

**FACTORS AFFECTING THE LACTATION
PERFORMANCE OF DEONI CATTLE**

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**FACTORS AFFECTING THE LACTATION
PERFORMANCE OF DEONI CATTLE**

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CERTIFICATE**

This is to certify that the thesis entitled “**FACTORS AFFECTING THE LACTATION PERFORMANCE OF DEONI CATTLE**” submitted by **Ms. SUPRIYA G**, I.D. No. **MVNK-1601** in partial fulfilment of the requirements for the award of **MASTER OF VETERINARY SCIENCE** in **LIVESTOCK PRODUCTION AND MANAGEMENT** of the Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar is a record of bona-fide research work done by her during the period of her study in this University, under my guidance and supervision, and the thesis has not previously formed the basis of the award of any degree, diploma, association ship, fellowship or other similar titles.

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Dedicated To
My Family

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LIST OF SYMBOLS AND ABBREVIATIONS

%	=	Percent
°C	=	Degree Celsius
kg	=	Kilogram
lit	=	Litre
yr	=	Year
CCBP	=	Cattle Cross Breeding Project
LL	=	Lactation Length
LMY	=	Lactation Milk Yield
LSA	=	Least Square Analysis of Variance
LSM	=	Least Square Means
NBAGR	=	National Bureau of Animal Genetic Resources
NDDB	=	National Dairy Development Board
NDRI	=	National Dairy Research Institute
PMY	=	Peak Milk Yield
SNF	=	Solids Not Fat

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Introduction

I. INTRODUCTION

An integral part of Indian agriculture is the cattle husbandry. The cattle biodiversity of the country is represented by more than 40 breeds evolved in different agro climatic regions. The cattle population of the country has been reduced and this decline is due to change of socio-economic level of farmers and ecological profile. Further, there has been dilution in breed purity due to uncontrolled breeding under rural managerial condition or because of crossbreeding with exotic cattle.

Since the beginning of civilization, humans depended on animals for their requirements, such as food (milk and egg), clothing (wool), labour (carrying load) so on. In India, the livestock sector alone contributes nearly 25.6% of value of output at current prices of total value of output of agriculture, fishing and forestry sector. The overall contribution of livestock sector in total GDP is nearly 4.11% at current prices during 2012-13 (19th Livestock Census-2012). India produces nearly 50 to 60 million tonnes of milk every year and currently contributes around 9.5% of the global milk production.

Deoni is a dual-purpose indigenous cattle breed found mainly in the districts of Bidar, Gulbarga in Karnataka; Parbhani, Nanded and Osmanabad districts of Maharashtra, and some parts of Medak district of Andhra Pradesh (Das *et al.*, 2011). Deoni cattle have three strains on the basis of coat colour variation viz. Wannera (clear white with black colour at the sides of the face), Shevera (white body with irregular black spots) and Balankya (clear white with black spots on the lower side of the body) (Kuralkar *et al.*, 2015).

The forehead is prominent, broad, slightly bulged and white in all the strains; ears are long and drooping with slightly curved tips; horns are medium, thick, apart and emerge from the sides of the poll ; tips of the horns are blunt; and eyes are prominent, bright and alert with black eyebrows.

The hump is massive and well developed in males and small in females. The neck is short, strong and well developed. Dewlap is thick, pendulous, and muscular with folds. It is more pendulous in males than in females. The chest is deep and wide. The skin of these animals is thick and loosely attached to the body. The tail is long reaching below the hock with black and white switch. The udder is well attached and medium in size with squarely placed black teats. Bulls are characterized by blackish scrotums of a good size. The animals are docile and calm (Singh *et al.*, 2002).

According to breed wise survey recorded by Department of Animal Husbandry, Dairying & Fisheries, the total population of Deoni cattle is 3,51,600 which comprises of pure Deoni cattle population of 1,51,236 and graded Deoni population of 2,00,364 (Dongre *et al.*, 2017). Regarding breed wise livestock population in Udgir and Renapur of Latur district was concerned that 55.00 percent respondents possessed Deoni breed (Mande *et al.*, 2009).

Recently, the State Animal Husbandry Department along with NDDDB has started registration of Deoni cattle in Information Network for Animal Productivity and Health (INAPH) for performance recording of this animal. The productive and reproductive traits of Deoni cows were studied by different workers and revealed that the average lactation milk yield varied from 238.86 ± 76.0 kg to 868.24 ± 49.56 kg, average lactation


length varied from 149.43 ± 33.52 days to 293.3 ± 2.9 days, average daily milk yield ranges from 2.17 ± 0.07 kg to 2.91 ± 0.05 kg; the peak yield was observed to be 4.58 kg (Dongre *et al.*, 2017).

The Network Project on Animal Genetic Resources (NBAGR, 2008) revealed that there are good animals yielding more than 10 litres of milk per day under village conditions. However, as no concerted efforts were made to improve and conserve this breed, its numbers have depleted rapidly. The National Bureau of Animal Genetic Resources, Karnal (NBAGR, 2008) has published the breed descriptor of Deoni cattle which gives details of its physical characters and performance. The average lactation milk yield was reported to be 868.24 ± 49.56 litres with a range of 638 to 1229 litres, indicating large variation among the population and a great scope for improvement. Sirohi and Saxena (2012) assessed the regional priorities for sustainable milk production in Karnataka and recommended upgrading non-descript stock with native cattle breeds like Deoni, which have a much higher production potential.

In view of the farmers preference for low-input, organic farming, the sustainability of Deoni cattle to the local agro-climatic conditions, and their ability to withstand drought, there is a need for the genetic improvement of the breed and enhancement of its productivity (Ambika, 2019).

Although some of the studies have reported the performance of Deoni cattle in field conditions, present study was undertaken to analyze the factors affecting the lactation performance and milk quality of Deoni cattle maintained in institutional farms. The objectives of this study are:

1. To study the Lactation performance of Deoni cattle.
2. To study the milk quality of Deoni cattle.
3. To analyze the factors affecting Lactation Performance of Deoni cattle.

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Review of Literature

II. REVIEW OF LITERATURE

2.1 Deoni cattle

Deoni is a dual purpose breed of cattle of the Marathwada region of Maharashtra state and adjoining parts of Karnataka and Andhra Pradesh. It is also known as Dongarapati or Dongri (which means “of the hills”) in many areas. Deoni cattle are found in most drought prone region of the country. Deoni cattle are calm and docile. The forehead is prominent and the eyes are bright and alert. They have strong and well developed short neck. The udder of Deoni cow is well attached, medium sized with squarely placed black teats. The tail is long, reaching below the hock, with black and white switch. The hooves are black in colour.

Deoni cattle is found in three colour variations. They are Wannera, animals with clear white body with black colour at both the sides of the face, Balankya, animals with clear white colour body and Shevera, animals with white body with irregular black spots.

2.2 Lactation Performance of Deoni cattle:

2.2.1 Lactation Milk Yield:

Padwal *et al.* (1977) studied the LMY in Deoni breed of cattle from Cattle Breeding Farm, Udgir and ACDF, Parbhani and reported the average LMY as 1120.49 ± 62.89 kg.

Deshpande and Singh (1977b) recorded an overall average total lactation milk yield of 942.7 ± 16.6 kg with 767 lactation records of Deoni cows maintained at Government Cattle Breeding Farms, Hingoli and Udgir, Maharashtra.

Singh *et al.* (2002) conducted a study on Deoni cattle in 69 villages of Latur district of Maharashtra from 1996-1999 and recorded a lactation milk yield of 868.24 ± 49.56 kg based on 597 observations.

Bajwa *et al.* (2004) studied the weekly milk yield records on 661 Sahiwal cows calving during 1990-2000 at the Livestock Experiment Station Bahadurnagar, Okara. The LMY averaged to be 1475 ± 651 kg.

Afzal *et al.* (2007) carried out a study on milk yield for 426 records in 134 Nili Ravi buffaloes maintained at the National Agricultural Research Center, Islamabad Pakistan during 1988-2004. The overall average milk yield was 1831.6 ± 530.9 liter per lactation.

Pundir *et al.* (2007) studied LMY of `Red Sindhi cows conducted in Dehra Dun and Tehri districts of Uttarakhand and Bargur district of Orissa. It was observed that LMY was 2429 kg.

Pundir and Singh (2008) selected Nanded, Parbhani and Latur districts from the breeding tract of Red Kandhari for survey and the LMY was found to be 400-600 kg.

Zafar *et al.* (2008) carried out a study on the data on production performance traits of Sahiwal cows maintained at the Livestock Experiment Station, Bahadurnagar, Okara, Pakistan during three different periods i.e. period-1 (1973-1982), period-2 (1983-1992) and period-3 (1993-2002) and were compared. The LSM for LMY for periods 1, 2 and 3 were 1429 ± 21.27 , 1632 ± 17.95 and 1527 ± 19.34 kg, respectively.

Gatchearle *et al.* (2009) recorded the lactation data on 122 calving from *interse* progeny of Holstein Friesian X Deoni (HF X D) breed maintained at Cattle Cross Breeding Project, Marathwada Agriculture University, Parbhani (MS) for 12 years period and analyzed the overall least square means (LSM) for LMY to be $1193.22 + 44.79$ kg.

Das *et al.* (2011) reported the production traits of 428 lactation records of 228 Deoni animals maintained at NDRI, SRS herd during 2002 to 2008 and analyzed the overall mean LMY over first 5 lactations was noted to be 779.27 ± 18.31 kg. The lactation yields of first 5 lactations were found to be 715.87 ± 32.11 , 858.79 ± 32.72 , 824.99 ± 40.47 , 719.41 ± 43.82 , and 776.41 ± 75.09 kg.

Kumar and Gandhi (2011) pooled the lactation records of Sahiwal cows maintained at 3 different farms over a period of 40 years and analysed them. The overall LSM was 1793.09 ± 12.63 kg for LMY.

Wondifraw *et al.* (2013) evaluated the milk production of 256 HF X Deoni crossbred cows from cattle crossbreeding project with 1485 total records of lactation over a 30 years period and reported that the overall LSM of LMY was 1661.35 ± 15.17 kg.

Bhutkar *et al.* (2014) analyzed LMY of 114 Deoni cows from 211 total records of lactation over a 30 years period at CCBP of Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani and reported least square mean of LMY to be 358.31 ± 27.18 kg.

Chandran *et al.* (2014) conducted a field study in 53 villages belonging to 5 blocks of Sitamarhi district of Bihar to study the performance traits of Bachaur cattle in

its breeding tract. Animals (752) of both the sexes belonging to different age groups were studied and the average lactation yield was found to be 752.10 ± 5.82 kg.

Patil (2014) studied lactation performance of 82 Deoni cows in field condition of Bidar district and reported a LMY of 881.35 ± 37.64 kg.

Anarase *et al.* (2015) reported the data pertaining to 662 lactations of 225 Holedo cows over a period of 18 years (1995-2008) and recorded that LMY was highest in 3rd lactation (1287.1 ± 97.68 kg), but did not differ significantly ($P < 0.01$) from the other lactations except the 5th lactation, which was the lowest (1234.9 ± 78.09 kg). The overall LSM for LMY was found to be 1263.4 ± 76.56 Kg.

Kuralkar *et al.* (2015) studied a total of 551 Deoni cows from 5 talukas of Latur district, and recorded the least squares mean for LMY as 884.29 ± 45.34 kg.

Shingare *et al.* (2015) analyzed the sample of dataset comprising 438 lactations of 114 Deoni cows over a period of 25 years between the period 1988 to 2012 maintained at CCBP, Vasanthrao Naik Marathwada Agriculture University, Parbhani, and reported LMY to be 236.43 ± 12.71 kg.

Thorat *et al.* (2015) in their study of records maintained at Cattle Cross Breeding Project, Vasanthrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS) for the period 1995-2010 reported that the average monthly milk production was 326.18 ± 20.45 kg.

Basak *et al.* (2018) carried out a study in Deoni breed of cattle maintained at NDRI, SRS, Bengaluru. In this investigation, effect of genetic and non genetic factors on

productive traits of Deoni cattle on first lactation was studied. It was estimated that mean first lactation milk yield was 643.079 ± 25.16 kg.

Basak and Das (2018) worked on a total of 710 lactation records of 274 Deoni cattle, maintained at ICAR- National Dairy Research Institute, Southern Campus, Bangalore to study the effect of non-genetic factors on production traits. On analysis, overall mean lactation milk yield was estimated to be 819.98 ± 16.5 kg.

2.2.2 Peak Milk Yield

Deshpande and Singh (1977b) studied an overall average peak yield of 4.48 ± 0.12 kg with 767 lactation records of Deoni cows maintained at Government Cattle Breeding Farms, Hingoli and Udgir, Maharashtra. The number of days to reach peak yield was observed to be 33.3 ± 0.51

Kakde *et al.* (1980) carried out the study for 75, 50, 39, 43 and 22 observations at 2 farms on Deoni cows in lactations 1-5, peak milk yield averaged 5.529, 5.721, 6.277, 5.822 and 5.645 kg respectively.

Pundir and Singh (2008) selected Nanded, Parbhani and Latur districts from the breeding tract of Red Kandhari for survey and the peak milk yield was found to be 2.0-4.0 kg.

Bhutkar *et al.* (2014) conducted the research to evaluate the effect of non- genetic factors on production traits in Deoni cattle. Data representing 114 Deoni cows from 211 total records of lactation over a 30 years period was analyzed..This study was conducted

at CCBP of Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani. The overall LSM of PMY of Deoni cow was 3.14 ± 0.18 kg.

Chandran *et al.* (2014) in their study undertaken in 53 villages belonging to 5 blocks of Sitamarhi district of Bihar found that the average peak yield of Bachaur cattle 4.70 ± 0.07 kg/ day.

Patil (2014) studied lactation performance of 88 Deoni cows in field condition of Bidar district and reported a PY of 4.19 ± 0.10 kg.

Anarase *et al.* (2015) carried out the study on the data on 662 *interse* mated progenies of Holdeo, maintained at CCBP at the department of Animal Husbandry and Dairy Science, Marathwada Krishi Vidhyapeeth, Parbhani, during 1995-2008 and they reported that the PMY is highest in 3rd lactation (10.11 ± 0.10), which was significantly higher than the first and fifth lactation. The overall populations mean for PMY found to be 9.21 ± 0.11 kg.

Shingare *et al.* (2015) analysed the sample of dataset comprising 438 lactations of 114 Deoni cows over a period of 25 years between the period 1988 to 2012 maintained at CCBP, Vasantrya Naik Marathwada Agriculture University, Parbhani, and reported PY to be 7.12 ± 0.24 kg.

Thorat *et al.* (2015) studied the effect of climate on peak milk yield in Deoni cows at CCBP, Department of Animal Husbandry and Dairy Science, College of Agriculture, Parbhani, during the year 2012-2013. Sixteen years (1995-2010) data was collected in respect of Deoni cows and average daily peak yield of Deoni cows was 2.60 kg.

2.2.3 Lactation Length

Padwal *et al.* (1977) reported the lactation period as 317.55 ± 4.20 days in Deoni cows.

Deshpande and Singh (1977 b) reported the lactation period as 293.30 ± 2.90 days in Deoni cattle.

Bajwa *et al.* (2004) studied the weekly milk performance records on 661 Sahiwal cows calving during 1990-2000 at the Livestock Experiment Station Bahadurnagar, Okara and found the average lactation length was 248 ± 67 days.

Afzal *et al.* (2007) studied and evaluated milk yield from 426 records in 134 Nili Ravi buffaloes maintained at the NARC, Islamabad Pakistan during 1988-2004. The overall average lactation length was 273.3 ± 52.8 days.

Pundir *et al.* (2007) conducted a study in Dehra Dun and Tehri districts of Uttarakhand and Bargur district of Orissa and found the LL was 291 ± 25 days.

Pundir and Singh (2008) selected Nanded, Parbhani and Latur districts from the breeding tract of Red Kandhari for survey and the LL was found to be 230-270 days.

Zafar *et al.* (2008) carried out a study on the data on production performance traits of Sahiwal cows maintained at the Livestock Experiment Station, Bahadurnagar, Okara, Pakistan during three different periods i.e. period-1 (1973-1982), period-2 (1983-1992) and period-3 (1993-2002) were compared. The LSM for LL for periods 1, 2 and were 258 ± 2.51 , 256 ± 2.13 and 267 ± 2.29 days, respectively.

Gatchearle *et al.* (2009) analyzed the data of 122 calvings from 58 *interse* halfbred cows HF X Deoni maintained at CCBP, Marathwada Agriculture University, Parbhani (MS) from 1990-2001. The overall LSM for LL in half-bred *interse* cows was found to be 284.88 ± 5.24 days.

Das *et al.* (2011) recorded the data of 428 lactation records of 228 Deoni animals maintained at NDRI, SRS herd during 2002 to 2008 and reported the overall mean lactation length over 5 lactations to be 186.61 ± 3.02 days. The lactation lengths of first 5 lactations were 189.43 ± 5.03 , 189.13 ± 5.49 , 185.50 ± 6.97 , 169.40 ± 8.36 , and 187.61 ± 15.00 days, respectively.

Kumar and Gandhi (2011) pooled the lactation records of Sahiwal cows maintained at 3 different farms over a period of 40 years and reported the overall LSM of 286.32 ± 1.52 days for LL.

Wondifraw *et al.* (2013) conducted the research on HF X Deoni crossbred cows. Data representing 256 HF X Deoni crossbred cows from Cattle Crossbreeding Project with 1485 total records of lactation over 30 years period was analyzed. The overall mean of LL was recorded as 296.80 ± 2.29 days.

Chandran *et al.* (2014) studied 53 villages belonging to 5 blocks of Sitamarhi district of Bihar, found that range of lactation length of Bachaur cows varied from 220 days to 280 days in the breeding tract with a mean of 258.79 ± 2.26 days.

Anarase *et al.* (2015) studied the data collected from 225 Holedo cows over a period of 18 years and observed that the LL was highest (269 ± 11.5 days) in first

lactation and declined thereafter with increase in the order of lactation. The LSM for LL was found to be 268 ± 11.5 days.

Kuralkar *et al.* (2015) conducted a survey on 1682 Deoni cattle of 579 owners from 48 villages of 5 talukas of Latur district. The LSM for LL was 246.89 ± 7.02 days.

Narwaria *et al.* (2015) conducted a study on Sahiwal cattle, utilizing 1724 lactation records with respect to LL, spread over a period of 15 years, maintained at LRC, NDRI, Karnal. The least squares means for LL was found to be 215.83 ± 3.08 days.

Basak and Das (2018) carried out a study on a total of 710 lactation records of 274 Deoni cattle, maintained at ICAR- National Dairy Research Institute, Southern Campus, Bangalore and found that the overall mean lactation length was 195.23 ± 2.62 days.

Basak *et al.* (2018) carried out a study in Deoni, the dual purpose cattle of Southern India, maintained at NDRI herd, SRS, Bengaluru. They found that LL was 178.24 ± 4.41 days.

2.2.4 Persistency of Lactation

Chaudhry *et al.* (2000) recorded the persistency of lactation index using 2390 lactation records of Nili-Ravi buffaloes. Weekly milk records of 993 Nili-Ravi buffaloes, maintained at Livestock Experiment Station, Bahadurnagar, Okara from 1970 to 1998 were used for the study. Out of 2704 observations, 2390 had information on milk yield for first 28 weeks and overall LSM was 79.4 ± 0.57 .

Kumar and Singh (2006) studied a total of 618 lactation milk yield records of first four parities at weekly interval from 1990 to 2001 (12 years) for 284 Karan Fries cows sired by five different measures viz. Johnsson and Hanson method (P_1 and P_2), Mahadevan method (P_3), Ratio method (P_4) and Prasad method (P_5). The overall least square means for P_1 , P_2 , P_3 , P_4 , and P_5 were 87.34 ± 1.27 , 52.80 ± 1.16 , 1.46 ± 0.02 , 204.03 ± 1.56 and 0.68 ± 0.00 respectively. The first calvers had the highest persistency of lactation across all the methods followed by second calvers. The correlation between peak yield and lactation milk yield (0.610) was positive and highly significant.

Anarase *et al.* (2015) carried out a study on data on 662 lactations in 225 Holdeo cows over a period of 18 years and found that the persistency of milk production (PMP) was 7.10 ± 0.98 kg. The result revealed that persistency of milk production was not significantly affected by environmental factors other than period of calving.

Shingare *et al.* (2015) collected the data on 114 Deoni cows maintained at Cattle Cross Breeding Project, Vasantrao Naik Marathwada Agriculture University, Parbhani over a period of 25 years. LSM for persistency of milk yield in Deoni cattle by Mahadevan method was 2.98 ± 0.20 . The non-significant effect of period of calving was recorded on persistency of milk yield.

Sharma *et al.* (2017) studied the data on 577 first lactation daily milk yield records of crossbred cattle maintained at GADVASU dairy farm over a period of 25 years from 1991-2015 which were utilized to calculate persistency coefficients by Khmel'Nit skii (P_1) and Sturtevent (P_2) methods. Overall least squares means for persistency by Khmel'Nit skii and Sturtevent (P_2) methods were 0.56 ± 0.11 and 84.2 ± 1.45

respectively. Persistency of milk production was measured in Holstein Friesian × Sahiwal cattle up to 42nd week of lactation and overall persistency (%) for weekly milk production in first lactation was found to be 84.22%. Effect of genetic group on Khmel'Nit skii and Sturtevent methods was non-significant. Season of calving and level of production had significant ($P < 0.01$) effect on persistency of milk yield by Sturtevent method. Effect of period of calving on persistency of milk yield was found to be significant ($P < 0.05$) by Khmel'Nit skii method. Present study revealed that Holstein Friesian × Sahiwal cattle have good persistency of milk production in first lactation.

2.3 Factors influencing Lactation Performance:

2.3.1 Age group

No reports regarding the effect of age on the production traits were found.

2.3.2 Parity

Bajwa *et al.* (2004) reported the weekly milk performance records on 661 Sahiwal cows calving during 1990-2000 at the Livestock Experiment Station Bahadurnagar, Okara. Milk yield gradually increased towards 4th and 5th parity and declined thereafter, while highest lactation length (263 days) was observed for first parity cows.

Afzal *et al.* (2007) studied on milk yield for 426 records in 134 Nili Ravi buffaloes maintained at the NARC, Islamabad Pakistan during 1988-2004. The milk production was significantly lower in first lactation than the yield in the 2nd, 3rd and 4th lactation.

Kumar and Gandhi (2011) pooled the lactation records of Sahiwal cows maintained at 3 different farms over a period of 40 years and analyzed them. The effect of parity was highly significant. The LSM for LMY were maximum (1949.71 ± 27.89 kg) in the fifth parity and LL was longest (306.81 ± 2.18 days) in the first parity whereas shorter (267.99 ± 5.90 days) in ninth and above parities.

Wondifraw *et al.* (2013) conducted the research with the data representing 256 HF \times Deoni crossbred cows from cattle crossbreeding project with 1485 total records of lactation over a 30 years period. First lactation cows had lowest milk production, and highest production occurred in 5th parity.

Kuralkar *et al.* (2015) reported the information on 1682 Deoni cattle of 589 owners from 48 villages of 5 talukas. In this study a significant gradual increase ($P < 0.05$) in LMY was observed during first to fourth parity, which declined from fifth parity.

Anarase *et al.* (2015) carried out a study on the data on 662 interse mated progenies of Holdeo, maintained at CCBP, Marathwada Krishi Vidhyapeeth, Parbhani, during 1995-2008 and they reported that the parity had significant ($P < 0.01$) effect on PMY, LMY and LL.

Basak and Das (2018) worked on a total of 710 lactation records of 274 Deoni cattle, maintained at ICAR-National Dairy Research Institute, Southern Campus, Bangalore, and classified them into five parity (1, 2, 3, 4 and ≥ 5). Effect of parity and period on lactation milk yield and length was found to be highly significant ($P < 0.01$).

Basak *et al.* (2018) carried out a study in Deoni, the dual purpose cattle breed of Southern India, maintained at NDRI herd, SRS, Bengaluru and reported a significant effect of parity on AFC and FSP.

2.3.3 Period of calving

Kumar and Gandhi (2011) pooled the lactation records of Sahiwal cows maintained at 3 different farms over a period of 40 years and analyzed that the effect of period was significant on all the pooled lactation production traits.

Bhutkar *et al.* (2014) conducted the research on Deoni cattle at Cattle Cross Breeding Project (CCBP) of Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani. The lactation milk yield was affected by period of calving ($P < 0.01$). The variation in LMY observed in different periods indicates the level of management as well as environmental effect.

Anarase *et al.* (2015) recorded the data on 662 interse mated progenies of Holdeo, maintained at CCBP at Marathwada Krishi Vidyapeeth, Parbhani during 1991-2008 and found that effect of period of calving was significant ($P < 0.01$) with PMY, PMP, LMY and LL.

Narwaria *et al.* (2015) conducted the study on Sahiwal cattle utilizing 1724 lactation records over a period of 15 years maintained at LRC, NDRI, Karnal and reported that the higher LL (276.50 ± 7.21 days) was found in animals calved in the first period than those calved in other periods.

Basak and Das (2018) worked on a total of 710 lactation records of 274 Deoni cattle, maintained at ICAR-National Dairy Research Institute, Southern Campus, Bangalore. Lactation records of Deoni cows were classified into six periods of two years interval (2002 to 2013). Significant influence ($P < 0.01$) of period was observed on service period and calving interval of the cattle.

Basak *et al.* (2018) studied Deoni, the dual purpose cattle breed of Southern India, maintained at NDRI herd, SRS, Bengaluru. They reported that effect of period of birth, period of calving and season of calving was found to be significant on first service period.

2.3.4 Calving Season

Bajwa *et al.* (2004) reported the weekly milk performance records of 661 Sahiwal cows calving during 1990-2000 at the Livestock Experiment Station Bahadurnagar, Okara. The season of calving and year of calving both significantly ($P < 0.01$) affected milk yield and lactation length. Winter calvers produced more milk (1546 kg) as compared to summer calvers (1362 kg).

Kumar and Gandhi (2011) pooled the lactation records of Sahiwal cows maintained at 3 different farms over a period of 40 years and analyzed them. The season had significant influence on lactation length. In case of LL, the summer calvers were having longest LL of 281.51 ± 2.84 days and the season had no significant effect on LMY.

Wondifraw *et al.* (2013) conducted the research with the data representing 256 HF \times Deoni crossbred cows from cattle crossbreeding project with 1485 total records of

lactation over a 30 years period were obtained from Marathwada Agricultural University CCBP and the UMOWS, respectively. It was observed that average LMY and LL was highest (2062.72 ± 62.56 kg and 307.84 ± 5.78 days) among the cows calved during winter season as compared to post-monsoon season (1970.93 ± 54.46 kg and 304.4 ± 7.94 days), Monsoon season (1830.15 ± 40.54 kg and 289.19 ± 6.24 days) and summer season (1714.97 ± 47.75 kg and 272.84 ± 5.78 days).

Bhutkar *et al.* (2014) conducted the research at Cattle Cross Breeding Project (CCBP) of Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani. Data representing 114 Deoni cows from 211 total records of lactation over a 30 years period were analysed. The LMY was non significantly affected by season of calving. Maximum production occurred during monsoon season (June to September). Milk production was depressed for cows calving in summer.

Anarase *et al.* (2015) conducted the research on data pertaining to 662 lactations of 225 Holdeo cows maintained at CCBP at the Department of Animal Husbandry and Dairy Science, Marathwada Krishi Vidyapeeth, Parbhani over a period of 18 years. Season of calving significantly ($P < 0.01$) influenced LL. It is higher ($P < 0.01$) in summer (267 ± 12.8 days) than in monsoon and winter (258 ± 10.8 and 259 ± 11.7 days).

Chauhan and Ghosh (2015) recorded the milk data of Deoni cows with 438 of lactation records over a period of 15 years (1995-2009) from CCBP, VNMKV, Parbhani and University Meteorological Observatory, respectively. It was observed that LMY and LL was highest (542.97 ± 16.40 lit and 289.07 ± 9.85 days) among the cows calved during

winter season (Oct-Jan) as compared to rainy (June-Sept) (515.91 ± 26.99 lit and 277.04 ± 5.3 days) and summer season (Feb-May) (480.24 ± 18.52 lit and 274.53 ± 7.29 days).

Shingare (2015) reported that season did not significantly affect persistency and lactation traits. In general, lactations initiated in summer followed by spring were associated with the highest lactation yield, lactation length and persistency. Rainy season calvers were observed to be early reaching to peak yield (54.07 ± 4.66 days) while winter and summer calvers required more days to reach peak record. Persistency of milk yield was highest in summer season followed by rainy and winter.

Thorat *et al.* (2015) carried out an investigation on effect of climate on peak milk yield in Deoni cows at Cattle Cross Breeding Project, Department of Animal Husbandry and Dairy Science, College of Agriculture, Parbhani, during the year 2012-2013 for a period of 16 years. The maximum peak milk yield was recorded during post monsoon (Oct-Nov) season followed by south-west monsoon season (Jun-Sep), cold season (Dec-Feb) and hot (Mar-May) season, respectively.

Thorat *et al.* (2015) carried out a research on 16 years data (1995 to 2010) on Deoni cows maintained at Cattle Cross Breeding Project, Vasant Rao Naik Marathawada Krishi Vidyapeeth, Parbhani (Maharashtra). The average monthly milk production (359.18 ± 25.85 lit) was more during post monsoon season followed by cold (326.81 ± 20.48 lit), south-west monsoon season (326.60 ± 20.45 lit) and hot (245.78 ± 19.13 lit), respectively.

Mote *et al.* (2016) studied the milk data of 145 Holdeo crossbred cows with 619 lactation records and the meteorological data over a period of 15 years (1995-2009) obtained from Cattle Cross Breeding Project, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani and University Meteorological Observatory, respectively. It was observed that lactation milk yield (1136.56 ± 21.04 kg.) and lactation length (295.29 ± 5.51 days) were highest among the cows calved during winter season as compared to rainy and summer season.

Thorat *et al.* (2016) carried out the research on 16 years data (1995 to 2010) on Deoni cows maintained at Cattle Cross Breeding Project, Vasantao Naik Marathawada Krishi Vidyapeeth, Parbhani (Maharashtra). The maximum lactation length was recorded during post monsoon season (240.94 ± 11.26 days) followed by south-west monsoon season (222.28 ± 9.00 days), cold season (218.67 ± 8.25 days) and hot season (198.95 ± 10.71 days), respectively.

Basak and Das (2018) worked on a total of 710 lactation records of 274 Deoni cattle, maintained at ICAR-National Dairy Research Institute, Southern Campus, Bangalore. Lactation records of Deoni cows were classified into three seasons i.e., winter (November - February), summer (March - June) and rainy (July - October). Lactation milk yield of Deoni cattle was significantly influenced ($P < 0.05$) by season of calving. Effect of season on lactation length, service period and calving interval was found to be non-significant.

2.4 Milk Composition

2.4.1 Milk Fat

Sontakke *et al.* (1978) analyzed 134 samples of Deoni cow milk and the milk fat was found to be 4.29 ± 0.10 per cent.

Singh *et al.* (2002) conducted a systematic survey of Deoni cattle in 69 villages of Latur district of Maharashtra during 1996-1999 and reported average milk fat to be 4.30 ± 0.14 per cent based on 200 observations.

Kumar (2004) in their study on the pooled samples of milk of Deoni cows collected from the cattle yard, NDRI, Southern Campus, Bangalore, recorded that the average fat percentage was found to be $4.07 \pm 0.39\%$. The fat ranged from 3.60 to 4.50 per cent.

Pundir and Singh (2008) selected Nanded, Parbhani and Latur districts from the breeding tract of Red Kandhari for survey and the fat percentage in this study was found to be 4.5.

Krovvidi *et al.* (2013) studied a total of 62 milk samples from Ongole herd with the objective of assessing milk composition of Ongole cattle and found that fat percent was 3.31 ± 0.18 .

Kuralkar *et al.* (2014) studied the performance of Deoni cows in Latur district of Maharashtra and found the milk fat to be $4.20 \pm 0.15 \%$.

Kuralkar *et al.* (2015) in their survey of 579 Deoni cattle owners on 1682 Deoni cattle from 48 villages of 5 talukas of Latur District from December, 2009 to November, 2011 reported that the least squares mean for fat percent in milk of Deoni cows was 4.01 ± 0.28 .

2.4.2 Solid not fat

Kumar (2004) in their study on the pooled samples of milk of Deoni cows collected from the cattle yard, NDRI, Southern Campus, Bangalore, found the average SNF was $9.11 \pm 0.36\%$. The values varied from 8.60 to 9.46%.

Krovvidi *et al.* (2013) collected a total of 62 milk samples from Ongole herd to access the milk composition of Ongole cattle and found that overall least-squares mean for the SNF was $9.34 \pm 0.12\%$ and found a non-significant effect on stage of lactation on SNF.

Kuralkar *et al.* (2014) studied the performance of Deoni cows in Latur district of Maharashtra and the SNF was found to be $8.43 \pm 0.05\%$ based on 551 observations.

Kuralkar *et al.* (2015) conducted survey of 579 Deoni cattle owners on 1682 Deoni cattle from 48 villages of 5 talukas of Latur District. This was carried out from December, 2009 to November, 2011, and found that the least squares mean for SNF percent of Deoni cows was 8.37 ± 0.85 .

2.4.3 Protein

Kumar (2004) conducted a study on milk samples of Deoni cows from NDRI, Southern campus, Bangalore and found that protein content was 3.02%.

Krovvidi *et al.* (2013) studied a total 62 milk samples from Ongole herd with the objective of assessing milk composition of Ongole cattle and reported that overall least-squares mean for protein was $3.51 \pm 0.08\%$.

2.4.4 Lactose

Kumar (2004) in their survey on milk samples of Deoni cows collected from the cattle yard, NDRI, Southern Campus, Bangalore, recorded that the mean lactose content in Deoni milk was $5.37 \pm 0.16\%$; the values varied from 5.10 to 5.53.

Krovvidi *et al.* (2013) studied a total 62 milk samples from Ongole herd with the objective of assessing milk composition of Ongole cattle and found that, overall least-squares mean for lactose was $5.12 \pm 0.07\%$.

2.4.5 Milk Salts

No reports regarding the milk salts were found.

2.5 Factors influencing Milk composition

2.5.1 Age

No reports regarding the effect of age on the milk composition were found.

2.5.2 Parity

Munde (2016) studied 104 Deoni cows maintained at Southern Regional Station of National Dairy Research Institute Bengaluru, Vasantrya Naik Marathwada Krishi Vidyapeth, Parbhani and College of Veterinary and Animal Sciences, Udgir and reported that the effect of parity on fat and solid not fat % were non-significant in Deoni breed. Higher fat was observed during sixth (4.91 ± 0.27 %) and lower during first parity (4.41 ± 0.10 %) in Deoni cattle. He also reported higher SNF during sixth (9.42 ± 0.29 %) and lower during seventh parity (8.69 ± 0.33 %).

2.5.3 Period of Calving

No reports were found regarding the effect of the period of calving on milk composition.

2.5.4 Season of Calving

Mundhe (2016) studied 104 Deoni cows maintained at Southern Regional Station of NDRI Bengaluru, Vasantrya Naik Marathwada Krishi Vidyapeth, Parbhani and College of Veterinary and Animal Sciences, Udgir and reported that the effect of season was moderately significant with fat and non-significant with SNF. Higher fat was recorded during summer season (4.77 ± 0.10 %) and lower during winter season (4.43 ± 0.07 %) in Deoni cattle.

Materials and Methods

III. MATERIALS AND METHODS

The Deoni is a medium-sized indigenous cattle breed which is predominantly found in Bidar district of Karnataka and Latur district of Maharashtra. This breed is also distributed in small numbers in the neighbouring district of Gulbarga in Karnataka; Parbhani, Nanded and Osmanabad districts in Maharashtra, and some parts of Medak district in Andhra Pradesh (Das *et al.*, 2011). It is found in 3 colour variations. Body is usually spotted black and white. This breed has three strains viz. Balankya - complete white (Plate 3), Wannera- complete white with partial black face (Plate 2) and Waghya or Shevera – white with black spots all over the body (Plate 4). The skin of all the strains is blackish white, thick and loosely attached to the body.

The head is broad and slightly convex. Ears are long drooping with slightly curved tips. Horns are medium, thick apart, emerged from side of the poles. Ears are long and drooping with slightly curved tip without notch. The hump is massive, well developed in males and smaller in females. Eyes are prominent, bright and alert. Dewlap is thick and pendulous. Chest is deep and wide. Rump is medium, inclining slightly to the tail. Limbs are well set, straight and strong. Hooves are black and symmetrically placed. Skin is thick, loosely attached with body. Tail reaches below the hock joint. Udder is well attached, medium sized, milky with squarely placed black teats.

In situ conservation of this precious genetic resource is vital as the Deoni is the only dual-purpose cattle breed of Karnataka, and it has immense value as a draft animal suited to the region's climatic conditions, as a good milk yielder with low inputs, and for the development of high milk yielding crossbreds like the Holdeo.

Though various reports on Deoni cattle maintained at institutional farms are available, only one detailed study (Singh *et al.*, 2002) has been reported on the performance of Deoni cattle under field conditions in Maharashtra. There are very few reports of studies on the milk quality of Deoni cattle, especially at field level (Patil, 2014). In a review of the status of Deoni cattle in India, (Dongre *et al.* 2017) suggested that productivity of the breed could be enhanced by recording performance of maximum number of animals for identification and evaluation of genetically superior animals.

The present study was undertaken to record and observe the lactation performance of Deoni cattle in LRIC (Deoni) Bidar during July 2015 to June 2018 with the following objectives:.

- (i) Study of the lactation performance of Deoni cattle
- (ii) Study of the milk quality of Deoni cattle
- (iii) Analyzing the factors affecting lactation performance of Deoni cattle.

3.1 Brief profile of the study area

3.1.1 Geographical location

The total geographical area of the Bidar district is computed by the Survey of India is 5,451 km². The district extends from latitude 17⁰ 35¹ N to 18⁰ 25¹ N and from longitudes 76⁰ 42' E to 77⁰ 39' E (<https://en.m.wikipedia.org/wiki/Bidar-district>).

3.1.2 Climatic conditions

The Bidar district experiences semi-arid climate with extreme summer. The temperature varies in the district between 20⁰ C and 42⁰ C. The climate is hot round the

year except in winter months. The mean annual rainfall varies from 750 mm to 890 mm. The relative average humidity of the tract ranges from 49 to 54% (<https://en.m.wikipedia.org/wiki/Bidar-district>).

3.1.3 Performance of Deoni cattle

Cows are moderately good milkers, yielding about 900-1800 kg in a lactation length of 300 days (NBAGR, 2008). The cows have an average age of 42-48 months at first calving and have dry period of 177 days and the average fat content in the milk is 2.5-5.3 percent (NBAGR, 2008).

The research work titled “Factors affecting Lactation Performance of Deoni Cattle” was carried out at the Livestock Research and Information Centre (Deoni), Hallikhed, a research centre of Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, (Plate 1).

3.2 Performance recording of Deoni cows

3.2.1 Data collection

The data of lactation performance of Deoni cattle from the records maintained at LRIC (Deoni), Bidar from July 2015 to June 2018 were included for the study.

Among the cattle at LRIC, 78 cows were considered for the study. The age, parity and date of calving were recorded. The performance parameters like Lactation milk yield, Peak Yield, Lactation length, Persistency and Milk composition were also calculated.

3.2.2 Analysis of milk

The milk sample was subjected to analysis of milk fat, SNF, Protein, lactose and salts content using an electronic milk analyzer available at the LRIC (Deoni).

3.2.3 Tabulation and classification of data

In the present study all the parameters such as LMY, PY, LL, persistency of lactation and milk composition (Fat, SNF, Protein, Lactose and salts) were tabulated in Microsoft Excel for all the cows according to factors influencing lactation performance that were studied.

3.3 Parameters studied

3.3.1 Lactation milk yield

The lactation milk yield was estimated using the Test Interval Method (Interpolation Method) approved by the International Committee for Animal Recording (2012). 78 female cows were considered for recording of LMY, (Plate 5).

The lactation milk yield (MY), in kilograms, was calculated as per the following formula:

$$MY = I_d M_1 + \frac{I_1 (M_1 + M_2)}{2} + \frac{I_2 (M_1 + M_2)}{2} + \dots + \frac{I_{n-1} (M_{n-1} + M_n)}{2} I_n M_n$$

where,

M_1, M_2, M_n are the weights, in kilograms, given to one decimal place, of the milk yielded in the 24 hours of the recording day,

I_1, I_2, I_n are the intervals, in days, between recording dates,

I_d is the interval, in days, between the lactation period start date and the first recording date, and I_n is the interval, in days, between the last recording date and the end of the lactation period.

3.3.2 Peak yield

The peak yield was recorded from the animals present in the farm (LRIC) as the maximum milk produced by the Deoni cow on a single day during the lactation period or the peak yield is the point where the cow reaches the highest milk production level during the entire lactation.

3.3.3 Lactation length

The lactation length in Deoni cows was recorded as the interval, in days, between the date of calving and the date of subsequent drying off, as per the farm records.

3.3.4 Persistency of lactation

Lactational persistency is the degree to which peak lactation yield is maintained during the remainder of the lactation season. The persistency was calculated as per the Ratio Method (Chaudhry *et al.*, 2000).

$$P = \frac{\text{Lactation milk yield}}{\text{Peak yield}}$$

3.3.5 Milk composition

The collected milk samples were stirred using a stirrer and then subjected to analysis for fat, SNF, protein, lactose and salt content by using a milk analyzer (Vector®) (Plate 6). The values were promptly recorded. Milk composition parameters of 66 milking cows were recorded.

3.4 Factors influencing lactation performance

3.4.1 Age

The cows for estimation of lactation performance were grouped into 5 groups according to the age of the cow. They were grouped as 3-5, 5-6, 7-9, 9-11 and >11 years.

3.4.2 Parity

The cows were grouped into 6 groups according to their number of calving i.e. 1, 2, 3, 4, 5 and > 6.

3.4.3 Period of calving

Deoni cows were grouped according to the periods that were considered in the present study. In this research, the performance of cattle were observed for the period of 3 years Period 1 (July 2015- June 2016), Period 2 (July 2016- June 2017) and Period 3 (June 2017- July 2018).

3.4.4 Season of calving

The cows taken into consideration in this study were grouped into 3 seasons based on the prevailing agro-climatic conditions: rainy (Jul-Oct), winter (Nov-Feb), and summer (Mar-Jun).

3.5 Statistical analysis

Analysis of the factors influencing lactation performance – age group, parity, period of calving and season of calving using Least Squares Analysis was carried out as per the SAS software version 9.3 (2010) using General Linear Model procedure.



Plate 1: Livestock Research Information Centre (Deoni), Bidar



Plate 2: Deoni cow, Wannera type



Plate 3: Deoni cow, Balankya type



Plate 4: Deoni cow, Shevera type



Plate 5: Collection of milk on test day to record LMY



Plate 6: Milk analysis using Analyser (Vector®)



Results

IV. RESULTS

4.1 Lactation Performance of Deoni cattle and Factors affecting the Performance

4.1.1 Lactation Milk Yield

The Least Square Means of Lactation Milk Yield is given in Table 4.1. The overall means of Deoni cattle for LMY was found to be 1297.99 ± 51.41 kg.

Age group was found to have a significant effect on the LMY. The LMY was highest (1669.39 ± 134.946 kg) in age group of 9-11 years and it was lowest (1095.68 ± 150.875 kg) in 3-5 years age group. No significant difference in LMY were observed between age groups 7-9 (1350.48 ± 95.421 kg), 9-11 (1669.39 ± 134.946 kg) and >11 years (1365.67 ± 106.684 kg).

Parity was found to have a significant effect on the LMY, with highest LMY of 1650.87 ± 139.265 kg in fourth parity and lowest of 1054.15 ± 101.330 kg in first parity. No significant difference was observed in the LMY between second to > six parities.

Period of calving did not have any significant effect on the LMY. Highest LMY was observed in cows calved in Period 3 (1378.10 ± 93.755 kg). Period 1 with LMY of 1325.78 ± 80.756 kg was intermediate and the lowest was observed in the Period 2 with 1206.60 ± 91.781 kg.

Season of calving did not have any significant effect on the LMY. Highest LMY was observed in the cows calved during winter season (1413.99 ± 87.213 kg) followed by rainy (1351.95 ± 92.727 kg) and summer (1151.18 ± 82.579 kg).

4.1.2 Peak Milk Yield

The Least Square Means of Peak yield is presented in Table 4.2. The overall means of Deoni cattle for PMY was found to be 6.19 ± 0.147 kg.

Age group did not have any significant effect on the PMY. The PMY was highest (6.93 ± 0.398 kg) in age group of 9-11 years and it was lowest (5.62 ± 0.445 kg) in 3-5 years age group.

Parity was found to have a significant effect on the PMY, with highest PMY of 6.00 ± 0.342 kg in second parity and lowest of 3.11 ± 0.484 kg in fourth parity. No significant difference was observed in the LMY between third, fourth and fifth parities.

Period of calving did not have any significant effect on the PMY. Highest PMY was observed in cows calved in Period 1 (6.41 ± 0.233 kg). Period 2 with PMY of 6.16 ± 0.264 kg was intermediate and the lowest was observed in the Period 3 with 5.91 ± 0.270 kg.

Season of calving did not have any significant effect on the PMY. Highest PMY was observed in the cows calved during rainy season (6.60 ± 0.264 kg) followed by winter (6.23 ± 0.250 kg) and summer (5.82 ± 0.236 kg).

4.1.3 Lactation Length

The LSM for LL of Deoni cattle under this study is given in Table 4.3. The overall mean for LL of Deoni cattle was observed to be 291.68 ± 6.786 days.

Age group did not have significant effect on LL. Highest LL (318.70 ± 18.732 days) was observed in the age group 9-11 years while lowest (271.00 ± 20.943 days) in 3-5 years.

Parity was not found to have a significant effect on the LL. Highest LL of 327.88 ± 19.479 days was in fourth parity and lowest LL of 267.47 ± 14.173 days was observed during first parity.

Period of calving did not have any significant effect on the LL. Highest LL was observed in cows calved in Period 3 (304.65 ± 12.489 days). Period 1 with LL of 291.90 ± 10.758 days was intermediate and the lowest was observed in the Period 2 with 278.95 ± 12.226 days.

Season of calving was found to have a significant effect on the LL. Cows calving in summer had shorter LL of 266.27 ± 10.638 days, winter had LL of 302.65 ± 11.235 days was intermediate and cows calving in rainy had highest LL of 311.30 ± 11.945 days. No significant difference was observed in the LL between winter and summer seasons.

4.1.4 Persistency

The Least Square Means of Lactation milk yield is given in Table 4.4. The overall means of Deoni cattle for persistency was found to be 207.68 ± 5.105 kg.

Age group did not have significant effect on the persistency. It was highest (234.17 ± 13.942) in age group of 9-11 years and it was lowest (194.05 ± 15.588) in 3-5 years age group.

Parity did not have significant effect on the persistency, with highest persistency of 236.36 ± 17.640 in fifth parity and lowest of 188.08 ± 10.479 in first parity.

Period of calving did not have any significant effect on the persistency. Highest was observed in cows calved in Period 3 (223.69 ± 9.182). Period 1 with persistency of 207.17 ± 7.909 was intermediate and the lowest was observed in the Period 2 with 192.98 ± 8.989 .

Season of calving did not have any significant effect on the persistency. Highest persistency was observed in the cows calved during winter season (224.14 ± 8.638) followed by rainy (202.73 ± 9.184) and summer (196.83 ± 8.179).

4.2 Milk Composition of Deoni cattle and Factors affecting the Milk Composition

4.2.1 Milk Fat

The Least Square Means of milk fat is given in Table 4.5. The overall means of Deoni cattle for Fat was found to be 4.8 ± 0.014 %.

Age group was found to have a significant effect on the fat. The fat was highest ($4.882 \pm 0.0336\%$) in age group of 9-11 years and it was lowest ($4.744 \pm 0.0401\%$) in 3-5 years age group. No significant difference in Fat were observed between age groups 3-5 ($4.744 \pm 0.401\%$), 5-6 ($4.777 \pm 0.0231\%$), 9-11 ($4.882 \pm 0.0336\%$) and > 11 years ($4.857 \pm 0.083\%$).

Parity was found to have a significant effect on the fat, with highest fat of $4.887 \pm 0.0383\%$ in fourth parity and lowest of $4.738 \pm 0.0289\%$ in first parity. No significant difference was observed in the fat between second to >sixth parities.

Period of calving did not have any significant effect on the fat. Highest fat was observed in cows calved in Period 2 ($4.833 \pm 0.0233\%$). Period 1 with fat of $4.791 \pm 0.0262\%$ was intermediate and the lowest was observed in the Period 3 with $4.778 \pm 0.0238\%$.

Season of calving did not have any significant effect on the fat. Highest fat was observed in the cows calved during winter season ($4.819 \pm 0.0233\%$) followed by rainy ($4.808 \pm 0.0262\%$) and summer ($4.778 \pm 0.0238\%$).

4.2.2 Solids Not Fat

The LSM for milk SNF of Deoni cattle under this study is given in Table 4.6. The overall mean for SNF of Deoni cattle was observed to be $8.48 \pm 0.008\%$.

Age group did not have significant effect on SNF. Highest SNF ($8.518 \pm 0.0199\%$) was observed in the age group 9-11 years while lowest ($8.454 \pm 0.0238\%$) in 3-5 years.

Parity was not found to have a significant effect on the SNF. Highest SNF of $8.517 \pm 0.0219\%$ was in fourth parity and lowest SNF of $8.454 \pm 0.0166\%$ was observed during second parity.

Period of calving did not have any significant effect on the SNF. Highest SNF was observed in cows calved in Period 2 ($8.493 \pm 0.0135\%$). Period 3 with SNF of

8.482±0.0138% was intermediate and the lowest was observed in the Period 1 with 8.473±0.0152%.

Season of calving was found to have a non significant effect on the SNF. Cows calving in rainy season had low SNF of 8.474±0.0157%, and calved cows summer had SNF of 8.484±0.0233% was intermediate and cows calving in winter had highest SNF of 8.490±0.0138%.

4.2.3 Milk Protein

The Least Square Means of milk protein is given in Table 4.7. The overall means of Deoni cattle for Protein was found to be 3.1±0.005%.

Age group did not have any significant effect on the protein. The protein was highest (3.124±0.0120%) in age group of 9-11 years and it was lowest (3.085±0.0144%) in 3-5 years age group.

Parity was found to have a significant effect on the protein, with highest protein of 3.124±0.0171% in fifth parity and lowest of 3.088±0.0102% in first parity.

Period of calving did not have any significant effect on the protein. Highest protein was observed in cows calved in Period 3 (3.112±0.0080%). Period 2 with protein of 3.100±0.079% was intermediate and the lowest was observed in the Period 1 with 3.097±0.0088%

Season of calving did not have any significant effect on the protein. Highest protein was observed in the cows calved during winter season ($3.105 \pm 0.0081\%$) followed by rainy ($3.104 \pm 0.0092\%$) and summer season ($3.101 \pm 0.0078\%$).

4.2.4 Lactose

The Least Square Means of milk lactose is given in Table 4.8. The overall means of Deoni cattle for lactose was found to be $4.68 \pm 0.005\%$.

Age group did not have any significant effect on the lactose. The lactose was highest ($4.690 \pm 0.0105\%$) in age group of >11 years and it was lowest ($4.669 \pm 0.0105\%$) in 7-9 years age group.

Parity was found to have a significant effect on the lactose, with highest lactose of $4.694 \pm 0.0108\%$ in >sixth parity and lowest of $4.66 \pm 0.0097\%$ in second parity.

Period of calving did not have any significant effect on the lactose. Highest lactose was observed in cows calved in Period 1 ($4.681 \pm 0.0091\%$). Period 2 with lactose of $4.677 \pm 0.0080\%$ was intermediate and the lowest was observed in the Period 3 with $4.676 \pm 0.0082\%$

Season of calving did not have any significant effect on the lactose. Highest lactose was observed in the cows calved during winter season ($4.690 \pm 0.0080\%$) followed by summer ($4.673 \pm 0.0077\%$) and rainy seasons ($4.669 \pm 0.0090\%$).

4.2.5 Salts

The Least Square Means of milk salts is recorded in Table 4.9. The overall means of Deoni cattle for salts was found to be $0.65 \pm 0.001\%$.

Age group did not have any significant effect on the salts. The salts was highest ($0.652 \pm 0.0024\%$) in age group of 7-9 years and it was lowest ($0.649 \pm 0.0024\%$) in >11 years age group.

Parity was found to have no significant effect on the salts, with highest salts of $0.653 \pm 0.0029\%$ in third parity and lowest of $0.648 \pm 0.0041\%$ in fifth parity.

Period of calving did not have any significant effect on the salts. Salt content was same when observed in cows calved in Period 1,2 and 3 ($0.650 \pm 0.0020\%$, 0.650 ± 0.0018 and 0.650 ± 0.0018 respectively).

Season of calving did not have any significant effect on the milk salts. Highest salts was observed in the cows calved during winter and summer seasons ($0.650 \pm 0.0018\%$) and rainy ($0.644 \pm 0.0021\%$).

Table 4.1: Least Squares Means of Lactation Milk Yield (kg) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	8	1095.68 ^a	±	150.875
	5-6	24	1121.80 ^a	±	87.107
	7-9	20	1350.48 ^{ab}	±	95.421
	9-11	10	1669.39 ^b	±	134.946
	>11	16	1365.67 ^{ab}	±	106.684
2.	Parity				
	1	17	1054.15 ^a	±	101.330
	2	18	1191.65 ^{ab}	±	98.475
	3	14	1211.40 ^{ab}	±	111.660
	4	9	1650.87 ^b	±	139.265
	5	6	1559.55 ^{ab}	±	170.564
	>6	14	1478.40 ^{ab}	±	111.660
3.	Period				
	Period 1 (July 15- Jun 16)	31	1325.78	±	80.756
	Period 2 (July 16- Jun 17)	24	1206.60	±	91.781
	Period 3 (July 17- Jun 18)	23	1378.10	±	93.755
4.	Season				
	Rainy (Jul-Oct)	23	1351.95	±	92.727
	Winter (Nov-Feb)	26	1413.99	±	87.213
	Summer (Mar-Jun)	29	1151.18	±	82.579
	Overall	78	1297.99	±	51.410

Note: Means within group having different superscripts differ significantly (P<0.05)

Table 4.2: Least Squares Means of Peak Yield (kg) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	8	5.62	±	0.445
	5-6	24	5.82	±	0.257
	7-9	20	6.53	±	0.281
	9-11	10	6.93	±	0.398
	>11	16	6.13	±	0.315
2.	Parity				
	1	17	5.60 ^a	±	0.352
	2	18	6.00 ^a	±	0.342
	3	14	4.58 ^{ab}	±	0.388
	4	9	3.11 ^b	±	0.484
	5	6	3.12 ^b	±	0.593
	>6	14	5.94 ^a	±	0.388
3.	Period				
	Period 1 (July 15- Jun 16)	31	6.41	±	0.233
	Period 2 (July 16- Jun 17)	24	6.16	±	0.264
	Period 3 (July 17- Jun 18)	23	5.91	±	0.270
4.	Season				
	Rainy (Jul-Oct)	23	6.60	±	0.265
	Winter (Nov-Feb)	26	6.23	±	0.250
	Summer (Mar-Jun)	29	5.82	±	0.236
	Overall	78	6.19	±	0.147

Note: Means within group having different superscripts differ significantly (P<0.05)

Table 4.3: Least Squares Means of Lactation Length (days) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	8	271.00	±	20.943
	5-6	24	276.33	±	12.091
	7-9	20	291.70	±	13.245
	9-11	10	318.70	±	18.732
	>11	16	308.12	±	14.800
2.	Parity				
	1	17	267.47	±	14.173
	2	18	284.00	±	13.774
	3	14	282.00	±	15.618
	4	9	327.88	±	19.479
	5	6	316.16	±	23.857
	>6	14	306.85	±	15.618
3.	Period				
	Period 1 (July 15- Jun 16)	31	291.90	±	10.758
	Period 2 (July 16- Jun 17)	24	278.95	±	12.226
	Period 3 (July 17- Jun 18)	23	304.65	±	12.489
4.	Season				
	Rainy (Jul-Oct)	23	311.30 ^a	±	11.945
	Winter (Nov-Feb)	26	302.65 ^{ab}	±	11.235
	Summer (Mar-Jun)	29	266.27 ^b	±	10.638
	Overall	78	291.68	±	6.786

Note: Means within group having different superscripts differ significantly (P<0.05)

Table 4.4: Least Squares Means of Persistency in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	8	194.05	±	15.588
	5-6	24	194.10	±	9.000
	7-9	20	207.92	±	9.859
	9-11	10	234.17	±	13.942
	>11	16	217.97	±	11.022
2.	Parity				
	1	17	188.08	±	10.479
	2	18	200.20	±	10.184
	3	14	199.07	±	11.548
	4	9	234.27	±	14.403
	5	6	236.36	±	17.640
	>6	14	220.29	±	11.548
3.	Period				
	Period 1 (July 15- Jun 16)	31	207.17	±	7.909
	Period 2 (July 16- Jun 17)	24	192.98	±	8.989
	Period 3 (July 17- Jun 18)	23	223.69	±	9.182
4.	Season				
	Rainy (Jul-Oct)	23	202.73	±	9.184
	Winter (Nov-Feb)	26	224.14	±	8.638
	Summer (Mar-Jun)	29	196.83	±	8.179
	Overall	78	207.68	±	5.105

Table 4.5: Least Squares Means of Milk Fat (%) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	7	4.744 ^{ab}	±	0.0401
	5-6	21	4.777 ^{ab}	±	0.0231
	7-9	14	4.756 ^a	±	0.0283
	9-11	10	4.882 ^b	±	0.0336
	>11	14	4.857 ^{ab}	±	0.0283
2.	Parity				
	1	14	4.738 ^a	±	0.0289
	2	16	4.781 ^{ab}	±	0.0270
	3	10	4.787 ^{ab}	±	0.0342
	4	8	4.887 ^b	±	0.0383
	5	5	4.810 ^{ab}	±	0.0484
	>6	13	4.852 ^{ab}	±	0.0300
3.	Period				
	Period 1 (July 15- Jun 16)	19	4.791	±	0.0262
	Period 2 (July 16- Jun 17)	24	4.833	±	0.0233
	Period 3 (July 17- Jun 18)	23	4.778	±	0.0238
4.	Season				
	Rainy (Jul-Oct)	18	4.808	±	0.0262
	Winter (Nov-Feb)	23	4.819	±	0.0233
	Summer (Mar-Jun)	25	4.778	±	0.0238
	Overall	66	4.800	±	0.0140

Note: Means within group having different superscripts differ significantly (P<0.05)

Table 4.6: Least Squares Means of Milk Solids Not Fat (%) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	7	8.454	±	0.0238
	5-6	21	8.463	±	0.0137
	7-9	14	8.477	±	0.0168
	9-11	10	8.518	±	0.0199
	>11	14	8.507	±	0.0168
2.	Parity				
	1	14	8.461	±	0.0166
	2	16	8.454	±	0.0155
	3	10	8.476	±	0.0196
	4	8	8.517	±	0.0219
	5	5	8.514	±	0.0278
	>6	13	8.517	±	0.0172
3.	Period				
	Period 1 (July 15- Jun 16)	19	8.473	±	0.0152
	Period 2 (July 16- Jun 17)	24	8.493	±	0.0135
	Period 3 (July 17- Jun 18)	23	8.482	±	0.0138
4.	Season				
	Rainy (Jul-Oct)	18	8.474	±	0.0157
	Winter (Nov-Feb)	23	8.490	±	0.0138
	Summer (Mar-Jun)	25	8.484	±	0.0233
	Overall	66	8.480	±	0.0080

Table 4.7: Least Squares Means of Milk Protein (%) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	7	3.085	±	0.0144
	5-6	21	3.094	±	0.0083
	7-9	14	3.105	±	0.0102
	9-11	10	3.124	±	0.0120
	>11	14	3.111	±	0.0102
2.	Parity				
	1	14	3.088	±	0.0102
	2	16	3.095	±	0.0095
	3	10	3.105	±	0.0121
	4	8	3.111	±	0.0135
	5	5	3.124	±	0.0171
	>6	13	3.116	±	0.1006
3.	Period				
	Period 1 (July 15- Jun 16)	19	3.097	±	0.0088
	Period 2 (July 16- Jun 17)	24	3.100	±	0.0079
	Period 3 (July 17- Jun 18)	23	3.112	±	0.0080
4.	Season				
	Rainy (Jul-Oct)	18	3.104	±	0.0092
	Winter (Nov-Feb)	23	3.105	±	0.0081
	Summer (Mar-Jun)	25	3.101	±	0.0078
	Overall	66	3.100	±	0.0050

Table 4.8: Least Squares Means of Milk Lactose (%) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	7	4.674	±	0.0148
	5-6	21	4.672	±	0.0085
	7-9	14	4.669	±	0.0105
	9-11	10	4.689	±	0.0124
	>11	14	4.690	±	0.0105
2.	Parity				
	1	14	4.675	±	0.0104
	2	16	4.666	±	0.0097
	3	10	4.670	±	0.0123
	4	8	4.685	±	0.0138
	5	5	4.690	±	0.0174
	>6	13	4.694	±	0.0108
3.	Period				
	Period 1 (July 15- Jun 16)	19	4.681	±	0.0091
	Period 2 (July 16- Jun 17)	24	4.677	±	0.0080
	Period 3 (July 17- Jun 18)	23	4.676	±	0.0082
4.	Season				
	Rainy (Jul-Oct)	18	4.669	±	0.0090
	Winter (Nov-Feb)	23	4.690	±	0.0080
	Summer (Mar-Jun)	25	4.673	±	0.0077
	Overall	66	4.680	±	0.0050

Table 4.9: Least Squares Means of Milk Salts (%) in Deoni cattle

Sl. No.	Group	n	Mean	±	SE
1.	Age Group (years)				
	3-5	7	0.648	±	0.0034
	5-6	21	0.650	±	0.0019
	7-9	14	0.652	±	0.0024
	9-11	10	0.649	±	0.0028
	>11	14	0.649	±	0.0024
2.	Parity				
	1	14	0.649	±	0.0024
	2	16	0.650	±	0.0022
	3	10	0.653	±	0.0029
	4	8	0.651	±	0.0032
	5	5	0.648	±	0.0041
	>6	13	0.650	±	0.0025
3.	Period				
	Period 1 (July 15- Jun 16)	19	0.650	±	0.0020
	Period 2 (July 16- Jun 17)	24	0.650	±	0.0018
	Period 3 (July 17- Jun 18)	23	0.650	±	0.0018
4.	Season				
	Rainy (Jul-Oct)	18	0.644	±	0.0021
	Winter (Nov-Feb)	23	0.650	±	0.0018
	Summer (Mar-Jun)	25	0.650	±	0.0018
	Overall	66	0.650	±	0.0010



Discussion

V. DISCUSSION

The research work titled “Factors affecting Lactation Performance of Deoni Cattle” was undertaken at the Livestock Research and Information Centre (Deoni), Hallikhed, a research centre of Karnataka Veterinary Animal and Fisheries Sciences University, Bidar. The present study was conducted on 78 Deoni cows based on performance data of Deoni cattle for the period July 2015 to June 2018.

5.1 Production Performance of Deoni cattle and factors affecting it

5.1.1 Lactation Milk Yield (LMY)

The mean lactation milk yield of Deoni cows, as calculated by the Test Interval Method given by the International Committee for Animal Recording was found to be 1297.99 ± 51.41 kg. Most of the previous workers have reported lower figures namely 236.43 ± 12.71 kg (Shingare *et al.*, 2015), 326.18 ± 20.45 kg (Thorat *et al.*, 2015), 358.31 ± 27.18 kg (Bhutkar *et al.*, 2014), 643.079 ± 25.16 kg (Basak *et al.*, 2018), 779.27 ± 18.31 kg (Das *et al.*, 2011), 819.98 ± 16.5 (Basak and Das, 2018), 868.24 ± 49.56 lit (Singh *et al.*, 2002), 884.29 ± 45.34 kg (Kuralkar *et al.*, 2015), 942.7 ± 16.6 kg (Deshpande and Singh, 1977b), and 1120.49 ± 62.89 kg (Padwal *et al.*, 1977).

In comparison, previous workers have also reported a wide variation in the performance of HF x Deoni crossbreds (Holdeo) : 1661.35 ± 15.17 kg (Wondifraw *et al.*, 2013), 1263.4 ± 76.56 kg (Anarase *et al.*, 2015) and 1193.22 ± 44.79 kg (Gatchearle *et al.*, 2009) in institutional farms.

The extreme variation in the LMY of Deoni cattle, ranging from 358 kg to 1298 kg could be due to various factors. In most recent reports, performance at institutional farms is inferior to that of performance of farmers' herds. This could be due to the constraints in institutional farms in terms of funds, fodder inconvenience and adequate labour. In comparison, as most Deoni cattle farmers have small herds of 1-2 cattle, they are able to provide adequate care in terms of management and nutrition. The high LMY figures in the present study indicate significant potential for improvement of the breed, as it has outperformed its crosses with exotic cattle breeds in some cases.

Age group and parity was significantly affected by LMY. LMY was highest (1669.39 ± 134.94 kg) in 9-11 years age group while it was lowest (1095.68 ± 150.87 kg) in 3-5 years age group. The PY observed in different parities where it was high in second parity (6.00 ± 0.342 kg) and least in fourth parity (3.11 ± 0.484 kg). Anarase *et al.* (2015) also reported significant effect of parity on LMY. Wondifraw *et al.* (2013) reported highest production in fifth parity. In contrast, Kuralkar *et al.* (2015) reported LMY was highest during first four parity and declined from fifth parity onwards. Shingare *et al.* (2015) reported that highest LMY occurred in second parity (281.91 ± 19.42 kg).

Period of calving did not have any significant influence on the LMY. The LMY of period 1 to 3 was 1325.78 ± 80.756 , 1206.60 ± 91.781 and 1378.10 ± 93.755 kg, respectively. In contrast, Basak and Das (2018), Bhutkar *et al.* (2014) and Anarase *et al.* (2015) reported that period of calving had significant effect on LMY. The variation as compared to previous workers could be due to the fact that their studies were for a much longer period of time ranging from 12 to 30 years, whereas the present study was for a

period of 3 years only, during which changes in agro-climatic conditions and management practices would not be so evident.

The study revealed that there was no significant effect of season of calving on LMY. The mean LMY in winter, rainy and summer seasons was 1413.99 ± 87.213 , 1351.95 ± 92.727 and 1151.18 ± 82.579 kg, respectively. Basak and Das (2018) reported that season of calving had significant effect on LMY whereas Bhutkar *et al.* (2014) and Shingare (2015) reported no significant effect on LMY. As the farm in which the present study was carried out was situated next to the dam, there was no shortage of green fodder even during the summer season. Further, animals were protected from adverse environmental conditions during summer months. This could possibly explain why there was no significant impact of season of calving on the LMY.

5.1.2 Peak Yield (PY)

The mean peak yield of Deoni cows was found to be 6.19 ± 0.147 kg. Most of the previous workers have reported lower figures: 4.48 ± 0.12 kg (Deshpande and Singh, 1977b), 1-5 lactations peak yield 5.529, 5.721, 6.277, 5.822 and 5.645 kg resp. (Kakde *et al.*, 1980), 3.14 ± 0.18 kg (Bhutkar *et al.*, 2014) and 2.60 kg/day (Thorat *et al.*, 2015)

In comparison, previous workers have also reported a wide variation in the performance of Red Kandhari : 2.0-4.0 kg (Pundir and Singh., 2008) and in Bachur: 4.70 ± 0.07 kg (Chandran *et al.*, 2014) in institutional conditions. The highest recorded peak yield in Deoni cattle was 7.12 ± 0.24 kg (Shingare *et al.*, 2015) in farm condition.

Age group did not have any significant effect on PY. PY was highest (6.93 ± 0.398 kg) in 9-11 years age group while it was lowest (5.62 ± 0.445 kg) in 3-5 years age group. Parity has significant effect on PY. Anarase *et al.* (2015) also reported significant effect of parity on PY. Wondifraw *et al.* (2013) reported highest production in fifth parity.

Period of calving did not have any significant influence on the PY. The PY of period 1 to 3 was 6.41, 6.16 and 5.91 kg, respectively. In contrast, Anarase *et al.* (2015) reported that period of calving had significant effect on PY.

The study revealed that there was no significant effect of season of calving on PY. The mean PY in rainy, winter and summer seasons was, 6.60, 6.23 and 5.82 kg, respectively.

5.1.3 Lactation Length (LL)

The mean lactation length of Deoni cows, was found to be 291.68 ± 6.786 days. Most of the previous workers have reported lower figures: 195.23 ± 2.62 days (Basak and Das, 2018), 178.24 ± 4.41 days (Basak *et al.*, 2018) and 246.88 ± 7.02 days (Kuralkar *et al.*, 2015)

In comparison, previous workers have also reported a wide variation in the performance of HF x Deoni crossbreds (Holdeo) : 268 ± 11.5 days (Anarase *et al.*, 2013) and 284.88 ± 5.24 days (Gatchearle *et al.*, 2009) in institutional farms.

Few previous workers have reported higher figures: 293.30 ± 2.90 days (Deshpande and Singh, 1970), 296.80 ± 2.29 days (Wondifraw *et al.*, 2013) and 317.55 ± 4.20 days (Padwal *et al.*, 1977).

Age group and parity did not have any significant effect on LL. LL was highest (318.70±18.73 days) in 9-11 years age group while it was lowest 271.00±20.94 days) in 3-5 years age group. The LL observed in different parities where it was high in fourth parity (327.88±19.47 days) and least in first parity (267.47±14.17 days). Anarase *et al.* (2015) and Basak and Das (2018) also reported significant effect of parity on LL.

Period of calving did not have any significant influence on the LL. The LL of period 1 to 3 was 291.90±10.758, 278.95±12.226 and 304.65±12.489 days, respectively. In contrast, Anarase *et al.* (2015) reported that period of calving had significant effect on LL.

Season of calving was significantly affected by LL. The mean LL in rainy, winter and summer seasons was 311.30, 302.65 and 266.27 days, respectively. Anarase (2015) reported that season of calving had significant effect on LL whereas Basak and Das (2018) and Shingare (2015) reported no significant effect on LL.

Most of the previous workers have reported lower figures: 289.07, 277.04 and 274.53 days in winter, rainy and summer seasons respectively (Chauhan and Ghosh, 2015), 267.12.8, 258, 259 days in summer, monsoon and rainy seasons respectively and 240.94, 222.28, 218.67 and 198.95 days in post monsoon, south west monsoon, cold and hot respectively. In comparison, few workers have also reported a wide variation in the performance of HF x Deoni crossbreds (Holdeo) : 307.84, 304.4, 289.19 and 272.84 days in winter, post monsoon, monsoon and summer (Wondifraw *et al.*, 2013).

5.1.4 Persistency

The mean persistency of Deoni cows was found to be 207.68 ± 5.105 . Most of the previous workers have reported lower figures: 79.4 ± 0.57 (Chaudhry *et al.*, 2000). This was comparable to the value of 204.03 ± 1.56 (Kumar and Singh, 2006).

Age group and parity did not have any significant effect on persistency. Persistency was highest (234.17 ± 13.94) in 9-11 years age group while it was lowest (194.05 ± 15.58) in 3-5 years age group. Higher persistency was observed in fifth parity (236.36 ± 17.64), while the persistency was low in the first parity (188.08 ± 10.47).

Period of calving did not have any significant influence on the persistency. The persistency of period 1 to 3 was 207.17 ± 7.909 , 192.98 ± 8.989 and 223.69 ± 9.182 , respectively. The study revealed that there was no significant effect of season of calving on persistency. The mean persistency in winter, rainy and summer seasons was 224.14, 202.73 and 196.83, respectively.

5.2 Milk composition of Deoni cattle and factors affecting it

5.2.1 Fat

The mean milk fat of Deoni cows, as calculated by the Test Interval Method given by the International Committee for Animal Recording was found to be $4.8 \pm 0.014\%$. Most of the previous workers have reported lower figures: 4.01 (Kuralkar *et al.*, 2015), 4.07% (Kumar, 2004) and 4.20% (Kuralkar *et al.*, 2014). In comparison, previous workers have also reported a wide variation in the performance of Deoni cows : 4.29% (Sontakke *et al.*, 1978) and 4.30% (Singh *et al.*, 2002)

Age group and parity had significant effect on milk fat. Fat was highest ($4.882\pm 0.0336\%$) in 9-11 years age group while it was lowest ($4.756\pm 0.0283\%$) in 7-9 years age group. The fat observed in different parities where it was high in fourth parity ($4.882\pm 0.0336\%$) and least in first parity ($4.744\pm 0.0401\%$).

Period of calving did not have any significant influence on the milk fat. The fat percentage of period 1 to 3 was 4.791 ± 0.0262 , 4.833 ± 0.0233 and 4.778 ± 0.0238 respectively. The study revealed that there was no significant effect of season of calving on fat. The mean milk fat in winter, rainy and summer seasons was 4.819, 4.808 and 4.778 %, respectively.

5.2.2 Solid Not Fat

The mean milk SNF of Deoni cows, was found to be $8.48\pm 0.008\%$. The previous workers have reported lower figures: $8.37\pm 0.85\%$ (Kuralkar *et al.*, 2015). In comparison, previous workers have also reported a wide variation in the performance of Deoni cows : $8.43\pm 0.005\%$ (Kuralkar *et al.*, 2014). In contrast some workers have reported higher SNF of Deoni cows: $9.11\pm 0.36\%$ (Kumar, 2004).

Age group and parity did not have significant effect on SNF. SNF was highest ($8.518\pm 0.0199\%$) in 9-11 years age group while it was lowest ($8.454\pm 0.0238\%$) in 3-5 years age group. The SNF observed in different parities where it was high in fourth parity ($8.517\pm 0.0219\%$) and least in second parity ($8.454\pm 0.0155\%$).

Period of calving did not have any significant influence on the milk SNF. The SNF percentage of period 1 to 3 was 8.473, 8.493 and 8.482%, respectively. The study

revealed that there was no significant effect of season of calving on fat. The mean milk SNF in winter, summer and rainy seasons was 8.490, 8.484 and 8.474 %, respectively.

5.2.3 Protein

The mean milk protein of Deoni cows was found to be $3.1 \pm 0.005\%$. Most of the previous workers have reported lower figures: 3.02% (Kumar, 2004). In contrast, higher protein percent have also reported a wide variation in the performance of Ongole : 3.51 ± 0.080 (Krovvidi *et al.*, 2013).

Age group and parity did not have significant influence on Protein. Protein was highest ($3.124 \pm 0.0120\%$) in 9-11 years age group while it was lowest ($3.085 \pm 0.0144\%$) in 3-5 years age group. The PY observed in different parities where it was high in fifth parity ($3.124 \pm 0.0171\%$) and least in first parity ($3.088 \pm 0.0102\%$).

Period of calving did not have any significant influence on the protein. The protein of period 1 to 3 was 3.097, 3.100 and 3.112%, respectively. The study revealed that there was no significant effect of season of calving on protein. The mean milk protein in winter, rainy and summer seasons was 3.105 ± 0.0081 , 3.104 ± 0.0092 and $3.101 \pm 0.0078\%$, respectively

5.2.4 Lactose

The mean milk lactose percent of Deoni cows was found to be 4.68 ± 0.005 . In contrast, higher protein percent have also reported a wide variation in the performance : 5.12 ± 0.07 (Krovvidi *et al.*, 2013) and 5.37 ± 0.16 (Kumar, 2004)

Age group and parity did not have significant influence on milk Lactose. Lactose was highest (4.690%) in >11 years age group while it was lowest (4.669%) in 7-9 years age group. The lactose content in milk observed in different parities where it was high in >sixth parity (4.694%) and least in second parity (4.666%).

Period of calving did not have any significant influence on the lactose. The milk lactose content of period 1 to 3 was 4.681, 4.677 and 4.676%, respectively. The study revealed that there was no significant effect of season of calving on lactose. The mean milk lactose in winter, summer and rainy seasons was 4.690, 4.673 and 4.669%, respectively.

5.2.5 Salts

The mean milk salts percent of Deoni cows was found to be 0.65 ± 0.001 . Age group and parity did not have significant influence on milk Salts. Salts in milk were highest (0.652%) in 7-9 years age group while it was lowest (0.648%) in 3-5 years age group. The salt content in milk observed in different parities where it was high in third parity (0.653%) and least in fifth parity (0.648%).

Period of calving did not have any significant influence on the milk salts. The milk salts content of period 1 to 3 was 0.650, 0.650 and 0.650%, respectively. The study revealed that there was no significant effect of season of calving on salts. The mean milk salts in winter, summer and rainy seasons was 0.650, 0.650 and 0.644%, respectively.



Summary

VI. SUMMARY

Deoni is a dual purpose cattle breed found in three colour variations i.e. Wannera, Balankya and Shevera. Deoni cattle is blessed novel with characters like adaptability and disease resistance. Deoni cattle breed is found in the neighboring districts of Gulbarga in Karnataka; Parbhani, Nanded and Osmanabad districts of Maharashtra and some parts of Medak district of Andhra Pradesh.

The present study entitled “Factors affecting lactation performance of Deoni cattle” was undertaken at Livestock Research Information Centre (Deoni), Bidar district Karnataka state with the following objectives.

1. To study the lactation performance of Deoni cattle.
2. To study the milk quality of Deoni cattle.
3. To analyse the factors affecting lactation performance of Deoni cattle.

In the present study age, parity, period of calving and season of calving influenced the production traits. Lactation milk yield was recorded using Test Interval Method specified by International Committee for Animal Recording. Peak yield was recorded as highest milk produced on a single day during lactation period. The Lactation length is the interval between the date of calving to the date of drying off. Persistency is the degree to which peak lactation yield is maintained during the remainder of the lactation season. Milk analyser was used to report the milk components such as fat, SNF, protein, lactose and salts.

The age group and parities of the Deoni cows were recorded from the data maintained at LRIC. Period of calving was recorded as July 15 to June 16 (Period 1), July 16 to June 17 (Period 2) and July 17 to June 18 (Period 3). Season of calving reported as rainy (Jul-Oct), winter (Nov-Feb) and summer (Mar-Jun) based on the agro-climatic conditions.

In all, 78 lactations were included in the study and subjected for statistical analysis. The statistical analysis was done using SAS software version 9.3 (2010) using General Linear Model procedure.

The overall mean for LMY, PMY, LL and Persistency of Deoni cattle was found to be 1297.99 ± 51.41 kg, 6.19 ± 0.147 kg, 291.68 ± 6.786 days and 207.68 ± 5.105 , respectively. The overall mean for milk fat, SNF, protein, lactose and salts in Deoni cattle was observed to be 4.8 ± 0.014 , 8.48 ± 0.008 , 3.1 ± 0.005 , 4.68 ± 0.005 and $0.65 \pm 0.001\%$, respectively.

There was significant effect of age group and parity on LMY and Milk Fat. There was significant effect of parity on PMY and also observed significant effect of season of calving on LL.

Conclusions:

The following conclusions can be drawn from the present study

1. Deoni cattle are highly suited as a dual-purpose breed (yielding milk, valuable calves, draught power and manure) for the agro-climatic conditions and semi intensive rearing practices followed in LRIC.

2. The study revealed that there was no significant effect of season of calving and period of calving on LMY and there was significant effect of season of calving on LL.
3. Significantly higher LL in rainy season calvers indicates no shortage of green fodder for animals.
4. Parity had a significant effect on LMY, PY and milk fat, there was improved performance in advanced parity from second to fifth. This indicates better productive life in Deoni cattle.
5. Persistency was not significantly affected by any of the factors studied.
6. The non-significant differences in milk composition, in general, indicate that milk production function was not affected by age, parity, period of calving and season of calving.

From the above study it could be concluded that Deoni cattle can be adapted to the seasonal changes. The standard management practices followed at the farm and availability of adequate amounts of green fodder round the year ensured that milk yield was not affected by season of calving. The high variation in the milk production of Deoni cattle is also indicative of further scope of improvement in the traits through selective breeding.



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Abstract



FACTORS AFFECTING THE LACTATION PERFORMANCE OF DEONI CATTLE

Supriya G**2019****Dr. Prashant G. Waghmare****ABSTRACT****Major Advisor**

The objective of this study was to document the lactation performance of Deoni cattle at the Livestock Research and Information Centre (Deoni), Hallikhed, a livestock research centre of Karnataka Veterinary Animal and Fisheries Sciences University, Bidar. The present study was conducted on 78 Deoni cows. This study was undertaken based on lactation performance data of Deoni cattle for the period July 2015 to June 2018. Period of calving was recorded as Period 1 (July 2015- June 2016), Period 2 (July 2016- June 2017) and Period 3 (July 2017- June 2018) Season of calving was recorded as summer (March to June), rainy (July to October) and winter (November to February). Cows were grouped based on age, parity, period of calving and season of calving to study the effect of each on lactation performance and milk composition. Results indicated that age group had significant effect on Lactation Milk Yield (LMY) and milk fat. Parity had significant effect on LMY, PY and fat. Season of calving had significant effect on LL. Period of calving had no effect on any of the traits. The overall mean values were estimated to be LMY 1297.99 ± 51.41 kg, PY 6.19 ± 0.147 kg, LL 291.68 ± 6.786 days, Persistency 207.68 ± 5.105 , fat $4.80 \pm 0.014\%$, SNF $8.48 \pm 0.008\%$, protein $3.10 \pm 0.005\%$, lactose $4.68 \pm 0.005\%$ and salt $0.650 \pm 0.001\%$. It was concluded that Deoni cattle are highly suited as a multi-purpose breed for Bidar district and there is potential for improvement in the performance of the breed by means of selective breeding techniques.