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SHORT COMMUNICATION

Comparative performance of six Holstein-Friesian x Guzera grades in Brazil. 10. Disposal value

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ABSTRACT

The prices at disposal of 346 dairy females of six Holstein-Friesian (HF) x Guzera crossbred groups in 67 farms were analyzed by a least squares analysis of variance under either additive-dominance or group classification models, including the effets of region, farm, age and trimester of sale. For groups with 1/4, 1/2, 5/8, 3/4, 7/8 and ≥ 31/32 HF fraction, the mean (± standard error) price of females sold for beef at mean age 8.1 years was equivalent to 921 ± 64, 901 ± 85, 882 ± 75, 798 ± 81, 727 ± 79 and 665 ± 85 liters of milk, respectively. Corresponding prices of females sold for dairying at mean age 11.8 years were 921 ± 150, 1093 ± 93, 976 ± 133, 1031 ± 116, 929 ± 137 and 408 ± 200 milk equivalents (m.e.). Price for beef declined linearly -249 ± 120 m.e. per unit of proportion of HF genes, while neither individual nor maternal heterosis were significant (P > 0.24). Price for dairying, on the other hand, was significantly affected by individual (636 ± 210 m.e.) and maternal heterosis (217 ± 106 m.e.), but not by the individual breed additive difference.

INTRODUCTION

Sale of animals makes an important contribution to farm receipts, even in specialized dairy systems (e.g. Madalena, 1986). Although estimates of crossbreeding effects and parameters are required for the design of efficient breeding strategies, estimates of differences in salvage values among crossbred groups is not readily available in the literature, although it is known that crossbreeding influences liveweights of tropical dairy cows (e.g. Katpatal, 1977).

This paper reports on the salvage values of dairy females, as a part of a more comprehensive crossbreeding trial described by Madalena (1989).

MATERIAL AND METHODS

Prices at disposal of 346 females were studied. Heifers of six red Holstein-Friesian (HF) x Guzera (Gu) crosses (denoted by their HF gene fraction: 1/4, 1/2, 5/8, 3/4, 7/8 and ≥ 31/32) were distributed for lifetime monthly milk recording to 65 private and two experimental farms located in the States of Minas Gerais, São Paulo, Rio de Janeiro and Espírito Santo. Rationale, farm locations and other trial details have already been published (Madalena, 1989).

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The crossbred groups were F_1, backcrosses to both parental breeds and *inter se* of 5/8 HF sires and dams. Number of HF, Gu and 5/8 sires represented in this sample were 24, 15 and 8, respectively. For further information on the origin of those crosses see Lemos *et al.* (1984).

The heifers were born on Santa Mônica Experimental Farm, State of Rio de Janeiro, between March 1977 and December 1981. They were distributed to cooperator farms at mean age 22 months and mean weight 220 kg. With few exceptions, each private farm received a set of six heifers, one of each crossbred group. Heifers in each set were contemporary (average age difference = 36 days; average range = 83 days). The two experimental farms (ex UEPAE São Carlos - SP and Santa Mônica) received 29 and 97 heifers with unequal numbers of each cross. Heifers on these farms were grouped into contemporary batches for statistical analyses.

Recording continued up to 12 years of age, except for 30 females, which had recording terminated earlier due to lack of funding. Those 30 females were sold for dairying at average age 9 years (range 8 to 11). Females in this study were sold either for dairying (122) or for beef (224). All animals sold for dairying and 209 sold for beef had calved at least once (15 non-parous).

Animals remained the property of the Research Center up to disposal, when they were sold by a supervising technician at local prevailing prices. The price received (salvage value) was expressed in milk equivalents (m.e.), i.e., price of animal divided by the price of one liter of farmgate quota milk. To reduce beef/milk price fluctuations, salvage value was adjusted by a year-month multiplicative factor, i.e., r_M/r_i, where r_i is the ratio of the price of fat cow liveweight/price of milk for the month in which the female was sold and r_M is the mean ratio in the period 1980 to 1993 (820.3 l). Prices of beef and milk were obtained from statistics for the State of São Paulo (IEA, 1980 to 1993).

Farms were grouped into six regions for analysis: 1) São Carlos, 2) Paraíba River Valley, 3) Southern Minas Gerais, 4) Zona da Mata of Minas Gerais, 5) Northern Minas Gerais plus Metalúrgica and Espírito Santo and 6) Santa Mônica farm, which was classed separately because its cattle were in much better condition when sold than the other farms. Farms within regions with only one observation were grouped together. Three classes of age at selling for beef were considered (3 years, 4 to 12 years and 2 plus 13 years) and six classes for cows sold for dairying (8 to 13 years).

Separate analyses were performed for animals sold for dairying and for beef, using the GLM procedure of SAS (1988) package.

Two models were fitted: an additive-dominance model (1) and a crossbred group classification model (2). The additive-dominance model was:

$$Y_{ijklm} = b_o + g^I q_i + h^I z_i + h^M w_i + R_j + F_{jk} + A_l + T_m + e_{ijklm}, \quad (1)$$

where

Y_{ijklm} = salvage value,
b_o = intercept,
g^I = individual breed additive difference (HF - GU),
q_i = expected fraction of HF genes in individuals of the *i*-th crossbred group (i = 1, ..., 6; q = 1 was assumed for the ≥ 31/32 HF group),
h^I = individual heterosis effect,
h^M = maternal heterosis effect,
z_i = expected proportion of loci with one gene from each breed in individuals of the *i*-th crossbred group; z-values were 1/2, 1, 30/64, 1/2, 1/4, and 0, for groups 1/4, 1/2, 5/8, 3/4, 7/8 and ≥ 31/32 HF,
w_i = expected proportion of loci with one gene from each breed in dams of the *i*-th crossbred group. w-values were 1, 0, 1/2, 1, 1/2, and 0, for groups in the same order,
R_j = effect of the j-th region (j = 1, ..., 6),
F_{jk} = effect of the k-th farm-batch within the j-th region (53 for beef, 42 for dairying),
A_l = effect of the l-th class of age at selling,
T_m = effect of the m-th trimester of sale,
e_{ijklm} = residual, assumed normally and independently distributed.

All effects were considered fixed. The g^I parameter corresponds to Dickerson's (1969) average direct individual HF gene effects, measured as a difference from the Guzera breed. The h^I and h^M parameters measure individual and maternal heterosis effects. They contain dominance and epistatic effects (Dickerson, 1969), which are confounded in the F_1 and backcrosses (Hill, 1982, Koch *et al.*, 1985). In addition, in these crosses the expected proportions of dam's HF genes equal 1 - z_i, so h^I is confounded with maternal additive effects.

In a second model (2), the discrete crossbred group classification effects G_i substituted for the g^I, h^I and h^M regressions of model 1. Goodness of fit of both models was assessed by F tests of the mean squares due to fitting model 2 over and above model 1, which was tested against the model 2 residual mean square. Contrasts among means were tested by Scheffé's (1959) S-test.

RESULTS AND DISCUSSION

The ANOVAs for model 2 are presented in Table I. Selling price for beef and for dairying was significantly ($P < 0.05$) influenced by all effects studied, except for trimester of sale for beef. Thus, adjustment to the average price of beef/price of milk ratio removed seasonal effects on the prices of females sold for beef, but not on the prices of females sold for dairying.

Table I - Analyses of variance of cattle selling prices under model 2[+].

Source	d.f.	Sold for Beef	Sold for Dairying
		— F-values —	
Region	5	8.02***	21.31***
Farm/region	47/36[1]	1.77**	1.92**
Crossbred group	5	4.32***	2.98**
Age class	2/5[1]	5.34**	5.14***
Trimester	3	0.99[ns]	3.27*
Residual SD[2] milk equivalents	161/67[1]	259.31	307.75

[+]See text for model 2.
[ns]$P > 0.40$, *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
[1]Degrees of freedom for sold for beef/sold for dairying.
[2]SD = Standard deviation, 1 milk equivalent = farmgate price of one liter of quota milk (US$ 0.22).

Overall least squares mean price of females sold for beef was 815 ± 17 m.e. (range 417 to 2922). Except for the experimental farms, prices of females sold for beef did not vary much between regions, with least squares means ranging from 1044 ± 74 for the Santa Mônica farm to 715 ± 84 m.e. in Southern Minas Gerais. The mean price of cows sold for dairying was 893 ± 28 (range 365 to 2043). Regional least squares means ranged from 1432 ± 167 m.e. in Santa Mônica to 403 ± 140 in Zona da Mata of Minas Gerais.

Least squares means for price of females sold for beef increased from 580 ± 168 m.e. in age group 2 plus 13 years to 840 ± 99 m.e. in age group 3 years and to 1027 ± 22 m.e. in group 4 to 12 years. Average age at sale for beef was 8.1 years. Least squares means for price of females sold for dairying ranged from 1442 ± 249 m.e. in age group 9 years to 245 ± 175 m.e. in age group 13 years. Average age at sale for dairying was 11.8 years.

Least squares means for price of females sold for dairying in the first to fourth trimesters were 1188 ± 146, 832 ± 120, 815 ± 212 and 737 ± 116 m.e. It is well known that prices of both liveweight and milk increase in the dry season (second and third trimesters), also being subjected to other complex influences, such as periodical cycles of beef prices and influences of governmental economic decisions, both national and international. The adjustment to the average ratio of prices in the whole period 1980 to 1993 reduced the influence of these factors on seasonal effects on prices of females sold for beef, but an effect was left on the price of females sold for dairying. No explanation is offered for this, however the latter prices have beef plus dairy value components, and the latter might not have been adjusted by the correction factors used.

Least squares means for the six crossbred groups are in Table II. Prices for beef consistently decreased with increasing HF fraction, although only the extreme difference 1/4 minus ≥ 31/32 reached significance ($P < 0.05$). Prices for dairying, on the other hand, showed a peak for F_1 and 3/4, decreasing for higher HF fractions, and also for 1/4 and 5/8.

Table II - Least squares means (LSM) ± standard errors (SE) for selling prices of cattle.

Holstein-Friesian fraction	Sold for Beef: LSM ± SE milk equiv.[1]	Beef: N	Sold for Dairying: LSM ± SE milk equiv.[1]	Dairying: N
1/4	921 ± 64[a]	67	921 ± 150[ab]	12
1/2	901 ± 85[ab]	25	1093 ± 93[a]	53
5/8	882 ± 75[ab]	43	976 ± 133[ab]	13
3/4	798 ± 81[ab]	30	1031 ± 116[ab]	26
7/8	727 ± 79[ab]	35	929 ± 137[ab]	14
≥ 31/32	665 ± 85[ab]	27	408 ± 200[ab]	4
Mean	815 ± 17[b]	224	893 ± 28[b]	122

[1]1 milk equivalent = farmgate price of one liter of quota milk (US$ 0.22).
[a,b] Means with different superscripts differ significantly ($P < 0.05$).

Crossbred group effects may be better described in terms of the additive-dominance model 1, which fitted the data equally as well as classification model 2, as indicated by the F-values for the model comparison, 0.86 and 1.46 for beef and dairying ($P > 0.05$ in both cases). Parameter estimates are in Table III. Only the breed additive difference was significant for beef prices. Thus, heterosis was not detected for this trait. Although animal condition at sale was not scored, a general trend towards a worse condition with higher HF fractions was apparent, and the proportion of females disposed of because of illness, mostly cachexia, was found to increase with HF gene fractions above 1/2 (Lemos *et al.*, in press).

Prices of females sold for dairying showed a different trend than prices for beef; the additive

Table III - Estimates of crossbreeding genetic parameters ± standard errors for selling prices.

		Sold for	
		Beef	Dairying
		— milk equivalents[1] —	
Breed additive difference	(g^I)	-249 ± 120*	288 ± 264^{ns}
Individual heterosis	(h^I)	121 ± 103^{ns}	636 ± 210***
Maternal heterosis	(h^M)	7 ± 64^{ns}	217 ± 106*

^{ns}P > 0.24, *P < 0.05, ***P < 0.005.
[1]1 milk equivalent = farmgate price of one liter of quota milk (US$ 0.22).

difference was not significant, whereas both the individual and maternal heterosis effects were (Table III). Important heterosis has also been found previously for milk yield (Madalena *et al.*, 1990). Nonetheless, no relation could be found between price and yield per day at the last lactation, when this trait was included in models 1 and 2, either as a continuous co-variable up to the third degree or as a class variable; so yield may be related to price through some other function.

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RESUMO

Os preços de venda de 346 fêmeas de seis grupos genéticos Holandês (HF) x Guzerá em 67 fazendas foram analisados pelo método dos quadrados mínimos, utilizando-se dois modelos genéticos, o aditivo-dominante e o de classificação dos grupos, incluindo ambos também os efeitos de região, fazenda, idade e trimestre da venda. Para os grupos com 1/4, 1/2, 5/8, 3/4, 7/8 e ≥ 31/32 de fração HF, o preço médio das fêmeas vendidas para corte, à idade média de 8,1 anos, foi equivalente, respectivamente, a 921 ± 64, 901 ± 85, 882 ± 75, 798 ± 81, 727 ± 79 e 665 ± 85 litros de leite. Os preços correspondentes das fêmeas vendidas para produção de leite à idade média de 11,8 anos, foram: 921 ± 150, 1093 ± 93, 976 ± 133, 1031 ± 116, 929 ± 137 and 408 ± 200 equivalentes de leite (m.e.). O preço para corte declinou linearmente -249 ± 120 m.e. por unidade de proporção de genes HF, não sendo significativas nem a heterose individual nem a materna (P > 0,05). O preço para leite, de outra parte, foi afetado significativamente pela heterose individual (636 ± 210 m.e.) e pela heterose materna (217 ± 106 m.e.) mas não pela diferença aditiva entre as raças.

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