PERFORMANCE OF DEONI CATTLE UNDER FIELD CONDITIONS IN BIDAR DISTRICT

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CERTIFICATE

This is to certify that the thesis entitled **"*PERFORMANCE OF DEONI CATTLE UNDER FIELD CONDITIONS IN BIDAR DISTRICT*"** submitted by Mrs **AMBIKA**, I.D. No. **MVNK-1622** 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, associationship, fellowship or other similar titles.

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Date: JANUARY, 2019

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January, 2019 ***Ambika***

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LIST OF ABBREVIATIONS

Abbreviations	Expanded form
CCBP	Cattle Cross Breeding Project
CMT	California Mastitis Test
EC	Electrical Conductivity
GDP	Gross Domestic Product
i.e.	that is
IMI	Intra-mammary Inflammations
LL	Lactation Length
LMY	Lactation Milk Yield
LSA	Least Square Analysis of Variance
LSM	Least Square Means
NDDB	National Dairy Development Board
NDRI	National Dairy Research Institute
PY	Peak Yield
SAS	Statistical Analysis System
SCC	Somatic Cell Count
SCM	Subclinical Mastitis
SNF	Solids Not Fat
viz	namely
π	pie = 3.14
%	percentage
<	smaller than
=	equals to
>	greater than
±	plus or minus
≤	lesser than or equals to

INTRODUCTION

I. INTRODUCTION

India is the highest milk producer in the world. It's milk production increased consistently from 55.6 MT in 1991-92 to 165.4 MT in year 2016-17 (NDDB, 2017). The bovine population is 29.96 crores (NDRI, 2017). Agriculture and allied sector contribute 10.5% (Rs 11,435 crores) of the total GDP (Rs 72,489 crores) and the dairy sector contributes 25.8% of this. The dairy sector contributes 4.5% (Rs 5,606 crores) of the GDP (Basic Animal Husbandry and Fisheries Statistics, 2017). The female cattle population has increased by 6.52% over the previous census (2007) and the total number of female cattle in 2012 has been recorded to be 2.29 crores.

In spite of the presence of large and diverse cattle genetic resources, the productivity of cows remains low in the country for various reasons, such as inadequate nutrition, poor genetic potential, inadequate animal health services, the harsh climatic conditions and other management related problems.

India has 42 descript cattle breeds. According to breed-wise Census 2013 conducted by Department of Animal Husbandry, Dairying & Fisheries, pure Deoni cattle population is 1,51,236, graded Deoni cattle population is 2,00,364 contributing a percentage share of 0.23 with respect to total cattle population of India.

Deoni is a dual-purpose cattle breed of India. The migration of Gir breed of cattle to Marathwada region and the consequent admixture with Dangi and local cattle of north western and western parts of erstwhile Hyderabad state resulted in the formation of Deoni breed (Thorat, 2013). Genetically, the Deoni breed was evolved through the crossbreeding

of the Gir cattle of the Kathiawar region of Gujarat with the Dangi breed of Marathwada and local desi cattle of Nizam state from Bidar and Osmanbad (Joshi and Phillips, 1953). The home tract of Deoni breed is Udgir, Ahmedpur, Nilanga and Ausa tehsils of Latur district of Maharashtra and adjoining areas of Telangana, Bidar and Gulbarga districts of Karnataka state. Deoni bullocks are suitable for heavy cultivation and carting works (Suryawamshi *et al*., 2000).

Various non-genetic factors influence the productive performance therefore it is necessary to assess the effects of non-genetic factors i.e., parity and season of calving on different traits. Therefore, in current study the effects of non-genetic factors including parity, age and season of calving are explored on the production traits of Deoni cattle.

The chemical make-up of milk and its physical and chemical behaviour provide scientific basis for processing of milk and manufacturing of milk products. In India, milk from buffalo and cow (indigenous and cross-bred) is commercially important. Depending on its characteristics, each type of milk is eminently suitable for certain types of region-specific indigenous milk products. The processability and functionality of milk and milk products are determined by the properties and concentrations of its principal constituents i.e. proteins, lipids, lactose and salts. Therefore, an attempt is made to analyse the composition of Deoni cattle milk in this study.

Sub-clinical mastitis occurs worldwide, besides causing huge economic losses to milk production, the sub-clinical mastitis remains a continuous source of infection to other herd mates. If the infection persists for long periods, then it may form a fibrous tissue barrier between the organisms and the antibiotic preparations, thus, limiting their efficacy.

It is therefore, important to know the prevalence of sub-clinical mastitis in dairy herds and delineate the important factors responsible for it (Rabbani and Samad, 2010).

The average decrease in milk yield due to clinical and subclinical mastitis was 50 and 17.5 %, respectively. The economic loss were Rs. 603.87 and 483.10 crores due to subclinical mastitis and Rs. 285.64 and Rs. 234.59 crores due to clinical mastitis in cattle and buffaloes, respectively (Singh, 1994). The total economic loss due to subclinical mastitis was assessed to be in the range of Rs. 21,677 to 88,340 for a lactation period, depending on the condition of the animal (Rathod *et al*., 2017).

Keeping in view the above facts, the present study was undertaken with the following objectives:

1. To record the productive performance of Deoni cattle under field conditions in Bidar district.
2. To study the factors affecting the productive performance and milk quality in Deoni cattle.
3. To study the prevalence of subclinical mastitis in Deoni cattle.

REVIEW OF LITERATURE

II. REVIEW OF LITERATURE

2.1 Deoni cattle

The name of the breed is derived from Deoni Taluk of the Latur district, Maharashtra. The breed is also known as Surti, Dongarpati and Dongri in many areas. Deoni cattle are docile and calm. The forehead is prominent, broad, slightly bulged with black muzzle and black eyelids. Their eyes are prominent, bright and alert. The tips of the horns are blunt. They have strong and well-developed short neck. The hump is small in cows and massive and well developed in bulls. Their dewlap is thick, pendulous (less pendulous in cows than the bulls) and muscular with folds. The udder of Deoni cow is well attached and medium sized with squarely placed black teats. The tail is long, reaching below the hock, with black and white switch. Their hooves are black in colour and are well made. Lactation milk yield averaged 868 litres. The average fat content in the milk of Deoni cows was 4.3% (Singh *et al*., 2002).

Deoni breed, over the years, has evolved into three morphological types that are distinguished by their body colour patterns. They are Balankya, animals with complete white body coat and without any spots on the body; Wannera, animals with white body and black shades on sides of the face and Shevera/Waghya, animals with white and black shades or patches or spots scattered all over the body.

The present study to record the performance of Deoni cattle under field conditions in Bidar district of Karnataka was undertaken from April 2017 to October 2018. The study included the following major components:

a) Analysis of the performance of Deoni cows in the study area,

b) Study of the factors affecting the productive performance and milk quality in Deoni cattle, and

c) Study of the prevalence of subclinical mastitis in Deoni cows in the study area.

2.2 Lactation Performance of Deoni cattle

2.2.1 Lactation Milk Yield (LMY)

Deshpande (1970) studied records of Deoni breed of cattle maintained at Government Cattle Farm maintained at Hingole, Parbhani and Cattle Breeding Farm Udgir, Osmanabad. The number of lactations available at Hingole farm were 340 and Udgir farm were 427. The average LMY were reported to be 818.1 and 1041.9 kg at Hingoli and Udgir farms respectively.

Padwal (1975) analysed the lactation performance of Deoni cattle in Cattle Breeding Farm Udgir and Agriculture College Dairy farm Parbhani and reported the LMY of Deoni cow to be in the range from an average of 636.52 ± 29.05 to 1890.90 ± 31.46 litres. The overall average milk yield was 1120.49 ± 62.89 litres.

Thombre *et al*. (2001) analyzed the breeding records of Deoni cattle reared at Marathwada Agricultural University dairy farms over a period of 21 years (1974 to 1994) and reported LMY to be 518.23 ± 22.44 kg based on 544 observations.

Chakravarthi *et al*. (2002) reported LMY to be 238.86 ± 76.00 kg based on 54 lactation records of 30 Deoni cows maintained at Dairy Experimental Station, Hyderabad from 1997-2000.

Singh *et al*. (2002) studied a total 597 Deoni cows from 69 villages of 10 strata from the Latur district and one stratum each from the Parbhani, Nanded and Osmanabad districts of Maharashtra State and reported LMY to be 868.24±49.56 litres.

Gatchearle *et al.* (2009) studied performance of 122 calvings from *interse* progeny of HF x Deoni crossbreed cows maintained at Cattle Cross Breeding Project (CCBP), Marathwada Agriculture University, Parbhani (MS) for a period 12 years and reported LMY to be 1193.22 ± 44.79 kg.

Das *et al*. (2011) reported the overall mean lactation milk yield over 5 lactations of 228 Deoni cows reared at the NDRI Southern Regional Station at Bangalore from 2002 to 2008 to be 779.27 ± 18.31 kg. The lactation milk yield of the first five lactations was found to be 715.87 ± 32.11, 858.79 ± 32.72, 824.99 ± 40.47, 719.41 ± 43.82 and 187.61 ± 15.00 kg.

Das *et al*. (2012) reported a LMY to be 911.14 kg in the NDRI Southern Regional Station herd of Deoni cattle at Bangalore.

Bhutkar *et al*. (2014) analysed lactation records of 114 deoni cattle over a 30 years period in CCBP of Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and reported least square mean of LMY to be 358.31± 27.18 kg.

Kuralkar *et al*. (2014) studied the performance of Deoni cows in Latur district of Maharashtra and found LMY to be 910.95 ± 27.62 kg based on 204 observations.

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.

Saravanan *et al.* (2015) studied lactation performance of 51 Deoni cows maintained at NDRI, Southern Campus, Bangalore reported that the mean LMY in Deoni cows to be 824.44 ± 149.99 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, Vasantrao Naik Marathwada Agriculture University, Parbhani, and reported LMY to be 236.43 ± 12.71 kg.

Basak and Das (2018) in their study conducted on a total of 710 lactation records of 274 Deoni cattle maintained at ICAR-NDRI, Southern Campus, Bangalore, reported that the overall mean LMY to be 819.98 ± 16.50 kg.

2.2.2 Lactation Length (LL)

Deshpande (1970) studied records of Deoni breed of cattle maintained at Government Cattle Farm Hingole (Dist Parbhani) and Cattle Breeding Farm Udgir (Dist Osmanabad). The number of observations available at Hingole farm was 67 and Udgir farm was 79. The LL was reported to be 301 and 282 days at Hingoli and Udgir respectively.

Padwal (1975) studied 236 lactations of 63 cows at Cattle Breeding Farm Udgir and Agriculture College Dairy Farm, Parbhani and reported the overall average LL to be 317.55 ± 9.05 days with a coefficient of variation of 43.77 % with an average range of

169.14 ± 1.58 to 474.66 ± 3.89 days. As much as 60 % lactations fell between the range of 251 to 351 days.

Chakravarthi *et al*. (2002) studied 54 lactation records of 30 Deoni cows maintained at Dairy Experimental Station, Hyderabad from 1997-2000 and reported the LL to be 149.43 ± 33.52 days.

Gatchearle *et al.* (2009) studied performance of HF x Deoni crossbreed cattle maintained at CCBP, Marathwada Agriculture University, Parbhani and reported LL to be 284.88 ± 5.24 days.

Das *et al*. (2012) reported LL to be 206.03 days in the NDRI Southern Regional Station herd of Deoni cattle at Bangalore.

Bhutkar *et al*. (2014) analysed lactation records of 114 deoni cattle over a period of 30 years in CCBP of Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and reported LL to be 213.90 ± 13.74 days in Deoni cattle.

Patil (2014) studied lactation performance of 82 Deoni cows in field condition of Bidar district and reported LL to be 253.66 ± 2.29 days.

Basak and Das (2018) after their study of 710 lactation records of 274 Deoni cattle, maintained at ICAR-NDRI, Southern Campus, Bangalore, reported the lactation length to be 195.23 ± 2.62 days

2.2.3 Peak Yield (PY)

Deshpande (1970) studied records of Deoni breed of cattle maintained at Government Cattle Farm maintained at Hingole (Dist Parbhani) and Cattle Breeding Farm Udgir (Dist Osmanabad). The number of observations available at Hingole farm was 67 and Udgir farm was 79. The average PY was reported to be 4.373 and 4.582 kg at Hingoli and Udgir, respectively.

Kakde *et al*. (1980) reported PY in the first five lactations of Deoni cows reared at Government Cattle Breeding Farms, Hingoli and Udgir, Maharashtra to be 5.529, 5.721, 6.277, 5.822 and 5.645 kg, respectively.

Bhutkar *et al*. (2014) analysed lactation performance of 114 Deoni cows from 211 total records of lactation over a 30 years period were at CCBP of Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and reported PY to be 3.14 ± 0.18 kg.

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.

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, Vasantrao Naik Marathwada Agriculture University, Parbhani, and reported PY to be 7.12 ± 0.24 kg.

Thorat *et al.* (2016) analysed sixteen years data (1995-2010) on daily PY in Deoni cows at CCBP, Department of Animal Husbandry and Dairy Science, College of Agriculture, Parbhani, and reported the average PY to be 2.77 ± 0.14 kg.

2.3 Milk Composition of Deoni cattle

Hashmi (1975) studied Deoni cattle maintained at Agriculture College Dairy, Parbhani and variations in fat percentage were reported to be from 2.51 to 8.00 in individual cow milk and 2.75 to 6.9% in herd milk with the mean values of 4.29 ± 0.097 and 4.3 ± 0.089% respectively. He elucidated that the mean values for Solids Not Fat (SNF) were 9.66 ± 0.035 and 9.70 ± 0.030 with the range of 8.30 to 10.60 and 8.50 to 10.50% in individual cow milk and herd milk, respectively. The total protein range was reported to be 2.90 to 4.25 and 3.10 to 4.25 with the mean values of 3.85 ± 0.027 and 3.87 ± 0.030% for individual cow milk and herd milk respectively. Lactose was reported to be in the range of 4.10 to 5.60% in individual cow milk, and 4.2 to 5.5% in herd milk with the mean values of 4.95 ± 0.02% and 4.94 ± 0.024%, respectively.

Sontakke (1975) revealed that in Deoni cattle, the fat % ranged from 2.50 to 6.00% for individual cow milk with a mean value of 4.29 ± 0.097%, whereas for herd milk samples it varied from 2.76 to 6.90% and average being 4.31 ±0.069%. SNF % for individual cow milk was 9.76 ± 0.029 with a range of 8.30 to 10.60%. The corresponding values for herd milk were 9.70 ± 0.03 and a range of 8.51 to 10.50%, respectively.

Kumar (2004) in his study on pooled samples of Deoni milk collected from cattle yard, NDRI, Southern Campus, Bangalore, reported that the average fat in Deoni cattle milk was found to be 4.07 ± 0.39%. The fat varied from 3.60 to 4.50%. The average SNF was found to be 9.11±0.36%. The values were found to vary from 8.60 to 9.46%. The mean lactose content in Deoni milk was found to be 5.37 ± 0.16%. The values varied from 5.10

to 5.53% accounting for 40-42% of total solids of milk. The average protein content was 3.02%.

Patil (2014) studied lactation performance of 82 Deoni cows in field condition of Bidar district and reported a fat percentage of 4.25 ± 0.11 and SNF percentage of 9.02 ± 0.06.

2.4 Factors influencing lactation performance

2.4.1 Season of calving

Kakde *et al*. (1980) studied Deoni cows reared at Government Cattle Breeding Farms, Hingoli and Udgir, Maharashtra found that in the winter, summer and rainy season calvings, peak yield was reported to be 6.026, 6.002 and 5.570 kg, respectively, with corresponding days to reach peak yield of 38.68, 33.55 and 40.60 days.

Dhumal *et al*. (1993) reported that effect of season of calving and parity did not have a significant effect on the lactation milk yield and lactation length in Deoni cattle

Bhutkar *et al.* (2014) analysed data representing 114 Deoni cows from 211 total records of lactation over a 30 years period in CCBP of Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to reveal that the LMY was non-significantly affected by season of calving. Maximum production occurred during monsoon season. Milk production was decreased for cows calved in summer.

Chauhan and Ghosh (2015) studied milk data of Deoni cows with 438 lactation records from CCBP, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and LMY was reported to be highest (542.97 ± 16.40 lit) among the cows calved during winter season

as compared to rainy (515.91 ± 26.99 lit) and summer season (480.24 ± 18.52 lit). Also, LL was reported to be highest (289.07 ± 9.85 days) among the cows calved during winter season as compared to rainy (277.04 ± 5.3 days) and summer season (274.53 ± 7.29 days).

Saravanan *et al.* (2015) studied 51 lactating Deoni cows maintained at NDRI, Southern Campus, Bangalore; revealed LMY to be 1008.97 ± 85.81 (32) (July to February) 949.97 ± 90.00 (22) (March to June) PY to be 2.12 ± 0.27 (32) (July to February) 1.76 ± 0.28 (22) kg (March to June).

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.

Mote *et al.* (2016) analysed milk data of 145 HF x Deoni crossbred cows with 619 lactation records which were obtained from CCBP, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and revealed that lactation milk yield was highest among the cows calved during winter season (1136.56 ± 21.04 kg.) as compared to rainy (1073.30 ± 79.92 kg) and summer season (1096.70 ± 86.57 kg). Lactation length were reported to be highest for cows calved in winter season (295.29 ± 5.51 days) followed by rainy season (277.04 ± 5.30 days) and summer season (274.53 ± 17.29 days).

Thorat *et al.* (2016) analysed sixteen years data (1995-2010) on daily peak milk yield in Deoni cows at Cattle Cross Breeding Project, Department of Animal Husbandry and Dairy Science, College of Agriculture, Parbhani, and reported the average peak milk production was more during post monsoon season followed by south-west monsoon season/June to September (2.69 ± 0.11 kg), cold season/December to Feburary (2.65 ± 0.11kg) and hot season/March to May (2.30 ± 0.16kg), respectively.

Singh *et al*. (2017) studied lactation performance of Sahiwal cows maintained at Uttar Pradesh Livestock- cum- Agriculture Farm, Chak Ganjaria, Lucknow, U.P. The data comprising a total of 2985 records on lactation yield spanning over a period of 62 years (1949 to 2011) were analysed and reported that the highest lactation yield was recorded during winter season (2097.62 ± 24.69 kg) and lowest during summer season (2046.50 ± 25.08 kg).

Basak *et al.* (2018) in their study on 296 Deoni cattle maintained at National Dairy Research Institute, Southern Campus, Bengaluru, first lactation milk yield were reported to be 648.46 ± 45.9 (78) in winter season (Nov – Feb), 619.93 ± 37.3 (105) in summer season (Mar - June), 675.50 ± 51.1 (62) in rainy season (Jul – Oct).

Basak and Das (2018) after their study of 710 lactation records of 274 Deoni cattle, maintained at ICAR-NDRI, Southern Campus, Bangalore reported the LMY and LL to be 869.10 ± 29.01 kg, 200.58 ± 4.58 days (252) in winter, 763.63 ± 27.68 kg, 190.55 ± 4.46 days (242) in summer, 825.75 ± 28.40 kg, 194.22 ± 4.54 days (217) in monsoon, respectively.

2.4.2 Parity

Wondifraw *et al.* (2013) in their study of 256 HF × Deoni crossbred cows from cattle crossbreeding project with 1485 total records of lactation over a 30 years period reported that the lactation milk yield was significantly ($P < 0.01$) affected by parity. First lactation cows had lowest milk production, and highest production occurred in 5th parity. Also revealed it had significant ($P<0.01$) effect on LL. The milk yield per day of lactation length was significantly ($P<0.01$) affected by parity.

Saravanan *et al.* (2015) studied 51 lactating Deoni cows maintained at National Dairy Research Institute (NDRI), Southern Campus, Bangalore; revealed effect of parity on lactation milk yield to be 903.67 ± 99.37 (17), 1250.17 ± 211.22 (3), 716.16 ± 128.23 (9), 951.59 ± 117.41 (14), 1188.74 ± 163.28 (6), 866.49 ± 166.45 (5) for 1^{st} to 6^{th} parity, respectively.

Shingare (2015) studied 114 Deoni cows maintained at Cattle Cross Breeding Project, Vasantrao Naik Marathwada Agriculture University, Parbhani over a period of 25 years reported that Parity had non-significant effect on persistency and all lactation traits in this study. The least square means for LMY in 1st lactation was highest (281.91 ± 19.42 kg), while lowest for 3rd lactation (211.42 ± 19.65 kg). LMY showed decreasing trend from 1st to 3rd lactation and increasing trend from 4th to 5th lactation in Deoni cattle.

Singh *et al*. (2017) in their study of Sahiwal cattle reported that the variation in MY due to parity was found to be statistically highly significant and it varied from 1992.50 ± 26.07 kg during first lactation to 2153.60 ± 27.74 kg during third lactation.

Basak and Das (2018) after their study of 710 lactation records of 274 Deoni cattle, maintained at ICAR-NDRI, Southern Campus, Bangalore reported that lactation milk yield and lactation length of Deoni cattle were highly influenced ($P<0.01$) by parity of the cows. Effect of parity on lactation length and calving interval were non-significant. They also observed maximum LMY (1022.84 ± 46.84 kg) and LL (217.24 ± 7.26 days) were observed from the fifth and above parity. However, minimum LMY (671.25 ± 27.30 kg) and LL (184.77 ± 4.65 days) were found in first lactation.

2.4.3 Age

No reports regarding the effect of Age on the lactation performance were found.

2.5 Factors influencing Milk composition

2.5.1 Season

Mundhe (2016) studied 104 Deoni cows maintained at Southern Regional Station of NDRI Bengaluru, Vasantrao Naik Marathwada Krishi Vidyapeth, Parbhani and College of Veterinary and Animal Sciences, Udgir and reported that the effect of season on fat and SNF were moderately significant ($0.01< P± 0.05$) with fat and non-significant with SNF. Also, higher fat was recorded during summer season (4.77 ± 0.10 %) and lower during winter season (4.43 ± 0.07 %) in Deoni cattle.

Balasaheb (2018) after his study on Deoni cattle in CCBP, Vasantrao Naik Marathwada Agriculture University, Parbhani over a period of 25 weeks, reported chemical composition of milk is lowest in summer 3.57% fat and 8.51% SNF, in rainy season 3.23% fat and 8.43% SNF and highest in winter 3.92% fat and 8.71% SNF.

2.5.2 Parity

Munde (2016) studied 104 Deoni cows maintained at Southern Regional Station of National Dairy Research Institute Bengaluru, Vasantrao 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 % was observed during sixth (9.42 ± 0.29 %) and lower during seventh parity (8.69 ± 0.33 %).

2.5.3 Age

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

2.6 Prevalence of sub-clinical mastitis

Chahar (2001) collected 300 quarter milk samples from 78 apparently healthy cows in Bikaner city and the prevalence of sub-clinical mastitis was reported to be 39.00 and 60.25% based on culture examination, 46.33 and 70.51% based on SCC and 30.66 and 51.28% based on modified CMT on quarter and cow basis.

Khan and Muhammad (2005) studied quarter wise comparative prevalence of mastitis in 50 crossbred cows belonging to Ayub Agriculture Research Institute Faisalabad; Livestock Experimental Station, Department of Livestock Management, and Department of Animal Breeding and Genetics, University of Agriculture, Faisalabad Pakistan were aseptically collected using Surf Field Mastitis Test and prevalence of sub-clinical mastitis was reported to be 36%.

Sudhan *et al*. (2005) studied a total of 352 milk samples from apparently healthy quarters of lactating crossbred cattle of two different organized farms and revealed that the quarter-wise and animal-wise incidence of SCM was 15.62 and 43.33 %, respectively.

Sharma *et al*. (2010) studied a total of 335 quarter milk samples from crossbred (HF x Jersy) dairy cows of an organized dairy farm, Jammu. On the basis of CMT and SCC prevalence of SCM was reported to be 227 (67.76 %) and 180 (53.73%), respectively.

Supriya *et al*. (2010) examined a total of 240 milk samples from 60 apparently healthy lactating cows from an organized herd in Meerut, Uttar Pradesh. A total of 53.33% animals were culturally positive and 35% had SCC more than 5,00,000 cells/ml of milk. Quarter wise infection rate was reported to be 32.5% and 22.5% on basis of cultural isolation and SCC, respectively.

Bachaya *et al*. (2011) screened 2000 quarter milk samples from 500 crossbred cows. All the milk samples were subjected to Surf Field Mastitis Test (SFMT) and overall prevalence were reported to be 35.25 and 36% on quarters and cows basis, respectively.

Guha and Gera (2011) studied 176 apparently healthy Holstein x Haryana crossbred (F1) cattle with no history of mastitis from organized dairy farms. Accuracy of 84.7 and 86.3% were reported for CMT and SCC, respectively. They suggested that CMT in conjunction with SCC is better to diagnose SCM than alone.

Kaşikçi *et al.* (2011) studied a total of 386 milk samples collected from quarters of 188 cows at 10 different farms in Thrace region of Turkey. Of these samples, 258 (66.85%) were CMT (+), 85 (22.02%) were CMT (++), and 43 (11.13%) were CMT (+++). The

mean EC and SCC were reported to be 25.71, 28.02, and 29.63 mS and 249,453, 1,167,058, and 2,108,139 respectively. As a result, it has been concluded that EC showed similarity with the CMT and the SCC in the detection of subclinical mastitis; furthermore, its reliability would further increase when used together with the other diagnostic methods.

Mustafa *et al*. (2012) detected 24.71% prevalence of mastitis in cattle. The prevalence of both clinical and sub-clinical mastitis in cattle were reported to be 61.26 and 30.63%, respectively. Quarter-wise prevalence was reported to be 47.72, 11.36, 36.36 and 4.54% in the left fore, left hind, right fore and right hind quarters, respectively.

Kamal *et al*. (2014) investigated to find out the effectiveness of CMT and EC in the diagnosis of SCM in dairy cows in comparison to SCC as a standard method for detection of subclinical mastitis. They reported that CMT showed 73.0% of SCM positive samples which were similar to SCC results. EC of normal and mastitic cow’s milk sample's mean values to be 4.08 and 7.42 mS/cm respectively.

Kathiriya *et al*. (2014) determined the prevalence of SCM in lactating dairy cows of rural areas of Rajkot district of Gujarat during the period of July 2012 to April 2013. A total of 200 milk samples were collected for this study which were screened for SCM using White Side Test (WST), CMT, and Surf Field Mastitis Test (SFMT). Overall prevalence of SCM in lactating dairy cows were reported to be 29 % and with CMT, WST and SFMT the prevalence was 29.5, 27.5 and 25.5 %, respectively.

Mir *et al*. (2014) studied subclinical mastitis in machine milked dairy farm (10) in Ludhiana, Patiala, Moga, Bathinda and Ferozpur districts of Punjab. A total 218 HF ×

Sahiwal cross-bred dairy cows in milk were studied. About 872 quarter foremilk samples were collected to observe the prevalence of disease. Prevalence of subclinical mastitis was reported to be 57.80 % and 30.73% on animal and quarter basis, respectively.

Badiuzzaman *et al*. (2015) studied a total of 111 CB dairy cows (Sahiwal × Deshi) in Rajshahi Dairy and Breed Development Farm, Rajabari, Rajshahi, Bangladesh. Among the 444 quarter milk samples tested for SCM in lactating cows, 265 and 230 milk samples were reported to be CMT and SCC positive respectively. An accuracy of CMT and SCC were reported to be 75.68% and 91.22%, respectively.

Bangar *et al*. (2015) conducted a systematic review of prevalence of SCM in dairy cows for the period 1995–2014. The pooled estimate of prevalence of SCM on cow-basis was obtained using 6344 cows from 25 studies and was found to be 46.35%. Meta-analysis for quarter-wise prevalence of sub-clinical mastitis was carried out using 18,721 udder quarters of dairy cows from 23 studies, and the pooled estimate of prevalence of sub-clinical mastitis on quarter basis was found to be 23.25%.

Jena *et al*. (2015) conducted on randomly selected apparently healthy cows which visited Teaching Veterinary Clinical Complex, M.J.F. College of Veterinary and Animal Science, Chomu, Jaipur for sub clinical mastitis. Prevalence of subclinical bovine mastitis in animal level was reported to be 67.27 and 74.55% by CMT and SCC respectively.

Singh (2015) screened milk samples from 50 cows for sub-clinical mastitis and recorded the prevalence of 42% (84/200) and 66% (33/50) on quarter and animal basis

based on modified California Mastitis Test and recorded the highest prevalence of mastitis in fourth parity both on quarter and cow basis.

Preethirani *et al*. (2015) studied a total of 190 bubaline quarter milk samples that were collected under aseptic conditions from 57 domesticated dairy buffaloes from two organized farms (n = 64; Dharwad district, Karnataka) and three unorganized sectors (n = 126; in and around Bengaluru district, Karnataka). Positive subclinical mastitis reported to be 48.4, 40.0 and 45.8% by SCC, EC and CMT respectively. As compared to the gold standard of SCC, CMT performed the better. However, a combination of the two methods was found to be the best option.

Jagadeesh *et al*. (2016) upon evaluation of 150 cross-bred (CB) and 40 Nondescript (ND) cattle of Hassan district, Karnataka, India, 65 (43%) of CB cattle and 5 (12%) of ND cattle were reported to be positive for SCM on CMT and Mastrip test. Overall, 70 of 190 animals (37%) were positive for SCM. The Direct Microscopic Somatic Cell Count (DMSCC) enumeration found 0.3-0.5 million SCC per ml for normal and 0.6-1.5 million SCC per ml for SCM positive milk. The SCC enumeration was reported to be 0.3-0.5 million SCC per ml for normal and 0.6-1.5 million SCC per ml for SCM positive milk.

Kushwaha (2016) screened milk samples from 270 apparently healthy cows for sub-clinical mastitis, noted the prevalence of 16.29% (44/270) on basis of modified CMT and recorded the highest incidence of mastitis in 5^{th} parity, followed by 4^{th}, 3^{rd}, 2^{nd} and 1^{st} parity.

Dasohari *et al.* (2017) reported animal wise incidence of subclinical mastitis to be 66.18%, 59.56% and 55.15%, respectively in their epidemiological studies of subclinical mastitis in cows “in and around Hyderabad” in cows using CMT, White Side Test (WST) and Surf Field Mastitis Test (SFMT).

MATERIALS AND METHODS

III. MATERIALS AND METHODS

Deoni is an important dual-purpose cattle breed of India. It has a medium heavy built body. Male are good draft animals where as the females are average milk producers. It is found in three colour variations viz. Wannera, Balankya and Shevera. The body is moderately developed and symmetrical with distinct muscles. Males are more developed than females. Body colour is clear white in Wannera and Balankya strain. Irregular black spots are found on the body in Shevera. The head is partially white in Wannera. Head is masculine, alert, broad and slightly convex. The colour of the head is black and white in Wannera and Shevera and completely white in the Balankya strain. 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 poles; tips of the horns are blunt; and eyes are prominent, bright and alert with black eyebrows.

The Deoni cattle has a breeding tract with a total area of about 11,240 km^2 is located approximately between 17° 35" and 20° 05" N and between 75° 16" and 78° 15" E. The elevation of the breeding tract ranges from 409 to 455 m above mean sea level. The climate of the Deoni breeding tract is generally hot throughout the year except for some winter months. The average temperature varies from 9 to 44°C and the average relative humidity from 40 to 54 percent. Lactation milk yield averaged 868 litres. The average fat content in the milk of Deoni cows was 4.3 percent (Singh *et al*., 2002).

The name "Bidar" appears to be derived from 'bidiru' which means bamboo. Bidar is a hill-top city situated on the Deccan plateau, in the north-eastern part of Karnataka state

in India. Bidar covering an expanse of 5,448 square kilometres of land lies between 17 º 35” and 18º 25” north latitudes and 76^0 42 " and 77^0 39" east longitudes, with the districts of Nizamabad and Medak in Andhra Pradesh on the east and the districts of Nanded and Osmanabad in Maharashtra on the west. On the south lies the district of Gulbarga of Karnataka. The average elevation of the district is between 580 to 610 m above mean sea level. December is the coldest month with mean daily maximum temperature of 27.3^0 C and mean daily minimum of 16.4^0 C. May is the hottest month with mean daily maximum temperature of 38.8^0 C and mean daily minimum of 25.9^0 C. The average annual rainfall at Bidar is 847.2 mm. The variation in rainfall from year to year is large and the district is drought-prone. The average numbers of rainy days in the district are 52 (www.bidar.nic.in).

The present study entitled "Performance of Deoni cattle under field conditions in Bidar district" was carried out in 13 villages of Bidar (12 villages are of taluk Bhalki and one village of Aurad taluk). A baseline survey was carried out to identify Deoni animals being reared by farmers in the breeding tract of Deoni cattle in the state of Karnataka under the project "Field Performance Recording of Deoni cattle in Bidar District" as part of Rashtriya Gokul Mission sponsored by Karnataka Livestock Development Agency.

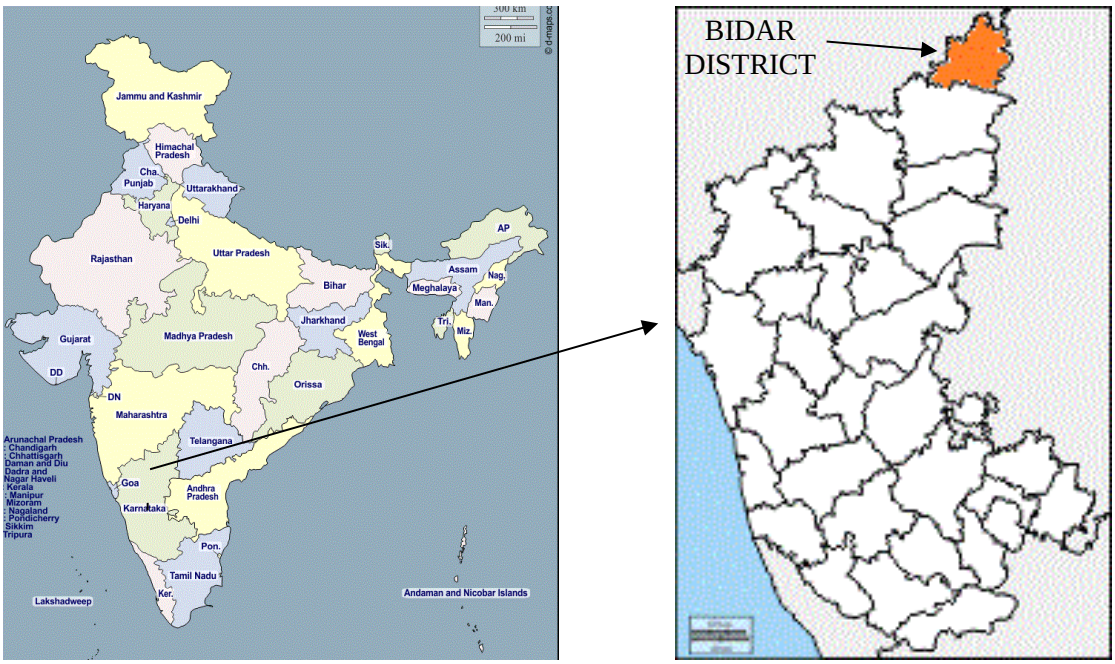
The state animal husbandry department along with National Dairy Development Board of India has started registration of Deoni cattle in Information Network for Animal Productivity and Health (INAPH) for performance recording of animals. It provides unique identification of animal along with the pedigree facts, lactation yields, record keeping of all activities related to breeding, nutrition, health and other important information related to the animal.

Plate 1: Deoni cow, Wannera type

Plate 2: Deoni cow, Balankya type

Plate 3: Deoni cow, Shevera/Waghya type

Plate 4: Map of Bidar district showing location of selected villages



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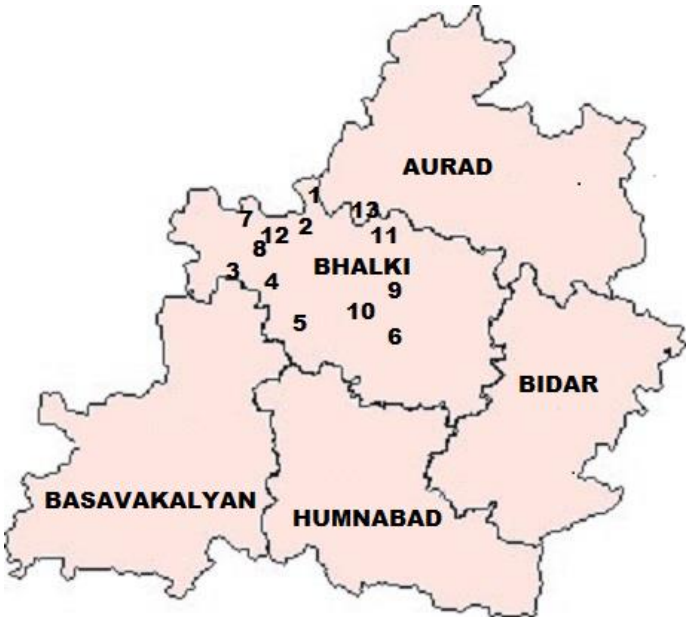


LEGEND

1. LAKHANGAON
2. KAKNAL
3. MEHKAR
4. SAIGAON
5. LADHA
6. TALWAD
7. MANIKESHWAR
8. ATTERGA
9. ATTNOOR
10. SOMPUR
11. DONGAPUR
12. SHIVNI
13. KALGAPUR

The performance records from April 2017 to October 2018 of 123 Deoni cows were compiled and analysed. The age group and parity of the animals were recorded. Season of calving was recorded as summer (March to June), rainy (July to October) and winter (November to February) based on agro-climatic conditions of the region.

3.1 Lactation performance:

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

$$MY = I_d M_1 + \frac{I_1 (M_1 + M_2)}{2} + \frac{I_2 (M_2 + M_3)}{2} + \ldots\ldots + \frac{I_{n-1} (M_{n-1} + M_n)}{2} + I_n M_n$$

where,

M_1, M_2 are 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.

3.1.2 Peak yield

The peak yield was recorded by the farmers as the maximum milk produced by the Deoni cow on a single day during the lactation period.

3.1.3 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.

Analysis of the factors influencing lactation performance – age group, parity and season of calving using Least Squares Analysis was carried out as per the procedure given by Harvey (1975) using SAS University Edition (ver. SAS Studio 3.8).

3.2 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 analyser (Vector®). The values were promptly recorded.

3.3 Screening for subclinical mastitis

A total of 125 milk samples from 12 villages were collected and were subjected to different mastitis diagnostic tests viz. California Mastitis Test (CMT), Electrical Conductivity (EC) and Mastrip test. Positive samples were subjected to Somatic Cell Count (SCC). The village Attnoor had one milk sample during the period of study, so it was not considered for statistical evaluation.

3.3.1 California Mastitis Test (CMT)

The test is based upon the amount of cellular nuclear protein present in the milk sample. CMT reflects the SCC level quite accurately (Mellenberger and Roth, 2000) and is a reliable indicator of the severity of infection. The CMT reagent dissolves or disrupts the outer cell wall and the nuclear cell wall of any leukocyte, which are primarily fat (detergent dissolves fat). DNA is now released from the nuclei and together forms a stringy mass. As the number of leukocytes increase in a quarter, the amount of gel formation will increase linearly.

The CMT provides only an indication of somatic cell count, not an exact value. The CMT was performed on the individual milk samples as per procedure of Schalm and Noorlander (1957) employing a modified CMT reagent of Sharma and Rajani (1969) which comprised of:

Sodium hydroxide	:	15.00 g
Teepol	:	5.00g
Bromothymol blue	:	0.10 g
Distilled water	:	1000 ml

About 3 ml of milk from a quarter was taken in a cup of the CMT paddle and an equal volume of reagent was added to it and the contents were mixed gently by horizontal rotation for 15-30 seconds and the results were recorded as:

Negative = Normal

Traces = No distinct wave, tiny lumps

\+ = Thick and definitive wave like, not adhered to the bottom of cup

++ = markedly thick and adhered to the bottom of cup

+++ = Too much thickening which appeared like a ball

CMT reactions were scored according to Radostitis *et al.* (2007) as follows

CMT scoring system (Scandinavian scale)

Score	Interpretation	SCC range
Negative	The mixture remained liquid with no evidence of precipitation	0-2 lakh cells/ml
Trace	A slight precipitation, that tends to disappear with continued movements of the paddle	1.5-5 lakh cells/ml
+/Weak positive	A distinct precipitation was formed but no tendency toward gel formation	4-15 lakh cells/ml
++/Distinct positive	The mixture thickens immediately due to gel formation. Mixture tends to move towards the centre leaving the bottom of the outer edge during swirling motion	8-50 lakh cells/ml
+++/strong positive	A distinct gel forms that tend to adhere to bottom of the paddle and a distinct centre peak forms during swirling.	More than 50 lakh cells/ml

3.3.2 Electrical Conductivity (EC)

Principle: The test is based on the ionic changes which occur during intra-mammary inflammations (IMI). Since the sodium and chloride concentrations increase in milk, the electrical conductivity of milk increases which can be detected by an electrical conductivity meter.

Procedure: Electrical Conductivity of milk sample was determined by using a hand-held Ecotester (Oakion®). Initially, the instrument calibration was checked with potassium chloride solution provided by the manufacturer. Five ml of milk sample was placed into the receptacle of milk checker and instrument is switched on to read the conductivity in milliSiemens per centimetre (mS/cm). The stable readings displayed in the display window of the electrical conductivity meter were recorded promptly. The standard range for EC of normal milk is between 4.0-5.5mS/cm (Spakauskas *et al*., 2006).

3.3.3 Impregnated pH Strip Test (Mastrip test)

The pH strip test was performed as per procedure mentioned by Davis (1999). Mastrip is a cellulose based Bromothymol blue (BTM) strip impregnated with stabilized ion sensitive indicator for detection of mastitis.

Procedure:

1. Quarter milk samples were first mixed by inverting the milk containing tubes 10-20 times to obtain a uniform distribution of cells.
2. The mixed samples were then allowed to stand for 2-5 minutes to permit air bubbles to rise and the foam to disappear.
3. One drop of milk with the help of micropipette with plastic needle was put on one strip of Mastrip and change in colour of the strip was observed within 30 seconds.
4. Separate strip was used for each quarter milk sample.

The interpretation of the changed colour was one as follows:

Colour Index	Indication
Yellow	Normal
Greenish yellow	Sub-clinical mastitis
Green	Advanced sub-clinical mastitis
Blue	Clinical mastitis

3.3.4 Somatic Cell Count (SCC)

Somatic cell count is an indicator of the milk quality. White blood cells (leukocytes) constitute the majority of somatic cells in question. The number of somatic cells will be increased in response to pathogenic bacteria causing mastitis. The SCC is quantified as cells per ml.

The procedure followed was according to the general principle advocated by Prescott and Breed, and as detailed by Schalm *et al*. (1971).

Procedure:

i) The milk samples were mixed 15-25 times to obtain a uniform distribution of cells. The samples were allowed to stand for 2-5 min to permit air bubbles to rise and foam to disappear. Identification number of the sample was written on a clean microscopic slide.

ii) A level surface was selected and the slide was placed over the template to outline four 1 sq.cm. areas. Ten µl of milk was placed exactly in the centre of the 1 sq.cm. template

and was spread evenly to cover all the area delineated by the template. From each sample, two films were prepared using successive areas of the slide. The films were dried at room temperature.

iii) The slide was placed on the slide rack and the smears were flooded with Newman Modified stain (Himedia) for 1 min. The excess stain was drained off by running water and air dried.

iv) Stained films were examined under oil immersion objective and the number of cells in 20 fields was counted. The fields were selected by moving the slide horizontally from one edge of the film through the centre to the opposite edge and then, repeated in a vertical direction. The average number of cells per field was multiplied by the microscopic factor.

v) The diameter of the microscopic field seen through oil immersion objective was measured using a stage micrometer slide ruled in 0.1and 0.01mm. The diameter of the field was measured up to two decimal points and the area of the field was calculated using the formula Πr^2.

$$\text{Microscopic factor (MF)} = \frac{\text{Area of the smear (in mm}^2\text{)}}{\text{Area of the microscopic field}}$$

The diameter was 0.16, then r = 0.08 so,

$$\text{Microscopic factor (MF)} = \frac{100}{3.14\text{x}0.08\text{x}0.08}$$

$$\text{Microscopic factor (MF)} = 4972 \approx 5000$$

Since the milk sample taken on the slide was 0.01 ml, the total number of cells per ml of milk was calculated using formula:

Cell count per ml of milk = Average number of cells per field×MF×100.

In present study the SCC of more than 2,00,000 per ml of milk was considered as positive for subclinical mastitis (International Dairy Federation, 1997; Hillerton, 1999; Guha and Guha., 2012*)*

RESULTS

IV. RESULTS

4.1 Production Performance of Deoni cattle and Factors Affecting Performance

4.1.1 Lactation Milk Yield

The Least Square Analysis of Variance (LSA) and Least Square Means (LSM) for LMY are given in Table 4.1 and 4.2, respectively. The overall mean for LMY of Deoni cattle was found to be 966.08 ± 35.915 kg. As per the LSA of LMY in Deoni cattle, there was no significant effect of age group, parity and season on LMY.

LMY was highest (973.00 ± 148.680) in 10-12 years age group while it was lowest (802.49 ± 145.410) kg in 12-14 years age group. However, there was no significant difference observed. The LMY observed during various parity in Deoni cows were 1st (767.95 ± 175.840), 2nd (819.89 ± 133.310), 3rd (772.12 ± 116.920), 4th (868.71 ± 120.780), 5th (912.03 ± 133.580), 6th (791.94 ± 187.930), 7th (882.43 ± 207.120), 8th (1074.01 ± 336.920) and 9th (1106.87 ± 441.000) kg. Cows calving in rainy season had highest LMY (1052.30 ± 81.907 kg) followed by winter (1003.38 ± 83.196 kg) and summer (609.64 ± 253.560 kg).

4.1.2 Lactation Length

The LSA and LSM for LL of Deoni cattle under this study are given in Table 4.3 and 4.4 respectively. The overall mean for LL of Deoni cattle was observed to be 259.15 ± 4.883 days. Age group and parity had no significant effect on LL of Deoni cattle. However, season had significant effect on the LL of cattle under this study.

Highest LL (230.26 ± 18.239 days) was observed in the age group 6-8 years while lowest (209.60 ± 14.959 days) in 8-10 years, though no significant difference between the age groups was observed. Highest LL of 239.38 ± 20.607 days was in 1st parity and lowest LL of 188.71 ± 51.684 days was observed during 9th parity. Cows calving in summer had shorter LL of 140.20 ± 29.716 days, winter had LL of 236.56 ± 9.750 was intermediate and cows calving in rainy had highest LL of 277.49 ± 9.599 days, differences being significant ($P<0.05$).

4.1.3 Peak Yield

The LSA and LSM for PY of Deoni cattle are given in Table 4.5 and 4.6, respectively. The overall mean for PY of Deoni cattle was observed to be 5.69 ± 0.176 kg. All three factors viz age group, parity and season of calving had no significant effect on PY of Deoni cattle.

Highest PY of 6.47 ± 0.720 kg was observed in the age group 10-12 years whereas least PY of 5.09 ± 0.705 kg was observed in the age group 12-14 years. PY observed in 4-6, 6-8- and 8-10-years age group were 6.25 ± 0.866, 6.36 ± 0.754 and 6.03 ± 0.618 kg, respectively.

Highest PY of 9.19 ± 2.137 kg was observed during the 9th parity and least PY of 4.83 ± 0.852 kg was observed during 1st parity. Highest PY was observed in cows calved in winter followed by rainy and least being summer season with values 6.42 ± 0.403, 5.95 ± 0.397 and 5.74 ±1.229 kg, respectively.

4.2 Milk Composition of Deoni cattle and Factors Affecting Composition

4.2.1 Fat

The LSA and LSM of milk fat percentage in Deoni cattle are represented in Table 4.7 and 4.8, respectively. The overall mean for milk fat in Deoni cattle was observed to be 4.492 ± 0.0233 %. It was observed that age group had significant effect while parity and season was had no significant effect on milk fat percentage of the cows.

Highest fat percentage of 4.681 ± 0.0910 was observed in the age group 10-12 years and lowest of 4.451 ± 0.0890 in 12-14 years. Fat content in age groups 4-6, 6-8 and 8-10 years were 4.549 ± 0.1095, 4.451 ± 0.0952 and 4.441 ± 0.0781%, respectively.

Highest fat percentage (4.809 ± 0.2063) was observed in 8^{th} parity and lowest (4.356 ± 0.2700) in 9^{th} parity, though the differences were non-significant. Cows calved in winter season had highest milk fat percentage of 4.57 ± 0.051 followed by rainy 4.49 ± 0.050 and summer 4.48 ± 0.155.

4.2.2 Solids Not Fat

The LSA and LSM for SNF in milk of Deoni cattle are given in Table 4.9 and 4.10, respectively. The overall mean of SNF percentage was found to be 8.181 ± 0.0117. Age group, parity and season of calving had no significant effect on SNF content of Deoni milk.

Highest SNF of 8.264 ± 0.0558 % was observed in the age group 4-6 years and lowest of 8.138 ± 0.0398 % was in 8-10 years age group. Highest SNF content of 8.401 ± 0.1052 % was observed in 8^{th} parity while lowest of 8.038 ± 0.1377 % was in 9^{th} parity. SNF content in 1^{st} ,2^{nd}, 3^{rd}, 4^{th}, 5^{th}, 6^{th} and 7^{th} parities were 8.144 ± 0.0549, 8.184 ± 0.0416,

8.169 ± 0.0365, 8.208 ± 0.0365, 8.237 ± 0.0417, 8.190 ± 0.0587 and $^{8.170}$ ± 0.0646% , respectively.

SNF percentage in milk varied from 8.207 ± 0.0791 in summer, 8.188 ± 0.0256 in rainy to 8.185 ± 0.0259 in winter season of calving, though differences were not significant.

4.2.3 Protein

The Least Squares Analysis of Variance and Least Square Means for protein content of Deoni cattle milk are given in Table 4.11 and 4.12, respectively. The overall mean of protein content was found to be 3.156 ± 0.0073 %. There was no significant effect of age group, parity and season on milk protein content of Deoni cattle.

Protein percentage in the age group 4-6, 6-8, 8-10 and 10-12 years were 3.199 ± 0.0342, 3.199 ± 0.0298, 3.188 ± 0.0244, 3.197 ± 0.0285 and 3.214 ± 0.0279, respectively.

7^{th} parity of Deoni cows had lowest protein content of 3.115 ± 0.0397 % and 9^{th} parity cows had highest of 3.402 ± 0.0845 %. Protein percentage was highest in cows calving in summer season (3.246 ± 0.0486%), intermediate in winter (3.190 ± 0.0159) and lowest in rainy season (3.163 ± 0.0157%).

4.2.4 Lactose

The LSA and LSM of lactose percentage in milk of Deoni cattle are represented in Table 4.13 and 4.14, respectively. The overall mean for lactose percentage in milk of Deoni cattle was observed to be 4.410 ± 0.0112. It was observed that age group, parity and season had no significant effect on lactose content of milk.

Cows of the age group 4-6 years had lactose percentage of 4.512 ± 0.0529 while 4.355 ± 0.0430 was observed in 12-14 years age group. 8th parity had 4.577 ± 0.0997 % lactose content while 3rd and 2nd parity had 4.36 ± 0.035 and 4.36 ± 0.039 %, respectively. Lactose content was 4.455 ± 0.0750, 4.449 ± 0.0242 and 4.406 ± 0.0246 % in summer, rainy and winter season of calving, respectively.

4.2.5 Salts

The LSA and LSM for milk salts of Deoni cattle are given in Table 4.15 and 4.16, respectively. The overall mean of salt percentage in Deoni cow milk was found to be 0.6374 ± 0.00176. Age of the cow and parity had no significant effect on salt content of Deoni milk. Season of calving was found to have significant effect on milk salts content.

A trend of decreasing salt content with age group of the animal was observed, age group of 4-6 years had salt content of 0.6519 ± 0.00834% and 12-14 years was 0.6367 ± 0.00678%. Salt content was increasing with the parity of cow. 1st parity had highest salt content of 0.6299 ± 0.00820 % while 9th had lowest salt content of 0.6624 ± 0.02057 %.

Season had a significant ($P< 0.05$) effect on salt content of milk. Highest salt content of 0.6467 ± 0.00382% was observed in rainy season followed by summer 0.6449 ± 0.01182% and winter 0.6372 ± 0.00388%.

4.3 Prevalence of Subclinical Mastitis in Deoni cattle

4.3.1 California Mastitis Test

In the present investigation, California Mastitis Test was carried out in 125 Deoni cows. Of these 23 were CMT positive. Table 4.17 represents the prevalence of SCM in

different villages of Bidar district using CMT in Deoni cattle. Overall prevalence of SCM using CMT was found to be 18.40%

The village wise prevalence of SCM ranged from 66.66 % in Dongapur to 0.00% in Kaknal and Kalgapur. Village Ladha had second highest prevalence of 50%. Low prevalence 7.14% was observed in village Shivni with highest number of milk samples.

4.3.2 Electrical Conductivity

Prevalence of SCM using EC in Deoni cattle are represented in Table 4.18. Overall mean for prevalence of SCM using EC test was found to be 4.80%. Out of 125 samples only 6 milk samples were found positive for SCM using EC, which was least among all other tests used in this study.

The highest mean of 5.13 ± 0.131 mS/cm was observed in Lakhangoan village and least of 4.15 ± 0.0278 mS/cm in Saigaon. The village wise prevalence of SCM ranged from 22.22% in Dongapur to 0.00% in Kaknal, Kalgapur, Ladha, Mehkar, Saigaon, Shivni, and Sompur.

4.3.3 Mastrip Test

Prevalence of SCM using Mastrip test in Deoni cattle are presented in Table 4.19. Out of 125 milk samples tested for SCM using Mastrip test, 27 were found positive. Overall prevalence of SCM using Mastrip test was found to be 21.60%.

The village wise prevalence of SCM ranged from 77.77% in Dongapur to 0.00% in Kaknal and Kalgapur. Village Shivni with highest number of samples tested 10.71%

positive. Village Atterga had 42.85% prevalence, village Ladha had 50% prevalence of SCM.

4.3.3 Somatic Cell Count

In the present study, prevalence of SCM using SCC in Deoni cattle is presented in Table 4.20. Overall prevalence of SCM was found to be 21.60%. Out of 125 milk samples tested for SCM using SCC test, 27 were found to be positive.

The village wise prevalence of SCM ranged from 77.77% in Dongapur to 0.00% in Kaknal and Kalgapur. Village Shivni with highest samples tested 10.71% positive. Village Ladha had second highest prevalence of 50 % for SCM.

4.3.5 Comparison of Different Techniques for Detection of SCM in Deoni cattle

The comparison of different techniques for detection of SCM in Deoni cattle is represented in Table 4.21. Accuracy in comparison with SCC was highest (100%) in Mastrip test followed by CMT (85.18%) and EC (25.92%). SCC above 2lakhs cell/ml and EC above 5.5mS/cm were taken as positive for SCM. All samples showing positive results by Mastrip were also positive by SCC.

Table 4.1: Analysis of Variance of Lactation Milk Yield in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	287126.1552	71781.5388	0.43	0.7887
Parity	8	323054.3159	40381.7895	0.24	0.9823
Season	2	565639.6159	282819.8080	1.68	0.1906

Table 4.2: Least Squares Means of Lactation Milk Yield in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	899.86	178.780
	6-8	28	932.67	155.630
	8-10	38	834.17	127.640
	10-12	15	973.00	148.680
	12-14	17	802.49	145.410
2.	**Parity**			
	1	13	767.95	175.840
	2	23	819.89	133.310
	3	25	772.12	116.920
	4	22	868.72	120.780
	5	22	912.03	133.580
	6	07	791.94	187.930
	7	08	882.43	207.120
	8	02	1074.01	336.920
	9	01	1106.87	441.000
3.	**Season**			
	Summer (Mar-Jun)	03	609.64	253.560
	Rainy (Jul-Oct)	70	1052.30	81.907
	Winter (Nov-Feb)	50	1003.38	83.196
	Overall	**123**	**966.08**	**35.915**

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

Table 4.3: Analysis of Variance of Lactation Length in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	5356.05986	1339.01497	0.58	0.6776
Parity	8	16653.25759	2081.65720	0.90	0.5177
Season	2	86881.92101	43440.96051	**18.82**	**<.0001**

Table 4.4 Least Squares Means of Lactation Length in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	219.64	20.952
	6-8	28	230.26	18.239
	8-10	38	209.60	14.959
	10-12	15	220.93	17.425
	12-14	17	209.97	17.042
2.	**Parity**			
	1	13	239.38	20.607
	2	23	201.75	15.623
	3	25	213.84	13.703
	4	22	230.50	14.155
	5	22	226.38	15.655
	6	07	216.36	22.025
	7	08	219.68	24.273
	8	02	228.14	39.485
	9	01	186.71	51.684
3.	**Season**			
	Summer (Mar-Jun)	03	**140.20** [a]	**29.716**
	Rainy (Jul-Oct)	70	**277.49** [b]	**9.599**
	Winter (Nov-Feb)	50	**236.56** [c]	**9.750**
	Overall	**123**	**259.15**	**4.883**

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

Table 4.5: Analysis of Variance of Peak Yield in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	10.33768743	2.58442186	0.65	0.6246
Parity	8	25.61345460	3.20168182	0.81	0.5940
Season	2	6.28919001	3.14459501	0.80	0.4533

Table 4.6: Least Squares Means of Peak Yield in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	6.25	0.866
	6-8	28	6.36	0.754
	8-10	38	6.03	0.618
	10-12	15	6.47	0.720
	12-14	17	5.09	0.705
2.	**Parity**			
	1	13	4.83	0.852
	2	23	5.99	0.646
	3	25	5.38	0.567
	4	22	5.36	0.585
	5	22	5.55	0.647
	6	07	5.26	0.911
	7	08	6.19	1.004
	8	02	6.58	1.633
	9	01	9.19	2.137
3.	**Season**			
	Summer (Mar-Jun)	03	5.74	1.229
	Rainy (Jul-Oct)	70	5.95	0.397
	Winter (Nov-Feb)	50	6.42	0.403
	Overall	**123**	**5.69**	**0.176**

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

Table 4.7: Analysis of Variance of Milk Fat in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	0.72051835	0.18012959	**2.86**	**0.0269**
Parity	8	0.32871523	0.04108940	0.65	0.7320
Season	2	0.14180345	0.07090173	1.13	0.3282

Table 4.8 Least Squares Means of Milk Fat in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	4.549 [ab]	0.1095
	6-8	28	4.451 [b]	0.0952
	8-10	38	4.441 [b]	0.0781
	10-12	15	4.681 [a]	0.0910
	12-14	17	4.446 [b]	0.0890
2.	**Parity**			
	1	13	4.453	0.1077
	2	23	4.462	0.0816
	3	25	4.523	0.0715
	4	22	4.465	0.0739
	5	22	4.563	0.0817
	6	07	4.510	0.1151
	7	08	4.482	0.1268
	8	02	4.809	0.2063
	9	01	4.356	0.2700
3.	**Season**			
	Summer (Mar-Jun)	03	4.480	0.1553
	Rainy (Jul-Oct)	70	4.494	0.0501
	Winter (Nov-Feb)	50	4.566	0.0509
	Overall	**123**	**4.492**	**0.0233**

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

Table 4.9: Analysis of Variance of Milk Solids Not Fat in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	0.11809291	0.02952323	1.80	0.1335
Parity	8	0.16151078	0.02018885	1.23	0.2869
Season	2	0.00134634	0.00067317	0.04	0.9597

Table 4.10: Least Squares Means of Milk Solids Not Fat in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	8.264	0.0558
	6-8	28	8.188	0.0486
	8-10	38	8.138	0.0398
	10-12	15	8.195	0.0464
	12-14	17	8.181	0.0454
2.	**Parity**			
	1	13	8.144	0.0549
	2	23	8.184	0.0416
	3	25	8.169	0.0365
	4	22	8.208	0.0377
	5	22	8.237	0.0417
	6	07	8.190	0.0587
	7	08	8.170	0.0646
	8	02	8.401	0.1052
	9	01	8.038	0.1377
3.	**Season**			
	Summer (Mar-Jun)	03	8.207	0.0791
	Rainy (Jul-Oct)	70	8.188	0.0256
	Winter (Nov-Feb)	50	8.185	0.0259
	Overall	**123**	**8.181**	**0.0117**

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

Table 4.11: Analysis of Variance of Milk Protein in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	0.00525181	0.00131295	0.21	0.9308
Parity	8	0.09978009	0.01247251	2.02	0.0503
Season	2	0.03521281	0.01760641	2.86	0.0619

Table 4.12: Least Squares Means of Milk Protein in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	3.199	0.0342
	6-8	28	3.199	0.0298
	8-10	38	3.188	0.0244
	10-12	15	3.197	0.0285
	12-14	17	3.214	0.0279
2.	**Parity**			
	1	13	3.221	0.0337
	2	23	3.179	0.0255
	3	25	3.171	0.0224
	4	22	3.183	0.0231
	5	22	3.192	0.0256
	6	07	3.162	0.0360
	7	08	3.115	0.0397
	8	02	3.170	0.0645
	9	01	3.402	0.0845
3.	**Season**			
	Summer (Mar-Jun)	03	3.246	0.0486
	Rainy (Jul-Oct)	70	3.163	0.0157
	Winter (Nov-Feb)	50	3.190	0.0159
	Overall	**123**	**3.156**	**0.0073**

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

Table 4.13: Analysis of Variance of Milk Lactose in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	0.10114375	0.02528594	1.72	0.1512
Parity	8	0.14293903	0.01786738	1.21	0.2977
Season	2	0.04991558	0.02495779	1.70	0.1883

Table 4.14: Least Squares Means of Milk Lactose in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	4.512	0.0529
	6-8	28	4.443	0.0461
	8-10	38	4.418	0.0378
	10-12	15	4.454	0.0440
	12-14	17	4.355	0.0430
2.	**Parity**			
	1	13	4.396	0.0520
	2	23	4.363	0.0395
	3	25	4.359	0.0346
	4	22	4.435	0.0357
	5	22	4.459	0.0395
	6	07	4.444	0.0556
	7	08	4.496	0.0613
	8	02	4.577	0.0997
	9	01	4.400	0.1305
3.	**Season**			
	Summer (Mar-Jun)	03	4.455	0.0750
	Rainy (Jul-Oct)	70	4.449	0.0242
	Winter (Nov-Feb)	50	4.406	0.0246
	Overall	**123**	**4.410**	**0.0112**

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

Table 4.15: Analysis of Variance of Milk Salts in Deoni cattle

Source	DF	Type III SS	Mean Square	F Value	Pr > F
AgeGp	4	0.00123424	0.00030856	0.84	0.5000
Parity	8	0.00349289	0.00043661	1.19	0.3089
Season	2	0.00240835	0.00120418	**3.30**	**0.0408**

Table 4.16: Least Squares Means of Milk Salts in Deoni cattle

Sl.	Group	n	Mean	SE
1.	**Age Group (years)**			
	4-6	25	0.6519	0.00834
	6-8	28	0.6478	0.00726
	8-10	38	0.6409	0.00595
	10-12	15	0.6373	0.00693
	12-14	17	0.6367	0.00678
2.	**Parity**			
	1	13	0.6299	0.00820
	2	23	0.6357	0.00622
	3	25	0.6338	0.00545
	4	22	0.6289	0.00563
	5	22	0.6434	0.00623
	6	07	0.6406	0.00876
	7	08	0.6496	0.00966
	8	02	0.6619	0.01571
	9	01	0.6624	0.02057
3.	**Season**			
	Summer (Mar-Jun)	03	0.6449 [ab]	0.01182
	Rainy (Jul-Oct)	70	0.6467 [a]	0.00382
	Winter (Nov-Feb)	50	0.6372 [b]	0.00388
	Overall	**123**	**0.6374**	**0.00176**

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

Table 4.17: Prevalence of SCM in Deoni cattle using California Mastitis Test

Sl.	Village	n	Positive score				Negatives	% Positive
			Traces	1	2	3		
1.	Atterga	7	3	-	-	-	4	42.85
2.	Dongapur	9	3	3	-	-	3	66.66
3.	Kaknal	18	-	-	-	-	18	0.00
4.	Kalgapur	4	-	-	-	-	4	0.00
5.	Ladha	6	3	-	-	-	3	50.00
6.	Lakhangaon	6	2	-	-	-	4	33.33
7.	Manikeshwar	8	2	-	-	-	6	25.00
8.	Mehkar	6	1	-	-	-	5	16.66
9.	Saigaon	7	1	-	-	-	6	14.28
10.	Shivni	28	2	-	-	-	26	7.14
11.	Sompur	7	1	-	-	-	6	14.28
12.	Talwad	19	2	-	-	-	17	10.52
	Overall	**125**	**20**	**3**	**0**	**0**	**102**	**18.40**

Table 4.18: Prevalence of SCM in Deoni cattle using Electrical Conductivity test

Sl.	Village	n	Mean ± SE	Range	+ve	%
1.	Atterga	7	4.86 ± 0.189	4.3-5.6	1	14.28
2.	Dongapur	9	5.06 ± 0.244	4.6-6.8	2	22.22
3.	Kaknal	18	4.16 ± 0.186	2.5-5.4	0	0.00
4.	Kalgapur	4	4.83 ± 0.131	4.6-5.1	0	0.00
5.	Ladha	6	4.85 ± 0.106	4.5-5.2	0	0.00
6.	Lakhangaon	6	5.13 ± 0.131	4.7-5.6	1	16.66
7.	Manikeshwar	8	4.70 ± 0.167	4.2-5.7	1	0.13
8.	Mehkar	6	4.72 ± 0.130	4.3-5.1	0	0.00
9.	Saigaon	7	4.15 ± 0.278	3.2-5.6	0	0.00
10.	Shivni	28	4.43 ± 0.072	3.5-5.1	0	0.00
11.	Sompur	7	4.76 ± 0.115	4.3-5.3	0	0.00
12.	Talwad	19	4.87 ± 0.092	4.4-5.8	1	5.26
	Overall	**125**	**4.64 ± 0.052**	**2.5-6.8**	**6**	**4.80**

Table 4.19: Prevalence of SCM in Deoni cattle using Mastrip test

Sl.	Village	n	+ve	%
1.	Atterga	7	3	42.85
2.	Dongapur	9	7	77.77
3.	Kaknal	18	0	0.00
4.	Kalgapur	4	0	0.00
5.	Ladha	6	3	50.00
6.	Lakhangaon	6	2	33.33
7.	Manikeshwar	8	2	25.00
8.	Mehkar	6	1	16.66
9.	Saigaon	7	1	14.28
10.	Shivni	28	3	10.71
11.	Sompur	7	1	14.28
12.	Talwad	19	4	21.05
	Overall	**125**	**27**	**21.60**

Table 4.20: Prevalence of SCM in Deoni cattle using Somatic Cell Count

Sl.	Village	n	(Mean ± SE) x 10^6	(Range)x10^6	+ve	%
1.	Atterga	7	10.53 ± 0.356	9.85-11.05	3	42.85
2.	Dongapur	9	8.75 ± 0.942	6.50-12.50	7	77.77
3.	Kaknal	18	----	----	0	0.00
4.	Kalgapur	4	----	----	0	0.00
5.	Ladha	6	7.73 ± 1.258	6.45-10.25	3	50.00
6.	Lakhangaon	6	7.75 ± 0.25	7.50-8.00	2	33.33
7.	Manikeshwar	8	10.88 ± 0.125	10.75-11.00	2	25.00
8.	Mehkar	6	9.25	9.25	1	16.66
9.	Saigaon	7	9.25	9.25	1	14.28
10.	Shivni	28	5.95 ± 1.225	3.50-7.20	3	10.71
11.	Sompur	7	8.00	8.00	1	14.28
12.	Talwad	19	7.88 ± 0.554	6.5-9.00	4	21.05
	Overall	**125**	**8.49 ± 0.396**	**3.50-12.50**	**27**	**21.60**

Table 4.21: Comparison of different techniques for detection of SCM in Deoni cattle

Sl.	Cow No.	SCC	CMT	EC	MT
1.	2123	P	P	N	P
2.	3024	P	P	N	P
3.	3480	P	P	N	P
4.	3627	P	P	N	P
5.	3126	P	P	N	P
6.	1277	P	P	N	P
7.	2123	P	N	N	P
8.	2704	P	P	N	P
9.	3365	P	P	N	P
10.	3640	P	N	P	P
11.	1621	P	N	P	P
12.	1517	P	P	P	P
13.	4483	P	P	N	P
14.	1357	P	P	N	P
15.	1882	P	N	N	P
16.	1893	P	P	N	P
17.	3387	P	P	N	P
18.	0662	P	P	N	P
19.	4062	P	P	N	P
20.	0640	P	P	N	P
21.	3343	P	P	N	P
22.	4938	P	P	P	P
23.	0720	P	P	P	P
24.	0285	P	P	N	P
25.	4450	P	P	N	P
26.	3673	P	P	N	P
27.	3423	P	P	P	P
	Total	**27**	**23**	**06**	**27**

Plate 5: Collection of data from farmers

Plate 6: Collection of milk in CMT paddle

Plate 7: CMT positive milk sample

Positive for subclinical mastitis

Plate 8: Electrical conductivity reading of the sample

Plate 9: Mastrip showing colour change in positive sample

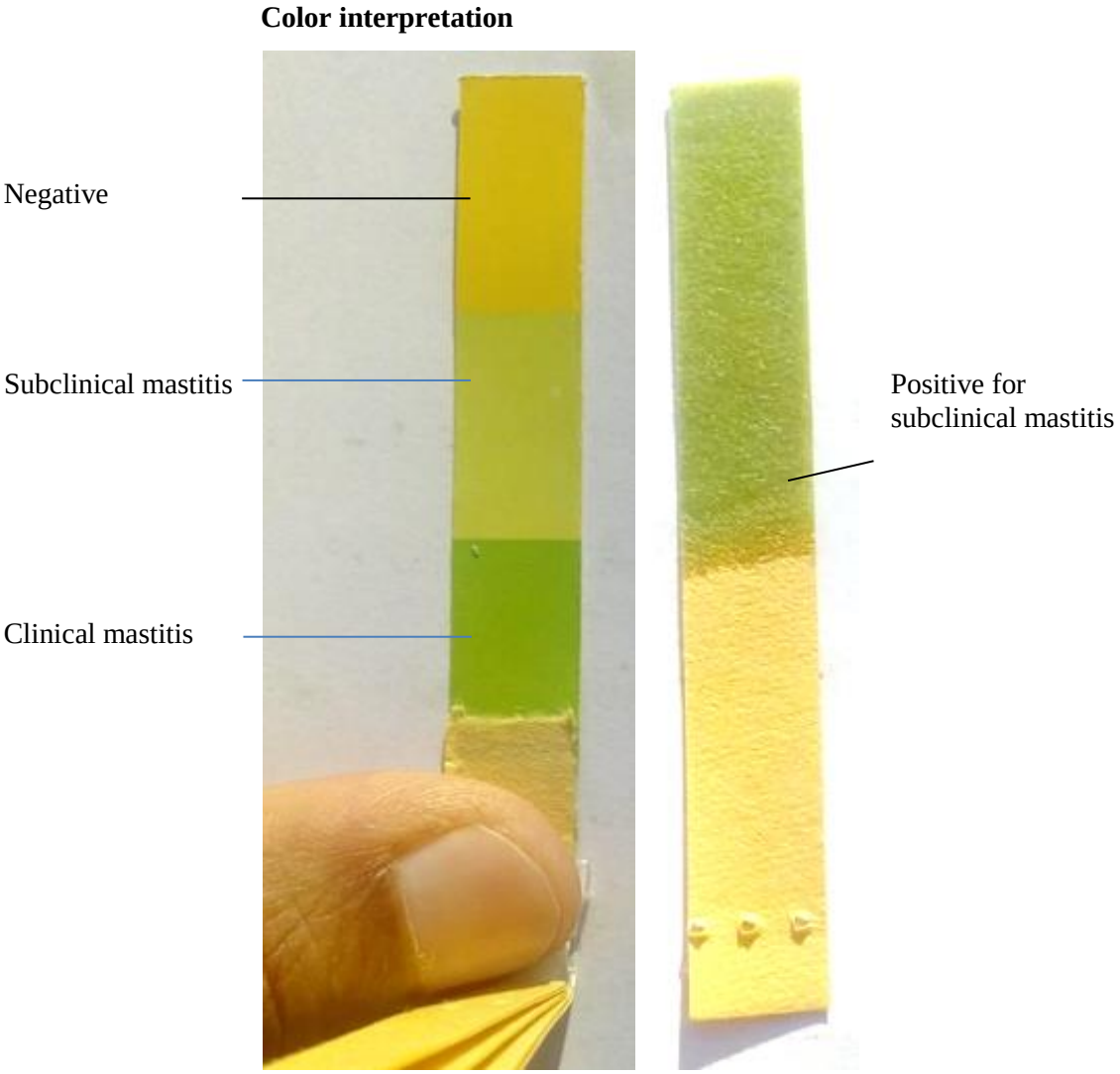
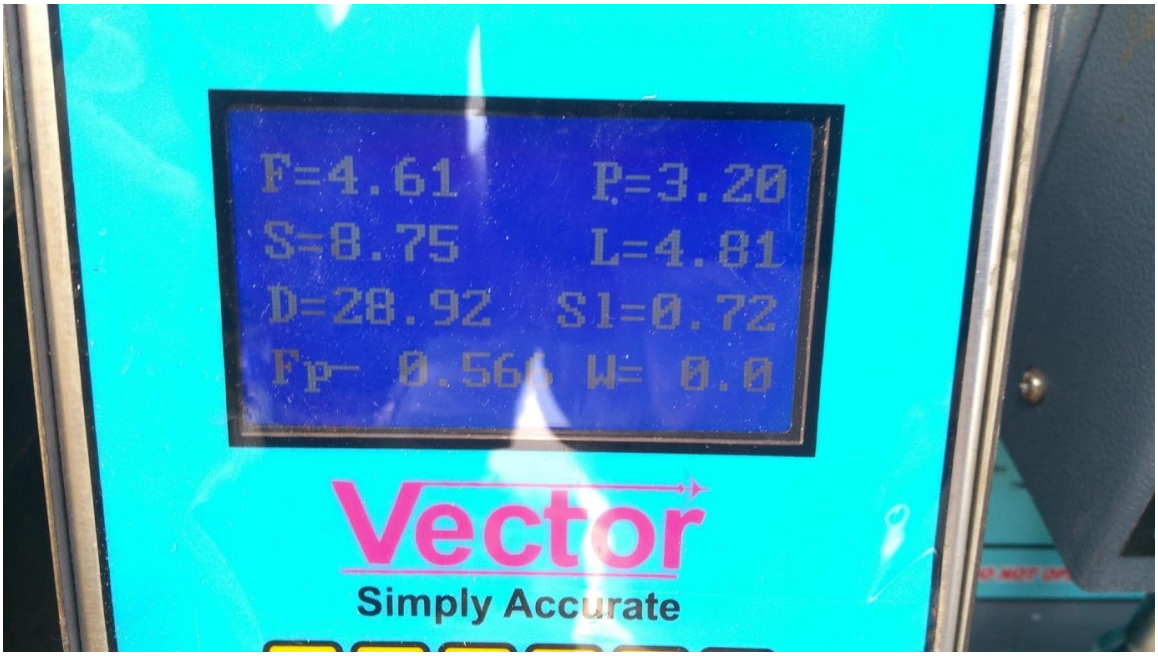


Plate 10: Testing of milk sample in milk tester



DISCUSSION

V. DISCUSSION

5.1 Production Performance of Deoni cattle and factors affecting it

5.1.1 Lactation Milk Yield (LMY)

The present study was carried on 123 Deoni cows maintained at field conditions in their home tract district of Bidar. The overall mean for LMY of Deoni cattle was found to be 966.08 ± 35.915 kg.

Lower LMY were reported by Shingare *et al*. (2015) (236.43 ± 12.71 kg), Bhutkar *et al*. (2014) (358.31± 27.18 kg), Das *et al*. (2011) (779.27 ± 18.31 kg), Chakravarthi *et al*. (2002) (238.86 ± 76.00 kg) and Thombre *et al*. (2001) (518.23 ± 22.44 kg).

The LMY values obtained in this study are comparable with Deshpande (1970) (818.1 and 1041.9 kg at Hingoli and Udgir farms respectively), Singh *et al*. (2002) (868.24±49.56 litres), Das *et al*. (2012) (911.14 kg), Kuralkar *et al*. (2014) (910.95 ± 27.62 kg), Patil (2014) (881.35 ± 37.64 kg), Saravanan *et al.* (2015) (824.44 ± 149.99 kg), Basak and Das (2018) (819.98 ± 16.50 kg).

In contrast high LMY values were reported by Padwal (1975) (1120.49 ± 62.89 litres) Gatchearle *et al.* (2009) (1193.22 ± 44.79 kg).

Of all the above studies were in Government institutional farms except Patil (2014) and Singh *et al.* (2002) which were carried out in field conditions. The higher LMY observed in the animals under this study could be attributed to care taken by the farmers as their herd sizes were small and their main occupation was agriculture and livestock rearing.

5.1.2 Lactation Length (LL)

The overall mean for LL of Deoni cattle was observed to be 259.15 ± 4.883 days based on 123 observations.

Higher LL were reported by Deshpande (1970) (301 and 282 days), Padwal (1975) (317.55 ± 9.05 days). Lower LL was observed by Chakravarthi *et al*. (2002) (149.43 ± 33.52 days.), Basak and Das (2018) (195.23 ± 2.62 days) The values obtained were in comparison with Gatchearle *et al.* (2009) (284.88 ± 5.24 days), Das *et al*. (2012) 206.03 days, Bhutkar *et al*. (2014) (213.90 ± 13.74 days), Patil (2014) (253.66 ± 2.29 days).

The lower values reported by a few studies outside the breeding tract suggest that the animal's performance in other agro-climatic conditions may not be that suitable.

5.1.3 Peak Yield (PY)

The overall mean for PY of Deoni cattle was observed to be 5.69 ± 0.176 kg. It was higher than the findings of Deshpande (1970) (4.373 and 4.582 kg at Hingoli and Udgir respectively), Bhutkar *et al*. (2014) (3.14 ± 0.18 kg), Patil (2014) (4.19 ± 0.10 kg), Thorat *et al.* (2016) (2.77 ± 0.14 kg). Whereas it was lower than Shingare *et al*. (2015) (7.12 ± 0.24 kg). The variations among the individual animals were large. This shows that there is a scope for improvement in peak yield in individual animals.

5.1.4 Effect of Season of calving

The study revealed that there was no significant effect of season of calving on LMY and PY. However, there was significant effect of season of calving on LL.

The LMY in summer was 609.64, rainy was 1052.30 and winter was 1003.38 days. Basak and Das (2018) reported that season of calving had significant effect on LMY whereas Dhumul *et al.* (1993), Bhutkar *et al.* (2014) and Shingare (2015) reported no significant effect on LMY. Lower values were reported by Chauhan and Ghosh (2015) (winter 542.97 ± 16.40 lit, rainy 515.91 ± 26.99 lit and summer 480.24 ± 18.52 lit), Basak *et al.* (2018) (648.46 ± 45.9-winter, 619.93 ± 37.3 summer, 619.93 ± 37.3 rainy), Basak and Das (2018) (869.10 ± 29.01 kg-Winter, 763.63 ± 27.68 kg, Summer, 825.75 ± 28.40 kg)

Higher LMY were observed in the study of Saravanan *et al.* (2015) (1008.97 ± 85.81 - July to February and 949.97 ± 90.00 22 March to June), Mote *et al.* (2016) (winter season -1136.56 ± 21.04 kg, rainy 1073.30 ± 79.92 kg and summer 1096.70 ± 86.57 kg.) Singh *et al*. (2017) (winter season 2097.62±24.69 kg and summer season 2046.50±25.08 kg).

The results of the study show that season of calving had significant effect on LL. Mean LL were 140.20, 277.49 and winter 236.56 in summer, rainy and winter days respectively. Basak and Das (2018) reported that season of calving had significant effect on LL whereas Dhumul *et al.* (1993), and Shingare (2015) reported no significant effect on LL. Higher LL were observed by Chauhan and Ghosh (2015) (289.07 ± 9.85, 277.04 ± 5.3 and 274.53 ± 7.29 days in winter, rainy and summer season respectively). Mote *et al.* (2016) (winter season-295.29 ± 5.51 days, rainy season -277.04 ± 5.30 days and summer season-274.53 ± 17.29 days).

Results were comparable with Basak and Das (2018) 190.55 ± 4.46, 194.22 ± 4.54 and 200.58 ± 4.58 days in summer, rainy and winter respectively.

Effect of season on PY was not significant. The overall mean values in summer, rainy and winter were 5.74, 5.95 and 6.42kg. Shingara *et al.* (2015) reported no significant effect of parity on PY. These findings were found to be lower than Kakde *et al*. (1980) 6.026, 6.002 and 5.570 kg for winter, summer and rainy season, respectively. And higher than Thorat *et al.* (2016) (2.69 ± 0.11 kg, 2.65 ± 0.11 kg 2.30 ± 0.16 kg in Jun to September, December to Feburary and March to May respectively.)

Significantly higher LL in winter calvers indicates that the availability of better quality/quantity of fodder and favourable environmental conditions contributes to better production. LMY and PY were also highest in winter calvers, but differences were not statistically significant, possibly due to lesser number of records in certain groups.

5.1.5 Effect of Parity

The LMY observed during various parity in Deoni cows were 1^{st} (767.95 ± 175.840), 2^{nd} (819.89 ± 133.310), 3^{rd} (772.12 ± 116.920), 4^{th} (868.71 ± 120.780), 5^{th} (912.03 ± 133.580), 6^{th} (791.94 ± 187.930), 7^{th} (882.43 ± 207.120), 8^{th} (1074.01 ± 336.920) and 9^{th} (1106.87 ± 441.000) kg. Wondifraw *et al.* (2013), Singh *et al.* (2017) and Basak and Das (2018) reported that there was no significant effect of parity over LMY at ($P<0.05$). The values were lower than reported by Saravanan *et al.* (2015) (903.67 ± 99.37, 1250.17 ± 211.22 ,716.16 ± 128.23, 951.59 ± 117.41, 1188.74 ± 163.28, 866.49 ± 166.45) kg. Shingare (2015) (281.91 ± 19.42kg), 3rd lactation (211.42 ± 19.65kg).

Higher LL of 239.38 ± 20.607 days was in 1st parity and lowest LL of 188.71 ± 51.684 days was observed during 9th parity which was lower than reported by Basak and Das (2018). While parity did not have a significant effect on any of the production traits studied, there was improved performance in advanced parity upto 7th-8th. This indicates better productive life in Deoni cattle. However, more records need to be collected before a final conclusion is made in this regard.

5.1.6 Effect of Age Group

There was no significant effect of age on LMY, LL or PY of Deoni cattle. LMY was highest (973.00 ± 148.680) in 10-12 years age group while it was lowest (802.49 ± 145.410) kg in 12-14 years age group. Highest LL (230.26 ± 18.239 days) was observed in the age group 6-8 years while lowest (209.60 ± 14.959 days) in 8-10 years. Highest PY of 6.47 ± 0.720 kg was observed in the age group 10-12 years whereas least PY of 5.09 ± 0.705 kg was observed in the age group 12-14 years. PY observed in 4-6, 6-8- and 8-10-years age group were 6.25 ± 0.866, 6.36 ± 0.754 and 6.03 ± 0.618 kg, respectively. The better performance in higher age groups, though not statistically significant, indicates better productive life in Deoni cattle. However, more performance records of higher age groups need to be collected before a final conclusion is made in this regard.

5.2 Milk composition of Deoni cattle and factors affecting it

The mean milk constituents are calculated by the Test Interval Method specified by the International Committee for Animal Recording. The overall mean for various milk components were fat 4.492 ± 0.0233 %, SNF 8.181 ± 0.0117%, protein 3.156 ± 0.0073 %. lactose 4.410 ± 0.0112 and salts 0.6374 ± 0.00176% which was in comparison with Kumar

(2004) (fat 4.07 ± 0.39%, SNF 9.11±0.36%, lactose 5.37 ± 0.16%) and Patil (2014) (fat 4.25 ± 0.11 and SNF .02 ± 0.06).

5.2.1 Effect of age at calving

There was no significant effect of age on SNF, protein, lactose and salts content in milk of Deoni cow. Significant effect of age was observed on fat content of milk. Highest fat percentage (4.681 ± 0.0910) was observed in the age group 10-12 years while lowest (4.441 ± 0.0781) in 8-10 years.

5.2.2 Season of calving

Season of calving had no significant effect on fat, SNF, lactose or protein. Effect of season of calving was found to be significant on salt composition. The mean values for fat percentage in summer were 4.480, rainy 4.494 and winter 4.566 which was comparable with the findings of Munde (2016) (summer 4.77 ± 0.10 %, winter 4.43 ±0.07 %) and Balasaheb (2018) (summer 3.57% fat and 8.51% SNF, in rainy season 3.23% fat and 8.43% SNF and highest in winter 3.92% fat and 8.71% SNF).

5.2.3 Effect of parity

The effect of parity on composition was not significant. Highest fat percentage (4.809 ± 0.2063) was observed in 8^{th} parity and lowest (4.356 ± 0.2700) in 9^{th} parity. Highest SNF content of 8.401 ± 0.1052 % was observed in 8^{th} parity while lowest of 8.038 ± 0.1377 % was in 9^{th} parity. This was in contrast with results of Munde (2016) where higher fat % was observed during sixth (4.91±0.27 %) and lower during first parity (4.41±

0.10 %) in Deoni cattle. Also, higher SNF % was observed during sixth (9.42 ± 0.29 %) and lower during seventh parity (8.69 ± 0.33 %).

The non-significant differences in milk composition, in general, indicate that milk production function was not affected by season of calving or parity.

5.3 Prevalence of SCM

In the present study 125 lactating Deoni cattle were studied for prevalence of SCM. The results indicated that 18.40% positive based on CMT, 4.80% positive based on EC values, 21.60 % based on Mastrip test and 21.60 % positive based on SCC.

Higher prevalence was reported by Sharma *et al.* (2010)(CMT 67.76%, SCC 53.73 %), Supriya *et al*. (2010)(SCC 35%), Mustafa *et al*. (2012) 30.63%, Kamal *et al*. (2014) (CMT 73%), Kathiriya *et al*. (2014) (CMT 29%), Mir *et al*., (2014) 57.80%, Bangar *et al*. (2015) 46.35%, Jena *et al*. (2015) (67.27 and 74.55 % by CMT and SCC respectively), Singh (2015)(CMT 66%), Preethirani *et al*. (2015) (48.4, 40.0 and 45.8% by SCC, EC and CMT respectively), Kushwaha (2016) (modified CMT 16.29%) and Dasohari *et al*. (2017)(66.18%, 59.56% and 55.15% using CMT, White Side Test and Surf Field Mastitis Test, respectively).

The above results were obtained in organised crossbred dairy farms and crossbred animals maintained by farmers. The lower prevalence of SCM in the population under study can be attributed to the natural disease resistance in indigenous cattle over crossbred cattle.

The values reported by Jagadeesh *et al*. (2016) were lower for prevalence of SCM of 12% using CMT and Mastrip.

The accuracy of different techniques in detection of SCM using CMT, EC and Mastrip with respect to SCC were 85.18%, 25.92% and 100% respectively. The results were found in comparison with Guha and Gera (2011) (CMT 84.7 and SCC 86.3%), Badiuzzaman *et al*. (2015) (CMT 75.68% and SCC 91.22%).

The high incidence of sub-clinical mastitis (21.60%) without corresponding number of cases of clinical mastitis in Deoni cattle under field conditions suggests that indigenous cattle have some level of innate immunity to many of the microbes causing mastitis. In view of the accuracy, ease of testing and low cost, Mastrip test was found to be effective for detection of sub-clinical mastitis in Deoni cattle under field conditions as compared to California Mastitis test and Electrical Conductivity test. It is suggested that in order to prevent losses to farmers, routine screening of Deoni cattle should be carried out to detect sub-clinical mastitis and treat.

SUMMARY

VI. SUMMARY

Deoni is an important dual-purpose cattle breed of India. It has a medium heavy built body. It is found in three colour variations viz. Wannera, Balankya and Shevera. The body is moderately developed and symmetrical with distinct muscles. It is endowed with unique characteristics, like hardiness, thermo-tolerance, disease resistance, drought resistance and adaptability to the agro-climatic conditions of the region with moderate production performance, which make it suitable for the semi-intensive, low-input production system being followed in the area. In the current study the effects of non-genetic factors including parity, age and season of calving are explored on the production traits of Deoni cattle.

The home tract of Deoni breed is Udgir, Ahmedpur, Nilanga and Latur district of Maharashtra and adjoining areas of Telangana, Bidar and Gulbarga districts of Karnataka state. Deoni bullocks are suitable for heavy cultivation and carting works (Suryawamshi *et al*., 2000)

A baseline survey was carried out to identify Deoni animals being reared by farmers in the breeding tract of Deoni cattle in 13 villages (12 villages are of taluk Bhalki and one village of Aurad taluk) of Bidar district in state of Karnataka under the project "Field Performance Recording of Deoni cattle in Bidar District" as part of Rashtriya Gokul Mission sponsored by Karnataka Livestock Development Agency.

The performance records from April 2017 to October 2018 were compiled and analysed. The lactation milk yield was estimated using the Test Interval Method

(Interpolation Method) approved by the International Committee for Animal Recording (2012). The peak yield was recorded by the selected farmers as the maximum milk produced by the Deoni cow on a single day during the lactation period. 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. Milk samples were analysed for fat, SNF, protein, lactose and salt.

The age group and parity of the animals were recorded. Season of calving was recorded as summer (March to June), rainy (July to October) and winter (November to February) based on agro-climatic conditions of the region.

Milk sample collected from each animal was subjected to different mastitis diagnostic tests viz. California Mastitis Test (CMT), Electrical Conductivity (EC) and Mastrip test. Positive samples were subjected to Somatic Cell Count (SCC).

The CMT was performed on the individual milk samples as per procedure of Schalm and Noorlander (1957) employing a modified CMT reagent of Sharma and Rajani (1969). Electrical Conductivity of milk sample was determined by using a hand-held Ecotestr (Oakion®). The pH strip test (Mastrip) was performed as per procedure mentioned by Davis (1999). The procedure for SCC followed was according to the general principle advocated by Prescott and Breed, and as detailed by Schalm *et al*. (1971).

Analysis of the factors influencing lactation performance – age group, parity and season of calving using Least Squares Analysis was carried out as per the procedure given by Harvey (1975) using SAS University Edition (ver. SAS Studio 3.8).

The overall mean for LMY, PY and LL of Deoni cattle was found to be 966.08 ± 35.915 kg, 259.15 ± 4.883 days and 5.69 ± 0.176 kg. The overall mean for milk fat, SNF, protein, lactose and salts in Deoni cattle was observed to be 4.492 ± 0.0233 %, 8.181 ± 0.0117%, 3.156 ± 0.0073 %, 4.410 ± 0.0112% and 0.6374 ± 0.00176, respectively.

There was significant effect of age group on milk fat. There was no significant effect of age group on LMY, PY, LL, SNF, protein, lactose and salts. There was no significant effect of parity on LMY, PY, LL, fat, SNF, protein, lactose and salts of Deoni milk. There was significant effect of season on LL and salts content of milk.

The overall prevalence of SCM in the population under study was 21.60% by SCC. The accuracy of different techniques in detection of SCM using CMT, EC and Mastrip with respect to SCC were 85.18%, 25.92% and 100% respectively. The lower prevalence of SCM in the population under study can be attributed to the natural disease resistance in indigenous cattle over crossbred cattle.

Conclusions:

The following conclusions can be drawn from the present study

1. The study revealed that there was no significant effect of season of calving on LMY and PY. However, there was significant effect of season of calving on LL.
2. Significantly higher LL in winter calvers indicates that the availability of better quality/quantity of fodder and favourable environmental conditions contributes to better production. LMY and PY were also highest in winter calvers.

3. While parity did not have a significant effect on any of the production traits studied, there was improved performance in advanced parity upto 7^{th}-8^{th}. This indicates better productive life in Deoni cattle. However, more records need to be collected before a final conclusion is made in this regard.

4. The non-significant differences in milk composition, in general, indicate that milk production function was not affected by season of calving or parity

5. The high incidence of sub-clinical mastitis (21.60%) without corresponding number of cases of clinical mastitis in Deoni cattle under field conditions suggests that indigenous cattle have some level of innate immunity to many of the microbes causing mastitis.

6. In view of the accuracy, ease of testing and low cost, Mastrip test was found to be effective for detection of sub-clinical mastitis in Deoni cattle under field conditions as compared to California Mastitis test and Electrical Conductivity test.

7. It is suggested that in order to prevent losses to farmers, routine screening of Deoni cattle should be carried out to detect sub-clinical mastitis and treat affected cows.

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ABSTRACT

PERFORMANCE OF DEONI CATTLE UNDER FIELD CONDITION IN BIDAR DISTRICT

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The present study was conducted on 123 lactating Deoni cows in 13 villages of Bidar district. A baseline survey was carried out to identify Deoni animals being reared by farmers in the breeding tract of Deoni cattle in the state of Karnataka. Season of calving was recorded as summer (March to June), rainy (July to October) and winter (November to February). Cows were divided based on age group, parity and season of calving to study the effect of each on lactation performance and milk composition. A milk sample of 50 ml was collected from each animal. The sample was analysed for the milk composition and to conduct California Mastitis Test (CMT), Mastrip test, Electrical Conductivity test (EC) and Somatic Cell Count. On analysis it was found that season had significant effect on Lactation Milk Yield (LMY), Lactation Length (LL), Peak Yield (PY), fat, protein, lactose, and salt. Age group had significant effect on PY, fat, SNF, lactose, salt. Parity had significant effect on LL, PY, SNF, protein lactose, salt. The overall mean values were estimated to be LMY 966.08 ± 35.915 kg, LL 259.15 ± 4.883 days, PY 5.69 ± 0.176 kg, fat 4.492 ± 0.0233%, SNF 8.181 ± 0.0117%, protein 3.156 ± 0.0073%, lactose 4.410 ± 0.0112% and salt 0.6374 ± 0.00176%. The overall incidence of SCM was found to be 21.60 per cent. Mastrip test was found to be a rapid and efficient technique to detect SCM in Deoni cattle under field conditions.