CONSERVING WILD CROP GERMPLASM

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India is home to a large reservoir of biological wealth. The diversity of this biological or genetic wealth is the foundation of sustainable food and nutritional security for India and the world. Access to a broad genetic base enables us to cope with the challenges to food production that can arise from a variety of biotic and abiotic stresses. Changes in soil and water conditions, new pest attacks, niche climate changes would all require new varieties. Breeding these varieties is only possible if a range of genes is available.

Take for example the threat of global warming. Scientists the world over are dipping into wild and cultivated gene pools in order to breed crop varieties that will have to replace existing varieties in disturbed agro-climatic zones, should the climate change significantly. If the gene pool that we have were to be lost, and new genes could not be located to breed varieties suited to the altered conditions, then this single factor: global warming could cause large scale starvation by lowering food productivity. This could happen with any number of causative agents.

Genetic diversity of concern to agriculture is available in the cultivated form that is in the form of the several crop varieties. It is also available in the wild form that is in the wild relatives of crop plants. The importance of these wild relatives cannot be over emphasised. It is this wild gene pool that the farming community has used to create the races of food and cash crops on which the agriculture of the world is based and it is this wild gene pool, which will provide the underpinning to sustainable agriculture.

India is home to a large number of plant species, both cultivated and wild. Almost 50,000 higher plant species (that is excluding plants like ferns and mosses) found in India are endemic, which means they are found only here. India also has a large number of crop plants (166) and an even larger number of wild relatives of these plants; so far 326 species have been documented as wild relatives of crop plants, many others remain undocumented.

The country is a major centre of diversity for rice, several kinds of millets, urad bean, moth bean, pigeon pea, black gram, several kinds of cucurbits (the pumpkin, cucumber family), cotton, jute, raspberry, cherry, jackfruit, banana, plantain, mango, jamun, several spices and medicinal plants. The wild relatives of these plant species are also found here.

Table. 1

Wild Relative of Crop Plants in India	
Crop	**Phyto-geographic Zones**
Cereals and millets	Western Himalayas Eastern Himalayas North-eastern region Gangetic plains Western peninsular tract Eastern peninsular tract Widely distributed

Legumes	Western Himalayas Eastern Himalayas North-eastern region Gangetic plains Indus plains Western peninsular tract Eastern peninsular tract
Fruits	Western Himalayas Eastern Himalayas North-eastern region Gangetic plains Indus plains Western peninsular tract
Vegetables	Western Himalayas Eastern Himalayas North-eastern region Gangetic plains Indus plains Western peninsular tract Eastern peninsular tract
Oilseeds	Western Himalayas Eastern Himalayas North-eastern region Gangetic plains Western peninsular tract Eastern peninsular tract
Fibre plants	Western Himalayas North-eastern region Gangetic plains Western peninsular tract Eastern peninsular tract
Spices and condiments	Western Himalayas Eastern Himalayas North-eastern region Western peninsular tract Eastern peninsular tract
Miscellaneous Crops	Western Himalayas Eastern Himalayas North-eastern region Gangetic plains Indus plains Western peninsular tract Eastern peninsular tract

Wild species and relatives of crop plants contain valuable genes that are of immense genetic value in crop improvement programmes. The most important characters derived from wild relatives have been the resistance to biotic and abiotic stresses. Such resistance has been mostly observed to be simply inherited, easily transferable and clearly expressed. Ever since the successful translocation of resistance factors in wheat against yellow stripe rust (*Puccinia striiformis*), this approach has been tried in several crops against different diseases, using various techniques and approaches. For crops with a unique biological cycle and narrow genetic variability in the cultivated types, such as potato and groundnut, breeders have little choice but to depend heavily on wild relatives for useful characters.

Despite our crucial dependence on it, the threat to our bio-wealth is increasing everyday. All available evidence indicates that human activities eroding the biological resource centres in nature are accelerating alarmingly and greatly reducing biodiversity. At least 10 per cent of India's wild flora and a larger fraction of its wild fauna are threatened, with many on the verge of extinction. This is not surprising, considering that in the past few decades India has lost at least 50 per cent of its forests, polluted over 70 per cent of its water bodies, built or cultivated on much of its grasslands, degraded many coastal areas and has even begun encroaching on the last refuge of conservation, the National Parks and Sanctuaries.

Given the high level of exploitation of genetic resources from forests and open areas, the fragile ecosystems in several parts of the country and the availability of genetic diversity in several useful, coexisting biological species, there is an urgent need to conserve the plant species themselves, the coexisting species and the ecosystems. This would need a variety of conservation approaches depending on specific biological factors. Such approaches should include conservation of ecosystems/agro-ecosystems, specific habitats, naturally occurring gene pools, special genetic stocks such as the tubers and roots used by communities during famines etc.

Conservation efforts will need to use a judicious mix of *ex situ,* on farm and *in situ* approaches. The fascination with the gene banks of the *ex situ* approach must be seen in perspective. Gene banks are limited in their conservation scope, they are also mired in ideological and political controversies, stemming from the nature and ownership of the international gene banks stewarded by the CGIAR (Consultative Group on International Agricultural Research) system. The major drawback of the gene bank method of conservation is the fact that although the genetic material can be conserved for a long time, it does not evolve with the rest of the biodiversity in its source area. This means, it is not exposed to the new pests and pathogens, or to the abiotic stress factors like drought and salinity, and so does not get a chance to develop resistance or tolerance to these. Hence it would not be very useful germplasm to either reintroduce in nature or use for breeding work. Nevertheless, for highly endangered germplasm or for economically important germplasm of limited availability, as also as a back up, gene banks have an important role to play.

The *in situ* and on farm conservation would be the most authentic way to conserve genetic diversity but it has the obvious limitations that have led to its destruction in the first place. On farm conservation can only be done with the support and cooperation of the farming community. Gene Campaign has conducted a study in Bihar and Jharkhand to assess the attitude of the farming community to the loss of genetic diversity in the field. The study also documented what the farmers would seek as compensation for growing traditional crop varieties rather than switch to high yielding varieties completely.

Table. 2

Incentives desired by farmers for growing traditional varieties
❑ Reliable supply of genuine fertilisers and pesticides
❑ Extension services
❑ Reliable seed source for traditional varieties
❑ Assured market for traditional varieties
❑ Availability of water for irrigation
❑ Adequate power supply
❑ Road links
❑ Health care facilities
❑ Education facilities
❑ Adequate price support measures

To have a long lasting impact, conservation must be done in a holistic and dynamic manner, based on the principle of sharing the benefits derived from conserved gene pools with the communities who conserve them. Strategies to conserve natural gene pools must include:

- Mapping and inventorisation of diversity at the micro level, to enable effective conservation and management and identify gaps for further work.
- Future surveys, collections and inventorisation should be prioritised on the basis of the gaps identified.
- Ecological niches, habitats of wild and related types and species of crop plants should be identified and demarcated. This should be done along with the documentation of the prevalent cropping systems, the practices of the indigenous communities in cultivation and management of genetic diversity in and around such areas, to enable holistic conservation.
- Specially designated gene reserves or gene sanctuaries should be earmarked in areas rich in diversity
- Since National Parks and Sanctuaries have been earmarked as priority conservation sites, the areas where the wild relatives of crop species are found within the protected areas should be demarcated. Such areas of genetic diversity should be clearly flagged and declared Special Gene Reserves, where no activity should be allowed.