European Journal of Applied Sciences – Vol. 9, No. 3
Publication Date: June 25, 2021
DOI:10.14738/aivp.93.10190.
Ikeda, A., Villca, Y. Z. F., Ivana, B., & Marini, P. R. (2021). Factors Affecting Weight Gain in Nelore Calves from Weaning to Marketing in the Bolivian Tropic. European Journal of Applied Sciences, 9(3). 58-65.

Factors Affecting Weight Gain in Nelore Calves from Weaning to Marketing in the Bolivian Tropic

Atsuko Ikeda
Méd. Vet. Msc. Zootecnista, PhD student – FCVUNR-Argentina

Yoselin Zelma Figueredo Villca
Méd. Vet. Msc. Zootecnista
Master student – Universidad Autónoma Gabriel Rene Moreno – Bolivia

Ivana, Barbona
Centro Latinoamericano de Estudios de Problemáticas Lecheras (CLEPL)
Facultad de Ciencias Agrarias, Universidad Nacional de Rosario – Argentina

Pablo Roberto Marini
Centro Latinoamericano de Estudios de Problemáticas Lecheras (CLEPL)
Facultad de Ciencias Veterinarias, Universidad Nacional de Rosario
Carrera del Investigador Científico (CIC-UNR)

ABSTRACT

The objective of the work was to evaluate the factors that affect live weight gain in the rearing stage in Nelore calves in grazing systems in the Bolivian tropics. Retrospective data corresponding to the period between 2015 and 2016 were used, corresponding to 109 weaned male calves of the Nelore breed, belonging to the Foundation Technology Center on Agriculture and Livestock in Bolivia, Santa Cruz, Bolivia. The following variables were evaluated: date of birth of the calf, live weight of the calf at birth in kg, age of the father in years, age of the mother in years, live weight of the mother in kg and live weight of the calf every 30 days until its sale slaughter in kg. The weights at birth were 38.8 ± 5 kg, at 240 days (weaning) 233.2 ± 25 kg and at 600 days (sale) 482 ± 40 kg. Live weight values at 600 days according to time of birth: late 488 ± 35 kg and early 479 ± 42 kg and according to the year of birth (2015) 481 ± 42 kg and (2016) 483 ± 37 kg. There was significant interaction between the Years-Epoch and time, indicating that the average final live weight over time differs between the different Year-Epoch groups. In addition, the variable live weight at birth was also significant (p≤0.05). For the two years (2015 and 2016) and the 4 seasons (early and late 2015; early and late 2016), the final weight increases 2.28 kg for each unit increase in live weight at birth. The live weight at birth, the years and times were shown to be the factors affecting the increase in live weight in the rearing stage in the Bolivian tropics.

Keywords: Nelore calves, birth weight, weaning weight, fattening, grazing system.

INTRODUCTION

One of the objectives of any agricultural company is the generation of efficient and productive results that lead to maximizing economic returns. In a beef cattle production system, several traits can affect economic and productive performance. The factors with the greatest impact on the rearing of beef cattle can be divided into two groups: reproductive and growth [1].

The increase in live weight during the life of an animal is a complex process that depends on the genotype, the environment and its conditions that act over time. Several methodologies can be used to evaluate, estimate or predict the factors to ensure the efficiency of the herd [2].

The Nelore breed has favorable traits, such as adaptation and production that allow maximizing production under tropical conditions, although despite this, under an extensive system it could also present reproductive deficiency and a low growth rate [3].

Koury Filho [3] reported that there are several biotypes in the Nelore breed, which is reflected in the different behaviors of the growth curves, and it is possible to identify each most productive biotype for each system. Beef cattle production in the tropics animals are raised in a variety of production systems and exposed to a wide range of nutrition levels. These different scenarios can cause a genotype-environment interaction in several productive traits [4, 5].

Birth weight plays an important role in a calf's ability to express its genetic potential, but it must be monitored to prevent dystocia. In Nelore cows, calving ease is associated with average birth weights of 30 kg, these being moderately low [6, 7].

The post-weaning period is important for the genetic evaluation of beef cattle, because it corresponds to the stages of the life cycle that best represents the rearing conditions and is little influenced by maternal effects [8].

The annual weight (550 days) is generally the last weight taken by producers in conventional systems before sending it to slaughter. However, in Bolivia, weaning is normally carried out at eight months of age, and since most calves are sold for fattening, only the herds and independent ranchers dedicated to the production of cattle for fattening, record the weights of their growth, from birth to slaughter. Despite growing concerns about the efficiency of economic performance in meat production systems, few studies have been conducted to evaluate the importance of the Nelore calf rearing stage in the Bolivian tropics.

For this reason, the objective of this work was to evaluate the factors that affect live weight gain in the rearing stage (from weaning to marketing) in Nelore calves in grazing systems in the Bolivian tropics.

MATERIALS AND METHODS

For the research work, retrospective data corresponding to the period between 2015 and 2016 were used, in the Foundation Technology Center on Agriculture and Livestock in Bolivia (Fundation CETABOL) in Japanese Community Okinawa. (17 ° 13 ′ 12 ″ south latitude, 62 ° 53 ′ 39 ″ west longitude) Santa Cruz, Bolivia.

The Japanese community is located at 286 m.a.s.l. and it has a tropical climate, with significant rainfall in most months of the year and a short dry season with little effect on the general climate. The average annual temperature is 24.3 ° C and 986 mm in Japanese Community Okinawa.

Rainfall is minimal in July, with average values of 50 mm. The wettest month in January with an average rainfall of 330mm. The highest average temperatures correspond to the month of January, with values of 26.5 ° C and the lowest to the month of July with records of 20.7 ° C.

Animals

The data corresponding to 109 weaned male Nelore calves born in two different years were used, in 2015: 52 calves and in 2016: 57 calves.

According to the date of birth they were divided into two groups: the calves that were born between the months of August and December were called: early birth (EB), while the calves born between the months of January and April were called: late birth (LB).

All calves from weaning to 240 days, the individual live weight was obtained every 30 days until reaching 600 days in which they were sold, in both years analyzed.

Food and Handling

The feeding of the herd was grazing managed under intensive conditions, on 82 hectares with cultivated pastures *Brachiaria decumbens* (8 to 12 t / ha / year of DM), *Brachiaria humidicola* (8 to 10 t / ha / year of DM*), Brachiaria dictyoneura (8 to 10 t / ha / year of DM), Cynodon dactylon (10 to 20 t / ha / year of DM) and Panicum maximum cv mombaza* (20 to 28 t / ha / year of DM), [9].

Body weight record

The calves had 13 individual weight controls. The weighing of the animals was always carried out at the same time (8:00 am) with previous closure the night before. The calves were weighed with a brand manual scale (POCKET BALANCE; Made in Germany) on the same day of birth. From two months of age, calves and dams were weighed with a brand electronic scale (ICONIX New Zealand Ltd.).

Variables used

Calf Date of Birth (DB)
Calf live weight at birth (CWB) in kg
Bull identification
Cow identification
Bull age (FA) in years
Cow age (MA) in years
Cow live weight in kg (MLV)
Calf live weight every 30 days until sale (CLW) in kg

Statistic analysis

The calves were grouped by date of birth, by years, and by two epochs (early and late). Descriptive measures of the variables under study were first calculated as an exploratory

analysis. A longitudinal linear regression model was fitted. First, an appropriate covariance structure was selected by which the correlation between the observations over time, corresponding to the same unit, was considered. Finally, the mean final live weight was modeled to study its relationship with the other explanatory variables considered in this work and time. The statistical analyzes were carried out with the R 4.0.0.

RESULTS

The mean values and standard deviations of the weights at birth were 38.8 ± 5 kg, at 240 days (weaning) 233.2 ± 25 kg and at 600 days (sale) 482 ± 40 kg.

Live weight values at 600 days according to time of birth: late 488 ± 35 kg and early 479 ± 42 kg, according to year of birth (2015) 481 ± 42 kg and (2016) 483 ± 37 kg and according to age of the bull: greater 491 ± 42 kg and less 474 ± 37 kg.

The variables Age of the bull and Age of the cow were discarded because they did not contribute significantly to the model. All double interactions were also ruled out except for the interaction between Season-Year and Days, which is the only one that was significant.

Table 1: General linear regression model for longitudinal data.

	numDF	F-value	p-value
(Intercept)	1	1 22389.644	<.0001
as.factor (epoch-Year)	3	4.092	0.0067
Days	1	6173.614	<.0001
Live Weight at Birth	1	20.343	<.0001
as.factor (epoch-Year): Days	3	8.105	<.0001

There is significant interaction between the Years-Epoch and time, this means that the behavior of the average of the final Live Weight through time differs between the different Year-Epoch groups. In addition, the Live Weight variable at birth was also significant.

Table 2: Estimated coefficients

Intercept	-31.94
Year 15 – Late	12.36
Year 16 – Early	42.00
Year 16 – Late	-31.19
Days	0.69
Birth weight	2.28
Year 15 – Late * Days	0.01
Year 16 – Early * Days	-0.05
Year 16 – Late * Days	0.07

In Table 3 it is observed that the average final live weight increases 0.69 kg for each day that passes in 2015 in the early season.

Table 3: Estimated equation for calves born in 2015 and early season	
Intercept	-31.94
Days	0.69
Birth Weight	2.28

Table 4 shows that the average final live weight increases 0.7 kg for each day that passes in 2015 in the late season.

Table 4: Estimated equation for calves born in 2015 and late season.	
Intercept	-19.58
Days	0.70
Birth Weight	2.28

Table 5 shows that the average final live weight increases 0.64 kg for each day that passes in the early 2016 season.

Tabla 5: Estimated equation for calves born in 2016 and early season.	
Intercept	10.06
Days	0.64
Birth Weight	2.28

Table 6 shows that the increase in the average final weight is 0.76 kg for each day that passes in 2016 in the late season.

Tabla 6: Estimated equation for calves born in 2016 and late season	
Intercept	-63.13
Days	0.76
Birth Weight	2.28

For the two years (2015 and 2016) and the 4 seasons (early and late 2015; early and late 2016), the final weight increases 2.28 kg for each unit increase in Live Weight at birth.

The rate at which the final liveweight increases in time is higher in the 2016 Late Season, while the slowest final liveweight increase in time occurs in the Early Season of 2015.

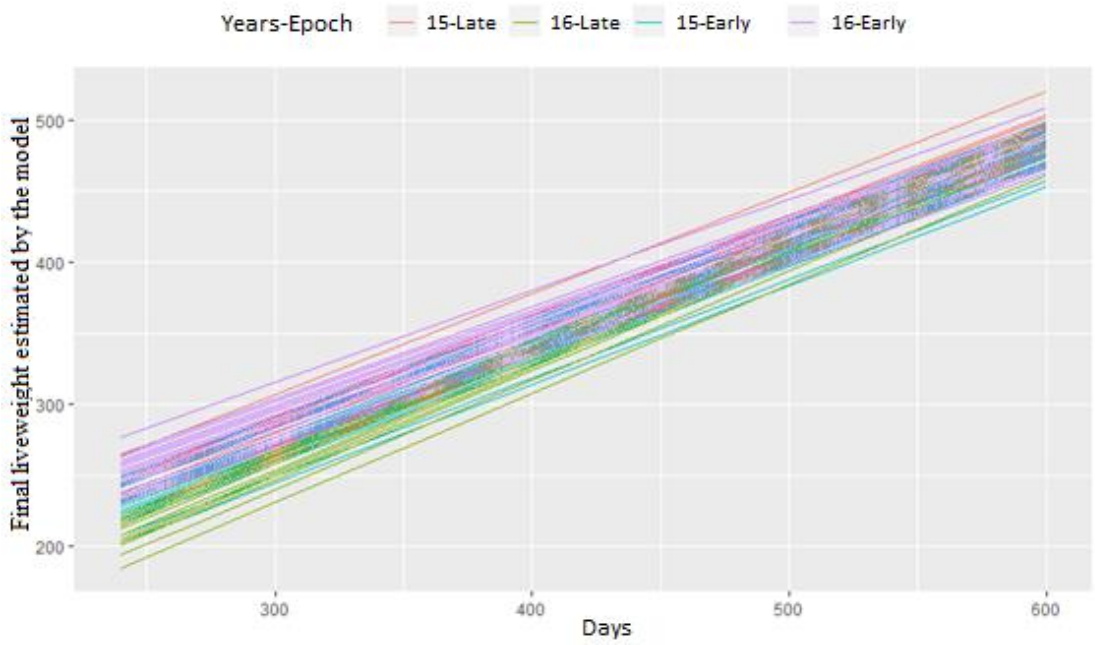

Figure 1: Individual profiles estimated by the model

DISCUSSION

Live weight is an important trait for beef cattle, several studies have evaluated birth weight and standardized weights at 120, 205, 365 and 550 days to estimate final weight [7,] (Amaral et al., 2014; Araújo et al. ., 2014; Ferreira et al., 2015; Passafaro et al., 2016). In this work, for the two years and four seasons studied, the final live weight at 600 days increased by 2.28 kg for each unit increase in live weight at birth.

The average live weight at birth in this work was higher than those reported by Leal et al., (2018), Holland et al., 2004; 13,14] that ranged between 28.9 and 36.6 kg for Nellore herds in the Midwest and Northeast Brazil. The performance of the calves found in this study were higher than those recommended by Gusmão [15], where they suggested that the ideal would be to produce a calf weighing 190 kg at 205 days of age, guaranteeing that it can reach a slaughter weight of 450 kg at 24 months of age.

In this work, the final slaughter weight was higher than that mentioned above, showing an average weight gain from weaning to slaughter of 0.700 kg / day with an average final weight of 483 kg in 360 days and less than and below of the 0.850 kg / day, observed by Fregadolli [16] working with Nellore animals carried out on pastures.

As is already known, until weaning, there is a great maternal influence on the development of the calf. On the other hand, the traits obtained later, such as post-weaning weight, allow analyzing the genetic growth potential of the animals that is not directly influenced by maternal effects (Table 1), representing a phase close to the final product [8, Oliveira et al. (2000], when studying Nelore animals, observed an inferiority in the live weights at weaning when the mothers were very young or had more than 200 months, and concluded that there is a need to adjust the weights at weaning to the conditions of birth of the women. cows using square or

cubic regressions. Other studies have also found similar results (Souza et al., 2000; Nobre et al., 1985; Euclides Filho et al., 1991).

It was already observed that the factors age of the father, age of the mother and live weight of the mother did not affect the final live weight of the Nelore calves at slaughter (Table 1). Although not coinciding with the work of Bocchi [21] verified that there was a better performance in live weight of calves of nine-year-old cows (sixth calving).

Calves born early are weaned with a higher live weight than calves born late. This may be due to the fact that calves born in the early season (August-December) when the rainy season begins in the Bolivian tropics, they take advantage of the forage supply more efficiently because they are three to four months old. While those born in the late season (January-April) when they are old enough to take advantage of the grass more efficiently enter the period of drought in the Bolivian tropics (Table 3, 4, 5 and 6). Not coinciding with a work by Ikeda [22] in which he did not find significant differences ($p \geq 0.05$) between the dry season and the wet season (rains) in the Bolivian tropics in live weights at birth, which could be due to the existence of mainly dietary restrictions, in the quantity and quality of the forage, both at one time and the other. Likewise, the interaction year x time of birth was not significant, coinciding with that reported by Martínez [23]. However, in the stage from weaning to slaughter the calves born in the late period were heavier than those born in the early period (Figure 1).

CONCLUSIONS

The live weight at birth, the years and times were shown in this work and for the animals analyzed to be the factors that affect the increase in live weight in the rearing stage (from weaning to marketing) in the Bolivian tropics.

References

Damasceno, C. and T. Calmon, *Breeding objectives for a Nellore cattle rearing system*. Pesq. Agropec. Bras.,Brasília, v.50, n.9, 2015. p.814-820. DOI: 10.1590 / S0100-204X2015000900010.

Silva, N., et al., *Hierarchical Bayesian model applied to the genetic assessment of growth curves of cut cattle*. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 2010, v. 62, n. 2:p. 409-418.

Koury Filho, W., *Escores visuais e suas relações com characteristics of growth in bovine cut,* f. Tese (Doutorado em Zootecnia) - São Paulo State University Júlio de Mesquita Filho, Jabuticabal, 2005. p.98

Cardoso, F. and R. Tempelman, *Linear reaction norm models for genetic merit prediction of Angus cattle under genotype by environment interaction. J. Anim*, 2012. Sci. 90: p2130-2141.

Mota, L., et al., *Genomic reaction norm models exploiting genotype × environment interaction on sexual precocity indicator traits in Nellore cattle*, 2020. Anim. Genet. 51, 210–223.

Menezes, L., et al., *Performance of Nelore and Blonde d'Aquitaine x Nelore bovines from birth to desmame*. Revista Brasileira de Saúde e Produção Animal, Salvador, v. 14, n. 1, 2013:p. 177-184.

Araújo, C., et al., *Estimate of genetic parameters of growth traits of Nellore cattle in the Midwest region of Brazil*. Revista Brasileira de Saúde e Produção Animal, Salvador, v. 15, n. 4, 2014:p. 846-853.

Cardoso, F., et al., *Components of (co) variance and genetic parameters of post-weaning characters in Angus cattle*. Revista Brasileira de Zootecnia, 2004. 33 (2), 313-319. Doi: 10.1590 / S1516-35982004000200006.

ESCASAN. 2020. Grass Seed Matsuda. Accessed Sept, 2020. https://www.escasan.com.ni/etiqueta-producto/matsuda

Amaral, R. S., et al., *Tendências, parâmetros fenotípicos e genétios de características de crescimento em bovinos Nelore mocho do Nordeste brasileiro*. Revista Brasileira de Saúde e Produção Animal, Salvador, 2014. v. 15, n. 2, p. 261-271.

Ferreira, F. L., et al., *Estimation of (co)variances for growth traits in Nellore cattle raised in the Humid Tropics of Brazil by random regression*. Semina: Ciências Agrárias , 2015. Londrina, v. 36, n. 3, p. 1713-1724.

Passafaro, T. L., et al., *Análise genética do peso em um rebanho de bovinos Nelore*. Pesquisa Agropecuária Brasileira, 2016. Brasília, v. 51, n. 2, p. 149-158.

Leal, W.S., et al., *Direct and maternal breed additive and heterosis effects on growth traits of beef cattle raised in Southern Brazil*. Journal of Animal Science.2018 v.96, p.2536-2544. DOI: https://doi.org/10.1093/jas/sky160.

Holanda, M. C. R.,et al*., Tendências genéticas para crescimento em bovinos Nelore em Pernambuco*, *Brasil.* Archivos de Zootecnia, Córdoba. 2004. v. 53, n. 202, p. 185-194.

Gusmão, F., et al., *Genetic, phenotypic and environmental tendencies for D160 and D240 in Nelore cattle in Bahia state*. Revista Ciência Agronômica, 2019. 40 (2): p.301-305.

Fregadolli, F., *Body composition and nutritional requirements of heifers of three genetic groups in herd*. 85f. Tese (Doutorado em Zootecnia) - Universidade Estadual Paulista, Faculdade de Ciências Agrárias e Veterinárias, Jaboticabal, 2005.

OLIVEIRA, F. F., et al. *Efeito da idade da vaca sobre o peso à desmama de bezerros Nelore*. In: Reunião anual da sociedade Brasileira de zootecnia, 37, 2000, Viçosa: SBZ, CD-ROM

Souza, J. C., et al., *Fatores do ambiente sobre o peso ao desmame de bezerros da raça Nelore em regiões tropicais Brasileiras*. Cienc. Rural, Santa Maria, 2000. v. 30, n.5, p. 881-885..

Nobre, P.R.C. , et al*., Influencia de fatores genéticos e de meio sobre os pesos de gado Nelore no estado da Bahia. Rev. Bras. Zootec.,* Viçosa, 1985. v. 14, n.3, p.338-357.

Euclides Filho, K., et al.,*. Idade da vaca e suas interrelações com a fazenda, reprodutor e sexo do bezerro.* Rev Soc Bras Zootec. 1991. v.20, p. 40-46.

Bocchi, A., et al., *Idade gives cow and more than birth weight to or weaning of calves in different Brazilian regions*. Acta Scientiarum. Animal Sciences, 2004. 26 (4): p.475-482.

Ikeda, A., et al., *Fruchtbarkeits- und Aufzuchtleistung von Nelore-Rindern verschiedenen Alters bei Weidehaltung in den Bolivianischen Tropen*. Zuchtungskunde, 2020. 92: p.125-132.

Martínez, G., et al., *Factors Affecting Weight at birth in a herd of beef cattle under well-drained savanna conditions*, Rev. Fac. Agron. (LIGHT), 1998: p. 446-454.