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GENETIC DIVERGENCE IN COMPONENT STRAINS OF KARAN-FRIES CATTLE

R.K. SETHI and M. GURHANI
NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL 132 001 INDIA.

SUMMARY

Data on 50 percent and higher Holstein Friesian crossbred genetic groups revealed significant differences with respect to age at first calving, first lactation 305 days yield, dry period and service period. 91.7 percent of the divergence among genetic groups was contributed by 305 days lactation yield. F1 crossbreds formed separate cluster. Among the higher crosses (75% and above) genetic groups involving only 2 breeds formed separate cluster from genetic groups involving three breeds. Three breed cluster was farthest from the F1 crossbreds cluster. There was an indication of all the clusters having animals of good genetic potential.

INTRODUCTION

Crossbreeding of Zebu cattle with different exotic breeds has improved the milk production at a significantly rapid rate. The production performance in almost all the genetic groups is found to be higher than Zebu cattle. In other crossbreeding experiments it is found that there is decline in production from F1 to F2 generations. Therefore, multiple breed crossing, for supposedly exploiting non additive genetic variance, produced no significant improvement (Sethi et al., 1982), over first generation (F1) crosses. The F1 crossbreds produced highest milk and calved at the youngest age group than any of the other grades. This indicated absence of any significant role of non genetic effects with regard to most of the important economic and adoptive traits. As a result of this all the genetic groups with 50 percent or more Friesian inheritance were pooled to formulate Karan Fries breed, though performance in different genetic groups differed, differences based on simultaneously several production traits indicate overall divergence among genetic groups (Taneja et al., 1979; Sharma, 1981). Performance of genetic groups in different clusters subsequently in the herd is yet to be observed.

MATERIALS AND METHODS

The data for this investigation were collected from the available records of all those genetic groups which were merged to form Karan-Fries breed (Fig. 1) in 1980. These animals involved in different genetic groups were born from 1973 to 1978. Some of the HS (Holstein X Sahiwal) animals were produced at Indian Agricultural Research Institute, New Delhi and later on shifted to NDRI, Karnal. Information on age at first calving and on first lactation traits (305 days yield, lactation length, dry period, service period and calving interval) was compiled. One-way analysis of variance of non-orthogonal data (Harvey, 1966const. was conducted for testing differences among genetic groups for individual traits. Dispersion matrix of variances and co-variances was obtained and Maholnobs $D^2$ statistics and clusters were formulated (Tocher method) as illustrated by Singh and Chaudhry, 1977. All the animals in

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different genetic groups (involved in Karan Fries) were traced to the end of 1985, to find out the percentage of culling. The symbols used for various breeds in crossbreeding programme were H: Holstein Friesian, B: Brown Swiss, J: Jersey, T: Tharparkar and S: Sahiwal.

RESULTS AND DISCUSSION

Data on all the traits on animals in each genetic groups involved in Karan Fries breed (Fig. 1) was put to analysis to find out the test of significance.

Differences based on individual traits:

The average and standard errors for age at first calving, first lactation 305 days yield, lactation length, dry period, service period and calving interval for all the genetic groups involved in Karan Fries are tabulated in Table 1. Animals in different genetic groups commenced their first lactation in the years mentioned in the table. Differences due to years were estimated to be non-significant which, therefore, are not likely to contribute in genetic divergence between various groups. The differences for age at first calving, 305 days milk yield, dry period and service period among various genetic groups were found to be statistically significant. Holstein x Tharparkar (HT F1) indicated better performance than any other crossbred genetic group. These findings are in accordance with the earlier reports on the same data (Nagarcenkar and Rao, 1982; Batnagar, 1984).

Divergence based on several traits:

Based on the test of significance on individual traits among various genetic groups multivariate analysis of data were conducted including only 4 traits for which significant differences were observed. Dispersion matrix was obtained from the error component of variances and co-variances of these traits.

Distance between genetic groups: The distance between various genetic groups based on four traits was found to be statistically significant (p<0.05). 91.7% of the divergence was contributed by the 305 days lactation milk yield, 8.3% by the dry period whereas service period and age at first calving did not contribute significantly in the divergence. These estimates are different from those of Taneja, 1973 and Sharma, 1981 in the Holstein x Sahiwal crosses. This difference in contribution of a trait towards divergence is due to the extent of variation between genetic groups and correlations among traits.

Pooling of genetic groups in clusters: The genetic groups were pooled into clusters on the basis of closeness of distance. Three clusters were formed.

Cluster - I: HT (75%), HT (87.5%), HS (75%), HS (87.5%).
Cluster - II: HT (F1), HS (F1).
Cluster - III: HBT (75%), HJT (75%).

Performance of clusters in the F1 crossbred groups were retained in the herd by the followed by 31.9 percent in cluster I (Table 1). Cluster II as compared to cluster I retained the herd from cluster I, which have lowest performance and potential since culling pattern in the clusters was uniform. This rate was higher in 87.5% grades since it was diseases and reproductive problem.

HJI crossbred genetic groups retained from Table 1 from the number of different crosses (75% and more) with two higher crosses with more than 2. The intra and inter-cluster divergence. These indicate that the three hundred from the 50% F1 crossbred as contributing a different.

REFERENCES

in Karan Fries) were traced percentage of culling. The crossbreeding programme was, J: Jersey, T: Tharparkar.

DISCUSSION

Animals in each genetic group (Table 1) was put to analysis to find:

a) For age at first calvina
tion length, dry period, and 305 days milk yield, dierent genetic groups were formed in Holstein x Tharparkar (HT F1), any other crossbreds genetic groups with the earlier reports (Rao, 1982; Shatnagar, 1984).

b) Significance on individual traits: Variate analysis of data were obtained from the error analyses of these traits.

The distance between various was found to be statistically divergence was contributed by the dry period when calving did not contribute. These estimates are different, 1981 in the Holstein x Tharparkar in proportion to the trait extent of variation between breeds.

The F1 crossbred groups formed a separate cluster, higher crosses (75% and more) with two breeds formed one cluster and higher crosses with more than 2 breeds formed another cluster. The intra and inter-cluster distance are presented in Fig. 2. These indicate that the three breed crosses (75%) were farthest from the 50% F1 crossbreds as compared to the 2 breed higher crosses.

Performance of clusters in the herd: 36.4 percent of the animals were retained in the herd by the end of 1985 in cluster II followed by 31.9 percent in cluster III and 27.6 percent in cluster I (Table 1). Cluster III indicated largest distance from cluster II as compared to cluster I whereas more number of animals left the herd from cluster I, which indicate that cluster III which have lowest performance also had animals of good genetic potential since culling pattern and management of animals in all the clusters was uniform. This is due to the fact that culling rate was higher in 87.5% grades involved in cluster I due to diseases and reproductive problems as compared to in the HST and HJI crossbred genetic groups (Kulkarni, 1985) as is also evident from Table 1 from the number of animals retained up to 1985.

REFERENCES


Table 1. First lactation performance of animals which were added to constitute KARAN-FRIES breed.

<table>
<thead>
<tr>
<th>Genetic group</th>
<th>No. of cows added</th>
<th>Year of first calving</th>
<th>Age at first milk yield</th>
<th>Lactation length</th>
<th>Dry period</th>
<th>Service period</th>
<th>Calving interval</th>
<th>Animals retained at the end of 1985</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No. %</td>
</tr>
<tr>
<td><strong>CLUSTER I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H x HT (75%)</td>
<td>74</td>
<td>77-80</td>
<td>34.8±0.5</td>
<td>3028±82</td>
<td>377±12</td>
<td>67±3.5</td>
<td>177±12</td>
<td>446±12</td>
</tr>
<tr>
<td>H x HT (87.5%)</td>
<td>5</td>
<td>79-80</td>
<td>42.6±1.4</td>
<td>2942±63</td>
<td>477±60</td>
<td>87±33.5</td>
<td>227±60</td>
<td>496±85</td>
</tr>
<tr>
<td>H x HS (75%)</td>
<td>25</td>
<td>75-80</td>
<td>33.8±0.8</td>
<td>3061±109</td>
<td>370±15</td>
<td>95±17.0</td>
<td>168±21</td>
<td>467±22</td>
</tr>
<tr>
<td>H x HS (87.5%)</td>
<td>3</td>
<td>75-80</td>
<td>33.0±3.0</td>
<td>3037±180</td>
<td>37±47</td>
<td>52±8.5</td>
<td>150±54</td>
<td>425±50</td>
</tr>
<tr>
<td>Overall</td>
<td>107</td>
<td></td>
<td>34.8±0.4</td>
<td>3032±178</td>
<td>380±10</td>
<td>74±5.0</td>
<td>172±10</td>
<td>452±11</td>
</tr>
<tr>
<td><strong>CLUSTER II</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H x T (50% F1)</td>
<td>74</td>
<td>74-79</td>
<td>28.7±0.4</td>
<td>3686±67</td>
<td>345±9</td>
<td>59±3.8</td>
<td>131±11</td>
<td>405±11</td>
</tr>
<tr>
<td>H x S (50% F1)</td>
<td>25</td>
<td>71-80</td>
<td>35.0±1.2</td>
<td>3597±117</td>
<td>341±19</td>
<td>83±12.8</td>
<td>121±22</td>
<td>427±22</td>
</tr>
<tr>
<td>Overall</td>
<td>99</td>
<td></td>
<td>30.3±0.5</td>
<td>3664±58</td>
<td>344±10</td>
<td>65±4.0</td>
<td>129±10</td>
<td>410±10</td>
</tr>
<tr>
<td><strong>CLUSTER III</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H x BT (75%)</td>
<td>24</td>
<td>78-80</td>
<td>36.8±0.8</td>
<td>2461±96</td>
<td>369±25</td>
<td>57±3.5</td>
<td>115±13</td>
<td>395±13</td>
</tr>
<tr>
<td>H x JT (75%)</td>
<td>45</td>
<td>78-80</td>
<td>33.8±0.5</td>
<td>2292±75</td>
<td>36±24</td>
<td>69±5.2</td>
<td>143±15</td>
<td>420±15</td>
</tr>
<tr>
<td>Overall</td>
<td>69</td>
<td></td>
<td>34.8±0.5</td>
<td>2346±62</td>
<td>36±18</td>
<td>65±7.0</td>
<td>134±12</td>
<td>413±12</td>
</tr>
<tr>
<td>F. test</td>
<td></td>
<td></td>
<td>17.8*</td>
<td>327.7*</td>
<td>1.4</td>
<td>2.5*</td>
<td>6.1*</td>
<td>1.6</td>
</tr>
</tbody>
</table>

* (p<0.05)  H = Holstein Friesian, T = Tharparkar S = Sahiwal  J = Jersey

**FIG.2. MATING PLAN FOR EVOLVING KARAN-FRIES STRAIN**
## CLUSTER II

<table>
<thead>
<tr>
<th></th>
<th>74</th>
<th>74-79</th>
<th>28.7 ± 0.4</th>
<th>3686 ± 67</th>
<th>345 ± 9</th>
<th>59 ± 3.8</th>
<th>131 ± 11</th>
<th>405 ± 11</th>
<th>28</th>
<th>37.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>H x T (50% F&lt;sub&gt;1&lt;/sub&gt;)</td>
<td>25</td>
<td>71-80</td>
<td>35.0 ± 1.2</td>
<td>3597 ± 117</td>
<td>341 ± 19</td>
<td>83 ± 12.8</td>
<td>121 ± 22</td>
<td>427 ± 22</td>
<td>8</td>
<td>32.0</td>
</tr>
<tr>
<td>Overall</td>
<td>99</td>
<td></td>
<td>30.3 ± 0.5</td>
<td>3664 ± 58</td>
<td>344 ± 10</td>
<td>65 ± 4.0</td>
<td>129 ± 10</td>
<td>410 ± 10</td>
<td>36</td>
<td>36.4</td>
</tr>
</tbody>
</table>

## CLUSTER III

<table>
<thead>
<tr>
<th></th>
<th>24</th>
<th>78-80</th>
<th>36.8 ± 0.8</th>
<th>2461 ± 96</th>
<th>369 ± 25</th>
<th>57 ± 3.5</th>
<th>115 ± 13</th>
<th>395 ± 13</th>
<th>11</th>
<th>45.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>H x BT (75%)</td>
<td>45</td>
<td>78-80</td>
<td>33.8 ± 0.5</td>
<td>2292 ± 75</td>
<td>361 ± 24</td>
<td>69 ± 5.2</td>
<td>143 ± 15</td>
<td>420 ± 15</td>
<td>11</td>
<td>24.4</td>
</tr>
<tr>
<td>Overall</td>
<td>69</td>
<td></td>
<td>34.8 ± 0.5</td>
<td>2346 ± 62</td>
<td>363 ± 18</td>
<td>65 ± 7.0</td>
<td>134 ± 12</td>
<td>413 ± 12</td>
<td>22</td>
<td>31.9</td>
</tr>
</tbody>
</table>

| F. test | 17.8* | 327.7* | 1.4 | 2.5* | 6.1* | 1.6 |

* (P<0.05)  
H = Holstein Friesian, T = Tharparkar

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**FIG. 2. MATING PLAN FOR EVOLVING KARAN-FRIES STRAIN**

[Diagram showing mating plan between Holstein Friesian (H), Brown Swiss (B), Jersey (J), Sahiwal (S), and Tharparkar (T) for evolving Karan-Fries strain. Diagram includes various crosses and resulting percentages.]
**FIG. 2. CLUSTER DIAGRAM INDICATING INTRA AND INTER-CLUSTER DISTANCE**

![Cluster Diagram](image)

**POPULATIONS IN CLUSTER**

I: HT 75%, HT 87.5%, HS 75%, HS 87.5%

II: HTF₁, HSF₁

III: HBT 75%, HJT 75%

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**RESULTS AND DISCUSSION**

Subsequent to earlier communications, three (3) more hybrids were born at the Station of the Himachal Pradesh Agriculture Research Institute, II, and Agra University, IIF, respectively. The relevant information is as follows:

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Parentage</th>
<th>Sire</th>
<th>Dam</th>
<th>Sex of Calf</th>
<th>Date of Birth</th>
<th>Date of Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jersey x Yak</td>
<td>Male</td>
<td>Yak</td>
<td>Female</td>
<td>26-10-85</td>
<td>17-12-85</td>
</tr>
<tr>
<td>2</td>
<td>Jersey x Yak</td>
<td>Male</td>
<td>Yak</td>
<td>Female</td>
<td>13-4-83</td>
<td>15-6-83</td>
</tr>
<tr>
<td>3</td>
<td>Jersey x Yak</td>
<td>Male</td>
<td>Yak</td>
<td>Female</td>
<td>26-10-85</td>
<td>17-12-85</td>
</tr>
</tbody>
</table>

**SUBSEQUENT REPORT ON SUCCESSFUL HYBRIDIZATION BETWEEN**

Yak and Agra, II and Agra University, IIF.