Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6758

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (5):** 1068-1072 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Genetic Analysis of Age at First Calving in Graded Sahiwal Cows in the Field Conditions of Jharkhand State of India

S. K. Bansal, K. G. Bhave, T. V. Shirsath*, S. A. Joshi, Marimuthu S. and J. R. Khadse

BAIF Central Research Station Uruli Kanchan, Pune, Maharashtra State Pin 412 202

*Corresponding Author E-mail: tejashreeshirsath@baif.org.in

Received: 1.08.2018 | Revised: 30.08.2018 | Accepted: 7.09.2018

ABSTRACT

Age at first calving is consider an important trait as it has direct correlation with both reproductive and productive performance of an animal. Present study was conducted to estimate the effect of birth year and birth season on age at first calving for 1282 F1 progenies born out of 6 Sahiwal breed sires during the period of four years from 2008 to 2011 spread over 19 districts of Jharkhand state. The data related to F1 progenies from Jharkhand state was collected through BAIF Cattle Breeding Centres. The least square mean of age at First Calving was estimated to be 1380.99±7.19 days. The least squares analysis revealed significant effect (P<0.01) of Agro climatic Zone, Birth Year and Birth season on age at First Calving. Using restricted maximum likelihood method, the heritability estimate of age at first calving was found to be 0.048 ± 0.001. It was concluded that for lowering the age at first calving in graded Sahiwal cows, better management practises are essential, as there was little scope of genetic improvement by selection.

Key words: *Sahiwal cattle, Age at first calving (AFC), Heritability.*

INTRODUCTION

Knowledge of genetic parameters has utmost importance in planning for selection and breeding strategies for genetic improvement of dairy cattle. That is why many countries stressed on genetic evaluations for reproductive traits[1]. Reducing age at first calving increases profitability[12]. Hence, age at first calving is a benchmark that should be properly managed in order to achieve the highest economic return and longer productive life.

Sahiwal is known as best milch breed of zebu cattle and known for its endurance, resistance to tropical diseases, tick resistance and drought resistance. Due to these attributes, Sahiwal is one of the few indigenous breeds, which has been imported by many other countries from India and Pakistan and has been used either for crossing or later on for incorporating some zebu genes[2].

In many cases, higher culling rate for cows could be due to fertility problems that lead to higher age at first calving (AFC). Lowering of AFC has positive effect on genetic improvement as it reduces generation interval, replacement rates and animal rearing expenses.

Cite this article: Bansal, S.K., Bhave, K.G., Shirsath, T.V., Joshi, S.A., Marimuthu, S., Khadse, J.R., Genetic Analysis of Age at First Calving in Graded Sahiwal Cows in the Field Conditions of Jharkhand State of India, *Int. J. Pure App. Biosci.* **6(5):** 1068-1072 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6758

Sahiwal cattle breed is one of the best milk cattle breeds in India, which has been widely used for up gradation of non- descript cows in India. Therefore, present study has a focus on estimating genetic parameters of age at first calving of F1 progenies born out of Sahiwal semen used under BAIF's door-to-door AI service programs in field conditions in the state of Jharkhand.

MATERIAL AND METHOD

Records of 1282 F1 progenies born out of 6 Sahiwal bulls during the period of 2008 to 2011 spread over 19 districts of Jharkhand state (Bokaro, Chatara, Deoghar, Garhwa, Godda, Gumla, Koderma, Latehar, Ranchi, Sahebganj, Dumka, Giridih, Jamtara, Lohardaga, Pakur, Pamalau, Khunti, Hazaribagh, Dhanbad) were collected. Based on the information, the districts were clubbed into two zones (Central & Western Plateau Zone and Central & North Eastern Plateau Zone). The seasons of birth were classified into Rainy, summer and winter.

Statistical analysis

Least-squares analysis method was used to study the effect of various non-genetic factors on various traits and to determine the factors contributing significant effect. The statistical model used is as follows.

$Y_{ijk} = \mu + A_i + B_j + C_k + e_{ijk}$

Where, Y_{ijk} = Age at first calving of K^{th} progeny

μ = overall mean

A_i = effect of i^{th} agro-climatic zone (i=1-2)

B_j = effect of j^{th} year of birth (j=2008-2011)

C_k = effect of k^{th} season of birth (k= summer, Rainy, Winter)

e_{ijk} = Random errors normally and independently distributed with mean zero and variance σ^2_e . NID $(0, \sigma^2_e)$

Covariance components were estimated through restricted maximum likelihood method using a sire model. The fixed effects that were found to be significant from the least-squares analyses were fitted into the model. The genetic parameters calculated from the model were used to estimate breeding values for age at first calving trait.

The statistical model is as follows.

$Y = Xb + Zu + e$

Where,

Y = Observation vector of trait age at first calving,

X = Incidence matrix of fixed effects of district × year of Birth

b = vectors for fixed effects

Z = Incidence matrix for random sire effect

u = Vector of sire effects

Least square analysis was carried out using R-Software (Version 3.4.1.), while restricted maximum likelihood (REML) method using WOMBAT software (Version 0.7.1.) was used to calculate heritability of age at first calving[11].

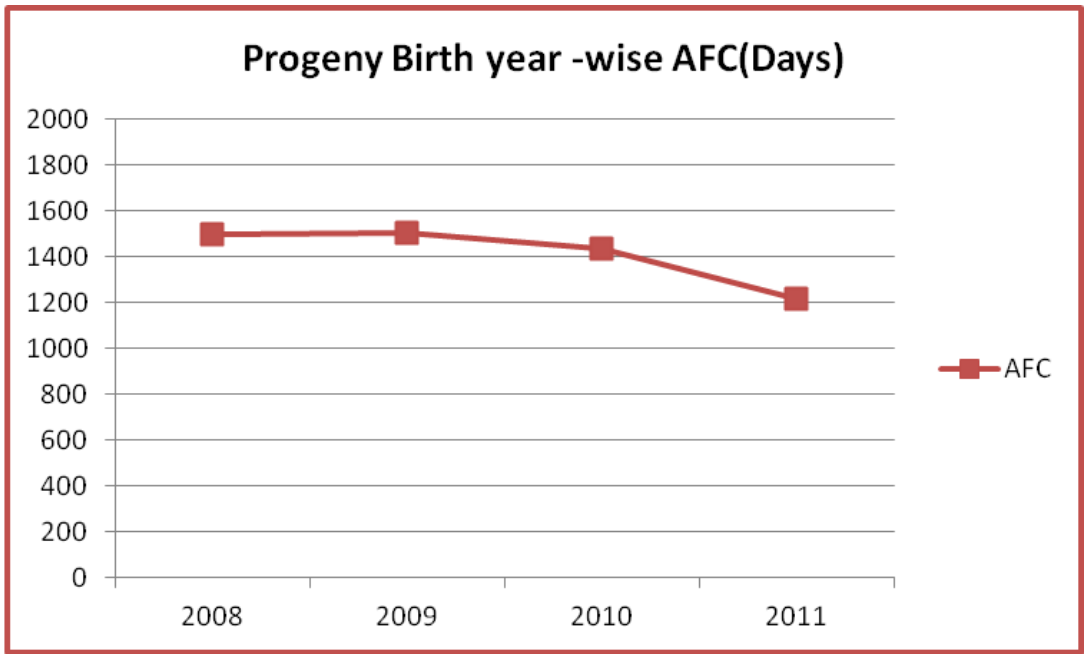
RESULT AND DISCUSSION

The least square means are given in table no. 1. It was observed that the overall mean of age at first calving of F1 progeny of graded Sahiwal cows was 1380.99 ± 7.19 days. Our findings are in close agreements with the reports of Ahmad, Javed *et al.*[8], Rehman *et al.*[17], Ilatsia *et al.*[7], Pundir and Ahalawat[15]. Bhatnagar *et al.*[5], Wakchaure and Meena[18], Manoj[10] and Raja[16], Yadav *et al.*[19] have reported lower AFC in Sahiwal cattle than our finding.

Effect of Agro Climatic Zone: In present study agro climatic Zones were Central &

Western Plateau Zone (Bokaro, Chatara, Garhwa, Gumla, Hazaribagh, Khunti, Latehar, Lohardanga, Palamau, Ranchi and Simdega) and Central & North Eastern Plateau Zone (Deoghar, Dhanbad, Dumka, Giridih, Godda, Jamtara, Koderma, Pakur and Sahebganj).The analysis revealed that the difference between the zones was non-significant at 5 per cent level of significance on age at first calving. The least square means of age at first calving of Sahiwal cows in the two zones were Central &Western Plateau Zone 1403.43±10.90 days compared to that in Central and North Eastern Plateau 1423.28±8.76 days.

Effect of Birth Year: In the present study, year of birth of the F1 heifer cows had significant effect (P<0.01) on their age at first calving. Lowest AFC (1207.37 ± 11.20 days) was recorded in year 2011 while in other years AFC was higher than population mean. The graph of AFC plotted against the year of birth indicated gradual reduction in age at calving over the years 2008 to 2011.



Effect of Birth Season: It was noticed that calves born during winter season grew comparatively well exhibiting significantly lower AFC of 1373.95±10.87 days followed by progeny born in summer season (1446.95±11.82 days) and rainy seasons (1419.17±12.51 days). Wakchaure and Meena[18] and Raja[16] have reported the significant effect of season of birth on AFC in Sahiwal cattle. The reason for this might be change in physical environment as the animals were raised in different climatic condition.

Heritability for age at first calving: Heritability estimates of age at first calving were found to be 0.048 ± 0.001. Our findings were in close agreements with the results of Banik and Gandhi[4] while Choudhary *et al.*[6] and Balasubramaniam *et al.*[3] have reported higher estimates in Sahiwal than our findings. Estimate of heritability indicated that variation in the age at first calving trait was highly due to non-genetic effect than that of sire effect, which contributed very less to it. This study suggested that there was very little scope for improvement, which could be done by genetic factor, and need more improvement in management practices. Therefore, care should be taken in estrus detection and timing of insemination and better nutritional status of the animal to improve the trait.

Table no. 1. Least Square Means of Independent Variable

Sr. No	Source	N	LSM of AFC
A	**Agro Climatic Zone*** **		
1	Central & Western Plateau Zone	561	1403.43 ± 10.90
2	Central and North Eastern Plateau	721	1423.28 ± 8.76
B	**Birth Year*** **		
1	2008	134	1501.33 ± 20.15
2	2009	237	1513.34 ± 15.03
3	2010	489	1431.38 ± 10.19
4	2011	422	1207.37 ± 11.20
C	**Birth Season*** **		
1	Rainy	352	1419.17 ± 12.51
2	Summer	467	1446.95 ± 11.82
3	Winter	463	1373.95 ± 10.87

(Significance codes: 0 '***', 0.001 '**', 0.01, NS- Non significant)

CONCLUSION

The estimates of heritability suggested that the variation in the age at first calving in graded Sahiwal cows were mainly due to non-genetic or environmental factors. So it was concluded from the study that for lowering the age at first calving, better management practises are essential, as there was little scope of genetic improvement by selection.

Acknowledgement

Authors are very much grateful to the Dr. B.R. Mangurkar and President, BAIF for his encouragement.

REFERENCES

1. Abe, H., Masuda, Y., Suzuki, M., Relationships between reproductive traits of heifers and cows and yield traits for Holsteins in Japan. *J Dairy Sci*. **92:** 4055–4062 (2009).
2. Upadhyay, A., Sadana, D. K., Gupta1, A. K., Chakravarty, A. K., Dash1, S., Das, M. K., Anushree, M. and Shivah, P. R., Age and lactation specific disposal pattern in Sahiwal cattle and influence of various genetic and non-genetic factors. *Veterinary World*, **7:** Oct. EISSN: 2231-0916 (2014).
3. Balasubramaniam, S., Singh, M., Gowane, G. R. and Kumar, S., Estimate of genetic and non-genetic parameters and trends for age at first calving in Sahiwal cows. *Indian J. Anim. Sci*., **83(9):** 948-952 (2013).
4. Banik, S. and Gandhi, R. S., Estimation of genetic parameters in Sahiwal cattle using single and multi-trait restricted maximum likelihood method. *Indian Journal of Animal Sciences* **80(3):** 266–268 (2010).
5. Bhatnagar, D. S., Taneja, V. K., Basu, S. B. and Murthy, K. M. K., Genetic parameters for some economic traits in sahiwal cattle. *Indian Journal of Dairy Sci*., **36(4):** 402-4O6 (1983).
6. Choudhary, V., Kothekar, M. D., Raheja, K. L., Kasturiwale, N. N., Khire, D. W. and Kumar, P., Genetic Evaluation of First Lactation Traits in Sahiwal Cattle Using Restricted Maximum Likelihood Technique. *Asian-Australasian Journal of Animal Sciences* **16(5):** 639-643 (2003).
7. Ilatsia, E. D., Muasya, T. K., Muhuyi, W. B. and Kahi, A. K., Genetic and phenotypic parameters and annual trends for milk production and fertility traits of the Sahiwal cattle in semi arid Kenya. *Trop. Anim. Health Production*, **39:** 37-48 (2007).
8. Javed, K., Mohiuddin, G. and Abdullah, M., Environmental factors affecting various productive traits in Sahiwal cattle. *Pakistan Vet. J.* **20:** 187-192 (2000).
9. Lee, C., Methods and techniques for variance component estimation in animal

breeding-review. *Asian-Aust. J. Anim. Sci*. **13(3):** 413-422 (2000).

10. Manoj, M., MVSc. Thesis. *National Dairy Research Institute (Deemed University), Karnal*, India (2009).
11. Meyer, K., WOMBAT: A program for mixed model analyses by restricted maximum likelihood. Retrieved from http://didgeridoo.une.edu.au/km/homepage.php (2010).
12. Nunez-Dominguez, R., Cundiff, L. V. and Dickerson, G. E., Lifetime production of beef heifers calving first at two vs three years of age. *Journal of Animal Science* **69:** 3467-3479 (1991).
13. Páchová, E., Zavadilová, L., Sölkner, J., Genetic evaluation of the length of productive life in Holstein cattle in the Czech Republic. *Czech Journal of Animal Science*, **50:** 493–498 (2005).
14. Pirlo, G., Miglior, F., Speroni, M., Effect of age at first calving on production traits and on difference between milk yield returns and rearing costs in Italian Holsteins. *Journal of Dairy Science*, **83:** 603–608 (2000).
15. Pundir, R. K. and Ahlawat, S. P. S., Indigenous breeds of cattle, buffalo, and their conservation. *Dairy Year Book.3rd edition*, P 301-310 (2006).
16. Raja, T. V. Part lactation records for Sahiwal sire evaluation. *Ph. D. Thesis, NDRI*, Karnal, India (2010).
17. Rehman, Z. U., Khan, S. M., Bhatti, S. A. and Iqbal, J., Factors affecting first lactation performance of Sahiwal cattle in Pakistan. *Arch. Tierz. Dummerstorf*. **51(4):** 305-317 (2008).
18. Wakchaure, R. S. and Meena, R., Factors affecting, birth weight, age and weight at first calving in Sahiwal cattle. *Indian J. Anim. Res*., **44(3):** 173-177 (2010).
19. Yadav, A. K., Jha, A. K., Singh, J., Singh, V. K., Effect of genetic and non-genetic factors on age at first calving in Sahiwal cattle. *Indian J. Animal Research*, **51(4):** 2017: 635-639 (2017).