Economic Value Estimation of Reproductive Traits for a Beef Cattle Herd in Brazil

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Introduction

The objective of this study was to present a set of profit equations to heifer pregnancy (HP) and stayability (STAY). The costs and revenues relation of these traits with a beef cattle production system were described as means to suggest a model of analysis and also contribute to the establishment of a routine of economic evaluation for such kind of selection criteria in Brazil.

Material and methods

There was evaluated a traditional beef cattle production system in Brazil, which is characterized by low production costs. The production is essentially based on natural mating and animals being raised on pasture regime. The average age at first breeding is around 36 months while the fertility rate is near 60%. These reproductive indexes highlight the importance of the inclusion of reproductive traits as selection criteria.

The values of costs, revenues and also the productive indexes applied to the present simulations were based on the average data obtained from Agropecuária Santa Bárbara Xinguara S/A (ASBX) in 2009. ASBX is a company dedicated to an extensive cow-calf production system in north of Brazil, pursuing a total herd number of 425.927 Nellore animals and 187.158 females in reproduction in 2009.

To analyze the economic aspects of HP it was considered the mating at 14 months of age. All costs and revenues regarding the mating of these heifers were evaluated. The procedures of economic aspects evaluation of HP were adapted from Short et al. (1990), as follow:

$$P_{HP} = (R_{HP} + R_{RE\text{-}HP}) - (C_{HP} + C_{RE\text{-}HP})$$

where,
P_{HP} = profit of HP;
R_{HP} = revenues from heifers pregnant at 14 months of age;

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R_{RE-HP} = revenues from rebreeding of the heifers pregnant at 14 months of age;
C_{HP} = costs of heifers reproduction at 14 months of age;
C_{RE-HP} = costs of rebreeding of the heifers pregnant at 14 months of age.

The profit equations to economic analysis for HP are presented as:

$$R_{HP} = (HP \times (1 - MRW)) \times RRD \times (0.5 \times ((WMCH \times SPMC) + (WFCH \times SPFC)))$$
$$R_{RE-HP} = (RR \times (1 - MRW)) \times (RRD \times HP) \times (0.5 \times ((WMC \times SPMC) + (WFC \times SPFC)))$$
$$C_{HP} = (RRD / NDS) \times SP \times DRS + (RRD \times DCS \times CS \times DS) + (CCP \times HP \times (1\text{-}MRW) \times RRD)$$
$$C_{RE-HP} = (RRD - (RRD \times HP) / NDS) \times DRS \times SP$$

The parameters applied to economic analysis of HP are shown in Table 1.

Table 1 – Parameters and respective values considered to economic analysis of HP

Parameter	Description	Value
CCP	annual costs of calve production	US$ 75.2 per animal
CS	cost of supplement	US$ 0.4 per kg
DCS	daily consumption of supplement	0.3 kg per heifer
DRS	discard rate of sires	25.0% per year
DS	days in supplementation	120.0 days
MRW	mortality rate until weaning	4.0%
NDS	number of dams per sire	30.0
RR	rebreeding rate	60.0%
RRD	replacement rate of dams	20.0%
SP	sire price	US$ 3.507.0 per sire
SPFC	sale price of female calves	US$ 1.4 per kg of life weight
SPMC	sale price of male calves	US$ 1.6 per kg of life weight
WFC	weight of female calves at weaning	180.0 kg
WFCH	weight of female calves from heifers	170.0 kg
WMC	weight of male calves at weaning	190.0 kg
WMCH	weight of male calves from heifers	180.0 kg

The economic value of STAY was estimated by increasing the fertility rate while decreasing the discard rate in the same proportion. The proceedings to evaluate the economic value of STAY were adapted from Charteris et al. (1999) as follow:

$$PPS = PMC + PFC + PDD + PRH$$

where,
PPS = profit of production system;
PMC = profit of male calves;
PFC = profit of female calves;
PDD = profit of discard dams;
PRH = profit of replacement heifers.

The profit equations to STAY are presented below as:

$$PMC = (0.5 \times N \times FR \times WMC \times SPMC) - (0.5 \times N \times FR \times PCC)$$
$$PFC = (0.5 \times N \times FR \times WFC \times SPFC) - (0.5 \times N \times FR \times PCC)$$
$$PDD = (DR \times WD \times SPDD) - PCD$$
$$PRH = N \times DR \times HPM$$

The parameters applied to estimate economic value to STAY are shown in Table 2.

Table 2 – Parameters and respective values considered to economic analysis of STAY

Parameter	Description	Value
DR	discard rate of dams	20.0%
FR	fertility rate	80.0%
HPM	heifer price at market	US$250.0, US$400.0 and US$500.0
N	number of dams in reproduction	1.0 dams
PCD	annual costs of dam production	US$ 110.2 per dam
PCC	annual costs of calve production	US$ 75.2 per calve
SPDD	sale price of discard dams	US$1.0 per kg of life weight
WD	weight of dams	420.0 kg

To the heifer price (HPM) there were applied values as means to represent different regions and genetic level of the animals of ASBX focus.

Results and discussion

The results of costs, revenues and marginal profit associated to HP are in Table 3.

Table 3 – Results of costs, revenues and marginal profit of HP

HP	R_{HP} (US$)	$R_{RE\text{-}HP}$ (US$)	C_{HP} (US$)	$C_{RE\text{-}HP}$ (US$)	P_{HP} (US$)
15.0%	7.6	4.8	10.7	5.0	-3.3
16.0%	8.1	5.1	10.9	4.9	-2.5
17.0%	8.6	5.5	11.0	4.9	-1.8
18.0%	9.1	5.8	11.1	4.8	-1.1
19.0%	9.6	6.1	11.3	4.7	-0.3
20.0%	10.1	6.4	11.4	4.7	0.4
21.0%	10.6	6.7	11.6	4.6	1.2
22.0%	11.1	7.1	11.9	4.5	1.9
23.0%	11.6	7.4	11.9	4.5	2.6
24.0%	12.1	7.7	12.0	4.4	3.4
25.0%	12.6	8.0	12.2	4.4	4.1

The values in Table 3 indicate a linear trend of costs, revenues and profit associated to increasing rate of HP. In accordance to the productive and economic scene simulated the HP is profitable when it reaches a rate of 20%. The results of economic analysis of STAY are shown in Table 4.

Table 4 – Results economic analysis of STAY in accordance to different heifer prices

DR	FR	Heifer cost (US$ 250.0)				
		PMC (US$)	PFC (US$)	PDD (US$)	PRH (US$)	PPS (US$)
20.0%	80.0%	168.3	156.3	-72.0	-26.1	226.6
19.0%	81.0%	170.4	158.3	-68.4	-30.3	230.0
18.0%	82.0%	172.5	160.2	-64.8	-34.5	233.5
DR	**FR**	**Heifer cost (US$ 400.0)**				
		PMC (US$)	**PFC (US$)**	**PDD (US$)**	**PRH (US$)**	**PPS (US$)**
20.0%	80.0%	168.3	156.3	-102.0	-26.1	196.6
19.0%	81.0%	170.4	158.3	-96.9	-30.3	201.5
18.0%	82.0%	172.5	160.2	-91.8	-34.5	206.5
DR	**FR**	**Heifer cost (US$ 500.0)**				
		PMC (US$)	**PFC (US$)**	**PDD (US$)**	**PRH (US$)**	**PPS (US$)**
20.0%	80.0%	168.3	156.3	-122.0	-26.1	176.6
19.0%	81.0%	170.0	158.3	-115.9	-30.3	182.5
18.0%	82.0%	172.5	160.2	-109.8	-34.5	188.5

As shown in Table 4 as the market price of the replacement heifer increases lower is the profit of production system (PPS). However, the economic importance of STAY is higher as the heifer market price increases. It means that a high price female should remain longer in the herd in order to pay back the investment compared to a low cost female for replacement.

The economic value for HP was US$ 0.70 per heifer exposed, while for STAY the importance varied from US$ 3.5 to US$ 6.0, depending on the replacement heifer cost. It implies that in economic terms STAY is 5.0 to 8.5 times more important than HP. Charteris (1999) found a relation close to 4.0 between these both traits.

Conclusion

Both reproductive traits, HP and STAY are economically relevant and might be incorporated to the selection routine as means to improve the efficiency of production(s) systems in Brazil.

References

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