

EVALUATION OF CROSSES OF HOLSTEIN, JERSEY OR BROWN SWISS SIRES X HOLSTEIN-FRIESIAN/GIR DAMS FOR FEMALE LIVEWEIGHTS

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INTRODUCTION

Cow liveweight has a strongly negative economic weight on farm profit because a high proportion of feed in dairy herds is required for maintenance (Vercesi Filho *et al.*, 2000). Crossbreeding *Bos taurus* and *Bos indicus* is a generalised practice in Brazil (Madalena, 1998). Although Holstein and Gir are the most popular breeds, Jersey and Brown Swiss are also locally available and a trial was set up to find out whether crossing with Jersey or Brown Swiss could further improve performance over the HF/Gir crosses. This paper reports on the female liveweights of that trial.

MATERIALS AND METHODS

Animals and Management. A total of 2937 liveweights of 100 females were used in this study. These animals were the progeny of Holstein-Friesian/Gir females of 1/2, 5/8 and 3/4 HF fractions, randomly assigned to H (14), J (9) or BS (9) sires. The experimental animals were kept at the same farm, where they were managed together, in a single herd. The farm where the trial was conducted is located in a hilly region at altitudes between 200 and 400 m over sea level. The climate corresponds to Cwa of Koeppen's classification (mild, dry winter, hot summer), with one dry season extending from April to September. Experimental calves were artificially reared on four liters of whole milk/day up to four mo of age and kept in *Cynodon dactylon* (L.) paddocks up to 6 mo., being fed up to two kg/head/day of an 18 % crude protein ration plus chopped elephant grass (*Penisetum purpureum*, Schumach). Heifers were kept in natural pastures of predominantly *Melinis minutiflora* (P. Beauv.), supplemented with chopped elephant grass plus concentrates in the dry season. Cows were kept in pastures of predominantly *Brachiaria decumbens* (Stapf.) and napier elephant grass. Maize and sorghum silage were fed to cows in the dry season. Lactating cows were fed a commercial ration (16 to 22 % crude protein). Parasite burdens were kept very low. All animals were routinely weighted in January, April, July and October each year in the period September 1977 to October 1993.

Analysis. The data were separately analysed for four categories : 1) heifer calves up to six mo of age, 2) heifers six to 18 mo-old, 3) heifers older than 18 mo and 4) cows. Numbers of records and ages in each group are shown in table 1. Observations were grouped in quarterly seasons of weighting, five classes of pregnancy status (≤ 94 , 95 to 188, > 188 d pregnant, non-pregnant and unknown, for cows culled) and four classes of days in milk (≤ 120 , 121 to 240, >240 and dry).

Table 1. Ages and numbers of records in female categories

Category	Animals	Age, mo			Records per animal			
		Min.	Max.	Average	Min.	Max.	Average	Total
Calves	84	0	6	3.6	1	5	2.2	187
Young heifers	98	7	18	11.7	1	9	4.1	404
Older heifers	87	19	41	27.1	1	8	5.5	477
Cows	75	28	185	86.3	1	49	24.9	1869

Least-squares analyses were performed using Proc GLM of the SAS (1995) package. The models for cows and older-than-18-mo heifers included the fixed effects of breed of sire, *Bos taurus* fraction, season of weighting, days in milk class (for cows only), pregnancy status class, yearly age class and the random effect of animal nested within breed of sire x *B. taurus* fraction sub-classes. F-tests were constructed from the expected mean squares for breed of sire and *Bos taurus* fraction effects (Scheffé, 1959). Repeatability for each trait was estimated.

RESULTS

ANOVAs for each category are in table 2. Breed of sire significantly affected weight of cows but not of heifers and the effect of *B. taurus* fraction was not significant in any category. Season effects were not significant for calves and older heifers but affected weights of cows and younger heifers. Pregnancy and lactation status also influenced the cow weights. Repeatability was high in all categories, particularly in cows.

Table 2. ANOVA results for liveweights of females

	Calves ≤ 6 mo-old		Heifers 1 yr-old		Heifers 2 and 3 yr-old		Cows	
	d.f.	F-values	d.f.	F-values	d.f.	F-values	d.f.	F-values
Breed of sire	2	0.59 ^{ns}	2	1.24 ^{ns}	2	1.54 ^{ns}	2	10.66 ^{**}
<i>B. taurus</i> fraction	2	3.04 ^{ns}	2	2.31 ^{ns}	2	0.63 ^{ns}	2	0.97 ^{ns}
Season	3	0.27 ^{ns}	3	10.75 ^{***}	3	1.66 ^{ns}	3	20.72 ^{***}
Age/breed of sire	3 ^a	179.35 ^{***}	3 ^a	521.63 ^{***}	3 ^b	65.38 ^{***}	34 ^b	59.11 ^{***}
Gestation status	-	-	-	-	3	79.05 ^{ns}	4	39.66 ^{***}
Days in milk class	-	-	-	-	-	-	3	31.48 ^{***}
Animal/ SxF	79	4.84 ^{***}	93	7.26 ^{***}	82	7.25 ^{***}	70	85.16 ^{***}
Error	97		300		381		1292	-
R ²		0.95		0.90		0.84		0.89
C.V.		10.46		9.70		9.95		4.87
Error s.d., kg ^c		8.33		15.41		31.42		21.81
Repeatability		0.64		0.61		0.54		0.78

^{ns}P>0.05, ^{**}P<0.01, ^{***}P<0.0001, ^a Regressions on age, ^byear classes, ^cStandard deviation

The liveweight LSM for breeds of sire are presented in table 3. BS sired cows showed higher average liveweight than H sired cows, which in turn were heavier than J sired group.

Table 3. Liveweight least-squares means (LSM) and standard errors (se) for breeds of sire at selected ages

Categories	Breed of sire					
	Holstein		Jersey		Brown Swiss	
	LSM	se	LSM	se	LSM	se
	kg					
Cows, average	464.1	2.8	413.4	1.6	478.3	1.7
3 yr-old heifers	379.9	5.1	369.2	8.2	389.7	4.1
2 yr-old heifers	326.5	4.3	303.2	3.7	318.5	4.1
1 yr-old heifers	167.6	1.8	159.2	1.5	154.9	1.4
≤ 6 mo-old calves	88.3	1.3	76.7	1.4	74.8	1.2

The interaction between breed of sire and age was highly significant in cows ($P < 0.0001$), indicating that growth curves were different for breeds of sire. The cubic regressions of liveweight least-squares means on age were the highest significant terms in all three breeds of sire ($P < 0.05$). The regression coefficients are shown in table 4 and the predicted growth curves are in figure 1. These regressions accounted for almost all the variation in the least-squares means in all three breeds of sire groups ($R^2 \geq 0.98$).

Table 4. Regression coefficients of cow liveweight least-squares means on age and standard errors (se) for three breeds of sire

	Breed of sire					
	Holstein		Jersey		Brown Swiss	
	LSM	se	LSM	se	LSM	Se
	kg/yr					
Intercept	212.0856	15.9970	247.2888	15.9510	240.4849	17.7812
Linear	86.7783	7.2746	49.8277	7.2303	72.8995	7.68193
Quadratic	-8.7064	0.9978	-4.1256	0.9841	-6.6937	1.0176
Cubic	0.2692	0.0421	0.1054	0.0410	0.1979	0.0419

DISCUSSION

Description of traits up to advanced ages is important in Brazil because hybrid *B. taurus/B. indicus* cows show long herd lives which coincides with recommendations on economically optimum culling age (Cardoso *et al.*, 1998). The growth curves of cows in this study were different for the three breeds of sire, with maxima at 7.8, 9.5 and 9.2 yr in H, J and BS, respectively. Inspection of figure 1 shows that the cubic regression was due to a slight increase in weight of the oldest cows. The cubic term was not significant, i.e. regressions on age were quadratic, when data of animals older than 11 yr were discarded in the H and J sired groups and above 10 yr in the BS sired group. Several reports indicated that Holstein or Friesian x *B. indicus* heifers were heavier than BS crosses and these heavier than J crosses at various ages (Khanna *et al.*, 1981 ; Kumar *et al.*, 1990 ; Chaudhry *et al.*, 1993).

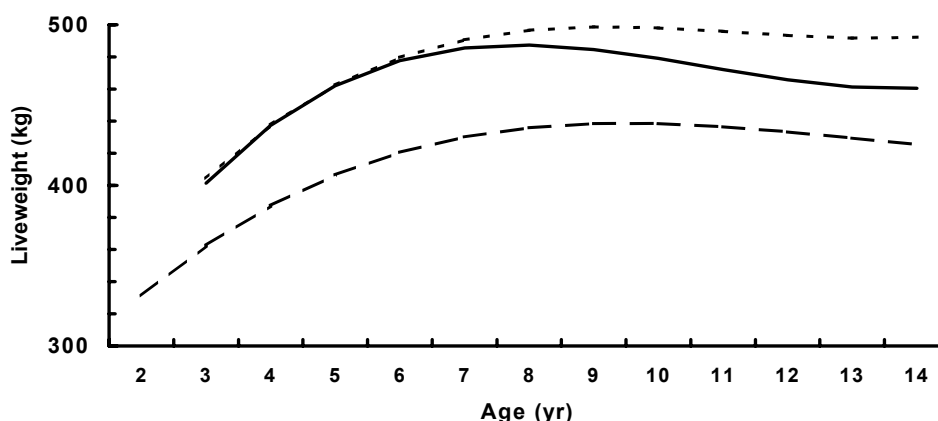


Figure 1. Growth curves of cows of three sire breeds :

----- Brown Swiss, _____ Holstein, - . - . Jersey.

Contrary to those reports, the slower initial growth of BS sired females found in the present results was also reported by Katpatal (1983), who presented combined means of five data sets of H, J and BS F₁ crosses with local Indian breeds. At age 12 mo the respective means were 181, 156 and 157 kg and at 24 mo, 289, 259 and 275 kg. In three breed crosses, J sired heifers out of Friesian x local *B. indicus* F₁s were heavier than BS sired heifers at 12 mo (182 and 174 kg, respectively) but not at 24 mo (253 and 271 kg). Khanna *et al.*, (1981) reported that BS x F₁ Friesian x Haryana were heavier than Jersey x (Friesian x Haryana) at six and 18 mo of age. Thus, although the present results agree with the literature on H crosses being the heaviest and J crosses the lightest, there are discrepancies on the growth pattern on the BS sired young females.

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