Abstract W28

Genetic parameters and genetic trends for growth and reproductive traits in a Colombian multibreed beef cattle population

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SUMMARY

Genetic parameters and trends for weaning weight adjusted to 240 d of age (WW240; n = 9,668), weight gain from weaning to 24 mo of age (GW730; n = 1,357), age at first calving (AFC; n = 1,615), and interval between first and second calving (CI1; n = 1,189) were estimated in a Colombian beef cattle population composed of Blanco Orejinegro, Romosinuano, Angus, and Zebu straightbred and crossbred animals. Data were analyzed using multiple trait mixed model procedures. Variance components and genetic parameters were estimated by Restricted Maximum Likelihood. The 4-trait model included the fixed effects of contemporary group (herd-year-season-sex; sex = sex of progeny for **CI1**), age of dam (**WW240** only), breed direct genetic effects, breed maternal genetic effects (**WW240** only), individual heterosis, and maternal heterosis (**WW240** only). Random effects for **WW240** were calf direct genetic, dam maternal genetic, permanent environmental maternal, and residual. Random effects for **GW730** were calf direct genetic and residual; and random effects for **AFC** and **CI1** were cow direct genetic and residual. Program AIREML was used to perform computations. Heritabilities estimates for additive direct genetic effects were 0.19 ± 0.003 for **WW240**, 0.53 ± 0.004 for **GW730**, 0.11 ± 0.007 for **AFC**, and 0.05 ± 0.001 for **CI1**. Maternal heritability was 0.11 ± 0.002 for **WW240**. The high direct heritability for **GW730** suggests that selection for this trait is feasible in this population. The genetic correlation between direct and maternal additive effects for **WW240** was negative (-0.18 ± 0.009). Correlations between additive direct genetic effects for all traits were close to zero. Calf and cow weighted yearly means showed negative trends for direct growth traits (-0.53 ± 0.19, P < 0. 05 for **WW240**; -2.64 ± 0.55, P < 0. 001 for **GW730**), and **AFC** (-0.04 ± 0.02, P < 0. 05). Cow direct genetic **CI1** yearly means showed positive trends (3.01 ± 0.42, P < 0.001). This suggests that some selection for **AFC** existed in this population during these years and other traits were neglected.

INTRODUCTION

Growth and reproductive characteristics have a substantial impact on operating costs in systems of beef production and largely determine their profitability. Animals with slow growth and reproductively inefficient make livestock farming uneconomic. Estimates of genetic variation and evaluation of animals for economically important traits may help improve the productive performance of herds and increase income for producers.

On the other hand, the choice of breed or cross to use is an important decision when constructing a livestock production system, both at farm and regional levels. Differences between breeds for production, reproduction, survival, productive life, and adaptation traits are a natural resource that must be used properly to enhance the economic efficiency of the production system (Madalena, 1993). The beef cattle population in Colombia is primarily multibreed and composed of imported *Bos taurus* and *Bos indicus* as well as Criollo *Bos taurus* breeds of Iberic ancestry. Thus, evaluation of various types of straightbred and crossbred animals is necessary to identify suitable breeds and breed combinations for Colombian production systems (Elzo and Famula, 1985). Thus, **the objectives of this research were to estimate genetic parameters and genetic trends for weaning weight, postweaning gain from weaning to 24 mo age, age at first calving, and calving interval between the first and second calving in a multibreed population composed of Blanco Orejinegro, Romosinuano, Angus, and Zebu cattle in Colombia**.

MATERIALS AND METHODS

Animals and Data. Data were collected by a private cattle company (Custodiar S.A., Medellin, Colombia) from 1995 to 2006. Data consisted of 9,668 weaning weights (**WW240**), 1357 2-yr old weights (**GW730**), 1,615 ages at first calving (**AFC**), and 1,189 intervals between first and second calving (**CI1**). Weaning weights were adjusted to 240-d of age (**WW240**), and 2-yr old weights were adjusted to 730 d of age. Postweaning gain between weaning and 730 d age (**GW730**) was computed as the difference between adjusted weight to 730 d and **WW240**. Four breeds were represented in the dataset for growth traits: Blanco Orejinegro, Romosinuano, Angus, and Zebu; and three breeds for reproductive traits: Blanco Orejinegro, Angus, and Zebu

Management and Feeding. Calves were born and raised until weaning in a single farm (La Leyenda, Antioquia, Colombia) owned by the Custodiar company. Approximately 12% of the yearly calf crop was kept postweaning and distributed among 14 farms in the departments of Antioquia and Cordoba. The remaining calves were sold to market.

Cows and preweaning calves at La Leyenda were maintained in a rotational grazing system. During the dry season, cattle were fed corn silage, and either sorghum (*Sorghum vulgare*) or guinea grass (*Pennisetum violaceum*). Postweaning management and nutrition were also based on rotational grazing on pastures throughout the year with supplementation of corn silage, and either sorghum or guinea grass during the dry season.

Heifers and cows had their first mating by artificial insemination, and then placed in a paddock with a bull for 50 to 70 d. Mating occurred throughout the year. Pregnancy status was determined by rectal palpation. Estimated days of pregnancy at palpation is used to help determine whether a pregnancy was product of artificial insemination or natural mating.

Genetic Predictions and Genetic Parameters. **A 4-trait mixed model** involving **WW240, GW730, AFC,** and **CI1** was used. Fixed effects were **contemporary group** (herd-year-season-sex; sex = sex of progeny for **CI1**), **age of dam** (**WW240** only), **breed direct genetic** effects, **breed maternal genetic** effects (**WW240** only), **individual heterosis**, and **maternal heterosis** (**WW240** only). Random effects for **WW240** were **calf direct genetic, dam maternal genetic, permanent environmental maternal**, and **residual**. Random effects for **GW730** were **calf direct genetic** and **residual**. Random effects for **AFC** and **CI1** were **cow direct genetic** 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 **calf or cow random** effects (Elzo and Wakeman, 1998). Weighted yearly means of EBV for calf, sire, and dam **WW240** and **GW730** direct genetic effects, and for cow **AFC** and **CI1** direct genetic effects were computed to study genetic trends between 1995 and 2006.

RESULTS AND DISCUSSION

Description of data. Means and standard deviations in this multibreed population were **169.5** and **25.3** kg for **WW240**, **152.5** and **61.7** kg for **GW730**, **37.4** and **5.7** mo for **AFC**, and **585.9** and **93.4** d for **CI1**.

Breed effects. **Zebu** had the **best performance** of **all breeds** in this population for direct and maternal breed effects for **WW240** and direct breeds effects for **GW730** under the tropical environmental conditions in Antioquia (Table 1). This indicated that purebred **Zebu** and **crossbred calves** with a **high Zebu fraction** had **higher** ability for **growth preweaning and postweaning** than that of crossbred calves with **higher fractions** of the other **3 breeds**.

Angus and Blanco Orejinegro had smaller **AFC** and longer **CI1** breed direct effects than Zebu under the tropical environmental conditions in Antioquia (Table 1). These breed effects suggested that purebred **Zebu** and **crossbred females** with **high Zebu fractions took longer to calve for the first time and tended to have shorter calving intervals** than crossbred cows with higher fractions of Angus and Blanco Orejinegro.

Table 1. Estimates of direct and maternal breed effects

	TRAIT			
Direct	**WW240, kg**	**GW730, kg**	**AFC, mo**	**CI1, d**
Angus	-15.80 ± 1.99 P < 0.001	-46.79 ± 8.46 P < 0.001	-3.06 ± 1.3 P < 0.001	24.10 ± 46.3 P = 0.102
Blanco Orejinegro	-15.56 ± 2.42 P < 0.001	-70.50 ± 9.41 P < 0.001	-3.40 ± 1.09 P < 0.001	148.73 ± 52.1 P = 0.158
Romosinuano	-15.27 ± 2.50 P < 0.001	-58.37 ± 10.17 P < 0.001		
Maternal	**WW240, kg**			
Angus	-5.91 ± 3.48 P = 0.3071			
Blanco Orejinegro	-6.09 ± 2.97 P = 0.0778			
Romosinuano	-15.29 ± 3.11 P < 0.001			

Heterosis Effects. Estimates of **direct heterosis effects** were **17.21 ± 1.14** kg (P < 0.0001) for **WW240**, **30.9 ± 5.73** kg (P < 0.001) for **GW730**, **-4.49 ± 0.6** m (P = 0.18) for **AFC**, and **-35.30 ± 17** d (P < 0.06) for **CI1**. **Maternal heterosis effects** was **4.73 ± 1.62** kg (P = 0.13) for **WW240**. The estimate of **direct heterosis** for **WW240** was over three times the value of **maternal heterosis**. This may be an indication that direct preweaning growth maternal milk was substantially more influenced by non-additive interbreed genetic effects than maternal milk. The high and significant value of **direct heterosis** for **WW240** and **GW730** suggests that it **would be economically advantageous to consider expected heterozygosis of the progeny when planning matings in this population**. **Heterosis values** close to the value of significance for **AFC** and **CI1, indicate that these traits could be decreased through crossing**

Genetic Parameters. Table 2 shows estimates genetic parameters for **WW240**, **GW730**, **AFC**, and **CI1**. Estimates of heritability for **direct WW240 (DWW240) and maternal WW240 (MWW240)** and for **direct GW730** suggest that selection for these traits is feasible in this population.

The genetic correlation between **direct additive** and **maternal additive genetic** effects for **WW240** indicating an **antagonistic relationship** between these effects. Correlations between **additive direct genetic** effects for all traits were **close to zero**. The genetic correlation between **direct additive** effects for **WW240** and other traits, suggests that selection of animals for direct **WW240** would have essentially no impact on these in this population.

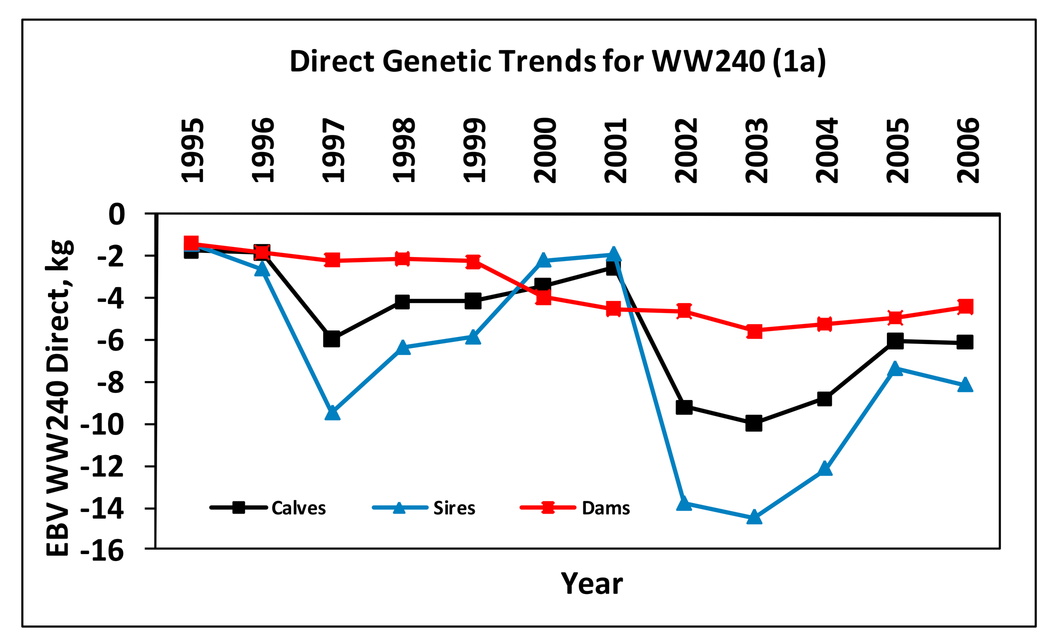
Table 2. Heritabilities (diagonal), genetic correlations (above diagonal), and phenotypic correlations (below diagonal)

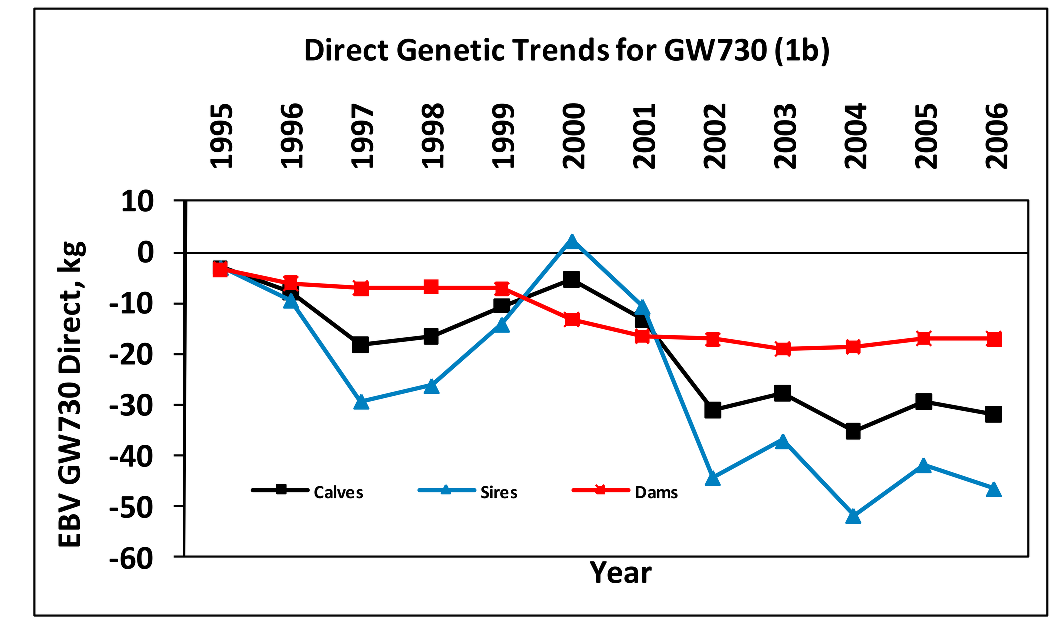
	TRAIT				
	DWW240	**MWW240**	**GW730**	**AFC**	**CI1**
DWW240	0.19 ± 0.003	-0.175 ± 0.009	-0.084 ± 0.009	-0.001 ± 0.012	-0.015 ± 0.009
MWW240		0.11 ± 0.002	-0.024 ± 0.008	0.032 ± 0.016	-0.010 ± 0.008
GW730	-0.154 ± 0.007		0.53 ± 0.004	-0.036 ± 0.009	-0.001 ± 0.008
AFC	-0.109 ± 0.07		-0.013 ± 0.003	0.11 ± 0.007	0.009 ± 0.009
CI1	0.023 ± 0.001		-0.006 ± 0.001	0.259 ± 0.01	0.05 ± 0.001

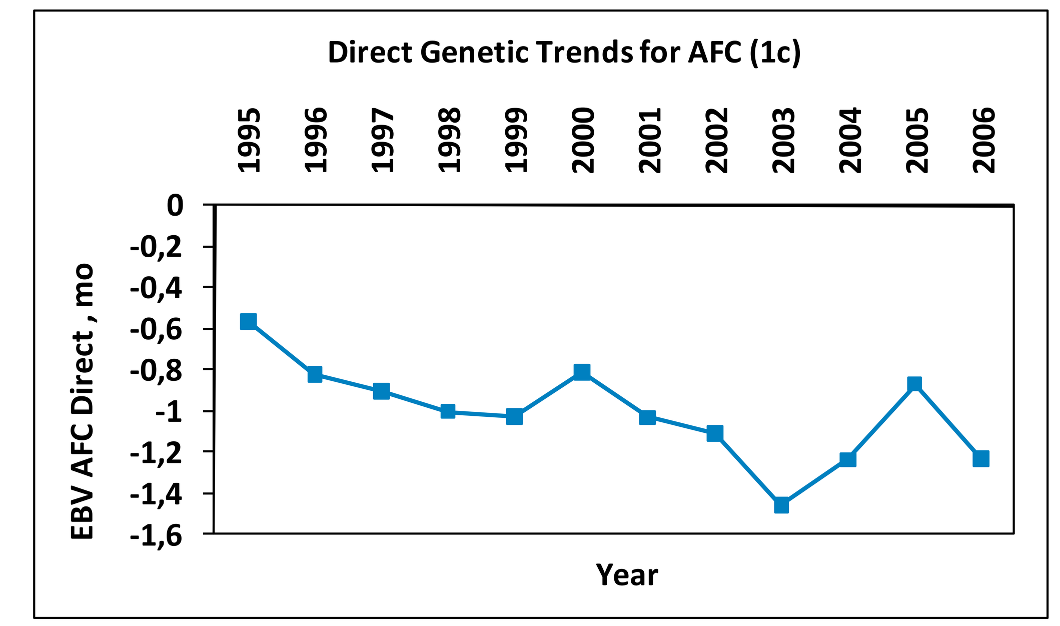
Genetic Trends. **Trends for weighted yearly means were negative** for **WW240** and **GW730 direct genetic effects** in calves, sires and dams (Figures 1a, 1b); also for **AFC** (Figure 1c). The **genetic trend** for **CI1 was positive** (Figure 1d; Table 3). This suggested that some selection for **AFC** existed in this population during these years and other traits were neglected.

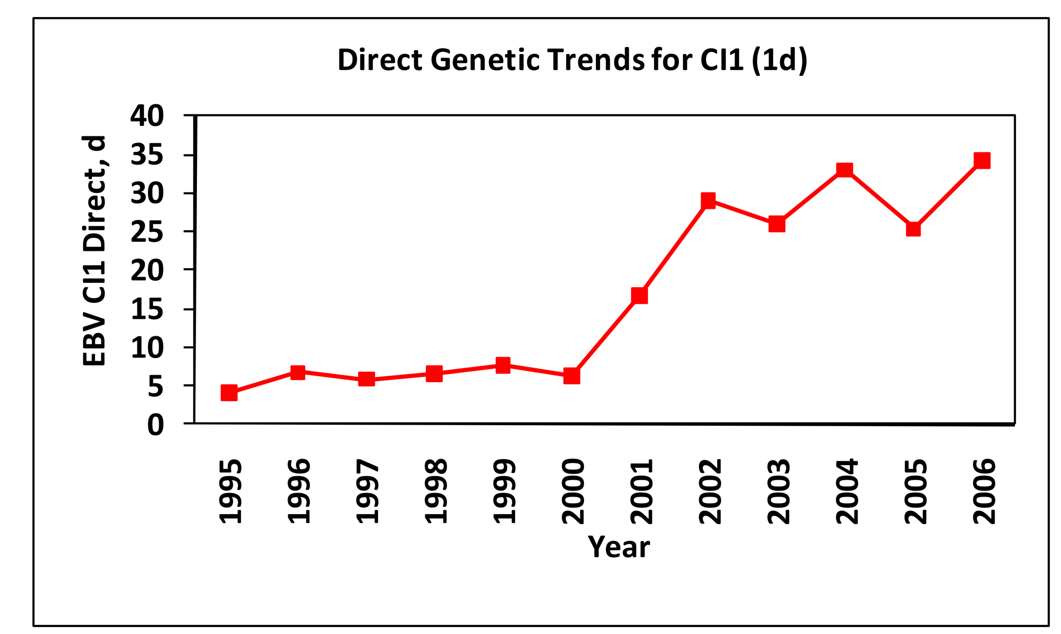
Table 3. Direct genetic trends for calves, sires and dams for WW240 and GW730, and for cows for AFC and CI1

	TRAIT			
	DWW240	**GW730**	**AFC**	**CI1**
Calves	-0.53 ± 0.19 P < 0. 05	-2.64 ± 0.55 P < 0. 001		
Sires	-0.70 ± 0.34 P = 0. 07	-3.78 ± 1.10 P < 0. 01		
Dams	-0.38 ± 0.06 P < 0. 001	-1.48 ± 0.21 P < 0. 001		
Cows			-0.04 ± 0.02 P < 0. 05	3.01 ± 0.42 P < 0.001









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