International Journal of Scientific Engineering and Applied Science (IJSEAS) – Volume-6, Issue-9, September 2020
ISSN: 2395-3470
www.ijseas.com

Genetic Study on Performance Traits in Organized Holstein Friesian herd in India

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Abstract

The data for present study belongs to 973 dams and 42 sires including their progenies. The location of herd observed climatic condition variation round the year and thus can be divided into 4 seasons in order to make the data homogenous within a group.The resultant classified data is unequal and non orthogonal and thus least squares method of analysis (Harvey, 1990) was adopted to further delineate the effects influence.Leastsqure means for traits like FLTMY, FL300/305DMY, AFC,FLL,FCI, FDP were to be found 5384.51 ± 240.14kg, 4932.48 ± 199.3kg,789.07 ± 7.31days, 331.72 ± 8.05days, 451.13 ± 11.33days, 116.11 ± 6.72 days respectively.Effect of season and period on all traits were reported significant result. The present investigation reconfirms that the milk production traits are largely modified by non genetic and managemental factors. There is a need to adopt appropriate managemental practice in varying seasons over different period for getting maximum yield. The farm is scientifically managed and has reflected as no influence of non genetic factors on important traits of lactation and age at first calving.

Key words: BLUP, first lactation traits; age at first calving; genetic parameter; Holstein-Fresian

Introduction

Increasing the efficiency of cattle dairy herd is a prime objective and could be achieved either by favorable environmental condition or by improvement of breeding value of traits in a dairy cattle population.The performance of dairy cattle largely depends on production and reproduction traits and being the QTL they are influenced by both genetic and non-genetic factors. India is unique in terms of agro climatic zones and experience diversified environmental condition in different

parts of the country. Thus, needs to study the influence of genetic and non genetic factors for overall genetic improvement of the livestock. As, HF cattle are very sensitive about environmental condition it was imperative to study exhaustively the role of various genetic as well as non genetic factors on performance traits in Holstein Friesian cattle maintained in organized herd in India.

In India, various workers were observed the effect of genetic and non-genetic factor on production and reproduction traits in different breed and crossbred cattle. Pol *et.al*(2013), Garudker(2011), Zol*et.al*(2002) were studied on PhuleTriveni cross bred. Whereas Talpe (2010), Laxshmi*et.al*(2009) Singh *et.al*.(2002) and Mukherjee(2005) were studied on Jersey cross, HF X Sahiwal, Friesian jersey brown Swiss cross with Haryana cattle, Frieswal crossbred respectively for different production and reproduction traits.

Materials and methods

For the present investigation, data were collected from Holstein Friesian adult cows maintained at Bhagylaxmi dairy farm,Manchar Pune Maharastra India. The complete Data was managed and maintained by using animal software i.e.Dairy plan c21 for dairy herd management provided by GEA a German technology(this soft ware attached to 50 stall rotary milking parlour).The information on various production and reproduction traits was collected from 2007 to 2014. The data for present study belongs to 973 dams and 42 sires including their progenies. Thelocation of herd observed climatic condition variationround the year and thus can be divided into 4 seasons in order to make the data homogenous within a group.

Methodology

The performance traits under study are quantitative in nature and are influenced by non-genetic factors, therefore in order to find out the effect of various non genetic factors on them the data was classified into different classes for fixed effect viz period, season and random effect of sire. The resultant classified data is unequal and non orthogonaland thus least squares method of analysis (Harvey, 1990) was adopted to further delineate the effects influence.

Statistical analysis

The production and reproduction traits were analyzed using statistical models. The models used with assumptions that different components being fitted into the model are linear, independent and additive. The statistical models used for various traits are as follows.

(a) Age at first calving

The following model was used for studying the influence of genetic and non genetic factors on it:

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

where,

Y_{ijk} =Age at first calving of k^{th} cow born in i^{th} seasonand j^{th} period

μ = Overall population mean

S_i = Effect of i^{th} season

P_j= Effect of j^{th} period

e_{ijk} = Random error (NID, σe^2)

(b)First lactation traits

The model used for various first lactation traits was as given below:

$$Y_{ijklm} = \mu + S_i + P_j + A_k + D_l + e_{ijklm}$$

where,

Y_{ijklm} =First lactation traits of m^{th} cow born in i^{th} season of j^{th} period belonging tokth age group with l^{th} number of days open

μ = Overall mean

S_i =Effect of i^{th} season

P_j = Effect of j^{th} period

A_k = Effect of k^{th} age group

D_l = Effect of l^{th} days open

e_{ijkm} = Random error(NID;0, σe^2)

c) All lactation traits

The following model will be used for all lactation traits:

$$Y_{ijkl} = \mu + P_i + S_j + (SL)_k + e_{ijkl}$$

where,

Y_{ijkl}= k^{th} observation in i^{th}period, j^{th}season of l^{th} cow

μ= Overall mean

P_i = Effect of i^{th} period of calving (i=1-5)

S_j= Effect of j^{th} season of calving (j=1-4)

SL_l= Effect of k^{th} stage of lactation (k=1-3)

e_{ijk}= Random error NID (0, σ^2_e)

Test of significance

The least squares means showing significance effect of factors were further subjected to Duncan's Multiple range test as modified by Kramer(1957) for testing differences among least squares means (using the inverse coefficient matrix). The differences were considered significant, if

$$(Y_i - Y_j)\sqrt{\frac{2}{(Cii + Cjj - 2\,Cij)}} > \sigma e Z_p\, n_2$$

where,

$(Y_i - Y_j)$ = Difference between two constants

C_{ii} = Diagonal element of i^{th} subclass

C_{jj} = Diagonal element of j^{th} subclass

C_{ij} = Diagonal element of ij^{th} subclass.

Z_p= Significant studentised value in Duncan's table at $_p$, $_{n2}$ df

$_P$ = Numbers of means in range chosen

n_2 = Degree of freedom of error

Prior to estimation of genetic parameters, the data was adjusted for different significant non-genetic factors. The adjusted records were then used for estimation of genetic parameters for production and reproduction traits.

Table: Analysis of variance for Genetic parameter estimation

Sources of variation	df	Mean sum of squares	Expected mean sum of squares
Between sires	S-1	MSS_S	$\sigma^2_e + K\sigma^2_s$
Within sires	N-S	MSS_E	σ^2_e

K : average number of progenies per sire

Result and Discussion

First lactation milk yield is the total amount of milk produced by the first calvers in 305 days of lactation length. This is an important parameter that gives an indication about the

production performance in subsequent lactations that finally gives an indication about the lifetime performance of the animal.

First lactation total milk yield (FLTMY) in present study was found to be 5384±240.14kg. The result is in disagreement withThombre (2007) who reported the lactation milk yield as 2837±168kg in PhuleTriveni three breed.However, lower estimate than the presentfinding was reported byJadhav(2011)and Garudkar (2011) as 3248 ± 113kg, 3224 ± 104kg respectively in PhuleTriveni three breed.

The effect of sire on first lactation total milk yield in present study was observed to be non significant.Whereas, effect of sire on FLTMY was found to be significant by Hadge*et al.* (2009) in Sahiwal x Jersey crossbred and Khara*et al.*(2008) in HF crossbred cows.The effect of season of calving on FLTMY in present study was observed to be significant. Highest FLTMY as 5560.51 ± 258.13kg was reported in winter season whereas lowest FLTMY as 4997.82 ± 266.8kg was reported in summer season. The significant effect of season of calving on FLTMY was also reportedby Nikam (2010), Garudkar (2011) and Jadhav (2011) in PhuleTriveniand FJG crossbred cows respectively. The significant influence of season was obvious due to availability of better quality feed and fodder in winter seasons compared to other seasons and the stress due to high temperature and humidity is also nil during this season. The effect of period of calving on FLTMY in present study was found to be significant. HighestFLTMY was reported as 7020.35 ± 475.66Kg in period 2007 and lowest FLTMY was reported as 2747.76 ± 970.74 kg in period 2012 as shown on table no2. There was significanteffect of period on FLTMY in the Holstein animals studied under present investigation. There is difference between period of calving related to cow comfort level, good environmental condition and good quality feeds and fodder availability.The significant effect of period of calving on first lactation total milk yield was reported by Mandakmale and Kale (1990) in Gir triple crosses, Jebale (1994) in FJG. However, Talape (2010) reported non-significant effect of period of calving on FLTMY in Jersey crossbreds.

Table 1. Least square analysis for production and reproduction traits

Traits	Season	Period	Error	R^2value(%)
FLTMY	14394712.12**	11643843.54**	3217172.39	67%
FL300/305DMY	8259444.30**	8024453.43**	1735914.60	73%

AFC	16514.33**	46135.19**	5164.91	59%
FLL	18837.31**	12164.96**	6202.11	34%
FCI	92346.59**	32135.68**	8989.12	78%
FDP	265228.35**	20004.22**	5406.62	77%

** Significant (P<0.01)

The first lactation300/305 Days milk yield in present study was observed 4932.48 ± 199.3kg as shown in table 2. Thombre (2007) has also reported 2837±168kg milk yield in 305 days lactation length inPhuleTriveni three breed. Jadhav (2011) and Garudkar (2011) observed 3248 ± 113kg, 3224 ± 104kg respectively in PhuleTriveni three breed.Effect of sire on FL300/305dMY was observed to be significant in the present study. The earlier workers also (Mukherjee, 2005 Nehra, 2011)observed significant effect of sire on FL300/305dMY in Holstein crosses in Indian condition.The effect of sire on FL300/305dMY was observed non-significant by Pol *et al.*(2013) in PhuleTriveni three cross.

Effect of season of calving on FL300/305dMY was found to be significant in the present study. Highest FL300/305dMY found to be 5120.69 ± 220.60kg in autumn season and lowest FL300/305dMY was found to be 4641.23 ± 216.75 in summer season as shown in table2.Sahana and Gurnani(2000) had observed significant result effect of season of calving on FL300/305dMY in KF crossbred. Pol *et al.*(2013) reported significant effect of season of calving on FL300/305dMY inPhuleTriveni three cross. Gauraker(2011) and Shelke (2012) were observed non- significant on season of calving on FL300/305dMY.

In the present investigation the effect of period of calving on FL300/305dMY was observed to be significant. Highest FL300/305dMY found to be 6222.61 ± 358.83kg in period of 2010 and lowest FL300/305dMY found to be 3060.99 ± 719.06kg in period 2007 show as table2. Shelke(2012) and Pol*et al.* (2013) reported significant effect of season of calving on FL300/305dMY in PhuleTriveni synthetic cow. However,Nehra(2011) and Divya (2012) reported non-significant effect of season of calving on FL300/305dMY in Karan Fries Cattle.

Age of calving was found to be 789.07±7.31days as shown in the table no2.Divya (2012) and Singh (2013) reported 1023 ± 5, 984 ± 4 respectively in KF. Annual report of PDC (2010-11)(give latest reference of annual report) and Mukherjee (2005) reported 1666.67±56.59 days, 972 ± 4 days respectively in Frieswal cross bred cows.Effect of sire on age of first calving was observed non-significant. Divya (2012) effect of sire on AFC was significant in KF. Singh (2013), Saha (2001),Panja (1997) were reported significant effect of sire on AFC in KF. The

effect of season on AFC found to be non significant. The effect of season on AFC was observed to be non- significant by various workers (Saha, 2001; Singh, 1995;Divya, 2012; Singh2013) in KF. Whereas, effect of season on AFC was reported significant by Mukherjee (2005) in Frieswal and Nehra(2011) in KF. The influence of period on AFC was observed significant. It means AFC influence by period of calving. Lowest AFC was reported 707.85±31.90 days during period 2014.The results are in agreement with the reports of Divya(2012) and Saha(2001) indicating significant effect of period of calving on AFC in KF. Nehra(2011) and Singh (2013) reported non-significant effect of period of calving on AFC.

The first lactation length was found to be 331.72±8.05 days shown as table no 2. Lakshmi *et al.*(2009) and Singh *et al.*(2008) also observed 329 ± 5 days, 304 ± 16 days respectively in HF x Sahiwal and Jersey x Rathi. Pol *et al.* (2013), Garuker(2011) was reported 339 ± 3 days, 389 ± 8days respectively in PhuleTriveni.

The influence of sire on first lactation length was found to be non-significant in the present study. Hadge*et al*. (2009) also found significant effect of sire on first lactation length (FLL)in Sahiwal x Jersey crossbred cows. However, effect of season on first lactation length was found to be non-significant. Highest lactation length was observed 343.27±9.06 days were observed in winter season. However, lowest first lactation length was observed 324.2±9.53 days in summer season shown as table no 2. The non-significant effect of season of calving on first lactation length was reported by Bhoite (1996) and Gawari (1999) in FJG triple crossbred cow.Effect of period of calving on first lactation length was found to be non-significant. Highest first lactation length was observed 366.9±19.74 days in period 2011. Lowest first lactation length was observed 287.61±33.83 days in season 2008.The non-significant effect of period of calving on first lactation length in different crossbred cows was reported by Pol *et al.*(2013) in PhuleTriveni synthetic cows, Khade (2001) in FG crossbred.

Table 2: Least square means of production and reproduction traits in HF cattle

Effects	Traits					
	FLTMY(kg)	FL305DMY(kg)	AFC(days)	FLL(days)	FCI(days)	FDP(days)
Overall	5384.51±240.14	4932.48±199.3	789.07±7.31	331.72±8.05	451.13±11.33	116.11±6.72
		Season of calving				
Winter	5560.51^{d}±258.13	5025.43^{c}±211.02	801.19±8.60	343.27±9.06	481.55^{d}±12.38	131.91^{c}±7.76
Summer	4997.82^{a}±266.80	4641.23^{a}±216.75	790.21±8.74	324.2±9.53	447.55^{c}±12.88	109.63^{a}±8.24
Rainy	5474.84^{b}±263.86	4942.55^{b}±214.80	777.3±8.59	334.73±9.37	442.55^{b}±12.71	114.06^{b}±8.08
Autumn	5504.87^{c}±272.58	5120.69^{d}±220.60	787.57±9.02	324.68±9.84	432.88^{a}±13.22	108.84^{a}±8.55
		Period of calving				
2007	2747.76^{a}±970.74	3060.99^{a}±719.06	839.43^{g}±38.78	313.5±42.07	447.04^{d}±50.99	102.24^{c}±39.14
2008	3590.83^{b}±786.01	3718.16^{b}±584.75	852.51^{h}±27.01	287.61±33.83	447.64^{d}±41.15	131.07^{e}±31.41
2009	5222.39^{c}±712.71	4740.66^{c}±531.65	805.28±21.05	319.95±30.54	427.73^{b}±37.23	85.49^{a}±28.32
2010	6782.74^{g}±471.94	6222.61^{h}±358.83	777.86^{c}±15.52	340.33±19.57	424.13^{a}±24.28	95.97^{b}±17.96
2011	7020.35^{h}±475.66	6168.91^{g}±361.46	729.86^{b}±15.80	366.9±19.74	451.97^{e}±24.48	102.03^{c}±18.13
2012	6077.2^{f}±508.65	5279.37^{f}±384.94	800.94^{f}±17.24	355.53±21.27	466.97±26.27	123.75^{d}±19.57
2013	6000.22^{e}±523.44	5120.22^{d}±395.50	798.82^{d}±18.92	348.87±21.95	505.98^{g}±27.07	157.84^{f}±20.22
2014	5634.59^{d}±732.96	5148.89^{e}±546.31	707.85^{a}±31.90	321.07±31.45	437.62^{c}±38.31	130.51^{e}±29.17

First calving interval was found to be 451.13±11.33days as shown in the table no 2. Mukherjee (2005) reported first calving interval 421 ± 10days in Frieswal cattle. Some other workers also reported first calving interval Nehra (2011) 438 ± 5 days, Saha(2001) 423 ± 13, Panja(1997) 405 ± 4 in KF. The influence of sire on first calving interval was observed non-significant. Non-significant effect of sire on first calving interval was reported by Nehra(2011) and Saha (2001) in KF. Mukherjee (2005) reported non-significant effect of first calving interval in Frieswal. The significant effect of period of calving on FCI was observed. It indicated first calving interval depends on period of calving. Lowest first calving interval was observed 424.13±24.28 days during period 2010. Highest calving interval was observed 505.98±27.07 days during period 2013. Non-significant effect of period of calving on first calving interval was observed between period 2007 and 2008. Nehra (2011) reported significant effect of period of calving on FCI in KF. Mukherjee (2005) reported significant effect of period of calving on FCI in Frieswal.

First dry period was found to be 116.11±6.72 days shown as table no 2. Khade (2001) reported in FJG three crossbred group of cattle the first dry period was 75.19 ± 9.12 days. The first dry

period (FDP) was 64.47 ± 1.46 days in Karan Fries cattle reported by Panja (1997).The non significant Effect of sire on first dry period was found in present study. Ratwan (2018) reported non- significant effect of sire on the first dry period. The significant effect of season of calving on first dry period was observed in present study. Lowest FDP was observed 108.84±8.55 days in Autunm season. Highest FDP was observed 131.91±7.76 days in winter season. There was non-significant effect between summer and autumn season on first dry period. It means there no effect of season between summer and autumn on first dry period. Ratwan(2018) was reported non-significant effect of season of calving on FDP. The significant effect of period on first dry period was observed in present study. Lowest FDP was observed 85.49±28.32 days in 2009 period. Highest first dry period was observed 131.07±31.41 days in 2008 period. There was non-significant effect of period between 2011 and 2007 on first dry period. Non-significant effect of season was observed between 2014 and 2008 on FDP. The significant effect of period of calving on first lactation dry period was observed by Zol*etal.(2002).*

Conclusion

The present investigation reconfirms that the milk production traits are largely modified by non genetic and managemental factors. There is a need to adopt appropriate managemental practice in varying seasons over different period for getting maximum yield. The farm is scientifically managed and has reflected as no influence of non genetic factors on important traits of lactation and age at first calving.

The study indicates that the scientific breeding and management of Holstein Friesian cows can perform best even in sub tropical climatic condition prevalent in India.

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