Original Research

Effect of Non-Genetic Factors on Pre-partum Reproduction Traits in Gir Crossbreds

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Rec. Date:	Aug 11, 2017 15:41
Accept Date:	Mar 25, 2018 16:49
DOI	10.5455/ijlr.20170811034109

Abstract

The data on pre-partum reproduction traits viz. age at first conception (AFCon) and age at first calving (AFC) of five groups of Gir crossbred (FG: 50% Holstein Friesian X 50% Gir, IFG:FG Interse, FJG: 50% Holstein Friesian X 25% Jersey X 25% Gir, IFJG: FJG Interse and R: 5/8 Gir) maintained at Research-cum-Development Project on cattle, Mahatma Phule Krishi Vidyapeeth (M. P.K.V.), Rahuri Maharashtra (India) were collected from year 1972 to 2015. The effects of period of birth and season of birth on pre-partum reproductive traits were determined by using Harvey's least-square technique. The overall least-squares means of AFCon in FG, IFG, FJG, IFJG and R group were 530.52 ± 8.35, 761.33 ± 10.66, 531.42 ± 6.60, 722.70 ± 8.64 and 798.06 ± 16.92 days, respectively. The overall least squares means of AFC in FG, IFG, FJG, IFJG and R genetic groups were 810.44 ± 8.41, 1040.64 ± 10.58, 809.88 ± 6.80, 1000.87 ± 8.69 and 1077.74 ± 17.17 days, respectively. The period of birth had significant effect on AFCon and AFC in IFG, FJG and IFJG genetic groups. The effect of season of birth on AFCon and AFC was non-significant in all the genetic groups.

Key words: Age at First Conception, Age at First Calving, Gir Crossbreds, Reproductive

How to cite: Mote, M., Bangar, Y., Bhoite, S., & Deokar, D. (2018). Effect of Non-Genetic Factors on Pre-partum Reproduction Traits in Gir Crossbreds. International Journal of Livestock Research, 8(8), 142-150. doi: 10.5455/ijlr.20170811034109

Introduction

India ranks first in milk production (146.3 million tonnes during 2014-15) by accounting for 18.5 per cent of world production (Anonymous, 2016). However, Indian dairy sector still faces the constraints of animals' productivity and inferior reproduction performance. The productive and reproductive performance of an animal depends upon genetic makeup of animal and its interaction with the environment under which the animal is brought up and maintained in given time (Ekka *et al.*, 2014). Additionally, pre-partum reproductive traits such as age at first conception or age at first calving in dairy cows plays very important in production cycle and thus, have high economic importance in farm profitability. An earlier age at first calving (AFC) can decrease rearing costs due to less feed, labour and managerial costs. Although, exotic cattle and their crosses are being used increasingly to raise milk production in hot climate of Indian subcontinent, it is extremely difficult to predict which breed, cross or generation will give highest economic returns over investment. This might be due to wide variation in productive and reproductive performance of crossbreds and adaptability of the crossbred to the divergent climatic conditions of the tropics (Patel and Dave, 1987). Hence, identification and stabilization of the optimum level of exotic inheritance is still moot point in the crossbreeding programme (Dalal *et al*., 1991). It is very essential to assess the comparative performance of crossbreds of various generations under divergent agro climatic environment for formulation and implementation of long term breeding programmes (Prabhukumar *et al*., 1990).

The aim of present study was to study the pre-partum reproductive performance in five genetic groups of Gir crossbreds by using data records of period from 1972 to 2015.

Materials and Methods

The present study was carried out to study two pre-partum traits *viz.* age at first conception (AFCon) and age at first calving (AFC). The data pertains to these pre-partum reproductive traits of five genetic groups of Gir crossbred (FG: 50% Holstein Friesian X 50% Gir, IFG:FG *Interse*, FJG: 50% Holstein Friesian X 25% jersey X 25% Gir, IFJG: FJG *Interse* and R: 5/8 Gir) were collected from Research Cum Development Project (RCDP) on cattle, Mahatma Phule Krishi Vidyapeeth, Rahuri, for the period of 44 years from 1972 to 2015. The records of abnormal cases like abortion, dystokia, and still-births were not included. Similarly, half breds, Triple cross and 5/8 Gir crossbred cows which yielded less than 1500 kg milk in lactation or an lactation less than 200 days were not considered. The data for the period from 1972 to 2015 were classified according to period of birth. As per climatic condition the data of each year were divided into three seasons as S_1 Rainy (June to September) S_2 Winter (October to January) S_3 Summer (February to May).

Statistical Methodology

The data were analysed with the help of two programmes Harvey (1990) and SAS version 9.3 (2013) available at Department of Statistics, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, (India). The means and standard error of the traits were calculated using General linear model PROC GLM (SAS 2013). Model for estimation of pre-partum reproductive traits:

The model for estimation of effects of period and season of birth on age at first conception and age at first calving was as given:

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$$Y_{ijk} = \mu + A_i + B_j + e_{ijk}$$

Where,

Y_{ijk} = Observations on age at first conception and age at first calving of k^{th} animal born in i^{th} period and j^{th} season.

μ= Overall mean

A_i = Effect of i^{th} period of birth (i=1, 2,......n)

B_j = Effect of j^{th} season of birth (j=1, 2 and 3)

e_{ijk} = Random error associated with normally independently distributed with mean 0 and variance 6^2.

Duncan's multiple range test (DMRT) as modified by Kramer (1957) was used to make pair wise comparison among the least-squares means.

Results and Discussion

Age at First Conception

The overall least-squares means of AFCon in FG, IFG, FJG, IFJG and R group were 530.52 ± 8.35, 761.33 ± 10.66, 531.42 ± 6.60, 722.70 ± 8.64 and 798.06 ± 16.92 days, respectively (Table 2). The lower AFCon was observed in cows of F_1 generation (FG and FJG) than F_2 generation (IFG and IFJG). This might be due to hetrotic effect in F_1 and gene segregation effect in *interse* (F_2).

Table 1: Analysis of variance of prepartum reproductive traits in Gir crossbreds as affected by various factors

Trait / Source of variation	d. f.	AFCon	AFC
		M.S.S.	M.S.S.
FG			
Period of birth	2	26498.49	27102.36
Season of birth	2	9434.40	11815.47
Error	162	11055.84	11215.14
IFG			
Period of birth	4	319694.98**	311088.02**
Season of birth	2	38772.83	37645.77
Error	265	22209.90	21872.21
FJG			
Period of birth	1	91961.32**	77390.31**
Season of birth	2	676.13	202.20
Error	112	4761.07	5051.17
IFJG			
Period of birth	4	764322.37**	750998.27**
Season of birth	2	27466.93	31196.83
Error	375	21279.34	21521.09
R			
Period of birth	2	50643.76	45841.29
Season of birth	2	25090.26	24611.55
Error	83	23264.70	23945.61

*** = P<0.01*

 DOI 10.5455/ijlr.20170811034109

These results were in close agreement with Kamble (2015) reported in FG half bred and FJG triple cross. The lower AFCon than the present results was reported by Bhoite (1996) in JG, IFG and IFJG genetic groups. However, higher AFCon was noticed by Rafique *et al*. (2000) in HS halfbreds, Madhuri *et al*. (2009) in FJH and in IFJG genetic groups and Saha *et al*. (2010) in Karan Swiss. The period of birth had significant (P<0.01) influence on AFCon in IFG, FJG and IFJG groups (Table 1). Similar results were reported by Bhoite (1996) in Gir crossbreds, Rafique *et al*. (2000) in HF × Sahiwal crossbreds and Madhuri *et al*. (2009) in triple crossbred cows. Kamble (2015) reported significant effect in IFG and IFJG interbreds and non-significant in FG and FJG Gir crossbreds. The variations in AFCon might be due to influence of environmental factors. The variation due to season of birth in AFCon was non-significant in all the genetic groups (Table 1). These results were in agreement with Bhoite (1996) reported in FG, IFG, JG, FJG, IFJG, JFG, IJFG, BFG and IBFG genetic groups, Rafique *et al*. (2000) in HF × Sahiwal crossbred, Sattar *et al.* (2005) in Holstein Friesian, Madhuri *et al*. (2009) in Hariana triple cross cows and Kamble (2015) in FG, FJG, IFG and IFJG groups.

Though the differences due to season of birth were statistically non-significant the heifers of FG, FJG, IFJG and R genetic groups born during summer season had shorter AFCon than those born in rainy and winter season. The non-significant effect of season of birth on AFCon in all the groups revealed that they are efficient to tolerate seasonal changes. This might be due to fact that one of the parent in all crossbreds being indigenous might have contributed its inheritance for better adoption.

Age at First Calving

The overall least squares means of AFC in FG, IFG, FJG, IFJG and R genetic groups were 810.44 ± 8.41, 1040.64 ± 10.58, 809.88 ± 6.80, 1000.87 ± 8.69 and 1077.74 ± 17.17 days, respectively (Table 3).

These results were in accordance with Deokar (2003) reported in Gir crossbred, Jadhav (2011) in *interse* of FG and FJG and Shelar (2012) in 5/8 Gir triple cross (R). The lower AFC than the present results were reported by Garudkar (2015) in FJG triple cross and Jawale (2015) in 5/8 Gir triple cross (R). However, higher values of AFC were noticed by Sahana and Gurnani (2000) in HJT triple cross, Singh *et al*. (2002) in FH halfbred, Thombre *et al*. (2002) in HF x Deoni halfbred and Dahiya *et al*. (2003) in FH and FJH crossbreds. AFC was significantly (P<0.01) influenced by period of birth in IFG, FJG and IFJG genetic groups (Table 1). These results were in consonance with Dahiya *et al*. (2003) in Hariana crossbreds, Zol (2007) and Ambhore *et al*. (2016) in Phule Triveni, Jadhav (2009) in Gir crossbreds, Singh *et al*. (2011) in Vrindavani cows, Shelar (2012), Ekka *et al.* (2014) in Kankrej and Jawale (2015) in 5/8 Gir crossbred cows. However, results did not agreed with Sawant *et al*. (2006) in Khillar cows, Talape (2010) in Jersey crossbreds and Jadhav (2011) in FG halfbred.

 DOI 10.5455/ijlr.20170811034109

Table 2: Least squares means of age at first conception (days) in Gir crossbreds

GG / Source of variation	FG		IFG			FJG			IFJG			R		
	N	**Mean±SE**		**N**	**Mean±SE**		**N**	**Mean±SE**		**N**	**Mean±SE**		**N**	**Mean±SE**
Population mean (μ)	167	530.52±8.35		272	761.33±10.66		116	531.42±6.60		382	722.70±8.64		88	798.06±16.92
Period of birth			**Period of birth**			**Period of birth**			**Period of birth**			**Period of birth**		
P_1 : 1972-73	**44**	554.76±16.09	**1980-86**	76	698.20±17.12^{c}	**1975-77**	68	502.23±8.61^{b}	**1977-83**	109	653.31±13.98^{c}	**1994-99**	28	822.02±28.90
P_2 : 1974-75	**57**	527.55±14.06	**1987-93**	59	719.40±19.48^{bc}	**1978-80**	48	560.61±10.05^{a}	**1984-90**	125	609.24±13.20^{d}	**2000-05**	34	826.64±26.99
P_3 : 1976-77	**66**	509.25±12.97	**1994-00**	62	881.23±19.10^{a}			-	**1991-97**	70	767.32±17.47^{b}	**2006 & above**	26	745.53±31.99
P_4		-	**2001-07**	59	768.09±19.63^{b}			-	**1998-04**	50	873.86±20.65^{a}			-
P_5		-	**2008-15**	16	739.71±37.52^{bc}			-	**2005 & above**	28	709.75±27.60^{bc}			-
Season of birth			**Season of birth**			**Season of birth**			**Season of birth**			**Season of birth**		
S_1 : Rainy	**60**	541.32±13.59	**Rainy**	80	736.76±18.30	**Rainy**	29	530.90±12.81	**Rainy**	119	719.63±13.84	**Rainy**	20	781.96±34.83
S_2 : Winter	**61**	535.45±13.48	**Winter**	100	768.46±15.70	**Winter**	45	535.67±10.66	**Winter**	149	738.45±12.93	**Winter**	36	831.19±26.21
S_3 : Summer	**46**	514.79±15.97	**Summer**	92	778.76±16.39	**Summer**	42	527.69±10.64	**Summer**	114	710.01±14.41	**Summer**	32	781.04±27.69

Means under each class in the same column with different superscripts differed significantly

DOI 10.5455/ijlr.20170811034109

Table 3: Least squares means of age at first calving (days) in Gir crossbreds

GG / Source of variation	FG N	FG Mean±SE	IFG	IFG N	IFG Mean±SE	FJG	FJG N	FJG Mean±SE	IFJG	IFJG N	IFJG Mean±SE	R	R N	R Mean±SE
Population mean (μ)	167	810.44±8.41		272	1040.64±10.58		116	809.88±6.80		382	1000.87±8.69		88	1077.74±17.17
Period of birth			**Period of birth**			**Period of birth**			**Period of birth**			**Period of birth**		
P$_1$: 1972-73	44	834.56±16.21	**1980-86**	76	980.22±16.99^{c}	**1975-77**	68	783.10±8.87^{b}	**1977-83**	109	931.34±14.06^{c}	**1994-99**	28	1101.18±29.32
P$_2$: 1974-75	57	808.23±14.16	**1987-93**	59	996.97±19.33^{bc}	**1978-80**	48	836.65±10.35^{a}	**1984-90**	125	889.82±13.28^{d}	**2000-05**	34	1104.35±27.39
P$_3$: 1976-77	66	788.54±13.06	**1994-00**	62	1159.27±18.95^{a}				**1991-97**	70	1045.84±17.57^{b}	**2006 & above**	26	1027.69±32.46
P$_4$			**2001-07**	59	1048.04±19.48^{b}				**1998-04**	50	1151.64±20.77^{a}			
P$_5$			**2008-15**	16	1018.70±37.23^{bc}				**2005 & above**	28	985.69±27.76^{bc}			
Season of birth			**Season of birth**			**Season of birth**			**Season of birth**			**Season of birth**		
S$_1$: Rainy	60	821.79±13.69	**Rainy**	80	1016.63±18.16	**Rainy**	29	810.23±13.2	**Rainy**	119	999.01±13.91	**Rainy**	20	1061.06±35.33
S$_2$: Winter	61	816.92±13.57	**Winter**	100	1046.98±15.58	**Winter**	45	811.88±10.98	**Winter**	149	1017.20±13.01	**Winter**	36	1110.62±26.59
S$_3$: Summer	46	792.61±16.08	**Summer**	92	1058.31±16.27	**Summer**	42	807.52±10.96	**Summer**	114	986.39±14.49	**Summer**	32	1061.54±28.09

Means under each class in the same column with different superscripts differed significantly

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The variation due to season of birth in AFC was non-significant in all the genetic groups (Table 1). These results were in agreement with Sahana and Gurnani (2000) reported in Karan Fries cows, Dahiya (2003) in FH, JH, FJH and JFH genetic groups, Dubey and Singh (2005) in Sahiwal crossbred, Zol (2007) in Phule Triveni, Jadhav (2009) in Gir crossbred, Talape (2010) in Jersey crossbreds, Manoj *et al.* (2012) in Sahiwal, Shelar (2012) in 5/8 Gir (R) crossbred, Ekka *et al.* (2014) in Kankrej and Garudkar (2015) in FG, IFG, FJG and IFJG groups. Whereas, contradictory results were obtained by Dutt *et al.* (2002) in Hariana crossbreds, Varade (2002) in Jersey, Gaolao and Tharparkar cows, Ahmed *et al*. (2007) in HF x Zebu halfbreds, Hassan and Khan (2013) in Holstein crossbred cows and Kumar *et al*. (2016) in Ongole cow.

Although the effect of season of birth on AFC was non-significant, the lowest AFC was observed in heifers born during summer season (792.61 ± 16.08 days) in FG and rainy season (1016.63 ± 18.16 days) in IFG group. In FJG and IFJG group lowest AFC as 807.52 ± 10.96 days and 986.39 ± 14.49 days was observed in heifers born during summer season. In R group lowest AFC was noticed in heifers born in rainy season (1061.06 ± 35.33 days).

Conclusion

On the basis of results obtained from present study, it can be concluded that the FG half bred and FJG triple cross had better performance with respect to pre-partum reproduction traits over their *Interse* and 5/8 Gir crossbred. Period of birth had significant influence on both pre-partum traits of FJG and interse mated population of FG and FJG.

Acknowledgements

The authors extend their sincere thanks to MPKV, Rahuri for providing the facilities for conducting the present investigation.

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DOI 10.5455/ijlr.20170811034109