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Estimate the effect of reproductive disorders on reproduction trait of HF X Gir Halfbred

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Abstract
The overall least squares means for open period, service period, calving interval, number of service per conception, monthly peak yield, average daily milk yield, monthly peak yield of previous lactation, lactational milk yield, lactational milk yield of previous lactation as affected by lactation order was 90.37 ± 4.99 (days), 171.72 ± 10.90 (days), 410.17 ± 8.67 (days), 3.80 ± 0.25 (days), respectively. The overall least squares means for open period, service period, calving interval, number of service per conception as affected by reproductive disorders were 97.67 ± 3.04 (days), 173.06±5.63 (days), 442.47 ± 8.48 (days), 3.90 ± 0.25 (days), respectively. The lactation order had significant effect on open period and non-significant effect on service period, calving interval, number of service per conception. The effect of reproductive disorders was significant on open period, service period, calving interval, number of service per conception. The per cent increase in open period, service period, calving interval due to reproductive disorders were 15.92 to 91.68, 56.60 to 94.62 and 10.36 to 39.33 per cent, respectively.

Keywords: reproductive disorders, reproduction trait, HF X Gir Halfbred

Introduction
In order to abrupt increase in milk production, the crossbreeding programme was initially started, at military dairy farms and afterwards systematic crossbreeding was planned at six centers as All India Coordinated Research Projects (AICRP) on Cattle during 1970. In Maharashtra State, this project was started at Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri in 1970 by the Indian Council of Agricultural Research (ICAR), New Delhi and continued up till 1986. Later on the Maharashtra state government continued the same projects after termination of AICRP from 1986 onwards with the same objectives. This project was redesigned as Research Cum Development Project (RCDP) on Cattle. Under All India Coordinated Research Projects on Cattle at M.P.K.V., Rahuri, the Gir cow had been used as foundation stock, to produce a breed of cow which should have minimum milk production of 2000 kg per lactation with herd average of 3200 kg per lactation and fat content in milk should not be less than 3.5%. For this purpose Gir cows were bred with semen of progeny tested Jersey and Holstein Friesian bulls to obtain half-breeds' and triple crosses.
HF x Gir Halfbred is a Halfbreed having a blood level of 50 per cent Holstein Friesian and 50 per cent Gir. The important feature of HF x Gir Halfbred is having 3000- 3200 L of milk with fat content in milk of 3.5-4.2 per cent. These cows are having considerable disease resistance and adaptability in various climatic conditions. Generally in crossbred animal's reproductive disorders like Dystocia, uterine prolapse, metritis, retained placenta, anestrus, repeat breeder, still birth etc have been noticed on a large scale. These disorders are affecting the postpartum reproductive performance viz; open period, service period, intercalving period etc. and the milk yield of crossbred cattle, which causes major economic losses to dairy farmers.
Reproductive efficiency is a critical component of a successful dairy operation and acts as an important component of a profitable dairy farm, whereas reproductive inefficiency is one of the most critical problems facing the dairy industry. Reproductive problems occur frequently in lactating dairy cows and can drastically affect reproductive efficiency in a dairy herd.
Low fertility reduces the profit by decreasing the average milk production and the number of calves per cow per year. Poor reproductive performance is a major cause of involuntary culling and therefore reduces the opportunity for voluntary culling and has a negative effect on the future productivity of a dairy herd. Reproductive performance is influenced by the interactive effect of environment, management, health and genetic factors. Hence the present study was undertaken.

Material and Methods

Present investigation was carried out by collecting the data from history and pedigree sheets maintained at Research-Cum-Development Project (RCDP) on Cattle, Mahatma Phule Krishi Vidyapeeth Rahuri, Dist.-Ahmednagar (MH). The feeding and management of the cattle was more or less uniform throughout the year. The calves were weaned immediately after birth and were fed with colostrums @ 1/10th of the body weight for the first four days. The level of whole milk feeding was as per the feeding schedule. The maintenance, production and growth ration were given as per ICAR (2013) [1] feeding standards & chelated minerals were also added to take care of any nutritional deficiency (Bhosale *et al.* 2021) [2] with roughages and concentrates.

Statistical analysis

In order to overcome results due to unequal subclass, the model (Harvey, 1990) [3] was used by considering effects of reproductive disorders on reproduction and production traits in HF x Gir halfbred.

Least squares analysis

In order to overcome results due to an unequal subclass model (Harvey, 1990) [3] model was used by considering effects of lactation order and reproductive disorders on reproduction and production traits in HF x Gir halfbred.

Model-I: Effect of lactation order

The least squares technique of fitting constants (Harvey, 1990) [3] was utilized to examine the influence of lactation order on reproduction and production traits by using the following model.

$Yij = \mu + Li + eij$

Where,
Yij = Observation of reproduction, production traits of j^{th} individual under i^{th} lactation order
μ = Population mean
Li = Effect of ith lactation order
eij = Random error NID (σ^2e)

Model - II: Effect of reproductive disorders

The data were corrected for the significant effect of lactation order and the adjusted data were used to estimate the influence of reproductive disorders on the traits under study by using following model,

$Yij = \mu + Ri + eij$
Yij = Observation of postpartum economic traits of J^{th} individual under i^{th} reproductive disorders
μ = Population mean
Ri = Effect of i^{th} reproductive disorders
eij = Random error NID (σ^2e)

Duncan's Multiple Range Test (DMRT)

Duncan's multiple range test as modified by Kramer (1957) [4] was used to make pair wise comparison among the least squares means with the use of inverse elements and root mean squares of error.

If the values (Yi – Yj) x Ö 2/Cij + Cjj – 2Cij > s2e, Z (P, ne)

Where,
Yi – Yj = Difference between the two least square means
Cij = Corresponding ith diagonal elements of C matrix
Cjj = Corresponding jth diagonal elements of C matrix
Z(P, ne) = Standardized range value in Duncan's table at the chosen level of probability for the error degrees of freedom
P = Number of means involved in the comparison
σ^2e = Root mean squares of error

Results and Discussion

The results obtained in the present investigation entitled, " Effect of Reproductive Disorders on Reproduction Trait of HF X Gir Halfbred " are presented and discussed below.

Reproductive traits

1. Open period

The overall open period as affected by lactation order was 90.37 ± 4.99 days while it was 97.67 ± 3.04 days as affected by reproductive disorders in HF x Gir halfbred (Table 1).

1.1 Effect of lactation orders

The analysis of variance (Table 2) showed that the lactation order had non significant effect on the open period. The highest open period was found in cows of LO_7 (107.66 ± 28.08 days) and the lowest open period was found in cows of LO_1 (75.90 ± 5.30 days) as affected by lactation order. The similar results were reported by Agasti and Choudhary (1990) [5] in Jersey x Hariana halfbred and Kanwade (1997) [6] in Gir crossbreds and significant effect by Kamble (2003) [7] in Gir crossbreds.

Table 1: Least squares means for open period of HF x Gir halfbred as affected by lactation order

Sr. No.	Lactation order	N	Open period (days)	
			Mean	SE
	Population Mean (μ)	289	90.37	4.99
1	LO_1	84	75.90	5.30
2	LO_2	79	94.40	5.47
3	LO_3	49	82.51	6.94
4	LO_4	38	103.13	7.89
5	LO_5	17	86.76	11.79
6	LO_6	10	89.50	15.38
7	LO_7	3	107.66	28.08
8	LO_8	9	83.11	16.21

Table 2: Analysis of variance for open period as affected by lactation order in HF x Gir halfbred

Sr. No.	Source of variation	d. f.	MSS
1	LO	7	3857.06
2	Error	282	2365.93

1.2 Effect of reproductive disorders

The DMRT revealed that the significantly higher open period (133.72 ± 8.67 days) was found in cows suffered from dystocia while the significantly lower open period (80.87 ± 4.11 days) was found in the cases in which metritis has been noticed and open period of unaffected animal was 69.76 ± 2.76 days (Table 3).

The analysis of variance indicated that the reproductive disorders had significant (P<0.01) effect on open period (Table 4). The similar result was reported by Roy and Tripathi (1989) [8] in Gir crossbreds cows and by Kharche *et al.* (1982) [9] in Gir crossbreds.

Table 3: Least squares means for open period of HF x Gir halfbred as affected by reproductive disorders noticed in HF x Gir halfbred

Disorders	N	Open period (days)		Per cent Increase/ decrease in open period over unaffected animals
		Mean	SE	
Population Mean (μ)	289	97.67	3.04	-
Unaffected	112	69.76^{d}	2.76	00.00
Anestrous	57	93.54^{bcd}	3.81	34.08
Metritis	49	80.87^{d}	4.11	15.92
Retention of placenta	28	89.03^{cd}	5.43	27.62
Dystocia	11	133.72^{a}	8.67	91.68
Abortion	17	84.70^{cd}	6.97	21.41
Uterine Prolapse	7	112.00^{b}	10.87	60.55
Repeat Breeder	5	120.40^{bcd}	12.86	72.59
Still birth	3	95.00^{bcd}	16.61	36.18

The means under each class in the same column with different superscript differed significantly

Table 4: Analysis of variance for open period as affected by reproductive disorders noticed in HF x Gir half bred

Sr. No.	Source of variation	d. f.	MSS
1	Disorders	8	8590.18**
2	Error	281	827.91

* * P<0.01

The percent increase in open period in the cows suffered from anestrus, metritis, retention of placenta, dystocia, abortion, uterine prolapse, repeat breeder and still birth was 34.08, 15.92 27.62, 91.68, 21.41, 60.55, 72.59 and 36.18 per cent respectively.

2. Service period

The overall service period as affected by lactation orders was 171.72 ± 10.90 days while it was 173.06 ± 5.63 days as affected by reproductive disorders in HF x Gir halfbred.

2.1 Effect of lactation orders

It was seen from Table 5 & 6 that lactation order had a non-significant effect on service period. The highest service period was found in cows of LO_7 (210.00 ± 61.33 days) and the lowest service period was found in cows of LO_1 (153.73± 11.59 days). The similar result reported by Bhoite *et al.* (1999) [10] in FJG, JFG and BFG three breed crosses, Kuthu *et al.* (2007) [11] in indigenous cows of Kashmir. Habib *et al.* (2010) [12] in Chittagong cattle & significant effect reported by Kamble (2003) [7] in Gir crossbred cow and Dahiya *et al.* (2003) [13] in Hariana crossbred cattle.

Table 5: Least squares means for service period of HF x Gir halfbred as affected by lactation order in HF x Gir halfbred

Sr. No.	Lactation order	N	Service period (days)	
			Mean	SE
	Population Mean (μ)	289	171.72	10.90
1	LO_1	84	153.73	11.59
2	LO_2	79	189.01	11.95
3	LO_3	49	162.73	15.17
4	LO_4	38	162.68	17.23
5	LO_5	17	158.05	25.76
6	LO_6	10	167.80	33.59
7	LO_7	3	210.00	61.33
8	LO_8	9	169.77	35.41

Table 6: Analysis of variance for service Period as affected by lactation order in HF x Gir halfbred

Sr. No	Source of variation	d. f.	MSS
1	LO	7	8771.05
2	Error	282	11286.17

2.2 Effect of reproductive disorders

Table 7 & 8 revealed that the reproductive disorders exerted a significant (p<0.01) effect on service period. The similar results were reported by Roy and Tripathi (1989) [8] at military dairy farms and NDRI farms. It was noticed by using DMRT that the significantly higher service period was found in cows affected by dystocia (201.27 ± 16.03 days) and which was at par with the animals suffered from abortion, anestrous, and stil birth followed by the cases under retention of placenta, metritis, repeat breeder and uterine prolapse while the significantly lower service period was found in unaffected animals (101.07 ± 5.02 days).

The per cent increase in service period of the animals suffered from reproductive disorders viz anestrus, metritis, retention of placenta, dystocia, abortion, uterine prolapse, Repeat breeder, and still birth was 94.62, 69.97, 74.83, 99.13, 94.85, 56.60, 68.99, and 82.05 per cent respectively.

Table 7: Least squares means for service period of HF x Gir halfbred as affected by reproductive disorders noticed in HF x Gir halfbred

Sr. No.	Disorders	N	Service period (days)		Per cent of increase in service period over unaffected animals
			Mean	SE	
	Population Mean (µ)	289	173.06	5.63	-
1	Unaffected	112	101.07[d]	5.02	00.00
2	Anestrous	57	196.71[a]	7.045	94.62
3	Metritis	49	171.79[b]	7.599	69.97
4	Retention of placenta	28	176.71[b]	10.052	74.83
5	Dystocia	11	201.27[a]	16.038	99.13
6	Abortion	17	196.94[a]	12.901	94.85
7	Uterine prolapse	7	158.28[c]	20.104	56.60
8	Repeat breeder	5	170.80[b]	23.788	68.99
9	Still birth	3	184.00[ab]	30.71	82.05

The means under each class in the same column with different superscript differed significantly

Table 8: Analysis of variance for service Period as affected by reproductive disorders noticed in HF x Gir halfbred

Sr. No	Source of variation	d. f.	MSS
1	Disorders	8	63367.42**
2	Error	281	2829.24

** $P<0.01$

3. Calving interval

The overall calving interval as affected by lactation order was 410.17 ± 8.67 days while it was of 442.47 ± 8.48 days as affected by reproductive disorders in HF x Gir halfbred.

3.1 Effect of lactation order

From the result shown in Table 9 & 10 it was observed that lactation order had non-significant effect on calving interval. The similar result reported by Bhoite *et al.* (1999) [10] in three breed crosses of HF, Jersey and Boran Swiss with Gir cows, Kuthu *et al.* (2007) [11] in indigenous cows of Kashmir. Jadhav (2009) [14] in HF x Gir halfbreeds and Chigale (2013) [15] in Red Sindhi. And significant effect of lactation order on calving interval by Deokar *et al.* (2005) [16] in Jersey cattle, Hammound *et al.* (2010) [17] in Friesian cows, Habtamu *et al.* (2010) [18] in Jersey cows. The highest calving interval was found in cows of LO_4 (439.10 ± 13.82 days) and the lowest calving interval was found in cows of LO6 (382.63± 25.72 days).

Table 9: Least squares means for calving interval of HF x Gir halfbred as affected by lactation order

Sr. No.	Lactation order	N	Calving interval (days)	
			Mean	SE
	Population Mean (µ)	293	410.17	8.67
1	LO_1	84	394.50	9.31
2	LO_2	80	426.41	9.54
3	LO_3	50	438.82	12.06
4	LO_4	38	439.10	13.84
5	LO_5	18	390.44	20.11
6	LO_6	11	382.63	25.72
7	LO_7	3	400.66	49.26
8	LO_8	9	408.77	28.44

Table 10: Analysis of variance for calving interval as affected by lactation order in HF x Gir halfbred

Sr. No	Source of variation	d. f.	MSS
1	LO	7	16994.51
2	Error	286	7280.40

3.2 Effect of reproductive disorders

It was noticed from Table 11 & 12 that the reproductive disorders had significant ($P<0.01$) effect on calving interval of HF x Gir halfbred. The similar results were shown by Roy and Tripathi (1989) [8] in crossbred cows of military farms and for NDRI farms. Contrastingly Prabhukumar *et al.* (1990) [19] reported non-significant effect in triple crossbred Ongole cows with HF, Brown Swiss and Jersey cattle.

The DMRT indicated that the cows having repeat breeder problem showed significantly ($P<0.01$) higher calving interval which was at par with over the cows with the reproductive disorders like dytocia, abortion, and uterine prolapse however significantly lower calving interval was observed in unaffected animals. The per cent increase in calving interval of the animals suffered from reproductive disorders viz anestrus, metritis, retention of placenta, dystocia, abortion, uterine prolapse, repeat breeder and still birth was 11.63, 11.07, 10.36, 13.83, 29.52, 18.10, 39.43 and 5.44 respectively.

Table 11: Least squares means for calving interval as affected by reproductive disorders noticed in HF x Gir halfbred

Sr. No.	Disorders	N	Calving interval (days)		Per cent of increase in service period over unaffected animals
			Mean	SE	
	Population Mean (µ)	293	442.47	8.48	-
1	Unaffected	112	383.13[c]	7.65	00
2	Anestrous	58	427.72[b]	10.63	11.63
3	Metritis	50	425.58[b]	11.45	11.07
4	Retention of placenta	29	422.86[b]	15.045	10.36

5	Dystocia	11	436.00^{ab}	24.42	13.83
6	Abortion	17	496.23^{ab}	19.65	29.52
7	Uterine prolapse	8	452.50^{ab}	28.64	18.10
8	Repeat breeder	5	534.20^{a}	36.23	39.33
9	Still birth	3	404.00^{bc}	46.77	5.44

The means under each class in the same column with different superscript differed significantly

Table 12: Analysis of variance for calving interval as affected by reproductive disorders noticed in HF x Gir halfbred

Sr. No	Source of variation	d. f.	MSS
1	Disorders	8	41206.76**
2	Error	285	6564.76

** P<0.01

4. Number of service per conception

The overall number of service per conception as affected by lactation order was 3.80 ± 0.25 while it was 3.90 ± 0.25 as affected by reproductive disorders in HF x Gir halfbred.

4.1 Effect of lactation orders

Table 13 & 14 indicated that lactation order had a non-significant effect on the number of services per conception. However, the contradictory significant effect were reported by Gaur (2001) [20] worked on Frieswal cattle, Nagawade (2005) [21] Phule Triveni crossbred cows, Sonawane (2008) [23] in Red Sindhi cows, Patond (2009) [22] in Jersey cattle, Mhasade in FG crossbred cows. The highest number of services per conception were found in cows of LO8 i.e. 4.66 ± 0.84 and the lowest number of services per conception were found in cows of LO1 i.e. 3.55 ± 0.28.

Table 13: Least squares means for number of services per conception as affected by lactation order in HF x Gir halfbred

Sr. No.	Lactation order	N	Number of services per conception	
			Mean	SE
	Population Mean (µ)	291	3.80	0.25
1	LO_1	81	3.55	0.28
2	LO_2	81	3.80	0.28
3	LO_3	50	3.64	0.35
4	LO_4	38	3.65	0.41
5	LO_5	18	3.83	0.59
6	LO_6	11	3.63	0.76
7	LO_7	3	3.66	1.46
8	LO_8	9	4.66	0.84

Table 14: Analysis of variance for number of services per conception as affected by Lactation order in HF x Gir halfbred

Sr. No	Source of variation	d. f.	MSS
1	LO	7	1.64
2	Error	284	6.46

4.2 Effect of reproductive disorders

Number of services per conception & anova of the same is presented in Table 15 & 16. It is indicated that the reproductive disorders had a significant (P<0.01) effect on the number of services per conception. The DMRT indicated that the cows having still birth problem required significantly (P<0.01) higher number of services per conception (5.00 ± 1.41) over the cows with the reproductive disorders viz metritis , retention of placenta , dystocia, abortion , uterine prolase , repeat breeder and still birth however significantly lower number of service per conception (2.12 ±0.23) were observed in unaffected cows. The per cent increase in number of services per conception of the animals suffered from reproductive disorders viz anestrus, metritis, retention of placenta, dystocia, abortion, uterine prolapse, repeat breeder, still birth was 98.11, 116.03, 94.81, 118.39, 58.01, 38.67 , 98.11 and 135.84 per cent respectively.

Table 15: Least squares means for number of services per conception of HF x Gir halfbred cows as affected by various reproductive disorders

Sr. No.	Disorders	N	Number of services per conception		Per cent of increase in service period over unaffected animals
			Mean	SE	
	Population Mean (µ)	291	3.90	0.25	-
1	Unaffected	109	2.12^{c}	0.86	00
2	Anestrous	59	4.20^{b}	0.31	98.11
3	Metritis	50	4.58^{b}	0.34	116.03
4	Retention of placenta	29	4.13^{bc}	0.45	94.81
5	Dystocia	11	4.63^{b}	0.73	118.39
6	Abortion	17	3.35^{bc}	0.59	58.01
7	Uterine prolapse	8	2.94^{c}	0.23	38.67
8	Repeat breeder	5	4.20^{bc}	1.09	98.11
9	Still birth	3	5.00^{a}	1.41	135.84

The means under each class in the same column with different superscript differed significantly

Table 16: Analysis of variance for number of services per conception as affected by reproductive disorders noticed in HFX Gir halfbred

Sr. No	Source of variation	d. f.	MSS
1	Disorders	8	19.90**
2	Error	283	5.96

** $P<0.01$

Conclusion

All the reproductive traits viz. open period, service period , calving interval, number of services per conception were significantly affected by the reproductive disorders indicating the losses in reproductive traits should be avoided to get more calving and ultimately milk production too.

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