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Economic Values for a Production System with Nelore Beef Cattle in the Central Region of Brazil.

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ABSTRACT: The objective of this study was to calculate the economic values (EV´s) to access the economic importance of traits to be included in breeding goals of a cow-calf commercial production system with Nelore beef cattle in the Central region of Brazil. The biological and economic data were obtained from literature and allocated into Excel spreadsheets for the development of bio-economic models that reflects a representative production system in this region. In the adopted system, calves were sold at weaning (180 days of age) and cows and heifers that failed to calve were sold for beef purposes. To evaluate the impact of changes in the goal traits (weaning weight - WW, weaning rate - WR and cow mature weigh - CMW) on the overall profitability of the system, their initial values were increased by 1%. The economic values for WW, WR and CMW were US$ 0.85/kg, US$ 1.86/1% and US$ 1.00/kg respectively. The economic values of these traits justify their inclusion in breeding goals for the studied production system.
Keywords: Beef cattle, Breeding goal, Cow-calf system

Introduction

The beef cattle industry is one of the largest chains of Brazilian agribusiness. Brazil is the largest producer and exporter of beef in the world and has a commercial herd of more than 176 million head. Among the strategies to increase productivity and quality of products related to the livestock sector, the selection of genetically superior animals for traits of economic importance must be one of the priorities of the sector.

According to Ponzoni and Newman (1989), the primary step in an animal breeding program is the definition of the breeding goals. The breeding goal or aggregate genotype (H) is defined as the combination of traits of economic importance in a given production system taking into account all sources of income and expense. According to Junior et al., (2007) in Brazil, there are currently some beef breeding programs that, despite their great importance, still use empirical economic values without specific economic studies for establishing breeding goals.

Modeling is the main tool used for the derivation of economic values through the application of profit functions or bio-economic models. In Brazil, Junior et al. (2007) and Brumatti et al (2011) utilized bio-economic models methodology to estimate economic values for productive and reproductive traits of interest in beef cattle in the country. The authors emphasized that reproductive traits induced higher impacts on profits, when compared with productions.

However, in the country there are few studies demonstrating the economic values of the traits that impact economically in Brazilian production systems. This may be happening because of the diversity of production system that exist, by variations in payments that occur in each region of country and the economic difficulties and qualities of information emanating from the production systems for the calculation of estimation of economic values.

Genetic information and economic evaluation were all important to the success of animal breeding, as define the important features to be selected by the economic index that maximized the economic response of this process by promoting increased economic and production efficiency of beef cattle industry.

The aim of this study was to calculate by bio-economic models, the economic values (EV´s) of traits with possibility of being included as breeding goals for a cow-calf production system with Nelore cattle in the Central region of Brazil.

Materials and Methods

The proposed production system was a typical commercial herd of Nelore breed reared in semi extensive form in pastures of *Brachiaria brizantha* cv Marandu supplemented in the dry season with protein salt.

This system was based on selling all males and a portion of females at weaning (180 days), and sales of cows and heifers that failed to become pregnant in the breeding season for beef purposes.

Biological and economic parameters (Table 1) utilized in the models were obtained from literature, simulating a representative production herd in the studied region. In the proposed herd all cows (684) and replacement heifers (316) were exposed in the breeding season. The sources of income were male calves (437) and a portion of females (57) sold at weaning and culled cows (146) and heifers (52) sold after pregnancy

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diagnosis for beef purposes. Expenses were: pasture costs (formation and maintenance), mineral supplementation (protein salt) and veterinarians.

Table 1. Biological and economic parameters used in the bio-economic models.

Biological Parameters	
Number of breeding cows	684
Number of breeding heifers	316
Replacement rate (%)[3]	20.00
Pregnancy rate – cows (%)[1]	80.00
Pregnancy rate – heifers (%)[4]	85.00
Calving rate (%)	98
Mortality up to weaning (P180) (%)[1]	4.00
Mortality after weaning (%)[1]	1.00
Cow mortality (%)	1.00
Average weaning weight (kg)[2]	182.96
Average cow weight (kg)[2]	450.00
Weaned calves	760
Culled heifers	52
Culled cows	146
Income and Expenses	
Weaned calves P180 (US$/kg)[5]	1.69
Culled cows (US$/kg)[5]	1.19
Pasture dry matter costs (US$/kg)[5]	0.03
Veterinary costs (US$/animal)[5]	0.67
Supplementation costs (US$/kg)[5]	0.62

[1] adapted from Euclides Filho, 2008; [2] Lôbo et al., 2013; [3] Anualpec, 2013; [4] Junior et al., 2007, [5] Brazilian currence US$ 1.00: R$ 2.23.

The EVs were calculated according to the methodology proposed by Groen et al. (1997), where the marginal difference in profit from an increase of 1% of improvement in the original level of each trait, while maintaining the level of the other traits constant, taking into account the interest of maximizing profit and fixed herd size.

This methodology can be described by the following equation:

$$EV = (1/n) [(\delta \text{ (Revenues farm)}) - (\delta \text{ (Cost farm)})],$$

where, EV is the economic value, n = number of animals and δ (Revenues farm) is the marginal difference in revenues after and before improvement and δ (Cost farm) is the marginal difference in costs after and before improvement.

Results and Discussion

All traits showed a positive change in income in response to selection. Evaluating the marginal difference in profit (Table 2) we see that the weaning rate exhibited marginal profit 20% higher than the cow´s mature weight and 17.3% higher than weaning weight indicating the importance of reproductive traits for beef cattle systems in Brazil raised on pasture. The weaning rate is directly related to the amount of animals to be sold presenting a greater influence on income in relation to the increase in average weight per calf weaned.

Table 2. Values of weaning weight (WW), cow mature weight (CMW) and weaning rate (WR), before and after 1% of increase, marginal profit and economic values expressed per unit of the trait.

Traits	WW	CMW	WR
OV	182.96	450.00	76
AI	184.79	454.50	76.76
MP (US$)*	685.40	663.21	828.19
EV (US$)*	0.85/kg	1.00/kg	1.86/1%

OV = original value, AI = after improvement, MP = marginal profit, EV = economic value, *Brazilian currence US$ 1.00: R$ 2.23.

In the present study, all traits presented positive economic values, reflecting the biological and economic parameters adopted to describe the proposed production system. Other studies conducted in Brazil showed positive economic values for weaning weight, as quoted by Bittencourt et al. (2006) for a cow-calf cycle obtained U$ 0.29/cow/year, Junior et al. (2006) evaluating a cow-calf cycle and a complete cycle obtained R$ 1.31/kg and R$ 0.40/kg respectively and Brumatti et al. (2011) with animals raised exclusively in pastures in the state of Mato Grosso obtained R$ 0.57/kg. These differences in values make it difficult to compare results because they represent marketing production issues at different times, they represent specific productions and by differences in methodologies applied to the model as expressions of values obtained economic system.

The same happened to the cow mature weight where VE of the this study was positive, in contrast to the those cited by Junior et al. (2006) obtained for the system and creates complete cycle values close to zero (0.09/kg) for both systems. Into the study by Junior et al. (2007) the amount of cow mature weight was negative (-0.16/kg) reported in complete cycle system. Despite the economic value of the cow mature weight be positive, this result may be mainly due to the low value of the cost of maintenance of pastures. However, this result should be carefully analyzed, because the selection for CMW positively affected profit, but would increase the nutritional requirements of the animals, which would require the property to provide new grazing areas to meet this new demand for food.

Similar to results obtained by Bittencourt et al. (2006) and Junior et al. (2007) the most economically important trait was the weaning rate. Brumatti et al (2011) verified that reproductive traits were economically more important than growth traits for Nelore beef cattle raised in pasture in the Central region of Brazil.

Importantly, the economic values calculated in this study are specific to the production system specified and cannot be used on systems with different biological and economic characteristics. However, this study evaluated and discriminated against the economic importance of each traits evaluated and that if they were inserted in an economic selection index, would maximize genetic response economic production system studied.

Conclusion

The trait with the largest impact on profit after improvement was the weaning rate.

The economic values of the traits justify their inclusion as breeding goal traits in the studied production system.

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