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RESEARCH ARTICLE

Evaluation of Productive and Reproductive Performance of Dairy Animals in District Muzaffarnagar of Uttar Pradesh

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ABSTRACT

India's top milk-producing state for the past two decades has been Uttar Pradesh. However, there is a dearth of information on the reproductive and production performance of dairy bovines.Therefore, an attempt was made to assess dairy animals' productive and reproductive parameters in the Muzaffarnagar district of Uttar Pradesh during the year 2021. For this objective, Interviews were conducted using a pre-tested interview schedule with 200 dairy farmers from four different villages near ICAR-NDRI centre in Lalukheri village. The various parameter assessed were Average daily milk yield (DMY), Lactation milk yield (LMY), Peak yield (PY), Lactation Length (LL), Dry period (DP), Age at first calving (AFC), Calving interval (CI), Service period (SP) and Service per conception (SPC). The means (± standard error) for DMY, LMY, PY, LL, DP, AFC, CI, SP and SPC were 6.01±1.07 L, 1694.82±111 L, 8.78±1.13 L, 282±18 days, 198±14 days, 1310±173 days, 490±33 days, 164±11 days and 2.79±0.12 respectively in Murrah buffaloes. The means for DMY, LMY, PY, LL, DP, AFC, CI, SP and SPC were 7.76±1.84 L, 2056±134 L, 10.90±2.10 L, 265±26 days, 185±21 days, 1103±157 days, 450±55 days, 133±18 days and 2.48±0.11 respectively in Jersey crossbred cows. The means for DMY, LMY, PY, LL, DP, AFC, CI, SP and SPC were 7.94±1.56 L, 2159.68±122 L, 11.21±2.22 L, 272±22 days, 201±24 days, 1016±189 days, 473±68 days, 147±19 days and 2.50±0.11 respectively in HF crossbred cows. Hence, the study was warranted to educate farmers about many aspects of livestock management and the issues related to them, as well as in gathering first-hand information regarding the productive and reproductive parameters to be used for improving the study area's livestock support services.

***Key words**: Milk yield; Dry period; Calving interval; Service period; Service per conception.*

Sustainable development can only be accomplished in a nation without hunger or poverty. The global food supply depends on livestock and agriculture. Livestock is essential to the survival of millions of underprivileged people. Protecting these livelihoods calls for sustainable livestock production systems. With 192.49 million cattle and 109.85 million buffaloes *(20th livestock census, 2019)* dispersed across the nation and supplying millions of rural households with a means of subsistence, dairy animals play a crucial role in the animal husbandry sector in our country. With an annual production of up to 23 per cent of the global milk, India is the world's highest milk producer (*Annual Report, 2020-21*). The livestock sector generated 5.21 per cent of the total Gross Value Added, which is around 28.36 per cent of the agriculture and allied sector GVA *(Annual Report, 2020-21)*. In Uttar Pradesh, the significance of livestock rearing is well-established *(Meena and Meena, 2005)*. Livestock plays a critical part in ensuring food security and serve as a risk-aversion strategy for maintaining families during times of crop failure (*Channappa et al., 2023*). Dairy farming's four main components - breeding, feeding, healthcare, and management strategies determine the profitability of the dairy enterprise. In terms of the economics of managing a dairy farm, average daily milk yield, lactation milk yield, peak yield, age at first calving, service period and calving interval are some key variables that impact the productive and reproductive efficiency of dairy animals

(*Dematawewa and Beger, 1998*). In the field, there are numerous productive and reproductive issues that cause animals to lose their ability to reproduce. This can result in a severe decline in reproductive effectiveness and, in rare circumstances, infertility or complete failure of reproduction. As a result, it's essential to educate dairy farmers about the specific approaches to dealing with reproductive problems in dairy animals. The policy planners have not been able to devote full attention to these crucial aspects of bovine production due to a lack of precise information on performance traits in different categories of livestock. A solid database is required for effective management. All efforts should be made to gather and correlate all relevant data. In the Muzaffarnagar district's Lalukheri village, an ICAR-NDRI field operation centre is located to offer local dairy farmers livestock support services including the supply of semen and mineral mixture. Therefore, knowledge of the reproductive and production potential of dairy animals is a prerequisite. With this theoretical background, an attempt was made to study the productive and reproductive performance of dairy animals in beneficiary villages around the field operations centre of ICAR-NDRI in Lalukheri village.

METHODOLOGY

The Muzaffarnagar in western Uttar Pradesh was purposely chosen for this study. This study was conducted during the year 2021. The district, blocks, villages and respondents were chosen using a multistage stratified sampling technique. This study included a total of 368 milch animals comprising 161 Murrah buffaloes, 99 Jersey crossbred and 108 HF crossbred cows from smallholder dairy farmers in and around the villages of field operational centre of ICAR-NDRI near Lalukheri village in Muzaffarnagar district. Four villages (Lalukheri, Alipur, Dhansaini and Bhoura-Khurd) were chosen at random. A random sample of 50 respondents was chosen from each village. Randomly selected farmers were questioned using a well-planned, scheduled questionnaire that was mostly based on socio-economic parameters, data on animals' reproductive and productive performance. The study's aims were taken into consideration when creating the questionnaire, which was made to be straightforward and to gather accurate data from dairy farm owners. The production and reproduction parameters assessed were average daily milk yield, total lactation milk yield, lactation length, peak yield, age at first calving, service period, dry period, calving interval, and service per conception.Various techniques, including focus group discussions, key informant interviews, transect walks, and field observations, were used to record the additional material as well. Descriptive statistics were employed to evaluate the information gathered. Quantitative variables such as production and reproduction parameters were entered in the spreadsheet. Data were analyzed and expressed as mean±standard error (SE).

RESULTS AND DISCUSSION

Table 1 illustrates the socioeconomic profile of the respondents. The results showed that 10 per cent of respondents were medium farmers and 90 per cent of respondents were marginal or small farmers. The average family size was more than five people, and the average landholding was 1.06 hectares. The majority of households belonged to the age category of 35 to 64 years, and 32 per cent of respondents were under the age of 35. In a similar vein, roughly 25 per cent of respondents had a secondary school education, while about 9 per cent of respondents were illiterate. 48 per cent of households had agriculture as their primary occupation, while 43 per cent relied on private labour and business as their primary occupation. Most of the respondents belonged to other backward class. About 45 per cent of respondents had been involved in dairy farming for between 10 and 20 years. A herd of 3-6 animals was reared by majority of farmers.

The means of various production and reproduction traits of Murrah buffaloes, Jersey crossbred cows and HF crossbred cows are presented in Table 2.

Average daily milk yield (lit): The economic potentiality of a dairy cow depends upon the quantity of milk produced. This naturally makes lactation milk yield per cow a potent and vital economic factor in the dairy industry. This trait is significantly influenced by genetic and non-genetic factors. High production efficiency in livestock is an economically desirable attribute that targets ultimately for genetic upgradation. The knowledge of genetic variability concerning each trait and co-variability existing among different traits is a beacon light for planning appropriate selection and breeding strategies as well as factors affecting production traits. When evaluating the potential of dairy animals, assessing milk production is significant. The average daily milk production of dairy animals was studied, and it was found that the Murrah buffalo, Jersey

Table 1. Socio-economic status of different categories of farmers in the study area

Particulars	Overall	Marginal	Small	Medium
Avg. land size (ha)	1.06	0.66	1.22	2.15
Household distribution (%)	-	45	44.5	10.5
Family size (No.)	5.70	6.17	5.49	4.57
Education status (%)				
Illiterate	9	10	6.7	14
Primary	17.5	23.3	11.2	19
Middle school	20	23.3	16.8	19
Secondary school	24.5	17.7	33.7	14
Higher Secondary & above	28.75	24.4	31.4	33
Age-wise distribution (%)				
<35	32.5	33.3	33.7	23.8
35-54	38.5	38.8	39.3	33.3
55-64	23.5	21.1	23.5	33.3
>65	5.5	6.6	3.3	9.5
Main occupation (%)				
Agriculture (crop +livestock)	48.6	47.6	40.5	56.4
Private	35	38	41.4	29.2
Business	8.3	9.5	5.4	7.5
Other	8.1	4.9	12.7	6.9
Social group (%)				
General	25.5	23.8	30.3	21.1
Other Backward Class	63	52.4	50.6	77.8
Scheduled Caste	11.5	23.8	19.1	1.1
Scheduled Tribe	-	-	-	-
Experience in dairy farming (%)				
<10 years	27	18.8	34.8	28.5
10 – 20 years	45	42.2	50.5	33.3
>20 years	28	38.8	14.6	38.1
Average herd size (%)				
< 3 animals	36.5	41.1	37.1	14.3
3-6 animals	44	45.5	49.4	14.3
>6 animals	19.5	13.4	13.4	71.4

crossbred, and HF crossbred animals had average daily milk production of 6.01±1.07, 7.76±1.84 and 7.94±1.56 litre/day/animal respectively. The average daily milk yield of Murrah buffalo in Uttar Pradesh was more or less similar to earlier studies (*Meena et al., 2015; Meena et al., 2022)*. The milk yield of HF crossbred is in line with the findings of *Mamun et al. (2016),* where the average milk yields of HF crossbred cows was 7.64±1.74. *Ananda et al. (2012)* found that the daily milk yield of Jersey crossbreed cows was 6.69±0.99 kg, which is less than the results of present study.

Lactation milk yield (Lit): Lactation yield is one of the important economic traits of dairy animals. It directly decides the economic worth of an animal in a herd. It can be used as one of the indices of production. Dairy animals' lactation milk production and overall animal performance are positively correlated. A cursory look at Table 1 revealed that the lactation milk yield for the Murrah buffalo, Jersey crossbred cow, and HF crossbred cow was found to be 1694.82±111 L/animal, 2056±134 L/animal, and 2159.68±122 L/animal, respectively. In line with the findings of the current study, *Thiruvenkadan et al. (2014)* reported a similar lactation yield (1686.2 ± 44.4 kg) of Murrah buffaloes. *Vijayakumar et al. (2019)* found substantially greater lactation milk yield of crossbred Jersey cows (2580.11±84.51 L), in contrast to our findings of lactation milk yield of Jersey crossbred cows (2056±134 L/animal). Additionally, this lactation yield was similar in comparison with breed-specific crosses of Jersey×Friesian *(Haque et al., 2011)* and Sahiwal x Jersey *(Hadge et al., 2012)* crossbred cows. The mean total lactation milk yield in HF crossbred cows (2159.68±122 L/animal) obtained in the present study was similar to the means reported by *Meena et al. (2015)*. However, several authors *(Lakshmi et al., 2010; Prasanna et al., 2021; Kumar et al., 2017; Kundu et al., 2018)* reported higher means. The discrepancies in the total lactation milk yields may be caused by variable genetic potential, irregular lactation lengths, as well as geographic location and management practises employed on separate farms.

Peak Yield (Lit): Lactation milk yield in dairy bovines is closely related to peak yield, persistency and lactation length. The maximum milk yield recorded on a single day during the course of lactation is taken as the peak yield of the animal. It is taken as the criteria for the selection of dairy animals. It is evident that an animal which gives a higher peak yield produces more milk. The benchmark for selling or buying animals was determined to be peak yield. The cost of the animal on the market will increase as its peak yield increases. According to the data in Table 1, the average peak milk yields of Murrah buffalo, Jersey crossbred cows, and HF crossbred cows were respectively 8.78±1.13, 10.90±2.10, and 11.21±2.22 litres/animals. A lower mean for peak yield was obtained by *Thiruvenkadan et al. (2014)* in Murrah buffalo. *Desai et al. (2017)* reported a lower peak yield (8.61±0.05 kg) of Jersey crossbred cows as compared to this study. In comparison to previous studies (*Lakshmi et al., 2010; Kumar et al., 2017; Prasanna et al., 2021*), the mean (11.21±2.22) peak yield in HF crossbred cows obtained in the current study was lower.

Table 2. Productive and reproductive performances of the dairy animals (N= 368)

Parameter	Murrah buffalo (n_1 = 161)	Jersey crossbred (n_2 = 99)	HF crossbred (n_3 = 108)
Productive parameters			
Average daily milk yield (Lit.)	6.01±1.07	7.76±1.84	7.94±1.56
Lactation milk yield (Lit.)	1694.82±111	2056±134	2159.68±122
Peak yield (Lit.)	8.78±1.13	10.90±2.10	11.21±2.22
Lactation Length (Days)	282±18	265±26	272±22
Dry period (Days)	198±14	185±21	201±24
Reproductive parameters			
Age at first calving (Days)	1310±173	1103±157	1016±189
Calving interval (Days)	490±33	450±55	473±68
Service period (Days)	164±11	133±18	147±19
Service per conception (No.)	2.79±0.12	2.48±0.11	2.50±0.11

Lactation length (Days): Lactation length is the actual number of days the cow remains in milk. One of the finest measures of a dairy animal's performance is the length of its lactation. The data relating to the lactation length of Murrah buffalo, Jersey crossbred cows and HF crossbred cows were 282±18, 265±26 and 272±22 days respectively. For any herd to be profitable, a lactation period of 305 days is ideal. However, no animal in the study area was observed to have a 305-day lactation length. The findings concur with those of *Sachan et al. (2015),* who estimated that a buffalo's lactation period in Uttar Pradesh's Unnao area is 293.5±27.1 days. In crossbred cattle, *Haque et al. (2011)* recorded a slightly higher figure for lactation length (291.49±29.30 days), and *Kabir and Islam (2009)* in Holstein crossbred cattle (295.0±33.96 days).

Dry period (Days): Dry period is referred to as a non-productive period between two consecutive lactations. For best lactation milk output, a dry period of 60–90 days is recommended to produce one calf per year. The dry period is crucial for the milch animal's relaxation and for nourishing the developing foetus. Usually long dry period affects the economics of dairy farms and longer dry period is also associated with lower conception rates. The result (Table 1) indicates that the dry period of Murrah buffalo, Jersey crossbred cows and HF crossbred cows was 198±14, 185±21 and 201±24 days, respectively. These results are higher than the ideal period, which decreased the returns from milk production. However, *Meena et al. (2015)*. reported a longer dry period (226±13 days) in buffaloes than the present study. Lower means of dry period in crossbred cows were reported by *Singh et al. (2014)* and *Kumar et al. (2015).*

Age at first calving (Days): It is the age at which heifers calve for the first time. This indicates the start of the productive life of the cow. Short generation interval increases genetic gain. It is among the most crucial elements in determining how well dairy animals will perform. As soon as a heifer calves, she becomes more economically valuable to the farm by producing more milk and calves (*Singh et al.,* 2012). The age at first calving of Murrah buffalo, Jersey crossbred cow, and HF crossbred cows, were 1310±173, 1103±157 and 1016±189 days/animals respectively. *Thiruvenkadan et al. (2015*) reported a higher age at first calving than the present study in Murrah buffaloes. Similarly, the mean age at first calving of Jersey crossbred cows estimated in the present study was lower than reported by *Vinothraj et al., 2016* (1204.00 days). In contrast to this study, *Prasanna et al. (2021)* observed a lower age at first calving (947.26 ± 19.67 days) in HF crossbred cows. The lower level of management and inadequate feeding of calves and heifers in the early stages led to a slower development rate and delayed puberty, which resulted in a higher age at first calving.

Calving interval (Days): One of the key economic characteristics of lactating animals is the calving interval. A shorter calving interval increases the economic profit of dairy animals in terms of the number of calf crops produced per cow. The calving interval of Murrah buffaloes, Jersey crossbred cows and HF crossbred cows, were 490±33, 450±55 and 473±68 days/animal respectively. The results of the present study are higher than the findings of *Balamurugan et al. (2020)*, who found that the average calving interval of Murrah buffaloes in IVRI's livestock farm was 435.61±6.87 days. The present findings are higher

than the findings of *Hussain et al. (2012)* in the case of HF crossbreds. Present findings are in line with the findings of *Vijayakumar et al. (2019)*, who reported that the average calving interval of Jersey crossbreds was 460.56±11.08 days.

Service period (Days): The service period is a critical criterion for evaluating a dairy animal's productivity and reproductive efficiency. If the service period is very long, the calving interval will be quite long and this will result in fewer calvings over the cow's lifespan and, as a result, lower lifetime production. Conversely, if the service period is too short, the dairy cow will become weak owing to a recent pregnancy, resulting in the lower persistency of milk production. Season, parity, and herd size all have an impact on the service period. The service period for the Murrah buffaloes, Jersey crossbred cows, and HF crossbred cows were 164±11, 133±18, and 147±19 days respectively, according to data reported in Table 1. The findings of *Balamurugan et al. (2020)* were lower than the present findings, who reported that the average service period of Murrah buffalo in ICAR-IVRI's livestock farm was 131.12±6.24 days. The current figure exceeds the findings of *Kumar et al. (2015)*, which revealed that the service period of Frieswal cattle was 121.60±16.74 days. The findings of *Hussain et al. (2012)* are in accordance with the present findings, which reported that the service period of HF crossbreds was 146.96±1.85 days. However, a lower service period was reported by *Hussain et al. (2012)* in the case of Jersey crossbred cows in field conditions of Assam as compared to the present findings. These findings in the research area are consistent with the findings of *Patel et al. (2018)*, who revealed that the majority of dairy cows in Rajasthan's Dungarpur district had a post-breeding interval of three to six months. Repeat breeding problems in animals were the cause of the longer service period. According to *Yadav et al. (2014)* dairy farmers in Rajasthan's Banswara district had a similar restraint.

Service per conception (number): The number of services per conception reflects the efficient use of time, germplasm, and the animal's productive life. The number of services required for conception depends on management, breeding and environmental effects. The data pertaining to service per conception was presented in Table-1 and the service per conception of Murrah buffalo, Jersey crossbred cow and HF crossbred cows, were 2.79±0.12, and 2.50±0.11 per animal respectively. The results of the present study are alike to the earlier findings of *Rao et al. (2000)*, who reported that the average service per conception of crossbred cows was 2.32±0.01 in farmers' herds of Banglore. Although, lower than the present findings were reported by *Islam et al. (2002),* who found that the average number of services per conception for HF crossbreds in Bangladesh was 1.65±1.0. The difference in service per conception might be related to the farmer's promptness in bringing the animal in for insemination at the appropriate time, or it could be owing to the inseminator's skill level. *Singh et al. (2004)* also found this irregularity in timely insemination, reported that only 34 per cent of dairy farmers in Uttar Pradesh inseminated their animals during mid-heat, the optimal time for insemination.

CONCLUSION

The reproductive performance i.e. age of first calving, service period and Calving interval were longer when compared to the optimum values desirable for lucrative milk production. Therefore, it was recommended that ICAR-NDRI should step up their efforts to improve the reproductive performance of dairy animals by offering assistance services for increased production of the dairy animals.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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