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# Effect of different genetic and non-genetic factors on production and reproduction parameters of Gangatiri cows maintained under organized farm

**Vikash Kumar, Rampal Singh, Kaiser Parveen, Raviranjan, Ossmah Kalim, Deepti Kiran Barwa and Aayush Yadav**

## Abstract
Gangatairi breed of cattle is also known as Eastern Haryana or Shahbadi and is a native breed of the tract falling between Ganga and Ghaghara rivers known as Duaba belt that includes four districts of Uttar Pradesh i.e. Varanasi, Ghazipur, Ballia and Chandauli, and five districts of Bihar i.e. Bhabhua, Sasaram, Arrah, Buxer and Chhapra. The present study was conducted on 100 Gangatiri cows (calved during 2003 to 2010) maintained at Livestock cum Agricultural Farm, Arajiline, Varanasi under the Department of Animal Husbandry, Govt. of Uttar Pradesh to study the effect of season and parity on productive and reproductive traits of Gangatiri cows. The productive traits studied were first, second and third lactation total lactation milk yield and lactation length; and first, second lactation dry period. The reproductive parameters studied included age at first calving, first and second calving interval. All the productive and reproductive data was classified into three seasons of calving viz. summer, rainy and winter and into three parity viz. 1-3. The average first, second and third lactation milk yield were 1069.9 Kg, 854.76 Kg, 1029.84 Kg, respectively . First, second and third lactation length was 309 days, 239 days, 249 days respectively. First and second lactation dry period as reported in this study was 170 days and 160 days respectively. In reproductive parameters the average age at first calving, first and second lactation calving interval was reported as 1456 days, 469 days and 398 days respectively. The season of calving was found to have non-significant effect on 1$^{st}$, 2$^{nd}$ and 3$^{rd}$lactation milk yield, lactation length and dry period; and first calving interval buthas significant effect on second calving interval. Parity had significant influence on all the production and reproduction traits under study.

**Keywords:** Gangatiri cows, lactation yield, lactation length, dry period, calving interval

## Introduction
In India, animal husbandry is an integral part of the agriculture and among livestock, cattle occupy central position and considered as backbone of rural population by providing nutritional and livelihood security. The cattle and buffalo account for more than two third of the total output value of the livestock sector. Various indigenous breeds of cattle in the country are the result of thousands of years of selection, evolution and development of the wild species in the process of domestication to the local agro climatic conditions. These breeds are now losing ground due to intense competition from other breeds and risk of economic viability under the present system of management. There are 50 well-defined breeds of cattle apart from several nondescript types and some lesser-known breeds (NBAGR, 2020) [1].To start an extensive and effective breeding programme for cattle, it is necessary to have knowledge of the phenotypic and genetic parameters of important economic traits for bringing about improvement and also for choosing appropriate selection programme.Gangatairi breed of cattle is also known as *Eastern Haryana* or *Shahbadi* and is a native breed of the tract falling between Ganga and Ghaghara rivers known as Duaba belt that includes four districts of Uttar Pradesh i.e. Varanasi, Ghazipur, Ballia and Chandauli, and five districts of Bihar i.e. Bhabhua, Sasaram, Arrah, Buxer and Chhapra. This breed was developed by upgrading during British regime when bulls of Hariana breed were brought to this area for genetic improvement of local cattle as a result a new genotype was developed and named as *Gangatiri* breed. Gangatiri breed of cattle was registered by NBAGR, Karnal as 39$^{th}$ Indian breed of cattle as assigned the accession number INDIA_CATTLE_2003_GANGATIRI_03039. To start an extensive and effective breeding programme for cattle, it is necessary to have knowledge of the phenotypic and genetic parameters of important economic traits for bringing about improvement and also

for choosing appropriate selection programme. The heredity and environment are two fundamental factors contributing to the variability in economic traits. It becomes essential to know as how much variation in these traits is of genetic nature and how much of environment. Livestock cum Agricultural Farm, Arajiline, Varanasi (Uttar Pradesh) and Surabhi Gopalan Anusandhan Kendra, Dagmagpur, Mirzapur (Uttar Pradesh) has the proud custodian of pure herd of Gangatiri cows. But the study onproduction traits and reproduction traits in Gangatiri cows maintained under organized farms are lacking. Hence with this view the present study was under taken to study different production traits and reproduction traits and non-genetic factors affecting them in Gangatiri cows.

## Materials and Methods

***Source of data:*** The information related to the present study was collected from records on Gangatiri cows maintained at Livestock cum Agricultural Farm, Arajiline, Varanasi (Uttar Pradesh). Calving records of Gangatiri cows, spread over the year from 2003 to 2010 were collected for the present study.

**Editing and normalization of data**: The records of the Gangatiri cows with known pedigree were taken for the present study. The animals with abnormal records like abortion, still birth, delayed calving and other reproductive problems were not considered. The data was edited and normalized by mean±2 S.D. Total 100Gangatiri cows with normal calving, 305 days milk yield more than or equal to 500 kg and lactation length more than or equal to 100 days were selected for the study.

**Classification of data:** The productive parameters studied were first, second and third lactation total lactation milk yield and lactation length; and first, second lactation dry period. The reproductive parameters studied were age at first calving, first and second calving interval.

The data were classified and coded on the basis of season of calving (3 levels; summer, rainy and winter) and parity (3 levels; 1-3). The data were classified in to groups using the Sturges's formula (Sturges, 1926)[2] after normalizing the distribution of data in the population using mean and two standard deviation.

**Statistical analysis**: The statistical analysis was carried out using the R statistical software.

The least square analysis was carried out to identify the environmental factors that have significant effect on the production and reproduction traits was done by using the linear model function (*lm*) of R statistical software (R 3.6.3 version). The significance of the fixed effects was analyzed by using the Duncan's multiple range test using the *agricolae* package of R statistical software (R 3.6.3 version).

The fixed linear model equation for the analysis of the effect of non – genetic factors on different production and reproduction parameters of Gangatiri cows was as follows:

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

$Y_{ijk}$ = $k^{th}$ observation of production and reproduction parameters of Gangatiri cows under the effect of $i^{th}$ season of calving group and $j^{th}$ parity group, $e_{ijk}$ = Random error, which is NID $(0, \sigma^2 e)$

## Results and Discussion

The average value of different production and reproduction traits in Gangatiri cows are presented in Table 1. In this study the average age at first calving in Gangatiri cows is reported as 48 months. The average first, second and third total lactation milk yield is obtained as 1070 Kg, 855 Kg and 1030 Kg, respectively. The average first, second and third lactation length is reported as 309 days, 239 days and 248 days, respectively. The average first and second dry period was 170 days and 160 days, respectively; and first and second calving interval was 469 days and 398 days, respectively.

In other newly registered breeds of cattle of India average age at first calving is reported as; 38 months in Belahi (Chandigarh)- Vohra *et al*. (2016), 45 months in Nari (Gujarat)- Ali *et al*. (2018) [3], 53 months in Kosali (Chhattisgarh)- Jain *et al*. (2018) [4], 50 months in Badri (Uttarakhand) - Joshi *et al*. (2019) [5], 39 months in Malnad Gidda (Karnataka) –Lohith *et al*. (2020) [6], 47 months in Lakhimi (Assam) –Savilia *et al*. (2020) [7].According to NBAGR, the average age at first calving in newly registered breed of cattle is reported as 50 months in Konkan Kapila (Maharashtra), 41 months in Binjharpuri (Orissa), 53 months in Dagri (Gujarat), 42 months in Ghumusari (Orissa), 50 months in Himachali Pahari (Himachal Pradesh), 48 months in Ladhakhi (Ladakh), 53 months in Motu (Orissa), 50 months in Poda Khurpu (Telangana), 50 months in Pulikulum (Tamil Nadu), 49 months in Purnea (Bihar), 45 months in Shweta Kapila (Goa), 30 months in Thutho (Nagaland). The average age at first calving of Gangatiri breed of cattle is less thanKosali (Chhattisgarh Badri (Uttarakhand), Lakhimi (Assam), Konkan Kapila (Maharashtra), Dagri (Gujarat), Himachali Pahari (Himachal Pradesh), Motu (Orissa), PodaKhurpu (Telangana), Pulikulum (Tamil Nadu) and Purnea (Bihar); where more than Nari (Gujarat), MalnadGidda (Karnataka), Binjharpuri (Orissa), Ghumusari (Orissa), Ladhakhi (Ladakh), ShwetaKapila (Goa), andThutho (Nagaland).

In other newly registered breeds of cattle of India average first lactation milk yield is reported as; 946.57 Kg in Gangatiri-Jaiswal *et al*. (2015) [8], 1071.6 Kg in Belahi (Chandigarh)-Vohra *et al*. (2016) [9], 193.74 Kg in MalnadGidda (Karnataka) –Lohith *et al*. (2020) [6]. The average first lactation total milk yield of Gangatiri breed of cattle is less thanBelahi (Chandigarh) but more than MalnadGidda (Karnataka).

### Estimates of genetic and non-genetic factors

The effect of season of calving and parity on different production and reproduction parameters of Gangatiri cows is presented in Table 2. The effect of season of calving is found to be non-significant on all the parameters except on second calving interval. From the perusal of data on second calving interval (days) of Gangatiri cows as influenced by three calving seasons it was observed the longest second calving interval of Gangatiri cows recorded in summer calving season followed by rainy season and winter seasons. Longest calving interval in summer season may be due to excessive hot weather and lack of green fodder and nutrition. The results are in conformity with the findings of Sentitula *et al*. (2008) [10], Manoj *et al*. (2010) [11], Verma *et al*. (2015) [12], Prakash *et al*. (2015) [13], Singh and Singh (2016) [14], Singh *et al*. (2017) [15] and Dash *et al*. (2018) [16].

The effect of parity was found to be significant on all the parameters under study. Highest milk yield in first parity may

be due to batter managemental and feeding practices in this parity. The The longer dry period and calving interval in first parity may be due to not fully develop productive organs in first calving. The present result is in accordance with results of Rehman *et al*. (2008) [17], Dongre *et al*. (2013) [18], Dangi *et al*. (2013) [19], Gandhi and Raja (2015) [20], Munde *et al*. (2015) [21], Singhare *et al*. (2015) [22], Ambore *et al*. (2017) [23], Singh *et al*. (2017) [15],Basak *et al*. (2018) [24], Dash *et al*. (2018) [16].Chaudhary *et al*. (2019) [25] and Ratwan *et al*. (2020) [26].

**Table 1:** Mean±S.E. of different production and reproduction traits in Gangatiri cows

| Production and reproduction traits | Mean±S.E. |
|---|---|
| Age at first calving | 1456±125Days |
| First lactation total milk yield | 1070±215 Kg |
| First lactation length | 309±35 Days |
| Second lactation total milk yield | 855±105 Kg |
| Second lactation length | 239±25 Days |
| Third lactation total milk yield | 1030±115 Kg |
| First lactation length | 249±18 Days |
| First dry period | 170±55 Days |
| Seconddry period | 160±85 Days |
| First calving interval | 469±46 Days |
| Secondcalving interval | 398±24 Days |

**Table 2:** Least-squares means and SE of Different Production and Reproduction traits in Gangatiri cattle (season of calving and parity in mixed model)

| **Effect of Season of Calving** | |
|---|---|
| **First Lactation Total Milk Yield** | |
| **Season of Calving** | **Mean±SE** |
| Winter | 1011.71±24.8 |
| Summer | 1022.89±112.5 |
| Rainy | 1381.17±78.1 |
| **Second Lactation Total Milk Yield** | |
| Winter | 822.67±78.5 |
| Summer | 1082.62±117.23 |
| Rainy | 667.21±74.2 |
| **Third Lactation Total Milk Yield** | |
| Winter | 1078.63±74.2 |
| Summer | 1049.33±44.5 |
| Rainy | 754.52±65.22 |
| **First Lactation Length** | |
| Winter | 292.50±16.88 |
| Summer | 317.80±88.5 |
| Rainy | 357.33±55.6 |
| **Second Lactation Length** | |
| Winter | 219.52±44.32 |
| Summer | 289.22±36.55 |
| Rainy | 240.57±45.12 |
| **Third Lactation Length** | |
| Winter | 263.680±24.2 |
| Summer | 239.75±62.3 |
| Rainy | 187.60±45.21 |
| **First Dry Period** | |
| Winter | 165.87±74.2 |
| Summer | 197.60±46.7 |
| Rainy | 142.83±36.22 |
| **Second Dry Period** | |
| Winter | 154.87±78.5 |
| Summer | 148.40±111.2 |
| Rainy | 192.00±45.22 |
| **First Calving Interval** | |
| Winter | 459.45±54.7 |
| Summer | 518.00±64.22 |
| Rainy | 429.66±66.25 |
| **Second Calving Interval** | |
| Winter | $371.00\pm25.0^{a}$ |
| Summer | $437.57\pm71.45^{b}$ |
| Rainy | $433.20\pm25.0^{b}$ |
| **Effect of Parity** | |
| **Total Lactation Total Milk Yield** | |
| Parity | Mean±SE |

| | |
|---|---|
| First | 1069.92±114.5[c] |
| Second | 854.76±47.2 [a] |
| Third | 1029.821±28.8[b] |
| **Dry Period** | |
| First | 170.350±14.75[b] |
| Second | 159.75±27.2 [a] |
| Third | 152.84±48.8 [a] |
| **Total Lactation Length** | |
| First | 308.55±44.35[b] |
| Second | 239.38±77.2 [a] |
| Third | 248.63±58.8 [a] |
| **Calving Interval** | |
| First | 469.62±14.35[b] |
| Second | 401.38±27.2 [a] |
| Third | 398.20±38.8 [a] |

## Conclusion

The level of systematic breeding, management as well as nutritional practices required to exploit genetic potential of dairy cow in best way is generally poor due to lack of scientific knowledge in cattle owners pertaining to genetical, non-genetical and environmental factors. Improvement through selective breeding within the indigenous breeds of dairy cattle can bridge the gap between the need and the production of milk within reasonable length of time to a level of efficient commercial dairy animals. Hence, to have increase in lactation milk yield, standard lactation length and optimum calving interval, further selective breeding, provided better scientific feeding and management practices is still a need for animals of Gangatiri breed.

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