HYBRID F_1 *Bos taurus x Bos indicus* DAIRY CATTLE PRODUCTION IN THE STATE OF MINAS GERAIS, BRAZIL

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SUMMARY

A survey of 291 dairy farms in Minas Gerais indicated that 89% of the cow population is hybrid *Bos taurus/B. indicus*. About half (47%) of the farmers wish to keep their herd intermediate between those species and 40% do not have a definite goal on this respect. Because most farms keep just one bull (72%) and use natural service (79%), rotational crossing is not feasible, so farmers resort to switching the sire species or to using hybrid sires, both of which generate undesirable genotypes. Thus, continuous F_1 replacements schemes are justified to capitalise on heterosis. Research results, shown graphically, indicate superior economic performance of F_1s in the prevailing production systems. Producers of F_1 females for sale were identified by the State extension agency. There were 267 producers, with more than 42,000 cows, which could supply replacements on the order of 1.5 % of the total needed for the 5 million milk cows in the State. A questionnaire answered by 68 F_1 producers indicated that 27% sell all F_1 females, 34% keep up to ½ of them for dairying and 39% keep more than ½. Prices of F_1 females were considerably higher than for other genotypes, indicating that buyers expect a higher profit from them. Almost all (99%) F_1 producers intend to continue this activity, mainly because of profitability and easy marketing of females.
Keywords: *Bos taurus, Bos indicus*, crossbreeding, dairy cattle, heterosis.

INTRODUCTION

Milk production in Minas Gerais was 4.5 million tons per year in 1992, with 5 million milk cows, corresponding to 29% of Brazil total production. Crossing of specialised breeds of *Bos taurus x Bos indicus* has been practised for more than 70 years in the tropical areas of the country, where a hybrid dairy herd completely replaced the 400-year long naturalised *B. taurus* Iberian breed Caracu. The methods followed by farmers to keep their cattle intermediate between both species have not been documented, although it is known that only a minority practise artificial insemination (IA) or controlled mating (CM) and most resort to switching the bull species or to using hybrid bulls. F_1 hybrids have been shown to excel in profit in the prevailing production systems (Madalena *et al* 1990b), due to important heterosis for most economic traits. Rotational crossing was the second best alternative and *inter se* crosses performed poorly. Moreover, there are presently no sources of genetically improved hybrid bulls. A simple scheme for sustainable production of F_1 heifers in specialised nucleus was then proposed (Madalena 1993), based on what some ranches were already doing. Recent surveys have quantified several aspects of crossbreeding practices. The objective of this paper is to present some of this new information and to discuss it in relation to the prospects for continuous F_1 replacement systems.

WHAT DO DAIRY FARMERS DO AND WISH TO DO?

A survey of 291 farms of one of the main dairy plants operating in the State indicated that most farmers have a hybrid herd and about half intend to keep it that way, while 40% have no defined goal (Table 1). About a half (47%) of those intending to keep the herd intermediate would be using just one purebred bull, implying switching the bull species, while 43% intended to use a hybrid bull. This was in agreement with the low usage of AI or CM. The survey points to the dilemma of tropical dairy cattle breeding: farmers wish to keep the herd hybrid, but have no satisfactory means for that purpose. Uncontrolled mating rules out rotational crossing. Single sire usage leads either to periodical switching of the bull species or to use of hybrid bulls, both generating undesirable genotypes Therefore, continuous replacement with F_1 heifers seems to offer a practical way to exploit heterosis in the context described..

Table 1. Characteristics of 291 dairy farms in Minas Gerais [A]

	%[B]		%[B]
Milk sold per farm, l/day	90.8	Only natural service, uncontrolled	79.4
Number of lactating cows	14.6	Farm keeps only one bull	71.6
Number of dry cows	10.1	In next 5 yr intends to keep herd:	
Once a day milking	78.3	Purebred *B. taurus*	12.4
Manual milking	98.6	Purebred *B. indicus*	1.4
Milking with stimulus of calf	94.8	Intermediate *B. taurus/B. indicus*	46.1
Hybrid[C] cows, % of total cows	89.1	Has no defined goal	40.0

[A] Source: Madalena et al 1997b.

[B] Percent of farms adopting practice, unless otherwise specified. [C] 1/32 to 31/32 *B. taurus*

SUPPORTING RESEARCH RESULTS

Research results support the farmers wish to keep their cattle intermediate as may be seen in Figure 1, where milk yield per day of calving interval (MY/CI), predicted from the individual additive-dominance regressions of several studies, is plotted against the nominal *B. taurus* gene proportion. F_1 outperformed the other grades in the lower (commonest) management levels. Performance would have to increase to a level of more than 10 kg/day of MY/CI before *B. indicus* crosses could be considered unnecessary. For Brazil this is a five-fold increase from the present national statistic of about 2 kg/day. Discrepancies in the slopes shown in Figure 1 may be due to several factors, including different editing out of short lactations and long CIs, which result in underestimation of heterosis (Madalena 1994) and different breeds represented within both species in the various studies.

Economic performance would be preferable to MY/CI in the context of this discussion, but results are scanty, although confirming F_1 superiority (Teodoro *et al* 1996). Inclusion of survival, age at first calving, herd life and other economic traits in a profit evaluation increased the superiority of the F_1 in the Brazilian results, as heterosis effects accumulated, particularly in the lower management (Lemos *et al* 1996, Madalena *et al* 1990b).

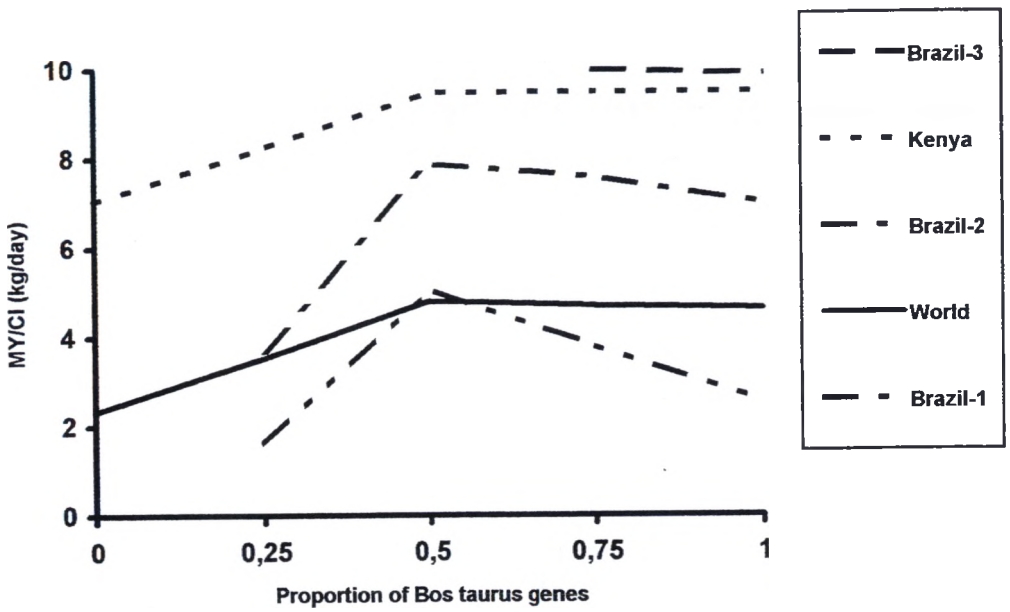

Figure 1. Milk yield per day of calving interval (MY/CI) of *Bos taurus/B. indicus* hybrids (by purebred sires) in different tropical countries/management. Sources: Kenya (Mackinnon *et al* 1996), Brazil 1 and 2 (Madalena *et al* 1990a), Brazil-3, (Madalena *et al* 1983), World, (Cunningham and Syrstad 1987).

PRODUCTION AND MARKETING OF F_1 REPLACEMENTS

The State extension agency (EMATER-MG) was requested to identify those farmers producing dairy F_1 hybrids for sale. Answers from 75% of the extension units, identified 267 F_1 producers with more than 42,000 cows, which under conservative assumptions could supply some 1.5% of the replacement females for the whole State (Silvestre *et al* 1996). A questionnaire was then mailed (in 1996) to those farmers, to which 68 replied. A range of farm types was apparent in this sample, from large ranches selling all the F_1 females and keeping most F_1 males for fattening or otherwise, to smaller herds keeping most F_1 females for darying and selling a large proportion of males as weaners (Table 2).

Half of the F_1 producing farms were located in beef cattle regions and sold females to the dairy regions. Average length of time in this activity was 13 years. The 68 farms had a total of 15.977 *B. indicus* cows, 62% of which were mated to produce F_1 and 38% to obtain *B. indicus* replacements; Gir type cows predominated (62% and 43% , respectively). Sires used for crossing were mostly Holstein-Friesian (87%). Frequencies of farms using AI, natural service or both for crossing, were, respectively, 55, 28 and 17%. Prices of F_1 females were US$ 372 for weaners, US$ 809 for pregnant heifers and US$ 939 for cows, which are considerably higher than prices of other crosses, indicating that buyers expect a higher profit from the F_1, in agreement with research results (Teodoro *et al* 1966). Almost all (99%)

F_1 producers intended to continue this activity, indicating as the main reasons profitability, easy marketing, milk yield and satisfactory growth/fattening of males (Madalena *et al* 1997a).

Table 2. Characteristics of 68 farms producing F_1 hybrids for sale in Minas Gerais^A

	Proportion of F_1 kept at farm for dairying		
	None	Up to 50%	More than 50%
Frequency, % of farms	27	34	39
Average cow numbers: for F_1 production	412	130	76
for zebu replacements	157	98	87
Distribution of F_1 males sold (%)			
As weaners	19	18	42
For fattening/slaughter/ bulls	71	82	58

^A Source: Madalena *et al* (1997a)

CONCLUDING REMARKS

Well designed tropical dairy production systems are profitable, in spite of some claims to the contrary. A demonstration hybrid herd at the Nat'l. Dairy Res. Ctre. in Minas Gerais obtained 14% return over capital invested, over a 17-year period (Stock *et al* 1995). Recommendations should be based on research results in tropical countries, which clearly show the economic basis of continuous F_1 replacement schemes. The surveys reported herein suggest that farmers in Minas Gerais are beginning to implement such schemes, favoured by the lack of feasible alternatives of crossbreeding. Given the large *B. indicus* population, AI is currently the method of choice, but embryo transfer might become preferable (Teodoro *et al* 1996). A word of warning should be issued on extending experimental results to all *B. indicus* breeds and to the reciprocal cross on *B. taurus* dams. Further research is needed on these topics.

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