I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3. 03

Generation-wise Comparative Lifetime Performance of Halfbred and Three Breed Crosses of Gir*

S.R. Garudkar[1], S.D. Mandakmale[2] and D.K. Deokar[3]

Abstract:*The data on lifetime performance i.e. reproduction and production traits of halfbred (221) and three breed crosses (184) of Gir maintained at MPKV, Rahuri, Maharashtra from 1972 to 2012 were used to investigate the generation-wise comparative lifetime performance up to six lactation. Pedigree of each animal born during this period was traced back up to foundation stock. The cows up to eighth generation from maternal side in halfbred and three breed crosses of Gir were observed. The averages for lifetime traits, viz. ALTPR, LTLMY, LT300DMY, ALT300DMY, ALTWA and ALT300DWA were 0.32 ± 0.01 per cent, 16093.12 ± 340.53 kg, 15234.41 ± 323.18 kg, 3165.32 ± 49.99 kg, 10.21 ± 0.15 kg and 10.79 ± 0.16 kg, respectively in FG group. In FJG group, the averages for lifetime traits, viz. ALTPR, LTLMY, LT300DMY, ALT300DMY, ALTWA and ALT300DWA were 0.28 ± 0.01 per cent, 15620.04 ± 277.99 kg, 14541.02 ± 261.91 kg, 3013.46 ± 40.80 kg, 9.53 ± 0.12 kg and 10.23 ± 0.13 kg, respectively. The first generation of FG halfbred and three breed crosses of Gir showed significantly higher performance over their interbreds.*

Keywords: *Generation, Girhalfbred, Lifetime traits, three breed crosses of Gir.*

INTRODUCTION

Research on crossbreeding in tropical countries has shown that performance of the F_1 animals are the best with respect to various reproduction as well as productive traits reported by Syrstad [1]. But it is practically not feasible to maintain pure F_1 population for a milking herd. Inter-se mating of animals with 50% exotic inheritance however is the usual practice. It was found that there was decline in performance from F_1 to F_2 crossbreds. The present breeding policy for improvement of synthetic crossbred population is through inter-se mating followed by selection with the maintenance of desired level of exotic inheritance. But exotic inheritance is not found to be the only key factor in determining the performance of the synthetic population.

In Maharashtra, one of the project was started at MPKV, Rahuri. The ICAR terminated this programme in 1986. Later on the AICRP on Cattle is designated as RCDP on Cattle. This project evolved Girhalfbred (FG) and triple cross cows (PhuleTriveni synthetic cows *i.e.* FJG) consists of 50% Holstein Friesian + 25% Jersey + 25% Gir inheritance also they had been bred *inter-se* followed by rigorous selection, and their performances were tested. Therefore, an attempt was made to investigate the lifetime performance of population over the generations.

MATERIAL AND METHODS

The data on reproduction and production traits of 221 Girhalfbred and 184 triple cross cows spread over a period of 41 years (1972-2012), maintained at Research cum Development Project on Cattle, Mahatma PhuleKrishiVidyapeeth, Rahuri were analysed to study the comparative lifetime performance.

Lifetime fertility is the ability of cow to conceive every 21 days after calving up to 6th lactation. Lifetime milk production and productivity is considered as the

* Part of the Ph.D. thesis submitted by the First author to MPKV, Rahuri (M.S.)

[1] Asst. Prof. ,College of agriculture, Aurangabad, Dept. ASDS, affiliated to VNMKV, Parbhani (M.S.) *Email : mailmesuwarna@rediffmail.com*
[2] Asso. Prof. and Senior Scientist, AICRP on Sangamneri Goat Imp., MPKV, Rahuri (M.S.)
[3] Asst. Prof. and Dairy Cattle Breeder, RCDP on Cattle, MPKV, Rahuri-413 722 (M.S.)

average milk production up to 6th lactation. Data of reproduction and production traits were standardized and normalized.

The pregnancy rates of cows in each lactation were calculated as suggested by USDA [3].

DPR = 21/(service period–voluntary waiting period +11)

The constant factors 11 centralize the measure of possible conception within each 21 days time period.

The voluntary waiting period (VWP) varies in the range of 70-90 days. However, to have the precise estimates of standard voluntary waiting period of 63 days was considered to estimate the pregnancy rate.

The collected data were analyzed by SAS [2] linear models of least-squares means. When the analysis of variance indicated the existence of significant within class, Duncan's Multiple Range Test (DMRT) was employed to test and locate means that are significantly differed from the rest. Data of lifetime performance traits were compared with '*t*' test to analyze the generation-wise genetic group differences.

The following statistical model was used to estimate the effect of genetic group and generation on reproduction and production traits as follows:

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

Where,

Y_{ijk} = Performance record of i^{th} genetic group of j^{th} generation

μ = Overall mean

A_i = Effect of i^{th} genetic group

B_j = Effect of j^{th} generation

e_{ijk} = Random error associated with NID (0, $\sigma^2 e$)

RESULTS AND DISCUSSION

The results pertaining to the analysis of variance and least-squares means for ALTPR, LTLMY, LT 300 DMY, ALT 300 DMY, ALTWA and ALT 300 DWA in Girhalfbred and triple crosses are presented in Table 1, 2, 3 and 4, respectively.

Average Lifetime Pregnancy Rate (ALTPR)

Overall mean ALTPR as affected by generation was 0.32 ± 0.01 per cent in FG and 0.28 ± 0.01 per cent in FJG group. The influence of generation was non-significant on average lifetime pregnancy rate in FG and FJG group. Though the effect of generation on ALTPR was non-significant, the highest ALTPR was observed in 1st generation in FG (0.35 ± 0.01 per cent) and in FJG (0.31 ± 0.01 per cent) group. The literature reviewing the effect of generation on average lifetime pregnancy rate was not available for crossbred cows.

Table 1
ANOVA of ALTPR, LTLMY, LT300DMY, ALT300DMY,ALTWA and ALT300DWA in halfbred and three breed crosses of Gir as affected by generation

Traits	*ALTPR*				*LTLMY*			
Source of variation	*Genetic group*				*Genetic group*			
	FG		*FJG*		*FG*		*FJG*	
	d.f.	*M.S.S.*	*d.f.*	*M.S.S.*	*d.f.*	*M.S.S.*	*d.f.*	*M.S.S.*
Generation	7	0.035	7	0.040	7	136159659.11**	7	39968009.23**
Error	204	0.052	173	0.033	213	219951113.24	176	13196146.72
Traits	*LT300DMY*				*ALT300DMY*			
Source of variation	*Genetic group*				*Genetic group*			
	FG		*FJG*		*FG*		*FJG*	
	d.f.	*M.S.S.*	*d.f.*	*M.S.S.*	*d.f.*	*M.S.S.*	*d.f.*	*M.S.S.*
Generation	7	138381690.32**	7	50332471.56**	7	6870708.98**	7	2117117.00**
Error	213	1929463.02	176	11122181.27	213	344787.02	176	234298.66
Traits	*ALTWA*				*ALT300DWA*			
Source of vaiation	*Genetic group*				*Genetic group*			
	FG		*FJG*		*FG*		*FJG*	
	d.f.	*M.S.S.*	*d.f.*	*M.S.S.*	*d.f.*	*M.S.S.*	*d.f.*	*M.S.S.*
Generation	7	64.79**	7	25.36**	7	72.96**	7	22.54**
Error	213	3.39	176	1.81	213	3.82	176	2.52

*: P < 0.05 **: P < 0.01

Life Time Total Lactation Milk Yield (LTLMY)

Overall mean LTLMY as affected by generation was 16093.12 ± 340.53 kg in FG and 15620.04 ± 277.99 kg in FJG group. The analysis of variance revealed that the effect of generation was significant (P < 0.01) on LTLMY in FG and FJG genetic groups.

In FG, the DMRT revealed that the cows of 1st generation had highest LTLMY (18281.08 ± 582.48 kg). Whereas, differences in LTLMY among cows of 2nd, 3rd, 4th and 6th generations were at par with each other in FG. In FJG, the 1st generation had highest LTLMY (17482.73 ± 596.91 kg) and differences in LTLMY among cows of 2nd, 3rd, 4th, 6th and 7th generations were at par with each other in FJG group. It was noticed from Table 2 that the generation-wise genetic group differences as compared with 't' test was found non-significant in LTLMY. However, the difference in LTLMY among cows of G_7 and G_8 have (P<0.05) significant difference with erratic results. It indicated that the genetic groups of *inter se* progeny had not much difference in LTLMY.

Lifetime 300 Days or Less Milk Yield (LT300DMY)

The overall mean lifetime 300 days or less milk yield as affected by generation was 15234.41 ± 323.18 kg in FG and 14541.02 ± 261.91 kg in FJG group.The analysis of variance revealed that the effect of generation was significant (P < 0.01) on LT300DMY in FG and FJG genetic groups. The DMRT revealed that 1st generation had highest LT300DMY (17472.46 ± 549.77 kg) than other generations. The differences in LT300DMY among cows of 2nd, 6th and 3rd, 4th, 5th, 7th generations were at par with each other in FG. In FJG, the 1st generation had highest LT300DMY (16701.46 ± 569.90 kg) than other generations. The differences in LT300DMY among cows of 2nd, 3rd, 4th and 5th, 6th generations were at par with each other in FJG group.

The generation-wise genetic group differences as compared with '*t*' test were found significant (P < 0.05) in LT300DMY. However, the differences among cows from G_3, G_7 and G_8 were significant with erratic results. It indicated that the genetic groups of *inter se* progeny had not much difference in LT300DMY.

Average Lifetime 300 Days or Less Milk Yield (ALT300DMY)

The overall mean ALT300DMY as affected by generation was 3165.32 ± 49.99 kg in FG and 3013.46 ± 40.80 kg in FJG group. The analysis of variance revealed that the effect of generation was significant effect on ALT300DMY in FG and FJG group.

The DMRT revealed that the cows of generation 1st had highest ALT300DMY in FG (3671.99 ± 69.31 kg) and FJG (3437.35 ± 64.29 kg) than other generations. The differences in ALT300DMY among cows of 3rd, 4th, 6th and 5th, 7th, 8th generation were at par with each other in FG. In FJG, the differences in ALT300DMY among cows of 2nd, 6th and 3rd, 5th, 8th generation was at par with each other.

It was noticed from Table 3 that the generation-wise genetic group differences as compared with 't' test were found highly significant in ALT300DMY. However, the differences in ALT300DMY among cows from G_1, G_3 and G_7 were significant with erratic trend. It indicated that the genetic groups of *inter se* progeny had not much difference in ALT300DMY.

Table 2
Least-squares means for ALTPR and LTLMYin halfbred and three breed crosses of Gir as affected by generation

Traits	*ALTPR*				*'t' Test*	*LTLMY*				*'t' Test*
Source of variation	*Genetic group*					*Genetic group*				
	FG		*FJG*			*FG*		*FJG*		
	N	*Mean ± S.E.*	*N*	*Mean ± S.E.*		*N*	*Mean ± S.E.*	*N*	*Mean ± S.E.*	
μ	212	0.32 ± 0.01	181	0.28 ± 0.01	4.00**	221	16093.12 ± 340.53	184	15620.04 ± 277.99	1.50
G_1	96	0.35 ± 0.03	38	0.31 ± 0.03	1.33	97	18281.08^{a} ±582.48	40	17482.73^{a} ± 596.91	1.36
G_2	16	0.31 ± 0.05	50	0.29 ± 0.03	0.55	15	15898.06^{ab} ± 1125.32	48	15867.30^{ab} ± 460.28	0.04
G_3	18	0.33 ± 0.05	37	0.29 ± 0.03	1.06	19	14422.28^{ab} ± 781.02	37	15174.40^{ab} ± 607.08	1.12
G_4	27	0.28 ± 0.04	21	0.25 ± 0.03	0.83	32	14517.72^{ab} ± 666.10	21	14697.40^{ab} ± 888.22	0.23
G_5	24	0.27 ± 0.02	20	0.20 ± 0.02	3.50**	25	13766.70^{bc} ± 549.44	22	13684.89^{b} ± 788.40	0.12
G_6	16	0.30 ± 0.04	6	0.19 ± 0.04	2.75**	17	15076.83^{ab} ± 931.35	7	14715.71^{ab} ± 1538.33	0.31
G_7	11	0.31 ± 0.05	6	0.31 ± 0.11	0.00	12	13724.16^{bc} ± 1169.46	6	16602.59^{ab} ± 1551.93	2.19*
G_8	4	0.18 ± 0.02	3	0.17 ± 0.03	0.40	4	10272.40^{c} ±1051.56	3	13105.86^{b} ± 1131.39	2.60*

Means under each class in the same column with different superscripts differed significantly
*: P < 0.05 **: P < 0.01

Table 3
Least-squares means for LT300DMY and ALT300DMYin halfbred and three breed crosses of Gir as affected by generation

Traits	*ALTPR*			*'t' Test*	*LTLMY*				*'t' Test*
Source of variation	*Genetic group*				*Genetic group*				
	FG		*FJG*		*FG*		*FJG*		
	N	*Mean ± S.E.*	*N*	*Mean ± S.E.*		*N*	*Mean ± S.E.*	*N*	*Mean ± S.E.*	
μ	221	15234.41 ± 323.18	184	14541.02±261.91	2.33*	221	3165.32 ± 49.99	184	3013.46 ±40.80	3.29**
G_1	97	17472.46^{a} ± 549.77	40	16701.46^{a} ± 569.90	1.38	97	3671.99^{a} ± 69.31	40	3437.35^{a}± 64.29	3.45**
G_2	15	14808.80^{ab} ± 996.36	48	14726.38^{abc} ± 430.14	0.13	15	3156.51^{b} ± 182.68	48	3126.03^{abc}± 84.22	0.26
G_3	19	13480.96^{bc} ± 664.23	37	1410.08^{abc}± 566.44	20.07**	19	2679.43^{bc}± 98.12	37	2816.09^{bc}± 71.19	1.68*
G_4	32	13206.38^{bc} ± 615.76	21	13438.12^{abc} ± 751.93	0.34	32	2737.36^{bc}± 72.73	21	2639.56^{c}± 82.85	1.27
G_5	25	13077.52^{bc} ± 547.24	22	12567.80^{bc} ± 690.40	0.82	25	2644.95^{c}± 78.16	22	2679.48^{bc}± 96.66	0.39
G_6	17	14515.34^{ab} ± 894.98	7	12774.60^{bc} ± 1463.97	1.59	17	2903.71^{bc}± 159.15	7	2973.13^{abc}± 219.05	0.38
G_7	12	13137.64^{bc} ± 1080.70	6	15679.00^{ab} ± 1370.00	2.14*	12	2552.76^{c}± 136.76	6	3155.46^{ab}± 270.59	3.13**
G_8	4	9937.88^{c} ± 819.97	3	12231.46^{c} ± 586.37	3.14**	4	2845.06^{bc} ± 107.59	3	2871.04^{bc}± 586.37	0.06

Means under each class in the same column with different superscripts differed significantly
*: P < 0.05 **: P < 0.01

Table 4
Least-squares means for ALTWA and ALT300DWA in halfbred and three breed crosses of Gir as affected by generation

Traits	*ALTPR*			*'t' Test*	*LTLMY*				*'t' Test*
Source of variation	*Genetic group*				*Genetic group*				
	FG		*FJG*		*FG*		*FJG*		
	N	*Mean ± S.E.*	*N*	*Mean ± S.E.*		*N*	*Mean ± S.E.*	*N*	*Mean ± S.E.*	
μ	221	10.21 ± 0.15	184	9.53 ± 0.12	4.95**	221	10.79 ± 0.16	184	10.23± 0.13	3.80**
G_1	97	11.74^{a} ± 0.20	40	11.03^{a}± 0.20	3.55**	97	12.41^{a}± 0.22	40	11.62^{a}± 0.21	3.63**
G_2	15	10.40^{ab}± 0.81	48	9.83^{abc}± 0.20	1.31	15	10.99^{ab}± 0.77	48	10.59^{ab}± 0.28	0.89
G_3	19	8.75^{c}± 0.27	37	8.88^{cd}± 0.22	0.54	19	9.22^{cd}± 0.29	37	9.61^{bc}± 0.23	1.54
G_4	32	8.52^{c}± 0.21	21	8.18^{d}± 0.24	1.52	32	9.28^{cd} ± 0.24	21	8.97^{c}± 0.28	1.20
G_5	25	8.76^{c}± 0.23	22	8.47^{d}± 0.28	1.13	25	9.23^{cd}± 0.24	22	9.17^{bc}± 0.33	0.21
G_6	17	9.53b^{c}± 0.55	7	9.07^{bcd}± 0.66	0.78	17	10.02^{bcd}± 0.53	7	10.00^{bc}± 0.75	0.03
G_7	12	8.54^{c} ± 0.35	6	10.29^{ab}± 0.81	3.19**	12	8.46^{d}± 0.53	6	10.70^{ab}± 0.89	3.33**
G_8	4	10.05^{bc}± 0.25	3	9.50^{bcd}± 0.62	1.22	4	10.41^{bc}± 0.17	3	9.97^{bc}± 0.70	0.92

Means under each class in the same column with different superscripts differed significantly
*: P < 0.05 **: P < 0.01

Average Lifetime Wet Average (ALTWA)

The overall mean ALTWA as affected by generation was 10.21 ± 0.15 kg in FG and 9.53 ± 0.12 kg in FJG. The analysis of variance revealed that the influence of generation was significant (P < 0.01) on ALTWA in FG and FJG genetic groups.

The DMRT revealed that the cows of 1st generation had highest ALTWA (11.74 ± 0.20 kg) than other generations. The differences in ALTWA among cows of 3rd, 4th, 5th, 6th and 7th generations were at par with each other in FG. In FJG, the cows of 1st generation had highest ALTWA (11.03 ± 0.20 kg) than other generations.

The generation-wise genetic group differences as compared with '*t*' test were found highly significant in ALTWA. However, the differences among cows of G_1 and G_7 were significant with erratic results. It indicated that the genetic groups of *inter*se progeny had not much difference in ALTWA.

Average Lifetime 300 Days or Less Wet Average (ALT300DWA)

The overall mean ALT300DWA as affected by generation was 10.79 ± 0.16 kg in FG and 10.23 ± 0.13 kg in FJG group.The analysis of variance revealed that the effect of generation was significant (P < 0.01) on average lifetime 300 days or less wet average in FG and FJG group.

The cows of 1st generation had highest ALT300DWA (12.41 ± 0.22 kg) and lowest in 7th generation (8.46 ± 0.53 kg) in FG. In FJG, cows of generation 1st had highest ALT300DWA (11.62 ± 0.21 kg) and lowest in 4th (8.97 ± 0.28 kg). It was noticed from Table 4 that the generation-wise genetic group differences as compared with '*t*' test were found highly significant in ALT300DWA. However, the differences among cows of G_1 and G_7 were significant with erratic results. It indicated that the genetic groups of *inter*se progeny had not much difference in ALT300DWA.

The literature reviewing effect of generation on ALTPR, LTLMY, LT300DMY, ALT300DMY, ALTWA and ALT300DWA of cows was not available.

CONCLUSIONS

From the results it could be concluded that the first generation of FG halfbred and three breed crosses of Gir showed significantly higher performance over their interbreds because of hybrid vigor, subsequent decline in further generations in FG halfbred and three breed crosses of Gir indicated to restrict the interse mating and to adopt suitable breeding system to retain the hybrid vigor like selective rotational crossing. The halfbreds performed better than the three breed crosses of Gir.

REFERENCES

Syrstad, O. (1990), A genetic interpretation of results obtained in Bos*indicus* x Bos*Taurus* crossbreeding for milk production. *Proceedings of the 4th Conference of Genetics Applied in Livestock Production*, Edinburgh **14**: 195-98.

SAS (Statistical Analysis System) (2011). SAS Version 9.3, SAS Institute Inc., Cary, NC, USA.

USDA. 2003. Estimated relative conception rate valuation. Animal Improvement Programs Laboratory Research Report.www. Aipl.arsusda.gov.com.

❍❍❍