Proceedings of the Pakistan Academy of Sciences 51 (4): 289–294 (2014)

ISSN: 0377 - 2969 (print), 2306 - 1448 (online)

Pakistan Academy of Sciences

Research Article

Breeding Efficiency of Indigenous × Jersey, Indigenous × Jersey × Friesian Crossbred Cows at Livestock Development Research Centre, Muzaffarabad, Azad Jammu and Kashmir

Muhammad Ijaz Khan[1]*, Samina Jalali[1], Beenish Shahid[2], and Sajjad Aslam Shami[1]

[1]Reproductive Physiology Lab, Department of Animal Science, Quaid-i-Azam University, Islamabad 44000, Pakistan

[2]Department of Zoology, University of Azad Jammu & Kashmir, Muzaffarabad 13100, Pakistan

Abstract: The primary objective of this study was to improve the reproductive efficiency of indigenous cattle of Azad Jammu and Kashmir at Livestock Development Research Center (LDRC) by crossing with European breeds. The indigenous heifers were impregnated with Jersey semen and F_1 crossbred were produced. The F_1 offspring were crossed among themselves (inter *se* mating) to obtain the F_2 offspring and simultaneously the F_1 cows were crossed with Friesian bull to produce three-breed crossbred cows. The number of cows for each group were 37 for indigenous, 25 for F_1 (Indigenous × Jersey) cross, 8 for F_2 ($F_1 \times F_1$) cross and 14 for F_1 × Friesian cross. The highest breeding efficiency was observed in F_1 (93.68 ± 1.85 %) and F_2 (93.71 ± 2.74 %) and increased highly significantly (P < 0.0001) compared to indigenous cows (73.46 ± 2.50 %). The mean breeding efficiency of F_1 × Friesian (65.62 ± 3.05 %) did not differ significantly from that of indigenous cows (P = 0.0870). The Jersey breed was found to be suitable for improving the breeding efficiency of indigenous cows of hilly areas of Azad Jammu and Kashmir.

Keywords: Subtropical, highland type, breeding efficiency, indigenous cows, crossbred cows

1. INTRODUCTION

The productivity of indigenous cattle of Azad Jammu and Kashmir is very low. This may be because of poor genetic makeup. Reproductive performance in dairy cattle is of paramount importance. To maintain efficient production, it is necessary that cows reproduce regularly [1]. It has been reported that lowered breeding efficiency may be associated with high production [2, 3] and contradictorily, that there is little relationship between production and breeding efficiency [4, 5, 6, 7]. The economic returns from dairy animals are not only based on milk production alone but also on their reproductive efficiency [8]. Everett et al [9] reported that breeding efficiency and production were essentially interdependent. Reproductive efficiency is proposed as a measure of the net biological accomplishment of all reproductive activities and phenotypic expression of the interplay of genetic and environmental factors [10]. Indicators of reproductive efficiency are service period affecting in turn, the calving interval. However, the breeding efficiency in addition to accommodating the number of calving also takes care of age at first calving and total number of days from first to last lactation. Reproductive efficiency represents the overall performance of the herd with respect to age and reproductive traits [11]. Age of dairy cows at first parturition and the lengths of her subsequent calving intervals are usually considered of primary importance in measuring breeding efficiency [12]. Low reproductive efficiency due either to delayed first service, missed estrus, or multiple services per conception continues to be

Received, April 2014; Accepted, September 2014
*Corresponding Author: Email: Muhammad Ijaz Khan: ijaznrsp@gmail.com

a major problem in dairy herds. Poor reproductive performance results in excessively late age at first calving and long lactations. Both are costly to the dairy producers because of the veterinarian breeding expense, high reproductive replacement costs and fewer calves being born [13]. Several reports had indicated that poor reproductive performance, manifested as prolonged calving intervals, can result in reduced milk yield and increased culling rates and replacement cost [14–16].

Although the crossbreeding has been adopted as a tool to improve traits of economic importance of indigenous cattle in canal irrigated areas of Punjab and other part of Pakistan, however, such adoptability studies are missing in AJK, therefore this study was planned to improve the overall productivity of indigenous cattle along with reproductive efficiency traits by crossing with European breed of Jersey and Friesian and to assess the adoptability of crossbred dairy cattle in local environmental conditions.

2. MATERIALS AND METHODS

2.1 Animals and Farms

LDRC is located at the bank of river Jhelum 6 kilometers away from the main city of Muzaffarabad which is the capital of Azad Jammu and Kashmir. This farm was established in 1990 by the Government of Azad Jammu and Kashmir by purchasing of 66 indigenous cattle. The animals were maintained in brick closed sheds throughout the year. The milking cows, dry cows and young calves were kept in separate shed with roof constructed from asbestos sheet and iron bar, the floor is of concrete. During the summer months the animals were showered with cold water and electric fan were provided in the shed to beat the heat.

2.2 Breeding Program

A breeding program with the introduction of Jersey and Holstein Friesian was started in July 1990. In first cross F_1 offspring from crosses between indigenous and Jersey were produced. Calving of F_1 offspring occurred from July, 1991 to April, 1998. In second type of cross F_1 female were crossed with F_1 male, as a result of which $F_1 \times F_1$ (F_2) offspring were produced during the period of May, 1994 to April, 1999. In third type of cross the F_1 female were crossed with pure Friesian bull to produce 25 % indigenous + 25 % Jersey + 50 % Friesian offspring during May 1994 to April 1999.

The diagrammatic presentation of breeding program is illustrated below:

1. Indigenous × Jersey

   ↓

   F_1 (Indigenous 50 % + Jersey 50 %)

2. F_1 (Indigenous 50 % + Jersey 50 %) × F_1 (Indigenous 50 % + Jersey 50 %)

   ↓

   F_2 (Indigenous 50 % + Jersey 50 %)

3. F_1 (Indigenous 50 % + Jersey 50 %) × Friesian

   ↓

   Indigenous 25 % + Jersey 25 % + Friesian 50%

2.3 Feeding Regime

All the animals were stall fed on farm raised green fodder. The ration was formulated to provide the recommended quantity of nutrients according to body weight and status of animals as given in Table 1. The composition of the feed varied according to the fodder crop available during the year. Elephant grass and maize were mainly fed during the months of May to October and from November to April green berseem and wheat straw were fed to these animals. Green fodder was chaffed and offered to these animals. Roughages comprised of wheat straw and stoves of maize. The concentrate mixture composed of wheat bran, oil seed cake (rape seed cake and cotton seed cake) and molasses. Lumps of common salts (sodium chloride) were placed in mangers and cows were free to lick with accessibility of clean drinking water.

2.4 Data Collection

It was a retrospective study, carried out over a period from 1990–2010. The data regarding

Table 1. Daily nutrient fed to cows per 500 kg body weight and according to their productive and reproductive status maintained at LDRC, AJK.

Status	Total Dry Matter (kg)	Nutrients (kg)			
		TDN[a]	CP[a]	Ca[a]	P[a]
Early Lactation	11.91	7.05	1.25	0.04	0.02
Lactating and Pregnant	11.41	6.27	0.99	0.03	0.02
Dry Non Pregnant	8.41	4.23	0.60	0.02	0.01
Pre-calving (60-90 days before calving)	10.32	5.59	0.88	0.03	0.02

[a]TDN = Total Digestible Nutrients; CP = Crude Protein; Ca = Calcium; P = Phosphorus

reproductive records of 84 cows out of which 37 were indigenous, 25 were F_1 (Indigenous × Jersey), 8 were $F_1 \times F_1$ (F_2) and 14 were F_1 × Friesian cows. Among reproductive parameters service period, calving interval and breeding efficiency were studied in present research work. Although, the other parameters of reproductive performance such as sex ratio, age at first calving, number of services per conception were also recorded for indigenous and crossbred groups in this breeding program. However, the data for these traits has not been included in this research paper.

2.5 Service Period

Service period of each cow was calculated by the difference between the date of calving and the date of subsequent fertile conception.

2.6 Calving Interval

Calving interval was calculated by the interval between the dates of two successive calving.

2.7 Breeding Efficiency

The breeding efficiency of each cow was calculated by using the following formula suggested by Wilcox et al [17].

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

Where N= Total number of parturitions, D= Number of days from first to last parturitions.

2.8 Statistical Analysis

The difference in the mean breeding efficiency among the four breed groups were worked out through analysis of variance. Graph Pad Prism 5 package was used for statistical analysis.

3. RESULTS

Mean breeding efficiency of indigenous and crossbred dairy cow is given in Table 2. Mean breeding efficiency increased highly significantly in F_1 (P<0.0001) and F_2 (P=0.0007) hybrid cows compared to that of indigenous cows. Crossing of F_1 females with Friesian bull decreased the breeding efficiency highly significantly in F_1 × Friesian cows compared to that of F_1 (P<0.0001) and F_2 (P<0.0001) hybrid cows. Mean breeding efficiency of F_1 and F_2 cows did not differ significantly from each other (P=0.9933). Statistically no significant difference of mean breeding efficiency was observed in F_1 × Friesian and indigenous cows (P=0.087).

Mean service period of F_1 × Friesian cows was highest (266.7 ± 16.56 days) and the lowest (81.81 ± 11.19 days) mean service period was observed in $F_1 \times F_1$ (F_2) cows. Crossbreeding of indigenous cows with Jersey decreased the service period highly significantly in F_1 (P < 0.0001) and F_2 (P < 0.0001) hybrid cows compared to that of indigenous cows and service period of F_1 and F_2 did not differ significantly (P = 0.37) from each other. Crossing of F_1 female with Friesian bull increased the service period in F_1 × Friesian cows and it was similar to that of indigenous cows (P = 0.549). Mean calving interval of indigenous and crossed dairy cows are given in Table 2.

Mean calving interval of indigenous and

Table 2. Mean breeding efficiency, service period and calving interval of indigenous and crossbred cows.

Breed Group	Breeding Efficiency (%)	Service Period (days)	Calving Interval (days)
Indigenous	73.46±2.50[1] (37)[2]	256.0±8.67 (102)	518.6±9.54 (102)
Indigenous × Jersey (F_1)	93.68±1.85^{***a} (25)	92.60±5.04^{***a} (121)	368.8±5.32^{***a} (121)
$F_1 \times F_1$ (F_2)	93.71±2.74^{***a} (8)	81.81±11.19^{***a} (26)	359.8±11.68^{***a} (26)
F_1 × Friesian	65.62±3.05^{***bc} (14)	266.7±16.56^{***bc} (34)	540.9±22.39^{***bc} (34)

[1]Mean ± SE; [2]Values in parenthesis ( ) are Number of cows
a = Indigenous vs F_1, F_2 & F_1 × Friesian ; b = F_1 vs F_2 and F_1 × Friesian; c = F_2 vs F_1 × Friesian
$P \leq 0.05$*, $P \leq 0.01$**, $P \leq 0.001$***

crossbred dairy cows is given in Table 14. Mean calving interval of indigenous cows was highest (518.6 ± 9.543 days) and lowest (359.8 ± 11.68 days) was observed in F_2 cows. Crossbreeding of indigenous cows with Jersey decreased the calving interval highly significantly in F_1 ($P < 0.0001$) and F_2 hybrid cows ($P < 0.0001$) compared to that of indigenous cows. Calving interval of F_1 hybrid did not differ significantly ($P = 0.482$) compared to F_2 hybrid cows. When F_1 hybrid cows were crossed with Friesian bull, then in F_1 × Friesian cows the calving interval increased to that of indigenous cows ($P = 0.289$).

4. DISCUSSION

In present study long service periods and subsequently long calving intervals of indigenous and F_1 × Friesian cows might have contributed to the low breeding efficiency. The long service period might be due to delayed resumption of ovarian activity after calving. The breeding efficiency varied among indigenous and crossbred cows in this study.

The breeding efficiency of indigenous cows (73.46 ± 2.50 %) in this study increased as a result of their crossbreeding with Jersey in F_1 and F_2 crossbred cows. The high breeding efficiency of F_1 (93.68 ± 1.85 %) and F_2 (93.71 ± 2.74 %) crossbred cows was due to their short service period and calving interval. Mean breeding efficiency of F_1 and $F_1 \times F_1$ (F_2) was higher than that of breeding efficiency of Jersey cows in different countries as 87.01 ± 1.73 % in Pakistan [18] and in India it was 88.20 ± 0.55 % [19]; 91.66 ± 1.25 % [20] and 83.98 ± 9.90 [21].

The breeding efficiency of Holstein Friesian cows was 73.12 ± 2.29 % [18] in Pakistan, 74.9 % in Sudan [22]; 87.28 % in USA [17]. In this study when F_1 crossbred cows were crossed with Friesian bull the breeding efficiency decreased in F_1 × Friesian crossbred cows (65.62 ± 3.05 %) compared to F_1 and F_2 crossbred cows. This decrease in breeding efficiency attributed to long service period and calving interval. The long service period of F_1 × Friesian cows might be due to the reason that the these cows did not resume the ovarian cycle at an early time after calving. The breeding efficiency of 50 % Friesian inheritance cows in this study was similar to that of 50 % Friesian inheritance cows (66.3 ± 0.49 %) in Ethiopia [23].

5. CONCLUSIONS

The high breeding efficiency of Indigenous × Jersey (F_1) crossbred cows compared to F_1 × Friesian crossbred cows in present study is an indicative of better adaptation of Jersey crossbred cow to climatic conditions of Muzaffarabad, Azad Jammu and Kashmir.

6. Acknowledgements

The authors express gratitude to the Livestock Development Research Centre (LDRC) and its entire staff whose hard work and cooperation made this study possible. Special thanks are to Dr. Muhammad Ashfaq Khan, Director General, Department of Animal Husbandry; Dr. Ashfaq A. Qazi, Director Livestock Extension, Research and Development; and Dr. Moshin Ali Mirza, Senior Research Officer, LDRC, for their cooperation.

7. REFERENCES

1. Verley, A. & R.W. Touchberry. Effects of crossbreeding on reproductive performance of dairy cattle. *Journal of Dairy Science* 44: 2058–2067 (1961).
2. Jones, I.R., R.W. Dougherty & H.R. Haas. Reproductive performance in dairy cattle. *Oregon Agriculture Experiment Station Bulletin* 395 (1941).
3. Lewis, R.C. & R.E. Horwood. The influence of age, level of production and management on the calving interval. *Michigan Agriculture Experiment Station Quarterly Bulletin* 32 (1950).
4. Eckles, C.H. A study of breeding records of dairy herds. *Minnesota Agriculture Experiment Station Bulletin* 258 (1929).
5. Boyd, L.J., D.M. Seath & D. Olds. Relationship between level of milk production and breeding efficiency in dairy cattle. *Journal of Animal Science* 13: 89 (1954).
6. Carman, G.M. Interrelations of milk production and breeding efficiency. *Journal of Animal Science* 14: 753 (1955).
7. Touchberry, R.W., K. Rottensten & H. Andersen. Association between service interval, interval from first service to conception, number of services per conception, and level of butterfat production. *Journal of Dairy Science* 42: 115 (1959).
8. Khan, M.A. Reproductive efficiency of farm animals in the tropics. *Animal Agriculture Bureau, Rawalpindi, Pakistan* (2002).
9. Everett, R.W., D.V. Armstrong & L.J. Boyd. Genetic relationship between production and reproduction efficiency. *Journal of Dairy Science* 49: 879–886 (1966).
10. McDowell, R.E. Crossbreeding in tropical areas with emphasis on milk, health and fitness. *Journal of Dairy Science* 68: 2418–2435 (1985).
11. Suhail, S.M., M.S. Qureshi, S. Khan & M. Saleem. Relationship among production and reproduction contributors of breeding efficiency in dairy buffaloes of Pakistan. *Pakistan Journal of Zoology* 9: 297–301(2009).
12. Chapman, A. B. & L. E. Casida. Factors associated with breeding efficiency in dairy cattle. *Journal of Animal Science* 1935: 57–62 (1935).
13. Oudah, E.Z.M., N.A. Shalaby & M.A. Mustafa. Genetic and non-genetic factors affecting days open, number of service per conception and age at first calving in a herd of Holstein-Friesian cattle. *Pakistan Journal of Biological Science* 4: 740–744 (2001).
14. Pryce, J.E., M.P. Coffey & S. Brotherstone. The genetic relationship between calving interval, body condition score and linear type and management traits in registered Holsteins. *Journal of Dairy Science* 83: 2664–2671(2000).
15. Kadarmideen, H.N., R. Thompson, M.P. Coffey & M.A. Kossaibati. Genetic parameters and evaluations from single- and multiple-trait analysis of dairy cow fertility and milk production. *Livestock Production Science* 81: 183–195 (2003).
16. Sewalem, A., F. Miglior, G.J., Kistemaker, P. Sullivan & B.J. Van Doormaal. Relationship between reproduction traits and functional longevity in Canadian dairy cattle. *Journal of Dairy Science* 91: 1660–1668 (2008).
17. Wilcox, C.J., K.O. Pfau, & J.W. Bartellet. An investigation of the inheritance of female reproductive performance and longevity and their inter-relationship within Holstein Friesian herd. *Journal of Dairy Science* 9: 942–947 (1957).
18. Lateef, M., K.Z. Gondal, M. Younas, M. Mustafa & M.K. Bashir. Reproductive performance of Holstein Friesian and Jersey cattle in Punjab, Pakistan. *Pakistan Journal Agriculture Science* 45: 245–249 (2008).
19. Methekar, K.U., A.D. Deshpande & K.S. Deshpande. Productive and breeding efficiency of Jersey cows. *Indian Journal of Animal Science* 62: 173–174 (1992).
20. Jain, J.K., F.H. Khan & D.N. Saha. Studies on breeding efficiency in Jersey cows. *Indian Veterinary Journal* 73: 1150–1153 (1996).
21. Rao, A.V.N. & H.R.M. Rao. The life time milk production and breeding efficiency of Jersey cows in Andhra Pradesh. *Indian Veterinary Journal* 73: 480–483 (1996).
22. Ageeb, A.G. & J.F. Hayes. Reproductive responses

of Holstein Friesian cattle to the climatic conditions of central Sudan. *Tropical Animal Health and Production* 32: 233–243 (2009).

23. Goshu, G. Milk yield and calf growth performance of cattle under partial suckling system at Andassa Livestock Research Centre, North West Ethiopia. *Livestock Research for Rural Development;* http://www.lrrd.org/lrrd22/8/bite22136.htm (2010).