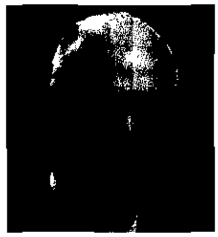
20 LINKING SCIENCE AND SUSTAINABLE DEVELOPMENT MSSRF



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ABSTRACTS & BIO DATA

Government of India
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Session 3: Biodiversity and Achieving the UNMDG of halving hunger and poverty by 2015

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At the UN Millennium summit (6–8 September 2000) in New York, 189 world leaders established the Millennium Development Goals (MDG). The MDGs aimed at reducing the proportion of people under poverty and hunger by half (by 2015), and achieving environmental sustainability, in particular, are directly or indirectly influenced by the conservation and use of biodiversity related to agriculture and allied areas.

The progress on achieving MDG targets has been uneven till date. The most recent estimate by FAO put undernourished people at 1.02 billion, comprising 15% of the estimated world population of 6.8 billion, and a sizeable increase from its 2006 estimate of 854 million people (FAO, 2009; http://www.fao.org/). In 2009, an estimated 55 to 90 million more people were living in extreme poverty than anticipated before the economic crisis. Nearly all of the undernourished are in the developing countries, with a majority in South Asia and sub-Saharan Africa, who depend directly or indirectly on agriculture for a large part of their livelihoods. Biodiversity is one of the key components in alleviating poverty and hunger through increased agriculture production.

United Nations Convention on Biological Diversity (CBD) defines biodiversity as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystems. Biodiversity in all its components (e.g. genes, species, and ecosystems) increases resilience to changing environmental conditions and stresses. Genetically-diverse populations and species-rich ecosystems have greater potential to adapt to impending challenges such as a warmer planet. Today, biodiversity is under immense pressure from both anthropogenic activities and natural factors. Plant genetic diversity is threatened by genetic erosion caused by replacement of local/ traditional varieties by modern cultivars, emergence of new pests, weeds and diseases, environmental degradation, urbanization and land clearing through deforestation and bush fires.

Traditional efforts to counter genetic erosion concentrated on conservation of crop germplasm in genebanks (*ex situ*). However, it is increasingly being realized that the best strategy combines *ex situ* conservation with on-the-ground (*in situ*) conservation by farmers in their agro-ecosystems, of both crops and their wild relatives (CWRs) in areas of adaptation. The finite and vulnerable PGR are the biological basis of world food security and support livelihoods. Several efforts have been made in the past to collect and conserve the global diversity. There are more than 1,750 genebanks worldwide, conserving about 7.4 million germplasm accessions, and about 130 of which hold more than 10,000 accessions each (available at: http://apps3.fao.org/wiews). There are also substantial *ex situ* collections in over 2,500 botanical gardens around the world. Among the largest genebank collections are those by the International Agriculture Research Centers (IARCs) under the CGIAR umbrella and held in trust for the world community. ICRISAT, has global responsibility to collect, characterize, conserve and distribute the germplasm comprising landraces, breeding lines, wild species and relatives of its five mandate crops: sorghum, pearl millet, chickpea, pigeonpea, groundnut; and six small millets: finger millet, foxtail millet, little millet, kodo millet, proso millet and barnyard millet, with over 119,000 germplasm accessions assembled from 144 countries. The existing collections represent 70 to 80% of the available diversity, with some gaps in crop collections, especially the CWRs, which need to be collected as early as possible with emphasis on trait-specific collections, besides collection of genetic resources at the extreme ends of diversity.

PGR are a strategic resource and lie at the heart of sustainable agriculture. The link between genetic diversity and sustainability has two main dimensions: (i) the deployment of different crops and varieties, and the use of genetically heterogeneous varieties and populations, as a mechanism to reduce risk and increase overall production stability; and (ii) genetic diversity as the basis for breeding new crop cultivars to meet future challenges. Some of the constraints to improved use of PGR for food and agriculture (PGRFA) are related to human resources, funding, facilities, cooperation and linkages, information access and management. There are emerging challenges and opportunities in the use of genetic resources for sustainable agriculture and ecosystem services, under-utilized species, biofuel crops, health and dietary related diversity, and climate change.

The development of new high yielding varieties of crops depends on breeders and farmers having access to the genetic diversity for sources of resistance to pests and diseases, tolerance to drought, water-logging, heat, cold and other stresses. However, a large gap exists between availability and actual use of the germplasm. This is true for different crops in national programs as well as in the international breeding programs, where <1% of germplasm has been used in the crop improvement programs. Limited information on large germplasm collections in genebanks is one of the main reasons for low use of germplasm. Efficient and judicious utilization in crop improvement programs is one of the aims of the ICRISAT genebank. Core collections (~ 10% of the entire collection) and mini core collections (~1% of the entire collection) have been suggested as a gateway to enhanced utilization of germplasm, through efficient and economic multi-location evaluations to identify trait-specific genetically diverse accessions that can be used to develop desirable cultivars with a broad genetic base (Upadhyaya and Ortiz, 2001). At ICRISAT, core and mini core collections have been developed for all its mandate crops and a few of the small millets. These have been evaluated and trait-specific sources identified for resistance to biotic and abiotic stresses, and for molecular mapping to identify new genes (reviewed in Upadhyaya et al., 2009). Molecular characterization of germplasm sets that include core or mini core collections, have helped in understanding genetic diversity of crops.

In a world of expanding populations, shifts in pest and disease scenarios due to climate change, growing resource scarcity and financial and social turmoil, the sustainable use of genetic resources has never been more important, and offered greater opportunities, than now. The adverse impact of climate change, ironically, will be greater on the very resource-poor people of marginal agricultural regions of the world. Climate change is considered to be the one of the main factors reducing biodiversity by the end of this century. The IPCC estimates that 20-30% of all species are likely to be exposed to a higher risk of extinction with a temperature rise exceeding 2-3 °C, resulting in substantial changes in ecosystem composition and functions. Biodiversity is the key component for adaptation of agriculture to future climate changes. There is a recognized need to strengthen international initiatives in agriculture for the sustainable use of biodiversity for food security. For example, CGRFA (The Commission on Genetic resources for Food and Agriculture), GIPB (Global Partnership Initiative for Plant Breeding Capacity Building), and GCDT (The Global Crop Diversity Trust) are some of the platforms at international level dealing with issues related to diversity and conservation of PGR. The establishment of Svalbard Global Seed Vault is an excellent example of international efforts to preserve world's crop diversity. ICRISAT has committed to safely duplicate its collection at the Svalbard Global Seed Vault.

PGR provide the biological underpinning for agriculture and food production. The link between conservation and use must be strengthened through the use of available International public goods (IPG) such as mini core collections, and through pre-breeding. Exploiting this potential requires an integrated approach that encompasses all relevant stakeholders, ranging from farmers to researchers to genebank managers, to develop mechanisms that will enable future farming systems to adapt to changes, such as a warmer planet, and thus would play an important role in achieving the global objective of food security, poverty alleviation and sustaining agriculture and environment in the future.

References

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