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Genetic studies on monthly test day milk yield of Jersey crossbred cattle

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Selection within the herd can be based on either 305-days or total lactation milk yield, which are generated from sets of test day milk yield (TDMY) records made throughout the entire lactation length of an animal (Cilek and Kaygýsýz 2008, Kokate *et al*. 2013, Singh *et al.* 2016). Test-day milk yield of the animals is the measurement of the milk produced by a cow over a period of 24 h (Schaeffer and Jamrozik 1996, Santos *et al*. 2013). Selection on test day yields of milk in the early part of lactation would result in a reduction in generation interval, cost of recording and cost of maintaining cows and bulls with low breeding values (Schaeffer *et al.* 2000, Swalve 2000). Alternatively cost of recording may also be reduced by less frequent than monthly recording (Monalisa *et al.* 2014, Dongre and Gandhi 2014). Further, the use of TDMY makes possible to assess animals with lactations in progress, allowing for more frequent assessments and thus a reduction in the generation interval (Jensen 2001). Besides, Visscher and Goddard (1995) stated that more environmental variation can be removed from the phenotypic observations by considering the effects acting on the TD measure that cannot be taken into account when modelling 305 days yield. Several authors (Rana 2008, Monalisa *et al*. 2010, Dongre *et al*. 2011) while estimating effect of genetic and non-genetic factors on test day yields reported that selection based on some test day records is as efficient as on all. Moreover, the usefulness of test day yield records depends upon the heritability estimates of these records as well as the genetic/phenotypic correlations amongst test-day milk yield records. Hence, the present research was undertaken to determine the effect of important environmental factors affecting the test day milk yields and their genetic control in Jersey crossbred cattle.

The test day milk yields of Jersey crossbred cows, maintained at the Eastern Regional Station of National Dairy Research Institute, Kalyani, Nadia, West Bengal, India, were collected for the present study. Records of test day milk yield of 326 crossbred animals for a period of 35 years (1980 through 2014) were used in the study. The location and climatic condition of the farm has been depicted by Mandal *et al.* (2011). In this study, majority of the crossbred animals were produced from the mating of two *Bos indicus cattle* [Tharparkar (T) and Red Sindhi (RS)] by out-crossing using imported semen of Jersey (J) breed. A total of ten genetic groups [viz. GG1 (½ J × ½ RS), GG2 (½ J × ½ T), GG3 (≥ 50% to 62.5% J), GG4 (1/2 J×1/4 RS ×1/4 T), GG5 (1/2 J × 1/4 RS × 1/8 T × 1/8 D), GG6 (½ J×¼ RS×¼ T), GG7 (Misc. 50% J), GG8 (≤ 50% J), GG9 (>62.5 to75% J), GG10 (>75% J)] having different levels of Jersey inheritance produced in the breeding program were used in this study. Test-day records obtained between day 6 and day 305 of lactation were considered in the analyses. Only data from cows with at least four test-day records were considered. Cows whose lactation length exceeded 305 days had their production records truncated at the last test-day before 305 days. The TDMY were then divided into monthly classes according to days after calving, for a total of 10 classes (TDMY1–TDMY10). Thus, test day milk yields, recorded at approximately monthly intervals throughout lactation (M1-M10) were the traits under analysis. Entire year of calving was divided into 7 periods; each period of 5 years. Each year of calving was classified into three seasons namely winter (November-February), summer (March-June) and rainy (July-October) based on agro-climatic conditions.The parities of animals were classified as 8 groups. Data were adjusted for different fixed effects like period of calving, season of calving, parity of animal and genetic group of animals.

Data were analyzed using the mixed model least-squares analysis for fitting constants (Harvey 1990) to study the effect of genetic and non-genetic factors on monthly test day milk yields, and to estimate the genetic and phenotypic parameters of these traits. Estimates of genetic and phenotypic parameters for various test day milk yields were carried out by the paternal half-sib method (Kokate *et al*. 2013, Monalisa *et al*. 2014). Duncan’s multiple range test (DMRT) as described by Kramer (1957) was applied to compare the different sub-groups mean.

The least-squares means along with standard errors for various test day milk yields of Jersey crossbred cattle have been presented in Tables 1 and 2. The overall least-squares means for different test day milk yields varied from

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Table 1. Least-squares means along with standard errors of different test-day milk yield in crossbred cattle

Effect	TD1 (kg)	TD2 (kg)	TD3 (kg)	TD4 (kg)	TD5 (kg)
Overall mean	10.89±0.43 (1097)	10.26±0.44(1080)	9.33±0.37(1063)	8.49±0.35 (1049)	7.97±0.38 (1035)
Period of calving					
Pd1 (1980–1984)	10.24^{a}±1.04 (29)	9.55^{a}±1.00 (29)	8.58^{a}±0.90 (29)	7.86^{a}±0.86 (29)	7.73^{a}±0.82 (29)
Pd2 (1985–1989)	10.87^{a}±0.72 (123)	10.02^{a}±0.71 (121)	9.57^{a}±0.63 (120)	8.27^{a}±0.60 (119)	8.34^{a}±0.59 (116)
Pd3 (1990–1994)	11.00^{a}±0.60 (164)	10.45^{a}±0.59 (162)	9.58^{a}±0.52 (155)	8.78^{a}±0.50 (152)	8.46^{a}±0.50 (150)
Pd4 (1995–1999)	10.98^{a}±0.55 (200)	10.59^{a}±0.54 (198)	9.60^{a}±0.47 (197)	8.96^{a}±0.45 (195)	8.33^{a}±0.46 (193)
Pd5 (2000–2004)	10.69^{a}±0.60 (126)	10.20^{a}±0.60 (124)	9.33^{a}±0.52 (124)	8.85^{a}±0.50 (121)	8.01^{a}±0.51 (121)
Pd6 (2005–2009)	11.11^{a}±0.71 (213)	10.62^{a}±0.69 (210)	9.63^{a}±0.61 (206)	8.68^{a}±0.59 (202)	7.81^{a}±0.58 (199)
Pd7 (2010–2014)	11.32^{a}±0.81 (242)	10.37^{a}±0.79 (236)	9.02^{a}±0.71 (232)	8.01^{a}±0.68 (231)	7.08^{a}±0.66 (227)
Season of calving					
Winter (November–February)	11.39^{a}±0.46 (339)	10.83^{a}±0.47 (335)	10.08^{a}±0.40 (331)	9.29^{a}±0.38 (327)	8.54^{a}±0.40 (323)
Summer (March–June)	11.16^{ab}±0.46 (377)	10.57^{ab}±0.46 (368)	9.48^{a}±0.39 (361)	8.27^{b}±0.38 (358)	7.70^{b}±0.40 (354)
Rainy (July–October)	10.11^{b}±0.45 (381)	9.37^{b}±0.46 (377)	8.43^{b}±0.39 (371)	7.90^{b}±0.38 (364)	7.66^{b}±0.40 (358)
Parity of animals					
P1	9.43^{c}±0.49 (326)	8.86^{b}±0.49 (324)	8.20^{b}±0.42 (320)	7.50^{b}±0.40 (316)	7.10^{b}±0.42 (313)
P2	10.99^{ab}±0.47 (261)	10.06^{ab}±0.48 (256)	9.17^{ab}±0.41 (253)	8.25^{ab}±0.39 (253)	7.76^{ab}±0.41 (248)
P3	11.26^{a}±0.48 (185)	10.49^{a}±0.48 (183)	9.59^{a}±0.41 (181)	8.62^{a}±0.39 (179)	8.28^{a}±0.41 (177)
P4	11.55^{a}±0.50 (129)	10.58^{a}±0.51 (125)	9.47^{a}±0.44 (122)	8.52^{ab}±0.41 (120)	8.11^{ab}±0.43 (119)
P5	11.52^{a}±0.55 (82)	10.69^{a}±0.54 (81)	9.54^{a}±0.47 (78)	9.01^{a}±0.45 (75)	8.47^{a}±0.46 (75)
P6	11.73^{a}±0.61 (53)	11.22^{a}±0.60 (52)	10.32^{a}±0.53 (52)	9.18^{ab}±0.50 (52)	8.34^{a}±0.50 (51)
P7	11.12^{ab}±0.70 (34)	10.52^{a}±0.69 (33)	9.53^{a}±0.62 (31)	8.96^{a}±0.60 (29)	7.89^{ab}±0.59 (29)
P8 or more	9.51^{bc}±0.82 (27)	9.64^{ab}±0.80 (26)	8.81^{ab}±0.71 (26)	7.84^{ab}±0.69 (25)	7.78^{ab}±0.68 (23)
Genetic groups of animals					
GG1 (½ J × ½ RS)	12.01^{a}±0.57 (75)	11.22^{a}±0.57 (74)	10.22^{a}±0.49 (74)	9.29^{a}±0.47 (72)	8.88^{a}±0.48 (72)
GG2 (½ J × ½ T)	11.60^{ab}±0.60 (218)	10.80^{ab}±0.60 (217)	9.67^{a}±0.52 (214)	8.61^{abc}±0.49 (212)	7.71^{ab}±0.50 (207)
GG3 (≥50% to 62.5% J)	11.12^{abc}±0.50 (244)	10.48^{ab}±0.50 (240)	9.40^{a}±0.43 (238)	8.79^{ab}±0.41 (235)	8.13^{ab}±0.42 (235)
GG4 (1/2 J × ¼ RS ×1/4 T)	11.48^{ab}±0.53 (156)	10.78^{ab}±0.53 (154)	9.88^{a}±0.45 (152)	8.98^{a}±0.43 (150)	8.52^{a}±0.44 (149)
GG5 (1/2 J × ¼ RS × 1/8 T × 1/8 D)	10.54^{bc}±0.56 (96)	9.67^{bc}±0.55 (95)	9.01^{ab}±0.48 (94)	7.72^{bc}±0.46 (94)	7.55^{ab}±0.47 (91)
GG6 (½ J × $^{3}/_{8}$ RS × $^{1}/_{8}$ T)	10.31^{bc}±0.62 (63)	9.87^{abc}±0.60 (63)	9.15^{ab}±0.53 (63)	8.30^{abc}±0.51 (62)	7.71^{ab}±0.51 (62)
GG7 (Misc. 50% J)	10.61^{abc}±0.64 (75)	10.90^{ab}±0.64 (70)	9.89^{a}±0.57 (67)	9.29^{a}±0.55 (66)	8.80^{a}±0.55 (66)
GG8 (≤ 50% J)	10.70^{abc}±0.80 (36)	10.01^{abc}±0.79 (36)	8.90^{ab}±0.72 (35)	7.97^{abc}±0.68 (35)	7.43^{ab}±0.66 (35)
GG9 (>62.5 to 75% J)	10.55^{abc}±0.63 (58)	9.95^{abc}±0.62 (56)	9.14^{ab}±0.54 (56)	8.53^{abc}±0.52 (55)	7.66^{ab}±0.52 (55)
GG10 (>75% J)	9.97^{c}±0.63 (76)	8.88^{c}±0.62 (75)	8.04^{b}±0.55 (70)	7.37^{c}±0.53 (68)	7.26^{b}±0.53 (63)

Figures in parenthesis indicates number of observation. Means with different superscripts differ significantly from each other.

10.89±0.43 to 4.70±0.37 kg in ten monthly test day yields taken at 30 days interval and the test day milk yield showed a decreasing trend over the time for lactation period in this study and the results were in agreement with the findings of the previous studies (Cilek and Kaygýsýz 2008). The average test day milk yields of crossbred cattle in this study was similar to the studies of Kokate *et al*. (2013) and Santos *et al.* (2013) in crossbred and Guzerat cattle, respectively. The present findings revealed the significant (P<0.01) influence of sire on all the test day milk yields of crossbred cattle. The significant (P<0.05) effect of period of calving on TDMY6, TDMY7, TDMY9 and TDMY10 respectively in Jersey crossbred cattle was noticed (Table 2). Kokate *et al.* (2013) found the significant effect of period of calving on all the monthly test day yields in Karan Fries cattle. Several workers (Singh *et al*. 2016, Monalisa *et al*. 2010, Dongre *et al*. 2013) also reported significant effect of period of calving on TDMY in different breeds of cattle. The significant differences in milk yields among crossbred cattle calved in different periods in this study may be attributed to differences in management, and different environmental conditions such as temperature, rainfall, humidity etc. Season of calving significantly (P<0.01) affected the most of the test day milk yields (TDMY1, TDMY2, TDMY3, TDMY4, TDMY5, TDMY6, TDMY7 and TDMY10) of crossbred cattle in the present investigation (Tables 1 and 2). In this study, cows calved in rainy season produced significantly less milk than the cows calved in winter and summer season, which may be due to the fact that the cows that calved in rainy season pass through a period with unfavorable climate, when good quality pasture was not available. Some researchers (Kokate *et al*. 2013, Mundhe *et al*. 2015) reported the significant effect of season of calving onTDMY in different breeds of cattle. In the present study, parity of animal was significant (P<0.05) for first test day milk yield of animal. On perusal of Table 1, it is evident that animals in fourth, fifth and sixth parities produced comparatively more milk as compared to animals of earlier and late parities, which was in agreement with one study (Yoon *et al.* 2004) and was not agreement with another study (Cilek 2009). This suggests that milk yield increases as parity proceeds because due to large body size and increased development of udder tissue, large cows produce more milk than cows of earlier parities/heifer (Nyamushamba *et al*. 2014). The milk yield was also lower in early parities because the feed that was provided to the heifers was also channeled to their growth, which was also reported by Nyamushamba *et al*. (2014). Further, with increase in parity/older age, the milk yield of cows declined due to decline in body condition and degeneration of the body system over the recurring pregnancies. Similarly, some researches (Gular *et al*. 2009, Rios-Utrera *et al*. 2013, Nigm *et al*. 2015) observed significant effect of parity on TDMY in cattle.

All the test day milk yields of animals under the present study were significantly influenced by the genetic groups of animals (Table 1). Animals having ½ J × ½ RS inheritance had more TDMY as compared to animals of other genetic groups. Several workers reported the significant effect of genetic group of animals on milk yield at different milking days (Dutt *et al*. 1999, Sahana and Gurnani 2000, Lakshmi *et al*. 2010, Mandal *et al*. 2013) in crossbred cattle. In the present study, the effect of age groups of animals was found to be non-significant for all test day milk yields. Similarly, Mandal *et al*. (2013) found non-significant effect of age group on first lactation total milk yield in crossbred cattle. Contrarily, Dongre *et al*. (2011) carried out the study on weekly test day milk yield of Sahiwal cattle and found that age groups of animals had highly significant (P<0.01) effect on different test day milk yields.

The estimates of heritability of various test-day yields ranged from 0.42±0.11 to 60 ± 0.13, with the highest values in the 9th (TD9) and 10th month (TD10) of lactation in this study (Table 3). The lowest heritability estimates for TDMY were observed in the first, third and fourth months of lactation. The higher heritabilities for various test day milk

Table 2. Least-squares means along with standard errors of different test-day milk yield in crossbred cattle

Effect	TD6 (kg)	TD7 (kg)	TD8 (kg)	TD9 (kg)	TD10 (kg)
Overall mean	7.23±0.35 (1021)	6.64±0.36 (993)	6.15±0.37 (964)	5.42±0.38 (906)	4.70±0.37 (769)
Period of calving					
Pd1 (1980–1984)	6.76^{ab}±0.79 (29)	6.42^{ab}±0.77 (29)	5.66^{a}±0.79 (29)	4.28^{b}±0.79 (26)	2.87^{a}±0.80 (24)
Pd2 (1985–1989)	7.39^{ab}±0.56 (114)	7.04^{a}±0.56 (109)	6.79^{a}± 0.58 (105)	5.57^{ab}±0.59 (97)	4.58^{b}±0.59 (87)
Pd3 (1990–1994)	7.61^{a}±0.47 (150)	7.19^{a}±0.47 (148)	6.62^{a}±0.48 (146)	6.01^{a}±0.49 (141)	4.92^{b}±0.49 (131)
Pd4 (1995–1999)	7.66^{a}±0.43 (193)	7.26^{a}±0.43 (190)	6.41^{a}±0.44 (186)	6.37^{a}±0.45 (173)	5.52^{b}±0.45 (154)
Pd5 (2000–2004)	7.43a±0.48 (120)	6.80^{a}±0.48 (116)	6.39^{a}±0.49 (115)	5.74^{ab}±0.49 (107)	5.12^{b}±0.49 (90)
Pd6 (2005–2009)	7.47^{a}±0.55 (194)	6.27^{ab}±0.55 (188)	5.81^{a}±0.56 (183)	5.13^{b}±0.56 (177)	4.76^{b}±0.57 (144)
Pd7 (2010–2014)	6.30^{b}±0.63 (221)	5.51^{b}±0.62 (213)	5.40^{a}±0.64 (200)	4.87^{b}±0.64 (185)	5.14^{b}±0.66 (139)
Season of calving					
Winter (November–February)	7.66^{a}±0.37 (318)	6.94^{a}±0.38 (316)	6.22^{a}±0.38 (311)	5.25^{a}±0.39 (295)	4.46^{b}±0.39 (241)
Summer (March-June)	6.87^{b}±0.37 (351)	6.22^{b}±0.37 (337)	5.96^{a}±0.38 (327)	5.46^{a}±0.39 (305)	4.96^{a}±0.38 (272)
Rainy (July- October)	7.16^{ab}±0.36 (352)	6.77^{ab}±0.37 (340)	6.28^{a}±0.38 (326)	5.56^{a}±0.39 (306)	4.69^{ab}±0.38 (256)
Parity of animals					
P1	6.55^{b}±0.39 (308)	6.30^{a}±0.39 (295)	5.92^{a}±0.40 (286)	5.67^{a}±0.41 (269)	5.28^{a}±0.40 (241)
P2	6.91^{ab}±0.38 (246)	6.47^{a}±0.38 (242)	5.92^{a}±0.39 (239)	5.31^{a}±0.40 (218)	4.89^{a}±0.39 (180)
P3	7.37^{a}±0.38 (175)	6.82^{a}±0.39 (169)	6.41^{a}±0.40 (163)	5.87^{a}±0.41 (156)	5.18^{a}±0.40 (132)
P4	7.50^{a}±0.40 (117)	6.73^{a}±0.41 (116)	6.07^{a}±0.41 (115)	5.40^{a}±0.42 (110)	4.94^{a}±0.42 (88)
P5	7.53^{a}±0.43 (75)	6.88^{a}±0.44 (73)	6.44^{a}±0.45 (70)	5.58^{a}±0.45 (67)	4.39^{a}±0.46 (54)
P6	7.88^{a}±0.48 (49)	7.24^{a}±0.48 (48)	6.57^{a}±0.49 (46)	5.56^{a}±0.49 (45)	5.07^{a}±0.49 (40)
P7	7.31^{ab}±0.56 (28)	6.32^{a}±0.56 (28)	6.10^{a}±0.58 (25)	5.19^{a}±0.59 (23)	3.93^{a}±0.62 (19)
P8 or more	6.79^{ab}±0.65 (23)	6.36^{a}±0.65 (22)	5.81^{a}±0.68 (20)	4.79^{a}±0.69 (18)	3.94^{a}±0.72 (15)
Genetic groups of animals					
GG1 (½ J × ½ RS)	7.99^{a}±0.45 (72)	7.49^{a}±0.45 (71)	6.97^{a}±0.46 (71)	6.25^{a}±0.46 (68)	5.75^{a}±0.46 (59)
GG2 (½ J × ½ T)	7.18^{abc}±0.47 (206)	6.55^{ab}±0.47 (203)	6.04^{ab}±0.48 (195)	5.21^{ab}±0.49 (186)	4.86^{abc}±0.48 (153)
GG3 (≥ 50% to 62.5% J)	7.53^{abc}±0.39 (233)	6.96^{ab}±0.40 (232)	6.36^{ab}±0.41 (227)	5.52^{abc}±0.41 (214)	4.82^{abc}±0.41 (194)
GG4 (1/2 J × ¼ RS × 1/4 T)	7.73^{ab}±0.42 (147)	7.32^{a}±0.42 (141)	6.95^{a}±0.43 (135)	6.14^{ab}±0.44 (130)	5.15^{ab}±0.44 (109)
GG5 (1/2 J × ¼ RS × 1/8 T × 1/8 D)	6.66^{bc}±0.44 (88)	6.16^{b}±0.45 (83)	5.72^{b}± 0.46 (81)	4.76^{c}±0.46 (75)	3.88^{c}±0.46 (61)
GG6 (½ J × ¼ RS × ¼ T)	7.28^{abc}±0.49 (59)	6.59^{ab}±0.49 (59)	6.23^{ab}±0.50 (53)	5.33^{abc}±0.51 (49)	4.38^{bc}±0.52 (39)
GG7 (Misc. 50% J)	7.88^{ab}±0.52 (65)	6.80^{ab}±0.52 (61)	6.58^{ab}±0.54 (61)	5.84^{abc}±0.53 (60)	5.46^{ab}±0.55 (52)
GG8 (≤ 50% J)	6.69^{abc}±0.64 (34)	6.34^{ab}±0.63 (31)	5.63^{b}±0.66 (30)	5.32^{abc}±0.67 (23)	4.05^{bc}±0.73 (18)
GG9 (>62.5 to 75% J)	6.94^{abc}±0.49 (54)	6.22^{ab}±0.50 (51)	5.75^{ab}±0.51 (50)	4.94^{abc}±0.52 (44)	4.31^{bc}±0.54 (34)
GG10 (>75% J)	6.44^{c}±0.50 (63)	6.00^{b}±0.50 (61)	5.31^{b}±0.51 (61)	4.91^{bc}±0.52 (57)	4.36^{bc}±0.53 (50)

Figures in parenthesis represent number of observation. Means with different superscripts differ significantly from each other.

Table 3. Estimates of heritability (diagonal), genetic correlations (below diagonal) and phenotypic correlations (above diagonal) of test day milk yields of Jersey crossbred cattle

Trait	TD1	TD2	TD3	TD4	TD5	TD6	TD7	TD8	TD9	TD10
TD1	0.43±0.11 (1097)	0.85	0.76	0.69	0.63	0.62	0.58	0.53	0.50	0.46
TD2	0.99±0.02	0.50±0.11 (1080)	0.84	0.76	0.71	0.70	0.65	0.61	0.56	0.51
TD3	0.98±0.03	1.00±0.01	0.43±0.11 (1063)	0.82	0.76	0.74	0.70	0.64	0.60	0.54
TD4	0.95±0.04	0.97±0.03	0.99±0.02	0.42±0.11 (1049)	0.82	0.77	0.72	0.68	0.63	0.55
TD5	0.96±0.04	0.96±0.03	0.99±0.03	1.00±0.02	0.57±0.12 (1035)	0.86	0.77	0.71	0.67	0.60
TD6	0.98±0.04	0.99±0.03	0.99±0.03	1.00±0.02	0.98±0.02	0.51±0.12 (1021)	0.83	0.76	0.71	0.61
TD7	0.91±0.06	0.92±0.05	0.94±0.04	0.96±0.04	0.98±0.02	1.00±0.01	0.58±0.13 (993)	0.83	0.78	0.68
TD8	0.92±0.06	0.97±0.04	0.98±0.04	0.97±0.04	0.97±0.03	1.00±0.02	1.00±0.02	0.57±0.13 (964)	0.83	0.72
TD9	0.85±0.08	0.90±0.06	0.88±0.06	0.92±0.06	0.94±0.04	0.98±0.03	0.99±0.02	0.99±0.02	0.60±0.13 (906)	0.82
TD10	0.93±0.07	0.97±0.06	0.92±0.06	0.93±0.06	0.95±0.05	0.98±0.04	0.95±0.04	0.94±0.04	0.94±0.03	0.59±0.14 (769)

yields in this study were in agreement with the findings of Cruz *et al.* (2015) in other cattle breeds. However, lower range of heritability of test day yields were reported by Ribas and Parez (1989), Machado *et al.* (1999), Cilek and Kaygýsýz (2008) and Kokate (2009) in other cattle breeds and its crosses. In this study, the higher heritability estimates of test day milk yields in crossbred cattle indicated that selection of cows/sires can be done on the basis of these yields individually or in combination with each other. The phenotypic correlations among TDMY (Table 3, above diagonal) were all positive and ranged from 0.46 (between TDMY1 and TDMY10) to 0.86 (between TDMY5 and TDMY6). Genetic correlations among TDMY (Table 3, below diagonal) ranged from 0.88 to 1.00, with standard errors ranging from 0.01 to 0.08. Similarly, higher estimates of phenotypic correlations amongst test-day milk yields were reported in literature (Kokate 2009, Monalisa *et al*. 2014, Pelmus *et al*. 2017). Genetic and phenotypic correlations between pairs of TDMY tended to decrease with increasing time distances between test days (Table 2). This may be due to the fact that different genetic and environmental factors act during different periods of lactation. The variation in genetic correlations between TDMY from different periods of the lactation, and higher genetic correlations observed between adjacent tests were also found in other studies (Pereira *et al*. 2013, Santos *et al*. 2013, Pelmus *et al.* 2017). Higher estimates of genetic and phenotypic correlations amongst test-day milk yields as well as higher estimates of heritability of all these traits revealed that selection for a particular stage of lactation will increase yield in the other stages in crossbred cattle.

SUMMARY

Data pertaining to test day milk yields of Jersey crossbred cattle, maintained at the Eastern Regional Station, National Dairy Research Institute, Kalyani, were collected on monthly basis to determine the effects of genetic and environmental factors affecting these traits and to estimate their genetic and phenotypic parameters.The study showed that different environmental factors significantly affected most of the test day milk yields of animals. The estimates of heritability of various test-day yields ranged from 0.42±0.11 to 60±0.13, with the highest values in the 9th (TD9) and 10th month (TD10) of lactation in this study. Genetic and phenotypic correlations between pairs of test day milk yields in this study were positive and medium to high in magnitude.The higher estimates of heritability of all test day milk yields indicated that there is ample scope of improvement of these traits through selection. Higher estimates of genetic and phenotypic correlations amongst test-day milk yields revealed that selection for milk yield at early stage of lactation will lead to increase in milk yield at later stage in crossbred cattle.

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