Journal of Animal Research: v.6 n.2, p. 127-130. April 2016

DOI: 10.5958/2277-940X.2015.00180.1

Factors Affecting Age at First Calving in Kankrej Cattle

N.K. Pareek[1*], K.J. Ankuya[2], M.P. Patel[3], N.A. Joshi[4], B.S. Rathod[5], K.B. Prajapati[6] and J.B. Patel[7]

Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Banaskantha, Gujarat, INDIA

Corresponding author: NK Pareek; Email: nawalpareek40@yahoo.com

Received: 20 December, 2015 **Accepted:** 08 February, 2016

ABSTRACT

The data of 35 years from 1980 to 2014 were analyzed to study the effect of genetic and non-genetic factors viz. period of calving, season of calving as fixed effect and sire as random effect on the reproduction trait (age at first calving) of Kankrej cattle maintained at Livestock Research Station, S.D. Agricultural University, Sardarkrushinagar, Gujarat. The least square mean of age at first calving in Kankrej cows was found to be 1376.0 9 ± 14.55 days. Heritability estimates was 0.44 ± 0.18 for the age at First calving. Genetic correlation of age at first calving (AFC) with first lactation 300 milk yield (F300Y), total milk yield (FLY) and lactation length (FLL) were 0.358 ± 0.218, 0.341± 0.216 and 0.661 ± 0.361, respectively while the phenotypic correlation were 0.055, 0.048 and 0.044, respectively. The effect of period of calving and sire was significant (P<0.01) on age at first calving. Season of calving did not affect significantly to this trait under study. Effect of season of calving was not significant on age at first calving indicated breed characteristic for adoption in particular environment. Age at first calving showed a significant variation over the period that indicated some selection measures for age at first calving.

Keywords: Age at first calving, correlation, heritability, Kankrej cattle

In dairy production, genetic change and improvements in milk production performance are realized when the parents of the next generation of animals are accurately chosen. For a dairy herd, this means selecting the sires and dams on the basis of their estimated genetic merit for mating to produce potential replacement heifers that have high expected genetic merit. Therefore, accurate estimation of the genetic merit of dairy animals has long been the subject in many studies and great advances have been made during the last decades. Age at first calving is closely related to generation interval and, therefore, influences response to selection. Thus, segregation of factors like season and years and their effect on trait like age at first calving will enable the breeder in assessing the effectiveness of selection programme and management conditions over time. This will help in designing more appropriate breeding strategies to maximize genetic gain and also suggest amendments in management standards if desired. A reduction in age at first calving will minimize the raising costs and shorten the generation interval and subsequently maximize the number of lactations per head. In general, earlier first calving increases lifetime productivity of cows. For example, Meaker *et al*. (1980) showed that, despite lower first conception rates, Africander heifers calving first at 2 years old produced 0.6 number more calves over their productive lifetime than those calving first at 3 years old. Therefore, the present investigation was planned with a view to study of the genetic and non-genetic factors affecting age at first calving in Kankrej cattle.

MATERIALS AND METHODS

Collection of data

The data on 475 normal first lactation records of Kankrej cattle sired by 75 sires maintained at Livestock Research Station, S.D. Agricultural University, Sardarkrushinagar, Gujarat (India) over a period of 35 years from 1980-2014 were included in the present study. Data of abnormal lactations like abortion, mastitis and below 150 day milk yield, specific or non-specific diseases, reproductive disorders and physical injury were excluded from the

study. The duration of 35 years was divided into 7 periods of five years each. The three seasons were delineated as winter (November-February), summer (March- June) and monsoon (July- October) on the basis of geo-climatic conditions prevailing in the region.

Statistical Methods

The data of milk production was analyzed for heritability, genetic and phenotypic correlation coefficient by the method of paternal half-sib correlation using Mixed Model Least-Squares and Maximum Likelihood (LSMLMW) computer programme developed by Harvey (1990). Heritability was estimated through half sib analysis in adjusted data as per the following model:

$$Yijkl = \mu + Sil + eijkl$$

where: μ = is the population mean, Yijkl is the observation of the traits made in i^{th} individual calved in j^{th} period and k^{th} season by the l^{th} sire, Sil= the effect of lth sire, eijkl = the random error effect.

The following mixed model was used to take the effect of different non-genetic factors on age at first calving:

$$Yijkl = \mu + Pj + Ck + Sl + eijkl$$

Where, Yijkl= observation of the traits made in i^{th} individual recorded in j^{th} period and k^{th} season by the l^{th} Sire, μ = population mean, Pj = Fixed effect of j^{th} period, j= 1-7 (period), Ck = Fixed effect of k^{th} season, i= 1-3 (season), Sl= random effect of l^{th} sire, l= (1-75) eijkl = Random effect of residual error, NID (0)

Duncan's multiple range test as modified by Kramer (1957) was used for testing the differences among least squares means.

RESULTS AND DISCUSSION

Heritability, Genetic and phenotypic correlation between different milk production traits

The heritability estimate of age at first calving was 0.44 ± 0.18 in first parity. Genetic correlation of AFC with F300Y, FLY and FLL were 0.358 ± 0.218, 0.341 ± 0.216 and 0.66 ± 0.361, respectively while the phenotypic correlations were 0.055, 0.048 and 0.044, respectively.

Heritability of age at first calving was good (0.44) and similar estimate of heritability was reported by Sachdeva and Gurnani (1989) and Singh *et al*. (1996) who have reported heritability heritability estimate 0.24 ± 0.10 in tharparker cattle. Gaikward and Narayankedkar (2000) investigated 564 crossbred cows (Gir X HF and Gir X Jersey) in India and reported heritability estimate 0.39 ± 0.28 for age at first calving, which was lower than the findings of the present study. However, Suresh and Sharma (1985) found 0.75 ± 0.12 for age at first calving. These reports showed that there was great genetic variation for age at first calving in different cattle breeds.

Table 1. Analysis of variance for Age at First Calving in Kankrej cattle

Source	DF	Mean Sum of Squares	F Value
SIRE	74	56464.40	2.120**
PERIOD	6	1039532.15	33.14**
SEASON	2	75527.16	2.41
Error	466	31367.34	

**P<0.01

Table 2. Period and Season-wise Least square means and standard errors in Kankrej Cattle

Factors	Least square means and standard errors of Age at First Calving
μ (n)	1376.09 ± 14.55 (475)
Period	
1980-1984 (23)	1627.93 ± 37.14[a]
1985-1989 (92)	1279.17 ± 18.57[de]
1990-1994 (72)	1554.92 ± 20.98[b]
1995-1999 (114)	1317.78 ± 16.67[de]
2000-2004 (51)	1395.81 ± 25.03[c]
2005-2009 (85)	1248.12 ± 19.25[e]
2010-2014 (38)	1326.12 ± 28.80[cd]
Season	
November-February (184)	1368.52 ± 13.90[a]
March- June (176)	1396.99 ± 13.97[a]
July-October (115)	1412.99 ± 17.34[a]

Means with the same letter are not significantly different

The genetic and phenotypic correlations of AFC with FLY (0.341 ± 0.216 and 0.048) and F300Y (0.358 ± 0.218 and 0.055) were positive. These correlations indicated that higher age at first calving were related with higher total milk yield and 300 days milk yield due to genetic reasons, though at environmental level high age at first calving were found related with lower first lactation milk yield on total as well as 300 day lactation basis. This could be due to the reason that cows sexually maturing and calving at higher age because of genetic reasons will attain bigger body size and hence is likely to produce more milk than cows maturing and calving at a lower age. However, cows attaining maturity and calving at a higher age due to environmental reasons, especially due to poor feeding and management, will possibly have poor body condition and will produce lower milk yield. Similar positive genetic and phenotypic relationships were between age at first calving and total milk yield have been reported by Jadhav *et al*. (1996), Suresh and Sharma (1985) and Jain *et al*. (1995) in various crossbred cattle herds. Higher estimate of correlation between AFC milk yields was reported by Rehman *et al*. (2008).

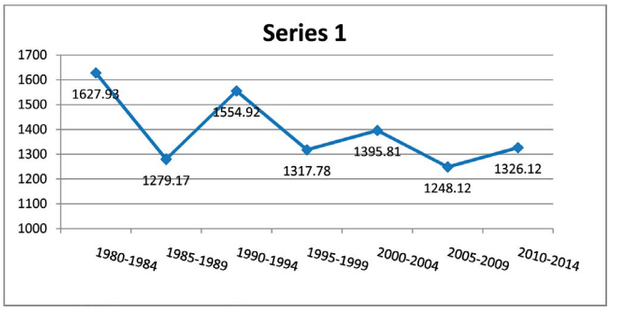

Fig. 1. Period - wise age at first calving (days) in Kankrej cattle

The genetic and phenotypic correlations between age at first calving and lactation length were positive (0.661±0.361and 0.044) and agreed with Rehman *et al.* (2008) who has reported almost slightly higher correlations (0.71) between these traits.

Effect of non genetic factors on age at first calving

The overall least square mean for age at first calving was 1376.09 ± 14.55 days which is similar finding with the ICAR ANNUAL REPORT 2010–11 (1,305 days). Nikhil and Vataliya (2014) found age at first calving as 1490.50 ± 111.04 in Gir cow which was slightly higher than Kankrej cattle. Lower estimates of age at first calving (1111.26 days) was reported by Manoj *et al*. (2012), while higher estimate of age at first calving (1390 days) were reported by earlier workers (Singh *et al*., 2005 and Rehman *et al*., 2008) in Sahiwal cattle. The age at first calving previously reported in Pakistani Sahiwal by Ahmad *et al*. (1992) and Mohiuddin *et al*. (1991), as 1,242 to 1,345 days. Basu *et al*. (1982) reported average age at first calving of 39.03 months in Tharparker cattle. Lower age at first calving were found by Zuzana and Juraj (2011) in HF cattle (837.52 days) and Muir *et al*. (2004) found in Canadian Holstein population (27.27 months).

Effect of period of calving

The least squares analysis of variance revealed that period of calving had significant (P<0.01) effect on age at first calving (Table 1). The age at first calving was maximum in first period (1980-1984) and minimum in sixth period (2005-2009) while in seventh period it was slightly increased which might be due to small size of data. Similar significant effect of period on age at first calving were reported by Basu *et al*. (1982), Hammoud *et al*. (2010) and Manoj *et al*. (2012) in tharparker, Friesian and Sahiwal cattle, respectively. Age at first calving showed recurring up down trends over period. However considerable improvement was noticed over the period (Table 2).

Effect of calving season

The effect of season of calving was non-significant (P<0.01) for age at first calving. Similar non- cow calved in winter season (1368.52 days), followed by summer (1396.99 days) and monsoon season (1412.99 days).

Effect of Sire

The differences among sires were significant (P<0.01) for age at first calving (Table 1). Similar significant effect of sire on age at first calving was reported by earlier workers (Basu *et al*. 1982; Soliman and Khalil, 1991; Oudah *et al*. 2001 and Hammoud *et al*. 2010).

CONCLUSION

It is concluded that year of calving significantly affect

the age at first calving which indicates considerable improvement was noticed over the period by the selection. However, age at first calving showed recurring up down trends over period. Based upon the findings of the present study it may be recommended that age at first calving needs to be considered in selection program. A high heritability estimate for age at first calving in the present study indicated that the selection on the basis of the individual's own phenotype should be effective for AFC. Higher correlations indicated that higher age at first calving were related with higher total milk yield and 300 days milk yield due to genetic reasons.

REFERANCES

Ahmad, Z., Perveen, R., Mohiuddin, G., Khan, M.A. and Akhtar, P. 1992. Genetic and phenotypic parameters of some reproductive traits in Sahiwal cows. *J. Anim. Plant Sci*., **2**: 11-14.

Basu, S.B., Bhatnagar, D.S. and Taneja, V.K. 1982. Estimates of genetic parameters for first lactation performances in Tharparkar cattle. *Ind. J. Anim. Sci*., **52**(5): 279-283.

Hammoud, M.H., El-Zarkouny, S.Z. and Oudah, E.Z.M. 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. *Arch. Zootech.,* **13**: 60-82.

Gaikward, I.S. and Narayankhedkar, S.G. 2000. Estimation of heritability of reproduction traits in crossbred cows. *Ind. Vet. J.,* **77**(9): 811-812.

Harvey, W.R. 1987. User's Guide for LSMLMW PC-1 Version, Mixed Model Least- Squares and Maximum Likelihood Computer Program. Mimeo.Ohio State University, Columbus, OH

Jain, A.K., Mehar, M.L., Parmar, J.S. 1995. Phenotypic and genetic parameters of three breed cross cows. *Ind. Vet. J.,* **72**: 1277-1281.

Kramer, C.Y. 1957. Extension of multiple range tests to group correlated adjusted means.

Biometrics, **13**(1): 13-18.

Meaker, H.J., Coetsee, T.P.N. and Lishman, A.W. 1980. The effect of age at first calving on the productive and reproductive performance of beef cows. *South Afri. J. Anim. Sci.,* **10**: 105-113.

Muir, B.L., Fatehi, J. and Schaeffer, L.R. 2004. Genetic relationships between persistency and reproductive performance in first-lactation Canadian Holsteins. *J. dairy sci.,* **87**: 3029-3037.

Manoj, M., Gandhi, R.S., Raja, T.V., Singh, A. and Sachdeva, G.K. 2012. Effect of Non-Genetic Factors on First Lactation Production and Reproduction Performance in Sahiwal Cattle. *Ind. J. Dairy Sci.,* **65**(3): 264-265.

Mohiuddin, G., Yaqoob, M., Nawaz, H. and Akhtar, P. 1991. Inheritance of breeding efficiency and its relationship with age at first calving and first lactation milk yield in Sahiwal cattle. *Pak. Vet. J.,* **14**: 238-241.

Nikhil, S.D. and Pravin, H.V. 2014. Factors Affecting Age at First Calving in Gir Cattle. *Int. J. Livest. Res.,* **4**(2): 86-91.

Oudah, E.Z.M., Shalaby, N.A. and Mustafa, M.A. 2001. Genetic and non-genetic factors

affecting days open, number of service per conception and age at first calving in a herd of Holstein-Friesian cattle. *Pak. J. Bio. Sci.,* **4**(6): 740–744.

Rehman, Z.U., Khan, M.S., Bhatti, S.A., Iqbal, J. and Iqbal, A. 2008. Factors affecting first lactation performance of Sahiwal cattle in Pakistan. *Arch. Tie. Dum.,* **51**(4): 305-317.

Sachdeva, G.K. and Gurnani, M. 1989. Evaluation of Friesian crossbred cattle genetic groups on the basis of total score. *Ind. J. Anim. Sci.,* **59**: 1446-1447.

Singh, M., Tomar, S.P., Singh, R.V. and Manglik, V. 1996. Studies on genetic and non genetic factors influencing reproduction parameter in crossbred cows. *Ind. J. Anim. Res.,* **30:** 65-69.

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

Soliman, A.M. and Khalil, M.H. 1991. Genetic and phenotypic associations of milk traits with age at calving and with length of open period, dry period and lactation. *Egypt. J. Anim. Prod.,* **28**(2): 131-146.

Zuzana, R. and Candrak, J. 2011. Analysis of Relationship between Production and

Reproduction Traits of Holstein Cattle Population in the Slovak Republic. *Anim. Sci. Biotech.,* **44**(1): 332-336.