle were fed corn silage and Angleton (*Dichantium aristatum*) grass hay.

Genetic Predictions and Genetic Parameters. A 2-trait mixed model was used to analyze BW and WW270. The model included the fixed effects of **contemporary group** (year-season-sex), **age of dam**, **breed direct** genetic effects**, breed maternal** genetic effects, **direct heterosis**, and **maternal heterosis**. Random effects were **direct genetic**, **maternal genetic**, **permanent environmental maternal**, and **residual**. Program **AIREML** (Misztal, 1997; Tsuruta, 1999) was used to perform computations. **Genetic predictions** were computed as a weighted sum of **breed genetic** effects and **random** effects (Elzo and Famula, 1985; Elzo and Wakeman, 1998). Weighted yearly means of EBV for calf **BW** and **WW270 direct** and **maternal genetic** effects were computed to study genetic trends between 1999 and 2010.

RESULTS AND DISCUSSION

Description of data. Means and **standard deviations** in this multibreed population were **36.3** kg and **3.4** kg for **BW**, and **151.0** kg and **35.7** kg for **WW270**.

Breed effects. Angus had the **best performance** for **direct breed** effects for **WW270** and had the **worst performance** for **maternal breed** effects for **WW270** under the tropical environmental conditions of this population (Table 1). Although non-significant, this indicated that purebred **Angus** and **crossbred calves** with a **high Angus fraction** had **higher ability** for **WW270**; and **dam Angus** and **crossbred dams** with a **high Angus fraction** tended to wean calves with **lower weights**.

Table 1. Estimates of direct and maternal breed effects as deviations from Brahman

	TRAIT	
Direct	**BW, kg**	**WW270, kg**
Angus - Brahman	**-0.83 ± 0.05 (P = 0.68)**	**4.93 ± 0.94 (P = 0.78)**
Maternal		
Angus - Brahman	**0.05 ± 0.02 (P = 0.92)**	**-5.38 ± 0.40 (P = 0.38)**

Heterosis Effects. Estimates of **direct heterosis** effects were **-0.32 ± 0.03** kg (P = 0.53) for **BW**, **7.32 ± 0.55** kg (P = 0.52) for **WW270**. **Maternal heterosis** effects were **zero** for **BW** and **WW270**. The estimate of **direct heterosis** for **WW270**, respect to value of **maternal heterosis**, indicate that direct **weaning weight** was substantially more influenced by **non-additive interbreed genetic** effects than the **production of milk of dams**. Although non-significant, the estimate of **direct heterosis** for **WW270** suggested that it would be **economically advantageous** to consider **expected heterozygosis** of the **progeny** when planning matings in this population. The **opposite occurred** with **BW**.

Genetic Parameters. Table 2 shows estimates genetic parameters for **BW** and **WW270**. Low estimates of heritability **direct** and **maternal** for **BW** and **WW270** suggested that **genetic improvement** for these traits **would be slow** in this population .

The genetic correlation between **direct additive** effects for **BW** and **WW270,** suggested that **selection of animals** for direct **BW** would have little **impact** on **WW270** in this population.

The negative genetic correlation between **direct** and **maternal additive genetic** effects for **BW** and also for **WW270** indicated an **antagonistic relationship** between direct and maternal effects for these traits. The same occurred between **direct additive genetic** effects for **BW** and **maternal additive genetic** effects for **WW270.**

Table 2. Estimates of genetic parameters and environmental and phenotypic correlations for BW and WW270

	BW	WW270
h^2_d	0.08 ± 0.005	0.10 ± 0.006
h^2_m	0.04 ± 0.002	0.08 ± 0.005
$r_{BWd, WW270d}$	0.18 ± 0.03	
$r_{BWd, BWm}$	-0.51 ± 0.02	
$r_{BWd, WW270m}$	-0.50 ± 0.02	
$r_{WW270d, BWm}$		0.07 ± 0.03
$r_{WW270d, WW270m}$		-0.21 ± 0.03
$r_{BWm, WW270m}$		0.28 ± 0.03
$r_{eBW,eWW270}$	0.04 ± 0.04	
$r_{pBW,pWW270}$	0.03 ± 0.03	

Genetic Trends. Trends for yearly means of calf EBV were **positive** for **BW** and **WW270 direct genetic** effects (Table 3; Figures 1, 2). The **genetic trends** for **BW** and **WW270 maternal genetic** effects were **negative** (Table 3; Figures 1, 2). **All genetic trends were not significant.** Thus, no selection for BW and WW270 appeared to have occurred during these years. **To improve genetic progress in this population, a genetic evaluation and selection system based on animal EBV would need to be implemented to choose sire and dam replacements.**

Table 3. Direct and maternal genetic trends for BW and WW270

	TRAIT	
	BW, kg/yr	**WW270, kg/yr**
Direct	**0.004 ± 0.005**	**0.035 ± 0.107**
	P = 0. 41	**P = 0. 75**
Maternal	**-0.002 ± 0.001**	**-0.044 ± 0.064**
	P = 0. 27	**P = 0. 51**

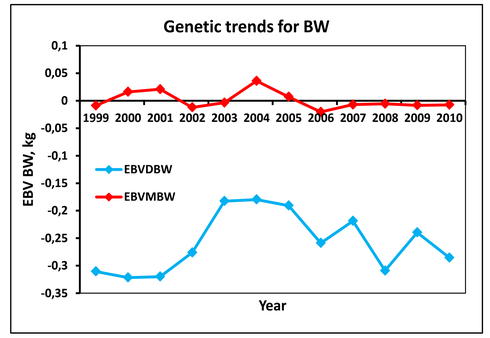

Figure 1. Genetic trends for direct and maternal EBV for BW

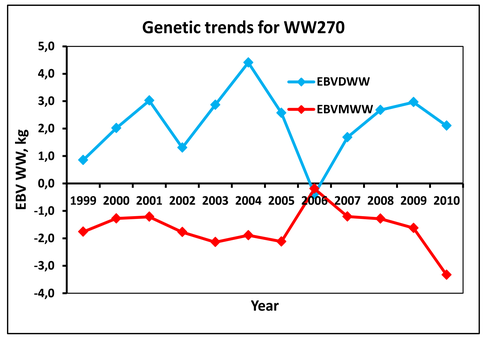

Figure 2. Genetic trends for direct and maternal EBV for WW270

LITERATURE CITED

Elzo, M. A., and D. L. Wakeman. 1998. Covariance components and prediction for additive and nonadditive preweaning growth genetic effects in an Angus-Brahman multibreed herd. J. Anim. Sci. 76:1290-1302.

Elzo, M. A., and T. R. Famula. 1985. Multibreed sire evaluation procedures within a country. J. Anim. Sci. 60:942-952.

Elzo, M. A., G. C. Lamb, D. D. Johnson, M. G. Thomas, I. Misztal, D. O. Rae, C. A. Martinez, J. G. Wasdin, and J. D. Driver. 2012. Genomic-polygenic evaluation of Angus-Brahman multibreed cattle for feed efficiency and postweaning growth using the Illumina 3K chip. J. Anim. Sci. 90:2488-2497.

Misztal, I. 1997. BLUPF90 – A flexible mixed model program in Fortran 90. University of Georgia, 24p.

Tsuruta, S. 1999. AIREMLF90 - A modification of REMLF90 with computing by the Average-Information Algorithm. University of Georgia.
http://nce.ads.uga.edu/html/projects/Readme.aireml.

Vergara, O .D, M. A. Elzo, and M. F Cerón. 2010. Models for multibreed genetic evaluation weaning weight in cattle. Rev. MVZ Córdoba. 15: 1985-1996.