FPR potential and weakness in management and breeding programme in transition and developing countries. The Indian experience

C.T. Chacko

Livestock consultant. Chathanatt, Kalampoor, Kerala, India, 686 664

Summary

The contribution of livestock sector to the gross domestic product of India is steadily increasing during the last decade. Milk contributes to some 67 % of the total value of livestock sector out put. The national policy for cattle and buffalo breeding emphasises for crossbreeding of the local cattle with exotic dairy breeds and grading up of the buffaloes with Murrah.

FPR integrated into the breeding programmes would be a better alternative to institutional farms for production of breeding bulls. A method for field based milk recording suitable for low input and small herd animal production system was developed and practiced by the KLDB since 1978. Its impact in terms of annual increase in first lactation milk yield of the crossbred cows (from 1 480 kg to 2 372 kg during 1983-1999), is worth five times the investment by the government. KLDB tested some 799 bulls in 23 batches from 1978 onwards and the proven bulls are routinely employed for the production of next generation bulls. BAIF employs FPR for selection of elite bull mothers and for evaluating the production of indigenous and crossbred cattle. Since 1994 BAIF is collaborating with the ICAR programme for progeny testing crossbred bulls. The DIPA programmes of NDDB have in all tested some 270 buffalo and 50 crossbred bulls and breeding values of 123 buffalo and 10 crossbred bulls have been estimated. The overall average first standard lactation milk yield was 1806 and 2 585 litres respectively for buffaloes and crossbred. NDDB succeeded in integrating FPR into the overall breeding programme of the milk unions. The ICAR progeny-testing programme envisages testing of 30 HF crossbred bulls in each batch.

FPR has the important roles of sire evaluation and bull mother selection in addition to monitoring of livestock performance at the smallholder level. Non-governmental organisations only could establish and run sustainable

FPR programme with the participation of farmers. A quick and simple method of FPR for estimating the milk yield would be necessary for states where introduction of a full-fledged FPR is difficult. A long-term strategy for integrating FPR into the breeding programme of the state and steps for cost recovery may be instituted.

Introduction

The livestock sector in India is linked with the livelihoods of millions of rural households and livestock production has always been an integral part of the farming systems. Almost 75% of the rural households own livestock of one type or the other and is more equitably distributed than land resources. The fact that 60% of the livestock owners are marginal and landless farmers support the claim that livestock related interventions are useful strategies for poverty alleviation.

India had some 219 million cattle and 94 million buffalo in 2000 (FAO, 2002). The average annual growth rate of cattle and buffalo population was 0.75 %, and 2% respectively, during the last two decades. The changes are also reflected in the dynamics of the cattle population (see Table 1): percentage adult females in the adult population progressively moving in favour of the female (from 43.1% to 50.4% in cattle and 78 to 86% in buffaloes); steadily decreasing proportion of adult breedable female among indigenous female with proportionate increase in the number of crossbred cattle. (GOI, 1992).

Table 1. Structural changes in cattle and buffalo population of India.

Details / Years	1972	1977	1982	1987	1992	1997*
Cattle						
Total (m)	178.3	180.0	192.4	195.8	204.5	210.4
Adult female (m)	56.5	57.9.	62.7	62.1	64.3	65.1
% Adult females –CB (m)			4.8	7.4	10.1	13.7
Adult fm % of total adults	43.1	43.6	46.3	45.4	46.4	50.4
Buffalo						
Total (m)	57.4	62.0	69.8	76.8	84.2	91.8
Adult female (m)	29.2	31.9	37.1	39.1	43.1	47.4
Adult fm % of total adults	78.4	79.2	82.4	84.0	84.2	86.3

*Estimate
m – million; fm – female.
(Source GOI 1997).

Livestock production systems

The predominant farming system in India is mixed crop-livestock farming, in terms of total production, numbers and number of people served. In this system livestock utilise the crop residues and crop by-products and in turn generate cash income, draught power & manure. Mixed crop livestock farming systems differ with the farming culture practiced by the holders; high-input-high-output systems as practiced in Punjab, low-input-low output systems (Haryana & Western Uttar Pradesh) and zero input-low-output subsistence systems (Orissa & Bihar).

There are some 11.85 million hectors of permanent pastures and grazing lands in India (Sastri, 1993). In addition around 121.1 million hectors are also used for grazing temporarily after the harvest of cereals and other seasonal crops. The pasturelands are not adequately managed for optimum yield and as such cannot sustain a good yielding dairy animal. Large livestock farms are rare and are mostly institutional farms. The few commercial farms that exist near the metro cities keep large herds of milking buffaloes. Transhumant livestock farming systems though still prevalent in India, the numbers involved, animals and human living a nomadic life are very few and are on the decline.

Inputs in livestock production

Feed and Fodder. The roughage requirement is met by agricultural and crop by-products and the estimated 7 million hectors of fodder cultivation would yield only 0.5 % of the roughage requirement. The total production of balanced cattle feed in the country is estimated as 5 million tons. Of the total raw materials available, about 25 % is milled as balanced feeds and the remaining fed directly to the animals (Chawla *et al*, 2002).

Management and health care. Management of crossbred stock was not satisfactory and has ended up in higher calf mortality, stunted growth, and infertility and poor milk production. While the extension support to the livestock sector provided by the state animal husbandry departments is oriented towards supply of inputs and providing of subsidies there is promising attempts by the milk cooperatives and NGOs. Livestock in India is ravaged by recurring epidemics, causing phenomenal production losses and lingering morbidity. The production losses due to diseases is estimated to the tune of 10 % of the annual out put value of the entire livestock sector (GOI.1996). Health services are provided to the farmers mainly by the state animal husbandry departments. Though the services are rendered free at the institution, only some 5 % of the budget is utilised for free supply of medicines and vaccines. India produces all most all medicines and vaccines required for the country.

Out put from livestock production

The contribution from livestock sector to GDP increased from 4.8 % in 1980-81 to about 6 % in 1998 –1999 (GOI, 2000). The estimated value of out put from livestock sector in 1998-99 was about INR 1 230.76 billion of which milk contributes to 67 %.

The growth in milk production in the country was faster than that of the world and other regions of the world (Figure 1) and is attributed to an emerging market for milk developed by NDDB. The annual compounded growth rate in milk production was around 5 % during the last three decades. The share of household income from dairy production for members in different land holding categories, showed that dairying provides 53 % of the income for the landless farmer and as the land holding increases the share of income from dairying decreases (NCAER. 1999).

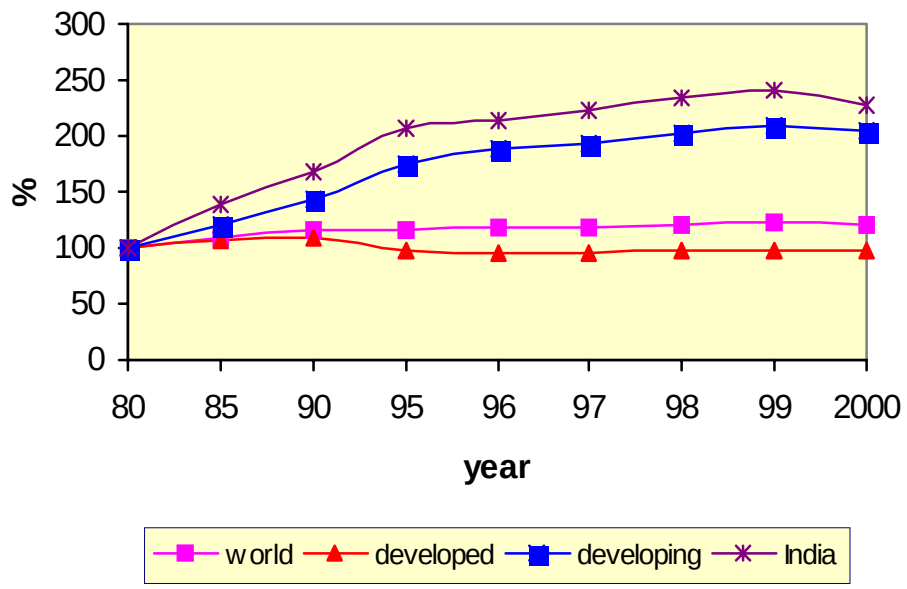

Figure 1. Standardised growth in milk production. (Source: FAO web site, 2002).

Breeding programmes

Breeding policy

The 26 different breeds of cattle, and 15 breeds of buffaloes, form only less than 20 % of the cattle and 40 % of the buffalo population of the country (Krishnamoorthy S., 1993). The launching of the intensive cattle development projects (ICDP) during early sixties all over the country, gave a direction to the cattle and buffalo breeding programmes of the country. The demand for milk produced by the milk cooperatives some 96 000 in number now, organised under the NDDB created the long felt need for genetic progress among the population.

The national policy for cattle and buffalo breeding postulated in 1962 emphasised the need for milk production increase through the use of selected dairy breeds of cattle and buffaloes in India. The use of exotic dairy breeds for crossbreeding of cattle gained momentum as the dairy co-operative network under NDDB provided the much needed market

stimulus and price incentive. The policy was to limit the level of exotic inheritance to around 50%. Jersey, Brown Swiss, Red Dane and Holstein Friesian were used initially but the choice has soon narrowed down to Jersey and Holstein.

AI for cattle and buffaloes is one of the most important services provided by the state governments. With some 63 frozen semen stations with a capacity to produce 36 million doses of frozen semen annually and 44 000 AI out lets, (30,000 of the government, some 12 000 by the milk cooperatives and the rest by NGOs and private practitioners) India has the world's largest AI infrastructure; some (GOI, 2000).

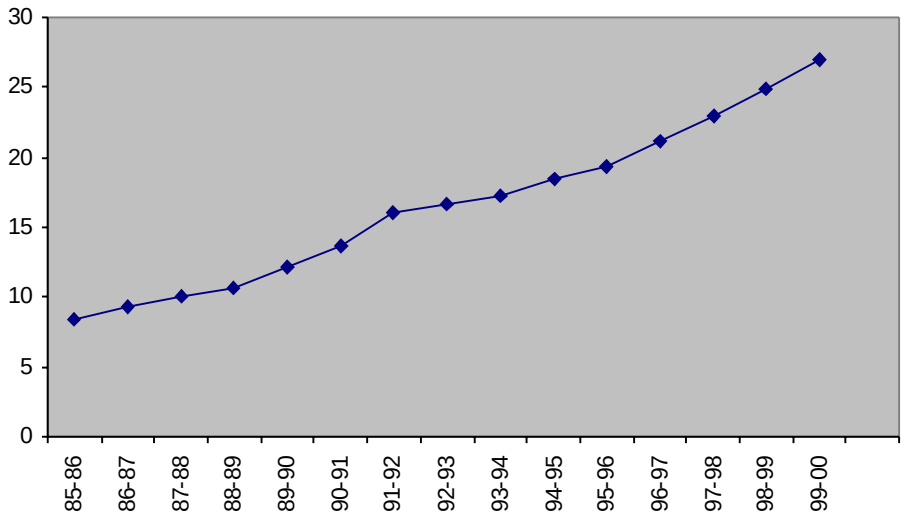

Figure 2. Growth of AI in India.

In all around 27 million AI are conducted in the country during 1999-20000 (See figure 2).The AI service at AI point is charged nominally and the charges vary between states; the maximum charge levied by Kerala state is INR 35. In most of the states the cost of AI is around the cost of one kg of milk. Almost 50% of the AI is conducted at the door of the farmer and invariably the inseminator charges for the door delivery extra. Though the growth of AI is steady only around 12 % of the population is covered annually. The impact of genetic improvement programmes varied widely between regions. Positive examples can be seen in states like Kerala, a result of the systematic approach initiated by the Indo Swiss Project, and Punjab, a state with a lot of fodder resources and hard working people. Breeding programme implementation failed in many states: there were lapses in maintaining the blood level at the prescribed levels due to non-availability of crossbred bulls, using genetically selected breeding bulls, ensuring quality of the frozen semen

and AI delivery. A national project for cattle and buffalo breeding proposed to provide farm gate AI service, create a national milch herd of cattle and buffaloes, support conservation of genetic diversity, improve the efficiency of the AI services, effect full cost recovery of the AI services by privatising the services and increase the coverage of AI to 40 % in the coming 10 years (GOI, 1997)

FPR programmes

Relevance of FPR

Government institutions and farms continue to be responsible for genetic improvement of cattle and buffaloes in India. It could be argued that the smallholder herds are too heterogeneous for a reasonably accurate estimation of genetic potential and government farms with reasonably large herds would provide better estimates. However it was not possible to benefit from the advantages due to the inherent weaknesses in the government system like, lack of clear objectives, non accountability, non availability of finances timely, decision making not at the place of activity, political interferences, etc.

FPR to select the best animals as bull mothers among the small herds with the smallholder will have the positive advantage of getting higher selection intensity and would cut the cost of bull mother production. A filed based progeny-testing programme cannot function with out FPR. It is a major task of the FPR organisations to properly involve the farmers. The recent attempt in Uttar Pradesh to institute Breeder's Association for the monitoring of the FPR programmes is found to be promising. Though the FPR programmes in India are not self-supporting, it can shown that the economic benefit, as a result of genetic improvement, will more than compensate the money spent by the government.

Development of FPR programmes in India

A method for field based milk recording suitable for low input and small herd animal production system was developed and practiced by the KLDB since 1977. BAIF started FPR to monitor the performance of crossbred animals in 1980 (Goe M R *et al*, 1998). FPR started as part of the Indian Council of Agricultural Research (ICAR) schemes during late eighties were discontinued, modified or shifted to new areas before demonstrating any measurable impact. NDDB started FPR for evaluation of breeding bulls both buffalo and crossbred cattle since 1987. The FPR for goats initiated in 1988 by the Indo Swiss Goat Project (ISGP) Rajasthan, employed it to select superior indigenous Sirohi bucks for natural service. The development of FPR programmes for cattle, buffaloes and goats are summarised in Table 2. (Chacko, CT, 1998)

Wherever it was a part of the breeding programme FPRs have been instrumental for genetic improvement of herds belonging to farmers. The average lactation yield of buffaloes in the DIPA villages increased from 1 600 litres during the pre - programme period to 1933 litres now (Trivedi, 2002). The first lactation milk yield of recorded animals in Kerala increased

Table 2. Field performance-recording programmes in India.

Organisation	Began	Breed or type	Objective
KLDB	1978	Sunandini	
BAIF Development Research Foundation	1980	HF, Jy, & their crosses Surti, Murrah, Jaffrabadi	Progeny testing & as part of the breeding programme
NDDB	1987	Mehsana & CB cattle	
Andhra Pradesh AHD	1988	Murrah & HF& Jy crosses	
Indo Swiss Project Sikkim	1995	Jersey crosses	Natural service bull selection
ISGP Rajasthan	1988	Sirohi goats	Bucks selection
Kerala Agric. Univ., Trichur	1986	Crossbred cattle	Research
Punjab Agricultural University	1988	Murrah buffalo	

from 1 480 kg to 2 372 kg from 1983 to 1999 (KLDB, 2000.) ISGP Rajasthan reported that milk yields and body weights of the local Sirohi goats were 50-75% greater than previous findings, which had been based on institutional herds (Groot, B.de.,1996).

Programmes run in the country

Kerala Livestock Development Board (KLDB)

The KLDB did pioneering work in developing a FPR system as part of a progeny-testing scheme. The impact of the FPR programme in terms of annual increase in milk yield of the crossbred cattle directly benefiting the farmers is worth five times the investment by the government. Initially the programme covered some 5 000 breedable Sunandini females, which increased to cover 80 000 animals by 1997 (Chacko, 1998). All Sunandini young bulls numbering around 40 annually are test mated each with 1 500 AI. The female calves born are registered and followed up till the completion of the first lactation. Around 50 milk recorders appointed on contact, control some 2 000 cows annually. KLDB tested 799 bulls in 23 batches from 1978 onwards. Till March 2001, 64 090 cows were enrolled for milk recording and 79 % of them gave completed lactation records (KLDB, 2000). Breeding value estimations of the bulls tested in the first fifteen batches are completed and the proven bulls are employed for the production of next generation bulls and proven semen is also made available for inseminating elite cows since 1995, on a premium price. FPR programme could identify the top cows in the FPR area, which were subsequently contract mated with the top proven bulls to produce replacement bulls. 1238 male calves born for such elite mothers were purchased (KLDB, 2000). Farmers support programme include

concessional animal insurance, free distribution of mineral mixture and dewormers. The government of India all through these years finances the running cost of the programme.

NDDB

The National Dairy Development Board (NDDB) has integrated FPR into its overall breeding programme by linking it with village level AI services as part of its Dairy Herd Improvement Programme Actions (DIPA). The DIPA programme started in Mehsana in 1987 was gradually extended to six other milk unions in Gujarat. Funding for FPR activities is obtained through milk sales and interest generated through a corpus fund established with contribution of the NDDB and the respective milk union. (Trivedi, 1998). While the implementation of the programme is the business of the concerned milk unions, it is the NDDB who provides technical guidance and professional support. The inseminator (employee of the local milk society) carries out the milk recording in all the milk unions; however Mehsana union is engaging the owners, since 1997 on experimental basis. A set of 20 bulls are put to test every year each with 2 000 AI with a view to produce not less than 60 completed daughter lactations per bull. NDDB practices a young bull programme; the genetic progress being ploughed in through the bull to bull and cow to bull paths. Male calves born for elite mothers mated to proven bulls are purchased by the AI organisation and brought up as future bulls. Female calves born for test AI are provided with 250 kg of cattle feed in five instalments each time the release is conditional to the proper growth of the calf. A management committee with representatives from the milk union and NDDB over see the implementation of the programme and provide the needed technical help.

BAIF

Bharatiya Agro Industries Foundation (BAIF) - Development Research Foundation is a non – governmental organisation, employs FPR for selection of elite cows for bull calf production and for evaluating the production of indigenous and crossbred cattle. The young bulls are progeny tested using the same infrastructure. The proven bulls' semen is used to mate the best 30% of the recorded herd.

GOI

Government of India is providing financial support for field progeny testing to the various states. Due to the absence of a clear objective and as progeny testing not forming part of the breeding programme, the schemes implemented in states other than Kerala and Andhra Pradesh were not successful. The animal husbandry department, Andhra Pradesh runs a progeny-testing programme with financial support from GOI for evaluating crossbred bulls from 1988 onwards. (Chacko, 1998). The FPR initiated in buffaloes by the Indo Swiss Project Andhra Pradesh (ISPA) is facing financial constraints since the discontinuation of the ISPA in 1995.

ICAR

A project for progeny testing of crossbred bulls in rural areas, began in April 1986 with the objective of developing a system of field recording and utilising the records for progeny testing of the bulls. This project was later discontinued but the interest of ICAR facilitated securing of GOI funds for the progeny-testing scheme. A new scheme was launched for progeny testing of crossbred bulls under field condition with the objective of developing methodology for computing genetic evaluations and estimating the accuracy of sire proofs during 1994. BAIF in Maharashtra, Kerala Agricultural University in Trichur, and Punjab Agricultural University in Punjab implement the scheme from 1998 onwards. The programme envisages testing of 30 HF crossbred bulls in each batch. Frozen semen for test AI is supplied by the Project directorate on cattle at Meerut. These programmes would generate a good amount of data on the performance of the crossbred cattle under field conditions in different ago climatic zones.

Use of information

FPR could well be an entry point for farmer participation in breeding. FPR can bring about real farmer participation and could be a feasible and better alternative to having nucleus herds on institutional farms. The KLDB results show that, the genetic potential of farmers' herds exceeds that of institutional herds. Furthermore, the selection intensity, which can be applied in the field, is much higher than in institutional herds.

FPR would be a means for local breed conservation and development. Only recently the potential of FPR for local breed improvement and conservation of biodiversity has been applied in the field. A general observation from all the areas where FPR is going on is value addition for animals under the FPR. Other potential benefits, which are yet to be tapped, are:

- Healthy competitions among farmers in the management of their herd. The milk societies can print out the ranks of cows under milk recording in the area.
- Suggest 'easy to practice' feeding regimes to the farmers based on the daily milk yield and considering the locally available feed materials.
- Advise farmers on efficient economic practices based on the reproductive data available from the FPR.
- Use for the planning exercises for breeding programmes.
- Research organisations can make good use of the information from FPR.

Results

A summary of the activities taken up by the major organisations carrying out FPR and the results are given as Table 3.

The average first standard lactation milk yield of the recorded animals plotted against the average of the daughters of the bulls tested through years given as Figure 4 confirms that the KLDB programme has significantly contributed to the genetic improvement of the cattle in the state. The first standard lactation milk is increasing at an average rate 3.3 % annually. The daughters average is also increasing steadily.

Table 3. Summary Statement of FPR programmes in India.

		KLDB	BAIF	NDDB	AHDAP	KAU
Period		78-00	80-99	87-01	88-97	92-00
Bulls tested		535	151	320	60	49
Bulls evaluated		441	112	123	60	34
Type of bull		CB	HF, JY, CB	Mehsani & CB	CB & Murrah	CB
Av. AI per bull		1 500	1 200	2 000	2 700	NA
Semen stored		3 000	2 000	5 000	3 000	1 000
Selection		YB	YB	YB	YB	
1st lactation	Cows	2 372	2 919	2 585	1 439	1 810
	Buf.	--	--	1 807	--	--
Comp. lactation %		79	70	20-25	62	46
Farmers awareness		Doubtful	Somewhat	Yes	Doubtful	Doubtful

YB – Young bull; HF - Holstein Friesian ; Jy- Jersey; CB – Crossbred
(Source: KLDB, 99-00; KAU, 2000; Trivedi, KR, 2000; Goe, MR, *et al*., 1997).

Table 4. Least square means for 305-day milk yield.

Effect of	Yield range kg	Highest yield	
Season	1710 - 1759	Rainy season	S
Holding size	1700-1769	50-99 cents	NS
Herd size	1563-1857	6 & above	S

The average standard lactation milk yield of the Mehsani daughters of the test bulls in the DIPA programme is ranging between 1 910 and 2 013 kg over the first six batches. The observation from the FPR by the KAU shows (see Table 4) that the season of calving and herd size has a significant effect on the yield.

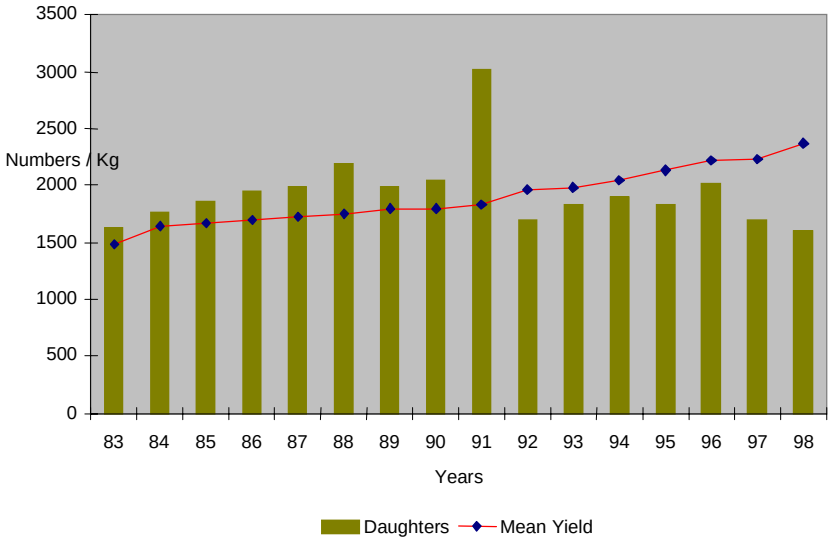

Figure 4. First lactation yield of crossbred cows in Kerala Source; KLD Annual report, 2000.

Strengths and weaknesses of FPR

Guaranteed availability of funds and resources are pre requisites for the sustainability of the project. The organisation implementing the FPR programme should have a reasonable autonomy to operate, a better understanding of its need and qualified persons for its management. Specific technical training in breeding strategies and FPR has received low priority in the last decade. Most technical problems within FPR are of a nature that they can be solved with a reasonable effort in research and development. It is felt that the early pioneering spirit in FPR cannot be found any more in many of the FPR programmes in the country. FPR is not a research project; it is an essential part of the breeding programme and as such is a continuous entity.

Strengths

- FPR as part of a well defined breeding programme: In Kerala and Gujarat FPR is employed for progeny testing and for selection of elite cows; and the context and role of FPR are well defined and accepted by all concerned including the main actors, the farmers.
- FPR as entry point for farmer participation in breeding: FPR can bring about real farmer participation. FPR can only be successful with true farmer involvement. In the KLDB and ISGP Rajasthan programmes this aspect has received adequate importance and attention. FPR is the most efficient tool for monitoring livestock performance at the smallholder level.
- FPR an alternative to large institutional farms: KLDB, NDDB and ISGP Rajasthan experiences show, that with FPR, the elite herd belonging to smallholder farmers can replace the bull mother herds

maintained by the government at least partially. The selection intensity, which can be applied in the field, would be much higher than in institutional herds.

- FPR as the base for local breed development: The potential of FPR for local breed development has been recognised recently by the milk federation of Uttar Pradesh under the World Bank programme for development of Sahiwal cattle and Bhadawari buffaloes.

Weaknesses

- *FPR has not been widely adopted*. In spite of its acknowledged relevance and reasonably well-documented results, FPR has not been taken up in a wider scale. It has remained within a few organisations and is not yet a mainstream methodology.
- *Government structures are not conducive for FPR programmes*. The problems faced in many states funded by government of India are instances that give the message that government set-up cannot successfully operate a FPR programme.
- *Emphasis in creation of awareness for FPR is not enough*. In spite of the well-documented evidence of the merits of FPR, efforts on a national level to create awareness on the benefits of FPR are not satisfactory.
- *The smallholder production system is not conducive*. For the smallholder, dairying is only one of the many sources of income. Some FPR organisations still do have a top-down approach and fail to get real participation of the smallholders.
- *Human and institutional developments not received sufficient attention*. The major bottlenecks of FPR are in the area of human and institutional development. Attempts to bring the scientists around a table for concerted action in the field of FPR were not common. NDDB would the apt body to initiate action on this regard.
- *The data analysis systems of the various FPR organisations have been developed in an iterative fashion*. All the models used are adapted versions of models used in FPR systems with larger herds. More specific research and development in this important area of FPR is needed.

Future directions

Should genetic progress to happen selection is inevitable and FPR is a prerequisite. Though there are not many alternatives for FPR, planners and administrators do not understand its necessity. All states should have a small but well run unit for progeny testing of their future bulls especially the buffalo, the crossbred and the widely used zebu bulls. This herd of animals should also provide a good number of elite cows to produce the replacement bulls through nominated mating.

Since government departments cannot handle the FPR, it shall be contracted to co operatives / NGOs / Autonomous bodies on a clearly spelt out memorandum of understanding and for a sufficiently long period.

In India it is now time ripe to introduce acts and rules to prevent falsification of FPR records. The penalties for offences done in FPR should be in par with that prevalent in other developed countries.

A quick and simple method of FPR for estimating the milk yield is to be developed for states where starting of a full fledged FPR is difficult with a view to select elite cows for production of young bulls. This would enable government to get rid off the large contingent of useless stock maintained in government farms, which are redundant for the purpose for which it is maintained.

Breeder's Associations may be formed in areas where FPR is taken up and they may involve in the running of the programme. A massive campaign for awareness creation about the essentiality of FPR is to be carried out at all levels (from planners to farmers).

A long-term strategy for integrating FPR into the breeding programme of the states and steps for cost recovery may be made. Value addition for proven bulls' semen, charging for managemental advice and assisting farmers in animal transactions, etc. should support the FPR programme on a long run.

References

Chacko, C.T. 1998. Field performance recording. Input paper for 2nd CAPEX workshop, September 3-4, Bangalore- Attibele.

Chawla, N.K., Kurup, M.P.G. & Sharma, V.P. 2002. State of the India farmer: A millennium study.

FAO. 2002. FAO statistics website, 2002.

Goe, M. R., Chacko, C.T. & Tuller, M. 1999. Field performance recording. Approaches used in selected animal breeding programmes. Capex; IC Bern.

Government of India. 1992. Land and livestock holding survey; National Sample Survey Report; 1992; Government of India.

Government of India. 1996. Report of the steering group, Government of India National livestock policy perspectives. 1996.

Government of India. 1997. Basic animal husbandry statistics, Government of India.

Government of India. 1997. Agenda notes of the workshop on the national project for cattle and buffalo breeding; Government of India New Delhi.

Government of India. 2000. Annual report 1999 – 2000; Department of animal husbandry & dairying; Government of India.

Government of Uttar Pradesh. 2000. Breeding policy for Uttar Pradesh, Department of animal husbandry, Lucknow, Uttar Pradesh.

Groot B de. 1996. Experiences on animal recording in bilateral collaborative projects for livestock development in India. In J. Renaud and J. van Gelder (Editors), Performance recording of animals, State of the Art. Proceedings of the 30th biennial session of ICAR, June 23-28, Veldhoven. European Association for Animal Production Publication No. 87. Wageningen Press, Wageningen ISPA, 33-39

Kerala Agricultural Univ. Trichur. 2000. ICAR Field progeny testing unit Mannuthy, Progress report.

Kerala Livestock Development Board. 1999. Kerala Livestock Development Board Annual report 1998-99; Trivandrum, Kerala.

Kerala Livestock Development Board. 2000. Kerala Livestock Development Board Annual report 1999-2000; Trivandrum, Kerala.

Krishnamoorthy, S. 1993. The Indigenous breeds of cattle and buffaloes in India; Present status and future outlook; Internal working paper; SDC; New Delhi.