Economic values for production and functional traits for crossbred (Holstein x Gir), Holstein and Gir cattle in Southeast Brazil[#].

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Abstract: Commercial herds of crossbred cattle compose the main group of milk producers in Brazil. Production systems are usually pasture based due to the high production potential of tropical grasses and adaptative capacity of animals. Gir (G) and Holstein (H) breeds are used to produce crossbred dairy cows (HG). To evaluate the relative economic importance of different production and functional traits for the three main genetic groups involved in the milk production in the Southeast Brazil (HG, H and G), economic values (EV) for milk (M), fat (F), protein (P), adult body weight (ABW), conception rate (CR) and herd life (HL) were calculated using a bio-economic model that describes performance, revenues and costs for pasture based milk production systems. The differences between genetic groups for production traits were small. EV (US$) for M, F and P (kg/cow/year) were, 0.18, -0.29 and –0.17 for H; 0.19, -0.28 and -0.17 for HG and 0.19, -0.24and -0.15 for G, respectively. Larger differences were found for ABW and CR. EV (US$) for ABW (kg/cow/year), CR (%) and HL (cow/day HL) were, –0.59, 1.16 and 1.29 for H; -0.24, 1.06 and 1.32 for HG and –0.41, 2.60 and 1.24 for G, respectively. Results provide solid basis for supporting breeding programmes.

Key words: dairy cattle, crossbreeding, milk production, breeding goals

Introduction

Commercial herds based on crossbreeding cattle compose the main group of milk producers in Brazil. These herds are formed either by different grades of Holstein x Zebu (using Holstein and Zebu sires alternately), or by F_1 females (produced by commercial Zebu herds from the mating of Holstein sires to Zebu females) which are continuously replaced. These milk production systems are usually pasture based because of the high production potential of tropical grasses, availability of grassland areas and the adaptive capacity of crossbred animals in pasture conditions. Thus, Gir (the main zebu dairy breed in Brazil) and Holstein breeds play an important role in the maintenance of crossbreeding schemes. The objective of this paper was to evaluate the relative economic importance of different production and functional traits among these three different breed groups usually involved in the milk production activity in the Southeast region of Brazil. For this purpose, economic values (EV) for milk (M), fat (F), protein (P), average adult body weight (ABW), conception rate (CR) and herd life (HL) were calculated using a bio-economic model to describe performance, revenues and costs for pasture based milk production systems, using a system approach.

Material and methods

We have developed a deterministic and static model to estimate the annual profit and economic values for pasture based milk production systems using crossbred cows (Cardoso et al., 2004), which were also adapted for other genotypes (Holstein – H and Gir - G breeds). The model was based on the following assumptions:

1. Crossbred commercial herds (HG) are based on the alternate mating of Holstein and Zebu sires or on the production of F_1 heifers in commercial Zebu herds from the mating of Holstein sires to Zebu females known as *the F_1 heifer continuous replacement schemes* (Madalena, 1993).
2. The animals were kept on pastures the whole year, receiving roughage supplementation (maize silage for H and the mixture sugar cane plus urea 0.5% for G and HG) during the dry season and concentrates according to production. The feeding scheme for growing animals (calves and heifers) was similar, with varying proportion of concentrates.

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3. The sources of farm revenues for the three different commercial production systems, were:
HG: milk (volume), surplus heifers, culled cows and yearling calves;
H: milk (volume), surplus heifers, culled cows (slaughter and production) and one-week male calves.
G: milk (volume), surplus heifers, culled cows and yearling male calves.
4. The current general policy for milk prices did not include additional payment for usual milk quality parameters (fat and protein content or somatic cell counts - Scc), only establishes minimum standards to be attained (3.1 % of fat and 3.0% of protein).
5. It was assumed that 12-month crossbred calf price is based on the average category price. The price of Gir male calves were established according to the milk production level of the mother (mother's milk production multiplied by milk price). Holstein male calves were valued by the price of one straw of semen.
6. Calving occurrence was equally distributed over the year resulting in a constant proportion of cows in milk and dry cows throughout the year.
7. Herd annual milk (and constituents) production was calculated based on individual monthly production level of cows, which were estimated based on lactation curves for 1st, 2nd and 3rd or more parities, according to the genetic group.
8. It was supposed that there was no restriction on inputs or outputs.
9. The production systems were described in terms of inputs and outputs, taking into account the average performance of animals in the system. Feeding costs are calculated according to genetic composition, herd production level and management and land use intensification level (fertilisation level).

Biological parameters in the model used to establish the basic situation (before genetic improvement), were taken from Brazilian literature to represent the different genetic groups. Information on prices of production components (inputs and outputs) were obtained mainly from monthly economical reports from the Agricultural Economics Institute of Agriculture Secretary of São Paulo State, as well as from other specialised reports (Table 1).

Economic values were calculated for milk (M), fat (F), protein (P), adult body weight (ABW), conception rate (CR) and herd life (HL), for the three different genetic groups, according to the selection interest of profit (revenues – costs) maximisation, given a fixed number of animals in the system (Groen et al., 1997).

Results and discussion

The economic values were obtained by increasing in 1% the original value each trait of interest, keeping the others constant. When increasing the production level of a trait, both the energy requirements and the amount of energy offered in the diet, after genetic improvement and before genetic improvement were compared. Additional supplementation was provided to the original diet to fulfil the new energy requirements. In the case of milk production traits (M, F and P), concentrate amounts were increased to adjust the diet to the new genetic level, while for average body weight, additional amounts of roughage were available (pasture area in the rainy season and roughage supply in the dry season). Economic values (US$) for M, F and P (kg/cow/year) were, 0.18, -0.29 and –0.17 for H; 0.19, -0.28 and -0.17 for HG and 0.19, -0.24 and -0.15 for G, respectively. Negative values for F and P were resulting from the absence of differentiated payment policies for milk constituents. The differences between genetic groups for production traits were small. Larger differences were found for ABW and CR. EV (US$) for ABW (kg/cow/year), CR (%) were, –0.59 and 1.16 for H; -0.24 and 1.06 for HG and –0.41 and 2.60 for G. Negative EV for ABW indicates that the increase in the revenues of culled cows for slaughter resulting from the increase of one unit of this trait would not compensate the increase in energy intake of cows. This was more evident for Holstein cows. Positive EV_{CR} reflected the reduction in AI costs and additional revenues from surplus heifers and male calves. The greater EV_{CR} for G resulted from the higher price of male calves. Economic values (US$) for HL (cow/day HL) were 1.29 for H; 1.32 for HG and 1.24 for G, respectively.

Economic values are obtained taking into account the production circumstances of commercial herds to evaluate the economic importance of traits in a breeding goal. They are used in the construction of selection indexes to rank animals in a breeding programme. In the Brazilian situation, herd structure of milk production involves crossbreeding and different populations. Differences in EV for same traits between genetic groups were, in general, small, with exception of ABW and CR. Prospects of implementing economic indexes to rank animals in breeding programs and consequences of using different economic values for a same trait will be further investigated. These preliminary results provide solid basis in the design of breeding programmes for dairy cattle in Brazil.

Table 1. Biological and economical parameters used to describe herd performance in the basic situation for the H, G and HG production systems.

Parameter	H	G	HG
No. Cows	100	100	100
Average Milk production (kg)	7015	2796	4073
Lactation length (days)	335	305	305
Average fat %	3.36	4.42	3.71
Average protein %	3.07	3.23	3.32
Cows in milk (%)	80.68	73	75.00
Conception rate (%)	88	81	88
Calving interval (months)	13.71	13.83	13.36
Voluntary culling rate (%)	7.35	8.67	16.18
Replacement rate (%)	25	16.67	19.24
Herd life (months)	48	72	66
Age at first calving (months)	27	36	33
Cow average body weight (kg)	600	449	514
Prices US$)*			
Milk	0.22	0.22	0.22
Culled cows (kg meat)	1.45	1.45	1.45
Surplus heifers	870.00	1000.00	652.00
Culled cows (other herds)	652.00	-	-
Calf[a]	13.00	608.00	108.70
Heifer raising costs	642.00	432.00	388.70
Yearling calf raising costs	-	208.00	205.00
Concentrate	0.17	0.17	0.17
Annual costs (pasture)	776.00	300.87	444.35
Roughage supply[b] (kg MS)			
Maize silage (kg DM)	0.10	-	-
Sugar cane + urea 0.5% (kg DM)	-	0.03	0.03
Semen (straw)	13.00	10.87	10.87

*Currency: US$ 1.00 = R$ 2.30

[a] Calf selling age: one week (H); one year (G and GH).

References

Cardoso, V.L.; Lima, M.L.P.; Paz, C.C.P. et al. Modelo bio-econômico para cálculo de valores econômicos de características em sistemas de produção de leite a pasto na região Sudeste. Proc. of the 41[a] Reunião Anual da Sociedade Brasileira de Zootecnia, 2004, Campo Grande, MS. CD-ROM.

Groen, A.F..; Steine, T.; Colleau, J.J. et al. (1997) Economic values in dairy cattle breeding, with special reference to functional traits. Report of an EAAP-Working Group. Livest. Prod. Sci., 49: 1-21.

Madalena, F.E. (1993). A simple scheme to utilise heterosis in tropical dairy cattle. World Anim. Rev., v.74/75:17-25.