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The performance and factors affecting first service period in Surti buffaloes

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Abstract
The present study was carried on 234 Surti buffaloes, sired by 56 bulls, maintained at Network Project on Buffalo Improvement (NPBI) Surti Unit of Livestock Research Station (LRS), Vallabhnagar (Udaipur), Rajasthan for the duration of 28 years (1990-2017). To investigate the effect of season of birth/calving on first service period (FSP), the total duration of a year into three seasons, followed by coding of the respective seasons. The data were classified into four periods according to the birth of year. To study the effect of various genetic and non-genetic factors on FSP, computer package programme, SPSS (Statistical Package for the Social Sciences) software version 20.0 was used for data analysis. Duncan's Multiple Range Test (DMRT) was used to test the significance of differences between different means. The Overall least square means of FSP was 189.83±8.5 days. The effect of sire, effects of season of birth, period of birth and effect of age at first calving (AFC) groups were non-significantly effects on FSP.

Keywords: First service period, Surti buffalo, factors

Introduction
Agriculture is the country's lifeline and a key sector which provides livelihood to millions poor people in India which is mainly based on monsoon rain fall. The livestock act as a augment income of the farmers, particularly in drought prone Rajasthan state. Agriculture diversification through animal husbandry is one of the primary drivers of rural income growth, and increased public investment in the livestock sector is urgently needed to double farmer's income.

India is one of the few countries in the world that has significantly contributed to the global livestock gene pool. The livestock sector contributes 6.17 percent to national GDP and 30.87 percent to total agriculture and allied sector GDP (BAHS, 2021) [2]. India leads the world in milk production with 209.44 million tonnes with 5.81 percent increase over the previous year.

India is a rich source of the buffalo gene pool; there are 20 breeds of buffalo recognized by the National Bureau of Animal Genetic Resources, Karnal (NBAGR, 2022) [3]. Surti buffalo characteristics are lighter in body weight, better adaptability to hilly regions, two white bands below the neck, disease resistance, lower maintenance costs, higher milk fat yield, and increased reproductive efficiency. Surti Buffalo is a one-of-a-kind dairy animal in terms of feed conversion capability with low-grade course feeds, and the ability to sustain in adverse climatic conditions. It is popular with land-less, small, and marginal farmers. The peculiarity of Surti buffalo horns are flat, Sickle-shaped, and directed downward, backward, and upward at the tip.

The interval between date of calving to subsequent service resulting in conception is called service period. It is an important reproductive parameter that reflects a dairy farm's profitability/viability. Short SP does not allow for proper uterine involution and restoration of the reproductive system after postpartum stress. However, due to late conception after calving, excessively long SP is also undesirable from an economical point of view.

Materials and Methods
The present study was carried on 234 Surti buffaloes, sired by 56 bulls, maintained at Network Project on Buffalo Improvement (NPBI) Surti Unit of Livestock Research Station (LRS),

Vallabhnagar (Udaipur), Rajasthan for the duration of 28 years (1990-2017). To investigate the effect of season of birth/calving on first service period (FSP), the total duration of a year into three seasons, followed by coding of the respective seasons. The data were classified into four periods according to the birth of year. To investigate the effect of season of birth/calving on first service period (FSP), the total duration of a year into three seasons; November to February (Winter); March to June (Summer) and July to October (Rainy) followed by coding of the respective seasons (Table 1). The data were classified into four periods according to the birth of year as 1990-1996 (1), 1997-2003 (2), 2004-2010 (3) and 2011-2017 (4) (Table 2). The effect of various genetic and non-genetic factors on FSP, computer package programme, SPSS (Statistical Package for the Social Sciences) software version 20.0 was used for data analysis. Duncan's Multiple Range Test (DMRT) was used to test the significance of differences between different means.

Table 1: Season of birth

Season of birth			
S. No.	**Months**	**Season**	**Code**
1.	November to February	Winter	S1
2.	March to June	Summer	S2
3.	July to October	Rainy	S3

Table 2: Period of birth

Period of birth	
Period	**Code**
1990-1996	1
1997-2003	2
2004-2010	3
2011-2017	4

Factors affecting first service period

The data were analyzed to see effect of genetic (sire) and non-genetic factors (season of calving period and age at first calving group) using the following mixed model on first service period:

$$Y_{ijklm} = \mu + s_i + M_j + P_k + A_l + e_{ijklm}$$

Where,

Y_{ijklm} = observation on the m^{th} animal which calved in j^{th} season k^{th} period sired by i^{th} sire and belong to l^{th} age group

μ = Overall mean

s_i = Random effect of i^{th} sire (i=1,2,3……57)

M_j = Fixed effect of j^{th} season of calving (j=1,2,3)

P_k = Fixed effect of k^{th} period of calving (k=1,2,3,4)

A_l = effect of l^{th} age group (l=1,2,3……9)

e_{ijklm} = Random error which is NID (0, σ_e^2)

Results and Discussion

The overall least-squares mean for first service period was estimated as 189.83±8.5 days (Table 3) and was in close agreements with results of Pathodiya *et al*. (1998) [11] and Nagda (2005) [10] in Surti buffaloes. Higher estimates were reported by Kothari (2004) [7], Kumar and Tailor (2010) [8], Kumar (2018) [9] and Bhat (2019) [4] in same breed of buffaloes. However, lower estimate was confirmed by Tailor *et al.* (1997) [14] in Surti buffaloes.

Effect of sire: The effect of sire on FSP was observed non-significant (Table 3). Which also supported by Pathodiya *et al.* (1998) [11], Kothari (2004) [7] and Vyas *et al.* (2021) [15] in Surti buffaloes.

Effect of season

Service period was not influenced by season of calving in present study. Tailor *et al*. (1997) [14], Pathodiya *et al.* (1998) [11], Kothari (2004) [7], Rathod *et al*. (2018) [12], Kumar (2018) [9], Bhat (2019) [4] and Vyas *et al.* (2021) [15] were observed similar results in same breed of buffaloes. However, contrary to this, Nagda (2005) [10] reported significant effect of season of calving on service period in Surti buffaloes.

Effect of period

The non-significant ($p \leq 0.05$) effect was caused by period of calving in service period in present study (Table 3). Service period was showing decreasing order than increase after period P3. Similar results were observed by Pathodiya *et al*. (1998) [11], Sule *et al*. (2001) [13] and Kothari (2004) [7] in Surti buffaloes. On the other hand, Tailor *et al.* (1997) [14], Nagda (2005) [10], Rathod *et al.* (2018) [12], Kumar (2018) [9], Bhat (2019) [4] and Vyas *et al.* (2021) [15] were found significant effect of period of calving on service period in Surti buffaloes.

Shorter service period was observed in period P2 whereas longest in period P1. Reason behind shorter service period might be managemental conditions and favorable environmental factors resulting in a shorter involution period of female. So, it may be concluded that better management practices, good health condition, early heat detection and favorable environment are more suitable to reduce the service period in buffaloes.

Table 3: Least squares means for FSP (days) in Surti buffaloes

Overall	**No. of observations**	**Mean±SE**
	234	189.83±8.5
Sire NS		
Season of calving NS		
S1 (Winter)	59	193.72±12.85
S2 (Summer)	24	175.90±19.39
S3 (Rainy)	151	199.86±8.09
Period of calving NS		
P1 (1995-2000)	45	200.06±15.28
P2 (2001-2006)	93	183.34±10.31
P3 (2007-2013)	53	184.35±14.65
P4 (2014-2020)	43	191.56±15.08
AFC groups NS		
1. (≤ 1226)	13	176.17±26.41
2. (1227-1341)	24	199.51±19.41
3. (1342-1455)	38	203.79±15.85
4. (1456-1569)	41	175.28±16.03
5. (1570-1684)	21	183.16±20.43
6. (1685-1799)	29	181.63±18.04
7. (1800-1914)	32	199.67±17.41
8. (1915-2029)	21	181.39±20.71
9. (≥ 2030)	15	207.90±24.93

S=Significant at 5% level ($p \leq 0.05$). NS = Non-Significant.
Mean with different superscript differ significantly.

Effect of age at first calving (AFC) groups

The effect of age at first calving groups on FSP was reported non-significant effect in the present study. Similar, result was reported by Brar *et al*. (2022) [5] in Murrah buffaloes and contrary result was found by Jamuna *et al*. (2015) [6] in Murrah buffaloes.

Conclusion

The effect of sire, effects of season of birth, period of birth and effect of age at first calving (AFC) groups were non-significantly effects on FSP that is shown uniformity in the farm.

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