Indian Journal of Animal Sciences **87** (4): 520–522, April 2017/Short communication

Evaluation of non-genetic factors affecting lactation traits of Frieswal cows in northern zone of India

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Received: 10 March 2016; Accepted: 12 September 2016

Key words: Frieswal cows, Lactation length, Peak yield, Total milk yield

Crossbreeding of local non-descript cattle with exotic breeds of high genetic potential is considered to be a rapid and effective method for increasing the milk production in order to meet the growing requirements of the human population. In India, cross breeding has played its role well and made a contribution in significantly increasing the milk production. The crossbreds constitute only 16.6% of the total cattle population but contribute 25.3 million tonnes (53%) of cow milk. In this regard, since 1987, ICAR has research collaboration with the Military Farms to evolve 'Frieswal' a national milch crossbred cattle with 5/8 Holstein Friesian and 3/8 Sahiwal blood, yielding 4,000 kg of milk with 4% butter fat in a mature lactation of 300 days (Gaur *et al*. 2006). The development of Frieswal breed has been progressing so far utilizing the existing crossbred herds available at various Military Farms and subsequently through selective breeding of *inter se* mating crossbred population.

The production performance of crossbreds is not optimum due to various factors which include direct effect of climate as well as various managemental problems prevailing in the farms. Improvements targeted towards these problems may help to substantially increase the performance of cattle (Machado *et al.* 1999). Therefore, adjusting records for non-genetic effects is essential to define appropriate breeding strategies and improving the selection procedures. The present study was, therefore, planned to assess the effects of non-genetic factors on the performance of milk production in Frieswal cows in northern zone of India.

Data pertaining to 9,148 lactation records of Frieswal cows sired by 97 bulls from 1991 to 2012 and maintained at Military Farms of Meerut and Ambala were used in the study. Least squares analysis of variance (Harvey 1990) was used to study the influence of season, period of calving and parity. The traits considered under the study were total milk yield (kg), peak yield (kg) and lactation length (days). Each year of calving was divided into 3 seasons i.e. winter (November to February), summer (March to June) and rainy (July to October) based on climatological conditions. Period of calving was classified into four periods as period-1 (1991– 1996), period-2 (1997–2001), period-3 (2002–2006) and period-4 (2007–2012).

The following model was used to analyze the effects of non-genetic factors on lactation traits of Frieswal cattle

$$Y_{ijklm} = \mu + F_i + S_j + P_k + Pa_l + e_{ijklm}$$

where, $Y_{ijkl,}$ record of animal in the i^{th} farm, j^{th} season and from k^{th} period and l^{th} parity; μ, overall mean; F_i, effect of i^{th} farm; S_j, effect of j^{th} season of calving; P_k, effect of k^{th} period of calving; Pa_l, effect of l^{th} parity; e_{ijklm}, random error, assumed to be NID (0, σ^2_e).

Duncan's multiple range test (DMRT) modified by Kramer (1957) was used to make pair-wise comparison among the means. The overall total lactation milk yield, peak yield and lactation length were 3409.04±16.62 kg, 15.69±0.08 kg and 322.84±0.87 days, respectively.The least squares means along with standard errors for different factors are presented in Table 1.The factors farm, parity, season and period of calving had significant effect on the lactation traits like total lactation milk yield, peak yield and lactation length (P<0.001), except farm for peak yield.

Military farm (Meerut) had higher total lactation milk yield and lactation length (3461.11±17.08 kg and 327.24±0.89 days) than Military Farm (Ambala) (3356.97±23.91 kg and 318.44±1.25 days). Better feeding and managemental practices available may be the reason for increased production in Military Farm at Meerut but the farm did not show any influence on peak yield of animals.

Period and season of calving were also found significant sources of variation over lactation traits in Frieswal cows. Animals calved in winter had significantly higher total lactation milk yield (3495.00±21.23 kg) and peak yield (16.91±0.83 kg) in comparison to other two seasons, whereas summer calved animals had an extended lactation (333.00±1.33 days). Seasonal variation could be due to the type of feed, environmental deviations, management and

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Table 1. Least squares means of total milk yield (kg), peak yield (kg) and lactation length (days) in Frieswal animals

Factor	No.	Total milk yield (kg)	Peak yield (kg)	Lactation length (days)
Overall mean	9148	3409.04±16.62	15.70±0.07	322.84±0.87
Farm		**		**
Meerut	5849	3461.11±17.09^{b}	15.62±0.07	327.24±0.89^{b}
Ambala	3299	3356.97±23.91^{a}	15.77±0.09	318.44±1.25^{a}
Season of calving	**	**	**	
Winter	3860	3495.00±21.23^{b}	16.91±0.08^{c}	318.17±1.11^{a}
Summer	2425	3394.00±25.49^{a}	15.23±0.10^{b}	333.00±1.33^{b}
Rainy	2863	3338.12±22.59^{a}	14.95±0.09a	317.36±1.18^{a}
Period of calving	**	**	**	
1991–96	1018	3341.93±37.04^{a}	14.60±0.15^{a}	340.36±1.93^{a}
1997–01	1965	3634.15±26.56^{b}	16.58±0.10^{c}	331.42±1.38^{b}
2002–06	4147	3353.64±18.78^{a}	15.87±0.07^{b}	315.70±0.98^{c}
2007–12	2018	3306.43±25.66^{a}	15.74±0.10^{b}	303.89±1.34^{d}
Parity		**	**	**
1	3367	2885.71±19.99^{a}	13.33±0.08^{a}	312.87±1.04^{a}
2	2198	3441.37±24.14^{b}	15.66±0.10^{b}	328.18±1.26^{b}
3	1552	3515.41±28.39^{bc}	16.29±0.11^{c}	324.20±1.48^{b}
4	1005	3609.51±34.63^{c}	16.54±0.14^{c}	324.65±1.80^{b}
5	560	3566.57±45.70^{bc}	16.33±0.18^{c}	324.63±2.38^{b}
6	466	3435.67±50.19^{b}	16.03±0.20^{bc}	322.52±2.62^{b}

**P<0.01, Means with different superscript differ significantly (P<0.01).

heat stress on animals during summer months. The high milk yield in winter may be due to the abundant green fodder supply and the animals which receive good management could be expected to respond well by expressing better production potentiality, while the decrease in their milk production, in summer and autumn, may be due to the decrease in adequate good quality feeds and the high temperature. Animal calved during the period 1997–2001 had significantly higher milk yield and peak yield (3634.15±26.56 and 16.57±0.10 kg) followed by period 2002–2007 (3353.64±18.78 and 15.87±0.07 kg). The significant effects of period of calving (Gaur *et al.* 2008, Komatwar *et al.* 2010 and Kumar *et al.* 2015) and season of calving (Gaur 2007 and Kumar *et al.* 2015) on milk yield were reported in previous studies. The variation in total milk yield (decrease over the periods) was primarily due to the shortening of lactation length (340.36 days during 1991–1996 to 303.89 days during 2007–2012).

The total lactation milk yield was less in first lactation (2885.71±19.99 kg), and it showed an increasing trend in subsequent parities up to 4th parity. A similar trend was observed in the case of peak yield and lactation length. This is logically due to increase in body weight combined with advancing age and the full development of the secretory tissue of the udder. The present study was also in agreement with Khan and Bhat (1972), who showed that the milk yield increased with advancement of age until the highest production was attained at the fourth lactation in Sahiwal-Holstein Friesian crossbred cattle. The least squares means of most of the production traits significantly varied from one to other lactation as reported by Taggar *et al.* (2014) in Jersey crossbreds.

SUMMARY

Data pertaining to 9,148 lactation records of Frieswal cows sired by 97 bulls from 1991 to 2012 and maintained at Military Farms (Meerut and Ambala) were used in the study. Results of the study clearly indicated that the non-genetic factors like farm, parity, season and period of calving had significant effect on the lactation traits like total lactation milk yield, peak yield and lactation length. So the adjustments have to be taken for accurate estimation of genetic parameters and breeding values. Since the Frieswal cattle is affected by non-genetic factors, proper production strategies should be adopted to improve the performance of Frieswal cows.

ACKNOWLEDGEMENT

The authors are thankful to Director, ICAR-Central Institute for Research on Cattle, Meerut for providing necessary facilities for conducting the study. We also acknowledge Director, Military Farms and Frieswal Project, as well as Officer In-charges of Military Farms (Meerut and Ambala) to supply the information and data.

REFERENCES

Gaur G K, Kumar A, Beniwal B K and Praveen. 2008. Evaluation of Frieswal bulls under farm and field conditions. *Indian Journal of Animal Sciences* **78**: 218–21.

Gaur G K. 2007. Environmental factors affecting various performance traits of Holstein Friesian × Sahiwal Cattle. *Indian Journal of Dairy Science* **54**: 209–13.

Harvey W R. 1990. User's Guide for LSMLMW and MIXMDL PC–2 Version Mixed Model Least-Squares and Maximum Likelihood Computer Program. Ohio State University, Columbus, USA.

Khanna R S and Bhatt P N. 1972. Genetic and non genetic factors associated with first five lactation yield of Sahiwal-Friesian crosses. *Indian Journal of Animal Sciences* **42**: 643.

Komatwar S J, Deshpande A D, Kulkarni M D, Kulkarni A P, Yadau G B, Ulemale A H and Shisode M G. 2010. Study on the production traits in Holstein Friesian × Sahiwal crossbreds. *Indian Journal of Animal Production and Management* **26**: 177–81.

Kramer C Y. 1957. Extension of multiple range tests to group correlated adjusted means. *Biometrics* **13**: 13–18.

Kumar S, Alex R, Singh U, Kumar A and Das A K. 2015. Comparative performance evaluation of Frieswal bulls in organized farms and farmers' herds. *Indian Journal of Animal Sciences* **85**: 316–19.

Taggar R K, Das A K, Kumar D and Mahajan V. 2014. Genetic studies on performance traits of Jersey crossbred cows in sub-temperate region. *Indian Journal of Animal Sciences* **84**: 771–74.