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The performance of fortnightly test day milk yields and factors affecting fortnightly test day milk yields in Surti buffaloes

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Abstract
In the present study, first lactation fortnightly test day milk records of 192 Surti buffaloes progeny of 46 sires; calved during the year 2001 to 2020 and maintained under Network Project on Buffalo Improvement (NPBI) Surti Unit at Livestock Research Station (LRS), Vallabhnagar (Udaipur), Further, 3387 fortnightly test day records were obtained from daily milk recording registers during the same period for performance of test day milk yields and to see the effect of non-genetic factors the year was divided into three seasons of calving based on temperature, humidity, and rainfall. The period was divided into four groups. Overall least squares means for 21 fortnightly test day milk yields ranged from 1.56±0.06 kg (TD21) to 7.00±0.12 kg (TD4). The season of calving had significant ($p \leq 0.05$) effect on fortnightly test day milk yield TD20 and non-significant effect was observed on the rest of test days. The period of calving had highly significant ($p \leq 0.01$) effect on fortnightly test day milk yield TD20 and significant ($p \leq 0.05$) effect was found on fortnightly test day milk yields namely TD1, TD2, TD3 and TD21. However, non-significant effect was observed on rest of test days in Surti buffaloes.

Keywords: Forthnightly test day, season of calving, period of calving, Surti buffaloes

Introduction

Livestock plays a significant role in the national economy and is a primary source of income for marginal and landless farmers. Animal husbandry contributes 30 percent of the Gross Value Added (GVA) in the Agricultural and Allied sector and 6.2 percent to the country's overall GVA (Anonymous, 2021) [3-4]. The livestock industry in India is one of the biggest in the world. There is 212 registered livestock breeds in India. These breeds are well adapted to the various agro-climatic conditions in India. Among total livestock breeds, there are 20 well-characterized and registered buffalo breeds in the country. In India, there is 535.82 million livestock, including 192.52 million cattle, 109.85 million buffaloes, 74.26 million sheep, 148.88 million goats, about 9.06 million pigs, and 0.85 million other livestock. As per 20th Livestock Census, 20.47 percent of the livestock population is buffalo population. The buffalo population has grown by 1.06 percent between 2012- 2019. The total buffalo population of Rajasthan is 13.69 million Anonymous (2019) [1]. India is still the world's top producer of milk (209.96 million tonnes) with growth rate 5.81 percent annually (Anonymous, 2021) [3-4]. According to the analysis, Indigenous/Nondescript Buffaloes produce 48.34 percent of the total country's milk production. Rajasthan is producing 14.63 percent of the total milk production with the second rank in the country (Anonymous, 2021) [3-4]. The Surti breed of buffalo has its origin in Surat, Anand, Bharuch, and Baroda District of Gujarat but is also found in south region of Rajasthan and some parts of the Vidharbha region in Maharashtra state. Due to having more measures per daughter than the lactation record of the 305-day model, the sire evaluation using the test-day milk production model is more accurate. Dairy cattle evaluation using test-day milk yields (TDMY) has significant advantages over the 305-day milk yield (Mostert *et al.*, 2006) [7].

Materials and Methods

Data collection: The records on the first lactation traits of 192 Surti buffaloes spread over a period of 20 years (2001-2020), maintained under Network Project on Buffalo improvement (NPBI) Surti Unit at Livestock Research Station (LRS), Vallabhnagar (Udaipur), Rajasthan were collected. A total of 3387 fortnightly test day records from 192 buffaloes were used in the study.

Season of calving

The season of calving was considered to be one of the main environmental factors that affect the performance of buffalo. There is a wide variety of climatic conditions throughout the year. Thus, the year was divided into three seasons of calving based on temperature, humidity, and rainfall as following:

Table 1: Season of calving

Season of calving	Duration	Code
Winter	November to February	1
Summer	March to June	2
Rainy	July to October	3

Period of calving

The expression of different traits varied in different periods of calving due to change in managerial practices over the study period.

Table 2: Period of calving

Period of calving	Code
2001-2005	1
2006-2010	2
2011-2015	3
2016-2020	4

Statistical Analysis

To study the effect of various non-genetic factors on first lactation forth nightly test day milk yields, SPSS (Statistical Package for the Social Science) was used for data analysis.

Factor affecting fortnight test day milk yield and first lactation 305-days or less milk yield: Least square fixed model analysis of data was carried out by SPSS (Statistical Package for the Social Sciences) software to study the effect of non-genetic factors (season of calving and period of calving) on test day milk yield. The following fixed model was used;

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

Where,
Y_{ijk} = Observation on the k^{th} progeny, related to i^{th} season of calving and j^{th} period of calving
μ = Population mean
S_i = Fixed effect of i^{th} season of calving (i = 1, 2….3)
P_j = Fixed effect of j^{th} period of calving (j = 1, 2……4)
e_{ijk} = Random error, NID (0, σ^2e)

Results and Discussions

Performance of fortnightly test day milk yields

The overall least squares means for 21 fortnightly test day milk yields ranged from 1.56±0.06 kg (TD21) to 7.00±0.12 kg (TD4). Least squares means for individual test day milk yields have been presented in Table 3 and the performance of first lactation fortnightly test day milk yields showing in figure 1.

Bhat (2019) [5] observed overall means for monthly test day milk yields ranged from 4.09±0.12 kg (TD1) to 5.45±0.12 kg (TD6), Tyagi *et al.* (2016) [12] estimated the test day milk yield (TDMY) ranged from 2.0 to 5.50 kg for group S15 and 4.10 to 7.40 kg for group S60 in Surti buffaloes. Singh *et al.* (2015) [10] estimated the mean for monthly test day milk yields ranged from 4.46±0.07 kg (TD10) to 7.64±0.07 kg (TD3), Sahoo *et al.*, (2014) [8] reported the least squares mean of overall weekly test day yields ranged from 2.44±0.07 kg (TD43) to 7.95±0.06 kg (TD8) in Murrah buffaloes. Sharma *et al.* (2017) [9] estimated the averages of monthly test day milk yield ranged from 2.76±0.21 kg (TD1) to 5.98±0.29 kg (TD5) in Jaffarabadi buffaloes.

Table 3: Least squares means with standard errors of first lactation fortnightly test day milk yields (kg) in Surti buffaloes

	TD1	TD2	TD3	TD4	TD5	TD6	TD7
Overall	4.96±0.11	5.72±0.09	6.32±0.12	7.00±0.14	6.68±0.08	6.30±0.12	5.87±0.11
	(192)	(192)	(192)	(192)	(192)	(192)	(192)
Season of calving	NS	NS	NS	NS	NS	NS	NS
S1	4.87±0.17	5.65±0.17	6.30±0.17	7.01±0.18	6.69±0.18	6.35±0.18	5.95±0.18
	(48)	(48)	(48)	(48)	(48)	(48)	(48)
S2	5.23±0.26	5.96±0.26	6.47±0.26	7.18±0.28	6.91±0.28	6.53±0.27	5.98±0.27
	(21)	(21)	(21)	(21)	(21)	(21)	(21)
S3	4.80±0.11	5.55±0.11	6.19±0.11	6.80±0.11	6.43±0.11	6.04±0.11	5.67±0.11
	(123)	(123)	(123)	(123)	(123)	(123)	(123)
Period of calving	*	*	*	NS	NS	NS	NS
P1	$4.83±0.13^{ab}$	$5.58±0.13^{ab}$	$6.16±0.13^{ab}$	6.93±0.14	6.61±0.14	6.26±0.14	5.83±0.14
	(86)	(86)	(86)	(86)	(86)	(86)	(86)
P2	$4.67±0.18^{a}$	$5.42±0.18^{a}$	$5.97±0.18^{a}$	6.70±0.20	6.46±0.19	6.10±0.19	5.69±0.19
	(47)	(47)	(47)	(47)	(47)	(47)	(47)
P3	$5.02±0.22^{ab}$	$5.80±0.22^{ab}$	$6.45±0.22^{ab}$	7.20±0.23	6.82±0.23	6.43±0.23	6.01±0.23
	(29)	(29)	(29)	(29)	(29)	(29)	(29)
P4	$5.34±0.23^{b}$	$6.08±0.23^{b}$	$6.70±0.23^{b}$	7.25±0.25	6.83±0.25	6.43±0.25	5.93±0.24
	(30)	(30)	(30)	(30)	(30)	(30)	(30)

* Significant at 5% level (P≤0.05), NS = non-significant
Mean with different superscript differ significantly

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	TD8	TD9	TD10	TD11	TD12	TD13	TD14
Overall	5.48±0.12	5.12±0.11	4.75±0.08	4.44±0.10	4.12±0.09	3.87±0.07	3.62±0.09
	(191)	(188)	(186)	(183)	(180)	(176)	(170)
Season of calving	NS	NS	NS	NS	NS	NS	NS
S1	5.56±0.17	5.19±0.17	4.83±0.16	4.47±0.15	4.16±0.14	3.89±0.13	3.61±0.13
	(48)	(47)	(47)	(47)	(47)	(46)	(45)
S2	5.60±0.26	5.22±0.25	4.81±0.24	4.57±0.23	4.20±0.22	3.95±0.20	3.77±0.21
	(21)	(21)	(21)	(20)	(20)	(20)	(18)
S3	5.27±0.11	4.96±0.10	4.61±0.10	4.30±0.09	4.01±0.09	3.76±0.08	3.49±0.08
	(122)	(120)	(118)	(116)	(113)	(110)	(107)
Period of calving	NS	NS	NS	NS	NS	NS	NS
P1	5.44±0.14	5.16±0.13	4.77±0.13	4.46±0.12	4.17±0.11	3.95±0.10	3.68±0.10
	(86)	(83)	(83)	(81)	(79)	(76)	(73)
P2	5.32±0.19	4.97±0.18	4.60±0.17	4.33±0.16	4.07±0.15	3.76±0.14	3.50±0.14
	(46)	(46)	(45)	(45)	(44)	(44)	(43)
P3	5.62±0.22	5.23±0.21	4.87±0.20	4.57±0.19	4.18±0.18	3.97±0.17	3.77±0.17
	(29)	(29)	(29)	(28)	(28)	(28)	(27)
P4	5.54±0.24	5.12±0.23	4.77±0.22	4.42±0.20	4.06±0.19	3.78±0.18	3.55±0.18
	(30)	(30)	(29)	(29)	(29)	(28)	(27)

NS = non-significant

Cont…

	TD15	TD16	TD17	TD18	TD19	TD20	TD21
Overall	3.35±0.09	3.09±0.11	2.82±0.08	2.63±0.14	2.35±0.07	2.06±0.12	1.56±0.06
	(159)	(141)	(126)	(110)	(93)	(77)	(63)
Season of calving	NS	NS	NS	NS	NS	*	NS
S1	3.38±0.13	3.16±0.13	2.92±0.12	2.72±0.11	2.47±0.11	2.23±0.10^{b}	1.67±0.09
	(41)	(37)	(33)	(30)	(24)	(19)	(16)
S2	3.43±0.20	3.04±0.20	2.71±0.19	2.49±0.18	2.19±0.17	1.91±0.15^{a}	1.42±0.15
	(17)	(15)	(14)	(12)	(10)	(8)	(6)
S3	3.25±0.08	3.07±0.08	2.83±0.07	2.67±0.07	2.40±0.07	2.04±0.06^{ab}	1.58±0.05
	(101)	(89)	(79)	(68)	(59)	(50)	(41)
Period of calving	NS	NS	NS	NS	NS	**	*
P1	3.42±0.10	3.16±0.10	2.95±0.10	2.67±0.10	2.48±0.09	2.29±0.93^{b}	1.66±0.09^{b}
	(66)	(56)	(47)	(42)	(34)	(25)	(20)
P2	3.25±0.13	2.95±0.13	2.70±0.12	2.48±0.11	2.24±0.11	1.88±0.09^{a}	1.38±0.08^{a}
	(41)	(38)	(35)	(32)	(26)	(24)	(22)
P3	3.43±0.16	3.22±0.16	2.94±0.15	2.75±0.14	2.44±0.13	2.11±0.11^{ab}	1.72±0.10^{b}
	(27)	(24)	(22)	(19)	(16)	(13)	(11)
P4	3.31±0.18	3.03±0.17	2.69±0.16	2.60±0.16	2.26±0.14	1.95±0.12^{a}	1.48±0.12^{ab}
	(25)	(23)	(22)	(17)	(17)	(15)	(10)

** Significant at 1% level (P≤0.01), * Significant at 5% level (p≤0.05), NS = non-significant

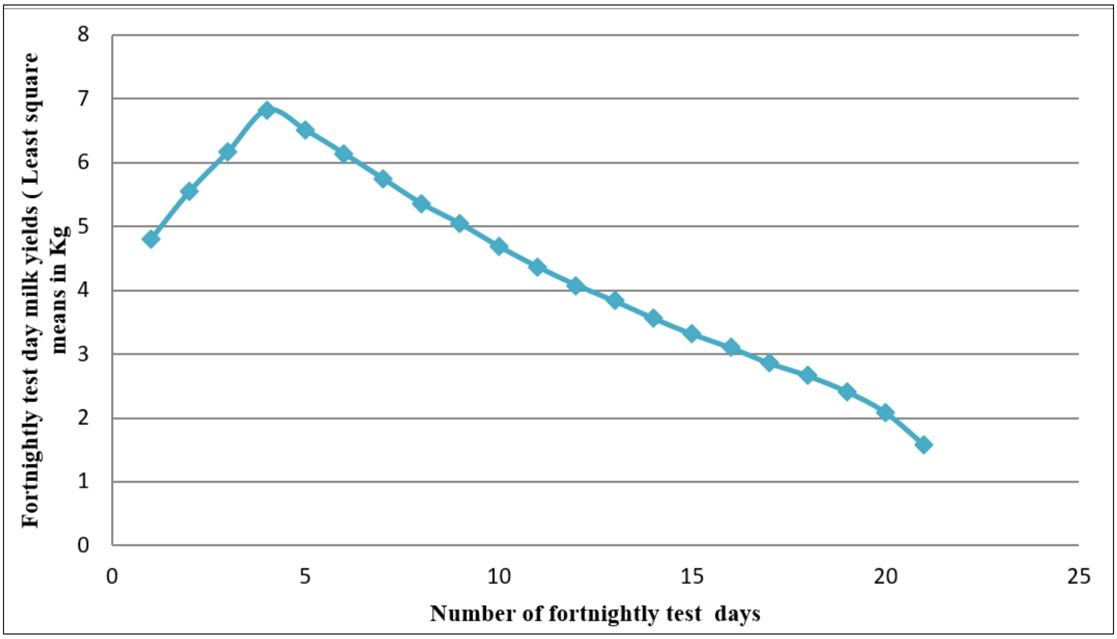

Fig 1: Performance of first lactation fortnightly test day milk yields in Surti buffaloes

Effect of Non-genetic factors

The non-genetic factors included in the least squares model for different individual fortnightly test day milk yields were season of calving and period of calving.

Season of calving: The season of calving had significant ($p \leq 0.05$) effect on fortnightly test day milk yield TD20 while non-significant effects on other test days (Table 3). Contrary to present study Tailor and Singh (2011) [11] found significant effect of season of calving on all monthly test day milk yields in Surti buffaloes. Bhat (2019) [5] also reported significant effect of season of calving on all monthly test day milk yields except TD4, TD10 and TD11 in the same breed of buffaloes.

Chakraborty *et al.* (2010) [6] did not find significant effect of season of calving on all monthly test day milk yields in Murrah buffaloes. Singh *et al*. (2015) [10] found significant effect of season of calving on monthly test day milk yields TD1, TD2, TD3, TD6, TD7 and TD8 in Murrah buffaloes. Verma *et al.* (2017) [13] also reported significant ($P \leq 0.05$) effect of season of calving on weekly test day milk yields 8TD, 12TD, 16TD, 20TD, 28TD, and 40TD test day yield in Murrah buffaloes.

The effect of season of calving was found non-significant for all the fortnightly test day milk yields except test day TD20 but all the fortnightly test day milk yields were observed highest during summer season (S2). The results show the adaptability of the breed with rearing environmental conditions and homogenous feeding and managemental practices over the study period. Secondly, mostly buffaloes were calved during rainy season (S3).

Period of calving

The period of calving had highly significant ($p \leq 0.01$) effect on fortnightly test day milk yield TD20 and significant ($p \leq 0.05$) effect had been found on fortnightly test day milk yields namely TD1, TD2, TD3 and TD21. However, no significant effect was observed on other test day milk yields (Table 3). Bhat (2019) [5] observed significant effect of period of calving on monthly test day milk yield TD1, TD2, TD4, TD5, TD6 and TD7 in Surti buffaloes. Tailor and Singh (2011) [11] also found the significant effect of period of calving on monthly test day milk yield TD1, TD4, TD6, and TD7 in same breed of buffaloes.

Verma *et al.* (2017) [13] reported significant effect of period of calving on all weekly test day milk yields except TD36 and TD40 in Murrah buffaloes. Singh *et al.* (2015) [10] also observed significant effect of period of calving on all monthly test-day milk yields except TD9 in Murrah buffaloes.

The effect of period of calving was not found significant ($p \leq 0.05$) on most of the fortnightly test day milk yields in Surti buffaloes. The performance of fortnightly test day milk yields were observed highest during period 2011-2015 (P3). The differences in different fortnightly test day milk yields over the periods may be attributed to the differential culling levels on the basis of production as well as difference in feeding and managemental practices besides the changing population dynamics over the periods.

Conclusion

Overall least squares means for 21 individual fortnightly test day milk yields ranged from 1.56±0.06 kg (TD21) to 7.00±0.12 kg (TD4). The season of calving had significant ($p \leq 0.05$) effect on fortnightly test day milk yield TD20 and non-significant effect has been observed on the rest of test days. The period of calving had highly significant ($p \leq 0.01$) effect on fortnightly test day milk yield TD20 and significant ($p \leq 0.05$) effect has been found on fortnightly test day milk yields namely TD1, TD2, TD3 and TD21. However, non-significant effect has been observed on other test days.

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