International Journal of Science, Environment and Technology, Vol. 5, No 4, 2016, 2467 – 2475

ISSN 2278-3687 (O)
2277-663X (P)

ENVIRONMENTAL FACTORS AFFECTING ECONOMIC TRAITS IN GIR CATTLE

B.D. Savaliya*, S.S. Parikh, P.M. Gamit and P.U. Gajbhiye
Cattle Breeding Farm, Junagadh Agricultural University, Junagadh-362001, Gujarat (India)
E-mail: drbdsavaliya@gmail.com (**Corresponding Author*)

Abstract: Present study involved performance records of 1352 lactations from 462 Gircows, spread over a period of 15 years (2001-2015), maintained at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat. Data were analyzed by least squares technique to examine the effect of non-genetic factors on various economic traits in Gir cattle. Overall least squares means of Age at first calving (AFC), Service period (SP), 305 days or less milk yield (305DMY), Lactation length (LL), Dry period (DP) and Calving interval (CI) were 1435.60±10.48 days, 150.79±4.59days, 1917.31±28.54 kg, 360.12±3.08 days, 110.80±4.35 days and 440.13±4.26 days respectively. Effect of season of birth was non-significant on AFC; while significant ($P<0.05$) on SP, DP and CI. Period of birth had significant ($P<0.01$) influence on AFC, 305DMY, LL and DP. Significant ($P<0.05$) effect of parity was observed on SP, 305DMY, DP and CI. The findings of this study had shown that hot and humid season adversely affected the economic traits of Gir cattle as compared to other seasons. Both productive and reproductive performances of pluriparous animals were found better than primiparous cows. The results of this study revealed that management can play key role in improving both productive and reproductive performances in Gir cows during adverse climatic conditions

Keywords: Age at first calving, Calving interval, Dry period, Gir cattle, Service period.

INTRODUCTION

Gir cow is one of the important milch breeds found in Saurashtra region of Gujarat state. The genetic potential of this dairy breed warrants greater attention for the improvement in its economic characters in order to achieve maximum milk production. Environment has an important role not only on the productive performance but also on the reproductive efficiency of the dairy animals. In dairy animals both production and reproduction traits are low to moderately heritable, which indicates that the major part of variation in these traits is governed by environmental factors that can be minimized by efficient managerial practices. Therefore, influence of non-genetic factors on production and reproductive performance of Gir cows was studied.

*Received July 13, 2016 * Published Aug 2, 2016 * www.ijset.net*

MATERIALS AND METHODS

The present investigation was conducted on Gir cows maintained at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat (India). Study area is located between 68° to 72° East longitude and 20° to 24° North latitude with an altitude of 60 m above the mean sea level in Saurashtra area of Gujarat state.

There are four major seasons in the year viz. winter (December to March), summer (April to June), rainy (July to September) and autumn (October and November). A subtropical climate with maximum air temperature during summer about 44° C and minimum temperature during winter near to 8° C prevails in the area. In the study area relative humidity ranges between 41-85% and annual rainfall between 1436 mm.

The data for present study were collected from the records of Gir cattle maintained at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat. The data spread over a period of 15 years (2001-2015) were utilized for this study. The performance traits examined were Age at first calving (AFC), Service period (SP), 305 days or less milk yield (305DMY), Lactation length (LL), Dry period (DP) and Calving interval (CI) of Gir cows. The data on the various performance traits were analyzed to evaluate the magnitude of various environmental sources of variation. Lactation records of less than 200 days and incomplete lactations for any recorded reason were not taken into the study.

In the present investigation for evaluating the effect of periods, the whole data were classified into 5 periods of 3 consecutive years. The periods were classified according to the year of birth for AFC and according to the year of calving for other remaining traits. Sixth and above lactations data were grouped together due to less number of observations after 6^{th} parity.

The influence of various non-genetic factors on different production and reproduction traits was studied by least squares analysis of variance, using the technique described by Harvey (1987). The statistical models used for different economic traits are described below.

1. For Age at first calving

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

Where,

Y_{ijk} = Dependent trait age at first calving of k^{th}cow born in i^{th} season, and j^{th} period, μ = Overall mean, S_i = Effect of i^{th} season of birth, P_j = Effect of j^{th} period of birth, e_{ijk} = Random error

2. For other traits

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

Where,

Yijkl = Dependent trait of l^{th} cow born in i^{th} season, j^{th}period and k^{th}parity,μ = Overall mean, Si = Effect of i^{th} season of calving. Pj = Effect of j^{th} period of calving, Ak = Effect of k^{th} parity, eijkl = Random error.

The statistical significance of various fixed effects in the least squares model were determined by ' F ' test, wherever the effects were significant, the differences between pairs of levels of effects were tested for significance by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Age at first calving (AFC)

The overall least squares mean for AFC in the present study was 1435.60±10.48 days (Table 1). Almost similar estimates of average AFC were observed by Danger and Vataliya (2014) in Gir cows. However, Manoj (2009) and Raja (2010) observed lower estimate of AFC in Sahiwal cows. The difference in the estimates of average AFC in Gir cattle reported by many researchers may be attributed to the difference in herds, reproductive management strategies and time/period considered. Non-significant effect of season of calving was observed on age at first calving. (Table 2), which is in accordance with Dangar and Vataliya (2014) and Ulmek (1990) in Gir cows and Manoj (2009) and Raja (2010) in Sahiwal cows. Highest value of AFC (1479.19±26.05days) was observed in cows born in autumn season, whereas cows born during summer season had lowest AFC of 1404.97±17.44 days (Table 2). Effect of season of calving was not significant on age at first calving indicating breed characteristic to adoption with environment. In this study the period of birth had shown a significant ($P<0.01$) influence on AFC (Table 2) which is supported by Ulmek (1990) and Dangar and Vataliya (2014) in Gir cows; Raja (2010) in Sahiwal cows. The cows born during period of 2010-2012 found with maximum average AFC (1510.50±20.35), while the lowest least squares mean of AFC (1403.63±15.26 days) was observed in the cows born in the period of 2007-2009 (Table 1). Age at first calving having a significant difference over the period that indicates some selection and managemental measure require for age at first calving.

Service period (SP)

The average SP in Gir cows was150.79±4.59 days (Table 1). The present finding is found near to the estimates reported by Zafar *et al.* (2008) and Rehman and Khan (2012) in Sahiwal cows. The variation in SP reported by different workers may be due to variation in the managemental efficiency in estrus detection and timely breeding followed in different herds. The findings of this study have shown that season of calving did influence the SP

significantly (P<0.05) (Table 2). Similar findings were reported by Rehman and Khan (2012), whereas non-significant values were observed by Zafar *et al.* (2008) in Sahiwal cattle. Maximum SP (172.85±12.30 days) was reported for autumn calvers, while summer calvers had lowest SP (136.48±7.38 days) (Table 2). Lactation number had significant (P<0.05) influence on SP, which is in accordance with Zafar *et al.* (2008) and Rehman and Khan (2012) in Sahiwal cattle. Higher SP value (171.34±7.44 days) was found in cows under first lactation which decreased with parity up to fifth lactation. Averages of least squares means of SP for first and second parity cows were found significantly higher than that of other parities (Table 2). The probable cause behind the decline of SP across the parities may be attributed to the culling of poor performing and problematic animals in subsequent lactations.

305-Days milk yield or less milk yield (305DMY)

The overall least squares mean for 305DMY was 1917.31±28.54kg (Table 1). The present finding is near to the values reported by Dangar and Vataliya (2015) and higher than those reported by Ulmek (1990) and Bhadoria *et al*. (2003) in Gir cows. However, Rehman *et al.* (2006), Manoj (2009) and Monalisa *et al.* (2010) have reported much lower estimates of 305DMY in comparison to present study in Sahiwal cattle. The effect of season of calving on 305DMY milk yield was non-significant in the present study and therefore no seasonal trend was observed in the lactation milk yield due to season of calving. The cows calved in autumn season had the highest 305DMY (1984.39±7412 kg) followed by winter calvers (1979.34±37.13 kg). Ulmek (1990) and Dangar and Vataliya (2015) in Gir cows of the same herd and Manoj (2009) and Raja (2010) in Sahiwal cattle observed non-significant effect of season of calving on 305DMY. However, Bhadoria *et al*. (2003) in Gir cattle and Zafar *et al.* (2008) in Sahiwal cattle reported significant effect of season of calving on lactation milk yield. The higher value of 305DMY during winter and autumn might be due to availability of good quality green fodder in sufficient quantity during winter months. In the present study, significant (P<0.01) effect of period of calving on 305DMY (Table 2) is in agreement with the findings of Ulmek (1990) and Dangar and Vataliya (2015) in Gir cows; Rehman and Khan (2012) in Sahiwal cows. The Highest average 305DMY (2261.57±66.83 kg) was found in animals calved during the period of 2001-2003, while the lowest (1697.11±57.10kg) value was observed for the period of 2004-2006. The differences in 305DMY over the periods might be attributed to difference in feeding and managemental practices besides the changing genetic structure of the population. Lactation number affected 305DMY significantly (P<0.01) (Table 2); similar result was also reported by Ulmek (1990) and Dangar and

Vataliya (2015) in Gir cows; Rehman and Khan (2012) in Sahiwal cows. Averages of 305DMY increased with increase of parity and maximum production was obtained at fourth lactation (2081.68±68.15 kg) where after there was a decline in the next lactation. The 305DMY of first lactation cows was found lowest (1554.28±4931 kg) among different parities that might have been associated with the first exposure of primiparous animals to calving and lactation stresses along with suboptimal growth in comparison to plueriparous ones.

Lactation length (LL)

On an average cow produced milk for 360.12±3.08 days (Table1). The present estimate of LL is found higher than the averages reported by Bhadoria *et al.* (2003) in Gir cows; Rehman *et al.* (2006), Zafar *et al.* (2008), Rehman and Khan (2012)in Sahiwal cows. The results of the present study revealed that the LL was not influenced by season of calving. However, period of calving affected LL significantly (P<0.01) (Table 2), which is supported by Zafar *et al*. (2008) and Rehman and Khan (2012) in Sahiwal cows. Average LL for first period (2001-2003) was found significantly higher than that of other periods, which could be due to better managemental proficiency along with favourable environmental factors. Parity had no significant effect on LL, which is in accordance with Rehman *et al.* (2006) and Zafar *et al.* (2008) in Sahiwal cows.

Dry period (DP)

The overall least squares mean for DP was 110.80±4.35 days (Table 1). This average value of DP, in the present study, isnear to the estimates of first DP reported by and Raja (2010) in Sahiwal cattle. The present estimate of DP islower than the estimates reported by Raja (2010). Singh *et al*. (2005), Zafar *et al.* (2008) and Rehman and Khan (2012) in Sahiwal cows. The variation in average DP reported by different workers is justified as this trait is mostly determined by the feeding, breeding and management practices followed at a dairy farm. The trait was significantly (P<0.05) affected by season ofcalving (Table 2), which is supported by Rehman and Khan (2012) in Sahiwal cows. As shown in Table 1, average DP was shortest (94.65±7.03 days) for cows calved during summer, while autumn calvers had longest average DP (133.72±11.47 days). In this study DP had significantly influenced by period of calving (P<0.01). Similar findings are also reported by Raja (2010) and Rehman and Khan (2012) in Sahiwal cows. Influence of lactation number on DP was found significant (P<0.05) (Table 2), which is in agreement with Rehman *et al.* (2006) and Rehman and Khan (2012) in Sahiwal cows. Averages of DP across parities had shown that DP for first lactation

was higher (130.63±7.06 days), which decreased along parity without showing any definite trend.

Calving interval (CI)

The average CI, observed in present study, was 440.13±4.26 days (Table 1) which is near to the estimates of Zafar *et al.* (2008), Rehman and Khan (2012), Ahmad *et al.* (2001) and Rehman *et al.* (2006) in Sahiwal cows. A significant ($P<0.01$) effect of season of calving on CI was observed (Table 2), which is in accordance with the findings of Zafar *et al.* (2008) and Rehman and Khan (2012) in Sahiwal cows. The cows calved during summer season had the lowest CI (426.50±6.89 days), while longest average CI (463.12±11.21 days) was found in case of autumn calvers (Table 1). Highest mean average of CI for autumn season calvers may be as a result of the higher mean value of service period for the same season, as any change in the service period is directly reflected in the CI owing to fixed duration of gestation period. In this study period of calving did not influence the CI. A significant influence of lactation number on CI was observed, which is supported by Zafar *et al.* (2008) in Sahiwal cows. The longest CI (465.69±6.95days) was observed in first calvers, which further decreased in subsequent lactations, might be due to culling of poor performing and problematic animals in subsequent lactations.

CONCLUSIONS

The findings of the present study had shown that all the traits, considered in study, except AFC, 300DMY and LL were found sensitive to seasonal variations; among different seasons, hot and humid season adversely affected the economic traits of Gir cattle as compared to other seasons. All the economic traits were significantly affected by periods except SP and CI; animals of first period (2001-2003) excelled in performance than those of other periods. Across the parities variation was apparent in all traits except LL; both productive and reproductive performances of pluriparous animals were observed better than primiparous cows. The effect of various environmental factors, viz. season, period and parity on economic traits was found to be significant in most of the cases, which indicates increased role of management in optimum utilization of livestock resource particularly during adverse climatic conditions.

REFERENCES

[1] Ahmad, M., van der Werf, J.H.J. and Javed, K. 2001. Genetic and phenotypic correlations for some economic traits in dairy cattle. *Pakistan Vet J.* 21(2): 81-86.

[2] Bhadoria, H.B.S., Khan, F.H., Tomar, S.S. and Yadav, M.C. 2003. Sources of variation in production traits and phenotypic and genetic correlations among themselves in Gir cattle. *The Indian journal of animal sciences* 73(11):1256-1259.

[3] Dangar, N.S. and Vataliya P.H. 2014. Factors Affecting Age at First Calving in Gir Cattle. *International Journal of Livestock Research*. 4(2):86-91.

[4] Dangar, N.S. and Vataliya P.H. 2014.Factors Affecting Lactation Milk Yield in Gir Cattle. Indian veterinary journal. 92 (7):71-73.

[5] Harvey, W.R. 1987. Least squares analysis of data with unequal sub-class numbers. Agricultural Research Services United State Dept. of Agri., USA.

[6] Manoj, M. 2009. Evolving multi-trait selection criteria using body weights and first lactation traits in Sahiwal cattle. M.V. Sc. Thesis, NDRI (Deemed University), Karnal, India.

[7] Monalisa, D., Gandhi, R.S., Raja, T.V., Singh, A. and Sachdeva, G.K. 2010. Influence of certain non-genetic factors on test day milk records in Sahiwal cattle.*Indian J. DairySci.* 63(6):504-506.

[8] Raja, T.V. 2010. Part lactation records for Sahiwal sire evaluation. Ph.D. Thesis, NDRI (Deemed University), Karnal, India.

[9] Rehman, S.U., Ahmad, M. and Shafiq, M. 2006. Comparative performance of Sahiwal cows at the livestock experiment station Bahadurnagar, Okaravspatadar's herd. *Pakistan Vet J*26:179-183

[10] Rehman, Z. and Khan, M.S. (2012) Environmental factors affecting performance traits of Sahiwal cattle in Pakistan. *Pakistan Vet J* 32(2): 229-233.

[11] Singh, V.K., Singh, C.V., Kumar, D. and Kumar, A. 2005. Genetic evaluation of some economic traits in Sahiwal and its crossbreds. *Indian J of Dairy Sci*. 58(3):206-210.

[12] Ulmek, B.R. 1990. Genetic studies of production traits in Gir Cattle. Ph.D. Thesis, Gujarat Agril. Univ., Sardar Krushinagar.

[13] Zafar, A.H., Ahmad, M. and Rehman, S.U. 2008. Study of some performance traits in Sahiwal cows during different periods. *Pakistan Vet J* 28(2):84-88.

Table 1: Least-squares means for performance traits in Gir cows

Source of variation	AFC		SP			305DMY (kg)	LL (days)		DP (days)	CI (days)
	N	Mean±SE	N	Mean±SE	N	Mean±SE	Mean±SE	N	Mean±SE	Mean±SE
Season of Calving										
Winter	82	1449.15±13.07	472	139.01±5.71[a b]	332	1979.34±37.13	360.32±40.0	482	101.26±5.25[a]	428.08±5.34[a]
Summer	77	1404.97±17.44	276	136.48±7.38[a]	330	1892.30±45.70	359.98±4.93	290	94.65±7.03[a]	426.50±6.89[a]
Rainy	75	1411.24±22.46	200	154.79±8.24[b]	357	1813.21±53.56	360.82±5.78	210	113.58±7.90[ab]	442.80±7.74[a]
Autumn	81	1479.19±26.05	93	172.85±12.30[c]	333	1984.39±7412	359.34±8.00	99	133.72±11.47[b]	463.12±11.21[b]
Period of birth										
1998-2000	64	1485.62±24.90[a]								
2001-2003	59	1470.22±23.70[b]								
2004-2006	58	1410.70±21.07[a]								
2007-2009	65	1403.63±15.26[a]								
2010-2012	69	1510.50±20.35[b]								
Period of calving										
2001-2003	-	-	147	146.31±9.90	166	2261.57±66.83[c]	394.58±7.21[d]	152	85.33±9.44[a]	436.32±9.21
2004-2006	-	-	202	150.97±8.65	245	1697.11±57.10[a]	343.87±6.16[a b]	204	131.02±8.35[c]	438.79±8.19
2007-2009	-	-	197	148.83±8.68	255	1706.00±54.95[a]	336.62±5393[a]	205	137.22±8.27[c]	438.35±8.12

2010-2012	-	-	235	160.03±8.35	315	1997.49±52.5[b]	367.92±5.66[c]	237	97.09±8.05[ab]	447.95±7.89
2013-2015	-	-	260	147.78±7.72	371	1924.39±46.17[b]	357.60±4.98[b][c]	283	113.34±7.17[bc]	439.22±7.04
Parity										
1st	-	-	291	171.34±7.44[b]	342	1554.28±4931[a]	369.08±5.32	307	130.63±7.06[c]	465.69±6.95[b]
2nd	-	-	251	164.44±7.79[b]	314	1931.66±50.48[b]	359.57±5.45	255	121.47±7.42[bc]	449.48±7.25[a][b]
3rd	-	-	193	144.83±8.66[a]	256	1981.28±54.86[b]	356.60±5.92	196	103.71±8.32[ab]	432.54±8.18[a]
4th	-	-	129	140.56±10.56[a]	164	2081.68±68.15[b]	357.26±7.35	128	104.21±10.20[ab]	428.80±9.96[a]
5th	-	-	86	139.74±12.86[a]	126	1931.38±78.34[b]	351.89±8.45	88	106.31±12.30[ab]	431.74±12.10[a]
6th and above	-	-	96	143.81±11.95[a]	154	2033.76±69.22[b]	366.29±7.47	107	98.50±11.02[a]	432.50±10.80[a]
Overall	315	1435.60±10.48	1043	150.79±4.59	1355	1917.31±28.54	360.12±3.08	1081	110.80±4.35	440.13±4.26

Means bearing same superscript did not differ significantly. AFC=Age at first calving, SP=Service period, 305DMY=305days milk yield, LL=Lactation length, DP=Dry period, CI=Calving interval

Table 2: Least-squares analysis of variance for performance traits in Gir cows

Source of variation	AFC		SP			300DMY	LL		DP	CI
	df	F-value	df	F-value	df	F-value	F-value	df	F-value	F-value
Season	3	0.84	3	2.84*	3	0.76	0.83	3	3.46*	3.53**
Period	4	6.97**	4	0.49	4	6.75**	12.31**	4	7.66**	0.43
Parity	-		5	2.58*	5	10.62**	1.02	5	2.43*	3.65**
Error	307		1030		1342			1068		

*Significant at 5% level (P<0.05); **Significant at 1% level (P<0.01)