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SHORT COMMUNICATION

EFFECT OF COST-PRICE STRUCTURE ON THE ECONOMIC EVALUATION OF ALTERNATIVE DAIRY CATTLE CROSSBREEDING STRATEGIES

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ABSTRACT

Profit per day in the herd was estimated for five Holstein-Friesian x zebu crossbreeding strategies utilizing data from accumulated dairy production of crossbred animals at two levels of management. Sixteen profit functions were generated by all combinations of two levels of: prices for fat and protein, beef value of the animals and price of feed concentrates. Cost-price structure had only small effects on the relative merits of crossbreeding strategies.

INTRODUCTION

Economic evaluation is required to choose among alternative breeding plans, but results may be dependent on the particular cost-price structure used, since relative weight of total merit component traits may change according to economic circumstances. Dairy cattle crossbreeding strategies for the Southeast Region of Brazil were compared in a previous paper (Madalena *et al.*, 1989b) using costs and prices of 1980 to 1985, when physical performance was measured. Extension of that comparison to a wider range of economic situations is presented in this paper.

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MATERIALS AND METHODS

Five crossbreeding strategies of Holstein-Friesian (HF) x Guzera (Gu) were compared: (1) grading up to HF, (2) forming a new breed from HF x Gu foundation, (3) crisscrossing, (4) modified crisscrossing of HF sires for two generations followed by one generation of zebu sires, and (5) continuous F_1 heifer replacement. The basic data were accumulated dairy production records of contemporary animals of six HF x Gu crossbred groups (1/4 to $\geqslant$ 31/32 HF), in farms of high and low management levels (HML and LML). Performance for the above five strategies was estimated by standard regression methods under a genetic model based on the breed additive difference and on dominance and mating type effects (*inter se* or purebred sired) (Madalena *et al.*, 1989b). Differences between the strategies predicted performance were tested by Scheffé's (1959) test.

Profit per day in the herd was adopted as the measure of economic performance, based on income from milk and animal sales minus cost of concentrates, milking labor, milk transport, heifer cost up to first freshening and other miscellaneous costs. Cows in the HML averaged 7.9 y of age at the end of recording, and those in the LML, 6.8 y, so performance was not comparable between management levels. Separate statistical analyses were performed for each level.

All prices were expressed in milk equivalents, i.e., relative to the on farm price of 1 kg quota base (3.3% fat) milk. Income and expense items were discounted to the initial 30-mo age at 6% per year interest rate, but some runs were also made at 3% and 9%.

Prices and costs of 1980 to 1985, when lactations occurred (referred to as "present") were described by Madalena (1989). Profit was calculated for 16 situations, arising from all combinations of two price levels of: milk fat, milk protein, beef value of animals and cost of concentrates, as follows:

Fat differentials: "present", F = 1 + 0.0415 (fat%-3.3), and 3F.

Protein differentials: "present" (not paid for) and 3P = 3 [1 + 0.0415 (protein % - 2.6)].

Beef value (applied to cows, heifers and calves): "present" and two times higher.

Concentrate costs: "present" and two times lower.

All 16 profit functions had prices and costs of other items set at their 1980 to 1985 present values (Madalena, 1989).

RESULTS AND DISCUSSION

Economic performance of crossbreeding strategies predicted by each of the 16 profit functions are given in Table I. Results for the 1980 to 1985 "present" prices

Table I - Profit per cow per day in the herd, in milk equivalents (me)[1], for different crossbreeding strategies of Holstein-Friesian (HF) x zebu (Z), evaluated under 16 price-cost structures, generated by all combinations of two levels of prices of: milk fat (%F), milk protein (%P), beef value of cows, heifers and calves (BV) and concentrates (Con).

Multiples of 1980 to 1985 prices				High management level					Low management level				
				Crossbreeding strategy[2]					Crossbreeding strategy[2]				
					Crisscrossing					Crisscrossing			
%F	%P	BV	Con	CF_1R	MCX	CX	Grading up to HF	New breed[3]	CF_1R	MCX	CX	Grading up to HF	New breed[3]
				me, kg/d									
1	0	1	1	1.82[a]	1.36[b]	0.75[c]	1.36[a,b]	-0.33[d]	4.64[a]	2.23[b]	2.72[c]	-0.95[d]	1.37[e]
1	1	1	1	2.00[a]	1.50[b]	0.89[c]	1.45[b]	-0.22[d]	4.76[a]	2.31[b]	2.81[c]	-0.90[d]	1.44[e]
3	0	1	1	2.27[a]	1.62[b]	1.05[c]	1.36[b,c]	-0.26[d]	5.11[a]	2.55[b]	3.06[c]	-0.82[d]	1.57[e]
3	3	1	1	2.82[a]	2.04[b]	1.50[c]	1.60[c]	0.04[d]	5.46[a]	2.81[b]	3.27[c]	-0.67[d]	1.79[e]
1	0	2	1	2.50[a]	2.02[b]	1.42[c]	1.99[a,b]	0.34[d]	5.44[a]	2.55[b]	3.45[c]	-1.53[d]	2.99[b,c]
1	1	2	1	2.68[a]	2.16[b]	1.57[c]	2.07[b]	0.44[d]	5.55[a]	2.63[b]	3.55[c]	-1.48[d]	3.06[b,c]
3	0	2	1	2.95[a]	2.28b	1.73[c]	1.98[b,c]	0.40[d]	5.90[a]	2.87[b]	3.80[c]	-1.40[d]	3.19[b,c]
3	3	2	1	3.50[a]	2.70[b]	2.17[c]	2.22[c]	0.71[d]	6.25[a]	3.13[b]	4.08[c]	-1.25[d]	3.41[b,c]

Continued

Table I - Continued.

Multiples of 1980 to 1985 prices				High management level					Low management level				
				Crossbreeding strategy[2]					Crossbreeding strategy[2]				
					Crisscrossing					Crisscrossing			
%F	%P	BV	Con	CF_1R	MCX	CX	Grading up to HF	New breed[3]	CF_1R	MCX	CX	Grading up to HF	New breed[3]
				me, kg/d									
1	0	1	0.5	3.47[a]	2.92[b]	2.20[c]	2.91[a,b]	0.79[d]	5.09[a]	2.65[b]	3.09[c]	-0.52[d]	1.74[b]
1	1	1	0.5	3.65[a]	3.05[b]	2.35[c]	2.99[a,b]	0.89[d]	5.20[a]	2.74[b]	3.18[c]	-0.47[d]	1.82[b]
3	0	1	0.5	3.92[a]	3.17[b]	2.50[c]	2.90[b,c]	0.85[d]	5.56[a]	2.97[b]	3.44[c]	-0.38[d]	1.94[e]
3	3	1	0.5	4.47[a]	3.59[b]	2.95[c]	3.14[c]	1.16[e]	5.91[a]	3.24[b]	3.72[c]	-0.23[d]	2.16[e]
1	0	2	0.5	4.15[a]	3.58[b]	2.87[c]	3.52[a,b]	1.45[d]	5.88[a]	2.97[b]	3.83[c]	-1.10[d]	3.36[b,c]
1	1	2	0.5	4.34[a]	3.72[b]	3.02[c]	3.60[a,b]	1.55[d]	6.00[a]	3.06[b]	3.92[c]	-1.05[d]	3.43[b,c]
3	0	2	0.5	4.60[a]	3.83[b]	3.18[c]	3.52[b,c]	1.51[d]	6.35[a]	3.29[b]	4.18[c]	-0.96[d]	3.56[b,c]
3	3	2	0.5	5.15[a]	4.25[b]	3.62[c]	3.76[c]	1.82[d]	6.70[a]	3.56[b]	4.46[c]	-0.81[d]	3.78[b,c]

[1] 1 me = price of 1 kg quota base milk (3.3% fat).

[2] CF_1R = continuous F_1 heifer replacement. MCX = modified crisscrossing, of two generations of HF sires and one of Z sires. CX = crisscrossing,

[3] 5/8 HF x 3/8 Z *inter se*.

a,b,c,d. Within management level, means within row with different superscript significantly differed under Scheffé's test ($P < 0.05$).

were discussed in detail by Madalena *et al.* (1989b). The F_1 was more profitable in both management levels, but more markedly so in the LML. Under the present conditions of low fat price differential and non payment for protein, upgrading to HF and modified crisscrossing were the second best alternatives and equally profitable. However, under the two higher milk component prices, which would be fairer to farmers (Madalena, 1986), modified crisscrossing would be preferable and simple crisscrossing would reach a profitability similar to that of upgrading to HF. The relatively higher increase in profitability of crisscrossing systems, with increased component prices, was a consequence of the better milk quality of zebu crosses, and of the heterosis for fat content detected in the HML (Madalena *et al.*, 1989a).

Increasing the beef value of animals caused only negligible changes in the relative economic performance of breeding strategies in the HML, which might be expected because no differences were found between crossbred groups in cull cow prices or in mortality. In the LML, on the other hand, a higher HF fraction increased mortality and reduced cull cow prices, which resulted in higher losses by upgrading when the beef value of the animals was doubled. The superiority of simple over modified crisscrossing may be explained in the same way, because the latter would generate animals with a higher HF fraction and lower heterozygocity. The new breed strategy showed the largest increase in expected profitability, upon doubling beef value, in the LML, because the proportion of income due to cull cow sales in the 5/8 HF *inter se* animals representing this strategy was larger than in the other crossbred groups (Madalena *et al.*, 1989b).

Halving the cost of concentrates had similar effects on the profitability of all strategies, because differences between crossbred groups in terms of concentrate expenditure per kg milk produced were not large at either management level.

These changes may be better visualized in Figure 1, which illustrates the fact that the relative merits of the breeding strategies were not much altered by changes in the cost-price structure. Simple correlations within management class, of individual economic performance calculated by any two profit functions, ranged from 0.92 to 1.00. All correlations between the same profit functions calculated with different interest rates (3, 6 or 9% p.a.), were, for the four functions in Figure 1, higher than 0.99. Thus, relative profitability depended more on physical performance than on the economic parameters used to compare them.

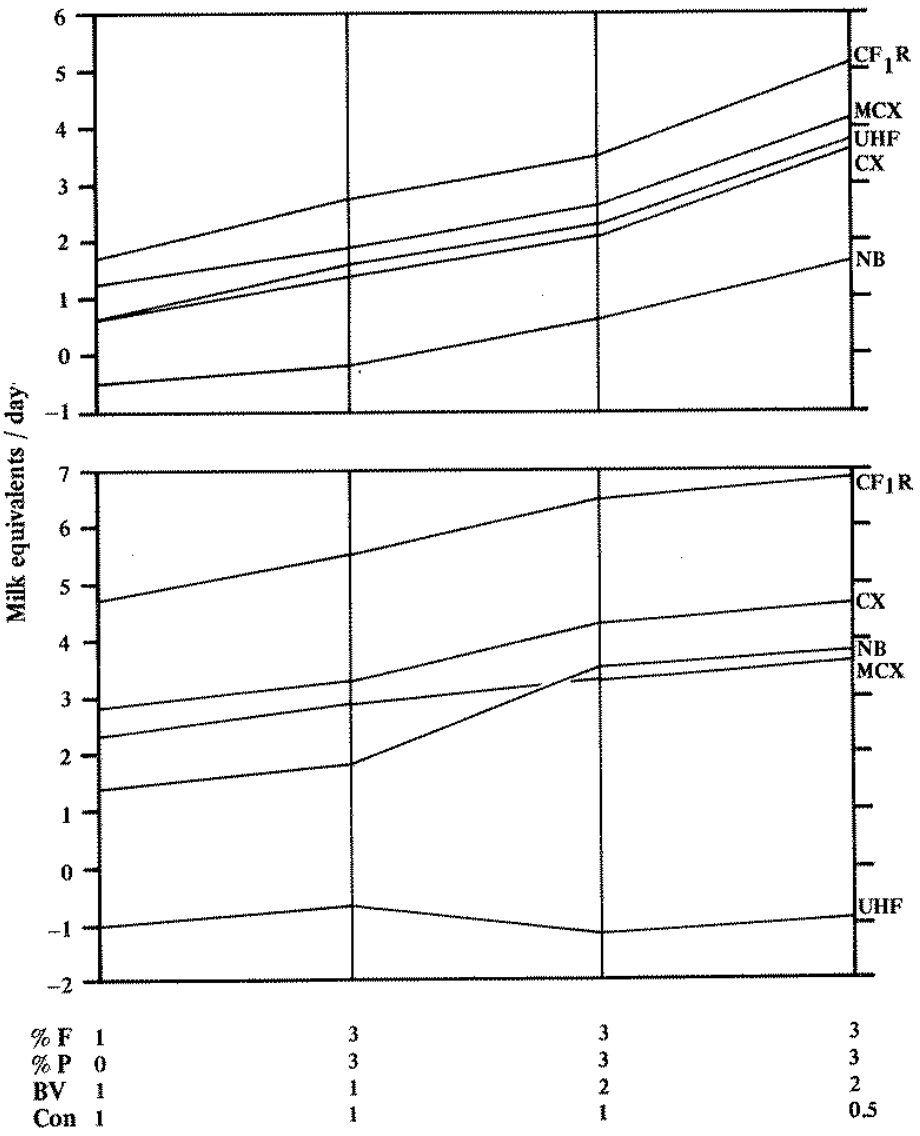

Figure 1 - Expected profit per day in herd, for different Holstein-Friesian (HF) x zebu (Z) cross-breeding strategies under four combinations of prices of: milk fat (%F), protein (%P), beef value of animals (BV) and concentrates (Con), expressed as multiples of 1980 to 1985 prices. CF_1R = continuous F_1 heifer replacement. CX = crisscrossing. MCX = modified crisscrossing (of two generations of HF sires and one of zebu sires. UHF = upgrading to HF. NB = new breed (5/8 HF x 3/8 Z *inter se*). HML, LML = high and low management levels.

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RESUMO

Estimou-se o lucro líquido por dia no rebanho decorrente do uso de cinco estratégias de cruzamentos de holandês x zebu, utilizando-se dados da produção leiteira acumulada de animais cruzados, obtida em dois níveis de manejo. Foram geradas 16 funções de lucro pelas combinações de dois níveis de preços de: gordura, proteína, valor para corte dos animais e concentrados. A estrutura de preços e custos teve pouca influência no mérito relativo das diferentes estratégias de cruzamentos.

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