May 1975

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Reproductive Efficiency of Jerseys, Red Sindhis, and Crossbreds[1]

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ABSTRACT

Ten measures related to breeding efficiency were used for comparisons among pure Jerseys and Red Sindhis and crossbreds with ¾, ½, or ¼ European dairy inheritance (Brown Swiss, Holstein, or Jersey) at two locations. Jerseys and crossbreds were common to both herds with Sindhis only at Jeanerette. Means for age at puberty (first estrus after 12 mo) were 425 ± 4.2, 434 ± 6.9, 459 ± 6.9, 504 ± 14.1, and 717 ± 40.4 days for Jerseys, crosses of ¾, ½, or ¼ and Sindhi. The increase in age of puberty was additive but not entirely. The ¾ and ½ tended to excel parent breeds in rebreeding less than 145 days postpartum, but by 200 days percentages of conception were similar. Average heterosis in percent was 18.4 for age at puberty, .04 days from calving to first heat, 9.6 days first breeding to conception, 8.5 days open, 4.3 calving interval, and 1.9 in services for conception. The average for the latter five measures was 4.9%. Significant effects of breed and location in several cases may have been due to sampling variance. Percentages of nonbreeding heifers were similar for Jerseys and ¾ or ½ crosses (8.0%) but high in ¼ crosses (15.4%). Fewer crosses completed two gestations. Both in first and later parities, crosses, particularly ¼, had higher frequencies of reproductive disorders than Jerseys (6.8 versus 4.2). Crosses also had higher frequencies of dystocia or abortions than Jerseys. Percentages of lactations terminated for health, sterility, or death were similar among breed groups. The ¾ and ½ crosses averaged about 17 days shorter in calving interval, but the calving interval required for the ¾ to equal Jerseys in milk yield should have been 15 to 29 days shorter than observed. The ½ crosses would need intervals less than 285 days to be as productive as Jerseys.

INTRODUCTION

Crosses among European beef breeds resulted in 5 to 13% heterosis for calving percentage per year with the higher values reported from areas of poorer environmental conditions (9). When one of the parents was Zebu, the heterosis ranged from 4 to 14% higher than for crosses among European breeds (11, 18).

The average heterosis in breeding efficiency from crossing two or more dairy breeds ranged from 2 to 5% (1, 5, 14, 17). However, there has been considerable variation depending on the measures, e.g., −1% for services per conception (14) to 10% for days open (5), or 11% for days from calving to first estrus (14).

In India, first generation crosses by Brown Swiss, Holstein, or Jersey sires markedly have excelled native types in age at puberty and age at first calving, with some reduction in calving interval and services per conception (2, 7, 15, 19, 20, 21). Heterosis could not be estimated since females of both parents were not present, but the magnitude of the regression coefficients for F_1 and backcrosses indicate heterosis may be higher than for dairy crosses in the U. S.

Within *Bos indicus* or *Bos taurus*, differences among breeds in breeding efficiency appear small. Nevertheless, Jerseys seem superior to other European breeds (E), both in temperate and subtropical areas (4, 6, 12, 14, 22). Among the >25 recognized breeds of *Bos indicus* in

Received May 29, 1975.

[1] This work was part of the Southern Regional Dairy Cattle Breeding Project, S-49 (Genetic Methods of Improving Dairy Cattle for the South).

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India, the Sindhi is well above average in breeding efficiency of females (20, 21). It is generally accepted that *Bos taurus* of the temperate regions reach puberty earlier and exhibit estrus sooner after parturition than *Bos indicus*, but both types are similar in services per conception (10, 13). These observations are based largely on performance where parental types were in different herds.

The purpose of this study was to evaluate the breeding efficiency of Red Sindhi and its crosses in comparison to Jerseys under good conditions of feeding and management.

MATERIALS AND METHODS

Source of Data

Breeding records were from two herds, Beltsville, MD, and Jeanerette, LA, where investigations were on the possible use of crosses with Red Sindhi breeding for improving traits important in dairying. The breeding plan in the two herds was reported earlier (3, 8). There were 736 parities for 246 purebred Jerseys or Sindhis and 865 parities for 315 crosses (Table 1). The ¾ E group consisted of: ¾ Jersey × ¼ Sindhi crosses (J × SJ) produced from mating F_1 cows to Jersey sires or the reciprocals; ¾ Holstein × ¼ Sindhi crosses (H × SH), which were all backcrosses of F_1 cows to Holstein sires; and 3-breed crosses from mating Brown Swiss or Holstein sires to F_1 Sindhi × Jersey females. The ½ E group was made up of F_1 crosses by mating Sindhi sires to Jersey or Holstein cows and F_2 crosses—inter se mating of F_1 Jersey crosses. The ¼ E crosses were all from backcrossing Sindhi sires to F_1 (S × J) cows.

Breeding Schedule

Estrus recording commenced at 12 mo of age and continued as long as the females remained in the herds. Heifers without estrus by 14 mo were palpated to distinguish between inactive ovaries and silent heats. Reproductive tracts also were palpated for abnormalities prior to each expected breeding. Heifers were bred at the first estrus following 15 mo at Beltsville and 17 mo at Jeanerette irrespective of size. Breeding continued at each observed estrus until conception or until the heifers reached 24 mo at Beltsville and 26 mo at Jeanerette.

Lactating cows were bred at the first estrus following 60 days postpartum. Those open

TABLE 1. Numbers of cows, records, sires, and daughters per sire for various groups.

Breed group	Jeanerette		Beltsville		No. sires	
	Cows	Parities	Cows	Parities	w/daughters	for breeding
			Purebreds			
Jer (J)	60	247	182	470	20	32
Sind (S)	4	19	...	...	3	6
			¾ E Crosses			
J × SJ	24	66	26	45	14	17
H × SH[a]	...	...	13	21	8	16
H × SJ	33	137	...	...	15	28
B[b] × SJ	10	37	...	...	6	19
			½ E Crosses			
S × J (F_1)	58	235	54	144	5	37
S × J (F_2)	12	33	5	5	5	7
S × H	2	5	14	24	3	11
			¼ E Crosses			
S × SJ	24	55	40	58	5	13

[a]H; Holstein.

[b]B; Brown Swiss.

after 300 days were culled. Within breeding periods, each female was bred for up to three services to one sire with subsequent services to alternate sires. All females that would rebreed were allowed to complete at least two gestations irrespective of milk yield. Culling for low production commenced about 150 days into the second lactation.

Most of the services were by AI (artificial insemination) with liquid or frozen semen, except in the case of some Sindhi bulls which would not work with AI. Sindhi sires were those imported from India and their descendents. Crossbred sires were largely from the Beltsville herd while Brown Swiss, Holsteins, and Jerseys were from a number of AI studs. The disparity in number of daughters per sire in some groups was more than desired (Table 1) but could not be avoided because of limitations in Sindhi sires or linebreeding programs in the Jersey herds.

Feeding

Heifers were fed for rapid development on rations of concentrates plus forages. During lactation, concentrates were allocated according to milk yield, fat content, and body weight. At Jeanerette, pastures were used as the main source of forages for 300 days or more per year. When grazing was inadequate, grass or sorghum silage and clover hay were used. At Beltsville, all groups were fed in the barn with corn or grass-alfalfa silage, plus hay and concentrates. Feeding was somewhat higher at Beltsville, 100 to 115% of Morrison's Feeding Standards while at Jeanerette it was 90 to 100% of the same standards (16).

Measures of Reproductive Performance

Measures of reproductive performance were: age at puberty, determined as the first estrus observed following 12 mo of age; number of

TABLE 2. Means and standard errors (days) for age at puberty and several measures of breeding efficiency by parity grouping across herds and herds across parities.

Breed group	Age puberty	Calving 1st heat	1st breeding to conception	Days open	Calving interval	Serv/ concep.
			Parity I			
Jer	425 ± 4.2	42 ± 3.2	28 ± 3.2	150 ± 5.8	431 ± 6.4	1.8 ±.12
¾ E	434 6.9	45 4.6	32 5.6	119 7.4	398 8.9	1.8 .19
½ E	459 6.9	42 3.6	26 3.4	135 6.1	418 6.1	1.8 .12
¼ E	504 14.1	49 8.2	25 6.0	126 9.4	406 9.8	1.7 .22
Sind	717 40.4	53 2.7	19 7.1	124 5.3	418 3.4	1.8 .25
			Later Parities			
Jer		43 2.3	27 2.1	131 4.6	410 4.8	1.7 .08
¾ E		51 2.9	32 3.7	118 5.2	399 6.2	1.9 .13
½ E		54 3.8	20 2.1	122 4.2	404 4.7	1.6 .09
¼ E		65 10.7	27 5.4	137 16.3	425 19.9	1.9 .24
Sind		71 7.4	43 7.1	147 7.6	439 9.7	1.7 .23
			Jeanerette			
Jer	491 10.9	47 2.3	29 3.4	125 4.0	405 4.3	1.7 .08
¾ E	461 8.3	50 2.4	33 3.5	119 4.2	399 5.0	1.9 .09
½ E	508 9.8	49 2.4	17 2.1	121 3.1	400 3.2	1.4 .05
¼ E	563 23.0	60 7.7	18 4.6	132 7.6	416 9.8	1.4 .10
Sind	717 40.4	61 6.2	33 6.9	141 8.9	433 8.8	1.8 .24
			Beltsville			
Jer	402 2.0	40 1.6	27 2.1	145 3.4	424 3.7	1.7 .06
¾ E	392 7.9	40 3.8	27 6.2	112 6.1	395 7.0	1.8 .18
½ E	408 4.2	50 3.4	30 3.2	141 4.3	428 4.9	1.9 .10
¼ E	461 13.2	50 6.6	34 6.5	128 10.2	412 10.5	2.3 .25

days from calving to first observed estrus; days from first breeding to conception; time open after parturition to 300 days; calving interval; number of services per conception; and proportion pregnant prior to 90, 120, 145, and 200 days postpartum. Two parity classifications were used. Parity one consisted of events occurring prior to or during first lactation. Later parities covered events in all other lactations.

Frequency of reproductive disorders or calving problems and lactations terminated because of problems of health, physical injury, sterility, and death were studied also.

Methods of Analysis

Two models for analysis of variance were used. In one, the main effects were breed group and location and in the second, parity and breed group. All effects were cross-classified and fixed in both models. Pure Sindhis were excluded because of small numbers. The final model included only three groupings of crossbreds following tests for differences among the groups in the ¾ E and ½ E classifications (Table 1). Age, season, year, and sire were not included in the models. Age was related to parity groupings. With breeding schedules based on age or a fixed postpartum interval, service periods and calvings were randomly distributed over seasons. Years were ignored due to confounding with type of cross. Breed of sire was also ignored because of confounding with type of mating and year within breed group. No interaction between breed of sire and breed of cow was assumed. The number of sires with progeny per breed group and those used for service are in Table 1.

RESULTS AND DISCUSSION

Age at Puberty

The means for age at puberty (Table 2) did not reflect the actual first estrus for Jerseys or ¾ E and ½ E crosses as most all had one or more estrus prior to 12 mo. The means do represent the first observed estrus for most of the ¼ E crosses and all pure Sindhis. The objective was to determine if late sexual maturity would delay breeding for first parturition beyond 26 mo. The means for age at first parturition were: 26.8 ± 7.1, 27.9 ± 10.0, 27.5 ± 6.9, 28.0 ± 14.6, and 36.7 ± 7.9 mo for Jerseys, ¾ E, ½ E, ¼ E, and Sindhis. Time of sexual maturity caused serious delay in the expected calving time for pure Sindhis but not in the crosses, even though the ¼ E had a reduced frequency of estrus prior to scheduled breeding.

The difference in age at puberty between Jerseys and Sindhis was nearly 300 days (Table 2). Even though the value for Sindhis was high, it was 100 to 200 days less than generally reported for the breed (19, 20, 21). In India, the onset of estrus for Sindhis was reduced from 795 to 726 days by improved feeding (13). However, the magnitude of the standard error in Table 2 suggests the variance may be sufficient to warrant selection for earlier puberty. Although there was a rise in age at puberty with increasing Sindhi inheritance, it was not entirely additive. Nevertheless, breed effects were significant (Table 3) and within herd accounted for 15 to 20% of the total variance (R^2). Location effects were also significant, but the interaction of breed and location was nonsignificant. The values for Jerseys and crosses were 70 to 100 days less at Beltsville than Jeanerette, indicating all groups responded to the higher feeding at Beltsville. If the pure Sindhis had reacted likewise to the environment, the differences between the two pure breeds in time of puberty would have remained greater than expected by chance.

Measures of Breeding Efficiency

In both parity groupings, there was indication of an additive relation to proportion of Sindhi in time of first postpartum estrus, but this trend was not readily evident in the other four measures (Table 2) even though breed effects were significant for days open and calving interval in Parity 1 and for first breeding to conception and services per conception at Jeanerette (Table 3). Locations were significant for age at puberty and services per conception in Parity 1 and services per conception in later parities. Interactions were significant for first breeding to conception and services per conception in later parities. The magnitude of the standard errors of the means (Table 2) and the inconsistency for significance between parity groupings across herds and breeds within herd indicate that sampling variance was important

TABLE 3. F-values and tests of significance for various measures of reproductive performance by parity and location.

Source	d.f.	Age puberty	Calving to 1st heat	1st breeding to conception	Days open	Calving interval	Serv/ concep.
			Parity 1				
Breed (B)	3	34.22**	.75	.86	3.20*	2.69*	.44
Location (L)	1	20.48**	.04	2.61	1.56	3.26	7.69**
B X L	3	1.44	1.08	1.57	1.60	.90	.99
Error (MS)	298[a]-490	3523	866	2118	2264	2550	1.65
			Later Parities				
Breed (B)	3		1.93	.68	1.42	1.38	2.43
Location (L)	1		6.78**	.23	.43	.42	5.91*
B X L	3		2.30	4.32**	.53	.44	7.39**
Error (MS)	512-955		1038	1889	2450	2716	1.38
			Jeanerette				
Breed (B)	3	11.93**	2.32	4.18**	1.05	1.27	4.72**
Error (MS)	281-719	6429	1125	2006	2256	2892	1.27
			Beltsville				
Breed (B)	3	32.36**	1.47	.46	2.52	2.15	2.28
Error (MS)	201-719	1445	800	1926	2593	2517	1.71

[a]Range of degrees of freedom.

*P<.05.

**P<.01.

in the statistical significance. Differences in age at puberty also may have been a partially confounding factor in determining breed and location effects. It appears that, except for age at puberty, environmental effects were likely more important than genotype. Low repeatabilities support this hypothesis. None of the estimates between parities of the same cow were significant in either Jersey or crosses: .18, .11 for calving to first heat; .02, .04 for first breeding to conception; and ,06, .03 for services per conception. These repeatabilities were similar to those reported by McDowell et al. (14) for Jerseys and European dairy breed crosses.

For percentage pregnant at various intervals postpartum, Chi-square analyses showed ¼ E crosses were below average and the ½ E above by 90 days postpartum (P<.05) (Table 4). The ½ E crosses were superior to all others in time

TABLE 4. Percent pregnant < 90, 120, 145, and 200 days postpartum.

Breed group	< 90	< 120	< 145	< 200
Jer	18.1[b]	48.6[b]	64.6[b]	90.4
¾ E	12.5[b]	50.2[b]	68.2[b]	85.4
½ E	31.3[a]	60.1[a]	75.3[b]	88.9
¼ E	5.9[c]	47.1[b]	60.8[b]	84.3
Sind	13.3[b]	46.7[b]	53.3[a]	83.3

[a,b,c]Values in the same column with a common superscript are not significantly different (P<.05), but do differ from those not having the same superscript.

TABLE 5. Means for services per conception and percentages pregnant to first service by breed of sire, breed of cow, and parities.

Breed of sire	Cow group				Parity group			
	Jersey		Crosses		First		Later	
	Ser.	%	Ser.	%	Ser.	%	Ser.	%
Jer	1.8	55	1.8	56	1.8	53	1.6	62
Sind	1.6	72	1.6	65	1.8	59	1.9	57
Cross	1.4	76	1.7	66	1.7	67	1.6	66
Swiss	...	...	2.1	53	1.4	77	1.9	33
Hol	2.0	54	1.8	60	1.6	64	1.7	60

of rebreeding up to 120 days but not thereafter. At 145 days, pure Sindhis were below average ($P<.05$); but by 200 days postpartum, differences among breed groups were small. The superiority of ½ E crosses over backcrosses in early rebreeding coincides with findings for crosses among European dairy breeds (1, 4, 8, 14).

Breed of Sire

Jerseys were bred to sires of four breed groups and crosses to five (Table 5). Both Jerseys and crosses tended to require fewer services when bred to Sindhi and crossbred sires. Sampling variances were large, thus breed of sire, breed of cow, and interactions were not significant in services per conception or percentage which conceived on first service. The possibility that Sindhi and crossbred sires gave higher rates of conception than Brown Swiss, Holstein, or Jersey sires must be accepted with reservations as system of breeding and source of semen were confounded. Some of the Sindhi and crossbred sires would not work in AI, thereby requiring natural service. All semen from these two groups of sires was collected and handled in the herds, whereas semen for the other breeds came from several locations.

First parity cows required slightly fewer services than cows in later parities (1.66 vs. 1.77) and a higher proportion conceived on first service (64 vs. 56%), Table 5. This agrees with a previous report on crossing (13).

Estimates of Heterosis

Estimates of heterosis, derived as percentage deviations from the means of the parent breeds weighted by their theoretical contributions, are in Table 6. Heterosis was high for age at puberty and similar in all three crossbred groups. All groups showed positive heterosis for days open and calving interval; but for the other three measures of breeding efficiency, the estimates were highly variable. Exclusive of age at puberty, the averages for heterosis were ¾ E, 2.0%; ½ E, 7.7%; and ¼ E, 1.6%. The mean for all measures was 4.9%. Although the overall mean and means by breed group employing the same five measures were higher than reported by McDowell et al. (14), 1.4% for 2-breed crosses, and .6% for backcrosses, the values from this study are generally lower than reported for *Bos indicus* crosses (9, 18, 21). On the other hand, heterosis of 20.9% for ½ E in first breeding to conception compares favorably with any other report. In most studies on

TABLE 6. Average percent deviation of crosses from proportional weighted mean of purebreds (% heterosis).

Breed group	Age puberty	Calving to 1st heat	1st breeding to conception	Days open	Calving interval	Serv/ concep.	FCM yield
¾ E	16.7[a]	.2	-4.6	14.8	5.6	-6.0	1.7
½ E	19.6	.6	20.9	4.8	3.7	8.4	-19.2
¼ E	18.7	-2.7	3.3	6.6	3.1	-2.2	-48.0

[a]Sign in economic direction.

changes in breeding efficiency from crossbreeding, sampling variances have been high due to limited numbers or large unexplained environmental effects. The consistent advantages of crosses over the parental means indicate heterosis may be expected, but the true influence of genotype on heterosis is probably lower than often has been reported, especially when the nutritional status or incidence of disease may have a marked effect on the performance of the *Bos taurus* breed involved (4, 13, 17).

As shown in Table 6, crosses with 50% or more Sindhi breeding showed a large negative heterosis for first lactation FCM (fat-corrected milk) yield even though heterosis for fat percent was positive.

Traits Related to Reproduction

The percentage of heifers which were exposed for breeding but did not conceive within the time limit was higher at Jeanerette than at Beltsville (Table 7). In both herds, losses were highest in ¼ E crosses mainly because the later onset of first estrus provided fewer opportunities for breeding. Although the late age of puberty in this group (Table 2) did not influence age of calving markedly for those which conceived, it appears the late first estrus would cause high losses if first breeding was initiated at 15 to 17 mo. Culling for sterility was the main basis for removal of cows through the second gestation, but extremely low yields and health problems also contributed. Therefore, the percentages which completed two gestations (Table 7) reflect a competitive estimate of longevity. Differences among Jerseys, ¾ E crosses, and ½ E crosses were small, but the removal rate of ¼ E crosses was high.

TABLE 7. Percentage of Jersey and crossbred females reaching breeding age that did not conceive (0) or completed (2) gestations.

Breed group	Gestations 0	Completed 2
	Jeanerette	
Jer	10.5	80.8
¾ E	8.0	77.2
½ E	11.8	72.4
¼ E	20.8	37.5
	Beltsville	
Jer	7.1	68.2
¾ E	10.1	54.5
½ E	2.9	62.9
¼ E	11.5	42.3
	Combined	
Jer	8.0	71.4
¾ E	8.8	68.5
½ E	7.4	67.8
¼ E	15.4	40.3

Percentages of parturitions of purebreds and crosses where reproductive disorders and calving difficulties were recorded are in Table 8. Reproductive disorders included mummified fetus, retained placenta, metritis, cystic ovaries, and prolapsed uterus. Calving troubles were recorded as abortion and dystocia. Frequencies of both reproductive disorders and calving troubles were higher in first parity than later parities. In both parity groupings, the crosses averaged somewhat higher than Jerseys, 6.8 vs. 4.2% for reproductive troubles in first parity and 6.1 vs. 3.4% in later parities. The overall average for calving troubles in crosses was 8.5% in first parity and 4.6% in later parities. Percentages for both measures were higher at Beltsville than at Jeanerette. The lower value at the latter location may have resulted in part from the later age of breeding of heifers. It seems that no matter how the data are sorted, the crosses tended to be inferior to Jerseys in frequency of reproductive problems, with perhaps some association of frequency and proportion of Sindhi inheritance.

Lactation records associated with each parity had an out-of-herd or end-of-record coded by a number of classifications. These encompassed four major classifications: (a) cow dried off, (b) termination of satisfactory lactation performance due to health problems, such as mastitis, foot rot, or physical injury, (c) sterility, and (d) death. For first parity, differences among breed groups were small in frequency of health problems (Table 8). Percentage terminations for sterility were not significant among breed groups although the crosses (6.9%) were slightly higher than Jerseys (5.1%). In later parities, differences among breed groups were small. However, the overall mean for crosses was slightly higher, 6.0% for health and 4.7% for sterility, than for Jerseys.

When grouped by herds, the means for Jerseys and all crosses were similar for both health problems and sterility. Frequency of

TABLE 8. Percent of parturitions with reproductive disorders or calving troubles and percentages of lactations terminated by problems of health, sterility, and death by breed group within location and parity.

Breed group	No. rec.	Reprod. disorder	Calving troubles	Lactation terminated		
				Health	Sterility	Death
			Parity 1			
Jer	197	6.3	7.6	7.2	5.1	1.5
¾ E	102	9.5	10.4	5.9	7.6	3.9
½ E	145	6.7	7.4	8.3	7.0	.0
¼ E	58	9.6	7.9	6.9	5.5	3.4
			Later Parities			
Jer	473	3.4	3.6	5.3	4.2	3.0
¾ E	206	4.3	1.1	2.9	4.4	1.9
½ E	304	6.9	5.8	8.2	4.9	2.0
¼ E	51	9.0	11.1	5.9	4.8	.0
			Jeanerette			
Jer	219	3.8	2.1	8.6	6.8	3.2
¾ E	239	4.1	1.9	8.8	6.7	2.5
½ E	279	6.9	6.6	7.6	6.6	1.4
¼ E	55	2.1	6.1	7.3	5.6	.0
			Beltsville			
Jer	451	4.5	6.2	12.2	3.9	1.8
¾ E	69	13.1	10.2	14.5	5.9	2.9
½ E	170	6.7	7.8	10.6	3.4	1.2
¼ E	54	14.6	14.6	9.6	3.2	3.7

health problems was higher at Beltsville in all groups, but losses due to sterility were lower. The high frequency of health problems at Beltsville was associated with higher milk yields. Similar trends were evident for these two herds for crosses among European dairy breeds (14). Hollon and Branton (8) found a significantly lower frequency of mastitis, foot rot, milk fever, ketosis, and anaplasmosis in crosses with ⅛ and 1/16 Sindhi breeding than in purebred Holsteins or crossbreds without Sindhi breeding in the Jeanerette herd. The frequency of health problems for the ⅛ and 1/16 Sindhi crosses were similar to that of the crosses in this study, but the frequency in Holsteins was higher than for Jerseys. It appears that crosses with 25 to 75% Sindhi breeding are likely to have lactations terminated for health problems as frequently as Jerseys under conditions of both high and medium feeding, but Jerseys and Sindhi crosses may be superior to the larger dairy breeds and their crosses, particularly in an environment such as expected in southern Louisiana.

Losses in all groups due to death were so infrequent that no conclusions could be made on the importance of breed groups. Death losses were similar to those reported from these herds for other cattle (14).

Overall Performance

On the whole, Jerseys averaged 10 to 25 days longer in calving interval than the crosses. With similar milk yields, this would have afforded economic advantages for the crosses. However, lactation length and FCM yields in first lactation varied much more with Sindhi breeding than measures of breeding efficiency (Table 9). Using kilograms of FCM per day of calving interval, the calving interval required for the crosses to provide milk yields equivalent to the average performance of Jerseys were calculated. For the ¾ E crosses to equal Jerseys would have required a calving interval 15 days less than observed at Beltsville and 29 days less at Jeanerette. Through scheduling rebreeding earlier than 60 days postpartum, the ¾ E

TABLE 9. Means for lactation length, FCM yield, calving interval, and percent time dry and equivalent calving interval for Red Sindhi or crosses to equal Jerseys in performance.

Breed group	Lact. length	FCM 1st lact.	Calving interval	Time dry	Equiv.[a] cal. int.
	(days)	(kg)	(days)	(%)	(days)
		Jeanerette			
Jer	301	2769	405	25.7	405
¾ E	281	2517	399	29.6	370
½ E	249	2245	400	37.8	330
¼ E	201	1434	416	51.7	< 285
Sind	296	2195	433	31.6	304
		Beltsville			
Jer	294	4585	424	31.8	424
¾ E	297	4118	395	26.1	380
½ E	264	2996	428	38.3	< 285
¼ E	184	1555	412	55.6	< 285

[a]Calving interval required for crosses to provide milk yield equivalent to average performance of Jerseys.

crosses could have been as efficient in overall performance as Jerseys. The low milk yields of the ½ E and ¼ E crosses could not have been offset by the slight advantage over Jerseys in calving interval. The conclusion made by Branton et al. (3) that Zebu crosses do not show any important advantages for dairying under good feeding and management is supported by findings in this study.

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