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PRODUCTION COST OF CALVES IN A BREEDING SYSTEM WITH NELLORE HEIFERS MATED BETWEEN 12 AND 17 MONTHS OF AGE

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Abstract: The objective was to evaluate the cost of calf production in a beef cattle breeding system with mated Nellore heifers from 12 to 17 months of age. It was also intended to identify the components that exerted greater influence on the operational costs of the activity. The evaluation of the was considered from the weaning of the heifers in June 2019 until May 2021, when the calves of these heifers were weaned. For profitability analysis, gross revenue, total operating cost and economic indicators such as operating profit, profitability index and leveling point were considered. The items that exerted the greatest influence on the costs of the activity were food with 65.85% and labor with 19.45%, however, a profitability index of 18.64% was obtained, indicating that the livestock activity of raising of Nelore calves, developed in the analyzed production system, is profitable. The economic analysis of livestock is a fundamental tool for management and decision making, as well as for profitable and efficient production.
Keywords:Beef cattle; fertility; economic indicators; profitability; precocity.

INTRODUCTION

Beef cattle in Bolivia is an activity that is increasingly pressured, demanding greater productivity from the sector. One of the factors that significantly influences beef cattle is the management adopted in the calves to reach the ideal weight for reproduction (SOLLECITO et al., 2016).

In cattle, as they have a longer reproductive period compared to other production species, reproduction becomes of paramount importance for production systems. Factors such as good farm management, genetic improvement and the adoption of biotechnologies such as artificial insemination, fixed-time artificial insemination and targeted mating reflect production efficiency (NICACIO, 2016).

The lowest age at first calving is important to achieve better production rates, however, it is a challenge that requires adequate management (DIAS; EL FARO; ALBUQUERQUE, 2004).

In mating early heifers there are advantages and challenges. As advantages, there is a faster return on investments, an increase in the reproductive life of cows, an increase in the number of calves and a reduction in the interval between generations. The challenges would be the increase in cost due to the greater nutritional requirement for the early reproduction of heifers, and the greater occurrence of dystocic births (SHORT et al., 1994).

According to Batista, et al. (2019) in a simulation of a bioeconomic model of beef cattle breeding systems highlights that systems with heifers mating at 15 months of age are more viable compared to those mated at 26 months of age.

However, in the literature there is little support regarding the production costs of calves with precocious heifers, demonstrating the need for studies and data collection.

The objective of this work is to evaluate the cost of production of calves in a system of raising beef cattle with Nellore heifers mated from 12 to 17 months of age.

MATERIAL AND METHODS

The study was carried out at Cabanha Capiguara, located in the municipality of Okinawa 1, in the region of the Ignacio Warnes province in the department of Santa Cruz - Bolivia (Latitude: 17°14'47.86"S; Longitude: 62°56'44.53"W). With an average annual temperature of 23.0°C and a rainfall of 937 mm per year.

In this work, the case study methodology was used. The property studied was chosen because of its adopted technology, as well as the presence of zootechnical and management control, in order to approach the reality found in the region.

The data used in this research came from the breeding phase, studying 88 precocious heifers, inseminated aged between 12 and 17 months and an average weight of 376kg. The activity evaluation was considered from the weaning of the heifers until the weaning of the progeny (June/19 - May/21).

Females were supplemented with protected fat, a source of polyunsaturated fatty acids (omega 3 and omega 6), Lactoplus®, in the first month after weaning. From the second month until the end of the breeding season, it was supplemented with energy concentrate at 0.4% of live weight, then mineral salt was supplemented at 0.02% of BW until the beginning of the droughts. In the dry period, the animals received a protein supplementation with urea at 0.1% of BW and, from the birth of the calves, they returned with mineral salt at 0.02% of BW.

At the beginning of the breeding season, the reproductive tract of the females was evaluated for the development and cyclicity of the ovary and uterus. Insemination was performed on January 6, 2020 by only one inseminator, using semen from five different bulls with proven fertility. Thirty days after insemination, the first pregnancy diagnosis was performed, through ultrasound, by a technician trained to evaluate pregnancy. 14 days after diagnosis, the animals were divided into 3 GROUPs and released with different andrologically approved bulls, until the second pregnancy diagnosis - performed on April 13 - to evaluate the total final pregnancy rate, which was 74 %.

All animals were submitted to rotational grazing management. Two GROUPs, formed by 29 and 28 animals were allocated in paddocks with Panicum maximus cv. BRS Zuri, and the third GROUP with 31 animals in a paddock with tangola grass (Brachiaria

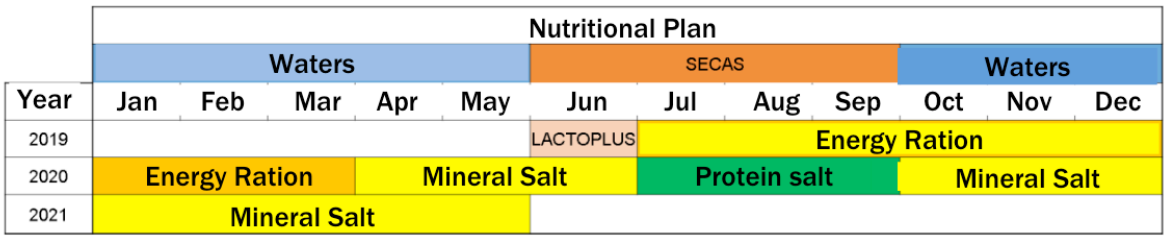

Figure1–Nutritional plan for heifers

GRASS	GROUP 1	GROUP 2	GROUP 3
ZURI	X	X	
TANGOLA			X
TANZANIA	X	X	X

Table1-Grass type for each lot.

Description	Specification	Quantity	Unitary value	Total value
		unit		US$
A- mechanized operations				
Fuel - Diesel oil	L[1]	670	0,54	361,8
				361,8
A- Manual operations				
multipurpose pawn	HH[2]	1523,44	3,44	5240,63
				5240,63
B- Services				
IATF	Animal	88	7,24	637,12
Ultrasound	Animal	176	2,17	381,92
Andrological	Animal	3	7,24	21,72
				1040,76
C- Material (inputs)				
Medicines:				
estradiol benzoate	Dose	88	0,21	18,48
prostaglandin	Dose	176	0,41	72,16
Estradiol Cypionate	Dose	88	0,05	4,40
Intravaginal device: P4	Dose	88	3,39	298,32
Somatotropin	Dose	88	1,15	101,20
GnRH	Dose	88	3,40	299,20
progesterone	Dose	88	2,02	177,76
umbicure	Dose	61	0,04	2,44
Doramectin	Dose	61	0,03	1,83
Penicillin	Dose	61	0,18	10,98
Iron	Dose	61	0,09	5,49
Vitamins	Dose	176	0,38	66,88
Minerals	Dose	88	0,38	33,44
Foot and mouth disease	Dose	352	0,80	281,60
Rage	Dose	176	0,17	29,92
Brucellosis	Dose	118	0,38	44,84

Ivermectin	Dose	88	0,20	17,60
Semen:				
Caliber	Dose	22	12,00	264,00
General	Dose	10	7,00	70,00
MAP	Dose	15	6,00	90,00
Rem USP	Dose	25	11,00	275,00
Velero	Dose	16	7,80	124,80
Ration:				
LactoPlus	Tons	0,369	1562,95	576,73
Sorghum	Tons	32,32	122,70	3965,66
Soybean meal	Tons	5,9	296,67	1750,35
Core	Tons	2,9	500,00	1450,00
protein salt	Tons	4,92	510,00	2509,20
mineral salt	Tons	2,52	460,00	1159,20
Pasture	[4]Animal/cycle	88	72,00	6336,00
Energy	Kw/hr[3]			270,24
				20307,72
Cost full operational (COT)				26950,92

[1]L: liters; [2]HH:man hour; [3]Kw/hr:kilowatts hour, 4Animal/cycle: Cost per animal over 24 months of study.

Table 2 -Operating cost of producing calves with mated heifers from 12 to 17 months.

Source: Research data, from the author

Specification	**Expenses (US$)**	**%**
Eating	17747,15	65,85
Labor	5240,63	19,45
Reproduction	2836,08	10,52
Sanity	495,02	1,84
Mechanized operations	361,80	1,34
Energy	270,24	1,00
Total	26950,92	100,00

Table 3 - Total operating cost of the different items and their representation in percentage.

Discrimination	**Results**
Gross revenue (US$)	33125,05
Total Production Cost (US$)	26950,92
Operating profit (US$)	6174,13
Profitability index (%)	18,64
Balance production (Kg)	12419,78
Cost price: Kg (US$)	1,77

Table 4 -Operating cost profitability of producing calves with mated heifers from 12 to 17 months of age.

mutica x Brachiaria arrecta). Subsequently, after the second pregnancy diagnosis, the animals returned to compose the same GROUP in paddocks with Panicum maximus cv. Tanzania. (Table 1).

At the time of birth of the calves, the belly button was weighed and cured with the drug Umbicura®, application of the vermifuge Doramectin, antibiotic Penicillin and iron. Seven months later, weaning and weighing was performed. Of the 65 pregnant females, 94% of the parturition rate was obtained, resulting in 61 animals born and weaned.

The costs were classified in total operating cost (TOC) represented by the composition of manual operations, inputs, depreciation and financial charges according to the methodology of the Institute of Agricultural Economics of São Paulo (IEA-SP), described by (MATSUNAGA et al, 1976).

For the effective operating cost (COE) expenses with materials consumed, as well as implements and labor incorporated for the activities of preparation and distribution of feed and supplements, and curing of calves were accounted for. The average prices in the region were collected in dollar (US$), referring to the year 2021 (US$ 1 = Bs 6.91 = R$ 5.31), as it is the reference currency used for the purchase of inputs and sales in Bolivia.

Thus, the respective TOC calculations corresponded to the items:

1) Mechanized operations – referred to fuel expenses, resulting from the amount of fuel consumed (liters) by the tractor, multiplied by the value of a liter of diesel oil;

2) Manual operations – related to the activities of preparing the feed, feeding and curing newborns, the number of working hours was multiplied by the technical man-hour coefficient (HH) by the value used on the farm referring to the total paid in the year, with social charges divided by hour worked in the year (US$3.44 hour);

3) Services – referred to services contracted in the production cycle with ultrasound, fixed-time insemination protocol (FTAI) and andrological, being obtained by multiplying the number of animals that received the service by the value of the service;

4) Materials (or inputs) – referred to the main expenses corresponding to food, supplements, vaccines, medicines, pasture, semen and energy. It was obtained by multiplying each quantity used by the respective price.

For the indicators of profitability analysis at work, the methods proposed by Martin et al. (1998), which are defined as:

a) Gross Revenue (RB): corresponds to the expected revenue for a given activity and respective income, for a pre-defined sale price, that is; RB = R x Pu, where: R = income from the activity per unit of area and Pu = unit price of the product.

b) Operating Profit (LO): indicates short-term profitability, estimated by the difference between gross revenue and total operating cost (TOC), expressed by: LO = RB – TOC.

c) Profitability Index: indicator resulting from the ratio of operating profit and gross revenue as a percentage. IL = (LO / RB) x 100.

d) Leveling Point (PN): refers to the minimum quantity to be produced or sold to settle the costs of the activity. PE = COT / Pu (balance production) and PC = COT / Production (cost price).

RESULTS ANDDISCUSSION

Table 2 shows the details of the operational

cost of producing calves in the breeding system with heifers mated from 12 to 17 months, referring to expenses from the weaning of the heifer to the weaning of the progeny, with fuel in mechanized operations, manual operations, services used in reproduction and material or inputs divided into medicines, semen, feed and electric energy represented in dollars (US$), totaled an operating cost of US$26,950.92 for the production of 61 calves.

For a better understanding and discussion of the data, the costs were divided into food, labor, reproduction, accounting for medicines, semen and services used in reproductive work, medicines used for the health of the herd, diesel oil used in mechanized operations and costs with electricity, represented in total cost per item and its percentage referring to the total operating cost (Table 3).

In Table 3 we can see that food was the most represented item, with 65.84% of the TOC, therefore it is directly linked to productivity, since food and mineralization are essential in animal production. Gottschal et al. (2018), points out that regardless of mating age, a minimum weight of 300 kg is necessary for higher reproductive rates, with feeding being the most important factor in the production system with precocious heifers.

The second most important item was labor, representing 19.45% of the total operating cost. It must be noted that the costs with manual operations refer to the 24 months of work, from food preparation, feeding and handling of newborn animals. Lucareli; Santos (2016) found similar results in beef cattle in the breeding phase with silage supply in the dry season, where the item with the highest representation was food and the second was labor, 42.3% and 27.5% respectively. Gonçalves et al. (2017) carried out cost analyzes of extensive calf production systems in Rio Grande do Sul and obtained a greater representation of the cost in labor followed by feeding, 41.32% and 27.64% respectively. Short et al. (1994) cited, as the most evident disadvantage in the production system with precocious heifers, the increase in the cost of feeding for the heifer to start reproduction at younger ages. However, it is possible to reduce the time for the return on invested capital.

For the reproduction of the 88 females, US$ 2,836.08 was spent, that is, 10.55% of the total costs and US$ 32.23 per female. Lucareli; Santos (2016) found similar values of 9.2% for reproduction.

The items with the lowest representation were sanitation, mechanized operations and energy, representing 1.84%, 1.34% and 1% respectively. The depreciation of the machines used in the preparation of the food, such as the grain mill and food mixer and the small Iseki® tractor used to transport the feed, were not accounted for because the machinery was 100% depreciated, no longer being accounted for in the income statement (DRE) of the company.

In Table 4 are found the data referring to the profitability of the operating cost of producing calves with mated heifers from 12 to 17 months of age with the indicators of profitability, total operating cost, operating profit, profitability index and leveling points.

The total income was estimated from the sale of 7-month-old calves, at an average cabin sale value of US$ 2.17 per kg of BW, and of the 61 weaned calves, 31 were males and 30 females, with an average weight estimated at 265kg and 235kg respectively, totaling 15,265.00 kg and gross revenue of US$ 33,125.05 (Table 3). Knowing that income comes entirely from the sale of calves, deaths and low reproductive performance must be avoided as much as possible, taking technical care throughout the production cycle. Therefore, within the same system, fundamental differences can be obtained due to fertility variation (TEIXEIRA; ALBUQUERQUE; FRIES, 2002).

Regarding the operating profit profitability indicators and profitability index, both were positive (table 4). Operating profit, represented by the difference between gross revenue and total operating costs (TOC) was US$ 6,174.13. This represents a profitability index of 18.64%, that is, revenues were sufficient to cover all operating expenses, and for the producer to pay production costs, a balance production of 12,419.78 kg and a sales price would be required. of US$ 1.77.

Cabanha Capiguara, for working with genetic improvement, estimates a sale price of animals of US$ 2.17/kg PV, differing from the market price, which corresponds to US$ 2.00/kg PV (FEGASACRUZ, 2021). But, if we calculate the revenues according to the market sales price, the gross revenue from the activity would be US$ 30,530.00 with a profitability of US$ 3,579.08 and a profitability index of 11.72%, presenting positive results for systems for selling commercial livestock.

Lucareli; Santos (2016) carried out an analysis of the economic viability of beef cattle in the breeding phase with silage supplementation in the dry season and obtained a profitability of 46.3%. It must be noted that the analysis was carried out from the breeding season with 350 sows to the weaning and sale of 300 calves, that is, 85% weaning rate. Gonçalves et al. (2017) in an extensive system analysis in calf production showed negative profitability of 23.2%, since the weaning rate of 58% does not cover the total production costs, requiring a weaning rate of 85% to reach the economic viability, emphasizing that investments in technology, mainly in food, could be alternatives to increase productivity in extensive livestock.

Pötter; Werewolf; Mielits (2000) economically analyzed production models with heifers mated at one, two and three years of age and obtained profitability of 50.5%, 59.66% and 36.98% respectively, concluding that the system with the highest gross margin it was the system two years. Batista et al. (2019) evaluated systems with mating ages at 15, 18 and 26 months of age in the states of Bahia and Paraná and obtained profitability of 12.36%, 10.28% and 6.86%, respectively, in the state of Bahia and 6, 83%, 4.88% and 2.65% respectively in the state of Paraná, and the system with mating at 15 months of age was the only one to achieve herd stability. Similar results were found by Teixeira; Albuquerque; Fries (2002), where systems with mating at 15 months of age showed better results than systems with mating at 18 and 27 months of age, emphasizing that it is possible to increase gross income through the anticipation of the first calving and that for a selection for fertility, minimum levels of 70% for heifers and 75% for cows must be reached, with the aim of maintaining the herd and avoiding decapitalization.

It is worth remembering that, as the main advantages of the system with mating of precocious heifers, the reduction of the time for the return of the invested capital, increase of the reproductive life of the cow, increase in the number of calves and reduction of the interval between generations. As disadvantages, we highlight the increase in production costs in relation to the greater food requirement of the female and the occurrence of dystocic births, and for the adoption of this system it is necessary to combine biological and economic mechanisms, depending on the existence of environmental, genetic conditions. and food resources in quantity and quality (SHORT et al. 1994).

Days; El Faro; Albuquerque (2004b) emphasize that for selection for age at first calving, adequate farm management and earlier exposure of heifers to reproduction are necessary. This practice may bring benefits in relation to the increase of genetic variability for age at first calving, increasing the

heritability estimate for the trait and selection for sexual precocity of the herd, improving its productive efficiency. In addition, the use of young animals reduces the interval between generations, contributing to the genetic gain of the population, in the desired characteristics.

CONCLUSION

The calf production system with heifers mated from 12 to 17 months old showed positive profitability, which indicates that the revenues generated are sufficient to cover the total operational cost. The most representative item in the cost was food followed by labor.

The economic analysis of livestock breeding through production cost, gross revenue and economic indicators such as operating profit, profitability index and leveling point are fundamental tools for management and decision making, as well as for profitable and efficient livestock.

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