Sire evaluation based on first lactation milk yield traits in HF X Gir halfbred

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Abstract: The data on first lactation milk production performance of 422, HF X Gir halfbred cows maintained at Research Cum Development Project on Cattle, MPKV, Rahuri were utilized for estimation of least squares means, correlation among the traits and heritability of traits. Breeding values of sires were estimated by REML computer programme. The overall least squares means (kg) of first lactation monthly test day milk yield (from 1st to 6th month) (FLMTDMY), first lactation peak milk yield (FLPMY) and first lactation 300 days milk yield (FL300 DMY) were 10.54 ± 0.14, 10.57 ± 0.13, 10.10 ± 0.12, 9.48 ± 0.12, 8.93 ± 0.11, 8.23 ± 0.11, 14.22 ± 0.14 and 2438.98 ± 38.49 respectively. Phenotypic and genotypic correlations among the traits were positive and significant (P<0.01). Heritability of traits was low to moderate and ranged from 0.06 to 0.25. Sire number HG-412 and HG-129 had highest breeding values for FLMTDMY and H-281 and HG-15 had highest breeding value for FLPMY and FL300DMY and ranked first.

Keywords: FLMTDMY, FLPMY, FL300 DMY, HF X Gir halfbreds, Sire evaluation

To bring about improvement in milk production of cattle, it is must to execute breed improvement program for genetic evaluation of males and females through selection of superior animals of high genetic merit. Based on first lactation milk production, the animal can be selected for future breeding. Use of monthly part lactation yields will be useful in selecting cows during early younger age resulting in reduced generation interval, increased intensity of selection attributed to the availability of more number of records on daughters having monthly records. The usefulness of part lactation records depends upon the accuracy with which sires are evaluated on the basis of these records besides the genetic correlations between part lactation milk yield records and 305-day milk yield. Literature available on part lactation milk yield also revealed that these milk yields can be used for prediction of 305-day milk yield as high genetic association between monthly part lactation milk yield and complete milk production records was observed Mundhe et al. (2018). Sire evaluation is most essential for selection of sire and for genetic improvement of cattle. It is also needful as majority of genetic improvement can be made through selection of males rather than females. Success of breeding programme depends on how early and accurately young bulls are evaluated. Systematic evaluation of bulls need complete records of daughters at least for first lactation. Hence, the present investigation was undertaken with the objective of estimation of breeding value of sires using first lactation monthly milk yield, peak milk yield and 300 days milk yield of the daughters.

The data for research were collected from pedigree, history and milk recording sheets of 422 HF X Gir cows maintained for period of 43 years from 1974 to 2016 at Research Cum Development Project on Cattle, Mahatma Phule Krishi Vidyapeeth, Rahuri.

The data of first lactation 1st to 6th monthly test day milk yield (FLMTDMY), first lactation peak milk yield (FLPMY) and first lactation 300 days milk yield (FL300 DMY) were estimated by least squares technique (Harvey, 1990) by considering period of calving and season of calving effects. Period of calving were grouped as P1 (1974-80), P2 (1981-87), P3 (1988-94), P4 (1995-2001), P5 (2002-08) and P6 (2009-16). Season of calving were divided as S1 (Rainy), S2 (Winter) and S3 (Summer). Duncan’s Multiple Range Test (DMRT) as modified by Kramer (1957) was used to make pairwise comparison among least squares means. Data were corrected for significant effects of non-genetic factors and used

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for estimation of genetic parameters as suggested by Gacula et al. (1968) and sire evaluation. Heritability of traits was estimated by Paternal half sib correlation method, genetic correlations were computed by Paternal half sib analysis of co-variance method and phenotypic correlations among traits were estimated according to procedure suggested by Snedecor and Cochran (2004). The HF X Gir half bred sires were evaluated on the basis of their breeding values estimated by Restricted Maximum Likelihood (REML) computer programme using univariate model (Meyer, 1998).

The least squares analysis of various means of first lactation monthly test day milk yield, peak milk yield and 300 days milk yield of HF X Gir half bred are presented in Table 1,2 and 3. The overall mean first lactation test day milk yield from 1st to 6th month was 10.54 ±6.14 kg. The analysis of variance indicated that the effect of period of calving on monthly test day milk yield was significant (P<0.01). Similar results were reported by Rashia Banu (2004). The HF X Gir half bred sires were evaluated on the basis of their breeding values estimated by Restricted Maximum Likelihood (REML) computer programme using univariate model (Meyer, 1998).

The overall mean first lactation peak milk yield in HF X Gir half bred was 14.22 ±0.14 Kg. The effect of POC on FLPMY was significant (P<0.01). The peak milk yield of cows calved during P1 (1974 to 1980) was significantly higher (16.95±0.24 kg) than those calved during rest of periods. Peak milk of cows calved during P2 (1981 to 1987), P3 (2002 to 2008) and P5 (2009 to 2016) did not differed significantly from each other and significantly higher than calved in P4 (1988 to 1994) and P6 (1995 to 2001) periods. The variation due to season of calving in peak milk yield of Gir halfbred was non-significant. The FLPMY was

| Table 1 Least squares means of monthly test day milk yield (kg) |
|---------------------------------------------------------------|
| Source of variation | N   | T1             | T2             | T3             | T4             | T5             | T6             | T7             | T8             |
|---------------------|-----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Population mean (µ) | 421 | 10.54 ± 0.14   | 10.57 ± 0.13   | 10.10 ± 0.12   | 9.48 ± 0.12    | 8.93 ± 0.11    | 8.23 ± 0.11    | 9.88 ± 0.43    | 9.36 ± 0.30    |
| Period of calving   |     |                |                |                |                |                |                |                |                |
| P1 (1974-1980)      | 1126| 12.69 ± 0.23   | 13.63 ± 0.22   | 12.90 ± 0.21   | 12.02 ± 0.20   | 11.41 ± 0.19   | 10.32 ± 0.19   | 9.09 ± 0.41    | 7.71 ± 0.38    |
| P2 (1981-1987)      | 665 | 11.10 ± 0.32a  | 10.79 ± 0.31b  | 9.95 ± 0.29b   | 9.21 ± 0.28b   | 8.76 ± 0.27b   | 8.30 ± 0.26b   | 7.89 ± 0.28b   | 7.66 ± 0.26bc  |
| P3 (1988-1994)      | 666 | 9.51 ± 0.32ac  | 9.39 ± 0.31c   | 9.31 ± 0.29bc  | 8.71 ± 0.28bc  | 8.15 ± 0.27bc  | 7.66 ± 0.26bc  | 8.30 ± 0.26bc  | 7.89 ± 0.28bc  |
| P4 (1995-2001)      | 73  | 9.48 ± 0.30a   | 9.67 ± 0.29a   | 9.23 ± 0.28a   | 8.78 ± 0.27a   | 8.35 ± 0.25a   | 7.52 ± 0.25a   | 8.43 ± 0.28b   | 7.89 ± 0.28bc  |
| P5 (2002-2008)      | 60  | 9.81 ± 0.34a   | 9.74 ± 0.33c   | 9.36 ± 0.31b   | 9.06 ± 0.30b   | 8.43 ± 0.28b   | 7.89 ± 0.28bc  | 8.30 ± 0.26bc  | 7.89 ± 0.28bc  |
| P6 (2009-2016)      | 31  | 10.66 ± 0.47a  | 10.23 ± 0.45b  | 9.88 ± 0.43b   | 9.09 ± 0.41b   | 8.45 ± 0.39b   | 7.71 ± 0.38bc  | 8.45 ± 0.39b   | 8.43 ± 0.39bc  |
| Season of calving   |     |                |                |                |                |                |                |                |                |
| S1 (Rainy)          | 1109| 10.40 ± 0.26   | 10.32 ± 0.24   | 9.83 ± 0.23    | 9.31 ± 0.23    | 8.90 ± 0.21    | 8.30 ± 0.21    | 9.76 ± 0.21    | 8.43 ± 0.17    |
| S2 (Winter)         | 1153| 10.57 ± 0.21   | 10.78 ± 0.20   | 10.35 ± 0.19   | 9.76 ± 0.19    | 9.16 ± 0.18    | 8.43 ± 0.17    | 9.76 ± 0.18    | 8.43 ± 0.17    |
| S3 (Summer)         | 1160| 10.66 ± 0.21   | 10.62 ± 0.20   | 10.13 ± 0.19   | 9.37 ± 0.19    | 8.71 ± 0.18    | 7.97 ± 0.17    | 8.62 ± 0.21    | 8.76 ± 0.21    |

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

| Table 2 Effect wise least squares means of first lactation peak milk yield |
|---------------------------------------------------------------|
| Source of variation | N   | Mean(kg) ± SE |
|---------------------|-----|---------------|
| Population mean (µ) | 421 | 14.22 ± 0.14  |
| Period of calving   |     |               |
| P1 (1974-1980)      | 126 | 16.95 ± 0.24a |
| P2 (1981-1987)      | 65  | 13.93 ± 0.34b |
| P3 (1988-1994)      | 66  | 12.71 ± 0.34a |
| P4 (1995-2001)      | 73  | 13.29 ± 0.32c |
| P5 (2002-2008)      | 60  | 13.83 ± 0.36b |
| P6 (2009-2016)      | 31  | 14.62 ± 0.49b |
| Season of calving   |     |               |
| S1 (Rainy)          | 109 | 14.08 ± 0.27  |
| S2 (Winter)         | 153 | 14.36 ± 0.22  |
| S3 (Summer)         | 160 | 14.23 ± 0.22  |

Means under each class in the same column with different superscript differed significantly
The role of environmental fluctuation on the trait. Similar low heritability estimates of MTDMY indicated higher heritability. Lower heritability estimates of MTDMY indicated higher heritability of monthly test day milk yield was 0.06±0.11, 0.09±0.12 and 0.09±0.13 respectively. These results indicated that the heritability of monthly test day milk yield was positive and significant (P<0.01) in HF X Gir halfbred. Similar results were observed by Kumar et al. (2018) in crossbred cattle. The genotypic correlations between FL300DMY (0.48±0.45) and peak milk yield as well as between monthly test day milk yield and 300DMY were positive and significant (P<0.01).

The Phenotypic correlations among the entire test day milk yield ranged from 0.51±0.03 (T1 with T6) to 0.84±0.01 (T1 with T6). Phenotypic correlation of peak milk yield with all monthly test day milk yield were positive and significant (P<0.01). The results indicated that in HFX Gir halfbred the genotypic and phenotypic correlations among FLMTDMY, FLPMY and FL300DMY were positive and significant.

Among the HF X Gir halfbred sires the highest EBV (16.82) based on FLPMY was noted for sire number H-281 and ranked first however the lowest EBV (13.27) was observed for sire number H-242 and ranked last. On the basis of FL300DMY the sire number HG-272 had highest EBV (2810.17) and ranked first, whereas the lowest EBV (2319.45) was observed for sire number HG-45 and ranked last.

**Conclusions**

In HF X Gir halfbred the effect of period of calving was significant while the season of calving was non-significant on MTDMY, FLPMY and FL300DMY. Heritability of all MTDMY and FL300DMY was observed to be low. However the medium h² of FLPMY indicated that judicious selection of sires to improve the productivity of HF X Gir halfbred. The sire number H-325 had highest estimated breeding value for MTDMY while the sire number H-281 and HG-272 had highest estimated breeding value for FLPMY and FL300DMY respectively.

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| Table 3 Effect wise least squares means of FL300DMY |
|--------------------------------------------------|
| **Source of variation** | **N** | **Mean(kg) ± SE** |
| Population mean (µ) | 421 | 2438.98 ± 38.49a |
| Period of calving | | |
| P1 (1974-1980) | 126 | 3310.33 ± 63.99a |
| P2 (1981-1987) | 65 | 2652.09 ± 88.39c |
| P3 (1988-1994) | 66 | 2087.19 ± 88.56c |
| P4 (1995-2001) | 73 | 2065.57 ± 84.03c |
| P5 (2002-2008) | 60 | 2265.28 ± 94.08c |
| P6 (2009-2016) | 31 | 2253.38 ± 129.04c |
| Season of calving | | |
| S1 (Rainy) | 109 | 2444.82 ± 71.04 |
| S2 (Winter) | 153 | 2447.63 ± 59.42 |
| S3 (Summer) | 160 | 2424.48 ± 59.13 |

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