Studies on fortnightly test day milk yields and non-genetic factors affecting these part milk yields in Sahiwal and crossbred cattle

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ABSTRACT: The present study was conducted utilizing data available on 166 Sahiwal cattle and 799 cattle belonging to Jersey, Holstein Friesian, or Red Dane inheritance as exotic breed in different combinations with Sahiwal as native breed .The exotic inheritance level for different crossbred cattle varied from 50% to 75% level.The local breed used was Sahiwal. These data were utilized to know the average values for different fortnightly test day yields from first fortnightly test day milk yield (FTDY-1) to twenty one fortnightly test day yield (FTDY-21).The means of these test day milk yields (FTDY-1 to FTDY-21)in kg in case of Sahiwal cattle were found as4.29 ±0 .5, 5.34±0.7, 7.71 ± 0.6, 7.63±0.8, 7.45 ± 0.10, 7.11± 0.9, 7.08 ± 0.10, 6.87± 0.75, 6.34 ± 0.08, 6.12± 0.64, 6.34± 0.12 , 5.96 ± 0.54, 5.65 ±0.12, 5.28± 0.10, 4.74 ±0.10, 4.24 ± 0.11, 3.49 ± 0.84, 3.28 ± 0.07, 2.93 ± 0 .47, 2.73 ±0.03 and 2.50 ± 0.03,respectively.The corresponding figures in case of crossbred cattle were observed as 4.48±0.3, 5.6±0.2 , 9.53±0.48 , 9.35±0.67, 8.7±0.45, 8.6±0.6 , 8.35±0.08, 7.83±0.3 , 7.6±0.7 , 7.11±0.08, 6.56±0.45 , 6.08±0.32 , 5.71±0.8 , 5.27±0.21 , 5.26±0.18 , 4.98±0.78 , 5.13±0.2 , 4.51±0.74 , 5.03±0.11 , 4.75±0.02 and 4.49±0.81.The fortnightly yields did not vary according to different periods and seasons in Sahiwal and crossbred cattle.

Key words: Crossbred cattle, fortnightly test day milk yields, part milk yields, factors affecting part milk yields, Sahiwal cattle, yields

Livestock farming plays a vital role in rural economy in India. The total cattle population of 193.46 million comprises of 73.45 per cent Indigenous and 26.55 percent crossbred cattle (Livestock census, GOI, 2019). Out of the well-known milch breeds, Sahiwal, Red Sindhi, Gir, Tharparkar and Rathi, the Sahiwal is most preferred breed of cattle in India. The animal breeders have always been interested in making genetic improvement in the existing stock. Therefore, it is very much required to assess the performance of these animals. Moreover, the selection of the dairy animals should be preferred at early stage. Considering this fact part milk records could be very useful.

The study of different fortnightly test day milk yields could suggest the chances of selecting the dairy cows at early stage and for taking proper measures for selecting the cows. There are very few studies available related to these part lactation milk yields specially in case of Sahiwal cattle. Therefore, an investigation was planned for studying the performance of different fortnightly test day milk yields and variation among the estimates according to period and seasons.

MATERIALS AND METHODS

The data on 166 Sahiwal cattle, distributed over a period of 30 years from 1987 to 2016, and 799 crossbred cattle, distributed over a period of 40 years from 1977 to 2016 ,were used for studying the least squares mean values for twenty fortnightly test day milk yields and to know the effect of period and season on these values. The data were obtained from Instructional Dairy Farm, Nagla of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) .This farm lies between 28º 52' to 28º 25' North latitude and 78º 58' to 79º 42' East longitude. The climate of the farm is subtropical in nature. The minimum temperature remained about 3ºc in winter and maximum as 40ºC in summer season and the annual rain fall was around 1300 to 1400 mm. The loose hosing system and standard management and feeding standards are practiced at the university farm. The young ones were weaned at birth and colostrum was fed to newly born calves for 4 days after which whole milk was given for one month of age and after that roughages, concentrates and mineral mixtures were given to claves. The milking is done manually twice a day (morning and evening) and being recorded. The data were corrected for non-orthogonality due to unequal (RER) subclass frequency using the mixed model likelihood programme (Harvey, 1990). Test day milk yield was recorded in kilogram by considering the record of the particular day milk yield throughout the lactation. The fortnightly test day yields were denoted as the First fortnightly test day yield (FTDY-1), second fortnightly test day yield (FTDY-2) and in the same way up to the last test day milk yield i.e. twenty-one fortnightly test day yield (FTDY-21).

Table 1: Distribution of observations according to period, season and genetic groups for Sahiwal and crossbred cattle

Factors	**No. of observations**		
Periods			
Crossbred cattle	Sahiwal Cattle		
Factors	No. of observations	Factors	No. of observations
Period-1(1977-1984)	113	Period-1(1987-1996)	42
Period-2(1985-1992)	197	Period-2(1997-2006)	37
Period-3(1993-2000)	168	Period-3(2007-2016)	87
Period-4(2001-2008)	152		
Period-5(2009-2016)	169		
Total animals	799	Total animals	166
Seasons			
Crossbred cattle	Sahiwal Cattle		
Summer Season (March-June)	299	Summer Season (March-June)	73
Rainy Season (July-October)	187	Rainy Season (July-October)	41
Winter Season (November-February)	313	Winter Season (November-February)	52
Total animals	799		166
Genetic groups			
Crossbred cattle(G1)	799	Sahiwal cattle(G2)	166

RESULTS AND DISCUSSION

Least squares means (±S.E.) of fortnightly test day milk yields and factor affecting test day milk yields

The least squares means for different fortnightly test day milk yields of Sahiwal and crossbred cattle are presented in the Table 2 and 3, respectively. The distribution of observations according to period, season and genetic groups has been indicated in Table 1.

Fortnightly test day milk yield (FTDY)
Means

The Least squares mean of fortnightly test day milk yield are given in Table 2 and 3 for Sahiwal and crossbred cattle, respectively. Perusal of the Table 2 showed that the highest fortnightly test day milk yield was observed in FTDY-3 (7.71±0.08 kg) and the lowest was observed in FTDY-21 (2.50 ± 0.03 Kg) in Sahiwal . In general, fortnightly test day milk yield increased till FTDY- 3 and thereafter, a gradual decline was noticed till the end of lactation in Sahiwal cattle. Ilatsia *et al*. (2007), Bilal *et al*. (2008) that highest milk yield was obtained during second monthly test day milk yield (MTDMY-2) in Sahiwal cattle.

Perusal of the Table 3 showed that the highest fortnightly test day milk yield in case of crossbred cattle was observed in FTDY-3 (9.53±0.48) and the lowest was observed in FTDY-21 (4.49 ± 0.81 Kg). In general, fortnightly test day milk yield increased till FTDY- 3 and thereafter, a gradual decline was noticed till the end of lactation in crossbred cattle. Similar findings were reported by Jamrozik and Schaiffer (1997), Machado *et al*. (1999), Rekaya *et al*. (1999), Kim *et al.* (2008), and Kokate (2009) that highest milk yield was obtained during second monthly test day milk yield (MTDMY-2) in Sahiwal , Holstein Frisian cows and Karan Fries cattle.

Factors affecting fortnightly test day milk yield

The effect of season of calving on all the fortnightly test day (FTDY) milk yields was non-significant in Sahiwal. The fortnightly test day milk yields were highest in winter followed by summer in FTDY-1 and FTDY-2. No definite trend for other seasons was observed in this trait. The effect of period of calving on all the fortnightly test day milk yields (FTDY) was non-significant in Sahiwal. The effect of period and seasons indicated constant feeding and management practices and proper health measures followed over different periods and seasons.

The season of calving had statistically non- significant effect on all test day milk yields in crossbred cattle. The effect of period of calving on all the fortnightly test day milk yields (FTDY) was not significant in crossbred cattle. However, many researchers reported the effect of season has significant effect on test day milk yield. Bhadouria *et al*. (1990) observed significant effect of season of calving on all the monthly milk yields except the fifth and sixth month where it was not significant in Jersey cows. Similarly, reports were given by Machado *et al.* (1997), Ribas and Perez (1989), Machado *et al.* (1999), Zafar *et al.* (2008) and Kokate (2009) in different breeds of cattle and buffaloes.

CONCLUSION

In case of Sahiwal the least squares means along with standard errors of different fortnightly test day milk yield (FTDY-1 to FTDY-21) traits were observed as 4.29 ±0 .5,

Table 2: Least squares means (±S.E.) of fortnightly test day milk yields in Sahiwal cattle

Source	FTDY-1	FTDY-2	FTDY-3	FTDY-4	FTDY-5	FTDY-6	FTDY-7	FTDY-8	FTDY-9	FTDY-10	FTDY-11
Overall mean	4.29 ±0 .5	5.34±0.7	7.71 ± 0.6	7.63±0.8	7.45 ± 0.10	7.11± 0.9	7.08 ± 0.10	6.87± 0.75	6.34 ± 0.08	6.12± 0.64	6.34± 0.12
Period											
P1	4.02±0.18	5.82±0.26	7.9±0.32	7.51±0.28	7.96±0.34	6.45±0.28	6.26±0.3	6.5±0.26	5.97±0.3	5.4±0.25	5.97±0.42
P2	4.96±0.13	5.15±0.18	7.23±0.22	7.1±0.2	7.76±0.24	7.98±0.2	7.76±0.21	6.9±0.18	6.46±0.21	6.06±0.17	6.44±0.29
P3	5.1±0.19	5.06±0.26	8.24±0.33	8.3±0.28	7.74±0.34	8.01±0.28	7.69±0.3	7.03±0.26	6.61±0.31	7.26±0.25	6.61±0.43
Season											
S1	4.28±0.08	4.81±0.1	7.98±0.13	7.43±0.12	6.99±0.15	7.93±0.12	7.61±0.14	6.84±0.11	6.26±0.12	6±0.1	6.27±0.18
S2	48.±0.1	5.51±0.14	7.08±0.18	6.93±0.16	7.6±0.19	7.63±0.16	7.35±0.17	6.81±0.14	6.19±0.17	6.22±0.14	6.13±0.23
S3	5.27±0.09	5.77±0.12	8.27±0.16	8.8±0.14	7.06±0.17	7.88±0.14	7.75±0.16	6.99±0.13	6.59±0.15	6.17±0.12	6.62±0.21

Source	FTDY-12	FTDY-13	FTDY-14	FTDY-15	FTDY-16	FTDY-17	FTDY-18	FTDY-19	FTDY-20	FTDY-21
Over-all mean	5.96 ± 0.54	5.65 ±0.12	5.28± 0.10	4.74 ±0.10	4.24 ± 0.11	3.49 ± 0.84	3.28 ± 0.07	2.93 ± 0 .47	2.73 ±0.03	2.50 ± 0.03
Period										
P1	5.61±0.45	5.22±0.44	5.03±0.4	4.43±0.37	3.94±0.32	3.24±0.23	3.04±0.24	2.91±0.18	2.78±0.14	2.6±0.12a
P2	5.85±0.31	5.89±0.31	5.33±0.27	4.84±0.26	4.26±0.23	3.52±0.16	3.23±0.16	2.97±0.12	2.88±0.1	2.54±0.09
P3	6.42±0.45	5.87±0.44	5.48±0.4	4.97±0.37	4.55±0.32	3.74±0.23	3.58±0.24	2.95±0.18	2.53±0.14	2.37±0.13
Season										
S1	6.09±0.18	5.71±0.18	5.37±0.16	4.83±0.15	4.41±0.15	3.58±0.11	3.39±0.1	2.97±0.08	2.78±0.06	2.53±0.05
S2	5.43±0.24	5.43±0.24	5.01±0.22	4.5±0.2	3.97±0.18	3.4±0.13	3.14±0.13	2.9±0.1	2.66±0.08	2.48±0.07
S3	5.83±0.21	5.83±0.21	5.47±0.19	4.91±0.18	4.37±0.17	3.51±0.12	3.31±0.12	2.95±0.09	2.76±0.07	2.5±0.06

Table 3: Least squares means (±S.E.) of fortnightly test day milk yields in crossbred cattle

Source	FTDY-1	FTDY-2	FTDY-3	FTDY-4	FTDY-5	FTDY-6	FTDY-7	FTDY-8	FTDY-9	FTDY-10
Overall mean	4.48±0.30	5.6±0.20	9.53±0.48	9.35±0.67	8.7±0.45	8.6±0.6	8.35±0.08	7.83±0.3	7.6±0.7	7.11±0.08
Period										
P1	4.72±0.23	5.51±0.2	9.7±0.32	9.12±0.66	8.89±0.37	7.86±0.61	8.35±0.72	7.88±0.34	6.8±0.73	6.81±0.84
P2	4.79±0.14	5.68±0.12	9.73±0.19	9.33±0.39	9.02±0.22	8.39±0.36	8.66±0.43	7.95±0.2	7.55±0.43	7.1±0.48
P3	4.45±0.12	5.48±0.1	9.54±0.17	9.26±0.34	8.76±0.19	8.68±0.31	8.09±0.37	7.79±0.17	7.81±0.37	6.98±0.42
P4	4.2±0.15	5.73±0.14	9.42±0.21	9.71±0.44	8.52±0.25	9.1±0.4	8.42±0.48	7.76±0.22	8.02±0.48	7.56±0.54
P5	4.24±0.17	5.62±0.15	9.28±0.24	9.33±0.49	8.33±0.27	8.97±0.45	8.21±0.53	7.76±0.25	7.81±0.54	7.12±0.6
Season										
S1	4.48±0.04	5.61±0.03	9.57±0.05	9.32±0.09	8.74±0.06	8.6±0.09	8.29±0.11	7.83±0.05	7.61±0.11	7.14±0.12
S2	4.44±0.04	5.59±0.04	9.46±0.06	9.28±0.12	8.62±0.07	8.53±0.11	8.27±0.14	7.75±0.06	7.51±0.13	6.98±0.15
S3	4.53±0.04	5.61±0.03	9.57±0.05	9.44±0.09	8.75±0.06	8.66±0.09	8.48±0.11	7.9±0.05	7.68±0.11	7.23±0.12

Source	FTDY-11	FTDY-12	FTDY-13	FTDY-14	FTDY-15	FTDY-16	FTDY-17	FTDY-18	FTDY-19	FTDY-20	FTDY-21
	(774)	(720)	(642)	(598)	(536)	(496)	(473)	(423)	(402)	(341)	(304)
Overall mean	6.56±0.45	6.08±0.32	5.71±0.8	5.27±0.21	5.26±0.18	4.98±0.78	5.13±0.2	4.51±0.74	5.03±0.11	4.75±0.02	4.49±0.81
	(642)	(598)	(536)	(496)	(473)	(423)	(799)	(402)	(341)	(799)	(304)
Periods											
P1	6.01±0.83	5.7±0.86	4.92±0.95	4.37±0.96	4.6±1.27	4.27±1.27	5.1±0.18	3.56±1.28	4.94±2.19	4.72±0.21	3.94±2.21
P2	6.66±0.48	6.08±0.49	5.61±0.52	5.24±0.53	4.84±0.63	4.68±0.63	5.35±0.11	4.32±0.63	5.05±0.88	4.99±0.13	4.09±0.89
P3	6.47±0.41	5.98±0.43	5.74±0.45	5.35±0.46	5.35±0.55	5.03±0.55	5.24±0.09	4.65±0.55	5.29±0.8	4.78±0.11	4.95±0.81
P4	7.03±0.53	6.53±0.55	6.39±0.58	5.95±0.59	6.02±0.7	5.72±0.7	4.99±0.12	5.25±0.7	5.05±0.99	4.61±0.14	4.84±1
P5	6.64±0.59	6.11±0.62	5.88±0.65	5.43±0.65	5.5±0.77	5.21±0.77	4.98±0.13	4.77±0.78	4.82±1.06	4.67±0.16	4.6±1.07
Seasons											
S1	6.59±0.13	6.09±0.13	5.76±0.13	5.34±0.13	5.28±0.16	5.01±0.16	5.01±0.5	4.52±0.16	5.3±0.19	4.74±0.03	4.71±0.19
S2	6.45±0.15	5.99±0.15	5.64±0.16	5.14±0.16	5.26±0.2	5.01±0.2	5.20±45	4.56±0.2	4.88±0.23	4.71±0.04	4.35±0.23
S3	6.64±0.12	6.16±0.12	5.73±0.12	5.32±0.12	5.23±0.15	4.92±0.15	5.98±0.24	4.44±0.15	4.91±0.18	4.81±0.03	4.4±0.18

5.34±0.7, 7.71 ± 0.6, 7.63±0.8, 7.45 ± 0.10, 7.11± 0.9, 7.08 ± 0.10, 6.87± 0.75, 6.34 ± 0.08, 6.12± 0.64, 6.34± 0.12 , 5.96 ± 0.54, 5.65 ±0.12, 5.28± 0.10, 4.74 ±0.10, 4.24 ± 0.11, 3.49 ± 0.84, 3.28 ± 0.07, 2.93 ± 0 .47, 2.73 ±0.03 and 2.50 ± 0.03.kg, respectively. The corresponding values in case of crossbred cattle were as 4.48±0.3, 5.6±0.2 , 9.53±0.48 , 9.35±0.67, 8.7±0.45, 8.6±0.6 , 8.35±0.08, 7.83±0.3 , 7.6±0.7 , 7.11±0.08, 6.56±0.45 , 6.08±0.32 , 5.71±0.8 , 5.27±0.21 , 5.26±0.18 , 4.98±0.78 , 5.13±0.2 , 4.51±0.74 , 5.03±0.11 , 4.75±0.02 and 4.49±0.81.In general, fortnightly test day milk yield increased till FTDY-3 and thereafter, a gradual decline was noticed till the end of lactation. These values did not vary according to periods or seasons. The study indicated maximum expression of gene commenced by third fortnightly milk yield. In general, peak milk production was obtained by third fortnightly part yield. This fact can be utilized for selecting the dairy cattle and this pattern of milk yield may be kept into mind while knowing the genetic pattern for part milk yield traits.

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REFERENCES

Bhadouria, S. S., Johar, K.S. and Lakhani, G.P. (1990). Effect of farm, year and season on milk yield and lactation period in Jersey cow. *Asian J. Dairy Res.,* 9 (1): 5-10.

Bilal, G., Khan, M. S., Bajwa, I.R. and Shafiq, M. (2008).Genetic control of test-day milk yield in Sahiwal cattle. *Pakistan Vet. J.,* 1: 21-24.

G.O.I. (2019). Basic Animal Husbandry Statistics-2019.Retrieved from http://dahd.nic.in/.

Harvey, W. R. (1990). Guide for LSMLMW, PC-1 Version, Mixed model least squares and maximum likelihood computer programme, January 1990. Mimeograph Ohio State Univ., USA.

Ilatsia, E. D., Muasya, T.K., Muhuyi, W.B. and Khai, A.K. (2007). Genetic and phenotypic parameters and annual trends for milk production and fertility traits of the Sahiwal cattle in semi-arid Kenya. *Trop. Anim. Health Prod.,* 39: 37-48.

Jamrozik, J. and Schaeffer, L. R. (1997). Estimates of Genetic Parameters for a Test Day Model with Random Regressions for Yield Traits of First Lactation Holsteins. *J. Dairy Sci.,* 80:762–770.

Kim, S. D., Han, K.J., Cho, J.H., Jeon, G.J., Lee, H.K. and Lee, D.H. (2008). National Genetic Evaluation of first parity using random regression Test day animal model in Korean Holstein cattle. *Korean J. Ani. Sci*., 51:118-122.

Kokate, L.(2009). Genetic evaluation of Karan fries sires based on test day milk yield records M. V. Sc. Thesis, NDRI, (Deemed University), Karnal, India

Machado, S. G., Freitas, M. A. and Gadini, C. H. (1999). Factor affecting first lactation test day milk yield in Holstein cattle. *Genetic and Molecular Biology*, 2 (3): 383-386.

Rekaya, R., Carabano, M.J. and Toro, M.A. (1999). Use of test day milk yield records for genetic evaluation of production traits in Holstein Friesian cattle. *Livestock Prod. Sci*., 57 (3):203-217

Ribas, M. and Perez, B. (1989). Monthly test day milk yield records and yield at 244 day. Environmental effect in first lactation. *Cuban J. Agr. Sci*., 23(1): 17-24

Zafar, A. H., Ahmad, M., and Rehman,S.U. (2008). Study of some performance traits in Sahiwal cows during different periods. *Pakistan Vet. J.,* 28(2): 84-88.

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