Journal of Animal Research: v.5 n.2, p. 223-226. June 2015

DOI Number: 10.5958/2277-940X.2015.00038.8

Identifying the Factors Affecting Birth Weight and Conception Rate in Sahiwal Bulls

Binoy Chandra Naha[1], Atish Kumar Chakravarty[2], Mohsin Ayoub Mir[2*], C. S. Patil[3], Arun Pratap Singh[2] and Dinesh Maher[2]

[1]Department of Animal Genetics, ICAR-Indian Veterinary Research Institute, Izatnagar, Barielly, Uttar Pradesh, INDIA.
[2]Dairy Cattle Breeding Division, ICAR-National Dairy Research Institute, Karnal, Haryana, INDIA.
[3]Department of Animal Genetics and Breeding, LUVAS, Hisar, Haryana, INDIA

** Corresponding author: MA Mir; Email: mohsinvet546@gmail.com*

Received: 17 January, 2015 **Accepted:** 10 April, 2015

ABSTRACT

The data on growth and fertility traits of 43 Sahiwal bulls during 27 years (1987-2013) belonging to 8 sets of Sahiwal Breeding Project at ICAR-National Dairy Research Institute, Karnal (Haryana), India were analysed using fixed linear model to assess the effect of non-genetic factors on birth weight and fertility traits in Sahiwal bulls. The average birth weight (BW), conception rate based on first AI (CRFAI) and overall conception rate (OCR) in Sahiwal bulls was estimated as 22.19 ± 0.05 kg, 45.95 ± 1.37% and 46.38 ± 1.55%, with coefficient of variation of 13.42%, 21.84 % and 22.32%, respectively. The overall least-squares means for birth weight, conception rate based on first AI and overall conception rate was estimated as 22.04 ± 1.08 kg, 46.24 ± 0.35% and 46.86 ± 0.27%, respectively in Sahiwal breeding bulls. Period of birth had not influenced the birth weight of Sahiwal bulls, though period of conception had significant ($P < 0.01$) effect on fertility traits. Season of birth/AI, parity and age of female did not influenced the birth weight and fertility traits of Sahiwal bulls.

Keywords: Birth weight, conception rate, fertility, non-genetic factor, Sahiwal bull

The birth weight is an important economic trait affecting subsequent growth rate and other performance traits. The reproduction parameters in animals are more influenced by environment (Mukhopadhyay *et al.,* 2010). Under breed improvement programme sires are considered to be "more than half of the herd" because; the contribution of bull in genetic improvement of herd is more than cow. The term fertility denotes the ability of an animal to produce young ones. Male fertility is regulated by animal's genetic disposition and environmental factors. More conception rate of the bull is useful to improve the productive and reproductive performance in the herd. Bull fertility helps in improving the herd reproductive performance. Fertility of the bull is often measured by the percentage of cycling cows exposed to the bull and impregnated during a specific time period, usually 60 – 90 days (Hamilton, 2006). Till date, most fertility related studies in dairy animals have done on female fertility but male fertility has not been investigated substantially in India. The differences in bull management studies have shown differences among conception rate in different bulls (Gerard and Humblot, 1991). In contrast to genetic evaluations for performance and conformation traits, only a bull's own records contribute to his male fertility evaluation. Effect of non-genetic factors can be assessed in terms of factors that affect an entire herd. The non-genetic factors such as period, season, parity, stage of lactation and age of female can influence the birth weight and conception rate of the bull. Therefore, the present study was undertaken to investigate the influence of various non-genetic factors on birth weight and fertility traits to suggest suitable selection strategies for improvement of Sahiwal bulls.

MATERIALS AND METHODS

Under progeny testing programme, bulls are evaluated based on the daughter's performance. A set of bulls are used in Sahiwal breeding programme and the duration of each set (test cycle) is around 24 months. The present study was conducted on 43 Sahiwal breeding bulls maintained under 8 sets at the NDRI herd. Data were collected on birth weight (BW), conception rate based on first AI (CRFAI) and overall conception rate (OCR). For BW, the data were classified into various sub-classes for season and period of birth, parity and age of Sahiwal cows while for CRFAI AND OCR data were classified into different sub-classes for period and season of conception, parity, stages of lactation and age of Sahiwal cows used in breeding programme. Conception rate based on first AI of Sahiwal bulls was defined by the ratio of each pregnancy over number of first AI and expressed in percentage. In similar way, overall conception rate of Sahiwal bulls was estimated by total numbers of pregnancy in each cow out of total numbers of AI and expressed in percentage.

Mean and standard error of the growth trait and fertility traits were calculated using standard statistical procedures (Snedecor and Cochran, 1994). To ensure the normal distribution of records, the outliers for each trait were removed and data follows the normal distribution were considered. The effect of non-genetic factors on growth and fertility traits were studied by least-squares analysis for non-orthogonal data, using fixed linear model (Harvey, 1990). The following models were used with assumptions that different components being fitted into the model were independent and additive.

1. For birth weight of Sahiwal bulls:

$$\mathbf{Y_{ijkmn} = \mu + P_i + S_j + PA_k + b\,(AF_m - \bar{AF}) + e_{ijkmn}}$$

where, $Y_{ijkmn,}$ observation on the n^{th} bull in i^{th} period , j^{th} season ,k^{th} parity of dam and m^{th} age of cow; μ ,overall mean; $P_{i,}$ effect of i^{th} period (1 to 8); $S_{j,}$ effect of j^{th} season (1 to 4); $PA_{k,}$ effect of k^{th} parity of dam (1 to 5and above); b, regression of age of female on birth weight; $AF_{m,}$ age of m^{th} female; $\bar{AF}$ is the average age of female; $e_{ijkmn,}$ random error ~ NID $(0, \sigma^2_e)$.

2. For conception rate based on first AI and overall conception rate of Sahiwal bulls:

$$\mathbf{Y_{ijklmn} = \mu + P_i + S_j + PA_k + SL_l + b\,(AF_m - \bar{AF}) + e_{ijklmn}}$$

where, Y_{ijklmn} is the observation on the n^{th} bull in i^{th} period, j^{th} season, k^{th} parity, l^{th} stages of lactation and m^{th} age of cow; μ is the overall mean; P_i is the effect of i^{th} period (1 to 8); S_j is the effect of j^{th} season (1 to 4); PA_k is the effect of k^{th} parity (1 to 5 and above); SL_l is the effect of l^{th} stage of lactation (1 to 3); b is the regression of age of female on the CRFAI; AF_m is the age of m^{th} cow; $\bar{AF}$ is the average age of cow; e_{ijklmn} is the random error ~ NID $(0, \sigma^2_e)$.

The difference of means between sub-classes of periods, seasons, parity and stage of lactation were tested for significance using Duncan's Multiple Range Test (Kramer, 1957).

RESULTS AND DISCUSSION

Average birth weight of Sahiwal bulls was estimated as 22.19 ± 0.05 kg with the coefficient of variation of 13.42 %. The overall least-squares mean for birth weight was estimated as 22.04 ± 1.08 kg . The analysis of variance for different non-genetic factors affecting BW, CRFAI and OCR under model are presented in Table 1. The effect of season, parity, stage of lactation and age of cows was found non-significant for all of the traits. Period had non-significant effect on birth weight of Sahiwal bulls. Similar finding was reported by other workers in Sahiwal bulls (Biswas *et al.*, 2003). Least-squares means of birth weight varied in different periods with a minimum of 43.32 kg during 1999-2002 to a maximum of 49.05 kg during 2010-2013.

Average conception rate based on first AI of Sahiwal bulls was estimated as 45.95 ± 1.37 % with the coefficient of variation of 21.84 % (Table 2). The overall least-squares means for conception rate of Sahiwal bulls based on first AI was estimated as 46.24 ± 0.35 %. Period had significant effect ($P<0.01$) on conception rate based on first AI (Table 1 and Fig 1). Least-squares means of conception rate based on first AI varied in different periods with a minimum of 43.32% during 1999-2002 to a maximum of 49.05% during 2010-2013. The conception rate based on first AI in 2010-11 was estimated as 37.6% (Anon, 2010), in 2011-12 as 43.87 percent (Anon, 2011), and in 2012-13 as 50 percent (Anon, 2012), respectively in Sahiwal cattle of NDRI herd. The variation of conception rate based on first AI in different years at NDRI herd may be due to less number of observations in each year. Season had non-significant effect on conception rate based on first

AI. Similar finding was reported by other workers (Hillers *et al.,* 1983). Least-squares means of seasons varied in different seasons with a minimum of 45.49% in summer season to a maximum of 47.43% in autumn season.

Table 1. Analysis of variance (M.S. values) of birth weight, first and overall conception rate of Sahiwal bulls

Sources of variation	Mean sum of squares		
	Birth weight (kg)	CRFAI %	OCR %
Period of birth/A.I.	9.46 (7)	836.90** (7)	1332.27**(7)
Season of birth/A.I.	22.26 (3)	282.84 (3)	175.00 (3)
Parity of female	10.85 (4)	111.60 (4)	68.44 (4)
Stages of Lactation	-	15.83 (2)	34.46 (2)
Regression (Age of female)	7.43 (1)	0.065 (1)	25.30 (1)
Error	7.59 (27)	86.34 (1958)	73.92 (2557)

Figures in parentheses indicate respective degrees of freedom. **p<.01

Average overall conception rate of Sahiwal bulls was estimated as 46.38 ± 1.55% with the coefficient of variation of 22.32% (Table 2). The overall least-squares mean for overall conception rate was estimated as 46.86 ± 0.27%. Period had significant effect (P<0.01) on overall conception rate (Table 1 and Fig 1). Least-squares means of overall conception rate varied in different periods with a minimum of 43.72% during 2004-2007 to a maximum of 49.52% during 2010-2013. The overall conception rate in 2011-12 was estimated as 40.04% (Anon, 2011), in 2012-13 as 46.89 % (Anon, 2012) in Sahiwal cattle of NDRI herd. The variation of overall conception rate in different years at NDRI herd may be due to less number of observations in each year. Season had non-significant effect on overall conception rate. Haugan *et al.,* 2005 also reported, non-significant effect of season of AI on overall conception rate in heifers. Kuhn and Hutchison (2008) reported lower overall conception rate and also found significant effect of periods, seasons and parity on overall conception rate in Holstein Friesian cattle. Least-squares means of seasons varied in different seasons with a minimum of 46.29% in summer season to a maximum of 47.63% in autumn season.

Table 2. Average conception rate based on first AI and overall conception rate of Sahiwal bulls

Type of A.I.	Total A.I.	Total pregnancy	CR (%)	CR (%) Range	CV (%)
First AI	3049	1401	45.95 ± 1.37	21.78 - 90	21.84
Overall	3719	1725	46.38± 1.55	21.78 - 100	22.32

CR= Conception rate, CV= Coefficient of variation

CRFAI = conception rate based on first AI, OCR = Overall conception rate

It is inferred from the study that during the first five periods from 1987-2004 no consistent trend was observed for conception rate based on first AI and overall conception rate, but thereafter from 2004-2013 the conception rate was found increasing gradually which indicates that management of sahiwal cows were improved significantly from 2004 onwards in the herd. The increase of conception rate in Sahiwal bulls may be due to the fact that silage based feeding system was gradually replaced by energy based feeding system from December, 2003 in the herd.

CONCLUSION

The overall least-squares means for birth weight, conception rate based on first AI and overall conception rate were estimated as 22.04 ± 1.08 kg, 46.24 ± 0.35% and 46.86 ± 0.27% in Sahiwal breeding bulls. Period had significantly affected the conception rate based on first AI and overall conception rate of Sahiwal breeding bulls whereas, season of birth/AI, parity, age of female did not significantly influenced the birth weight and fertility traits of Sahiwal bulls. It was concluded that the difference in performance of breeding bulls among different periods might be attributed to differences in managemental practices in the herd. The feeding of balanced ration to Sahiwal bulls could be the cornerstone for improving the conception rate through AI. It can be emphasized that improving management in different periods may have an important bearing on higher conception rate of Sahiwal bulls in tropical and subtropical regions.

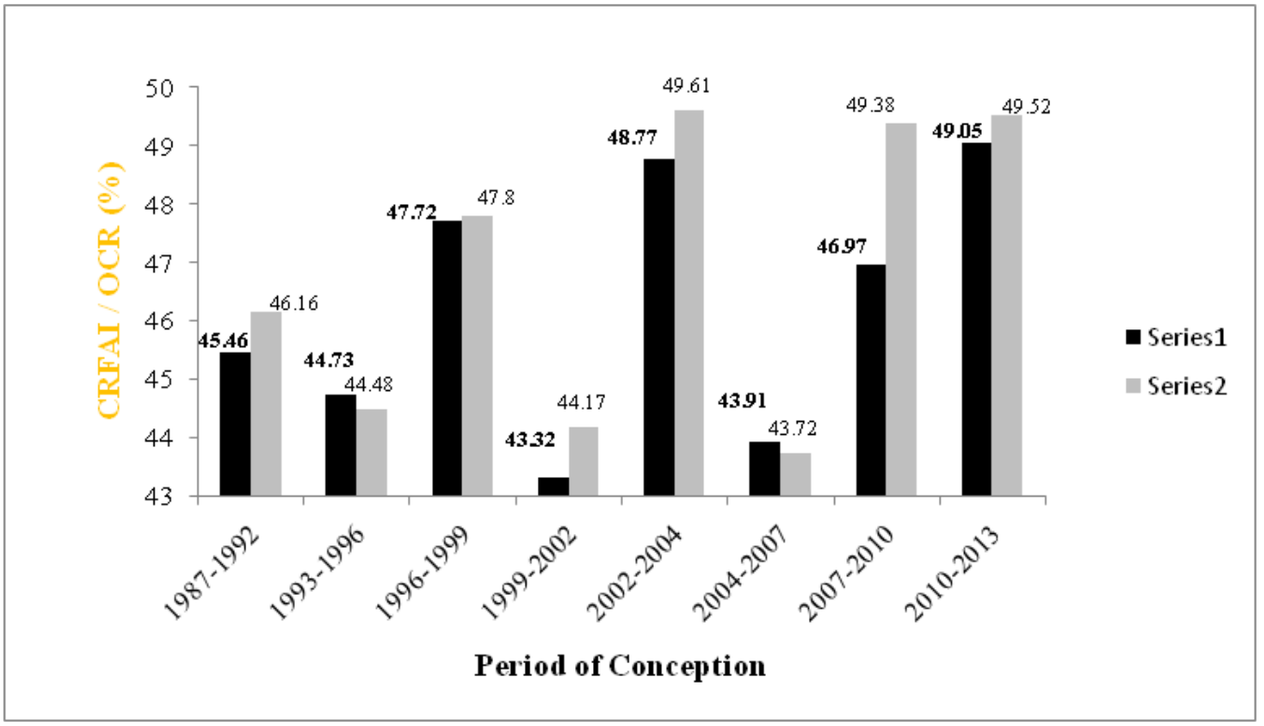

Figure 1. Period wise variation of conception rate based on first AI and overall conception rate of Sahiwal bulls

ACKNOWLEDGEMENTS

The authors are indebted to the Director and Vice Chancellor, ICAR-NDRI, Karnal, Haryana for providing the infrastructure facilities. The first author is also thankful to NDRI for providing financial assistance for the successful completion of the project.

REFERENCES

Anonymous. 2010. Annual Report, National Dairy Research Institute, Karnal, India. P.151.

Anonymous. 2011. Annual Report, National Dairy Research Institute, Karnal, India. P.145.

Anonymous. 2012. Annual Report, National Dairy Research Institute, Karnal, India. P. 159.

Biswas, T. K., Bhattacharya, T. K., Narayan, A. D., Badola, S., Kumar, P. and Sharma, A. 2003. Growth Hormone Gene Polymorphism and its Effects on Birth Weight in Cattle and Buffalo. *Asian-Austr. J. Anim. Sci*., **16**(4): 494-497.

Gerard, O. and Humblot, P. 1991. Influence of Interactions Between Semen Extender and Number of spermatozoa on Nonreturn Rate Estimates of Fertility for Individual Holstein Bulls. *Theriogenology.,* **36:** 727–36.

Hamilton, T. 2006. Beef Bulls Fertility. *Ontario Ministry of Agriculture and Food* ISSN: 1198- 712.

Harvey, W. R. 1990. Guide for LSMLMW, PC–1 Version, Mixed Model Least-Squares and Maximum LikelyHood Computer Programme. Mimeograph, Ohio State University, USA.

Haugan, T., Reksen, T., Grohn, Y. T., Kommisrud, E., Ropstad, E. and Sehested, E. 2005. Seasonal Effects of Semen Collection and Artificial Insemination on Dairy Cow Conception. *Anim. Reprod. Sci*., **90**: 57–71.

Hillers, J. K., Senger, P. L., Darlington, R. L. and Fleming, W. N. 1983. Effects of Production, Season, Age of Cow, Days Dry, and Days in Milk on Conception to First Service in Large Commercial Dairy Herds. *J. Dairy Sci.,* **67**: 686.

Kramer, C. Y. 1957. Extension of Multiple Range Tests to Group Correlated Means. *Biometrics.,* **13:** 13–8.

Kuhn, M. T. and Hutchison, J. L. 2008. Prediction of Dairy Bull Fertility from Field Data: Use of Multiple Services and Identification and Utilization of Factors Affecting Bull Fertility. *J. Dairy Sci.,* **91:** 2481–92.

Mukhopadhyay, C.S., Gupta, A.K., Yadav, B.R., Khate, K., Raina, V.S., Mohanty, T.K. and Dubey, P.P. 2010. Subfertility in males: an important cause of bull disposal in bovines. *Asian-Aust. J. Anim. Sci*., **23**:450–455.

Snedecor, W. and Cochran W. G. 1994. Statistical Methods. 6th Ed., Oxford and IBH Publishing Co, Kolkata, India.