International Journal of Veterinary Sciences and Animal Husbandry

**ISSN:** 2456-2912
NAAS Rating (2025): 4.61
VET 2025; SP-10(10): 148-153

www.veterinarypaper.com
Received: 07-07-2025
Accepted: 10-08-2025

# Effect of non-genetic factors on production and reproduction traits in Deoni cattle

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**DOI:** https://www.doi.org/10.22271/veterinary.2025.v10.i10Sc.2679

## Abstract
The research study titled "Studies on Breeding Efficiency of Deoni Cattle Maintained at an Organised Farm" was conducted using the performance records of Deoni cattle maintained at the Cattle Cross Breeding Project, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS), covering the period from 1991 to 2024. The investigation focused on productive and reproductive traits, including lactation milk yield, peak milk yield, days to attain peak yield, lactation length, dry period, age at first calving, service period, gestation period, and calving interval.

The analysis utilized 34 years of data (1991-2024), comprising 713 lactation records from 494 Deoni cows. The overall least-squares means for LMY, PMY, DRPMY, LL, DP, AFC, SP, GP, and CI were estimated as 416.17±4.65 kg, 2.97±0.03 kg, 40.36±1.14 days, 204.70±3.26 days, 293.66±7.72 days, 1687.17±18.44 days, 229.04±6.33 days, 280.20±0.34 days, and 485.51±6.57 days, respectively.

The period of calving significantly influenced LMY, PMY, LL, DP, AFC, SP, GP, and CI, but showed no significant effect on DRPMY. Conversely, the season of calving did not exert a significant effect on either productive or reproductive traits. Age at first calving was found to significantly affect LMY, PMY, and DP, while its effect on DRPMY, LL, SP, GP, and CI was non-significant.

**Keywords:** Deoni, productive and reproductive traits

## Introduction
India is home to 54 well-recognized cattle breeds (NBAGR, 2025), which are known for their adaptability to local and harsh climates, ability to thrive on low-quality fodder, and strong disease resistance. Among them, the Deoni breed holds significant importance as a dual-purpose breed of southern India. It is characterized by attributes such as disease resistance, heat tolerance, capacity to survive and reproduce under stress, low feed requirements, and potential for dairy improvement.

Deoni is considered one of the best milch breeds of Maharashtra, well-suited to the hot and drought-prone climate of the state. This breed is distributed across five states—Andhra Pradesh, Karnataka, Rajasthan, Uttar Pradesh, and Maharashtra—though its native breeding tract lies in the Latur district of Maharashtra. To strengthen breed management, the state animal husbandry department, in collaboration with the National Dairy Development Board (NDDB), has recently initiated the registration of Deoni cattle in the Information Network for Animal Productivity and Health (INAPH) for systematic performance recording. The productivity of dairy animals largely depends on both productive and reproductive traits. For the present study, productive traits such as lactation milk yield (LMY), peak milk yield (PMY), days to reach peak milk yield (DRPMY), lactation length (LL), and dry period (DP), along with reproductive traits including age at first calving (AFC), service period (SP), gestation period (GP), and calving interval (CI), were considered.

## Materials and Methods
### Study area
The Cattle Cross Breeding Project is located on the main campus of VNMKV, Parbhani, at 19º 60' N latitude and 76º 50' E longitude, with an elevation of 489 meters above mean sea level.

The project maintains purebred Deoni cattle for breeding purposes along with their crossbred progeny. Data on productive and reproductive traits namely lactation milk yield (LMY), peak milk yield (PMY), days to reach peak milk yield (DRPMY), lactation length (LL), dry period (DP), age at first calving (AFC), service period (SP), gestation period (GP), and calving interval (CI) were systematically collected from individual pedigree records and daily milk yield registers maintained at the research station.

**Management of animals**

Uniform management and feeding practices are followed at the CCBP research farm. Deoni cattle are provided rations as per a structured feeding schedule. With the onset of the monsoon, grazing becomes available within a month, and grazing practices are adopted from mid-July to the end of January. Along with grazing, the cattle are regularly supplemented with dry and green fodder. During morning and evening milking, each cow is provided concentrates based on its maintenance and production requirements. The animals are also fed dry sorghum roughage and green fodder, depending on availability, which includes green maize, lucerne, green jowar, and natural grasses.

**The Sources and Collection of Data**

Data from 494 Deoni dams maintained at CCBP, comprising 713 lactation records spanning a 34-year period (1991-2024), were compiled to assess the influence of period of calving, season of calving, and age at first calving on productive and reproductive traits. For analysis, the study period was divided into seven groups: P1 (1991-1995), P2 (1996-2000), P3 (2001-2005), P4 (2006-2010), P5 (2011-2015), P6 (2016-2020), and P7 (2021-2024). Similarly, the year was categorized into four seasons: winter (December-February, S1), summer (March-May, S2), monsoon (June-September, S3), and post-monsoon (October-November, S4). Age at first calving (AFC) was classified into five groups: A1 (below 1200 days) through A5 (above 1650 days).

To evaluate the impact of non-genetic factors on production and reproduction traits, data were analyzed using the least squares technique (Harvey, 1990) [12]. Duncan's Multiple Range Test (DMRT) was employed to compare pairwise differences among least squares means. The following statistical model was applied for analysis:

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

Where,

$Y_{ijk}$ = is the record of a cow calved during $j^{th}$ period in $i^{th}$ season

μ =is the population mean common to all the observations

$S_i$ = is the effect of $i^{th}$ season of calving (1..4)

$P_j$ = is the effect of $j^{th}$ period of calving (1..7)

$e_{ijk}$ = is the random error assumed to be NID (0, $\delta^2$, e)

## Results and Discussion

### Production traits

#### Lactation milk yield (LMY)

The least squares means of lactation milk yield (LMY) and the analysis of variance assessing the effects of period of calving, season of calving, and age at first calving on LMY in Deoni cows are presented in Tables 1 and 2. The overall least squares mean for LMY was estimated at 416.17±4.65 kg. These findings are consistent with earlier reports by Bhutkar *et al*. (2014) [7] in Deoni cattle.

Results of DMRT revealed that the highest LMY was observed during period P6 (507.03±8.87 kg), followed by P5 (478.63±8.64 kg), P4 (434.31±8.57 kg), P7 (418.34±14.69 kg), P3 (381.32±8.88 kg), and P2 (356.47±9.82 kg), with the lowest yield recorded in P1 (337.05±15.60 kg). The variation in LMY across periods likely reflects differences in management practices and the availability of quality fodder. These observations align with earlier reports by Mruttu (2013), Bhutkar *et al*. (2014) [7], and Basak *et al*. (2018) [5-6] in Deoni cattle.

The effect of season of calving on LMY was found to be non-significant. Mean LMY was slightly higher in cows calved during S1 (416.10±7.15 kg), followed by S2 (415.31±8.15 kg), S3 (413.80±6.94 kg), and lowest in S4 (410.13±8.93 kg). The negligible seasonal variation in milk yield suggests that Deoni cattle possess strong adaptability to seasonal fluctuations in tropical climates. Comparable results have been reported by Bhutkar *et al*. (2014) [7].

The estimated least squares means for LMY across different AFC groups were 416.63±12.58 (A1), 397.63±12.00 (A2), 414.93±9.50 (A3), 444.02±8.71 (A4), and 407.61±5.74 (A5). Analysis of variance revealed a highly significant ($p$<0.01) effect of AFC on LMY. DMRT results indicated that cows calving under group A4 exhibited significantly higher LMY compared to those in A1, A2, A3, and A5. This may be attributed to superior nutritional and management practices implemented at CCBP, VNMKV, Parbhani. Similar findings have been reported by Mruttu (2013), Bhutkar *et al*. (2014) [7].

#### Peak milk yield (PMY)

The least squares means of peak milk yield (PMY) and the analysis of variance evaluating the effects of period of calving, season of calving, and age at first calving on PMY in Deoni cows are presented in Tables 1 and 2. The overall least squares mean for PMY was estimated at 2.97±0.03 kg. These findings are in agreement with earlier reports by Bhutkar *et al*. (2014) [7].

DMRT analysis indicated that cows calved during period P6 (3.38±0.06 kg) recorded significantly higher PMY compared to those calved in P1 (3.02±0.11 kg), P2 (2.90±0.07 kg), P3 (3.06±0.06 kg), P4 (3.19±0.06 kg), P5 (3.24±0.06 kg), and P7 (2.01±0.10 kg). Furthermore, cows calved during P5 (3.24±0.06 kg) exhibited significantly higher PMY than those calved in P1, P2, P3, P4, and P7. These results suggest that effective management and improved nutritional inputs play a crucial role in enhancing PMY in Deoni cattle. Comparable findings on the significant influence of calving period on PMY were reported by Bhutkar *et al*. (2014) [7].

The effect of season of calving on PMY was found to be non-significant. However, mean PMY was marginally higher in cows calved during S2 (3.02±0.06 kg), followed by S4 (2.99±0.06 kg), S3 (2.94±0.05 kg), and S1 (2.93±0.05 kg). These observations are in agreement with the reports of Bhutkar *et al*. (2014) [7] in Deoni cattle.

Analysis of variance further revealed a highly significant ($p$<0.01) effect of age at first calving on PMY. DMRT analysis showed that cows with AFC group A4 (3.14±0.08 kg) had significantly higher PMY compared to cows calved under A2 (3.00±0.08 kg), A3 (2.97±0.07 kg), A5 (2.92±0.06 kg), and A1 (2.82±0.09 kg). These findings indicate that higher AFC is associated with improved peak milk yield, likely due to better maturity and development at calving. Similar trends were reported by Bhutkar *et al*. (2014) [7] and

Sawant (2023) in Deoni cattle, as well as by Yadav and Rathi (1992) in Haryana cattle.

**Days to reach peak milk yield (DRPMY)**

The least squares means of days to reach peak milk yield (DRPMY) and the analysis of variance assessing the influence of period of calving, season of calving, and age at first calving on DRPMY in Deoni cows are presented in Tables 1 and 2. The overall least squares mean for DRPMY was 40.36±1.14 days. These results are consistent with the findings of Salunkhe (2007), Bhutkar *et al*. (2014) [7] in Deoni cattle.

The effect of period of calving on DRPMY was found to be non-significant. Nevertheless, the highest DRPMY was recorded during P2 (43.26±2.41 days), followed by P3 (40.62±2.18), P6 (40.51±2.18), P5 (40.37±2.12), P4 (40.02±2.10), P7 (39.04±3.61), with the lowest value observed in P1 (38.73±3.83). Similar observations have been reported in Tharparkar cattle by Khadda *et al*. (2012), in Sahiwal cattle by Kumar *et al*. (2012), and in Deoni cattle by Bhutkar *et al*. (2014) [7] and Sawant (2023).

Season of calving also had a non-significant effect on DRPMY. Mean values were highest in cows calved during S1 (42.95±1.75 days), followed by S4 (39.88±2.19), S2 (39.49±2.00), and lowest in S3 (39.13±1.70). This indicates that DRPMY remained relatively stable across seasons, suggesting that Deoni cows are well adapted to seasonal variations in tropical climates. These findings are in agreement with earlier reports by Nanavati and Qureshi (1996) in Gir cattle, as well as Salunkhe (2007) and Sawant (2023) in Deoni cattle.

The effect of age at first calving on DRPMY was also non-significant. The highest mean DRPMY was observed in group A4 (43.39±2.14 days), followed by A3 (42.83±2.33), A1 (40.54±3.09), A5 (38.94±1.41), and lowest in A2 (36.12±2.94). These observations are comparable with those reported by Kulkarni (2001) in Red Sindhi, and by Salunkhe (2007) and Sawant (2023) in Deoni cattle.

**Lactation Length (LL)**

The least squares means of lactation length (LL) and the analysis of variance examining the effects of period of calving, season of calving, and age at first calving on LL in Deoni cows are presented in Tables 1 and 2. The overall least squares mean for LL was estimated at 204.70±3.26 days. These findings are consistent with earlier reports by Bhutkar *et al*. (2014) [7] in Deoni cattle.

Analysis of variance revealed a highly significant effect ($p<0.01$) of period of calving on LL. DMRT results showed that cows calved during P5 (230.15±6.05 days) recorded significantly higher LL compared to those in P1 (204.26±10.93), P2 (203.17±6.87), P3 (216.59±6.21), P4 (229.00±6.00), P6 (229.33±6.21), and P7 (120.40±10.20). This variation can primarily be attributed to improved nutritional supply and timely management practices at the farm. Comparable observations were reported by Jagtap *et al*. (1994) in Red Sindhi cattle, Anarse *et al*. (2015) in Holstein Friesian × Deoni interse crossbreds, Basak *et al*. (2018) [5-6] in Deoni cattle.

The effect of season of calving on LL was non-significant. However, higher mean LL was observed in cows calved during S2 (209.97±5.71 days), followed by S3 (208.76±4.86), S1 (204.11±5.01), and the lowest in S4 (195.97±6.25). These findings are in line with earlier reports by Salunkhe (2007), Bhutkar *et al*. (2014) [7], and Basak *et al*. (2018) [5-6].

The effect of age at first calving on LL was also found to be non-significant. The highest mean LL was recorded in cows with AFC group A3 (210.81±6.65 days), followed by A4 (209.24±6.10), A5 (201.96±4.01), A2 (200.84±8.40), and A1 (200.64±8.80). These results suggest that AFC does not markedly influence LL, thereby highlighting the potential for rearing early-maturing Deoni heifers through improved feeding and management practices. Similar findings were reported by Bhutkar *et al*. (2014) [7] in Deoni cattle.

**Dry Period (DP)**

The least squares means of dry period (DP) and the analysis of variance assessing the influence of period of calving, season of calving, and age at first calving on DP in Deoni cows are presented in Tables 1 and 2. The overall least squares mean for DP was estimated at 293.66±7.72 days. These findings are comparable with those reported by Bhutkar *et al*. (2014) [7] in Deoni cattle.

Analysis of variance revealed a highly significant effect ($p<0.01$) of period of calving on DP. DMRT results indicated that cows calved during P1 (318.79±25.91 days) recorded significantly longer DP than those calved in P7 (317.73±24.38), P2 (295.55±16.29), P3 (278.13±14.73), P5 (276.45±14.34), P4 (268.42±14.22), and P6 (228.51±14.72). The variation in DP across periods highlights the role of improved nutritional and managemental inputs in reducing the dry period. Similar results have been reported by Nanavati and Singh (2009) in Nimari cattle, as well as by Bhutkar *et al*. (2014) [7] in Deoni cattle.

The effect of season of calving on DP was found to be non-significant. Mean DP was longest in cows calved during S3 (296.84±11.52 days), followed by S4 (294.19±14.83), S1 (292.12±11.87), and shortest in S2 (291.50±13.53). These findings are consistent with earlier reports by Mruttu (2013), Bhutkar *et al*. (2014) [7].

A significant effect ($p<0.05$) of age at first calving on DP was observed. DMRT analysis revealed that cows in AFC group A2 (304.30±19.91 days) and A1 (303.52±20.87 days) exhibited longer DP compared to A5 (287.64±9.52), A3 (278.79±15.76), and the lowest in A4 (276.07±14.45). This indicates that age at first calving influences the length of the dry period, likely due to variation in managemental and environmental conditions at the Deoni farm. These findings are in agreement with Salunkhe (2007) and Sawant (2023) in Deoni cattle.

**Table 1:** Least squares means for LMY (Kg), PMY(Kg), DRPMY(Kg), LL(Days), and DP(Days) as affected by period of calving, season of calving and AFC group in Deoni cows

| Sources | Code | N | LMY(Kg) | PMY(Kg) | DRPMY(Kg) | LL(Days) | DP(Days) |
|---|---|---|---|---|---|---|---|
| Overall mean | μ | 494 | 416.17±4.65[b] | 2.97±0.03 | 40.36±1.14 | 204.70±3.26 | 293.66±7.72 |
| Period | $P_1$ | 26 | 337.05±15.6[c] | 3.02±0.11[ab] | 38.73±3.83 | 204.26±10.93[b] | 318.79±25.91[a] |
| | $P_2$ | 76 | 356.47±9.82[ac] | 2.90±0.07[b] | 43.26±2.41 | 203.17±6.87[b] | 295.55±16.29[ab] |
| | $P_3$ | 82 | 381.32±8.88[c] | 3.06±0.06[ab] | 40.62±2.18 | 216.59±6.21[ab] | 278.13±14.73[b] |
| | $P_4$ | 102 | 434.31±8.57[b] | 3.19±0.06[ab] | 40.02±2.10 | 229.00±6.00[a] | 268.42±14.22[b] |
| | $P_5$ | 96 | 478.63±8.64[ab] | 3.24±0.06[ab] | 40.37±2.12 | 230.15±6.05[a] | 276.45±14.34[b] |
| | $P_6$ | 83 | 507.03±8.87[a] | 3.38±0.06[a] | 40.51±2.18 | 229.33±6.21[a] | 228.51±14.72[c] |
| | $P_7$ | 29 | 418.34±14.69[b] | 2.01±0.10[c] | 39.04±3.61 | 120.40±10.2[c] | 317.73±24.38[a] |
| Season | $S_1$ | 141 | 416.10±7.15 | 2.93±0.05 | 42.95±1.75 | 204.11±5.01 | 292.12±11.87 |
| | $S_2$ | 111 | 415.31±8.15 | 3.02±0.06 | 39.49±2.00 | 209.97±5.71 | 291.50±13.53 |
| | $S_3$ | 155 | 413.80±6.94 | 2.94±0.05 | 39.13±1.70 | 208.76±4.86 | 296.84±11.52 |
| | $S_4$ | 87 | 410.13±8.93 | 2.99±0.06 | 39.88±2.19 | 195.97±6.25 | 294.19±14.83 |
| AFC | $A_1$ | 41 | 416.63±12.58[ab] | 2.82±0.09[b] | 40.54±3.09 | 200.64±8.80 | 303.52±20.87[a] |
| | $A_2$ | 44 | 397.63±12.00[c] | 3.00±0.08[a] | 36.12±2.94 | 200.84±8.40 | 304.30±19.91[a] |
| | $A_3$ | 69 | 414.93±9.50[ab] | 2.97±0.07[ab] | 42.83±2.33 | 210.81±6.65 | 278.79±15.76[b] |
| | $A_4$ | 96 | 444.02±8.71[a] | 3.14±8.71[a] | 43.39±2.14 | 209.24±6.10 | 276.07±14.45[b] |
| | $A_5$ | 244 | 407.61±5.74 [b] | 2.92±5.74[ab] | 38.94±1.41 | 201.96±4.01 | 287.64±9.52 [ab] |

Means with similar superscripts are not differ significantly

**Table 2:** Analysis of variance for LMY, PMY, DRPMY, LL and DP in Deoni

| Sources | DF | LMY | | PMY | | DRPMY | | LL | | DP | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MSS ('000) | F value cal. | MSS ('000) | F value cal. | MSS ('000) | F value cal. | MSS ('000) | F value cal. | MSS ('000) | F value cal. |
| **Period** | 6 | 251200.00 | 41.5** | 7.533 | 22.25** | 117.2 | 0.32 NS | 50880.0 | 17.16** | 101800.00 | 6.11** |
| **Season** | 3 | 2387.00 | 0.39NS | 0.2202 | 0.65NS | 419.6 | 1.14 NS | 3916.0 | 1.32 NS | 771.900 | 0.04 NS |
| **AFC** | 4 | 25200.00 | 4.16** | 1.036 | 3.06** | 621.5 | 1.70NS | 1857.0 | 0.62NS | 20850.00 | 1.25* |
| **Error** | 480 | 6049.00 | | 0.3385 | | 365.2 | | 2965.00 | | 16650.00 | |
| Total | 494 | | | | | | | | | | |

** Significant at $p<0.01$, * Significant at $p<0.05$, NS= Non significant

## Reproduction traits

### Age at first calving (AFC)

The least squares means of age at first calving (AFC) and the analysis of variance examining the effects of period of calving and season of calving on AFC in Deoni cows are presented in Tables 3 and 4. The overall least squares mean for AFC was estimated at 1687.17±18.44 days. These results are in close agreement with earlier reports by Bhutkar *et al.* (2014) [7] in Deoni cattle.

Analysis of variance revealed a highly significant effect ($p<0.01$) of period of calving on AFC. DMRT analysis indicated that cows calved during P2 (1856.19±37.39 days) had significantly higher AFC compared to those in P1 (1630.47±37.32), P3 (1641.03±36.26), P4 (1684.83±32.17), P5 (1709.58±34.08), P6 (1600.98±37.42), and P7 (1603.02±32.19). These results highlight the scope for improvement through culling and adoption of timely breeding practices to reduce AFC further. Comparable findings were reported by Nanavati and Singh (2009) in Nimari cattle, as well as by Mruttu (2013) and Sawant (2023) in Deoni cattle.

The effect of season of calving on AFC was found to be non-significant. Mean AFC was highest in cows calved during S4 (1703.63±41.97 days), followed by S2 (1687.06±32.47), S1 (1680.76±28.98), and lowest in S3 (1672.57±26.79). These results indicate that Deoni cattle maintain reproductive efficiency across seasonal variations. Similar observations were reported by Thombre (1996) [17] and Bhutkar *et al.* (2014) [7] in Deoni cattle.

### Service Period (SP)

The least squares means of service period (SP) and the analysis of variance showing the effects of period of calving, season of calving, and age at first calving on SP in Deoni cows are presented in Tables 3 and 4. The overall least squares mean for SP was 229.04±6.33 days. These findings were comparable with earlier reports by Salunkhe (2007), Mruttu (2013), Bhutkar *et al.* (2014) [7] in Deoni cattle.

The analysis of variance revealed a significant effect ($p<0.05$) of period of calving on SP in Deoni cows. DMRT analysis showed that the longest SP was observed in cows calved during P7 (247.15±19.97 days), followed by P1 (242.63±21.23), P5 (226.79±11.75), P4 (215.33±11.65), P2 (215.17±13.35), P3 (212.23±12.07), and the shortest in P6 (184.77±12.06). These results indicated that variation in SP is closely related to differences in nutritional availability and management efficiency across periods. Similar findings were reported by Thombre (1996) [17], Basak *et al.* (2018) [5-6], and Sawant (2023) in Deoni cattle.

The effect of season of calving on SP was found to be non-significant. However, mean SP was highest in cows calved during S3 (239.46±9.44 days), followed by S1 (231.65±9.73), S2 (229.14±11.08), and lowest in S4 (215.92±12.15). These results suggested that Deoni cattle maintain reproductive performance across seasonal variations. Comparable observations were reported by Bhutkar *et al.* (2014) [7] and Sawant (2023) in Deoni cattle.

The analysis of variance further revealed non-significant effects of age at first calving on SP in Deoni cows. The highest SP was obtained in A1 (238.44±17.10 days), followed by A5 (238.15±7.80), A3 (235.72±12.91), A2 (222.04±16.31), and the lowest in A4 (210.86±11.84). These results were consistent with the findings of Thombre (1996) [17], Basak *et al.* (2018) [5-6] in Deoni cattle.

### Gestation Period (GP)

The least squares means of gestation period (GP) and the analysis of variance evaluating the effects of period of calving, season of calving, and age at first calving on GP in Deoni cows are presented in Tables 3 and 4. The overall least squares mean for GP was 280.20±0.34 days. These results are in agreement with earlier reports by Deshpande and Bhutkar *et al*. (2014) [7] in Deoni cattle.

Analysis of variance revealed a highly significant effect ($p<0.01$) of period of calving on GP. DMRT analysis indicated that cows calved during P7 (284.18±1.08 days) had significantly longer gestation periods compared to P2 (280.66±0.72), P3 (280.59±0.65), P1 (279.78±1.15), P4 (279.16±0.63), P5 (278.96±0.63), and P6 (278.67±0.65). This suggests that management and environmental practices followed during different periods influenced GP. Similar findings were reported by Chakravarthi *et al*. (2002) [9] in Deoni cattle.

The effect of season of calving on GP was non-significant. Mean GP was slightly longer in cows calved during S1 (280.54±0.52 days), followed by S2 (280.09±0.60), S3 (280.09±0.51), and S4 (280.08±0.66). These observations are consistent with the reports of Chakravarthi *et al*. (2002) [9], Bhutkar *et al*. (2014) [7], in Deoni cattle.

The effect of age at first calving on GP was also non-significant. The trend showed that cows in AFC group A5 had the longest GP (280.61±0.42 days), followed by A4 (280.51±0.64), A3 (280.38±0.70), A1 (280.24±0.93), and the shortest in A2 (279.26±0.88). These results are comparable with the findings of Bhutkar *et al*. (2014) [7] in Deoni cattle.

## Calving Interval (CI)

The least squares means of calving interval (CI) and the analysis of variance assessing the effects of period of calving, season of calving, and age at first calving on CI in Deoni cows are presented in Tables 3 and 4. The overall least squares mean for CI was 485.51±6.57 days. These results are consistent with earlier findings by Thombre *et al*. (2002) in Deoni cattle.

The effect of period of calving on CI was significant ($p<0.05$). DMRT analysis indicated that cows calved during P1 (518.87±22.05 days) had the longest CI, followed by P5 (507.04±12.21), P2 (498.05±13.87), P4 (496.78±12.10), P3 (494.46±12.54), P6 (458.25±12.53), and P7 (425.10±20.75), which recorded the shortest CI. This reduction in CI over periods suggests that improved nutritional management throughout the year plays a crucial role in shortening calving intervals. Similar trends were reported by Yadav *et al*. (1992) in Sahiwal cattle, Basak *et al*. (2018) [5-6], in Deoni cattle, and Dhaware *et al*. (2008) [11] in Khillar cattle.

The effect of season of calving on CI was non-significant. Mean CI was highest in cows calved during S3 (496.59±9.80 days), followed by S2 (491.62±11.52), S1 (480.74±10.11), and lowest in S4 (473.08±12.62). These observations align with the findings of Bhutkar *et al*. (2014) [7], Basak *et al*. (2018) [5-6] in Deoni cattle.

The effect of age at first calving on CI was also non-significant. The longest CI was observed in cows of AFC group A2 (500.16±16.95 days), followed by A5 (494.02±8.10), A3 (483.64±13.42), A1 (479.89±17.77), and the shortest in A4 (469.82±12.30). These findings are consistent with previous reports by Thombre (1996) [17], Bhutkar *et al*. (2014) [7] in Deoni cattle.

**Table 3:** Least squares means for AFC (Days), SP(Days), GP(Days) and CI(Days), as affected by period of calving, season of calving and AFC group in Deoni cows

| Sources | Code | N | AFC(Days) | SP(Days) | GP(Days) | CI(Days) |
|---|---|---|---|---|---|---|
| Overall mean | μ | 494 | 1687.17±18.44 | 229.04±6.33 | 280.20±0.34 | 485.51±6.57 |
| Period | $P_1$ | 26 | 1630.47±37.32$^b$ | 242.63±21.23$^a$ | 279.78±1.15$^{ab}$ | 518.87±22.05$^a$ |
| | $P_2$ | 76 | 1856.19±37.39$^a$ | 215.17±13.35$^b$ | 280.66±0.72$^{ab}$ | 498.05±13.87$^b$ |
| | $P_3$ | 82 | 1641.03±36.26$^{ab}$ | 212.23±12.07$^b$ | 280.59±0.65$^{ab}$ | 494.46±12.54$^b$ |
| | $P_4$ | 102 | 1684.83±32.17$^{ab}$ | 215.33±11.65$^b$ | 279.16±0.63$^{ab}$ | 496.78±12.10$^b$ |
| | $P_5$ | 96 | 1709.58±34.08$^{ab}$ | 226.79±11.75$^{ab}$ | 278.96±0.63$^{ab}$ | 507.04±12.21$^{ab}$ |
| | $P_6$ | 83 | 1600.98±37.42$^c$ | 184.77±12.06$^c$ | 278.67±0.65$^{ab}$ | 458.25±12.53$^{ac}$ |
| | $P_7$ | 29 | 1603.02±32.19$^c$ | 247.15±19.97$^a$ | 284.18±1.08$^a$ | 425.10±20.75$^c$ |
| Season | $S_1$ | 141 | 1680.79±28.97 | 231.65±9.73 | 280.54±0.52 | 480.74±10.11 |
| | $S_2$ | 111 | 1687.06±32.47 | 229.14±11.08 | 280.09±0.60 | 491.62±11.52 |
| | $S_3$ | 155 | 1672.57±26.79 | 239.46±9.44 | 280.09±0.51 | 496.59±9.80 |
| | $S_4$ | 87 | 1703.63±41.97 | 215.92±12.15 | 280.08±0.66 | 473.08±12.62 |
| AFC | $A_1$ | 41 | | 238.44±17.10 | 280.24±0.93 | 479.89±17.77 |
| | $A_2$ | 44 | | 222.04±16.31 | 279.26±0.88 | 500.16±16.95 |
| | $A_3$ | 69 | | 235.72±12.91 | 280.38±0.70 | 483.64±13.42 |
| | $A_4$ | 96 | | 210.86±11.84 | 280.51±0.64 | 469.82±12.30 |
| | $A_5$ | 244 | | 238.15±7.80 | 280.61±0.42 | 494.02±8.10 |

**Table 4:** Analysis of variance for AFC, SP, GP and CI in Deoni

| Sources | DF | AFC | | SP | | GP | | CI | |
|---|---|---|---|---|---|---|---|---|---|
| | | MSS ('000) | F value cal. | MSS ('000) | F value cal. | MSS ('000) | F value cal. | MSS ('000) | F value cal. |
| Period | 6 | 503816.00 | 4.71** | 55050.00 | 4.92** | 140.200 | 4.23** | 41600.00 | 3.44** |
| Season | 3 | 15023.00 | 0.14$^{NS}$ | 10320.00 | 0.92$^{NS}$ | 6.73700 | 0.20$^{NS}$ | 12830.00 | 1.06$^{NS}$ |
| AFC | 4 | | | 13890.00 | 0.25$^{NS}$ | 15.2400 | 0.46$^{NS}$ | 12130.00 | 1.00$^{NS}$ |
| Error | 480 | 106831.00 | | 11180.00 | | 33.0900 | | 12070.00 | |
| Total | 494 | | | | | | | | |

** Significant at $p<0.01$, NS= Non significant

## Conclusion

Based on the findings of the present study, it can be concluded that the Deoni genotype is well-adapted to tolerate seasonal variations. However, the period of calving exerted a highly significant influence on AFC, LMY, PMY, DP, SP, GP, and CI. Age at first calving showed significant ($p<0.01$) effects on LMY, PMY, and DP in Deoni cows. Since the age at first calving in Deoni cows was relatively high, it is recommended to manage heifers to achieve optimal body weight at an earlier age, thereby enhancing the productive life and overall performance of the breed.

**Conflict of Interest**
Not available

**Financial Support**
Not available

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**How to Cite This Article**
Todkar KB, Chauhan DS, Thombre BM, Eerabattini SS. Effect of non-genetic factors on production and reproduction traits in Deoni cattle. International Journal of Veterinary Sciences and Animal Husbandry. 2025;SP-10(10):148-153.