

in the treatment of many cancers with greatly reduced morbidity and disfigurement. PDT can be applied before and after surgery, chemotherapy and or ionizing radiation therapy, and can be repeated many times. Also, the adjunctive use of PDT at the time of surgical removal of a primary tumour may aid in the elimination of residual microscopic metastases. Neeta Singh (AIIMS) depicted the attempt of her group to produce a human papillomavirus (HPV)-16 chimeric prophylactic cum-therapeutic vaccine. The high-risk HPV-16 and -18 types account for approximately 70% of cervical cancer in women. Hence, discovering appropriate vaccines would be a major contribution for prevention and treatment of cervical cancer. M. C. Pant (King George's Medical University, Lucknow) expressed his views on

the future prospects of cancer treatment involving molecular targeted therapy that could be achieved by targeting the cancer cells with signal transduction inhibitors, proteasome inhibitors that prevent proteolysis of proteins affecting multiple signaling cascades, Cox-2 inhibitors that prevent malignant transformation, and vaccines, immunotherapy and gene therapy. D. C. Doval (RGCIRC) stated that besides conventional chemotherapy by taxanes, the current concept of using molecular markers has opened a new field of early prediction for breast cancer, which would certainly contribute to reduction of morbidity rate.

R. Kapoor (PGIMER) discussed various strategies of early detection and prevention of breast cancer involving self as well as clinical examination and mammo-

graphy. V. Singh (PGIMER) discussed the management of gall-bladder carcinoma by employing CT, biopsy/fine-needle aspiration cytology, cholecystectomy, endoscopic plastic/metal stenting. Kapil Kumar (RGCIRC) in his discussion on management of gall bladder cancer, mentioned the latest trends to explore the combination of gemcitabine/cisplatin in locally advanced gall-bladder cancer treatment.

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MEETING REPORT

Recognition and reward to the tribal and farming communities for conservation of agro-biodiversity*

India, in compliance with the requirement under the Trade Related aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO), enacted the Protection of Plant Varieties and Farmers' Rights Act (PPVFR Act) in 2001. TRIPS require Member countries of WTO to provide legal protection to plant varieties either by patents or by an effective *sui generis* system or a combination of both¹. Having India chosen not to grant patent to plants and animals and the parts thereof, including seeds, varieties and species under its Patent (Second Amendment)² of 2002, the *sui generis* system was the only national option for protection of plant varieties. The Intellectual Property Rights (IPR) available to plant varieties under the PPVFR Act is similar to the Plant Breeder's Right (PBR). This IPR confers exclusive right on the breeder or his/her successor, agent or licensee of a plant variety to produce,

sell, market, distribute, import or export the propagating material of the protected variety³. A plant variety, unlike a patentable non-biological innovation, is always generated from pre-existing varieties. All such pre-existing varieties in all cases are traceable to the land races and varieties evolved by farmers and the wild relatives conserved by them over hundreds of years. Thus, farmers are the immediate or distant contributors to the prior art associated with any new variety and this entitles them to the Farmers' Rights (FR). The FR were introduced by the Food and Agricultural Organization (FAO) of the United Nations to recognize the past, present and future contributions of farmers in all regions of the world, particularly in centres of origin and diversity, for conserving, improving and making available plant genetic resources for continued improvement of all crop plants⁴. The recent FAO Treaty on Plant Genetic Resources on Food and Agriculture defined FR as the rights to save, use, exchange and sell farm-saved seeds and other propagating materials, and to participate in decision-making regarding, and in the fair and equitable sharing of the benefits arising from, the use of plant genetic resources⁵.

In November 2005, the Government of India implemented certain sections of the PPVFR Act for the purpose of establishing the PPVFR Authority, which is competent to implement the PPVFR Act. This Authority, based in Delhi, is currently engaged in developing framework and regulations for implementation of the rest of the sections of the Act with progressive opening of different crop species for the purpose of registration. As part of this process, the PPVFR Authority along with M.S. Swaminathan Research Foundation (MSSRF), Chennai organized a multi-stakeholder national consultation on FR to develop guidelines for implementing the three important aspects of the FR provided in the Act. This consultation was held on 4 November 2006 and attended by about 85 participants from different regions of the country representing tribal communities, farmers, farmers' associations, panchayat representatives, non-governmental organizations, legal experts, scientists, officials from the Department of Agriculture associated with variety release, etc. M. S. Swaminathan (MSSRF) and S. Nagarajan (Chairman, PPVFR Authority) chaired the two sessions. Jeypore, Koraput district, Orissa was chosen as the venue of

*A report on the National Consultation on Farmers' Rights held in Jeypore, Koraput on 4 November 2006 under the auspices of Protection of Plant Varieties and Farmers' Rights Authority, Government of India and M.S. Swaminathan Research Foundation, Chennai.

this consultation in view of the importance of this region to the national agrobiodiversity, particularly for the rich rice genetic diversity in the Jeypore tract⁶. With many tribal communities of this region engaged in rice cultivation and conservation over several hundreds of years, Koraput eminently represents the dynamic interaction between cultural diversity and biological diversity on the one hand, and the richness of biodiversity and economic poverty on the other.

As reflected in its title, the PPVFR Act concurrently offers protection of plant varieties and FR. It also grants Researchers' Rights (RR). FR in this Act are dealt in a separate chapter with eight sections. These rights, a unique feature of this Act, are of nine kinds and relate to the multiple roles of a farmer as cultivator, conservator and breeder⁷. Three of these rights were the agenda of the national consultation. First is on the recognition and reward to a farmer/farm community for significant contributions to the conservation of land races and wild relatives of economic plants and their improvement through selection and value addition with knowledge on their useful traits. Second is on the procedure for the registration of farmers' varieties. Third is on the financial compensation entitled to farm families when the seeds of a registered plant variety they had procured had not performed on the lines claimed by the concerned public/private sector agency.

An invaluable contribution of farmers, which has profound importance for the global, regional and national food and nutritional security is their past, present and future role in conservation of plant genetic resources and their continuous improvement by cultivation and selection. The preamble to the Act calls for recognition to the contributions of farm families to crop improvement made at any time. Further, the Act provides for specific recognition and reward from the National Gene Fund to farmers engaged in the conservation of land races and wild relatives of economic plants and their improvement through selection⁸. The Act suggests criteria like contribution of conserved genetic resources as source of genes in varieties registrable under this Act. The National Gene Fund under this Act is constituted largely with grants from the Government of India⁹.

Farmers' variety, which is defined in the Act as the variety traditionally cultivated and evolved by the farmers in their fields, is eligible for registration and se-

curing the PBR¹⁰. Registration of these varieties is allowed on satisfaction of the criteria of distinctiveness, uniformity and stability (DUS)¹¹. Application for registration of farmers' variety is to be filed within three years from the date of notification of the concerned species by the PPVFR Authority for the purpose of registration¹². Farmers are also allowed to register new plant varieties.

Agrobiodiversity centres like the Koraput region, Orissa, where tribal families have preserved and improved rice genetic material over many centuries, need to be protected from genetic erosion. Tribal families who have conserved important genetic material for public good at personal cost deserve recognition and reward.

Seeds of varieties are usually sold to farmers with a claim on their agronomic performance or other economic attributes, which normally are realizable under certain levels of management. In this context, this Act seeks to discourage unrealizable claim on seeds with a provision that seeds of a registered variety have to be sold to farmers along with disclosure on their expected performance under the given conditions, and the breeder of a variety shall be liable to pay due compensation to the farmers if such claims fail to materialize under specified conditions of production leading to economic loss to farmers¹³. The PPVFR Authority exercises the admissibility, determination and award of compensation. The awarded compensation is to be paid by the breeder to the farmer. The Rules on this provision prescribe the procedure for filing application for compensation by the farmers¹⁴.

This one-day consultative meeting on three FR resulted in a set of recommendations called as 'Koraput Declaration on Farmers' Rights', providing guidance to the PPVFR Authority for developing guidelines on the implementation of these rights.

For determination of recognition and reward to the farmer or community, it is recommended that the role played by the land races and cultivars developed and conserved by them for contributing specific characteristics to the improved varieties either in the public or private sector should be an important criterion. It is well known that many agronomically critical and economically important genes to the modern improved varieties have been drawn from the land races, farmers' varieties and wild species. For example, Bikaneri Nerma, a farmers' cotton variety, is widely in the

pedigree of several cotton hybrids, including *Bt*-cotton hybrids. Similarly, the wild relative of rice, *Oryza nivara*, conserved in eastern UP, is the known donor for resistance to grassy stunt virus. The recognition can include conferment of titles to individuals/communities for undertaking conservation over a long period. The reward may include substantial monetary award determined on the basis of contribution of critical genes, extent of diversity and prolonged conservation at personal/community cost. The Consultation viewed that the cases of individual farmers conserving many land races and causing their improvement are rare and these roles are largely played by the community, and hence promotion of conservation be given emphasis at the community level. The communities may be ensured to use such award for common causes associated with *in situ* on-farm conservation of land races and wild species, and strengthening capacity related thereto. It is also important to take care on the gendered inclusiveness of the recognition and reward. The Authority should provide specific budgetary provision for recognition and reward, or earmark funds for the same in the National Gene Fund. Rich agro-biodiversity regions like Koraput, Orissa, where tribal families have been preserving and improving several hundreds of rice varieties over centuries deserves recognition and reward. Immediate intervention to promote on-farm conservation of large genetic diversity of important food crops at private cost by communities for public good is needed to reverse genetic erosion. It is recommended that the Government of India may provide an initial grant of Rs 5 crores during 2006–07 and a total of Rs 50 crores during the XI Plan to support the budget head on recognition.

Discussion on the registration of existing and new varieties developed or conserved by farmers, called for the relevant guidelines adhering to the letter and spirit of the Act in this regard. For the purpose of registration, the extant variety, which also includes farmers' variety, is required to satisfy the criteria on distinctness, uniformity and stability¹¹. Here, clarity on germplasm, land races and farmers' varieties assumes importance. Extant varieties include many thousands of released, public domain and farmers' varieties. While registration of all these varieties could be cumbersome, it is important that those satisfying one or more of the following

four features are to be registered within the given time-frame in each crop¹²: (i) having known distinctness in one or more important biotic or abiotic attributes; (ii) having widely known and definable economic attribute other than biotic/abiotic resistance, such as nutritional quality in food crops and industrial quality in commercial crops; (iii) possessing unique characteristics uncommon in a given crop germplasm, such as medicinal property and shelf life, and (iv) variety known for high adaptability to specific ecosystems or growing conditions as illustrated by SR-26 B, Pokkali, and Basmati 370 rice, Saathi maize, Kharchia wheat and Bikaneri Nerma cotton. The Consultation also wanted to ensure registration of all extant varieties, whether bred by farmers or professional breeders, which occupy a sizeable area and make contributions to food and income security. The Consultation recognized the need to provide qualified assistance to the tribal and farming communities in filing application for registration of their varieties. Immediate initiative from PPVFR Authority to impart the required training to rural institutions such as Krishi Vigyan Kendras (KVKs), Panchayat-level Biodiversity Management Committees and selected NGOs on identification and registration of farmers' varieties is recommended.

Deliberating on the third agenda item on granting compensation to farmers, the Consultation affirmed the necessity of breeders disclosing the specified growing conditions and expected performance of varieties protected for intellectual property rights. Using this disclosure as the benchmark, a procedure for claiming compensation, its determination and expedited, hassle-free grant to eligible farmers has to be framed. Need for such safeguard is gaining increasing importance in the context of seeds like *Bt*-cotton being sold at high prices, and cultivation of such crops involves huge cost. When such varieties fail to deliver the performance claimed by the breeders, it causes economic hardship to farmers, particularly the poor marginal ones and in the rain-fed region having low capacity to cope to such losses. The positive aspect of this compensation provision is that it will promote fair practices in seed trade. This provision has also to be incorporated in the Seeds Bill before Parliament. It is recommended that either the PPVFR Authority independently assesses and certifies the agronomic performance and the appropriate

agro-climatic regime and farming practices required to realize the agronomic potential, or ensures that these aspects are clearly declared by the breeder and displayed in vernacular on every seed packet. Information on the potential benefits and risks associated with the variety also should be given on the seed packets. Wherever there is a failure of the seed to provide the declared performance under recommended management or on grounds beyond the control of the farmer, the Authority shall ensure payment of compensation by the breeder/breeding institution or company at a rate not less than ten times the value of the seed. Cancellation of registration for providing falsified disclosure, as provided in the Act, should be effectively enforced.

The Consultation noted the uniqueness of the PPVFR Act in granting different FR and urged the PPVFR Authority to effectively implement all provisions. To this end, the Consultation recognized the importance of functional autonomy to the Authority, particularly in assisting the registration of farmers' varieties. In this context, the necessity of setting up an autonomous National Institute for Plant Variety Testing under the Authority is stressed. This institute should function on a hub-and-spokes model, with the hub located at an appropriate central location and the spokes at major agroecological and agroclimatic regions. Similar autonomous testing of varieties is common in industrialized countries. For example, the Netherlands has the National Institute for Variety Testing at Wageningen, and UK has the National Institute of Agricultural Botany at Cambridge. The proposed institute in India will provide the required impartial, credible and transparent variety testing free from the influence of research institutions, which will be applicants to variety registration. It should also be made responsible to develop and maintain a computerized database on all varieties released under the Seed Act of 1966, and all farmers' varieties. The Government of India is hence requested to provide Rs 100 crores during the XI Plan for establishing such an institute to support the PPVFR Authority.

The PPVFR Act has provided for constituting the National Gene Fund under the PPVFR Authority with a grant from the Government of India to support and promote agro-biodiversity conservation. In view of the accelerated genetic erosion agro-biodiversity during the last few

decades, there is an urgency to put the National Gene Fund in action. Recognition and reward system is one of the approaches for promoting conservation. However, sustainable conservation cannot happen without creating an economic stake in conservation, without promoting the underlying linkage between cultural diversity and biodiversity, and without assigning social prestige to primary conservers, who are often women. It is hence recommended that the Government of India provide Rs 10 crores as an initial contribution to the National Gene Fund during 2007–08, along with a total government provision of Rs 100 crores during the XI Plan to support conservation of agro-biodiversity as envisaged under this Act.

Realization of the full benefits from the FR provided in the Act and the objectives of creating and operating the National Gene Fund demand wider awareness on this Act among the stakeholders, in particular, the farming communities and grass roots institutions. The Consultation, therefore, urged the PPVFR Authority to launch a 'National Genetic and Legal Literacy Movement' with the help of NGOs and other agencies such as farmers' clubs, KVKs, etc. on the provisions of the Act relating to the triple role of farmers – as cultivators, conservers and breeders. This movement may also be latched up with the Gyan Chaupal system linked to the Common Service Centre Programme of the Department of Information and Technology, Government of India, as well as the formal information channels like visual and print media, depending on the reach to rural households.

Contributions of farmers in the development of popular varieties are higher in horticultural crops. The excellent varieties and grafts evolved by farmers in Crossandra, rose, cadomom and citrus was explained by the farmer-participants. They are better equipped to evolve new varieties in these crops and wanted the PPVFR Authority to provide them the earliest opportunity to register their varieties. Moreover, India is the home of mango, citrus, banana and other fruit trees, in which farmers play a major role in conservation and improvement of genetic diversity. Therefore, inclusion of selected fruit, vegetable and floricultural crop species for registration should receive high priority. Contributions of farmer-breeders in the conservation and improvement of horticultural crops need recognition and reward.

Finally, the participants recommended that the guidelines on implementation of this Act should adequately be gender-sensitized with special consideration to female-headed households and women's role in community conservation. The important role of women farmers in conservation demands adequate inclusiveness in the recognition and reward, and other National Gene Fund-based conservation promotion activities.

1. Section 27.3(b) of Trade Related aspects of Intellectual Property Rights require Member countries to provide protection to plant varieties either by patents or by an effective system of *sui generis* or by a combination thereof.
2. Section 4(j) of the Second Patent (Amendment) Act, 2002 declaring plants and ani-

mals and parts thereof as non-patentable subject.

3. Section 28 of the Protection of Plant Variety and Farmers' Rights Act, 2001.
4. FAO Conference Resolution 9/83; <http://www.fao.org/ag/cgrfa/default.htm>
5. The International Treaty on Plant Genetic Resources for Food and Agriculture, adopted by the 31st Session of the Conference of the Food and Agricultural Organization, UN, Rome, 3 November 2001, p. 45.
6. Govindaswamy, S. and Krishnamurthy, A., *Rice Newsl.*, 1958, **6**, 22–24.
7. Bala Ravi, S., *Manual on Farmers' Rights*, M.S. Swaminathan Research Foundation, Chennai, 2004, p. 80.
8. Section 39(1)(iii) of the Protection of Plant Variety and Farmers' Rights Act, 2001.
9. Section 45(1) of the Protection of Plant Variety and Farmers' Rights Act, 2001.

10. Sections 14(c) and 39(1)(i) of the Protection of Plant Variety and Farmers' Rights Act, 2001.
11. Sections 2(j)(ii) and 15(2) of the Protection of Plant Variety and Farmers' Rights Act, 2001.
12. Rule number 24(1) of the Protection of Plant Variety and Farmers' Rights Act, 2001.
13. Section 39(2) of the Protection of Plant Variety and Farmers' Rights Act, 2001.
14. Rule number 66 of the Protection of Plant Variety and Farmers' Rights Act, 2001.

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RESEARCH NEWS

Are 'secondary building units' the true building blocks in crystal engineering of coordination polymers?

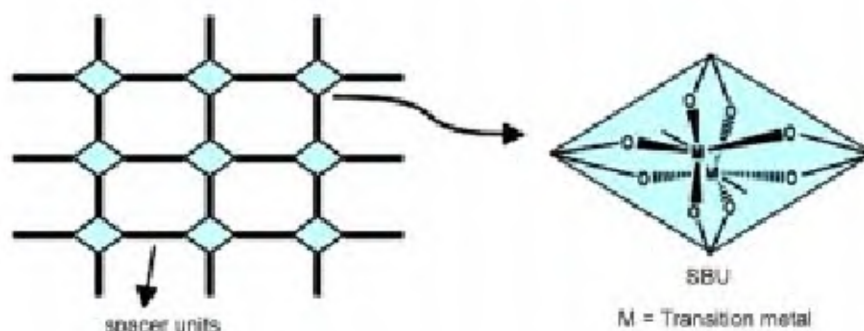
Kumar Biradha

Crystal engineering of coordination polymers/metal organic frameworks (MOFs) is a burgeoning field of research due to the interesting applications of these compounds in areas as diverse as gas adsorption, separation, host-guest chemistry, optics, magnetism, catalysis and photoluminescence¹⁻⁴. Among all these, porosity is the most explored and targeted property of these materials in view of the possible importance of hydrogen gas-based economy in future decades. In fact, MOFs are considered as rival candidates to zeolites due to their excellent porous properties (Scheme 1). The structural characteristics of MOFs offer unprecedented advantages in the fine-tuning of shapes and sizes of the channels and also the network connectivity. Further, they offer control over the chemistry of the channels due to ease in the introduction of various functional groups which can act as active sites for catalysis and sorption. The term 'hybrid materials' is also in regular usage to describe those MOFs which range from organic polymers bear-

ing inorganic bridges to organically grafted inorganic materials^{1,5}.

Despite plethora of recent literature on MOFs, prediction of framework geometries for a given ligand and transition metal still remains elusive⁶. Further, almost no attention has been paid towards the mechanism of formation of MOFs as crystalline materials. Crystallization of

these materials from solution raises some fascinating but so far unanswered questions: What is the true building block of the framework? Is there a limit to the size of a building block in solution? Is it possible to predict chemical building blocks which, through an iterative self-assembling process, will lead to higher-dimensional frameworks with complete



Scheme 1. Part of the two-dimensional coordination polymer built with 1,4-benzene dicarboxylate spacer and the SBU (paddlewheel cluster).