INTEGRATING GENETIC IMPROVEMENT INTO LIVESTOCK DEVELOPMENT
IN MEDIUM-TO-LOW INPUT SMALLHOLDER DAIRY PRODUCTION SYSTEMS

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INTRODUCTION
Dairy herd improvement organizations in the developed countries have shown that the establishment of semen production facilities, country-wide infrastructure for insemination and milk recording, and computer network for processing of data and providing information to all stakeholders from farmers to national and international level is prerequisite for development of an efficient genetic improvement programme in any country. Similar attempts made in the developing countries particularly for smallholder dairy farmers, however, have not always been successful. This paper describes some successful genetic improvement programmes implemented in some developing countries, examines the factors that made these programmes succeed and draws the lessons that are learned from the programmes.

INTEGRATION OF GENETIC IMPROVEMENT PROGRAMMES WITH OTHER PROGRAMMES
In a situation where a large number of smallholders each having one to five animals are involved, India’s Operation Flood (OF) has shown that an organization that integrates different functions in the commodity chain – milk procurement, processing and marketing of milk and milk products as well as farm supplies (cattle feed, fodder seed, breeding services, farm advisory services etc.) and ensures participation of farmers at all levels provides better price to producers, avoids exploitation by processors, raises milk production, enhances employment, income, nutritional status and education of producers, and makes more women to participate in decision making on matters important to them. National Dairy Development Board (NDDB), which is spearheading this programme, over the last thirty years, have established some 98,000 village level cooperative societies forming 170 district cooperative unions in 22 states involving some 10.8 million farmers. They together in 2000-1 collected on an average 16.5 million litres of milk daily, produced and supplied some 4300 MT of cattle feed daily through 47 cattle feed factories, provided AI services in 20,000 villages carrying out some 5.5 million inseminations. Seven district unions implemented a progeny testing programme in buffaloes and crossbred cattle covering 220 villages and some 25,000 animals. Milk production has increased at an annual rate of 4.4 per cent reaching to 81 million MT in 2000, making India the largest milk producer in the world.

All services, however, are not perceived as equally important by producers at different stages of development. The first major stimulus to increase milk production comes with the establishment of a dairy cooperative society in a village as it ensures year round remunerative market to milk producers. Having received some cash by selling milk, farmers start buying cattle feed and fodder seed. This increases demand for cattle feed and fodder seeds. However when technological limits to increasing milk production are encountered because of genetic
potential limits of animals, they look for better animals as well as the technologies that increase genetic potential of their animals. At this stage the introduction of AI, milk recording, genetic evaluation etc becomes important and they are easily accepted.

MANAGEMENT OF GENETIC IMPROVEMENT PROGRAMMES

The main factors for successful establishment of performance recording and genetic evaluation systems in the developing countries could be put into three groups: (i) Right institutional structure; (ii) Well defined objectives and well thought programme design, and (iii) Focus on needs of participating farmers.

Right institutional structure. Existence of an organization having necessary technical know-how and finance is a prerequisite for development of an effective animal recording and genetic improvement programme in developing countries. The main reason for successful development of milk recording and genetic improvement programme by KLDB in the state of Kerala in India is that from the very beginning a separate organization was established with the technical and financial assistance of the Swiss Agency for Development and Cooperation (Chacko and Kishore, 1998). KLDB started a progeny testing of bulls in crossbred cattle in the state of Kerala in India in 1977. A batch of 40 young crossbred bulls is put to test every year and evaluated with about 40 daughters records per bull. The average standard lactation yield, which was 1480 litres based on 1627 recorded crossbred cows in 1983 increased to 2191 litres based on 1565 records in 1997.

The success of DIPA programmes in Gujarat in India could be attributed to its implementation by some of the biggest and powerful farmers’ cooperatives in India and the technical and financial support they received from NDDB (Trivedi, 2000). Seven Milk Cooperative Milk Unions (Mehsana, Kheda, Sabar, Surat, Panchmahals, Vadodara and Banas) have been implementing the milk recording and progeny testing programme in 220 villages involving some 20,000 buffaloes and 5000 crossbred cows. They together have been putting annually some 40 buffalo and 10 crossbred cattle young bulls under test and evaluating them on the basis of about 40 daughter records per bull. Some 270 buffalo bulls and 50 crossbred bulls have completed test mating and breeding values of 123 buffalo bulls and 10 crossbred bulls have been estimated using 35-50 first lactation daughter records per bull. The average 305-day first lactation yield of crossbred daughters based on 585 records was 2585 litres.

In Egypt initially the IDRC of Canada helped the Animal Production Department, Faculty of Agriculture, Cairo University establish a pilot Cattle Information System Egypt (CISE) and later set up a separate center with the assistance of FAO (Mansour, 1998). This centre carries out monthly milk recording of farmers herds, processes collected monthly milk production and reproduction data and sends feedback to farmers on a monthly basis. In Zimbabwe the government formed a separate organization the Zimbabwe Dairy Services Association (ZDSA) to provide milk recording services and carried out genetic evaluation of cattle in the country (Banga, 1998).
Well-defined objectives and well-thought programme design. In smallholder production systems, careful designing of breeding programmes assumes greater significance. In many circumstances, a village could be treated as “herd” and breeding programmes could be designed in such a way that the maximum number of bulls put to test produce their daughters in each village included in the breeding programme.

Focus on needs of participating farmers. It has been widely observed that in the long term, programs designed without careful consideration of farmers’ needs, have not yielded good results. Several progeny testing programs run by the government without a component of information on feeding, healthcare and management have been discontinued before time. For instance the Official Milk Recording Services (ROPL) run and financed by the Ministry of Agriculture and Breeding (MAC) in Venezuela for the purpose of progeny testing of bulls did not last long when the direct subsidy provided to farmers for participating in progeny testing programme was withdrawn (Vaccaro, 1998). Providing relevant information to smallholders who have just one or two animals is however equally challenging. When a farmer has one or two animals, he knows everything about his animals, and hence a performance report for an individual animal does not add much to what he knows about his animals. However, if a report gives performance of animals in relation to all other animals in the village(s), the information provided in the report becomes very relevant. Development of appropriate information package that meets the information needs of smallholders is very important.

RELEVANCE OF EMBRYO TRANSFER AND OTHER BIOTECHNOLOGIES

Embryo transfer may not be a cost effective tool for production of replacement stock in the field, but it could be a very relevant technology in the developing countries if it is applied for production of genetically evaluated bulls under an Open Nucleus Breeding System (ONBS) as demonstrated by NDDB in India for production of genetically evaluated crossbred bulls (Sahiwal X Holstein Friesian) under their ONBS programme. In 1987, the Department of Biotechnology, Government of India (DBT) initiated a Science and Technology Project on Embryo transfer technology involving many key institutions in the country. The four research institutes attained all capabilities to carry out research in any area of embryo biotechnology. The main laboratory, 4 regional centers and 14 state centres together produced some 875 cattle and 110 buffalo calves. In addition, they cryopreserved some 5000 cattle and 700 buffalo embryos. However, after the Project ended in 1995, the embryo transfer activities could not be carried forward in absence of subsidy that it received during the project period.

The project on ONBS using ET started in 1994-95 by NDDB and DBT for production of genetically evaluated crossbred bulls, however, has been progressing well. In first phase of the project, a Sahiwal herd was established and in each annual set 24 best Sahiwal cows were selected as donors. Six donors were allotted to one Holstein Friesian sire forming four sire families. Three such sets have been completed. The complete results of the first set are now available (Table 1). All the bulls produced under the project and gave freezable semen have also been put to test under the field progeny testing programme. The results of progeny tests are awaited. In Phase II, 24 F₁ crossbreds have been selected out of available F₁ crossbred cows and have been divided into four families each of six crossbred cows and each group has
been allotted to one of the four top crossbred evaluated sires of the first set of Phase I. The first set of Phase II is right now in progress. Simultaneously the pure Sahiwal herd is also being developed.

Table 1. Progress of ONBS Project Set I

<table>
<thead>
<tr>
<th>Particulars/Sire Families (HF)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Sahiwal Donors</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Avg. lactation yield of donors (Sahiwal)</td>
<td>2324</td>
<td>2956</td>
<td>2644</td>
<td>2407</td>
</tr>
<tr>
<td>No. of Flushing</td>
<td>59</td>
<td>47</td>
<td>46</td>
<td>44</td>
</tr>
<tr>
<td>No. of total/viable embryos produced</td>
<td>311/189</td>
<td>254/185</td>
<td>176/118</td>
<td>336/206</td>
</tr>
<tr>
<td>No. of embryos transferred (Recipients)</td>
<td>168 (132)</td>
<td>145 (101)</td>
<td>114 (100)</td>
<td>151 (117)</td>
</tr>
<tr>
<td>No. of crossbred males/Females born</td>
<td>13/16</td>
<td>14/15</td>
<td>21/15</td>
<td>19/17</td>
</tr>
<tr>
<td>Avg. 305 days first lactation yield –litres</td>
<td>5424 (12)</td>
<td>5038 (10)</td>
<td>4810 (9)</td>
<td>4260 (11)</td>
</tr>
</tbody>
</table>

The experience of establishing ONBS indicates that it could be very rewarding; however, it should be mentioned that running an ONBS project is very challenging and could only be sustained with adequate financial support and technical backup.

POLICY ENVIRONMENT

In many areas in developing countries smallholder production systems will continue to be competitive considering the fact that smallholders would continue to use agriculture by-products with very little purchased inputs and employ family labour. Policy makers in these countries will have to think about appropriate policy initiatives and institutional support to make smallholder dairy farming systems more efficient and competitive. As implementation of genetic improvement programmes needs specialized skills, the organizations implementing genetic improvement programmes in the developing countries could greatly benefit by collaborating with breeding service providing organizations in the developed countries. Establishing one live successful example of implementing a genetic improvement programme in one area in any country could greatly help in expanding and replicating it in many other parts in the country. Setting a mechanism for quality control of data collection and processing also becomes important as genetic improvement programs expand.

References