

Management of Plant Genetic Resources Information in the Intellectual Property Regime: Some Issues and Strategies

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SUMMARY

Plant Genetic Resources (PGR) consists of the diversity of genetic material contained in traditional varieties and modern cultivars grown by farmers, as well as wild relatives of crops and other wild plant species that can be used for food, feed, fibre, clothing, shelter, wood/timber, energy, etc. One of the major challenges for food security in the next generation is the effective management of PGR worldwide. Thus, documentation of PGR becomes very important at the national, regional and global levels for effective conservation of rapidly disappearing genetic stocks for possible future use and also for immediate utilization of already conserved and evaluated/characterized germplasm in the on-going crop improvement programmes. The documentation of information related to PGR is now having greater importance as India is a party to the Convention on Biological Diversity (CBD) and is also a signatory of the International Treaty on PGR for Food and Agriculture (ITPGRFA). The Global Plan of Action (GPA) represents an important contribution to the implementation of the CBD in the field of food and agriculture and it is one of the supporting elements of the ITPGRFA.

A network of National Information Sharing Mechanism (NISM) for PGR involving 114 stakeholders in India was initiated during the year 2005-06 to facilitate the actions required to be accomplished under the GPA. Many more initiatives have been taken in this regard by National Bureau of Plant Genetic Resources (NBPGR). In the present article, the sharing of PGR information under the international treaties has been discussed and reviewed.

Key words: Plant Genetic Resources, Information System, Convention on Biological Diversity, Global Plan of Action, International Treaty on Plant Genetic Resources.

1. INTRODUCTION

During the process of development of agriculture, human have identified, selected, tended and utilized the variation among and within plant species for food and other needs. This tangible diversity in plants has been recognized as an economic resource, similar to other natural resources as soil, water, oil and minerals and has been called as Plant Genetic Resource (PGR). PGR are defined as genetic material of plants which is of value for present and future generations of human beings and include total genetic diversity found among and within plant species (Dhillon and Agrawal 2004). This enormous diversity generated over the years helps in ensuring food security and provide a protection against future threats,

adversity and ecological changes. Traditionally, PGR include primitive forms, farmers' varieties, landraces, obsolete cultivars, modern cultivars, breeding lines and genetic stocks, wild and other related species. A subset of PGR are the plant genetic resources for food and agriculture (PGRFA) which is the diversity contained in traditional crop varieties, modern cultivars, crop wild relatives and other wild plants used for food, medicine, feed for domestic animals, fibre, clothing, shelter and energy. The PGRFA exclude the plants used for pharmaceuticals and other industrial products. Importantly, there is much greater inter-dependence among countries for PGRFA than for any other kind of biodiversity, and they are not distributed evenly throughout the world.

The effective management and sustainable utilization of PGRFA is of paramount importance for long-term security of mankind. In the past century, more than 90% of crop varieties have been lost from farmers' fields due to various reasons (ITDG 2001). Urgent actions are needed to reverse this trend. Also, there is a need to implement actions to protect the genetic resources stored in *ex situ* public genebanks, which are often poorly maintained. Threats to these resources, both *in situ* and *ex situ*, is further compounded by the advent of genetically modified organisms and the increasing use of intellectual property rights (IPRs) to claim sole ownership over varieties, breeds and genes, which thereby restricts free and easy access. In the past, open access to PGR across nations, have provided enormous economic benefits in the form of food, medicines and industrial products; but concerns are now expressed, both about the risks of extinction, and about future conditions of access.

There is an urgent need for effective management of PGRFA on a global level, to quantify its loss, and develop strategies for conserving and using it. By inventorizing and monitoring diversity, it would be possible to maintain or even enhance the quality of human life. Good managers and policy-makers know that their best decisions are based on results from the most accurate scientific analyses. Such analyses are based on solid, documentable data that have been recorded directly from the observation of nature. Such records are called 'primary' data. A large part of the primary data and observations are recorded by various means and stored in various media. In making choices for policy and management of living resources, decision-makers are often forced to rely on analyses that are not based on primary data. This is because the world's store of primary data about biodiversity is scattered, and not readily and easily accessible, at present. Modern opportunities in information technology have greatly expanded the possibilities for collating and analyzing the vast data related to organisms, and to make that information broadly available (Agrawal and Burman 2002, Agrawal 2004, Agrawal and Pudota 2006, Agrawal *et al.* 2007). In fact, the amount of information is simply too great to be organized logically in any other way than to use computers and databases. A global information mechanism is developed by putting information in a common way into electronic databases available on the web so that everybody can contribute to it and also draw from it.

2. INTERNATIONAL TREATIES AND AGREEMENTS RELATED TO PGR

The growing concern over the loss of biological diversity inspired negotiations for the first legally-binding instrument in 1992. The Convention on Biological Diversity (CBD), the first global agreement on the conservation and sustainable use of biodiversity, was adopted at the Earth Summit of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. The legally binding Convention entered into force on 29 December 1993 after ratification by 180 parties. The CBD recognized that the future food security lies in those regions of the tropics and subtropics that are centers of crop genetic diversity, and that internationally-held collection of seeds in genebanks are the one of the defences against environmental change. The CBD provides a broad framework for member states' policies concerning access to PGR and development and transfer of technologies. Further, it acknowledges the necessity for all parties to recognize and protect IPR in this field (Dhillon and Agrawal 2004).

In June 1996 in the Fourth International Technical Conference on Plant Genetic Resources for Food and Agriculture (PGRFA) of Food and Agricultural Organization (FAO) of the United Nations the most important meeting on agricultural biodiversity ever, was held in Leipzig, Germany. The Leipzig Conference adopted the first-ever Global Plan of Action (GPA) for the conservation and sustainable utilization of PGRFA for enhanced world food security and socio-economic development, reduced poverty, and more sustainable agricultural systems. The GPA represents the input of 158 countries, scientific experts and NGOs, and the synthesis of over 2000 recommendations resulting from regional meetings and country reports. It identified 20 priority programmes for securing and better utilizing of PGRFA as a basis for global food security. The Leipzig Conference also considered the FAO Report on the State of the World's Plant Genetic Resources, based on reports submitted by the countries. This document provides the first comprehensive assessment of the status of PGR and existing capacity to conserve and utilize them.

On 29 June 2004 the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) came into force. The Treaty ensures that PGRFA, which are vital for human survival, are conserved and sustainably

used and that benefits from their use are equitably and fairly distributed. Till date, 54 countries including India, have ratified the Treaty representing a broad range of both developing and industrialized countries. The Treaty signifies the wide international commitment that both traditional and modern technologies should serve humanity, in particular to alleviate hunger and promote sustainable development in developing countries. This is a unique comprehensive legally binding International Treaty, considering needs of farmers and plant breeders and aims to guarantee the future availability of the diversity of PGRFA. The Treaty provides a framework to ensure access to PGRFA, and to related knowledge, technologies, and international agreed funding. The Treaty covers all PGR of importance to agriculture, but for some 35 key food crops and 29 forage species it establishes a unique Multilateral System of Access and Benefit-sharing. Benefits are to be shared through information exchange, technology transfer, capacity building and the mandatory sharing of the profits of commercialisation.

3. GLOBAL INFORMATION SYSTEM FOR PGRFA

One of the key points of the ITPGRFA is the reference to the development of a mechanism to disseminate information on PGRFA. In particular, Article 17 includes the following provisions:

- 17.1 The Contracting Parties shall cooperate to develop and strengthen a global information system to facilitate the exchange of information, based on existing information systems, on scientific, technical and environmental matters related to PGRFA, with the expectation that such exchange of information will contribute to the sharing of benefits by making information on PGRFA available to all Contracting Parties. In developing the Global Information System, cooperation will be sought with the Clearing House Mechanism of the Convention on Biological Diversity.
- 17.2 Based on notification by the Contracting Parties, early warning should be provided about hazards that threaten the efficient maintenance of PGRFA, with a view to safeguarding the material.
- 17.3 The Contracting Parties shall cooperate with the Commission on Genetic Resources for Food and Agriculture of the FAO in its periodic reassessment

of the state of the world's PGRFA in order to facilitate the updating of the rolling Global Plan of Action referred to in Article 14.

In addition, Articles 5 and 6 of the ITPGRFA spell out the commitments of Contracting Parties to ensure an integrated approach to the exploration, conservation and sustainable use of PGRFA. Such commitments, which widely reflect the 20 priority activity areas of the GPA, together with those related to the establishment of, and participation in the Multilateral System of Access and Benefit-Sharing (Part III of the Treaty) have direct implications with respect to information handling and exchange.

Article 13.2(a) indicates the type of information to be exchanged among the Parties, as part of the benefit-sharing arising under the mechanism of the Multilateral System including, 'catalogues and inventories, information on technologies, results of technical, scientific and socio-economic research, including characterization, evaluation and utilization'. A Global Information System for PGRFA through the effective and open sharing of information will facilitate access to and sustainable use of PGRFA, exchange of material and the sharing of benefits.

Building a Global Information System under the terms of the Treaty requires an inventory of existing relevant information systems, including some data mapping, and the identification of the organizations that manage these systems. In addition, sound design and development of a Global Information System requires analysis to determine:

- (i) the primary users of a Global Information System
- (ii) the user's requirements of the System
- (iii) the range of anticipated functions of the System

3.1 Primary Users of a Global Information System

The primary users and beneficiaries of a Global Information System on PGRFA are many and diverse, and would include:

- nominated officials (focal points) responsible for PGRFA issues in a particular country
- policy makers and scientific and technical services in agriculture, education, natural resources, environment and other sectors

- agricultural development agencies and other civil society organizations
- collection managers and curators, plant breeders, farmers and gardeners
- other researchers working in the field of genetic resources
- the general public/consumers

3.2 User's Requirements of a Global Information System

In terms of user requirements, the following should be taken into consideration to assist the effective implementation of the ITPGRFA.

- (a) Providing information on PGRFA and agricultural biodiversity, *inter alia* for conservation, plant breeding, broadening the genetic base of crop and increasing the range of genetic diversity available to farmers.
- (b) Facilitating the exchange of information on scientific, technical and environmental matters related to PGRFA for benefit of all contracting parties, not least through improved accessibility to PGRFA cross-cutting issues addressed in both structured and unstructured information (i.e. in databases and publications, respectively).
- (c) Early warning of depletion/erosion of PGRFA. Article 17.2 of the Treaty specifically mentions provision of early warning of threats to the efficient maintenance of PGRFA.

3.3 The Range of Anticipated Functions of the System

User requirements could be facilitated through a range of anticipated functions of the system including:

- retrieving information on specific thematic areas
- downloading documents and data-sets for conducting local analyses
- uploading documents and data-sets for publishing results of PGRFA research and development
- accessing guidelines and methodologies
- downloading tools for PGRFA information management, risk analysis or project formulation

4. GLOBAL PLAN OF ACTION: PARTICIPATION OF INDIA

The GPA is essentially a country-driven process and countries which have adopted the GPA are required to take actions within the framework of the defined priority areas (Table 1), depending on their capacity and also on the status of PGRFA management. There is also a need to monitor these actions under the FAO system. Thus, an FAO project, funded by Government of Japan (GCP/RAS/186/JPN), has been implemented in seven countries namely India, Thailand, Philippines, Vietnam, Sri Lanka, Malaysia and Bangladesh. In India, the project was implemented during 2005. It aims to promote the implementation of the 20 priority activities of the GPA mentioned above for the conservation and sustainable utilization of PGRFA, and to contribute to the establishment of a continuing monitoring framework of the GPA implementation at national level. This was envisaged to be achieved through (Agrawal *et al.* 2006):

- (a) A thorough assessment of the present status of PGRFA in the country and the region for the identification of needs and effective strategies for conservation and utilization of PGRFA
- (b) the establishment of a National Information Sharing Mechanism (NISM) on the GPA Implementation to enhance coordination of plans and activities on conservation and utilization of PGRFA amongst stakeholders and for achieving the objective (a)
- (c) capacity building and training for National PGRFA Programmes
- (d) sharing of experiences in PGRFA *in situ* conservation and on-farm management
- (e) the improvement of regional cooperation

4.1 New Monitoring Approach of GPA

The GPA project commenced activities in June 2003 at FAO. At that time, the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA) was considering a new approach for monitoring the GPA implementation being developed by FAO, with inputs from Bioversity International, in line with recommendations made by the Inter-governmental Technical Working Group on PGRFA of the Commission in 2001. The new approach implied a country-driven, participatory and capacity building process, which culminates with the

Table 1. Priority activity areas of GPA

<i>In situ</i> Conservation and Development	
1.	Survey and inventory of PGRFA
2.	Supporting on-farm management and improvement of PGRFA
3.	Assisting farmers in disaster situations to restore agricultural systems wild crop relatives and wild food
4.	Promoting <i>in situ</i> conservation of plants
<i>Ex situ</i> Conservation	
5.	Sustaining existing <i>ex situ</i> collections
6.	Regenerating threatened <i>ex situ</i> accessions
7.	Supporting planned and targeted collecting of PGRFA
8.	Expanding <i>ex situ</i> activities for non-orthodox seed and minor crops
Utilization of Plant Genetic Resources	
9.	Expanding the characterization, evaluation and number of core collections
10.	Increasing genetic enhancement and base-broadening efforts
11.	Promoting sustainable agriculture through diversification of crop production and broader diversity in crops
12.	Promoting development and commercialization of under-utilized crops and species
13.	Supporting seed production distribution
14.	Developing new markets for local varieties and promoting public awareness of diversity-rich products
Institutions and Capacity Building	
15.	Building strong national programmes
16.	Promoting networks for PGRFA
17.	Constructing comprehensive information systems for PGRFA
18.	Developing monitoring and early warning systems
19.	Expanding and improving PGRFA education and training
20.	Promoting public awareness

establishment of a National Information Sharing Mechanism (NISM) on the implementation of the GPA. It is based on a set of internationally agreed indicators and a reporting format for monitoring the GPA implementation, and an information system developed to facilitate and simplify recording, processing, analysis and sharing of the information addressed by the indicators and the reporting format. The indicators and the reporting format were developed in consultation with an expert group at a meeting convened by FAO and Bioversity International.

The main objectives of the new monitoring approach of GPA are to improve countries' capacities to manage

information on PGRFA; allow meaningful analysis of gaps and priorities; improve decision-making on and planning of available resources; build stronger partnerships among stakeholders in the management of PGRFA within each country.

The process for applying the new monitoring approach and establishing the NISM for the Implementation of the GPA requires the involvement of as wide a range as possible of stakeholders of PGRFA from across the different government departments and ministries, research and educational institutions, private sectors, NGOs and international organizations in the country. Through this participatory process, all

stakeholders were called to contribute to the establishment of the NISM with their own information, experience and perspectives.

Information that was gathered and compiled under the NISM, provided for a thorough assessment of the state of PGRFA in the country and for the identification of needs and priorities on PGRFA activities. Furthermore, the information gathered through the same processes in the different countries in the region and around the world would allow a better analysis of the status of PGRFA on a regional and global scale, based on the need assessment of the countries involved. Thus, country-driven national, regional and global strategies for *in situ* conservation and development, *ex situ* conservation, utilization and institution and capacity building would be properly addressed and developed through NISM.

4.2 Monitoring of GPA in India

The process for the establishment of the NISM in India began in 2004 through a letter of agreement, which was signed between Department of Agriculture and Co-operation (DAC), Government of India and the FAO Regional Office at Bangkok (Agrawal *et al.* 2006). All activities foreseen under this agreement were coordinated by the National Bureau of Plant Genetic Resources (NBPGR), New Delhi, an organization under the Indian Council of Agricultural Research (ICAR) that serves as a nodal institute for PGR activities. The NBPGR was designated as the focal point for the implementation of GPA in India with the following responsibilities:

- To report on the GPA implementation to the CGRFA
- Coordinating and facilitating in-country activities of information exchange and presenting reports at national, regional, and international levels
- Initiating, organizing and directing the involvement of stakeholders
- Revising and completing the common tables in the computer application, to be used as reference information by stakeholders to facilitate data entry
- Organizing in-country stakeholders' meetings
- Assisting and guiding the stakeholders in the participatory data sharing process

- Distributing the Computer Application and all relevant documents to the stakeholders participating in the NISM on GPA implementation
- Compiling the information received by the stakeholders

4.3 The Role of Stakeholders in India

Stakeholders as defined by FAO are the institutions, organizations or individuals that, either directly or indirectly, participate to the definition and implementation of the National Programme on PGRFA. Stakeholders include governments, ministries of agriculture and of environment, genebanks, breeders and breeders' associations, seed producers, research and training institutions, rural associations, civil society organizations involved with and related to the conservation and utilization of PGRFA, and focal points of international conventions such as the CBD. The contribution of the stakeholders in India is as follows:

- Improving the effectiveness of the information gathering process
- Expanding the knowledge base on the conservation and utilization of PGRFA
- Generating support from institutions and political groups, and the public opinion in general
- Ensuring real ownership in the establishment and evolution of the NISM on GPA implementation and building awareness in the country

All activities which were coordinated by the NBPGR were divided in three distinct phases: (i) a preparatory phase, (ii) an implementation phase and (iii) a conclusion/reporting phase.

During the preparatory phase, work was focused on reviewing all materials, briefing and raising awareness of authorities and getting necessary permissions to undertake a collaborative information sharing process that includes the national PGR programme, the private sector, NGOs' and other public sector organizations and cross-ministerial collaboration. A committee of key stakeholders was formed to guide the GPA monitoring process and the Country Report preparation, and to identify stakeholders to be involved into this process. A total of 114 stakeholders were identified during the preparatory phase. The categories of the major

stakeholders along with their numbers are given in Table 2.

In the implementation phase a number of meetings and workshop were held to explain the process and build capacity of stakeholders in the use of the computer application for gathering information. Direct technical assistance to stakeholders was also provided during this phase.

Table 2. Category wise list of stakeholders

Category	Number
Indian Council of Agricultural Research (ICAR)	58
Non-Governmental Organization (NGO)/ Private	5
State Universities of Agricultural Research	29
Council for Scientific and Industrial Research (CSIR)	2
Ministry of Environment and Forest (MoEF)	2
State Department of Agriculture	16
Consultative Group on International Agricultural Research (International Crop Research Institute for Semi-Arid Tropics)	1
Ministry of Commerce	1
Total	114

During the conclusion/reporting phase, data gathered from stakeholders were analyzed and two reports were produced and discussed with participating stakeholders. A website describing the mechanism and including a database search engine was developed and made available to the users. Compact discs including the complete database of the mechanism were produced and distributed to the stakeholders involved in the process.

The NISM on implementation of the GPA has been very useful in bringing all the institutes involved in PGR related activities under a common platform, thereby generating a comprehensive information on PGR work in India. The information gathered could be used for effective planning of projects and identifying priority areas. It would also help to eliminate duplication in efforts of the various agencies. Gap identified in PGRFA activities are based on actual data and not on speculation. As part of awareness raising and strategic development,

policy makers in the country would be supplied with vital information on PGRFA. This would help to promote coherence and collaboration of work between different sectors, like, environment and agriculture. As much as possible the Implementation of the NISM should be strongly linked with other areas of national policy.

4.4 Use of Computer Application for Information Sharing

The FAO with collaboration of Bioversity International has developed and is delivering a multi-language Computer Application aimed as the information management tool to facilitate and simplify data recording, processing, analysis and sharing of the information addressed by the questionnaire to assist countries to monitor GPA implementation and establish the NISM. The application is serving to gather and exchange information between and among Stakeholders and the National Focal Point, which are the two types of active users taking part in this information sharing process. This application has been developed with license-free, open-source software.

Starting from the database of the National Mechanism, the National Focal Point identified and registered the Stakeholders who participated in the process. The information on the Common Tables was completed, as far as possible. Each stakeholder appropriately answered the questions related to the 20 priority activity areas of the GPA. Stakeholders then exported and returned to the National Focal Point their datasets, including answers to the questionnaire and modifications to the Common Tables. The National Focal Point then incorporated stakeholders' datasets into the database of the National Mechanism. The procedure of bringing together the different datasets provided by the stakeholders into the national database, which in the Computer Application is referred to as merging, represents perhaps the most critical phase of the entire process, therefore it required particular attention by the National Focal Point.

The following seven steps have been used in completing one iteration of data gathering, analysis and data sharing in India (Table 3).

Table 3. Steps for completing one iteration cycle of NISM

1.	Revise and complete the Common Tables
2.	Select and register participating Stakeholders
3.	Create and distribute the CD with the computer application and the updated Common Tables to the Stakeholders
4.	Answer the questions of the National Mechanism, and if necessary update the information in the Common Tables
5.	Export and send data to the NFP for merging
6.	Merge stakeholders' data and revise all answers
7.	Close the iteration and open a new one

5. CONCLUSION

The monitoring of the implementation of the GPA has highlighted the need for facilitating the exchange of data and information to ensure the conservation and sustainable utilization of PGRFA. The Global Information System on PGRFA, as foreseen in the Treaty, specifically addresses this need. Its development would involve at least two major exercises – (i) pooling of existing information systems and (ii) building capacity in information management. The effectiveness of pooling would depend on the ease of access to the corporate resources available to the end-user and would be greatly facilitated by the adoption of common basic standards. Individual information systems could be made available to the end-users by means of a Common Portal including a dynamic directory of information sources organized under appropriate thematic categories. Such a Common Portal could be set up and monitored under the guidance of an expert group to ensure that its form and function effectively meets current and evolving needs. Also individuals involved are not adequately trained in gathering, characterizing, evaluating, processing, storing, disseminating and exchanging information. The existence of the “digital divide” i.e. of the have’s and have-nots of access to the Internet was recognized as being a continuing impediment to access information in many parts of the developing world.

Capacity building is needed to remove these barriers to information. The existing infrastructures, which are sustained by local governments, offer opportunities for donor funded programmes on conservation and utilization

of PGRFA through institutional strengthening and human resource development programmes. As an alternative to the Internet, a Global Information System on PGRFA might explore how to offer other data delivery services, such as the provision of thematic data sets and documents extracted from existing information systems, *via* hard copies and/or CD ROMs.

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