CHAPTER V
SUMMARY AND CONCLUSIONS

The study was carried out on Gir cattle maintained at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh. The production and reproduction traits were evaluated.

Data on 3236 lactation record of 700 Gir Cows up to 10 lactation were collected from pedigree & history sheets/registers maintained at CBF (Cattle Breeding Farm, Junagadh Agriculture University, Junagadh) for various production and reproduction traits for the period of 1965 to 2016 (51 Years).

The Least squares analysis was carried out for the estimation of magnitude of effects of non-genetic factors significantly affecting the traits as well as for estimation of genetic parameters. The data was classified according to period of calving (10 groups of five years each), season of calving (4 groups Rainy, winter, spring and summer), AFC group (5 groups) and CI group (7 groups) for analysis.

The data were analyzed for production traits like First lactation length (FLL), First lactation yield (FLY), 300 day First lactation yield (FLY300), Monthly peak yield (MPY), First lactation yield per day of lactation length (FLY/LL) and First lactation yield per day of calving interval (FLY/CI), Age at first calving, First calving interval (FCI) and First Dry period (FDP) in first parity while lactation length (LL), lactation yield(LY), 300 day lactation yield (LY300), monthly peak yield (MPY) in pooled parity.

The data were analyzed by least squares analysis of variance on the production and reproduction records of Gir cows using LSML, mixed model (Harvey, W R. 1990) for estimation of significance of effects of non-genetic factors such as period of calving, Season of Calving and effect of Age at First calving on first lactation reproduction traits in Gir cattle.

Genetic parameters such as heritability of first lactation traits, repeatability of production traits of pooled parity and genetic trends of lactation yield were estimated using sire breeding values over a period of 51 years and regressing them on period.
5.1 First lactation:

General means for Lactation length, Lactation yield, 300 days lactation yields, monthly peak yield, lactation yield per day of lactation length and lactation yield per day of calving interval was observed as 375.89 + 3.66 days, 2174.02 + 30.01 Lit, 1814.47 + 19.81 Lit, 241.78 + 206.2 Lit, 5.64 + 0.06 Lit and 3.60 + 0.08 Lit, respectively. While General means for age at first calving, calving interval and dry period was 1558.3 days, 454.8 + 8.81 days and 104.3 + 3.43 days respectively.

The overall least-squares mean for first lactation length (FLL) in Gir cows was 308.9 + 8.4, days

The least–squares analysis of variance results indicated that lactation length (LL) was significantly (P<0.05) influenced by season of calving and age at first calving (AFC Group) (Table-4.3). Highest average lactation length was observed in cows those calved in season – spring (Jan-March) and lowest lactation length (LL) was observed in cows those calved in rainy season (July-Sept), the averages being 388.0 + 9.67 and 356.6 + 11.02 days, respectively. The cows those calved in the comfortable months of the year (spring) produced for longer period. While, those calved during uncomfortable climatic season i.e. rainy season produced for short duration. Graphical presentation indicates that cows calved in spring season had longer lactation length.

First lactation length was also found to be affected by AFC Group, significantly (P<0.05). Cows calved with age at first calving ranging between 1601 - 1800 days had maximum FLL (389.0 + 10.10 days) while those calved with AFC ranging between 1801-2000 days had lowest FLL (360.0 + 12.27 days) Table - 4.2. This indicated that higher age at first calving did not favor for producing for longer duration.

Overall Least square mean for First Lactation Yield (FLY) in Gir cattle was found as 2174.1 + 62.56. Lit. First Lactation Yield (FLY) was significantly affected by AFC group only (P<0.05). Cows having Age at first Calving between 1601-1800 days had highest FLY (2346.9 + 80.53 Lit), while cows having Age at First Calving between 1401-1600 days had lowest FLY (2092.9 + 81.8 Lit.). First lactation yield (FLY) in Gir cattle was not found to be influenced by period of calving and season of calving.

Overall least squares mean for 300-day first lactation yield was obtained as 1809.8 + 43.06 Lit. 300-day first lactation milk yield (LY-300) was not influenced by either of the factors like period of calving, season of calving and AFC group, at all.
Overall least squares mean for first lactation monthly peak yield (MPY) was obtained as 243.0 + 5.84 Lit. Monthly peak yield was found to be significantly (P<0.05) affected by period of calving and seasonal of calving. Highest MPY (303.1 ± 32.60 Lit) was observed in the cows which calved during the period 10 (Year 2011-2016) while lowest MPY was observed in the cows which calved in the period 01 (Year <1971). While The cows calving in the winter season (October –December) produced MPY maximum (250.7 + 7.21 Lit) while those calved during summer season (April-June) produced MPY minimum (226.5 + 8.20 Lit).

The overall least squares means for first lactation yield per day of lactation length was 5.7 ± 0.11. First lactation yield per day of lactation length (FLY/LL) was significantly (P<0.05) affected by period. The highest Lactation yield per day of lactation length was observed in period 8 i.e. from 2001-2005 was 6.8 ± 0.50. While lowest Lactation length per day of lactation yield was observed in period -9 i.e. 2006-2010 was 4.8 ± 0.51 Lit

The overall least square means for first lactation yield per day of calving interval (FLY/CI) was 3.7 ± 0.15 Lit. First lactation yield per day of calving interval (FLY/CI) was significantly (P<0.05) affected by period of calving The highest first lactation yield per day of calving interval (FLY/CI) was observed as 4.9 ± 0.68 Lit. It was recorded in period - 2 i.e. in 1971-1975. While the lowest first lactation yield per day of calving interval (FLY/CI) was observed as 2.1 ± 0.52. It was recorded in period - 7 i.e. in years of 1996-2000.

The overall least squares mean for AFC was observed as 1570.0 ± 16.93 days. The least–squares analysis of variance results indicated that age at first calving was highly significantly (P<0.01) affected by period of calving while season of birth had no significant effect on AFC The highest value of age at first calving was observed in period 10 i.e. 2011-2016 (1782.0 ± 117.42 days) while, the lowest value of age at first calving was observed in period 2 i.e. in 1971-1975 (1356.8 ± 71.25 days).

The overall least squares mean for first calving interval was obtained as 456.2 ± 17.53 days. The first calving interval was not found to be affected by period of calving and season of calving in present study.

The overall least squares mean for first dry period was observed as 104.0 ± 6.59 days. The first dry period did not found to be influenced by season of calving and period of calving in the present study.
5.1.1 Heritability of First lactation production and reproduction traits:

Heritability estimates were obtained using intraclass paternal half sib correlation method. The analysis of variance for half sib data with unequal number of progenies under different sires was carried out.

Heritability of first lactation length, first lactation yield, first 300 day lactation yield, first lactation monthly peak yield, first lactation yield per day of lactation length and first lactation yield per day of calving interval in Gir cattle herd was found as 0.328 ± 0.116, 0.188 ± 0.096, 0.22 ± 0.100, 0.26 ± 0.108, 0.18 ± 0.096 and 0.16 ± 0.15.

The results indicate that sufficient amount of additive genetic variance existed in the herd for first lactation length and there is ample scope of genetic improvement in the first lactation length (FLL) through selection. However in general average FLL in Gir cows is already very high (375.79 days) there is need to reduce FLL through selection in order to balance the reproduction and production traits for optimum yield.

Heritability of first 300 day lactation yield in Gir cattle herd was observed as 0.22 ± 0.100 The heritability indicated that the first 300 day milk yield possesses moderate genetic variability, However first 300 day lactation yield should be the criterion for selection in the Gir cattle.

Heritability of first lactation monthly peak yield was obtained as 0.26 ± 0.108 in Gir cattle herd. This trait seems to be emerging out as a promising trait exhibiting sufficiently moderate genetic variability in the Gir herd. First lactation monthly peak yield (MPY) hence on ward could be used as important criteria for selection in Gir cows for future breeding and can be safely included in the breeding program.

Heritability of age at first calving, first calving interval and first dry period were found to be 0.06 ± 0.144, 0.156 ± 0.092 and 0.12 ± 0.088.

In general it can be concluded that genetic variability among the reproduction traits is low and these traits can be improved through management.
5.1.2 Genetic and phenotypic correlation coefficients among first lactation traits:

Genetic correlations of first lactation length were all positive and high with FCI, while low and positive with FLY, FLY-300 and DP. Genetic correlations of FLL with MPY, FLY/LL and FLY/CI were low and negative as expected. Phenotypic correlations of FLL with FLY, FLY-300, FCI, were positive and high while, with MPY, FLY/CI were low and positive. Phenotypic correlations of FLL with DP and FLY/LL were low and negative.

Genetic correlations of FLY with FLY-300, MPY, FCI, FDP, FLY/LL and FLY/CI were all positive and very high. While, phenotypic correlation of FLY with all other traits were moderate to high and positive except with FDP which was very low (-0.005) and close to zero.

Genetic correlation coefficients of FLY-300 with MPY, FCI, FDP, FLY/LL and FLY/CI were all expectantly very high and positive. While, phenotypic correlations of FLY-300 with all above were all ranging from moderate to high except again with DP, which was negative and low. (-0.023).

MPY was found to be genetically highly positively correlated with FDP, FLY/LL and FLY/CI. However, with FCI, the MPY was negatively correlated. This indicates that higher MPY leads to shorter persistency and consequently shorter FCI. MPY was phenotypically positively and moderate to highly correlated with FLY/LL, FLY/CI, while with FCI and DP the correlation coefficient were very low.

First calving interval (FCI) was found to be genetically, positively and highly correlated with FDP. While with FLY/CI, the genetic correlation was low. Phenotypically, FCI was found to positively and moderately correlated with FLY/CI and FDP.

Genetic correlation among FDP and FLY/LL was astonishingly high but within range and with FLY/CI it was moderately high. Phenotypic correlation among FDP and FLY/LL and FLY/CI were all very low.
5.2 Pooled parity:

General means for Lactation length, Lactation yield, 300 days lactation yields and monthly peak yield of pooled parity was observed as 332.15 ± 1.99 days, 2151.12 ± 15.08 Lit. and 1934.47 ± 11.84 Lit, 283.24 ± 1.49 Lit, respectively, in Gir cattle.

The general average Lactation length (LL) was observed as 308.95 ± 8.43 days in Gir cattle. The least–squares analysis of variance results indicated that lactation length (LL) was highly significantly (P<0.01) influenced by parity of lactation, period calving, while significantly (P<0.05) influenced by season of calving. The lactation length ranged from 360.7 ± 8.29 days, the highest lactation length in 1st parity to 275.92 ± 19.61 days and the lowest in 9th parity. The highest lactation length recorded in cows those calved in spring (Jan-March) (314.13 ± 8.96 days) while the lowest lactation length recorded in cows those calved in summer (April- June) (300.76 ± 9.20 days).

The overall average lactation yield (LY) was observed as 1933.32 ± 63.01 Lit in Gir cattle. The least–squares analysis of variance results indicated that Lactation yield (LY) was highly significantly (P<0.01) affected by parity, period and season of calving. The highest lactation yield was recorded in fifth parity (2125.59 ± 74.33 Lit). While the lowest lactation yield was recorded in tenth parity (1525.53 ± 160.62 Lit). The maximum average lactation yield was observed as 2292.83 ± 82.81 Lit. in 9th period i.e. years 2006-2010 and the lowest lactation length was observed as 1748.10 ± 89.25 Lit. in 4th period i.e. years 1981-1985. Animals calved in spring (Jan-March) produce average LY 1999.74 ± 66.94 Lit. While those calved in summer (April- June) produced average LY as 1840.98 ± 68.78 Lit.

The overall average for 300 day lactation yield (LY300) was observed as 1820.99 ± 48.77 Lit in Gir cattle. The least–squares analysis of variance results indicated that 300 day lactation yield (LY300) was highly significantly (P<0.01) influenced by parity, period and season of calving. The highest 300 day lactation yield was observed in 5th parity (2027.61 ± 57.53 lit.), While the lowest 300 day lactation yield was observed in 10th parity, in present study (1562.32 ± 124.32 lit.). The period from 1986-1990 was seen as period of most depression in all the production traits. The highest 300 day lactation yield was observed in period 8 i.e. 2001-2005 (2007.87 ± 63.41 lit.) While the lowest 300 day lactation yield (LY300) was recorded in 5th period i.e. 1986-1990 (1673.99 ± 67.53 Lit). The highest 300 day lactation yield recorded in season spring i.e. Jan-March was 1882.39 ± 51.81 Lit. While lowest 300 day lactation yield (LY300) was recorded in season summer i.e. April- June was 1727.06 ± 53.23 Lit.
The overall monthly peak yield as observed, averaged 276.68 ± 5.75 Lit. The least-squares analysis of variance reveals that monthly peak yield was varying highly significantly (P<0.01) due to parity, period and season of calving. The highest monthly peak yield reached in 5th parity (303.55 ± 6.79 lit.) while the lowest monthly peak yield was recorded in 1st parity (220.78 ± 5.66 Lit). Spring season (January-March) was observed to be more favorable season for calving where the animal produced maximum MPY (284.71 ± 6.11 Lit.). While rainy season (July – September) was found to be most inconvenient and uncomfortable season of calving where the animals produced lest average MPY (268.73 ± 6.35 Lit).

5.2.1 Repeatability of production traits in Gir cattle:

Repeatability estimates for lactation length was found as 0.0195 in Gir cattle herd. This is a very low estimate indicating, poor reliability on single or repeated recodes. Repeatability estimates for lactation milk yield was observed as 0.1301 in present study. Repeatability estimates for 300 day milk yield in Gir cattle in present study was observed as 0.1342. The repeatability of LY300 was towards lower side. Repeatability estimate of monthly peak yield found to be 0.1216 in Gir cattle herd.

5.3 Trends in the breeding value of sires:

Genetic trend evaluation is the most powerful tool to analyze and evaluate the result of selection work in the population.

Thus ranking of sires on the basis of the BLUP estimates of breeding value revealed that the sire Lilam was having highest breeding value for trait FLY i.e. 2318.2 Lit.

All the estimates of BV of 57 sire used during 51 years were subjected to regression analysis for estimation trends. The trend estimated represents regression of BV on period 1 to period 10 and thus BV were regressed on period. The regression coefficient obtained was 7.22 Lit. per generation (5 year period). Thus from 1965-2016 there is an overall steady improvement in BV of sires at the rate of 7.2 Lit. Which indicates genetic trend of the BV of Sires towards positive side overall improvement in the herd structure.

The sires used in 2011-2016 were of highest merit. The average breeding value being 2157 Lit. The rate of genetic improvement as the genetic trends suggested was 7.22 Lit. per generation.
5.4 **Following conclusions can be made based on this study:**

1. MPY, FLY/LL and FLY/CI were influenced by period of calving
2. Season of calving influence FLL and MPY
3. AFC affects FLL and FLY
4. MPY was maximum in winter season of calving
5. AFC varied due to Period of calving.
6. FCI and FDP were not affected by either season of calving, period of calving or AFC.
7. LL, LY300 and MPY were moderately heritable.
8. First lactation monthly peak yield (MPY) hence on ward could be used as important criterion for selection in Gir cows for future breeding and can be safely included in the breeding program.
9. All the four traits, i.e. LL, LY, LY300 and MPY among pooled parity were affected by parity, period of calving and season of calving.
10. MPY achieved peak in Fifth lactation.
11. MPY reached maximum in spring season of calving.
12. Repeatability of all four traits was low.
13. From 1965-2016 there is an overall steady improvement in BV of sires at the rate of 7.2 Lit. Which indicates positive genetic trend of the BV of Sires and overall improvement in the herd structure.
14. The sires used further in 2011-2016 were of highest merit. The average breeding value being 2157 Lit.