I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Studies on Effect of Period and Season on Lactation Milk Yield in Holstein Friesain X Deoni Interse Crossbred Cattle in Maharashtra

Bhopale J. J., Chauhan D. S and Thorat B. N.*

ABSTRACT: *Imbalance in husbandry practices caused deterioration in the productivity of our livestock. Restoration of symbiotic system between livestock and rich flora on strong footing would be a solution to overcome the present imbalance and to accomplish remunerative life under varied environment are the ways of restoration of natural balance. The permanent improvement in performance characteristics of indigenous breeds can be brought about by changing their genetic composition. The Holstein Friesian x Deoni interse crossbred progeny developed was available for evaluation. In the present study systematic record in respect to LMY was taken from the pedigree sheets and daily milk yield record maintained at CCBP farm. In all records of 71 Holstein Friesian x Deoni interse crossbred dams with 185 lactations over a period of 16 years (1992 to 2007) were utilized for study. The data were classified in to the four period and season as cold, hot, south-west monsoon and post monsoon season. For the statistical analysis of data the Least Square Technique is employed for minimizing the error sum of squares. The LSM for LMY of Holstein Friesian x Deoni interse crossbred cows was 1296.74 ± 12.98 kg. The LSM for LMY recorded in Post monsoon season and period P_4 was higher to that of the LSM for LMY recorded in cold, hot and south west monsoon season and P_1, P_2 and P_3. The differences observed in the LSMs for LMY were non-significant due to season and period effect. Season and period did not influenced significantly LMY in Holstein Friesian x Deoni interse crossbreed.*

Key word: *LMY, Period, Season, Holstein Friesain X Deoni cattle*

INTRODUCTION

Improved cattle should be supported by improved feeding and management systems. Marathwada region has been gifted by two important breeds of cattle i.e. Deoni and Red Kandhari. The Marathwada Agricultural University, Parbhani after its formation took up the work of improvement of local germplasm through crossbreeding with exotic breed as well as through selective breeding. Scientifically the term dual purpose animal was misnomer and has disappeared. Development of dairy purpose and draft purpose animals has been now taken up. Holstein Friesian is the exotic elite milch purpose breed. It was originated in two Northern provinces of Netherland i.e. West-Friesland and North-Holand. Later on it has spread almost all over the European countries, as well as all over the world.

The conventional methods of breeding requires prolonged period. It was decided to enrich the present genetic status of Deoni through induction of elite genetic material i.e. from Holstein Friesian. The programme of crossbreeding was formulated and implemented by Marathwada Agricultural University, Parbhani. The Holstein Friesian x Deoni interse crossbred progeny developed was available for evaluation. To study the productive performance of Holstein Friesian x Deoni interse crossbred. The population under consideration for the research was crossbred which produced from crossing within F_1 generation (i.e. 50 per cent Holstein Friesian x Deoni).

MATERIALS AND METHODS

Selection of Animals

Crossbreeding programme was initiated in 1972 and thereafter it was continued on farm. Deoni female formed the maternal line and the semen from proven Friesian bulls was used to produce F_1 generation. Further the programme was taken up to the second phase to take up interse mating between halfbred male and female on the farm. In addition to this induction of high potential germplasm from Friesian has also been taken up. However, the interse progeny

* Department of Animal Husbandry and Dairy Science, College of Agriculture, Parbhani (MS), India, *E-mail: badam.thorat2010@gmail.com*

was aimed at and they formed the material for investigation in this study.

The Sources and Collection of Data

Earlier the CCBP and ACDF farms use to maintain Deoni, Friesian x Deoni and Jersey x Deoni cattle. The data accumulated on production characters of Holstein Friesian x Deoni interse crossbred was considered in the present study. The information on characters namely LMY were taken from the pedigree sheets and daily milk yield record maintained at the farm. In all records of 71 Holstein Friesian x Deoni interse crossbred dams with 185 lactations over a period of 16 years (1992 to 2007) were included in the study.

Compilation of Data

The data accumulated on LMY in respects of Holstein Friesian x Deoni interse crossbred cows during the period from 1992 to 2007 were compiled from the pedigree and daily milk yield record maintained at CCBP farm.

Classification of Data

The raw data collected on the characters under study were classified in suitable sub-class frequency and were subjected for correction. The data were classified in to,

1. Season
   - S_1 - Cold Season (December to February) (33)
   - S_2 - Hot Season (March to May) (46)
   - S_3 - South West Monsoon Season (June to September) (80)
   - S_4 - Post Monsoon Season (October to November) (26)
2. Period
   - P_1 - (1992-1995) (42)
   - P_2 - (1996-1999) (38)
   - P_3 - (2000-2003) (61)
   - P_4 - (2004-2007) (44)

Statistical Methodology

The fixed effects and random effects were partitioned with suitable statistical methodology to obtain the estimates. In order to accomplish the statistical analysis of data the Least Square Technique as outlined by Harvey (1976) was employed. The principle of this technique is to minimize the error sum of squares, sum of squared difference between observed and expected values called the residual sum of square. The following mathematical model was employed to analyze the data.

$$Y_{ijk} = \mu + S_i + P_j + e_{ijk}$$

Where,

- Y_{ijk} - is the record of a cow calved during j^{th} period, in i^{th} season.
- μ - is the population mean common to all the observations.
- S_i - is the effect of i^{th} season of calving (1...4)
- P_j - is the effect of j^{th} period of calving (1...4)
- e_{ijk} - is the random error assumed to be NID (0, δ^2,e)

The Least Squares Analysis

Setting-up of normal equation

From the above mathematical model a set-up of normal equations were developed.

Table 1
Normal Equations Table

Model	$Y_{ijk} = \mu + S_i + P_j + e_{ijk}$			
	μ	Si	Pj	RHM
μ	n..	ni...	n.j	Y…..
S_i	ni..	ni...	nij	Yi…..
P_j	nj..	nij...	n j	Yj…..

To estimate nine unknown constants, nine normal equations were formed and these were one for ì, four for seasons and four for periods. These equations were then set up in the form of a Matrix. The normal equation so developed were not independent of each other, therefore, a unique solution could not be obtained. To obtain the estimates of the constants the following restrictions were imposed.

$$\Sigma S_i = \Sigma P_i = 0$$

By imposing these restrictions, on the estimates of constants, it becomes possible to compute the S_i and P_j. Having obtained the value of total SS, error SS and main effect SS, the analysis of variance (ANOVA) was run.

The mean squares were obtained by dividing the SS of each effect by the corresponding degrees of freedom (DF). The ratios of mean square for each of the effect and also for error provided the 'F' values for testing the significant differences. The 'F' value was compared with the table value. The statistical methodology given for correction and analysis of data on the parameters under study in respect of Holstein Friesian x Deoni interse crossbred was followed.

Table 2
Pattern of Analysis of Variance

Source	*DF*	*SS*	*MSS*	*F*
Season	i –1	1 -1 $A_i Z_i A_i$	SS/DF	MSS/MSSE
Period	j –1	1 -1 $A_j Z_j A_j$	SS/DF	MSS/MSSE
Error	Residual	e_{ijk} x Y_{ijk} -R (μ , S_i , P_j)	SS/DF	–
Total	n….-1	Σ Σ Σ i j k Y^2 i j k	*SS/DF*	

Standard error (SE) for least squares means of main effect were obtained from the values of error mean squares $\delta^2 e$ and the element of variance co-variance matrix viz.,

$$SE = \sqrt{C\,\mu\,\mu}$$

$$SE(\mu + ai) = \sqrt{(C\ \mu\ \mu) + Cii + C\,\mu i)\,\delta^2 e}$$

Where,

C μ μ = element of variance and co-variance matrix corresponding to μ row and column.

Cii = element of the i^{th} effect by row and column.

C μi = element in μ^{th} row and i^{th} column

RESULTS AND DISCUSSION

Lactation Milk Yield of Holstein Friesian x Deoni Interse Crossbred Cows

As an individual genotype a cow is valued on the basis of her milk yield, she produces in her lifetime. The quantity and quality of LMY is significant from economic point of view. Her productivity is influenced by the inheritance, she received from her parents and also the non-hereditary factor i.e. largely the extraneous environment, to which she is exposed during the entire lactation. The LSM on LMY of Holstein Friesian x Deoni Interse crossbred cows under study is presented in Table 3.

It is observed from Table 3 that the LSM for LMY of Holstein Friesian x Deoni interse crossbred cows was 1296.74 ± 12.98 kg. Earlier studies on LMY in Holstein Friesian x Deoni crossbred cattle were reported as 1575.65 ± 29.64 kg by Patil (1983), 1804.32 ± 43.97 kg by Thalkari (1984) and 1589.35 ± 212.64 kg by Thombre *et al.* (2002).

In India few interse crossbred have recorded higher LMY as compared to that of Holstein Friesian x Deoni interse crossbred. Singh and Dave (1989) reported the LMY in Holstein Friesian x Tharparkar interse crossbred as 1459.19 ± 47.45 kg, Khade (2001) reported the LMY in Holstein Friesian x Gir interse and Holstein Friesian x Jersey x Gir interse crossbred cows as 3395.48 and 2900.14 kg, respectively. Bhattacharya *et al.* (2002) reported LMY in Holstein Friesian x Tharparkar interse crossbred as 1747.99 ± 169.50 kg.

Table 3
Least Squares Means and Standard Error for Lactation Milk Yield (kg) of Holstein Friesian x Deoni Interse Crossbred Cows.

Sources	*Code*	*LSM + SE*
Mean	M	1296.74 ± 12.98
Season	S_1	1274.91^{a} ± 28.06
	S_2	1281.01^{a} ± 24.05
	S_3	1279.51^{ab} ± 17.58
	S_4	1351.52^{ac} ± 31.61
Period	P_1	1300.43^{a} ± 25.41
	P_2	1279.05^{a} ± 26.60
	P_3	1270.61^{ab} ± 21.31
	P_4	1336.85^{ac} ± 24.65

Means with similar superscripts are not significantly different.

Various crossbreds have recorded higher LMY as compared to that of Holstein Friesian x Deoni interse crossbred. Malik *et al.* (1996) reported LMY as 2557.34 ± 34.59 kg in Hariana crosses, Arora *et al.* (1996) reported LMY as 2712.30 ± 27.60 kg in Holstein Friesian x Sahiwal, Nagare and Patel (1997) reported LMY as 3214.18 kg, in Gir crosses, Borade (1997) reported LMY as 3154.41 ± 72.59, 2770.71 ± 86.80 and 2902.66 ± 81.60 kg in Holstein Friesian x Jersey x Local, Jersey x Holstein Friesian x Local and Brown Swiss x Holstein Friesian x Local crossbred, respectively. Pachpute *et al.* (1999) reported LMY as 2723.63 + 216.83, 2910.15 ± 272.63 and 2621.77 ± 2909.35 kg in Holstein Friesian x Jersey x Gir, Jersey x Holstein Friesian x Gir and Brown Swiss x Holstein Friesian x Gir, respectively. Sharma and Singh (1999) reported LMY as 2857.00 ± 60.20 kg in Holstein Friesian x Sahiwal, Thakur and Singh (2001) reported LMY as 2202.75 kg in Jersey x Red Sindhi, Khade (2001) reported LMY as 3718.45 and 3350.40 kg in Holstein Friesian x Gir, Holstein Friesian x Jersey x Gir, respectively. Bhattacharya *et al.* (2002) reported LMY as 2753.16 ± 67.15 kg in Holstein Friesian x Tharparkar. Dhara (2003) reported LMY as 1815.50 ± 74.27, 1905.01 ± 85.62 and 2215.70 ± 83.14 kg in Jersey x Hariana halfbred, Holstein Friesian x Hariana halfbred and Brown Swiss x Hariana halfbred cows, respectively. Singh and Gurnani (2004) reported LMY as 3677.00 ±

135.00 and 2952.00 ± 120.00 kg in Karan Fries and Karan Swiss respectively, Yadav *et al.* (2004) reported LMY as 2269.00 ± 162.00 in Holstein Friesian x Hariana crossbred, Dubey and Singh (2005) reported LMY as 2711.56 ± 46.93 kg in Gir crosses.

The lower value than Holstein Friesian x Deoni interse crossbred was reported by Tomar *et al.* (1997) as 1192.36 in Holstein Friesian x Zebu crossbred.

Season Effect on LMY in Holstein Friesian x Deoni Interse Crossbred Cows

The genotypes produced either on the field scale or on an organized farm respond to the season accept and adopt seasonal changes as and how they affect. Generally the physiology and physicality manifestation would be the sole aim. Adverse season experienced for a short stipulated time affects and temporary depression in the yield is recorded. Seasonal effect on LMY in Holstein Friesian x Deoni interse crossbred cattle were studied. The corrected data along with the analysis of variance is presented in Table 4. The LSMs for LMY in Holstein Friesian x Deoni interse crossbred cows in season S_1, S_2, S_3 and S_4 were 1274.91 ± 28.06, 1281.01 ± 24.05, 1279.51 ± 17.58 and 1351.52 ± 31.61 kg, respectively.

Table 4
Analysis of Variance for Lactation Milk Yield in Holstein Friesian x Deoni Interse Crossbred Cows.

Source	*DF*	*SS*	*MSS*	*F*
Season	3	116790	38930	1.53^{NS}
Period	3	120450	40150	1.58^{NS}
Error	179	4562710	25490	
Total	185	4799950	104570	

LSM for LMY recorded in S_4 was higher to that of the LSM for LMY recorded in S_1, S_2 and S_3. The differences observed in the LSMs for LMY were non-significant due to season effect (Table 4). This has revealed that Holstein Friesian x Deoni interse crossbred genotypes are efficient to tolerate the seasonal changes and can get on comfortably. Similar, non-significant season effects were reported by Khade (2001) in Holstein Friesian x Jersey x Gir interse crossbred, Bhattacharya *et al.* (2002) in Friesian x Tharparkar interse crossbred, Sharma *et al.* (1982) in Holstein Friesian x Sahiwal, Pandey *et al.* (1983) in Hariana crossbreds, Shelke *et al.* (1992) in Jersey x Red Kandhari crossbreds, Nagare and Patel (1997) in Gir crossbreds, Thombre *et al.* (2002) in Holstein Friesian x Deoni crossbreds, Dubey and Singh (2005) in Sahiwal crossbreds. This has revealed that the seasonal changes do not influence the variance in LMY in crossbred including Holstein Friesian x Deoni interse crossbred. The crossbred carry adoptive behavior to the seasonality differences and overcome the stress.

Period effect on LMY in Holstein Friesian x Deoni Interse Crossbred Cows

The LSMs for LMY from Holstein Friesian x Deoni interse crossbred in different periods viz., P_1, P_2, P_3 and P_4 were recorded as 1300.43 ± 25.41, 1279.05 ± 26.60, 1270.61 ± 21.32 and 1336.85 ± 24.65 kg, respectively. The LSM for LMY recorded in period P_4 was higher to that of the LSM for LMY in P_1, P_2 and P_3. The differences observed in the LSMs for LMY were non-significant due to period effect (Table 4). Similar non-significant period effect on LMY were recorded by Sharma *et al.* (1982) in Holstein Friesian x Sahiwal, Koul *et al.* (1985) in Jersey x Hariana, Bhattacharya *et al.* (2002) in Holstein Friesian x Tharparkar. This indicated that irrespective of any period of calving the cows LMY remains unchanged and does not get significantly deviated.

CONCLUSIONS

The LSM for LMY in Holstein Friesian x Deoni interse crossbred was recorded as 1296.74 ± 12.98 Kg. Season and period did not influenced significantly LMY in Holstein Friesian x Deoni interse crossbreed. It could be concluded that Holstein Friesian x Deoni interse crossbred genotype adapted to the periodicities but with seasonal changes and warranting testing further for effects of season and modifying the management practices. The management factor had indirectly affected the LMY though not to a significant level, its sensitivity remains unchanged. The period effect which is basically of non-genetic origin contributed to certain extent in the manifestation of the production and reproduction characteristics. Thus management is the major component while Holstein Friesian x Deoni interse crossbred genotype as major respondent. Although the data was on small herd of Holstein Friesian x Deoni interse crossbred, individuals has given firm guidance for manipulation of non-genetic components efficiently while deciding about the future selection and breeding programme.

REFERENCE

Arora, C. L., Singhal, R. A., Garg, R. C. and Subramaniam, N. B. (1996), Age at First Calving in Frieswal Cows and Its Influence on First Lactation Milk traits. *Indian J. Anim. Sci.* **66** (10): 1067-1069.

Bhattacharya, T. K., Patil, V. K., Joshi, J. D., Mahapatra A. S. and Badola, S. (2002), Dairy Performance of

Tharparkar, Holstein Friesian and Their Crosses. *Indian J. Anim. Sci.* **72** (2): 154-156.

Borade, S. S., Kale, K. M., Ulmek, B. R. and Deokar, D. K. (1997), Comparative Study on Productive and Reproductive Performance of Triple Crossbred Cattle. *Indian J. Anim. Prod. Mgmt.* **13** (4): 206-208.

Dhara, K. C. (2003), Factors Affecting Lactation Milk Yield in Three Consecutive Lactation of Halfbred Dairy Cattle in West Bengal. *Indian J. Anim. Hlth.* **42** (1): 58-60.

Dubey, P. P. and Singh, C. V. (2005), Estimates of Genetic and Phenotypic Parameters Considering First Lactation and Lifetime Performance Traits in Sahiwal and Crossbred Cattle. *Indian J. Anim. Sci.* **75** (11): 1289-1294.

Harvey, W. R. (1976), Least Squares Analysis of Data with Unequal Sub-class Numbers, Agricultural Research Service, United States, Department of Agriculture, Washington. D. C.

Khade, P. B. (2001), Studies on Herd Structure of Holstein Friesian Crosses in Relative with Production Performance at RCDP on Cattle, Rahuri. M.Sc. Thesis submitted to Mahatma Phule Krishi Vidyapeeth Rahuri (M.S.).

Koul, G. L., Pandey, H. N. and Katpatal, B. G. (1985), Studies on AFC and its Relationship with Weight and First Lactation Milk Yield in Crossbreds. *Indian J. Dairy. Sci.* **38** (4): 332-334.

Malik, Z. S., Singh, B., Dhaka, S. S. and Chikara, S. S. (1996), Genetic and Non-Genetic Factors Influencing Lactation Milk Yield in Crossbred Dairy Cattle. *Indian J. Anim. Res.* **30** (11): 61-64.

Nagare, W. K. and Patel, A. M. (1997), The Comparative Performance of Gir Crossbreds under Maharashtra Conditions *Indian J. Anim. Prod. Mgmt.* 13 (2): 87-92.

Pachpute, S. T., Kale, K. M. and Lawar, V. S. (1999), Factors Affecting First Lactation Milk Yield of Threebred Crosses. *Indian J. Anim. Prod. Mgmt.* **15** (3): 125-127.

Pandey, H. N., Garg, R. C. and Kaushik, S. N. (1983), First Lactation Milk Yield, Lactation Length and Dry Period in Hariana-exotic Crosses. *Indian J. Dairy. Sci.* **53** (3): 307-309.

Patil, C. Y. (1983), Study on Production and Reproduction Traits of Friesian x Deoni Crossbreds. M.Sc. Thesis submitted to Marathwada Agriculture University, Parbhani (M. S.).

Sharma, J. M., Dhinora, M. M. and Gurang, B. S. (1982), Note on the Genetic and Non-Genetic Factor Affecting Some Production Traits in Crossbred (Friesian x Sahiwal) Cattle. *Indian J. Anim. Sci.* **52** (1): 42-45.

Sharma, K. C. and Singh, P. K. (1999), A Study on the Environmental Factors Affecting the Performance of Friesian x Sahiwal Crossbreds. *Indian J. Anim. Res.* **33** (1): 1-6.

Shelke, B. S., Sakhare, P. G. and Deshpande, K. S. (1992), Studies on Lactation Yield and its Prediction from Part Lactation Yield. *Indian J. Dairy Sci.* **45** (8): 416-418.

Singh, N. P. and Dave, S. K. (1989), Performance of Tharparkar x Holstein Friesian Interse Crossbreds in Central India. *Indian J. Anim. Prod. Mgmt.* **5** (1): 1-4.

Singh, M. K. and Gurnani, M. (2004), Genetic Analysis Production and Reproduction Traits in Karan Fries and Karan Swiss Cattle. *Indian J. Anim. Sci.* **74** (2): 225-228.

Thakur, Y. P. and Singh, B. P. (2001), Performance Evaluation of Jersey x Sindhi Crossbreds. *Indian Vet. J.* **78** (1): 62-63.

Thalkari, B. B. (1984), Optimisation of Some Production and Reproduction Traits in Friesian x Deoni and Jersey x Deoni Crossbreds. M.Sc. Thesis submitted to Marathwada Agriculture University, Parbhani (M. S.).

Thombre, B. M., Mitkari, K. R., Karanjkar L. M. (2002), Studies on Age at First Calving and Milk Yield in Deoni and Holstein Friesian x Deoni halfbreds. *Indian J. Anim. Res.* **36** (2): 141-143.

Tomar, A. K. S, Joshi, J. D., Sidhu, N. S. and Bisht G. S. (1997), Indirect Selection for Improving Production and Reproduction Traits in Holstein x Zebu halfbreds at an Early Age. *Indian J. Anim. Res.* **31** (1): 6-10.

Yadav, J. S., Dutt, G. and Yadav, M. C. (2004), Genetic Studies of Some Lactation Traits in Crossbred Cows. *Indian J. Anim. Sci.* **74** (12): 1232-1233.