Abstract M44

Genetic parameters and genetic trends for pre and postweaning growth in a Colombian Blanco Orejinegro-Romosinuano-Angus-Zebu cattle population

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SUMMARY

Genetic parameters and trends for weaning weight adjusted to 240 d of age (WW240), and weight gain from weaning to 24 mo of age (GW730) 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 2-trait model included the fixed effects of contemporary group (herd-year-season-sex), 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. Program AIREML was used to perform computations. Heritabilities estimates for additive direct genetic effects were 0.20 ± 0.003 for WW240 and 0.32 ± 0.004 for GW730. Maternal heritability was 0.14 ± 0.002 for WW240. Low direct and maternal preweaning heritabilities suggest that nutrition should be improved to allow fuller expressions of calf direct growth and cow maternal ability. The genetic correlation between direct and maternal additive effects for WW240 was negative (-0.42 ± 0.009). The near zero (-0.04 ± 0.009) correlation between additive direct genetic effects for WW240 and GW730 suggested that genes affecting preweaning and postweaning growth may differ in this population. Calf, sire, and dam weighted yearly means showed negative trends for direct WW240 and GW730. Maternal WW240 showed near zero trends during these years. Trends for calf direct WW240 and GW730 followed sire trends closely, suggesting that more emphasis was placed on choosing sires than on dam replacements.

INTRODUCTION

Colombia has a great diversity of climates and ecological regions (IDEAM, 2008) that challenges the ability of one breed to be well adapted and productive in all environments. This has led producers to experiment with a variety of beef breeds (including Criollo breeds and importation of semen and animals of various beef breeds) in search of genotypes that are suitable to specific sets of environmental conditions.
Economically relevant growth traits in the Colombian beef commercialization system are weaning weight and weight at 24 mo age. Thus, commercial producers in Colombia would greatly benefit from timely genetic evaluations that include weaning weight and postweaning gains based on farm-collected information. Considering the multibreed nature of the beef cattle population in Colombia, genetic evaluations would need to include additive genetic and nonadditive genetic effects to permit the comparison of animals of diverse genetic composition (Elzo and Famula, 1985). Thus, the objectives of this research were to estimate genetic parameters and genetic trends for weaning weight and postweaning gain from weaning to 24 mo age in a multibreed population composed of Blanco Orejinegro, Romosinuano, Angus, and Zebu cattle in Colombia.

MATERIALS AND METHODS

Animals and data. This study used growth data collected in 14 farms located in the northern coastal and Antioquia regions of Colombia by a private cattle company (Custodiar S.A., Medellin, Colombia) from 1995 to 2007. The dataset consisted of 9668 weaning weights and 1357 2-yr old weights. 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: Blanco Orejinegro, Romosinuano, Angus and Zebu.

Management and feeding. Calves were born and raised until weaning in a single farm (La Leyenda) 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 or guinea grass. 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

Genetic predictions and genetic parameters. A 2-trait analysis involving WW240-GW730 was used, which included the fixed effects of contemporary group (herd-year-season-sex), age of dam (WW240 only), breed direct genetic effects, breed maternal genetic effects (WW240 only), direct heterosis, and maternal heterosis (WW240 only). Random effects for WW240 were direct genetic, maternal genetic, permanent environmental maternal, and residual. Random effects for GW730 were 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 random effects (Elzo and Wakeman, 1998). Weighted yearly means of EBV for calf, sire, and dam WW240 and GW730 direct genetic effects and for dam WW240 maternal 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 177.6 kg and 29.0 kg for WW240, and 152.4 kg and 61.7 kg for GW730.
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 (Table 1). This indicates 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.

Table 1. Estimates of direct and maternal breed effects

	TRAIT	
Direct	**WW240 (kg)**	**GW730 (kg)**
Angus	-0.24 ± 4.61; P = 0.69	19.61 ± 13.08; P = 0.0001
Blanco Orejinegro	-0.39 ± 4.74; P = 0.21	-7.07 ± 12.56; P = 0.19
Zebu	14.71 ± 4.52; P = 0.0001	63.54 ± 14.07; P = 0.0001
Maternal		
Angus	9.56 ± 4.32; P = 0.0001	
Blanco Orejinegro	9.35 ± 4.33; P = 0.003)	
Zebu	15.74 ± 3.97;P = 0.0001	

Heterosis effects. Estimates of heterosis were 17.28 ± 1.28 kg (P < 0.0001) and 4.49 ± 1.77 kg (P < 0.30) for direct and maternal heterosis effects for WW240, and 31.00 ± 7.16 kg (P < 0.003) for GW730 direct heterosis effects. Direct heterosis was higher that maternal heterosis for WW240. 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 GW730 suggests that it would be economically advantageous to consider expected heterozygosis of the progeny when planning matings in this population.

Genetic parameters. Table 2 shows estimates genetic parameters for WW240 and GW730. Estimates of heritability for direct and maternal WW240 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. The correlation between maternal additive genetic effects for WW240 and direct additive genetic effects for GW730, could indicate that calves whose dams provided greater care and quantities of milk in the preweaning period tended to have lower postweaning gains. The genetic correlation between direct additive effects for WW240 and GW730, suggests that selection of animals for direct WW240 would have essentially no impact on GW730 in this population.

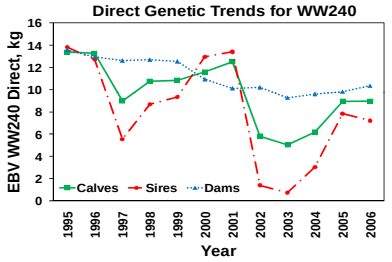
Table 2. Estimates of genetic parameters and environmental and phenotypic correlations for WW240 and GW730

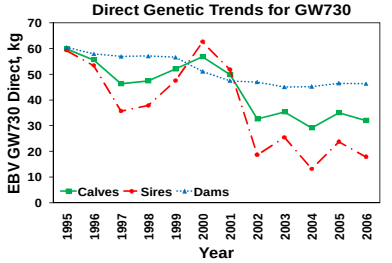
	TRAIT	
	WW240	**GW730**
h^2_a	0.20 ± 0.003	0.32 ± 0.004
h^2_m	0.14 ± 0.002	
r_{am}	-0.42 ± 0.009	
$r_{mWW240,\ aGW}$		-0.10 ± 0.009
$r_{aWWT,\ aGW}$		-0.04 ± 0.009
r_e	-0.19 ± 0.01	
r_p	-0.16 ± 0.007	

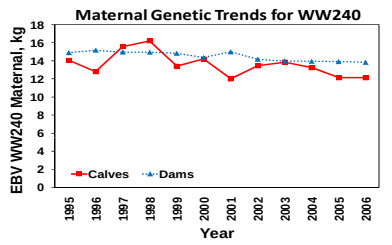
Weighted genetic means per year. Trends were negative for WW240 and GW730 direct genetic effects in calves, sires and dams (Top and Middle Figures; Table 3). Further, the pattern of yearly means for calves and sires showed a closer association (r = 0.98 (P < 0.001) for WW240 direct and for GW730). This suggests that a genetic evaluation and selection system needs to be implemented in this population.
The trend for dam WW240 maternal was essentially zero (Bottom Figure; Table 3). This trend suggests that replacement heifers in this population were chosen based more on the maternal performance of their dams than on their sire information or their own growth performance.

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

	TRAIT	
	WW240 (kg/yr)	**GW730 (kg/yr)**
Calves	-0.52 ± 0.19 (P<0.05)	-2.58 ± 0.51 (P<0.01)
Sires	-0.69 ± 0.35 (P>0.05)	-3.64 ± 1.00 (P<0.01)
Dams	-0.38 ± 0.06 (P<0.01)	-1.51 ± 0.19 (P<0.01)







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