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Growth of Bovine Females and Meat Production Systems of the Subregion Mojana Sucre Colombia

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Abstract

Objectives: To evaluate some growth characteristics Birth Weight (BW), Adjust Weaning Weight (AWW) and Daily Weight Gains (DWG) between birth and weaning of bovine females managed under grazing conditions in the Mojana subregion of the department of Sucre Colombia. **Methods / Statistical Analysis**: Made an analysis of the information of the productive records of the offspring born from the year 2017 – 2018 in 3 livestock farms. The genetic analysis belonged to the race Zebu, F1 Romo x Zebu and F1 Simmental x Zebu was done. The statistical model used included the effects of year of birth, weaning, farm, racial group, paternal and maternal race. For the analysis, the minimum squares method was used by the PROC GLM procedure, contained in the Statistical Analysis System (SAS). Tukey's multiple comparison test was performed to determine differences between means, when these differed statistically in the analysis of variance. **Findings**: The mean for BW, AWW and DWG were 27.5 ± 3.1; 155.5 ± 3.2 kg and 485, ±06 gr/day respectively. The effects of racial group, paternal type and farm were significant ($p \leq 0.05$; $p \leq 0.01$). On the contrary, the year of birth, as well as the year of adjusted weaning, did not significantly affect ($p > 0.05$) the characteristics analyzed. **Application:** There are differences between the genetic groups for the analyzed characteristic, which can be used in animal genetic improvement programs in the farms analyzed, in order to achieve increases in the productive variable of growth.

Keywords: Birth Weight, Crossing, Genetic Groups, Pre-Weaning Daily Gain, Weaning Weight

1. Introduction

The livestock production systems, social sustainability and the most appropriate culture to maintain the well-being of the communities, because it is the only activity that can maintain insurance in the daily subsystem, conserve ecosystems, promote the conservation of wildlife and satisfy cultural values and traditions[1]. In this context, the region of La Mojana, in the north of Colombia, presents livestock production systems, in aerobic soils, planted with non-native pastures as Admirable (*Brachiaria mutica*), Angletón (*Dichanthium aristatum*), Aleman (*Echynochloa poIystachya*) and Braquipará (*Brachiaria plantaginea*) and natives such as canutillo (*Hymenachne amplexicerulis*) and Gramalote (*Paspalum faciculatum*), grazed by bovines under the double system and managed by the land producers in the savanna and that lead the cattle to graze on the farms left by the swamps, on farms between 20 and 100 hectares. The animals are mobilized in critical periods, practicing transhumance between the hills and La Mojana[2]. Knowing how calf growth is affected and the relative importance of the factors that influence it: genetic and non-genetic, is basic to the design in general of practices that allow animals to express their genetic potential optimally within their own environment. For this reason, the growth capacity of calves is one of the characteristics that most affect the profitability of livestock farms. The weaning weight is a component that is subject to factors such as year and time of birth, age of the cow, number of parturition, age at weaning and race, among others[3,4]. The crossbreeding between breeds can contribute to

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improve the characteristics of economic importance, such as birth, survival and weights at different ages, crosses between taurus-indicus is the most expeditious way to maintain in the herds additive and heterozygous genetic effects, both for the production of milk, as of meat[5]. To achieve a better adapted and efficient genotype, numerous types of crosses have been practiced involving different racial groups[6]. The choice of the appropriate crossing strategy requires the evaluation of available genotypes, both from a zootechnical and economic point of view, which makes it possible to predict the outcome of the different production systems based on the evaluation of some crosses, using genetic models that allow explaining the performance based on crossing parameters. The objective of the present work was to evaluate some growth characteristics BW, AWW and DWG of bovine females managed under grazing conditions in the Mojana subregion in the department of Sucre Colombia.

2. Materials and Methods

The work was developed in 3 cattle ranches in the municipality of Sucre-Sucre subregion of the Mojana geographically located in northern Colombia belonging to the physiographic zone of the momposina Depression[7]. The genetics analyzed were the Zebu, F1 of Romo x Zebú (RxZ) and F1 Simmental x Zebu (SxZ) breeds. The feeding of the animals was based on a continuous and extensive grazing system on flat and poorly drained soils, on pastures of natural pastures that contained: Canutillo (*Antephora hermafrodita*), Lambe lambe (*Leerxia hexandra*), Gramalote (*Paspalum fasciculatum*), Angleton (*Dichanthium aristatum*), Alemán (*Echynochloa poIystachya*) and Braquipará (*Brachíaria plantaginea*). The reproductive management of the herds consisted of continuous breeding, with the use of insemination.

An analysis of the information of the productive records of the offspring born from the year 2017 – 2018 was made. The BW, AWW and DWG were established as dependent variables. As independent variables were considered: the Racial Group, paternal and maternal factors, Farm, Year of Birth (YB) and Year of Weaning (WY).

Were excluded from the statistical analysis animals that did not present complete information such as: race of paternal or maternal, birth weight, date of birth, or weaning. The Weaning Weight (WW) was adjusted to 270 days of age according to the following formula[8]:

$$AWW = [(WW - BW) / (WA)] \times 270 + BW$$

Where:

AWW = Weight adjusted at 9 months of age;
WW = Actual Weight Weaning;
WA = Weaning Age;
BW = Birth Weight

For the analysis of the data of the evaluated characteristic, the minimum method, through the PROC GLM contained in the Statistical Analysis System (SAS®)[9].

The mathematical model for BW, AWW and DWG was as follows:

$$yikjnlmn = \mu + A_i + B_k + D_{n(i)} + E_l + \varepsilon_{iknl}$$

yijklmn = dependent variable studies (BW, AWW and DWG)
μ = is the overall mean effect.
A_i = fixed effect of the *i*th farm (i = 1,2,3);
$B_{k(i)}$ = effect of the nth parent (i = 1.2...12);
D_n = effect n^{th} year of birth (2017–2018);
E_l = effect l^{th} year of weaning (2017–2018);
ε_{iknl} = effect of the random error.

Tukey's multiple comparison test was performed to determine differences between means, when these differed statistically in the analysis of variance.

3. Results and Discussion

In Table 1, the sources of variation that significantly impacted the BW, AWW and DWG can be evidenced. The racial group, paternal type and farm were the main factors that influence the variables studied. On the contrary, the year of birth, as well as the year of adjusted weaning, did not significantly affect (p>0.05) the characteristics analyzed. Values found in this study for the BW and AWW and DWG growth characteristics between births and weaning of females in beef cattle production systems in the sub-region Mojana Sucre - Colombia, are presented in Table 2, being less than reported in other investigations[10-12]. The greatest variation was presented in the variable DWG (22.40%), on the contrary, the BW and the AWW behaved within the normal ranges for these characteristics[8].

Table 1. Analysis of variance (ANOVA) of growth characteristics of females to BW, AWW and DWG between birth and weaning in bovine cattle meat production systems in the Mojana Sucre sub region Colombia

FV	gl	BW	AWW	DWG
Group Racial	2	0.0158**	0.0235*	0.0325*
Father	12	0.0842NS	0.003**	0.0422*
Mother	72	0.3542NS	0.089NS	0.345NS
Farm	2	0.0391*	0.0483*	0.0258*
YB	1	0.089 NS	0.6891 NS	0.887 NS
WY	1	0.567 NS	0.7414 NS	0.669 NS

** p<0.01; * p<0.05; NS = Not significant; YB = Year of birth; WY = weaning year.

Table 2. Minimum (Min) and maximum (Max) standard deviation (SD) and variation coefficients (CV) of the growth characteristics of females to BW, AWW and DWG, in beef cattle production systems in the Mojana Sucre subregion – Colombia

Characteristics	n	Mean	SD	Min	Max	CV(%)
BW (kg)	260	27.2	3.1	20.8	35.4	8.9
AWW(kg)	230	155	3.25	122.8	205.6	16.8
DWG (gr/day)	230	485	0.69	298	720	22.4

When making the contrasts of each of the variables (BW, AWW and DWG) by genetic groups and farm, statistically significant differences were found (p<0.05), between the Zebu and F1 SxZ groups, when compared with the Crossing F1 RxZ (Table 3). According to Bolívar et al (2009)[13], when the bull breed is Zebu (*Bos indicus)*, it goes to greater weights and daily gains, probably, due to the adaptability that this race presents to the conditions of humidity and temperature, it occurs in the region where the study was carried out, on the contrary, if the breed is used, it is Romosinuano, the weights have been reduced at birth reflecting a hybrid vigor in a negative way, resulting in calves with low birth weights[8].

Table 3. Mean BW, AWW and DWG characteristics between birth and weaning according to Farm and racial group, in beef cattle production systems in the Mojana Sucre subregion -Colombia

Variable Farm				
Nº		BW(kg)	AWW(kg)	DWG(gr/ day)
176	La Delicia	30.5[a]	128.2[a]	385.2[a]
170	El Deseo	31.4[b]	127.8[a]	361.5[b]
156	Porvenir	29.2[a]	132.3[b]	388.3[a]
Variable Racial Group				
119	Cebú	32.03[a]	138.9[a]	400.2[a]
205	R × C	28.05[a]	129.2[b]	379.3[b]
178	S × C	31.25[b]	144.2[a]	410.2[a]

a, b: Averages with different letters within each column differ (p <0.05).

However, many investigations on Romosinuano cattle give other qualities, presenting them as animals completely adapted to the environmental conditions in Tropical Dry Forest, originating precocious animals (Puberties between 9–12)[10], with excellent fertility, survival, longevity indexes, rusticity[10,14]. The higher weights and gains in favor of SxZ, can be explained by the maximum heterosis obtained in the first generation of the crossing (F1), since in this case, all individuals receive a gene from each parent race for each locus. The daily weight gain of this crossover (0.410 kg/day), demonstrates a good maternal skill of the mother cows of these offspring, standing out, their productive potential in the exposed environmental management conditions.

The values of daily weight gain (GPD) of this work were lower than the values reported by[15] who evaluated different genetic crosses of breeds, commercial zebuíno and mestizas (Simmental, Angus and Holstein in proportions 1/2 – 1/16).

The mother effect was statistically not significant (Table 1), however, females with greater potential for milk production have higher requirements for consumption of metabolizable energy per day, finding an interaction between the breed and nutritional level, so that females coming from breeds or genetic crosses with high or medium milk production in environments where feeding supposes some limitation, produce offspring at weaning with little yield[16].

In this investigation it was obtained that animals with Simmental parents have higher BW, AWW and DWG, with respect to calves born from crosses where the parent is Romosinuano or Zebu (Table 4), observing statistically significant differences between the F1 crosses of SxZ and Zebu compared F1 RxZ. This may be attributable to the genetic effect of the crossing of the paternal race, which gives the F1 SxZ crossing greater productive advantage with respect to the other two races. Similar results are reported in the literature with different racial types of parents[8]. The differences between the different genetic groups must be taken into account in animal breeding programs, since these can have a direct effect on the BW, AWW and DWG, reflecting on the productivity of the herd.

Table 4. Mean BW and DWG characteristics between birth and weaning according to the breed of the paternal source, in bovine cattle meat production systems in the Mojana Sucre subregion –Colombia.

Paternal race	n	BW(kg)	DWG(gr/day)	Paternal source	n	BW(kg)	DWG(gr/day)
235-C	40	132[a]	389[a]	112 -C	40	134[a]	390[a]
455-C	47	130[a]	410[a]	222-C	40	128[a]	405[a]
689-S	40	135[a]	413[a]	777-S	42	137[b]	415[a]
878-S	53	140[a]	419[a]	888-S	30	135[b]	412[a]
442-R	57	125[b]	375[b]	401-R	38	130[a]	384[b]
526-R	40	127[b]	380[b]	402-R	32	129[a]	378[b]

a, b: Averages with different letters within each column differ ($p<0.05$).

4. Conclusion

The year of birth, weaning, the racial group and the paternal factor significantly influenced the variables such a birth weight, adjusted weaning and preweaning daily gain. There are differences between the genetic groups for the analyzed characteristic, which can be used in animal genetic improvement programs in the farms analyzed, in order to achieve increases in the productive variable of growth.

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