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Research Article

GENETIC STUDIES ON REPRODUCTION TRAITS IN CROSSBRED JERSEY CATTLE IN WESTERN ODISHA

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ABSTRACT: The present study was conducted on 412 crossbred (Jersey X Deshi) cows sired by 24 bulls, maintained over the period from 2005 to 2014. The economic traits studied were age at first calving (AFC; months), calving interval (CI; days), dry period (DP; days) and service period (SP; days). The averages for AFC, CI, DP and SP were 34.46±0.22 months, 505.95±3.24, 224.20±3.31 and 228.26±3.21 days, respectively. Effect of management system was significant for all the economic traits (AFC, CI and DP) except SP. It may be inferred that rearing crossbred Jersey cows under intensive system of management may be advocated to utilize the maximum genetic potential of crossbred cattle for all the traits. Semi-intensive system may help moderate exploration of the traits. But exclusively pasture dependent management should be avoided for rearing crossbred Jersey cows. Heritability estimates for AFC, CI and DP were found to be 0.462 ±0.179; 0.062 ±0.088; 0.270 ±0.138, respectively. Genetic correlations of AFC with CI and SP were high and positive. For maximum genetic improvement and their correlated response, it is necessary to include all the economic traits with differential weightage for achieving accuracy in selection programs.

Key words: Crossbred, Correlation, Heritability, Reproduction traits.

INTRODUCTION

Cross breeding of indigenous cows (*Bos indicus*) with exotic (*Bos taurus*) bulls was started toenhance genetic potential of milk production. The basic theme was to integrate the milk yield potential of exotic breeds and stress sustainability and disease resistance capabilities of indigenous breeds within the crossbred progenies, which would be desirable to maintain them under tropical climatic conditions (Kurup, 2003).

For establishing any selection or breeding programme the knowledge of genetic properties of traits of economic importance is the pre-requisite. It is therefore, essential to understand the genetic and phenotypic association among

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these traits and the extent to which the genetic variation exist in them. Genetic improvement of a population under selection is highly dependent on heritability of each trait, studied in respective population. This genetic parameter is the characteristic of the population in which it is estimated; it may change over time due to selection and management decisions (Koots *et al.*,1994). Estimation of genetic parameters is essential in animal breeding and genetics because theseare location and time-specific and it may not be appropriate to apply estimates from other populations (Islam *et al*., 2004). Additionally, differences in management, feeding conditions and statistical methodology as well, may offer different results.The genetic correlation expresses the extent to which two characters are influenced by the same genes and it is important when selecting for net merit involving several traits. Estimates of genetic correlation between any pair of traits suggest that selection for one trait can lead to an indirect genetic response in the other trait (Gebeyehu *et al*., 2014). Therefore, the present investigation was undertaken to estimate genetic and phenotypic parameters of different reproduction traits and to evaluate the effect of genetic and non-genetic factors on these traits.

MATERIALS AND METHODS

The data on sire were collected on crossbred (Jersey X Deshi) cattle from the history-cum-pedigree sheets maintained over the period from 2005 to 2014 in the government veterinary dispensaries of four representative blocks in Kalahandi and Nabarangapur districts in western Odisha. The reproduction traits studied were age at first calving (AFC) in months, calving interval (CI), dry period (DP) and service period (SP) in days. A total of 412 reproduction records of cows sired by 24 bulls were collected by interacting with the owners. Abnormal records due to specific causes like abortion, culling and pre-mature birth were excluded. To study the effect of genetic factor on different economic traits and to obtain sire and residual variance, co-variance components for various performance traits, the mixed model Least-squares analysis technique (Harvey, 1990) was used. SPSS (version 16) software was used to evaluate the effect of different management system *viz*. intensive, semi-intensive and extensive on reproductive performance traits. Chi-square test was used to analyse dependency of the frequency of cows under different management systems and blocks before the data were used for genetic studies. Heritability estimates for different economic traits were obtained by paternal half-sib correlation method. Standard error of heritability was estimated by the formula given by Swiger *et al.* (1964). Phenotypic correlations between different economic traits were calculated from components of variances and co-variances while sire components of variances and co-variances were used to estimate genetic correlations.

RESULTS AND DISCUSSION

Least-squares means along with standard errors for different reproduction traits are presented in Table 1.

Averages for reproduction traits

The Least-squares mean for AFC in crossbred (Jersey x Deshi) cattle was 34.46± 0.22 months which was in agreement with Hunduma Dinka (2011) and Wangdi *et al*. (2014) but of higher magnitude than that estimated by Yifat *et al.* (2009), who reported the mean values of AFC to be 32.1 months in

Table 1. Least-squares means along with standard errors for different reproduction traits.

Trait	N	AFC (months)	CI (days)	DP (days)	SP (days)
Overall Mean	412	34.46±0.22	505.59±3.24	224.20±3.31	228.26±3.21
Intensive	84	33.36±0.49[a]	489.82±5.57[a]	199.40±5.98[a]	216.37±5.68
Semi intensive	185	33.90±0.32[a]	508.03±5.24[b]	228.11±5.09[b]	229.63±3.21
Extensive	143	35.39±0.34[b]	511.71±5.43[b]	233.71±5.60[b]	233.46±5.29

Means with different superscripts are significantly different (P<0.05) for a parameter within a column. AFC=Age at first calving; CI=Calving interval; DP=Dry period;SP=Service period.

crossbred cattle, Meena *et al.* (2015) and Zewdu *et al.* (2015) reported comparatively higher estimates in crossbred cattle. The Least-squares mean for CI was 505.59±3.24 days, which was in close agreement with findings of Elamin *et al*. (2012) in Sudan and of higher magnitude than those reported by Miazi *et al.* (2007) who reported the average value to be 422± 18.6 days for CI in Jersey X Local crossbred cows. However, Sreedhar *et al.* (2013) reported higher estimate 552.25 ± 5.02 days in Jersey X Sahiwal crossbred cows under field condition, than that observed in the present study. The least-squares mean for SP was 228.26 ±3.21 days. This was in close conformity with that of Arya and Tailor (2013). However, Zewdu *et al*. (2015) and Meena *et al.* (2015) reported lower and Yifat *et al.* (2009) and Sreedhar *et al*. (2013) reported higher estimates as compared to the present study. The Least-squares mean for DP was estimated as 224.20±3.31 days.This was in close conformity with that of Meena *et al*. (2015). However, Sreedhar *et al*. (2013) reported estimates of lower magnitude compared to the present finding.

Effect of system of management on different reproduction traits

The influence of system of management was highly significant (P<0.01) for AFC and significant (P<0.05) for CI and DP. No significant difference was observed in SP with respect to system of management. Higher values of AFC, CI, DP and SP were observed in cows reared under extensive system of management, followed by semi intensive and then intensive management system, which shows dependency of productivity of crossbred Jersey cows with better environmental conditions and feeding.There was no significant difference in AFC with respect to intensive and semi-intensive systems of management but significant difference (P<0.01) was observed in extensive form of management. It was also found that the difference of CI and DP were non- significant in semi intensive and extensive system of management but the influence of intensive management was significant (P<0.05) on CI and DP.

Estimates of heritability for different reproduction traits

The estimates of heritability for AFC in present study was 0.462 ± 0.179. Similar result was reported by Suhail *et al.* (2010) in Jersey cows in Pakistan and Deb *et al.* (2008) in BCB-1 cows in Bangladesh. Comparatively lower estimate (0.39±0.29) was reported by Gaikward and Narayankhekar (2000) in crossbred cows (Gir XHF and Gir X Jersey). The high

Table 2. Estimates of heritability (along diagonal), genetic correlation (above diagonal) and phenotypic correlation (below diagonal) between different economic traits.

Trait	AFC	CI	DP	SP
AFC	**0.462 ±0.179**	0.599 ±0.487	0.181 ±0.135	0.556 ±0.454
CI	-0.008 ±0.003	**0.062 ±0.088**	0.933 ±0.231	0.978 ±0.036
DP	0.006 ±0.001	0.847 ±0.163	**0.270 ±0.138**	0.929 ±0.292
SP	-0.019 ±0.012	0.992 ±0.232	0.846 ±0.184	**0.052 ±0.085**

AFC=Age at first calving; CI=Calving interval; DP=Dry period; SP=Service period.

heritability estimate for AFC indicated that age at first calving can be reduced by individual selection. Very low heritability estimate of 0.062 ± 0.088 with regard to calving interval was realized in the present study, which is corroborated with the findings of Suhail *et al.* (2010) in Jersey cows. Higher heritability estimates (0.89 ± 0.39) was reported by Gaikward and Narayankhekar (2000). Low heritability for CI was indicative of the presence of lesser additive genetic variance, so selection on individual's own performance will not be effective in improving this trait. Better management practices could be the alternate choice for improvement in CI. Heritability estimate for DP in the present study was 0.270 ± 0.138 (Table 2), which is in close conformity with the reports of Goshu *et al*. (2014) in Holstein Friesian cows. The moderate heritability estimate for this trait suggested that there was scope for reducing DP by both individual selection and providing uniform management.The heritability for SP was estimated as 0.052 ± 0.085, which is on lower side than reported by Singh and Gurnani (2004); while estimate reported by Komatwar *et al*. (2009) was in agreement with the present finding.

Phenotypic and genetic correlations

Phenotypic and genetic correlations among different traits under study are presented in Table 2. Estimates of phenotypic and genetic correlations between the traits under study and their correlated responses are important to find out so that simultaneous improvement in more than one trait may be planned.

Association between AFC and CI

Phenotypic correlation between these traits was - 0.008±0.003. Singh and Gurnani (2004) reported higher and significant correlation between the two traits. Dubey and Singh (2005) found negative and very low (-0.04±0.15) correlation between these two traits, similar to the present study. Genetic correlation between these traits was 0.599±0.487 which indicated that simultaneous genetic improvement could be achieved while selecting any one of them, that is, animals with lower AFC should be selected to have less value for CI on genetic scale, which is very much desirable.

Association between AFC and SP

A negative and very low (- 0.019±0.012) phenotypic correlation but a high positive genetic correlation (0.556± 0.454) between these traits was observed in the present study.

Association between DP and SP

A high positive phenotypic and genetic correlation was estimated as 0.846±0.184 and 0.929± 0.292 respectively between these two traits. This result offers scope for practicing selection based on the phenotype. Lower values of both the traits are desirable for increasing the life time productivity.

Association between SP and CI

A high positive genetic and phenotypic correlation was estimated as 0.978±0.036 and 0.992±0.232, respectively between these traits, which is in agreement with the findings of Saha *et al.* (2010) and Sreedhar *et al.* (2013).They reported high phenotypic correlation (0.88±0.01) but low genetic correlation (0.26±0.23) in crossbred cattle. High positive phenotypic correlation between two traits suggested that selection in any trait would result in the improvement of other trait through correlated response.

Association of AFC with DP

A low phenotypic correlation (0.006±0.001) was observed in the present study. However, Singh and Gurnani (2004) reported a high and positive correlation (0.88±0.04) between these two traits. The genetic correlation between AFC and DP in the present study was observed to be 0.181 ±0.135.

Association of DP with CI

In the present study, the phenotypic correlation between these two traits was 0.847±0.163, and genetic correlation between these two traits was estimated as 0.993±0.231, high phenotypic and genetic correlation was also reported by Dubey and Singh (2005). The high and positive phenotypic and genetic correlation indicates simultaneous improvement in other trait while selecting any one of them.

CONCLUSION

It may be inferred from the estimates of heritability, genetic and phenotypic correlations that AFC with other economic traits may be used in simultaneous selection for overall improvement in traits of economic importance. For maximum genetic improvement and their correlated response, it is necessary to include all the economic traits with differential weightage for achieving accuracy in selection programs. The present investigation also suggested that Jersey crossbred cows have the potential to improve in the warm and humid agro-climatic condition of Odisha, India.

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