EVALUATION OF BREEDING STRATEGIES IN A CROSSBRED DAIRY CATTLE HERD RAISED ON A MEDIUM-INPUT PRODUCTION SYSTEM IN BRAZIL

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INTRODUCTION

In the Southeast region of Brazil (states of Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo) most of the dairy cattle herds are composed of crossbred cows. Crossbreeding between *Bos taurus* (Holstein, Jersey, Brown Swiss, etc.) and *Bos indicus* (Gir, Guzerá, Nelore, Tabapuã, etc.) breeds is a common practice. In general, there is the production of a great proportion of progenies with less than 50% of genes from specialized *Bos taurus* dairy cattle breeds and, consequently, of lower production potential, because producers do not utilize a well defined crossbreeding system (Madalena, 1989), and also because changes in the proportion of milk to beef prices stimulate milk producers to use beef cattle bulls on the crossbred cows, specially when that proportion is lower than 15% (Barbosa, 2001).

Breeding strategies for dairy cattle in the southeast region of Brazil were compared in a trial initiated in 1975 by Embrapa dairy Cattle with assistance from FAO and the United Nations Development Program (UNDP). Some results were reported by Madalena et al. (1990a,b) concluding that, if the low level of management is considered to be the prevailing situation, the ranking of the breeding strategies was: 1) production of F_1 Holstein (H) x Zebu (Z); 2) criss-crossing or H-Z rotation; 3) developing a new breed (5/8 H + 3/8 Z); and 4) upgrading to H. Based on these results, Madalena (1993) proposed a scheme to utilize heterosis in tropical dairy cattle (the F_1 replacement scheme – F_1R).

From 1977 to 1992, another trial was carried out by Embrapa Dairy Cattle and Embrapa Southeast Cattle with the objective of progeny testing crossbred bulls (1/2 to 7/8 of genes from specialized dairy breeds) for milk production (Madalena, 1989). Some results were reported by Valente et al. (1982). This breeding strategy could help to overcome the inferiority of the development of a new breed, as compared to the production of F_1 and H-Z rotations, and also would facilitate management because, once the new breed is developed and strongly selected, no special matings would be required avoiding the production of animals with a great variation in genetic make-up, as pointed-out above.

The objective of this paper is to present the trends that occurred in milk yield, lactation length, calving interval, dry period and milk yield per day of calving interval, after 22 years (1978-1999) of using on-test or progeny tested Brazilian Dairy Crossbred bulls (a composite of 1/2 to 7/8 of genes from specialized *Bos taurus* dairy breeds and the complement of genes from *Bos indicus* breeds) in a crossbred dairy cattle herd raised on a medium-input milk production system in the southeast region of Brazil.

MATERIAL AND METHODS

A medium-input milk production system (pasture grazing year-round plus silage or sugarcane during the dry season for all animals and a low level of concentrate feed supplementation for lactating cows) has been maintained and recorded for production and reproduction traits at Embrapa Southeast Cattle, São Carlos, São Paulo state, since September of 1977. Herd management and feeding practices remained almost the same thoughout the period from 1978 to 1999.

The herd is composed mainly of crossbred animals (1/4 to 7/8 of genes from specialized dairy breeds) and some high-grade, non-registered, Holstein cows. Up to 1979, females in reproduction were mated to Holstein, Jersey, Canchim (a beef composite of 5/8 Charolais + 3/8 Zebu) and Zebu bulls, without following a defined breeding strategy. From 1980 and thereafter, the females were mated to either on-test or progeny tested for milk yield Brazilian Dairy Crossbred bulls (a composite of 1/2 to 7/8 of genes from specialized *Bos taurus* dairy breeds) through artificial insemination. Matings were planned with the objective of obtaining replacement females with approximately 3/4 of genes from specialized *Bos taurus* dairy breeds and 1/4 of genes from *Bos indicus* breeds. The replacement females from the first generation had their productive life initiated in 1985; therefore, two periods can be considered for evaluating the breeding strategy: 1) 1978-1984 (traditional scheme) and 2) 1985-1999 (use of on-test or progeny tested crossbred bulls). Lactating cows were milked mechanically twice a day, with calf at foot. The criteria for drying-off were: 1) drying-off to rest before next calving: up to 75 days before the next calving; 2) low production: less than 5 kg of milk/day; and 3) other reasons: cow death, calf death, cow sale, cow calved but did not milk at all, mastitis, etc.

Data collected from 1978 to 1999 on milk yield and lactation length (N = 1464) and on calving interval, dry period and milk yield per day of calving interval (N = 990) were analyzed by the least-squares method using the GLM procedure of the Statistical Analysis System (SAS, 1996). The mathematical model included the fixed effects of year of calving (1978 to 1999), season of calving (Summer = January-March; Fall = April-June; Winter = July-September; Spring = October-December), calving order (1 to 5), genetic group (1/4, 1/2, 5/8, 3/4, 7/8 and high-grade Holstein), sex of calf (male, female), cause of drying-off (pre-calving, low production, others) and the random effect of sire.

RESULTS AND DISCUSSION

There were significant effects of year of calving on all traits analysed. The least-squares means for milk yield, lactation length, calving interval, dry period and milk yield per day of calving interval are given in Table 1, according to year of calving.

Significant improvements in milk yield, calving interval, dry period and milk yield per day of calving interval occurred after 1985 when replacement females obtained from using the new breeding strategy initiated their productive life in the herd (Table 1). Similar results for the Australian Milking Zebu (AMZ), submitted to a breeding program through progeny test of AMZ bulls from 1965 to 1979, were reported by Franklin (1982).

However, lactation length did not have a significant improvement, with the exception of two years of calving (1985 and 1986). Short lactations have been recognized to be a major problem in tropical dairy cattle for a long time (Rhoad, 1935), even when cows are milked with the calf at foot (Madalena, 1988; 1989). Franklin (1982) reported a significant gain for lactation length of Australian Milking Zebu cows mated to progeny tested bulls from 1965 to 1979.

Table 1. Least-squares means for milk yield (MY), lactation length (LL), calving interval (CI), dry period (DP) and milk yield per day of calving interval (MY/CI), according to year of calving

Year of calving	MY (kg)	LL (days)	CI (days)	DP (days)	MY/CI (kg/d)
1978	1808	231	493	266	3.44
1979	1867	218	464	257	3.80
1980	1842	210	442	250	3.81
1981	1937	235	449	221	4.21
1982	1940	224	450	237	4.16
1983	2103	237	477	249	4.27
1984	2035	248	470	208	4.70
1985	2573	283	438	168	5.74
1986	2826	292	423	153	6.13
1987	2615	240	359	144	6.52
1988	2701	233	442	211	6.84
1989	2774	250	394	147	6.91
1990	2889	239	382	154	7.10
1991	2416	217	384	171	6.28
1992	2835	252	416	169	6.77
1993	2744	219	401	186	6.91
1994	2796	237	404	173	6.78
1995	2545	222	414	190	6.63
1996	2521	234	424	164	6.21
1997	2857	244	455	221	5.91
1998	2663	241	465	222	5.69
1999	3330	251	378	152	7.94

The means calculated for the two breeding strategies are shown in Table 2. The most important gains were obtained for milk yield per day of calving interval, milk yield and dry period. Lactation length was the trait with the lowest trend between the breeding strategies and calving interval had a medium trend. Since milk yield per day of calving interval is a compound trait that measures milk production efficiency, it can be observed (Table 2) that the most important trends between breeding strategies came from an increase in milk yield and a reduction in the dry period of the crossbred cows.

The results obtained for milk yield, dry period and milk yield per day of calving interval show that it is possible to use a breeding strategy that maintains a good combination of *Bos taurus* specialized dairy breeds and *Bos indicus* (Zebu) breeds germplasm in tropical conditions.

There is also an indication that lactation length should be included as a selection criterion in the progeny test breeding programs of dairy crossbred bulls in tropical regions.

Table 2. Means for milk yield (MY), lactation length (LL), calving interval (CI), dry period (DP) and milk yield per day of calving interval (MY/CI), according to breeding strategy (T = traditional criss-crossing *Bos taurus* x *Bos indicus*; N = use fo selected and progeny tested crossbred *Bos taurus* x *Bos indicus* bulls)

Breeding strategy	MY (kg)	LL (days)	CI (days)	DP (days)	MY/CI (kg/d)
T (1978-1984)	1933	229	464	241	4,06
N (1985-1999)	2739	244	412	175	6,56
T – N, %	**41.7**	**6.6**	**12.6**	**37.7**	**61.6**

CONCLUSION

The results obtained in this study demonstrate that it is possible to have significant gains for milk yield (41.7%), dry period (37.7%) and milk yield per day of calving interval (61.6%) in crossbred *Bos taurus* x *Bos indicus* dairy herds through the continuous use of selected and progeny tested crossbred bulls for milk production. The use of unselected, not progeny tested crossbred *Bos taurus* dairy breeds x *Bos indicus* (Zebu) bulls is not warranted, because knowing their pedigree will not make them any better. The results also indicate that lactation length is a trait that should be included as a major selection criterion in progeny test breeding programs for improving milk production in tropical regions.

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