Research Journal of Chemical and Environmental Sciences
Res J. Chem. Environ. Sci. Vol9 [4] September 2021: 16-20
Online ISSN 2321-1040
CODEN: RJCEA2[USA]

Website: www.aelsindia.com/rjces.htm

RJCES

ORIGINAL ARTICLE

Least Square Means and The Effect of Non-Genetic Parameters on Production Traits of Hardhenu Cattle

Sandeep Kumar Sangwan, Surander Singh Dhaka, Abhay Singh Yadav,Vikram Jakhar* and Patil C S
Department of Animal Genetics and Breeding, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar -125 004
*Corresponding author: vjakhar61@gmail.com

ABSTRACT
The present study was conducted to evaluate the effect of non-genetic factors of production traits {First Lactation Milk Yield (FMY), First Lactation standard Milk Yiels (MY), Peak Milk Yield (PMY) and Lactation length (LL)} in Hardhenu Cattle. The records pertaining to the first lactation of 341 cows, the progeny of 51 sires; calved during the year 1995-2018 and maintained at Cattle Breeding Farm, LUVAS, Hisar were analysed by using a mixed technique of Harvey model. The overall least-squares means of FMY, MY, PMY and LLin Hardhenu cattle for present investigation were 2366.48±81.22 kg, 2159.01±70.81 kg, 10.97±0.30 kg/dayand 315.62±7.48, respectively in Hardhenu cattle. The effect of calving period on FMY, MY and PMY for Hardhenu cattle was obtained significant under the present study. The results revealed that the effect of the linear regression of age at first calving was significant on PMY and LL in Hardhenu cattle
Keywords: *Hardhenu cattle, Production Traits and Non-genetic factors.*

Received 26.08.2021 Revised 29.09.2021 Accepted 13.10.2021

INTRODUCTION

Hardhenu is recently developed one of the synthetic breeds developed by Dept of Animal Genetics and Breeding, LUVAS, Hisar and gaining popularity in the north India due to its better adaptability during local environment weather temperature variations and high milk-producing capacity; moreover, it is having promising high potential for further genetic improvement. This breed is gaining popularity in districts of adjoining states (Punjab, Rajasthan, UP and Delhi)and all over Haryana. As reported in 2019th livestock census, India is having 192.49 million heads of cattle. Improvement in productive period in terms of Lactation length and Peak milk yield are current demands in Dairy sector. The situation gets more tough when the environment becomes harsh and non-supportive which hults utilization of animal to its fullest capability in term of milk production. In order to get improvement of Hardhenu cattle by developing better breeding schemes; evaluation of the non genetic values of performance traits becomes necessary. The present study was planned to determine the influence of Period of calving, Season of calving and Age at first calving on several production traits of Hardhenu cattle maintained at an organised farm at LUVAS, Hisar.

MATERIAL AND METHODS

The data from history and pedigree sheets on certain production performance traits obtained from 341Hardhenu cattle born to 51 sires at Cattle Breeding Farm, LUVAS, Hisar for 24 years (1995-2018) were obtained. The data was recorded from first lactation on all animals which were milked more than 150 days in the herd. Records on First Lactation Milk Yield (FMY), First Lactation standard Milk Yiels (MY), Peak Milk Yield (PMY) and Lactation length (LL) were analysed to estimate the effect of period of calving, season of calving and regression of age at first calving by using a mixed model technique of Harvey (1990). The duration of twenty-four years was divided into six periods, viz. period 1 (1995-1998), period 2 (1999-2002), period 3 (2003-2006), period 4 (2007¬2010), period 5 (2011-2014) and period 6 (2015-2018). The year was divided into four seasons viz., summer (April-June); rainy (July-September); autumn (October-November) and winter (December-March). The mixed statistical model used to explain the biology of the various performance traits in the study was:

$Y_{ijk} = \mu \pm S_i \pm h_j + c_k + b_1(A_{ijk} - \bar{A}) + b_2(A_{ijk} - \bar{A})^2 + e_{ijk}$

Where,

Y_{ijkl} was record of individual pertaining to i^{th} sire calved in j^{th} period and k^{th} season.
μ was the overall population mean.
S_i was the random effect of i^{th} sire;
h_j was the fixed effect of j^{th} period of calving.
c_k was the fixed effect of k^{th} season of calving.
b_1&b_2 were linear and quadratic partial regression coefficients of age at first calving on trait(s), respectively.
A_{ijk} was the age at first calving.
$\bar{A}$ was the mean for age at first calving.
e_{ijk} was the random error associated with each and every observation and assumed to be normally and independently distributed with mean zero and variance σ^2_e.

RESULTS AND DISCUSSION

The overall least-squares means for first lactation milk yield (FMY), first lactation standard milk yield (MY), peak milk yield (PMY) and Lactation length (LL)in the present study were 2366.48±81.22 kg,2159.01±70.81 kg, 10.97±0.30 kg/day and 315.62±7.48 days in Hardhenu cattle.

The overall least-squares means obtained for First lactation milk yield (FMY) during the present investigation was in agreement with the findings of Verma *et al.*[28] and Manjeet *et al.*[19] as they also obtained similar results for FMY in Hardhenu cattle. Estimates for FMY in Hardhenu cattle in the present study was obtained lower than reported by other researchers in other crossbred cattle like Friswal [23], Karanfries [7, 9, 11, 12, 24] and Vrindavani cattle [27, 4]. The obtained value of MY in Hardhenu cattle was lower than other crossbred cattle obtained from Holstein in India like Frieswal [14, 23], KaranFries [7, 9, 11, 12, 24], HF x Deoni [30] HF x Sahiwal [16], HF x Gir (Jadhav *et al.,*2019), HF x Jersey x Sahiwal [5] and Virnadavani [27, 4] cattle. Verma *et al.*[28] reported slightly lower values of PMY in Hardhenu cattle. Other crossbred cattle like Vrindavani cattle [27, 4]) and HF X Sahiwal [18] were having higher PMY comparative to Hardhenu cattle. However, lower PMY in indigenous Sahiwal cattle was reported by Kumar *et al.*[16].The overall least-squares means obtained for Latation length (LL) during the present investigation was in agreement with the findings of Jadhav *et al.* [11] and Dash *et al.* [6] as they also obtained similar results for LL in Girhalfand Karan-Fries, respectively. However, in indigenous breeds Basak and Das*.* [1] reported shorter LL. .

Effect of period

The effect of the period of calving was found to be significant on FMY,MY and PMY in hardhenu cattle under study was significant.

Results obtained for FMY in present study is in agreement with the results reported in Hardhenu [29], Karan Fries [24, 7, 11, 13, 6] and Vrindavani [4, 27] cattle. However, Chakraborty *et al.* [3], Gupta *et al.* [10] and Pawar *et al*. [22] contrarily reported the non-significant effect of period of calving on FMY in Hardhenu cattle [19].In Hardhenu cattle result obtained for MY were similar to the reports cited in the literature in various other crossbred cattle [24, 6, 4, 7, 11, 14, 15, 16, 23]; however, Kakati *et al.,* [14] found a non-significant effect of the period of calving in Frieswal cattle. Dev *et al.,* [8] and Jakhar *et al.,* [12] also reported a significant effect of calving period on a similar significant effect of calving period on PY in Hardhenu and HF X Sahiwal, respectively. Jadhav *et al*. [11], Bhutkar *et al*. [2], Kumar *et al* [17] and Sawant *et al.* [26] also reported a significant effect of calving period on a similar non-significant effect of calving period on LL in Girhalf, Deoni, HF crossbred and Gir cattle, respectively. However, Katati *et al* [14] obtained Significant effect of calving period in Frieswal cattle.

The period-wise least-squares mean for FMY in Hardhenu cattle indicated that it was the highest (3364.53±330.94 kg) for cattle calved during the sixth period (2015-2018) and the lowest (1297.21±671.35 kg) for cattle calved during the first period (1995-1998). The least-squares mean of FMY for cattle calved during the first and second period did not differ significantly among themselves, further least-square means for FMY for cattle calved during the third, fourth and fifth period also not differ significantly. However, these means of FMY differed significantly from those calved calved during the sixth period. A definite trend was obtained for FMY over periods and showed remarkably better performance of Hardhenu cattle for FMY over the periods, indicating that selection for this trait was in desirable direction. The period-wise least-squares means for MY in Hardhenu cattle indicated that it was the highest (3148.63±249.13 kg) for cattle calved during sixth-period (2015-2018) and the lowest (1175.49±501.20) for cows calved during first-period (1995-1998). The least-squares means of MY for cattle calved during the second, third, fourth and fifth period did not differ significantly among themselves; but differed significantly from those calved during sixth period. Furthermore, least-square means for MY for cattle calved during sixth-period differ significantly with all other periods. A definite

trend was obtained for MY over periods showing remarkably better performance for MY during later period, indicating that selection for this trait was in a desirable direction. The period-wise least-squares means for PMY in Hardhenu cattle indicated that it was the highest (15.96 kg/day) for cows calved during sixth-period (2015-2018) and the lowest (7.18 kg/day) for cows calved during first-period (1995-1998). The least-squares means of PMY for cattle calved during the first, second and third period did not differ significantly among themselves However, LSM of cattle calved during first-period differed significantly from cattle calved during fourth, fifth and sixth period. Further, the value of PMY for cattle calved during sixth-period differed from all other periods. A definite increasing trend was obtained for PMY over periods showed remarkably better performance of PMY during the later period (sixth) indicating that selection for this trait in Hardhenu cattle was in a desirable direction.The period-wise least-squares means for LL in Hardhenu cattle indicated that it did not differ significantly among themselves However, a definite decreasing trend was obtained for LL over last four periods showed remarkably better performance of LL during the later period (sixth) indicating that selection for this trait in Hardhenu cattle was in a desirable direction.

Effect of season of calving

In this present investigation, the effect of calving season on FMY,MY, PMY and LL was non-significant in Hardhenu cattle.

The results of effect of season of calving on FMY obtained during the present investigation were in close confirmation with the findings of other workers in Hardhenu cattle [19], Karan Fries [6], Frieswal cattle [23]. While some significant results on crossbred cattle for the effect of season of calving on FMY were also reported likewise in Hardhenu [28], Karanfries [25, 13, 6], Virnadavani [3] cattle. Reports similar to findings of non-significant effect of season of calving on MY during the present study were found in the literature in crossbred cattle like Karanfries [6, 7] and HFXGir (Jadav *et al.,* 2019). However, Rathee *et al.* [23] obtained significant effect of calving season on MY in Frieswal cattle. Moreover, Kumar *et al.* [16] in HF X Sahiwal obtained significant effect of calving period on PMY. Contrarily, Verma *et al*. [28] in Hardhenu cattle and Chandrakar *et al*. [3] in Virnadavani cattle reported significant effect of calving period on PMY. Reports similar to findings of non-significant effect of season of calving on LL during the present study were found in the literature in crossbred cattle like Girhalf [11], HF*Deoni [30] and HF crossbred [15]. However, Dash *et al.* [6] obtained significant effect of calving season on LL in Karan-Fries cattle.

The season-wise averages for MY, PMY and LL in Hardhenu cattle indicated that it was the highest (2408.98 kg and 11.25 kg/day and 323.74 days) for the cattle calved during autumn season (Oct. to Nov.) while no significant difference was obtained in different seasons. The season-wise averages for FMY in Hardhenu cattle indicated that it was the highest (2539.57 kg) for cows calved during autumn season (Oct. to Nov.) and the lowest (2226.51 kg) for monsoon season calvers (Nov. to Dec.); however, there was no significant difference in these seasons. Comparatively lower performance in monsoon season calvers would be attributed to high humidity in the environment, unpleasant for Holstin cattle or crossbred cattle in the calving season.

Effect of age at first calving

The contents of results revealed that the effect of age at first calving on PMY and LL in hardhenu cattle under study was significant for the linear regression and non-significant for quadratic regression. The result further revealed that by increase in one day of age at first calving there would be increase in PMY and LL of 2.1 gm and 0.057 days respectively, in Hardhenu cattle. Kumar *et al.* [15] also reported a significant effect of age at first calving on PMY in crossbred cattle. The effect of (linear and quadratic regression of) age at first calving was non-significant on FMY and MY in Hardhenu cattle. The similar non-significant effect of age of calving on FMY was also reported in Karanfries cattle [6, 7]. However, a significant effect of age at first calving on FMY in Sahiwal cattle was obtained by Parveen *et al*. [21]. A similar non-significant effect of age of calving on MY was also reported in Karanfries [6, 7] and HF x Gir [11].

Table: 1. Analysis of variance for various production traits.

Source of Variance	D.F.	Mean Squares			
		FMY	MY	PMY	LL
Sire	50	951871.90	672589.04	12.45	7886.92
Period	5	1938766.40*	1679434.85**	39.41**	5136.29
Season	3	1201381.88	1297462.05*	4.24	3666.84
Regressions					
AFC (Linear)	1	747618.54	290394.72	32.61*	24490.46*
AFC (Quad)	1	891.67	9394.80	8.78	1453.44
Remainder	280	682637.69	378407.83	8.39	5289.75

Table 2 Least Squares Means with standard errors for various production performance traits						
Effects		Obs	Least Sq. Means ± S.E.			
			FMY (kg)	MY (kg)	PMY (kg)	LL (Days)
Over All Mean		341	2366.48 ±81.22	2159.01 ±70.81	10.97 ±0.30	315.62±7.48
Period of calving	1995-1998	33	1297.21^{c} ±671.35	1175.49^{c} ±501.20	7.18^{c} ±2.36	279.95±59.14
	1999-2002	**28**	1983.56^{c} ±325.66	1806.57^{bc} ±245.24	8.67^{bc} ±1.15	331.62±28.75
	2003-2006	67	2401.36^{b} ±228.42	2106.53^{bc} ±174.01	10.48^{bc} ±0.81	347.68 ±20.23
	2007-2010	**51**	2615.50^{b} ±257.33	2335.71^{b} ±195.10	11.24^{b} ±0.91	341.36 ±22.76
	2011-2014	71	2536.71^{b} ±267.76	2381.13^{b} ±202.73	12.31^{b} ±0.94	302.81 ±23.67
	2015-2018	**91**	3364.53^{a} ±330.94	3148.63^{a} ±249.13	15.96^{a} ±1.16	290.31±29.21
Season of calving	Summer (Apr-June)	97	2435.95 ±111.84	2125.56 ±91.05	10.67 ±0.40	318.32 ±10.08
	Monsoon (July- Sept)	**69**	2226.51 ±128.04	2033.47 ±102.20	10.84 ±0.46	303.91±11.48
	Autumn (Oct-Nov)	50	2539.57 ±143.86	2408.98 ±113.27	11.25 ±0.51	323.74 ±12.85
	Winter (Dec-March)	**125**	2263.89 ±106.78	2068.04 ±87.62	11.13 ±0.38	316.52 ±9.65
AFC B (Linear)			0.31 ±0.30	0.20 ±0.22	0.0021 ±0.0011	0.057±0.026
AFC B (Quad)			-0.000018 ±0.00048	0.000056 ±0.00036	-0.0000017 ±0.0000017	-0.000022 ±0.000042

REFERENCES

1. Basak S and Das ND.(2018) Effect of parity, period and season of calving on production and reproduction traits on Deoni Cattle. J Anim. Health Prod.; 6:1-4
2. Bhutkar SS, Thombre BM and Bainwad DV. (2014) Effect of non–genetic factors on production traits in Deoni cows. J ofAgri. and Vety. Sci.; 7:09-14.
3. Chakraborty D, Dhaka SS, Pander BL, et al. (2010) Prediction of lactation milk yield from test day records in Murrah buffaloes. Ind J Anim Sci. 2010; 80(3): 244–5p
4. Chandrakar, J., Kumar, A., Naskar, S., Gaur, G.K. and Dutt, T. (2019). Performance evaluation and prediction of first lactation milk yield in Vrindavani cattle. *Indian J. Anim. Sci.* **89(2)**:187-192.
5. Dandapat, A., Banerjee, D. and Chakraborty, D. (2010). Genetic studies on various production and reproduction traits of Sahiwal and crossbred cattle (HF ×Jersey × Sahiwal) of an organised farm. Veterinary World. 3: 167-168.
6. Dash SK, Gupta AK, Singh A, Chakravarty AK, Mohanty TK, Panmei A and Shivahre PR (2016) Genetic analysis of first lactation production and fertility traits in Karan Fries cattle Indian Journal of Animal Sciences 86 (10): 1159–1164
7. Divya P, Singh A, Gandhi RS and Singh RK. (2014) Estimation of breeding values of first lactation 305-day milk yield from single and multi-trait animal models in Karan Fries cattle. The Indian journal of animal sciences 84(10):1085-1089
8. Dev, K, Dhaka, SS., Yadav, AS. and Sangwan, SS. (2015). Genetic parameters of early performance traits in Murrah buffalo Haryana Veterinarian 54(2):144-146
9. Divya P, Singh A, Gandhi RS, Singh RK. 2014 Estimation of breeding values of first lactation 305-day milk yield from single and multi-trait animal models in Karan Fries cattle. The Indian journal of animal sciences 84(10):1085-1089
10. Gupta J P, Sachdeva G K, Gandhi R S and Cahkaravarty (2012) Non-genetic Factors Influencing Growth and Production Performance in Murrah Buffaloes. Indian J. Dairy Sci. 65(3), 237-241
11. Jadhav, S.S., Deokar, D.K., Fulpagare, Y.G., Bhoite, U.Y., Mandkmale, S.D. and Nimbalker, C.V. (2019). Effect of Genetic and Non-Genetic Factors on First Lactation Production and Reproduction Traits in HF × Gir Cattle. *Int.J.Curr.Microbiol.App.Sci.***8(1):** 45-51
12. Jakhar, V., Vinayak, A.K. and Singh, K.P. (2016). Genetic evaluation of performance attributes in Murrah buffaloes. Haryana Vet. 2016; 55(1): 66–9p.
13. Japheth, PK., Mehla, RK. and Bhat, ISA. (2015). Effect of non-genetic factors on various economic traits in Karan Fries crossbred cattle Ind. J. Dairy Sci., 68: (2).
14. Kakati, P., Panchal, D., Patel, A., Bahuguna, P., Joshi, R. and Rank, D. (2017). Genetic Parameters of Production and Reproduction Traits and Factors affecting it in Frieswal Cattle. Int. J. Livest. Res. 7(7):190-199.
15. Kumar N, Eshetie A and Tesfaye A. (2014) Productive performanceof Indigenous and HF Crossbred in Gondar, Ethiopia. VetWorld.; 7:177-181.
16. Kumar R, Das AK, Raja TV, Rathee SK, Dubey PP and Prakash B (2017[a]) Performance of crossbred cattle (HF × Sahiwal) under tropical farming conditions of Punjab. Indian J. Anim. Sci. 87(11): 1402–1405

17. Kumar S, Sharma R K, Dar A H, Singh S K, Kumar S, Kumar R R, Singh M K and Singh D. (2017[b]) Estimation of Means and Trends in Economic Traits of Sahiwal. Indian J. of Ani. Res. 7(4):705-709.Kumar et al (2019)
18. Kumar, P., Dalal, D., Sharma, S., Verma, S., and Patil, C.S. (2019). Genetic Parameters of Performance Traits in Crossbred Cattle. Int. J. Livest. Res. 9(5): 46-52.
19. Manjeet, Pander, B.L., Kamaldeep, Sharma, R., Dev, K., Dhaka, S.S., and Magotra, A. (2017) Estimates of genetic parameters of first lactation traits in Crossbreed hardhenu (bos taurus x bos indicus) cattle*Int. J. Agric. Sci. Res.* **7(6)**: 253-258
20. Narwaria US, Mehla RS, Verma KK, Lathwal SS, YadavR, Verma AK. (2015). Study of short lactation in Sahiwal cattleat organized farm. Veterinary World; 8:690-694.
21. Parveen, K., Gupta, AK., Gandhi, RS., Chakravarty, AK. and Mumtaz, S. (2018). Genetic analysis of trends in production and reproduction traits over years using regression methods in Sahiwal cows. Indian J. Anim. Sci. 88(3):344-351
22. Pawar, HN., Kumar, GVPPSR. and Narang, R. (2012). Effect of Year, Season and Parity on Milk production traits in Murrah buffaloes. J. Buff. Sci., 1: 122-125.
23. Rathee, S.K., Gupta, A.K., Raja, T.V. and Chakravarty, A.K. (2017). Factors influencing production and reproductive performance of Frieswal cattle maintained at organized farm conditions Indian J. Anim. Sci. 87(11):1350-1357
24. Saha, S., Joshi, B. K. and Singh, A. (2010). Generation wise genetic evaluation of various first lactation traits and herd life in Karan Fries cattle. Indian Journal of Animal Sciences, 80(5): 451-456
25. Sahoo, S., Singh, A., Gupta, A.K., et al (2014)., Estimation of genetic parameters of weekly test-day milk yields and first lactation 305-day milk yield in Murrah buffaloes. Vet World. 2014; 7(12): 1094–8p
26. Sawant P, Singh B, Sawant D, Yadav SP, Bhinchhar BK. (2016) Effect of genetic and non-genetic factors on first lactationtraits in Gir cows. Indian J Anim. Res.; 50:872-876.
27. Singh, R.R., Dutt, T., Kumar, A., Tomar, A.K.S., Singh, M. (2011). Comparison of sire evaluation method for milk production in Vindavani cattle. Ind. J. Anim. Sci., 80: 448-450.
28. Verma, R., Yadav, A.S. and Dhaka, A.S. (2016). Genetic studies on production and production efficiency traits in Hardhenu crossbred cattle. Haryana Vet., 55: 166-169.
29. Verma R, Yadav A S, Dhaka SS, Kumar S and Promila 2017 Genetic and Phenotypic Evaluation of Hardhenu Crossbred Cattle Using Reproduction Traits Int.J.Curr.Microbiol.App.Sci.2017.6(12): 1486-1490 DOI: https://doi.org/10.20546/ijcmas.2017.612.165
30. Wondifraw, Z., Thombre, B.M. and Bainwad, D.V. (2013). Effect of non-genetic factors on milk production of Holstein Friesian Ũ Deoni crossbred cows. African Journal of Dairy Farming and Milk Production, 1: 079-084.

CITE THIS ARTICLE

S K Sangwan, S S Dhaka, A S Yadav, V Jakhar and Patil C S. Least Square Means and The Effect of Non-Genetic Parameters on Production Traits of Hardhenu Cattle. Res. J. Chem. Env. Sci. Vol 9[5] October 2021. 16-20