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Breeding efficiency of Murrah and Nili-Ravi buffaloes at ICAR-CIRB, Hisar

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ABSTRACT

Present study was conducted to investigate breeding efficiency (BE) in Murrah and Nili-Ravi buffaloes maintained at ICAR-CIRB Hisar and sub campus Nabha, Punjab, respectively. A total 5955 production and reproduction records of 679 Murrah and 501 Nili-Ravi from the year 1983 to 2017 were utilized to calculate BE using Wilcox and Tomar methods. The effects of various non-genetic factors like age at first calving, season of first calving, period of first calving and lactation completed on BE was studied. The results indicated that the overall least-square means for BE in Murrah and Nili-Ravi were estimated as 80.09 to 82.97% and 79.57 to 82.50% by Wilcox method while it was 76.62 to 78.12% and 76.04 to 77.73% by Tomar method, respectively. Both Wilcox as well as Tomar method indicated that the effect of season of first calving was highly significant on BE in Murrah and Nili-Ravi buffaloes with highest BE in rainy and lowest in winter season. A change in BE due to period of calving depends on the management practices followed during that particular period of time. Breeding efficiency linearly increased with the increase in number of lactations. Therefore, our efforts should be towards improvement in breeding efficiency that leads to better reproductive performance, thereby improve overall efficiency of the dairy farm.

Keywords: Breeding efficiency, Murrah, Nili-Ravi, Tomar and Wilcox

Buffaloes are valued for their milk, meat and draught power. They have major role in livestock economy of India. According to 20th Livestock Census, total buffalo population of our country is 109.85 million. Buffalo population contributes 20.45% of total Livestock population of India. Murrah and Nili-Ravi breeds are the finest genetic material of milk producing buffalo in the country. Breeding efficiency is the major factor to determine reproductive performance of animals. It is measured by the timeline of getting an animal bred back and producing a healthy calf within a 12 months period. Poor reproductive efficiency in buffaloes is a major economic problem with high incidence rate in our country (Ingawale and Dhoble 2004). It involves number of calving, calving interval and age at first calving. Reproductive performance is a biologically crucial phenomenon, which determines the efficiency of animal production (Genzebu *et al*.2016). Delayed onset of postpartum oestrous is a most crucial factor responsible for poor breeding efficiency of buffaloes (Ahlawat *et al*. 2016). Poor breeding efficiency can be attributed to longer age at first calving, irregular oestrous cycle, poor heat detection, low rate of conception, abnormal calving, longer days open and longer calving interval in buffaloes (Drost *et al*. 1983) but too early age at first calving also results in poor breeding efficiency because of ill developed reproductive organs and mammary gland which may leads to greater veterinary costs to treat reproductive disorder and relatively higher rate of culling. Buffaloes had better reproductive performance in cooler months (70 to 80% conception rate) because they are sexually more active during shorter day length and low temperature. As they have very few sweat glands which leads to poor thermal regulation system (Agarwal 2003). Profit is almost zero if breeding efficiency is below 70% (Kumar *et al*. 2006). Environmental conditions throughout the world are the major factor affecting breeding efficiency. The primary goal of dairy farm management program should be in the direction to economically maximize the number of pregnancies per lifetime of the cow. Hence efforts should be made to increase breeding efficiency, which would increase herd life profit. Breeding efficiency can be improved through improving management systems and utilizing controlled breeding techniques in buffaloes (Barile 2005). Therefore, the present study was undertaken to assess the effect of various non-genetic factors on breeding efficiency in buffaloes.

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MATERIALS AND METHODS

The data on first lactation and life time performance traits

pertaining to Murrah and Nili-Ravi buffaloes was collected from the history sheet of animal for a period from 1983 to 2017 (35 year) maintained at ICAR-Central Institute for Research on Buffaloes, Hisar and Sub-Campus, Nabha, Punjab. The data on performance records of 1180 buffaloes, which included 679 Murrah and 501 Nili-Ravi, were collected.

The data for all the buffaloes born and calved in the farms was recorded up to the date of death/disposal. The animals completed minimum of three lactations with minimum lactation length >150 days and production >1,000 kg for first lactation were selected while, buffaloes having incomplete and abnormal records due to abortion, still birth, chronic illness etc. were excluded.

The data was classified according to age at first calving, season of first calving, period of first calving and number of lactations completed. Age at first calving (AFC) were divided into six categories, viz. < 36 months, >36–42 months, >42–48 months, >48–54 months, >54–60 months and >60 months. Each year was further delineated into four seasons of calving according to geo-climatic conditions in the area, viz. summer (April to June), rainy (July to September), autumn (October to November) and winter (December to March). Period of calving (1983 to 2012) was divided into six groups each consisting of five consecutive years. Number of lactations completed was further classified, viz. Three, Four, Five, Six, Seven and above. Breeding efficiency (BE) was estimated by the following formula:

$$\text{BE (\%)} = \frac{365(N-1)}{D} \times 100$$

N, Total number of parturition/Total number of parities; D, Number of days from first to last parturition/Sum of calving intervals (Wilcox *et al*. 1957) and

$$\text{BE (\%)} = \frac{(365N+1040)}{(AFC+\sum CI)} \times 100$$

N, Total number of calving intervals; AFC, Age at first calving; ΣCI = Sum of calving interval (Tomar 1965)

RESULTS AND DISCUSSION

The overall least-square means for breeding efficiency in Murrah and Nili-Ravi were estimated as 80.09 to 82.97% and 79.57 to 82.50% by Wilcox method while it was 76.62 to 78.12% and 76.04 to 77.73% by Tomar method, respectively. Raina *et al*. (2016) reported average breeding efficiency of Murrah buffaloes as 78.03±1.01% ranging from 69% to 84% by Wilcox method and 78.39±0.39% ranging from 74% to 80% by Tomar method under the similar management conditions. Average breeding efficiency varied between 64% (Bashir *et al*. 2007) to 70% (Khan *et al*. 1990) in Nili-Ravi buffaloes.

Effect of age at first calving: The analysis of variance estimated through Wilcox method indicates that the effect of age at first calving was non-significant on breeding efficiency in both Murrah and Nili-Ravi buffaloes. It may be because of the fact that Wilcox method doesn't consider the age at first calving for calculation of breeding efficiency. Contrary to our findings, Sohail (2010) and Ambhore *et al.* (2017b) reported age at first calving had significant effect on breeding efficiency. Hammoud *et al*. (2009) reported that age at first calving had highly significant effect (P≤0.01) on breeding efficiency, and stated that by increasing age at first calving the breeding efficiency decreased when measured by Wilcox method. However, in our results, breeding efficiency calculated by Tomar method indicated that the effect of age at first calving had highly significant (P<0.01) effect on both the breeds. The breeding efficiency was significantly higher in Murrah (86.01 to 91.63%) and Nili-Ravi (84.47 to 88.12%) for the group of AFC <36 months while, significantly lower in Murrah (66.12 to 68.92%) and Nili-Ravi (62.01 to 67.95%) for the group of AFC >60 months. The decreasing trend was observed for breeding efficiency with increased AFC (Table 1). In conformity with our findings, Eman *et al*. (2012) reported that age at first calving had highly significant effect on breeding efficiency. They reported maximum breeding efficiency of 81.82% at less than 30 months of ages at first calving by Tomar Method. The delay in age at first calving, consequently delays further conception and results in low reproductive efficiency and lengthening of the non-productive life (Warriach *et al*. 2015).

Effect of season of first calving: The results of effect of season of first calving on breeding efficiency are depicted in Table 1. The analysis by Wilcox method revealed that the effect of season of first calving was highly significant on BE in both the breeds. It was significantly higher (81.73 to 84.98% and 82.30 to 85.81%) in rainy and lower (76.74 to 80.68% and 76.54 to 80.75%) in winter for Murrah and Nili-Ravi breeds, respectively. Late winter and early summer have lower reproductive efficiency compared to those calving during other periods (Singh *et al*. 2000). Similar to our findings, Singh and Yadav (1987), Sahana and Sadana (1999), Bashir *et al*. (2007) and Hammoud *et al*. (2009) reported that effect of season was significant on breeding efficiency by both the methods. Contrary with our findings, Singh *et al*. (2016) reported non-significant effect of season of first calving on BE by Wilcox as well as Tomar method. Also, Singh *et al*. (2016) and Ambhore *et al*. (2017a) reported non-significant effect of season of first calving on BE by Tomar and Wilcox method. In this study, effect of season of first calving was highly significant on BE in Murrah and Nili-Ravi buffaloes as per Tomar method. Rainy season revealed significantly higher (77.36 to 79.05% and 77.40 to 79.42%) while, winter season had lower (75.13 to 77.18% and 74.14 to 76.57%) BE in Murrah and Nili-Ravi, respectively. Similar to our findings, Raina *et al*. (2016) reported that effect of season was significant on breeding efficiency by Tomar method. Contrary with our results, Ambhore *et al*. (2017a) reported non-significant effect of season of first calving on BE. Non-significant effect of season of first calving on BE was also reported by Shinde (2010) in HF crossbreds and Kohle (2011) in Gir

Table 1. Least-square means with standard errors for effect of non-genetic factors on breeding efficiency in Murrah and Nili-Ravi buffaloes by Wilcox and Tomar method

Source of variation	Wilcox method		Tomar method	
	Murrah	Nili-Ravi	Murrah	Nili-Ravi
Overall mean	81.53±0.73 (679)	81.04±0.74 (501)	77.37±0.38 (679)	76.88±0.43 (501)
Age at first calving				
< 36 months	80.13±2.75 (19)	80.49±1.61 (43)	88.82^{f}±1.43 (19)	86.29^{e}±0.93 (43)
>36–42 months	81.37±1.31 (63)	82.10±0.93 (169)	83.44^{e}±0.68 (63)	84.68^{e}±0.54 (169)
>42–48 months	81.12±0.82 (210)	81.83±0.88 (165)	78.42^{d}±0.43 (210)	78.75^{d}±0.51(165)
>48–54 months	82.73±0.86 (203)	83.26±1.18 (81)	75.70^{c}±0.45 (203)	75.89^{c}±0.68 (81)
>54–60 months	80.92±1.25 (104)	80.42±2.06 (26)	70.30^{b}±0.65 (104)	70.71^{b}±1.19 (26)
> 60 months	82.89±1.37 (80)	78.12±2.61 (17)	67.52^{a}±0.71 (80)	64.98^{a}±1.51 (17)
Season of first calving				
Summer (April to June)	81.58±1.57 (48)	81.69±1.27 (76)	77.35^{ab}±0.81 (48)	77.12^{bc}±0.73 (76)
Rainy (July to September)	83.35±0.83 (304)	84.05±0.89 (223)	78.20^{b}±0.43 (304)	78.41^{c}±0.52 (223)
Autumn (October to November)	82.48±0.98 (170)	79.75±1.27 (88)	77.76^{b}±0.51 (170)	76.65^{ab}±0.73 (88)
Winter (December to March)	78.71±1.00 (157)	78.65±1.07 (114)	76.16^{a}±0.52 (157)	75.36^{a}±0.62 (114)
Period of first calving				
1983–1987	81.79±3.00 (125)	81.30±1.64 (76)	76.71±1.56 (125)	76.51^{ab}±0.94 (76)
1988–1992	79.15±2.58 (122)	85.32±2.68 (44)	76.74±1.34 (122)	78.05^{b}±1.55 (44)
1993–1997	81.77±2.08 (106)	79.87±2.85 (84)	77.87±1.08 (106)	77.14^{ab}±1.64 (84)
1998–2002	85.13±1.65 (138)	83.60±1.91 (84)	79.52±0.86 (138)	78.22^{b}±1.10 (84)
2003–2007	82.96±2.48 (112)	81.67±1.70 (110)	76.73±1.29 (112)	78.32^{b}±0.98 (110)
2008–2012	78.37±2.98 (76)	74.46±2.89 (103)	76.63±1.55 (76)	73.06^{a}±1.67 (103)
Lactation completed				
3	81.47±0.97 (170)	79.22±1.01 (139)	75.11^{a}±0.50 (170)	75.43^{a}±0.58 (139)
4	81.72±1.06 (130)	81.67±1.02 (128)	76.57^{b}±0.55 (130)	76.73^{ab}±0.59 (128)
5	80.48±1.14 (110)	80.90±1.20 (80)	76.82^{bc}±0.59 (110)	76.65^{ab}±0.69 (80)
6	81.44±1.19 (102)	81.53±1.33 (72)	78.05^{c}±0.62 (102)	77.21^{bc}±0.77 (72)
7 and above	82.54±1.06 (167)	81.86±1.26 (82)	80.28^{d}±0.55 (167)	78.40^{c}±0.72 (82)

Means bearing different superscripts in a column differs significantly (P<0.05).

crossbred cows. Most of calvings (70–80%) in buffaloes occurs between July to January and buffaloes normally perform better during the cool months with enhanced breeding efficiency (Potdar *et al*. 2019). In India, the buffalo's libido declines during the hot humid season while improves with onset of the colder season (Misra and Sengupta 1965).

Effect of period of first calving: The effect of period of first calving on breeding efficiency was shown in Table 1. Non-significant effect of period of first calving was found on BE in both the breeds by Wilcox method. Similar to our findings Baghdasar and Juma (1998) and Eman *et al.* (2012) reported that year of calving had no significant effect on breeding efficiency in Iraqi buffaloes. In contrast, Ambhore *et al*. (2017a) reported that period of first calving had significant effect on breeding efficiency. Also, Singh *et al*. (2016) reported significant effect of period of first calving on breeding efficiency by Wilcox method. In our study, the results of Tomar method showed that the effect of period of first calving was non-significant (P<0.01) on BE in Murrah but significant in Nili-Ravi. Contrary to our finding, Raina *et al*. (2016) reported that effect of period on breeding efficiency was significant by Tomar method in Murrah buffaloes. The breeding efficiency in Nili-Ravi was highest (76.39 to 80.25%) for the period 2003–07 and lowest (69.78 to 76.34%) for the period 2008–12. In conformity to our finding in Nili-Ravi, Sahana and Sadana (1999), Bashir *et al*. (2007), Sohail (2010) and Ambhore *et al*. (2017a) stated that year of calving significantly affected breeding efficiency. Significant effect of period of first calving on BE was also observed by Kohle (2011) in Gir crossbred cows and Dash (2014) in Karan Fries.

Effect of lactation completed: Table 1 revealed the effect of lactation completed on breeding efficiency. Estimates of Wilcox method indicated non-significant effect of lactation completed on breeding efficiency in Murrah as well as Nili-Ravi buffaloes. Contrary to our finding, Ambhore *et al*. (2017a) reported that effect of parity was highly significant (P<0.01) on breeding efficiency. Cady *et al*. (1983) also reported significant effect of number of lactations completed on breeding efficiency in Nili-Ravi buffaloes. However, calculation of our results by Tomar method revealed that the effect of lactation completed was highly significant (P<0.01) on breeding efficiency in both the breeds. Breeding efficiency was highest for the animals completed 7 and above lactations while, lowest for those completed only 3

lactations. These results are in agreement with the study of Dash (2014) who reported that breeding efficiency tended to improve with advancing parity in Karan Fries cattle.

Breeding efficiency is a key to determine reproductive performance of animal. Season greatly affected the breeding efficiency in buffaloes and had better performance in rainy season than in winter. Changes in breeding efficiency due to period of calving depend on the management practices during that particular period of time. Breeding efficiency linearly increased with increase in number of lactations except for fifth lactation in this study. Breeding efficiency also varied with the method of calculation and according to breeds of buffalo. In the present study, the different trends for breeding efficiency between Murrah and Nili-Ravi breeds could be due to genetic diversity, feed and fodder availability, management system, climatic conditions as the two farms were located at different places. Efforts should be made towards improvements in breeding efficiency of animals leading to better reproductive performance and thereby improve overall efficiency of the dairy farm. The results obtained from the study may be utilized to develop better management practices for enhancing breeding efficiency.

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