

Creativity, conservation, and compensation: Honey Bee Network approach to augment, sustainably utilize biodiversity , and share the benefits

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The debate on conservation of agrobiodiversity has generally been characterized by three strands: a) the entire diversity should be in public domain, it should be open access, that is how green revolution became possible and there is no reason why similar growth in production and productivity would not be possible in future; the conservation in this approach is essentially through *ex situ* gene banks, b) given the fact that conventional breeding approaches have not been able to generate significant increases over the potential of productivity realized in many crops decades ago, there is a need for using biotechnology as well as other approaches to augment the farmers' choices through generation of new varieties. Since the investment in biotechnology or other approaches for improving productivity particularly by private sector (but also public sector) would require adequate returns, enactment and implementation of stronger intellectual property right regime was necessary; and c) the conservation of agrobiodiversity in regions where it already abounds (such as drought prone, flood prone, mountain, forests and other marginal rain fed regions) may best be achieved by following *in situ* conservation with limited extent of participatory breeding (much of which is restricted to providing farmers some choice of selection from advanced lines bred by breeders).

Each of this approach has limitations and detailed discussion on these will be out of scope of this paper. However, what we intend to do is to describe through our work in Honey bee network, some ideas that can expand the debate by providing new choices to various stakeholders including state, international agencies, private sector (both national as well as international), community organizations, NGOs and farmer breeders themselves.

Before we describe the incentives that are needed to encourage farmer breeders to conserve as well as develop new varieties themselves through their own selection and crossing processes, with or without outside help, it will be useful to appreciate what are the major threats to agrobiodiversity :

- A) Much of the decline in agro-biodiversity took place during last three decades or more through the diffusion of high yielding varieties (HYV) as well as hybrids developed by public sector research institutions. The private sector had negligible role in this in at least Asian region. The reasons are obvious. The seed replacements ratios have varied in most crops from 5 to maximum 30 per cent in a few crops like Mustard and share of private seed companies in such a seed market has been small. The fear that entry/expansion of private sector would lead

to large scale decline of agrobiodiversity is possible but need not necessarily follow. Within private sector, French seed industry offers an interesting variant in European context in which cooperatives of farmer breeders have successfully managed to compete with large multi national corporations in many crops. US model is just one and not necessarily the best model in this regard.

- B) The consumer preference for local varieties and so-called inferior millets, sorghum, etc., has gone down due to a kind of sanskritization effect. That is the lower income classes which consume these grains tend to emulate the behaviour of higher income classes (which consumed rice/wheat) in order to aspire for better social status.
- C) The cheap subsidized grains like rice and wheat distributed through public distribution system as well as food-for-work programme further depressed the demand for local grains and varieties.
- D) The lack of price and procurement support for the local varieties reduces incentives for growing the same for market.
- E) The allocation of better land and plots for high yielding varieties which responded to external inputs eventually meant that only marginal land and plots were left for local varieties. The environmental risks affected the productivity of these crops much more, though farmers still grow these crops in the niches where better alternative did not exist.

There are many other factors including socio-economic and cultural changes, which influence the decision of farmers to grow local varieties. Given all these pressures, it is useful to understand how farmers' innovation provide a hope for not only conserving but also augmenting the agro-biodiversity by improving productivity and/or reducing costs through other complementary innovations.

Part One: Innovations for Conservation and Augmentation

Farmers have always been known to make selections in the available diversity through natural mutations, mixtures or out crossing. Sometimes diversity also comes about due to natural stresses, which creates selection pressure. This provides opportunity for some less common characters to be manifested. For instance, if a few rice plants survive in a flooded field, then farmers may select these plants and accordingly develop a flood tolerant variety. In Bangladesh, Dr. Nurul Alam observed a practice of farmers in which such plants were uprooted and then cut, like sugarcane sets, with each piece having one or two nodes. These are transplanted for vegetative propagation of rice plants. In this case, a stress created a selection pressure which when complemented with a management innovation generated scope for a new varieted development.

Hone Bee network has documented a large number of these examples over the last 12 years. In each case, farmers' unique ability to observe and select a unique variety has brought out the potential of farmers' innovation for augmentation.

Case One: Farmers' Selections: an eye for detail, diversity and deviance

Thakershibhai Savalia, a 70 year-old farmer from Pankhan village in Saurashtra, dry part of Gujarat had a very keen eye for variation in the field. During 1987, there was a severe drought, said to be the worst in the last 100 years. Most of the crops of groundnut had withered. However, there were two plants which he found were not only green but also seemed healthy and different from the rest. He marked those two plants and started observing their growth every day. After maturity he used the seed of these plants to multiply next year and within five years through recurrent selection, he developed a variety which he initially named as Morla. The pod of this variety had a peacock's beak kind of curvature on one hand. Hence was called Morla i.e. like peacock. Apart from having very good oil content, it had two unique characteristics, a) the lack of ridges on the pod and b) the strong peg. Further the variety also had better than average disease and pest resistance. Through word of mouth, the variety spread to more than 40 villages in the last few years. It was also tolerant to drought more than other varieties. The taste was extremely good. While the variety was rejected in the All India Coordinated Research trials conducted by ICAR (Indian Council of Agricultural Research), the farmers in the region continue to grow it. Thakershibhai is very keen to get varietal protection for his selection. The stronger peg and lesser ridges help in digging out the groundnuts after maturity easily. Harvesting involves heavy cost because some of the pods are left in the soil requiring second or third digging. Much soil does not attach to the pod due to near absence of ridges and the weight is thus lighter. The stronger peg further helps in digging process.

Case Two: A Pigeon pea Variety with Pink Flowers

Dhudabhai Punjabhai Patel of Gadha village, Sabarkantha district, Gujarat, selected an odd plant in a field sown with BDN-2 variety. He found in his field a few odd plants which were neither affected by pest or disease nor seem to have the flowers or pod bearing pattern similar to other plants. These plants had pink flowers. Most varieties of pigeon pea have yellow flowers which attract the pests. In addition, the new type had higher number of pods, five to six seeds per pod and most of the pod bearing was on the upper part of the plant making it easier for women to harvest. The green pods were very good to cook and the yield was satisfactory (25 to 30 quintals per hectare) even when low level of fertilizer was provided. It was also resistant to wilt and was early maturing. The farmer had named the variety as Gadha Dudhabhai Punjabhai – 1 (GDP-1). The cooking time for the dried pulse was lesser. The grain was bolder and it was found highly suitable for certain specific recipes.

A selection in 1994 led to development of this farmer bred variety which has been registered with National Bureau of Plant Genetic Resources. Mansukhbhai Ramjibhai Murani has also made a selection of pigeon pea mutant from BDN-2 variety. This has bigger leaves, four to five seeds per pod, equal pod bearing on each branch, requires less water, seems resistant to the sucking pests, the flowers are red from outside and yellow from inside and yields well.

Laljibhai Ramjibhai, brother of Mansukhbhai, made another selection of sesamum variety which had higher yield and larger number of grains per pod. In 1994, he had sprayed an insecticide which was time barred and apparently caused mutation in the field. He observed erratic pod bearing behaviour in the crop. He selected some plants which had upto eight rows of grains as against two to four in the normal varieties. There were pods with two halves/rows, as well as four and eight halves/rows of grains. Variety was found to be resistant to pests and diseases besides yielding 50 per cent higher than Gujarat Ses-1, the official release varieties. One of the short coming of the new variety developed by Laljibhai is that it has pods with two rows as well as upto eight rows in the same plant. The number of pods is much higher. He has named it as Adarsh-8 (Agricultural Development and Research Superhouse Seed Farm-8).

Sundaram is one of the most enterprising young breeders and experimenter that Hone Bee Network has found in recent times. He has developed a very innovative agro-forestry system in arid parts of Rajasthan having rainfall less than 20 inches per year. In addition, he has developed larger number of varieties of vegetables as well as pulses and spices through selection in farmers' fields. He has made unique selections which even the formal research system does not have. One of his first outstanding selection was a variety of chilli which had three times more colour value than the best variety in the country so far, 50 per cent higher yield than the popular improved variety and two times more market value than the other varieties.

Among his notable selections, there are two varieties of garlic which have early maturity than the rest and one which has better yield than all the improved varieties released by formal research system. In onion, he had six varieties which recorded higher productivity than the improved released varieties. In cluster bean, he had four varieties which were free from powdery and two from leaf curl disease. In sesamum, he had a selection which was resistant to drought and free from red rot disease. In green gram, fenu greek, chikpea, cumin, he found many disease and pest resistant varieties. In coriander, he found 13 varieties which were resistant to both blight and wilt. In several varieties, he observed synchronous maturity. In pearl millet, he found 22 varieties which were free from black smut and 19 which were free from downey mildew. For one farmer to have made so much of improvement single handedly is an unique contribution. Support from SRISTI and a small grant from using diversity project supported by IDRC and administered by SRISTI have made small contribution to his research. He also got a national award from Indian Council of Agricultural Research. He has maintained complete details of each farmer from whose field he has made these selections so that part of the benefit should go to the original conservator of germplasm, should some of these become commercially successful. At this point he has no external support to continue his research though SRISTI and National Innovation Foundation are trying to provide some support to him.

In West Bengal, a farmer Dholaram Mondal had grown two types of broad bean variety along side in his field. Three years ago, he noticed a plant with odd pods. He grew these seeds separately and found that new variety had higher number of pods, larger number of

grains per pod and thicker skin. He thought that the new variety was developed by natural crossing between the two of the local broad bean varieties.

Jita Bhai of Wetla village, Wadali taluka, Sabarkantha district in Gujarat presented his selection of a new beans variety in a recent meeting of Shodh Sankal held at Modasa in North Gujarat. He had procured fodder during drought of 1987 and found mature beans mixed with the dry fodder. He grew these separately and found that few of the plants were very vigorous in growth and yield. He kept seeds of those plants separately eventually a new variety was developed. IT has become quite popular in the local region.

There are several other examples of this kind of breeding by farmers in Honey Bee database. The question that arises is why the modern agricultural research system nationally or internationally does not focus its efforts on augmenting the efforts of such farmers. Why is it that millions of dollars continue to be spent in the Consultative Group of International Agricultural Research (CGIAR) whereas not even half a million dollar is spent for augmenting the pursuits of farmer plant breeders. There have been numberless discussion in FAO on the farmers' rights. All the consultations must have costed millions of dollars. Why couldn't even five such farmer breeders been invited once to FAO to advise how farmers' rights should be exercised. Mr. Sundaram had represented SRISTI in an international consultation on traditional knowledge and intellectual property protection organized by WIPO two years ago in Geneva as a key-note speaker. There are large number of programmes on the so-called participatory building around the world, but somehow whenever I have asked the international community to share examples of varieties developed by the farmers, I have never found many responses. That does not indicate that there are not enough farmer breeders in the world. It only indicates that these innovative farmer breeders are not the main focus of researchers engaged in so called participatory breeding.

Case Three: In situ conservation in humid flood prone regions

I had coordinated a study in collaboration with Dr Maurya of ND University of agri. Technology, Faizabad in 1989-90 on strengthening the on farm research processes. As a part of this, mapping of plot wise cultivation of farmers' Varieties, land races as well as improved varieties in three seasons in five villages also did a study. The same villages were revisited recently after ten years to see what has been extent of changes in proportion of area and plots under local varieties and for what reasons. While the study is still under process, initial results have indicated some very interesting results. There has been decline in almost all crops of area and number of plots under local varieties ranging from 16 per cent in some villages and crops to almost 100 hundred percent under other varieties (that is, those varieties have disappeared from these villages all together). Except for cauliflower, in which area under local varieties had increased, most local varieties had lost acreage maximum under medium high land conditions-the situation that approximates the best, the conditions at research stations. The decline under millets and other minor crops was of course much lesser than say rice. Among different land holding classes, the larger farmers had made the most changes at aggregate level though the

pattern was different at village level (Gupta, Shukla, Chandok, Neeraj, Vasanth, Sinha, 2001).

Obviously, the *in situ* conservation of local land races cannot take place by just letting farmers know that Biotechnology industry as well as seed industry might need these land races for future breeding. Thus it is in the interest of local farmers to conserve these races. Studies show that maximum gain from new high yielding varieties have taken place, which are not rich in local land races. The regions, which are rain fed and suffer greater fluctuations in production and also have lower productivity, and thus lower income levels, apart from heterogonous ecological conditions have higher agro biodiversity. But we have no policy framework to address anxieties, aspirations and assessment of local communities about agro-biodiversity.

How do we change this situation? The story of Honey Bee network provides some lessons in this regard. The Honey Bee network philosophy also offers some lessons for the accountability of formal research system towards the people whose knowledge we often use for improving our own work, without any acknowledgement, reciprocity or sharing of benefits. I am not suggesting that Honey Bee network is necessarily the best way or the only way through which we can scout, spawn, support and sustain grassroots innovators who are solving local problems through their own genius without outside support. I am certainly intrigued by the fact that there are not many such networks around which build upon a resource in which poor people are rich i.e. their knowledge, creative spirit and values.

Part two: Policy Measures for augmenting agro-biodiversity and benefit sharing with conservators of diversity

Conserving agro biodiversity poses many challenges, key among which deals with incentives that local communities need to have for growing local varieties. These incentives (also see Gupta, 1989, 1995, 1998, 2000) are summarized below:

- a) Increased demand for local land races through development of niche markets
- b) Compensation to a certain percentage of farmers in each region for growing low return land races based on the difference in productivity and price product of high yielding varieties and local land races
- c) Support to local farmer breeders as well as communities in participatory breeding with or without involvement of outside scientists so as to improve the land races and make them viable in market place through increased productivity
- d) Link the conservation of agro biodiversity with development of organic agriculture and provide institutional support for certification of output, development of market channel for marketing, generation of consumer demand and other post harvest processing and branding
- e) Provision of non-chemical inputs such as herbal pesticides, beneficial insects, technologies for enriching farm yard manure, etc., so as to make the cultivation of local land races more economical

- f) The provision in national plant variety acts for Gene Fund as attempted in Indian Plant Variety and Farmers' Rights Bill for sharing benefits with local conservators of agro-biodiversity whenever the same are used for breeding of varieties by public or private sector with in the country or outside,

Non Material incentives

- g) Awards and honour to the communities/individuals which are conserving the rare or endangered agro-biodiversity
- h) Policy measures aimed at procurement of local land races on priority while designing food security programmes and buffer stock
- i) Curriculum and pedagogy at primary and higher level of schooling to include lessons and references about the contribution specific communities make for conservation of specific agro-biodiversity
- j) Acknowledgement of the indigenous knowledge provided by the farmers conservators in the passport data sheets of germplasm in gene banks. Such has not been the practice, unfortunately, anywhere so far.
- k) Development of an international registration system (such as INSTAR proposed by SRISTI, in 1993) as mentioned in section two for providing quick IP protection to conserving communities as well as individual breeders
- l) National authorities to take responsibility for generating data required for plant variety protection since farmers on their own can not generate all the formalities involved in the matter, NGOs supporting the local conservators in the matter need also to be supported for the purpose
- m) Risk fund for encouraging local communities and innovators to take up test marketing, value addition and seek outside help

There may be various other ways in which this issue can be taken forward. The gene fund set up by UC Davis at the initiative of Dr Pamela Ronald unfortunately never worked and no amount ever accrued in it. So much so that UC Davis also did not agree to mainstream this initiative. The Biopiracy continues at the international level. But can we stop exploitation and erosion of agro biodiversity at national level. This paper is a small response to that.