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Conservation of Plant Genetic Resources at the Scarascia Mugnozza Community Genetic Resources Centre

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The importance of community managed on–farm conservation in promoting intra–specific plant genetic variability and providing sustained supply of agricultural produces to local communities, feed stock for modern plant breeding and ecosystem services to support rural livelihoods is well recognized. The life and livelihood as well as the cultural ethos of the rural communities are deeply embedded in local agro–biodiversity they conserve and use. Thousands of rural communities including over 550 tribal communities living in diverse agro–ecological regions of India have been conserving and enriching genetic resources of diverse agricultural crops to meet their nutritional, health and livelihood needs as well as the ecological security. They often constitute the unsung heroes of the agricultural revolution triggered by the genetic material conserved by them. On–farm conservation vis–à–vis ex situ conservation in genebanks is assuming greater importance in the context of global climate change. The threat to food security from climate change, which is predicted to usher in unprecedented biotic and abiotic stresses, can be mitigated only with that genetic diversity which has better adaptive strength and fitness to extreme vicissitudes of these stresses. Under this scenario, the on farm conserved agro–biodiversity has a better advantage over the in situ genebank conserved variability for the following reasons: (i) Climate change is a continuous and rather slow progressing event and all those components of agro–biodiversity, which are annual and continuously cultivated and selected by communities in different regions exposed to variable impact of climate change may facilitate evolution of these

material in sync with climate change to provide better adapted genetic variability; (ii) Such opportunity for evolving improved adaptation to progressing climate change is not available to the PGR conserved in a in situ genebanks; and (iii) This apart, the on–farm conservation also generates a body of knowledge on every component of PGR on its specific adaptive and agronomic potential, which is readily usable for breeding new varieties.

On the other hand, the breeding value of accessions in the genebanks, usually stored without associated traditional knowledge (TK), could be ascertained only with time and cost consuming screening for different adaptive attributes. Thus, the PGR of annual and biannual crops, which are subjected to continuous cultivation with associated seed selection cycles practiced by farmers across several seed generations under the changing climate, would generate genetic resources possessing better adaptive value to breed better climate resilient varieties. Therefore, on–farm conservation in the era of climate change has more strategic importance over the in situ conservation including in national parks and protected areas.

However, an important risk inherent with on–farm conservation is the loss of certain components of this variability due to multiple causes. Such genetic erosion may be due to targeted promotion of high yielding varieties sans attention to traditional cultivars, cropping system shift, changes in the life and cultural styles of communities, drastic agro–climatic change, land fragmentation, traditional seed storage systems, seed supply and germination, etc. Here, in situ genebank conservation provides a safety net against irreversible loss. It is important such in situ banks be readily accessible to farming communities to retrieve and restore the varieties lost during on–farm conservation. Collection and conservation of all traditional cultivars in the genebank also serve an important purpose of accounting and mapping the on–farm diversity, which is important to detect their periodic loss and restoration at the choice of local communities.

Therefore, strong on–farm community conservation aided by in situ genebank conservation, which provides periodic feed back to the former, is the best possible system for shaping genetic resources for enhanced adaptation to climate change. The above integrated strategy on agro–biodiversity conservation linking strong community based on–farm conservation and in situ genebank back up was developed

and practiced by the M. S. Swaminathan Research Foundation (MSSRF) since its inception in 1989. While the MSSRF got engaged in community based on–farm conservation from 1989 in three agro–biodiversity rich locations in Eastern and Western Ghats of India, the community ex–situ genebank was started in 1994. This genebank facility was established with the help of a munificent grant provided by the Government of Italy through the good offices of the International Plant Genetic Resources Institute (currently Bioversity International). This integrated community genetic resource facility at MSSRF is named as the G.T. Scarascia Mugnozza Community Genetic Resource Centre (SMCGRC) in recognition of the monumental contributions made by Prof. G.T. Scarascia for promoting the conservation and enhancement of PGR.

1. Participatory on farm community conservation

A key to on farm conservation promoted by MSSRF is what is termed as the 4C continuum. The 4Cs stand for cultivation, conservation, consumption and commercialization. Virtually all farm families engaged in conservation of agro–biodiversity in many parts of India are poor and own small or marginal farm holdings. Many of these conservers are tribal women and men who have long years of expertise in conservation and deep knowledge on the genetic resources they hold. They consume much of the produce they grow with little or no marketable surplus. Their preference for traditional varieties for own consumption and for other cultural needs is important reason enforcing the conservation.

Within this frame work, MSSRF makes farmer participatory interventions to optimise the productivity of traditional varieties by adopting appropriate and sustainable technologies for production enhancement and value addition of marketable surplus for increased food and income security. The intervention also includes building capacity of communities for production of quality seeds of traditional varieties and promotion of need based participatory plant breeding. The largest agro–biodiversity in India is located in rain–fed farming areas. The adverse conditions of rain-fed farming by small and marginal farmers as well as the poverty of many among them cause

situations where they may consume the seed saved and kept for next crop. This is a frequent cause for genetic erosion and also a poor crop during following season. Poor crop is due to poor quality seed (often grain) fetched at last moment from the local market. Such genetic erosion and cause of low production could be obviated with local availability and access to quality seeds by the poor farmers. The MSSRF innovated and introduced the community managed Village Gene–Seed–Grain Banks (VGSGB) to ensure access by the poor to grain for food and quality seed for raising good crop. Member farmers of each village seed bank are trained to produce quality seeds of all local varieties with fair genetic purity. Certain quantity of these seeds are assembled as initial stock and these seeds are made available to needy member farmers on loan on condition that it is returned after harvest with 'seed interest' at a rate fixed by the bank.

A group of village women manages the seed transactions of the bank and its records. The same unit also manages a grain bank, which has an initial grain corpus of locally available grains including underutilized ones. These grains are also loaned out to the needy member families as loan, which is returnable with 'grain interest' fixed by the bank. This banking system takes care of the food security of the poor who lacks temporary purchasing power on account of lean period in employment, sickness, etc.

Another important feature integrated by MSSRF to strengthen the on farm conservation is innovation of an economic stake to the conserved diversity in conjunction with the local market. This commercial component of conservation designed to enhance the household income may be by promoting a niche value of the produce or by introduction of value addition, development of commercially attractive products and building market linkage. Some of the examples successfully demonstrated commercialization by the communities are the 'Kalajeera' rice variety developed by participatory breeding in Koraput district of Orissa, finger millet malt and other value added products from small millets in Kolli Hills of Tamil Nadu and Koraput district of Orissa and Haveri district of Karnataka (see Box 1), and a medicinal rice variety 'Njavara' in Wayanad district of Kerala.

The value addition and new product development may involve specialized training to farm women and men from processing to marketing, supply of essential machineries which are simple and

Figura 1. India grows six species of minor millets. They are cultivated in marginal areas with low rainfall, low–soil fertility and hilly and mountainous regions. These crops have high climate resilience, better nutritive and few nutraceutical properties. However, their low yield and income were making farmers to switch over to alternative crops causing their massive genetic erosion. During such change in Kolli Hills in Tamil Nadu, an area rich in genetic diversity of four of these species, MSSRF in collaboration with Bioversity International supported by International Fund for Agricultural Development, initiated conservation of local cultivars with participatory strategies to enhance income from these crops. Change to quality seeds, improved agronomic practices, value addition and market linkage of products were introduced. Value addition required intensive training, supply of machinery and creation of marketing skill. Finger millet (ragi) is second to barley in good quality malt production. Community level production of ragi malt and other products provided substantial income. The enhanced income from increased yield and value added products has narrowed the competitive disadvantage of these crops and their restoration in on–farm conservation.

suited to village level operation, promoting group approach, building entrepreneurship, so on and so forth. Value added commercialization of traditional varieties offers far higher economic opportunities to the conserving community and sustainability to on–farm conservation.

2. Role of community ex situ genebank under SMCGRC

The Community ex situ genebank under the SMCGRC is a medium term storage facility (at 4oC and 25% RH) with holding capacity for 3000 accessions. Current accessions include from crops such as rice

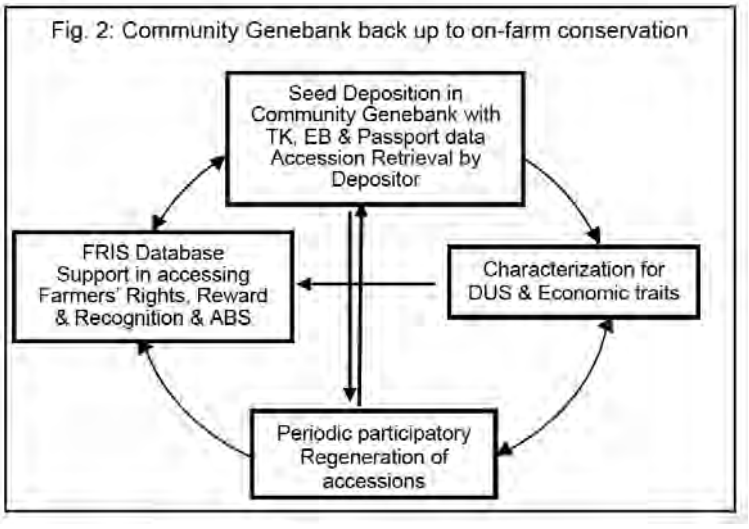
Figura 2. Prof Scarascia inaugurating the Community ex situ Genebank of the SMCGRC at MSSRF in Chennai on Jan 27, 1994

and pulses and under–utilised crops such as small millets deposited by farmers/communities from the states of Orissa, Tamil Nadu and Kerala. Some of the underutilized species being conserved have higher resilience to certain elements predicted from climate change. The in situ community genebank is integrated with village–gene–seed–grain banks (VGSGB) in hub and spoke model (Fig 1).

This genebank has certain features distinct from the national or international genebanks (Fig 2).

Farmers and communities are encouraged to deposit their varieties and MSSRF serves as the trustee of these accessions with responsibility for their safe preservation and supplying back seed samples to the depositor on request. Such request had happened in the past due to total crop loss under a natural calamity. Access by third parties is allowed in accordance with Indian Biological Diversity Act with prior informed consent and under mutually agreed terms and material transfer agreement, wherein provision for benefit share is an essential element. As the safe storability in the genebank is only for 8 to 10 years, MSSRF undertakes periodic seed regeneration of accessions. Maintenance of this genebank involves high recurring cost and MSSRF seeks the help from various donor agencies. Such assistance is also used to

Fig.1: Organogram of SMCGRC



characterize the accessions for their DUS and economically important characters. The data on characterization and passport details of every accession are constituted under farmers' right information system (FRIS). Another important feature of the MSSRF genebank is that every accession is received with all associated traditional knowledge (TK), cultural and ethno–botanical information. This also forms part of the FRIS database. The TK on genetic resource has high importance in providing a face value on its utility in breeding. The FRIS database together with the herbarium specimen on each accession provides holistic information for the purpose of establishing ownership and intellectual property rights on each accession. MSSRF promotes legal access to these accessions with facilitated prior informed consent of concerned farmers/communities. A duplicate set of all accessions is deposited with the National Bureau of Plant Genetic Resources, New Delhi. The Indian plant variety protection law (the Protection of Plant Varieties and Farmers' Rights Act or PPVFR Act) has certain unique provisions to promote on farm conservation.

These are the common seed right related to saving and re–planting, right to reward and recognition for on–farm conservation, improvement and making available plant genetic resources (PGR), right to establish plant breeder's right (PBR) on farmers' varieties, etc (Bala Ravi, 2004). The PPVFR Authority established under the above said Act has instituted an award and reward system designated as "Plant Genome Saviour Award" to honour farmers/communities who have made outstanding contributions in conservation of PGR (Bala Ravi and Parida, 2007). Up to five prizes, each of value Rs 10,000,000 (equivalent to US $ 24,000) are awarded to the community every year. In addition, up to five individual farmers are awarded with prize of Rs. 100,000 every year.

They are also honoured in public function held in Delhi. This is a unique system devised under law to revitalize the in situ on–farm conservation traditions of rural and tribal families. Leveraging the field experience that MSSRF has on the PGR wealth being conserved by different farming communities over last many years and the unique features of these PGR as evidenced in the FRIS database, two of the communities were facilitated to receive the "Plant Genome Saviour Award" in 2008 and 2009. Earlier in 2002, MSSRF assisted one of the farming communities from Koraput in Orissa, a region with

rich diversity in rice, to receive the "Equator Initiative Prize" of the UNDP, at the World Summit on Sustainable Development in Johannesburg. MSSRF activities under the SMCGRC are guiding farming communities to register some of the promising traditional varieties under the Indian PPVFR law. So far 11 such varieties belonging to farming communities in Koraput, Orissa and Wayanad in Kerala are applied for registration. MSSRF under the SMCGRC is also working with the PPVFR Authority of India to expand the National Register on Plant Varieties with DUS database of the farmers' varieties.

Figura 3. His Excellency Mr. Carlo Azeglio Ciampi, the former President of Italy being briefed by Prof. Scarascia on the activities of SMCGRC during the Tenth Anniversary eventin 2005

The tenth anniversary of the community ex situ genebank under the SMCGRC was celebrated on 13 February 2005 in India and this was inaugurated by His Excellency Mr. Carlo Azeglio Ciampi, the former President of Italy. Need for strong public support for on–farm conservation. While the genebank conservation being undertaken by the national and international institutions is supported with huge public funding, the on–farm conservation of PGR is being left at the private cost, which is solely borne by the poor farmers in many biodiversity rich countries. The PGR these farmers are conserving and enriching is accessed for the feeding the global plant breeding, public and private. This PGR is important feedstock to the global food security, now and times to come. Ethics, equity and fair deal demand that these poor

conservers are duly compensated and the important role they play is promoted by the national and global communities. Although these are recognized in the Farmers' Rights provided in the International Treaty on Plant Genetic Resources for Food and Agriculture (IT) and the fair and equitable benefit sharing for commercial utilization of genetic resources and associated TK provided in the Convention on Biological Diversity, these are yet to benefit the conserving communities across the world in any tangible scale.

Hence on–farm conservation is in decline at a period when it has to be strengthened. It is in this context, the framework of National Gene Fund and the reward and recognition to primary conservers provided in the Indian PPVFR Act deserve wider emulation. Establishment of a Global on–Farm Diversity Fund in line with the Global Crop Diversity Trust, which is being mainly used to support conservation in international genebanks, or broad basing the GCDT to provide strong support to on–farm conservation with prioritized fund flow to regions rich in PGR for food and agriculture and exposed to intense climate change is an urgent need. The existing Benefit Sharing Fund under the IT could be unified with GFDF.

3. Farmers' Rights and Agro–biodiversity conservation

Farmers' Rights is an ethically important policy in the context of intellectual property rights to plant varieties. Prof. M.S.Swaminathan as the Independent Chairman of the FAO Council (1981–85) has been associated with Farmers' rights from its very early stage when it was endorsed by the International Undertaking on Plant Genetic Resources in 1983. Way back in 1990 MSSRF championed the cause of farmers' rights on PGR, reward and recognition to primary conservers and the concept of equitable benefit sharing on commercialization of the genetic resources in a Keystone Dialogue held at MSSRF, Chennai under the chairmanship of Prof. Swaminathan (KSC,1990). The concept on benefit sharing was taken forward by the CBD in 1992 through its Articles 8(j), 15 and 16 and the farmers' rights in 2001 with restricted national scope by the IT. In India MSSRF played a major role in developing first frameworks and drafts on the Indian legislations which were later enacted as Biological Diversity Act and PPVFR Act. The

PPVFR Act is notable for extensive farmers' rights, where farmer is recognized as the cultivator, the conserver and the breeder, the concept of National Gene Fund to promote on–farm conservation of agro–biodiversity, the reward and recognition for primary conservers, the equitable benefit sharing for using farmers' varieties in commercial plant breeding, right to register farmers' varieties, prohibition of all genetic use restriction technologies that would limit farmers' rights on seeds, etc. Farmers' rights are important ethical and legal requirement to promote sustainable conservation in countries like India which are a recognized primary centre of many crop species. Apart from empowering the conservers and grass root democratic institutions on best practices on sustainable conservation and use, the SMCGRC is also engaged in genetic and legal literacy of farmers and grass root democratic institutions (Panchayats) on the national legislations pertaining to biodiversity and farmers' rights. For promoting such literacy among school children, 'Genome Clubs' in schools are innovated by the MSSRF. These Clubs are established in a network of schools across the country with the support of Department of Biotechnology, Government of India. These Clubs create awareness among students on the biodiversity, its conservation and sustainable use and legal regime associated with access and benefit sharing, ecology, evolution and molecular biology.

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