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## Effect of non-genetic factors on age at first calving in Gir cattle

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#### Abstract

The present study was carried out using data of first lactation records of 513 Gir cows sired by 75 bulls spread over a period of 34 years (1981 to 2014), maintained at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh. Analysis was carried out by least squares analysis method described by Harvey (1966) and Duncan's new multiple range test as modified by Kramer. The overall least squares means for age at first calving (AFC) was  $1558.63 \pm 23.30$  days. Season of birth had non-significant effect on AFC while period of birth had highly significant ( $P < 0.01$ ) effect on AFC.

**Keywords:** Age at first calving, Effect of season and period and Gir cow

#### Introduction

India is believed to be a rich reservoir of livestock biodiversity with 43 registered cattle breeds. Livestock play an important role in rural economy and contribute significantly to agricultural GDP of our country. The total cattle population of India is 190.9 million of which 512.5 million is livestock population. Cattle contribute around 37.28 percent of the total livestock population of the country. Total cattle population of Gujarat state is 9.46 million out of which 1.40 million are Gir animals. Gir is well known high yielder milch breed of India and has originated from Gir forests and adjoining districts like Junagadh, Amreli, Bhavnagar, Gir-Somnath, Rajkot, Porbandar and also some parts of Jamnagar, Morbi and Surendranagar districts of Gujarat.

Get at first calving (AFC) is an important reproductive trait as well as an economic trait in cattle. Decrease in age at first calving decreases the cost of raising the animals to productive life, increases the annual genetic gain and raises the average productive life of the animal. The estimate of additive genetic variability for traits of economic importance gives an idea about the scope of genetic improvement of the trait through selective breeding. The selection and evaluation of breeds to be used as the parental stock is an important step for the success of any animal breeding program.

Gir is considered to be best milch cattle breed in Indian scenario. The knowledge of age at first calving is essential for bringing early improvement in milk production. Age at first calving (AFC) is an important reproductive trait as well as an economic trait in cattle. Decrease in age at first calving decreases the cost of rearing of heifer, increases the annual genetic gain, reduce generation interval and raises the average productive life of the animal. The present investigation shall help formulate breeding policy and selection decisions which shall lead to genetic improvement of this valuable breed in its native tract trait as well as an economic trait in cattle. Decrease in age at first calving decreases the cost of raising the animals to productive life, increases the annual genetic gain and raises the average productive life of the animal. The estimate of additive genetic variability for traits of economic importance gives an idea about the scope of genetic improvement of the trait through selective breeding. The selection and evaluation of breeds to be used as the parental stock is an important step for the success of any animal breeding program.

#### Materials and Methods

The present investigation was conducted on data comprised of 513 Gir cattle completed first lactation in a span of 34 years from 1981 to 2014 from pedigree cum lactation registers and birth registers of Gir cattle maintained at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh.

The data were classified into 7 periods with first six periods had five consecutive years and last period had four consecutive years. Each year was divided into four seasons viz., summer, rainy, autumn and winter.

Analysis was carried out by least squares analysis method to study the effect of various non-genetic factors on AFC described by Harvey (1966) using following model.

$$Y_{ijm} = \mu + a_i + b_j + e_{ijm}$$

#### Where

$Y_{ijm}$  = Observation on the  $m^{\text{th}}$  individual in  $i^{\text{th}}$  season,  $j^{\text{th}}$  period

$\mu$  = Overall population mean

$a_i$  = Effect of  $i^{\text{th}}$  season ( $i = 1$  to 4)

$b_j$  = Effect of  $j^{\text{th}}$  period ( $j = 1$  to 7)

$e_{ijm}$  = Random error, NID ( $0, \sigma^2_e$ )

Duncan's new multiple range test as modified by Kramer (1957) was used for testing differences among different least

squares means (using the inverse coefficient matrix).

## Results and Discussion

### Age at First Calving of Gir Cows

The overall least squares mean for AFC in the present study was  $1558.63 \pm 23.30$  days in Gir cows (Table 1).

Present AFC estimate was near to the value reported by Gaur *et al.* (2003) [8] and Ramani (2016) [27] in Gir cows, Govindaiah *et al.* (2005) [10] in Amrit-mahal cows, Gokhale *et al.* (2008) [9] in Khillar cows, Pundir and Ahlawat (2006) [23] in Sahiwal cows.

AFC estimates were lower as compared to present study as reported by Raja (2004) [26], Kumar (2007) [7], Manoj (2009) [20] and Bansal *et al.* (2017) [3] in Sahiwal cows, Dangar and Vataliya (2014) [6] and Savaliya *et al.* (2016) [30] in Gir cows, Pareek *et al.* (2016) [24] in Kankrej cows, Divya (2012) [7] in Karan-Fries cows and Kakati *et al.* (2017) [13] in Frieswal cows. However, higher values of AFC were reported by Barwe *et al.* (1996) [2] and Singh *et al.* (2016) [31] in Gir cows, Chaudhary *et al.* (1995) [5] in Kankrej cows, Khatri *et al.* (2004) [16] in Red Sindhi cows.

**Table 1:** Least squares means for AFC (days) in Gir cows

Factors	N	Mean $\pm$ SE
Over all	513	1558.63 $\pm$ 23.30
<b>Season of birth</b>		
Summer	156	1583.46 $\pm$ 19.24
Rainy	106	1531.70 $\pm$ 26.88
Autumn	98	1501.32 $\pm$ 26.66
Winter	153	1555.24 $\pm$ 25.84
<b>Period of birth</b>		
1981-1985 (P1)	24	1651.95 $\pm$ 85.89**ab
1986-1990 (P2)	105	1566.12 $\pm$ 25.70**bc
1991-1995 (P3)	67	1693.89 $\pm$ 38.87**a
1996-2000 (P4)	38	1584.36 $\pm$ 43.43**bc
2001-2005 (P5)	90	1579.30 $\pm$ 26.38**bc
2006-2010 (P6)	104	1486.49 $\pm$ 23.64**cd
2011-2014 (P7)	85	1411.11 $\pm$ 22.39**d

[\*\* Highly significant at 1% level ( $P < 0.01$ ), Means with the same superscript are not significantly different]

### Effect of season of birth on age at first calving

The effect of season of birth was found to be non-significant on AFC in Gir cows. The highest number of observations were found in summer (156) as compared to winter (153), rainy (106) and autumn season (98) (Table 1).

The least square mean of AFC was found to be highest ( $1583.46 \pm 19.24$  days) for the cows born during summer season, followed by winter and rainy, while the cows born during autumn season had the lowest least squares mean i.e.  $1501.32 \pm 26.66$  days (Figure 1). That might be due to no. of observation in particular season but season had not-significant effect on AFC.

Similarly, effect of season of birth was found to be non-significant on AFC by other workers viz. Singh *et al.* (2016) [31] in Gir cows, Manoj (2009) [20], Kathiravan (2009) [15] and Monalisa *et al.* (2010) [21] in Sahiwal cattle and Bhambure and Dave (1989) [4] in Kankrej cattle. Contrary to this, effect of season of birth was found to be significant on AFC observed by Ahmad *et al.* (1999) [1], Javed *et al.* (2000) [12], Rehman *et al.* (2006) [28], Zafar *et al.* (2008) [33] and Narwaria *et al.* (2015) [22] in Sahiwal cows, Dangar and Vataliya (2014) [6] and Ramani (2016) [27] in Gir cows and Saini *et al.* (2014) [29] in Rathi cows.

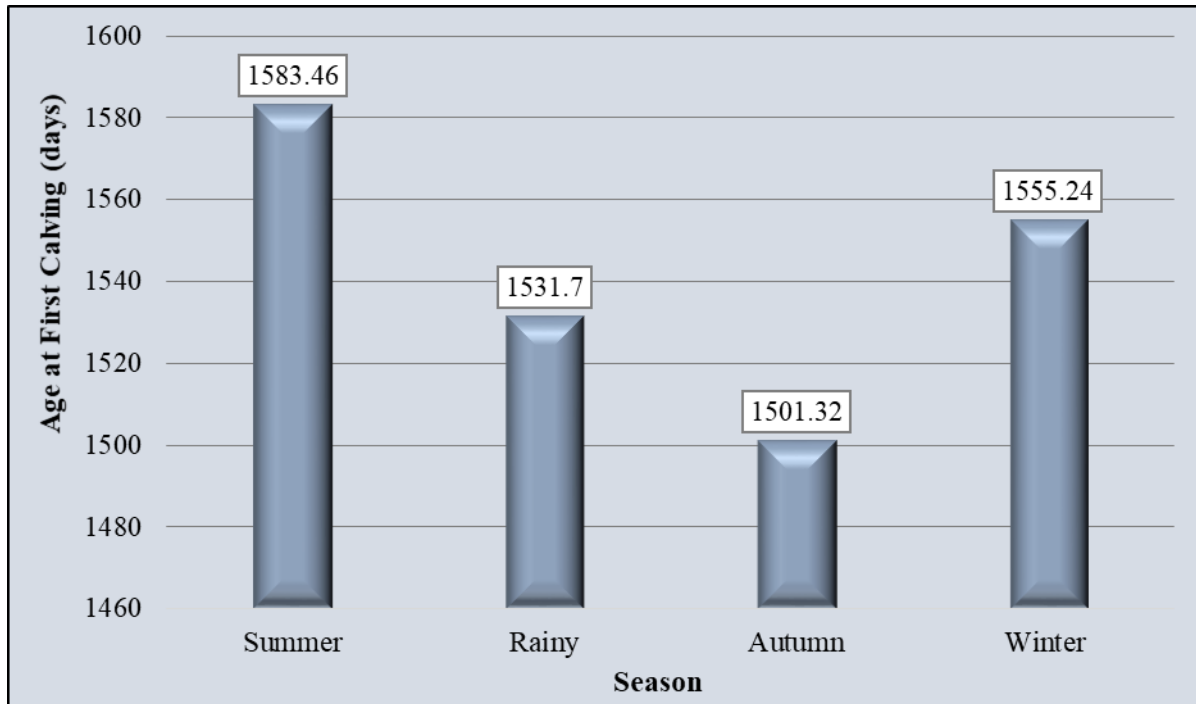


Fig 1: Season of birth wise least square mean of age at first calving in Gir cow

**1.2 Effect of period of birth on age at first calving**

The effect of period of birth on AFC was found to be highly significant ( $P < 0.01$ ) in Gir cows (Table 1). The highest number of observations were found during 1986-1990 (P2) followed by 2006-2010 (P6), 2001-2005 (P5), 2011-2014 (P7), 1991-1995 (P3), 1996-2000 (P4) and low in 1981-1985 (P1) (Table 1). The least squares means for AFC was highest ( $1693.89 \pm 38.87$ ) for the animals born during 1991-1995 (P3) followed by P1, P4, P5, P2, P6 and lowest ( $1411.11 \pm 22.39$ ) for the period 2011-2014 (P7) (Figure 2).

Similar results were reported by Javed *et al.* (2000) [12], Kannan and Gandhi (2004) [14], Kumar (2007) [7], Manoj (2009) [20], Raja (2010) [25] and Narwaria *et al.* (2015) [22] in Sahiwal cows, Dangar and Vataliya (2014) [6] and Ramani (2016) [27] in Gir cows and Kakati *et al.* (2017) [13] in Frieswal cows. While contrary to this non-significant effect of period of birth on AFC was observed by Singh *et al.* (2016) [31] in Gir cows and Saini *et al.* (2014) [29] in Rathi cows, Tajane and Rai (1990) [32] and Kuralkar *et al.* (1996) [19] in Sahiwal cows.

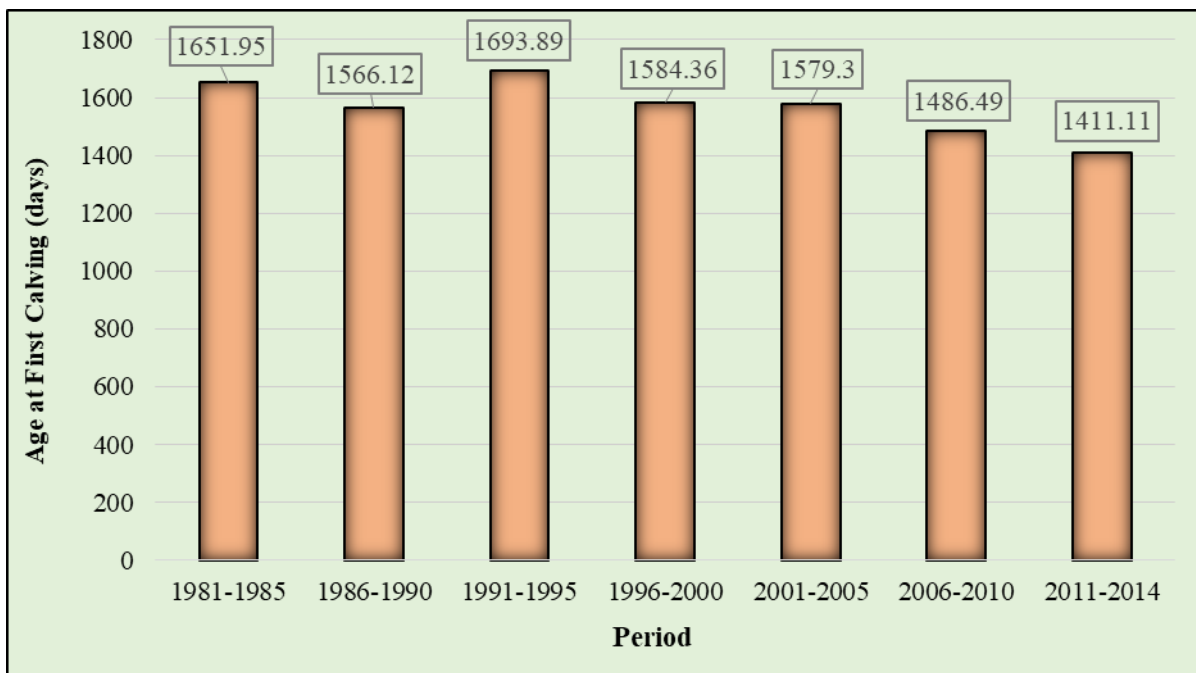


Fig 2: Period of birth wise least square mean of age at first calving in Gir cow

**Conclusion**

The non-significant effect of season of birth on AFC might be due to the endurance of Gir cows to the hot tropical climatic conditions with respect to AFC. It may also be due to the fact

that the effect of season of birth gets diluted by the time the animal conceived. The periods of birth had highly significant effect on AFC may be attributed to feeding practices of young stock that varied from period to period and the young stock

raised during period of adequate nutrition grew faster than others and better selection of animal. Even though definite decreasing trend was observed after 1995, there was a decline in the AFC over the periods due to better managemental practices on farm for reduced AFC.

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