Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8554

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(1), 359-366

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Study of Effect of Non – Genetic Factors on Reproduction Traits in Holstein Friesian Crossbreed Cows

Kaustubh Bhave, Tejashree Shirsath-Kalbhor*, Vinod Potdar*, Sachin Joshi, Yuvraj Guandare and Marimutthu S.

Central Research Station, BAIF Development Research Foundation, Urulikanchan, Pune, Maharashtra, India

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

Received: 22.12.2020 | Revised: 27.01.2021 | Accepted: 2.02.2021

ABSTRACT

Any genetic improvement in dairy cattle requires information on reproductive performance in the given population. This study was carried out to evaluate the effect of non-genetic factors on reproductive performance traits of Holstein Friesian dairy cattle maintained under different states of Indian environment. The data used in this study included records of cows that calved between 2011 and 2016. The data on reproduction traits, Age at First Calving (AFC), Service Period (SP), Calving Interval (CP), Service per Conception (SPC). Pertained to 4432 for Age at first calving, 24809 for Service Period, 11084 for Inter Calving Period and 44759 for Service per conception (SPC) Holstein Friesian cattle. The overall least squares mean of Age at first calving(AFC), Service Period (SP), Calving Interval (CI), Service per conception (SPC) were 1211.85 ± 2.53, 136.52 ± 0.62,412.83 ± 0.98, 2.02 ± 0.01 respectively. The service period (SP) were shows significantly influenced by Agro climatic zone, calving year and calving season. The Monsoon season shows high service period than other season. The Calving intervals (CI) were significant effect on Agro climatic zone, calving year and Calving season. The significantly influenced by Agro climatic zone, calving year and Calving season. The summer season shows high than other seasons.

Keywords: *HFX, Non – genetic Factors, Reproduction Traits.*

INTRODUCTION

The overall productivity and adaptive efficiency of cattle depends largely on their reproductive performance in a given environment. Reproduction is an indicator of reproductive efficiency and the rate of genetic progress in both selection and crossbreeding programs particularly in dairy and beef production systems, Nuraddis et al. (2011).

Crossbreeding programme of dairy cattle has played significant role in attaining India's top position as highest milk producer country of the world.

Cite this article: Bhave, K., Shirsath-Kalbhor, T., Potdar, V., Joshi, S., Guandare, Y., & Marimutthu, S. (2021). Study of Effect of Non – Genetic Factors on Reproduction Traits in Holstein Friesian Crossbreed Cows, *Ind. J. Pure App. Biosci. 9*(1), 359-366. doi: http://dx.doi.org/10.18782/2582-2845.8554

Increase in crossbred cattle population milk production and per capita of milk availability, lactation length, growth rate, decrease in age puberty, and calving interval higher birth weight, better growth rate, better reproductive efficiency, advantage of breed complementarity and non-additive effects (dominance and epistatic) thus leading to heterosis. It tends to be most important for lowly heritable traits such as fertility and survival as well as makes crossbred animals more productive and better than either of the parental breeds. Crossbred animals are docile, can be easily handled and more suited for machine milking, Heat detection and artificial insemination is easier in cows.

In the dairy sectors calving interval and service period traits play important role for the lifetime milk production as well as productive life of the milch animal, which affects the economy of the farmers. The reproductive performance of the breeding female is most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity (Kiwuwa et al., 1983). Productive and reproductive traits are crucial factors determining the profitability of dairy production (Lobago et al., 2007). Therefore, it is important to study the reproductive traits to know the status of animals and to avoid the economic loss of farmers. Keeping in view these points, the present study was therefore, planned to assess the effect of non-genetic factors on reproduction traits and productive traits in HFX crossbred cows.

MATERIALS AND METHODS

The present study was conducted in five different agro climatic zones of India viz. Scarcity zone of Maharashtra, North West alluvial plain of Bihar, Central plain of Uttar Pradesh, Mid-western plain of Uttar Pradesh and Western plain zone Uttar Pradesh (Table 1). Study covered the period from Jan 2011 to December 2016.

The data on reproduction traits, Age at first calving (AFC), Service Period (SP), Calving Interval (CP). Pertained to 24809 for Service Period, 11084 for Inter Calving Period and 10947 for Gestation Period Holstein Frieswal cattle, over a period of 6 years (2011-2016). The total years were classified into five periods taking into three seasons winter (November-February), summer (March-June), Rainy (July-October) in accordance with agro-climatic condition of the study centre. Data were collected from three states Maharashtra, Bihar and Uttar Pradesh. Generally, the district is categorized into Agro climatic Zones within state. In Maharashtra state, the Beed and Jalgoan district represents scarity zone of Maharashtra. In Bihar state, the Chapara, Siwan, Samastipur and Vaishali district represents of North West alluvial plain of Bihar. Also ,From Uttar Pradesh Agro climatic zones divides within 2 zones which were Central Plain of Uttar Pradesh (Etah, Unnao) and another one is Mid-Western plain of Uttar Pradesh(Meerut, Bareilly).

Statistical analysis: Data were analysed by linear model R. When the analysis of variance indicated the existence of significant within class, Duncan Multiple Range Test (DMRT) Kramar (1957) were employed to test and locate means that are significantly differed from the rest. The following statistical model was employed to analyse the data.

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

Yijk = is the record of a cow calved during j^{th} period in i^{th} season

μ = is the population mean common to all the observations

Si = is the effect of ith season of calving (1...4)

Pj = is the effect of jth period of calving (1...6)

Eijk = is the random error assumed to be NID (0, δ2, e)

To investigate if differences in Age at first calving (AFC), Service Period (SP) and Calving Interval (CP) existed between different sub-classes of independent variables, Duncan Multiple Range Test (DMRT) model was constructed with Age at first calving (AFC), Service Period (SP) and Calving Interval (CP) as the dependent variables and the independent variables of interest were category of agro climatic zones, Calving Year, Calving season.

Table 1: Least square means and SE of Age at first calving (AFC), Service Period (SP), Inter Calving Period (ICP) and Service per Conception (SPC) of Holstein Friesian Crossbreed cows

Sr.No	Particulars	N	Age At First Calving	N	Service Period(SP)	N	Inter Calving Period(ICP)	N	Service Per Conception
Agro climatic zone* **									
1	Central plain of UP	458	1251.59 ± 7.74^{a}	2766	137.91 ± 0.77^{a}	919	414.58 ± 1.31^{a}	4371	1.95 ± 0.02^{a}
2	Mid-western plain of UP	299	1252.65 ± 8.98^{a}	1874	139.15 ± 0.92^{ab}	902	411.72 ± 1.32^{b}	3721	2.13 ± 0.01^{b}
3	North west alluvial plain of Bihar	2415	1191.42 ± 3.42^{b}	8511	137.76 ± 0.45^{a}	2592	417.27 ± 0.80^{a}	15738	2.06 ± 0.02^{bc}
4	Scarcity zone of MH	1260	1226.87 ± 4.74^{c}	11652	131.26 ± 0.40^{c}	6671	407.80 ± 0.54^{c}	20224	1.97 ± 0.03^{a}
Calving Year* **									
1	2011	294	1204.82 ± 10.24^{a}	1443	145.89 ± 1.04^{a}	563	416.89 ± 1.62^{a}	2904	2.02 ± 0.01^{a}
2	2012	1142	1213.48 ± 4.90^{b}	5324	139.62 ± 0.56^{b}	2217	413.40 ± 0.84^{a}	10461	1.90 ± 0.04^{b}
3	2013	1200	1227.45 ± 4.69^{c}	7049	134.21 ± 0.51^{bc}	3305	412.40 ± 0.74^{bc}	12501	1.95 ± 0.05^{b}
4	2014	756	1204.10 ± 6.09^{a}	4842	130.60 ± 0.30^{c}	2313	410.94 ± 0.92^{b}	8515	2.02 ± 0.02^{a}
5	2015	653	1201.90 ± 6.97^{a}	3503	136.25 ± 0.72^{b}	1874	413.68 ± 1.02^{c}	7320	2.19 ± 0.05^{c}
6	2016	387	1195.94 ± 8.85^{d}	2642	132.55 ± 0.80^{c}	812	409.72 ± 1.45^{bd}	3058	2.08 ± 0.02^{d}
Calving season **									
1	MONSOON	1276	1213.64 ± 4.72	7986	138.38 ± 0.49^{a}	3368	415.73 ± 0.78a	14033	2.02 ± 0.01
2	SUMMER	1514	1206.14 ± 4.36	7258	137.90 ± 0.53^{a}	3358	413.15 ± 0.79^{a}	15925	2.03 ± 0.01
3	WINTER	1642	1215.72 ± 4.14	9559	133.27 ± 0.47^{b}	4358	409.63 ± 0.73^{b}	14801	2.01 ± 0.02
	Total	4432	1211.85 ± 2.53	24803	136.52 ± 0.62	11084	412.83 ± 0.98	44759	2.02 ± 0.01

Averages having same superscripts do not differ significantly from each other ** $P<0.01$, *$P<0.05$

RESULT AND DISCUSSION

Based on the data collected during the survey, the result and discussion part of this study gave more emphasis on (AFC), Service Period (SP), Calving Interval (CP) and Service per Conception (SPC) those are the major constraints of dairy cattle productivity.

Age at First Calving

Age at first calving is one of the important factors contributing to economic return. A reduction in AFC will minimize the raising costs, shorten the generation interval, and subsequently maximize the number of lactations per head. Earlier first calving increases lifetime productivity of cows. It is an important factor in determining the overall productivity of dairy cows (Singh et al., 1986). The results were less than the mean Age at first calving (AFC) where 1242.75±16.46 Kumar, S., et al. (2016), and While the findings similar to were 1153.10±24.84 Lodhi et al (2016) in crossbreed cattle, 1204.00±12.20 days obtained S. Vinothraj et al. (2016) in Jersey × Red Sindhi crossbred cows, 1153.10±24.84 Kumar (2015) in Frieswal cattle 1198.54±8.18 W. Zewdu1 et al. (2015) in Holstein Friesian × Deoni crossbred cows. Age at first calving more than finding were 962.13±6.34 days Kumar et al. (2008) in Frieswal cattle, 975.13+12.83, Deokar et al. (2017) in Phule Triveni Crossbred Cattle.

1.1 Effect of Agro climatic zone on Age at First Calving

The analysis of variance indicated that effect due to agro climatic zones from three different states on Age at First Calving in Holstein Friesian x cow was significant (Table 1). Mid-western plain of UP (Meerut, Bareilly)

1252.65 ± 8.98 shows greater Age at First Calving (AFC) period from other agro climatic zones. North west alluvial plain of Bihar (Chapara, Siwan, Samastipur and Vaishali) 1191.42 ± 3.42shows less Age at First Calving (AFC) period from other agro climatic zones.

1.2 Effect of Calving year on Age at First Calving

The analysis of variance indicated that effect due to period of calving on AFC in Holstein Friesian x cow was significant (Table 1). The higher age at first calving 1227.45 ± 4.69 observed in 2013 than other periods. 2012, 2013, 2014, 2015, and 2016 period results were supported with the findings of Kumar (2015) in Frieswal cattle, Lodhi et al. (2016) in crossbreed cattle. In crossbred cattle while Nehra (2011) observed non-significant effect. The variation due to period reflects quality and quantity of feed and fodders available during different periods and differences in management practices.

1.3 Effect of Calving Season on Age at First Calving

The statistical analysis revealed that observed differences of AFC due to season of calving were non-significant. Almost all the authors observed non-significant effect of season of calving on AFC more than finding were 962.13±6.34 days Kumar et al. (2008) in Frieswal cattle, 975.13+12.83, Deokar et al. (2017) in Phule Triveni Crossbred Cattle and 1153.10±24.84 Lodhi et al. (2016) in crossbreed cattle.

Service Period

Longer service period rendered cattle uneconomic by reducing the overall milk yield per day of calving interval. The least squares means and ANOVA of service period as affected by Agro climatic Zone, Calving Period and Calving Season, respectively. The overall LSM of SP of Holstein Friesian x 136.52 ± 0.62 days. The results were less than to S.S Bhutkar (2014), Prabhukumar et al. (1990) in Friesian x Ongole and Thombre et al. (2001) in Holstein Friesian x Deoni half-bred. The Results were greater than MJA Mamun et al. (2015) were.

2.1 Effect of Agro climatic zone on Service period

The analysis of variance indicated that effect due to agro climatic zones from three different states on SP in Holstein Friesian x cow was significant (Table 1). Mid-western plain of UP (Meerut and Bareilly district) 139.15 ± 0.92 shows greater service period from other agro climatic zone.

2.2 Effect of Calving year on Service period

The analysis of variance indicated that effect due to period of calving on SP in Holstein Friesian x cow was significant (Table 1). The higher service period 145.89 ± 1.04 observed in 2011 than other periods. 2012, 2013, 2014, 2015, and 2016. The results were supported with the findings of Singh and Tomar (1991) in Karan Fries cattle, Rafique et al. (2000) in Holstein Friesian x Sahiwal interse crossbred and Bajetha and Singh (2011) in crossbred cattle.

2.3 Effect of Calving Season on Service Period

The statistical analysis revealed that observed differences of SP due to season of calving were significant. The present results revealed that the Holstein Friesian x basically possess certain shorter SP and well adopted to the seasonal changes of the tract, as such there will be significant deviation in the expression of this character. Nagarcenkar and Rao (1982) in Friesian x Tharparkar, Brown Swiss x Tharparkar and Jersey x Tharparkar cattle and Komatwar et al. (2010) in Friesian x Sahiwal cattle.

Calving Interval

For profitable milk production and to achieve best reproductive efficiency, the dairy cattle should reproduce at regular interval. The inter calving is a period between two consecutive calving's. The overall LSM of ICP of Holstein Friesian x cow was 412.83 ± 0.98 days. The results were less than the mean Calving Interval (CI) of 462.87±19.48 days obtained Hafts Kebede et al. (2015) Herath et al. (2002) and Fekadu et al. (2011). The results were close to Thombre et al. (2002) in Holstein Friesian x Deoni half-bred. Calving interval in Zebu (418 days), Red Sindhi (429 days) and

Sahiwal cattle (418 days) has been reported by various authors (Qureshi, 2003; & Nahar & Basure, 1992), are in agreement with the figures of present study for Red Sindhi cattle. While the findings (515.28, 674.57 days) of Mustafa et al. (2004) and Khatri et al. (2004) were higher than the current results for HFX. Shorter calving interval (380.0±36.6 days) was reported by Abeyagunawardena and Abeyawansa (1995) in Zebu cattle than the current findings in HFX.

3.1 Effect of Agro climatic zone on Calving Interval

The analysis of variance indicated that effect due to agro climatic zones from three different states on Calving Interval in Holstein Friesian x cow was significant (Table 1). North West alluvial plain of Bihar (Chapara, Siwan, Samastipur and Vaishali district) 417.27 ± 0.80 shows greater Calving Interval (CP) period from other agro climatic zones.

3.2 Effect of Calving year on Calving Interval

The analysis of variance indicated that effect due to period of calving on SP in Holstein Friesian x cow was significant (Table 1). The higher Calving Interval 416.89 ± 1.62 observed in 2011 than other periods. 2012, 2013, 2014, 2015, and 2016.

3.3 Effect of Calving Season on Calving Interval

The effect of seasons of calving on the calving interval of HFX crossbred cows was significant (P>0.05). However, Auradkar (1999) and Dahiya et al. (2003) reported significant effect of season of calving on calving interval in different crossbred cows. The summer season shows high Calving Interval (CP) period than other seasons 415.73 ± 0.78.

Service per Conception

The number of services per conception (SPC) is the number of services (natural or artificial), required for successful conception. The optimum recommended number of services per conception for profitable dairy cows ranges from 1-1. Evelyn, C.G et al. (2001). The finding was consistent with the values 1.6-1.67% reported for the same breed in different part of the country by different authors Belayneh et al. (2012), S hiferaw et al. (2003). Our results showed that the overall mean of SPC was found to be 2.02 ± 0.01. This result is comparable with the reported values of 2.0 ± 0.1 Makgahlela ML et al. (2007) and 1.8 for Holstein Friesian cows in Ethiopia Million TM et al. (2010).

3.1 Effect of Agro climatic zone on Service per Conception

The analysis of variance indicated that effect due to agro climatic zones from three different states on Service per Conception in Holstein Friesian x cow was significant (Table 1). Mid-western plain of UP (Meerut, Bareilly district) 2.13 ± 0.01 shows greater Service per Conception (SPC) and Central plain of UP (Etah, Unnao) shows lower Service per Conception (SPC) 1.95 ± 0.02 from other agro climatic zones**.** This study showed that number of services per conception was influenced ($p<0.05$) by production system where it was higher for peri-urban compared to urban dairy system. This could be due to the reason that urban beneficiaries had better awareness and skills on proper heat detection, better access for AI and better nutritional management.

3.1 Effect of Calving Year on Service per Conception

On the other hand, year had shown significant ($P<0.05$) effect on number of services per conception in the study area. Highest number of services per conception was recorded in the year 2015 is 2.19 ± 0.05 as compared to earlier and latter service years. The result is similar to Makgahlela ML et al. (2007) and greater than 1.8 for Holstein Friesian cows in Ethiopia Million TM et al. (2010).

3.1 Effect of Calving Season Service per Conception

Season had not shown significant effect ($P>0.05$) on number of service per conception. Several environmental factors affect NSC in dairy cows. Different to our finding, fewer NSC were required for heifers that conceived in the main rainy sea-son than those conceived during the other season Fonseca FA et al. (1983). The summer season shows high

Service per Conception (SPC) than other seasons 2.03 ± 0.01.

CONCLUSION

This study indicates that the performance of cows for (AFC), Service Period (SP), Calving Interval (CP)and Service per Conception(SPC) is comparatively medium which needs an improvement to lowering this using overall management practices in state wise different. Most of the reproduction traits concerns seasonal changes had any affects. Therefore, additional reproduction strategies like improving environmental factors and management factors needed to improve their production performance.

Acknowledgement

The authors are thankful to Management team of BAIF Development Research Foundation and all stakeholders in study area those who participated and cooperated during study.

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