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Genetic and Phenotypic Evaluation of Hardhenu Crossbred Cattle Using Reproduction Traits

Rakesh Verma[1*], A.S. Yadav[1], S.S. Dhaka[1], Sunil Kumar[1] and Promila[2]

[1]Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125004, India
[2]Department of Animal Nutrition, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125004, India
**Corresponding author*

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A B S T R A C T

The present study was conducted on data pertaining to 274 Hardhenu crossbred cows from the history-cum-pedigree sheets maintained in the Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana over a period of 20 years from 1996 to 2015. The overall least squares mean were 1245.36±16.97 days, 132.09±5.61 days, 412.70±5.60 days, 1.96±0.11, 41.57±4.96 days and 94.55±4.03 days for AFC, FSP, FCI, NSC, FHSC and CFSI, respectively. The period of calving had significant effect only on AFC while season of calving had significant effect ($p<0.05$) on FSP and FCI. The estimates of heritability of first lactation reproduction traits were moderate to high 0.24 (NSC) to 0.44(AFC). Genetic and phenotypic correlation among FSP, FCI, FHSC and CFSI were high and significant. Phenotypic correlations of AFC with all traits were low while genetic correlations of AFC with all first lactation traits were negative except CFSI (0.51). The genetic and phenotypic correlations of NSC were high with FHSC, whereas, negative genetic and phenotypic correlations were observed with CFSI.

Introduction

Milk production is one of the most important traits in dairy cattle. Hence, in most of the genetic improvement programmes in the country, selection is generally focussed on production traits, whereas, reproductive performance of the animal is not being given the due emphasis. The most striking consequence is that large number of high yielder cows are becoming repeat breeder and infertile which results in increased generation interval and thereby reduces the genetic gain per unit of time. Therefore, need was felt to consider reproduction traits in addition to production traits during selection programmes. Selection considering reproduction traits along with production performance was advocated under Indian conditions due to small number of daughters per sire and at the same time to improve the accuracy and efficiency of sire evaluation.

Moreover, including reproduction traits along with production traits in sire evaluation programme would enable genetic improvement in production potential along with simultaneous improvement in reproduction traits.

Materials and Methods

The data for present study were collected on 274 first lactation records of Hardhenu crossbred cattle from the history-cum-pedigree sheets maintained in the Department of Animal Genetics and Breeding, LUVAS, Hisar over a period of 20 years duration from 1996 to 2015. The reproduction traits included were age at first calving (AFC), first service period (FSP), first calving interval (FCI), number of services per conception (NSC), first heat to successful conception (FHSC) and calving to first service interval (CFSI). Abnormal lactation records resulting due to specific causes like abortions and pre-mature births were excluded in the present investigation. The entire duration of 20 years was divided into five periods each having four years duration. Year to year variation within the period were assumed to be non-significant. Each year was further divided into four seasons viz. summer (April to June), rainy (July to Sept.), autumn (Oct. to Nov.) and winter (Dec. to March) on the basis of fluctuations in atmospheric temperature and relative humidity prevailing in the region.

The following statistical model was used to explain the underlying biology of the traits included in the study.

$$Y_{ijklm} = \mu + c_i + h_j + s_k + g_l + e_{ijklm}$$

Where, Y_{ijklm} is the m^{th} record of individual calved in i^{th} period, j^{th} season pertaining to k^{th} sire belonging to l^{th} sire group, μ is the overall population mean, c_i is the fixed effect of i^{th} period of calving, h_j is the fixed effect of j^{th} season of calving, s_k is the random effect of k^{th} sire, g_l is the fixed effect of l^{th} sire group, e_{ijklm} is the random error associated with each and every observation and assumed to be normally and independent distributed with mean zero and variance σ_e^2. Sire groups were made on the basis of year in which their first daughter calved.

To study the effect of genetic and non-genetic factors on different reproduction traits and to obtain sire and residual variance -covariance components for various performance traits to estimate genetic and phenotypic parameters, least squares analysis technique (1) using Henderson's method III (2) was used. Paternal half-sib correlation method using Henderson's method III (2) was used to estimate heritability of traits under study after adjustment of data for various significant effects.

Results and Discussion

The least-squares means and their standard errors for different first lactation reproduction traits presented in Table 1 for AFC, FSP, FCI, NSC, FHSC and CFSI were obtained as 1245.36±16.97 days, 132.09±5.61 days, 412.70±5.60 days, 1.96±0.11, 41.57±4.96 days and 94.55±4.03 days, respectively. The results of the present study are in analogy with those reported by Chaudhari *et al.,* (3) and Kumar (4) for AFC, FSP and FCI in crossbred cattle whereas higher FSP and FCI than present study was reported by Dubey and Singh (5) and Goshu *et al.,* (6). The present results for NSC and CFSI are comparable with those reported by Veerkamp *et al.,* (7) and Hammoud *et al.,* (8) in crossbred cattle, whereas less NSC was reported by Asimwe and Kifaro (9). Lower estimate for CFSI was reported by Grosshans *et al.,* (10), however, higher estimates were reported by Asimwe and Kifaro (9).

The least-squares analysis of variance (Table 2) indicated that the effect of sire group was non-significant on all reproduction traits. Kumar (4) also reported non-significant effect of sire group on AFC, FSP and FCI. Period of calving significantly affected AFC, while season of calving showed significant effect on FSP and FCI. Similar findings were also reported by Chaudhari *et al.,* (3) in crossbred cattle.

Table.1 Least squares means with standard error for various reproduction traits

Effects		AFC (days)	FSP (days)	FCI (days)	NSC	FHSC(days)	CFSI (days)
Overall mean		1245.36± 16.97 (274)	132.09±5.61 (274)	412.70±5.60 (274)	1.96±0.11 (274)	41.57±4.96 (274)	94.55±4.03 (274)
Sire group	**SG 1 (1996-97)**	1180.38±58.29 (14)	102.64±39.12 (14)	374.10±39.04 (14)	1.21±0.78 (14)	20.91±14.57 (14)	83.08± 10.06 (14)
	SG 2 (1998-00)	1322.58±89.60 (13)	98.43±29.65 (13)	370.58±29.60 (13)	1.67±0.59 (13)	23.44±16.21 (13)	76.86±11.27 (13)
	SG 3 (2001-03)	1267.34±36.63 (71)	137.86±12.12 (71)	417.64±12.10 (71)	2.02±0.24 (71)	39.17±10.71 (71)	98.87±8.69 (71)
	SG 4 (2004-06)	1271.23±50.30 (67)	124.54±16.64 (67)	411.51±16.61 (67)	2.04±0.33 (67)	43.46±14.71 (67)	86.31±11.94 (67)
	SG 5 (2007-09)	1246.36±57.02 (36)	160.66±18.87 (36)	439.84±18.83 (36)	2.20±0.38 (36)	56.17±16.68 (36)	103.03±13.54 (36)
	SG 6 (2010-12)	1283.75±49.06 (48)	151.79±16.23 (48)	436.32±16.20 (48)	2.01±0.32 (48)	48.46±14.35 (48)	102.82±11.64 (48)
	SG 7 (2012-15)	1145.94±118.19 (25)	156.68±19.29 (25)	433.91±19.25 (25)	2.55±0.38 (25)	60.22±17.05 (25)	96.88±13.84 (25)
Period of calving	**1996-99**	1370.19^{a}±100.99 (23)	173.75±33.43 (23)	454.47±33.36 (23)	1.98±0.67 (23)	66.49±29.54 (23)	110.40±23.98 (23)
	2000-03	1245.01^{ab}±47.41 (42)	147.64±15.69 (42)	430.63±15.66 (42)	2.33±0.31 (42)	56.35±13.87 (42)	94.39±11.25 (42)
	2004-07	1148.38^{c}±53.12 (79)	127.60±17.58 (79)	405.32±17.55 (79)	2.32±0.35 (79)	39.26±15.54 (79)	89.65±12.61 (79)
	2008-11	1184.04^{bc}±53.70 (54)	108.82±17.77 (54)	392.17±17.74 (54)	1.66±0.35 (54)	20.24±15.70 (54)	88.84±12.75 (54)
	2012-15	1279.23^{ab}±45.01 (76)	102.64±54.77 (76)	380.90±14.87 (76)	1.50±0.30 (76)	25.51±13.16 (76)	89.48±10.68 (76)
Season of calving	**Summer (Apr-Jun)**	1241.94±27.25 (75)	149.41^{a}±9.02 (75)	432.40^{a}±9.00 (75)	2.10±0.18 (75)	49.19±7.97 (75)	103.14±6.47 (75)
	Rainy (Jul-Sep)	1209.67±32.66 (47)	122.16^{ab}±10.8 (47)	400.56^{b}±10.79 (47)	1.87±0.21 (47)	32.23±9.55 (47)	93.94±7.75 (47)
	Autumn (Oct-Nov)	1298.78±30.86 (50)	113.22^{b}±10.21 (50)	393.52^{b}±10.19 (50)	1.68±0.20 (50)	31.35±9.02 (50)	89.10±7.32 (50)
	Winter (Dec-Mar)	1231.09±23.13 (102)	143.57^{a}±7.65 (102)	424.31^{a}±7.64 (102)	2.18±0.15 (102)	53.51±6.76 (102)	92.03±5.49 (102)

Figures in parenthesis are number of observations.
Mean with different superscripts differ significantly among themselves.

Table.2 Analysis of variance for various reproduction traits

Source of variation	d.f	Mean sum of squares					
		AFC	FSP	FCI	NSC	FHSC	CFSI
Sire group	6	59004.39	4332.26	3486.03	1.13	3204.95	2723.14
Period	4	103383.33*	7130.94	8636.32	3.03	3605.85	283.19
Season	3	70085.77	17221.87*	20203.62*	3.16	8206.91	2404.06
Error	260	42532.59	4660.16	4642.57	1.89	3639.68	2398.07

*P<0.05 Where, AFC = age at first calving; FSP = first service period; FCI = first calving interval; NSC = number of services per conception; FHSC = first heat to successful conception and CFSI = calving to first service interval

Table.3 Estimates of heritability (diagonal), genetic correlation (above diagonal) and phenotypic correlation (below diagonal) among various reproduction traits in crossbred cattle

Traits	AFC	FSP	FCI	NSC	FHSC	CFSI
AFC	**0.44±0.24**	-0.056±0.39	-0.023±0.37	-0.74±0.50	-0.68±0.42	0.51±0.35
FSP	-0.08±0.06	**0.36±0.21**	0.98±0.07	0.32±0.44	0.73±0.21	0.61±0.27
FCI	0.06±0.06	0.97**±0.01	**0.31±0.22**	0.32±0.42	0.62±0.25	0.61±0.27
NSC	-0.09±0.06	0.57**±0.05	0.57**±0.04	**0.24±0.20**	0.89±0.17	-0.55±0.50
FHSC	-0.16**±0.06	0.68**±0.04	0.65**±0.04	0.73**±0.04	**0.36±0.21**	-0.15±0.43
CFSI	0.03±.06	0.50**±0.05	0.51**±0.05	-0.16**±0.06	-0.17**±0.06	**0.42±0.22**

(*P<0.05, **P<0.01) where AFC = age at first calving; FSP = first service period; FCI = first calving interval; NSC = number of services per conception; FHSC = first heat to successful conception and CFSI = calving to first service interval

The contents of Table 3 revealed that the estimates of heritability for AFC and CFSI were higher to the tune of 0.44±0.24 and 0.42±0.22, respectively. In addition to this, heritability estimates for other reproduction traits included in the study were moderate ranging from 0.24±0.20 (NSC) to 0.36±0.21 (FSP and FHSC). The heritability estimate of AFC is in close agreement with heritability estimate reported by Nehra (11), Chaudhari *et al.,* (3) and Ghosu *et al.,* (6). While, lower estimates of heritability were reported by Singh *et al.,* (12) and Kumar (4) in crossbred cattle.

The estimate of heritability for FSP was moderate (0.36±0.21) in the present study. Similar results were also reported by Chaudhari *et al.,* (3) and Ghosu *et al.,* (6). However, Dubey and Singh (5) obtained higher estimates of heritability of FSP and Kumar (4) obtained lower heritability estimates for FSP than the present study. Similar magnitudes of the heritability estimate of FCI were also reported by Dubey and Singh (5) and Goshu *et al.,* (6). While, Chaudhari *et al.,* (3) and Kumar (4) found low heritability estimates for FCI.

Phenotypic correlations of AFC with all other reproduction traits were low while genetic correlations of AFC with all first lactation traits were negative except CFSI (0.51). Contrary to the results of phenotypic correlations of AFC with others first lactation traits in present study, Chaudhari *et al.,* (3) and Goshu *et al.,* (6) reported low phenotypic correlation of AFC with all other traits. Genetic and phenotypic correlation among FSP, FCI, FHSC and CFSI were high.

The genetic and phenotypic correlations of NSC were high with FHSC, whereas, negative genetic and phenotypic correlations were observed with CFSI.

High positive genetic and phenotypic correlations between FSP, and FCI in the present study were supported by the findings of Dalal *et al.,* (13), Chaudhari *et al.,* (3), Goshu *et al.,* (6) and Kumar (4). High genetic and phenotypic correlations among FSP, FCI and CFSI observed in our study were supported by Hoekstra *et al.,* (14) and Grosshans *et al.,* (10) indicated that all three can be improved by selecting any of them.

In the present study, most of traits have moderate to high heritability which indicate towards existence of additive genetic variance for these traits in the herd and this can be exploited by using suitable technique like progeny testing or individual selection for further improvement in the herd. High correlation was seen among reproduction traits which indicated that improvement in one trait will cause simultaneous improvement in other trait as well.

References

1. Harvey WR. 1990. Guide for LSMLMW, PC-1 Version, mixed model least squares and maximum likelihood computer programme, January 1990. Mimeograph Ohio State Univ., USA.
2. Henderson CR. 1973. Sire evaluation and genetic trends. Journal of Animal Science, 1973 (Symposium), 10-41.
3. Chaudhari M, Kumar R, Khanna AS, Dalal DS, Jakhar A 2013. Genetic studies on reproduction traits in crossbred cattle. Haryana Vet. 52:75-78.
4. Kumar P. 2015. Genetic evaluation of frieswal sires for test day record on first lactation traits, M.V.Sc. Thesis, LUVAS., Hisar, India
5. Dubey PP, Singh CV. 2005. Estimates of genetic and phenotypic parameters considering first lactation and lifetime performance traits in Sahiwal and crossbred cattle. Ind. J. Anim. Sci. 75(11).
6. Goshu G, Singh H, Petersson KJ, Lundeheim N. 2014. Heritability and correlation among first lactation traits in Holstein Friesian cows at Holeta Bull Dam Station, Ethiopia. Int. J. Livest. Prod. 5(3):47-53.
7. Veerkamp RF, Koenen EP, De Jong G. 2001. Genetic correlations among body condition score, yield, and fertility in first-parity cows estimated by random regression models. J. Dairy Sci. 84(10):2327-35.
8. Hammoud MH, El-Zarkouny SZ, Oudah EZ. 2010. Effect of sire, age at first calving, season and year of calving and parity on reproductive performance of Friesian cows under semiarid conditions in Egypt. Archiva Zootechnica. 13(1):60-82.
9. Asimwe L, Kifaro GC. 2007. Effect of breed, season, year and parity on reproductive performance of dairy cattle under smallholder production system in Bukoba district, Tanzania. Livest.Res. Rural Dev. 19(10):1-9.
10. Grosshans T, Xu ZZ, Burton LJ, Johnson DL and Macmillan KL. 1997. Performance and genetic parameters for fertility of seasonal dairy cows in New Zealand. Livestock Production Science. 51(1-3):41-51.
11. Nehra M. 2011. Genetic analysis of performance trends in Karan Fries cattle. M.V.Sc. Thesis. NDRI (Deemed University), Karnal, India.
12. Singh VK, Singh CV, Kumar D, Sharma RJ. 2008. Genetic parameters for first lactation and lifetime performance traits in crossbred cattle. Ind. J. Anim. Sci. 78: 497-501.
13. Dalal DS, Rathi SS, Raheja KL. 2002. Estimates of genetic and phenotypic parameters for first lactation and lifetime performance traits in Hariana cattle. Ind. J. Anim. Sci. 72(5):398-401.
14. Hoekstra J, Van der Lugt AW, Van der Werf JH, Ouweltjes W. 1994. Genetic and phenotypic parameters for milk production and fertility traits in upgraded dairy cattle. Livest. Prod. Sci. 40(3):225-32.

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