

## Genetically modified seeds\*

In 2006, the plant biotechnology industry completed a decade of existence. On surveying the R&D, socio-economic impact, and IPR issues related to plant biotechnology industrial products, it was found that R&D on genetically modified (GM) seeds dominated this era of plant biotechnology. It was also found that products of GM technology were too few compared to other biotech industries. The technology was also not fully developed in many cases. Besides, there is a lot of confusion and conflicting views regarding GM seeds among those concerned, which needs to be addressed. In order to analyse the R&D results obtained so far on different kinds of GM seeds and other related issues (socio-economic parameters, IPR and ethical issues), a two-day conference on GM seeds was recently organized. The conference was attended by 200 delegates and guests. Participants represented Agricultural Universities, State Agricultural Departments, and Agricultural Biotech Industry, West Bengal State Agricultural Commission, farmers' representatives, NGOs, etc.

In the session 'GM seeds: Costs versus benefits', P. G. Chengappa (University of Agricultural Sciences, Bangalore) spoke on 'Agri-biotech in India: Economics and policy implications'. His talk covered integration of biotechnology alternative to chemical-based industry, potential benefits associated with GM crops, status of GM crops in India, major policy issues in agricultural biotechnology, biosafety, food safety, environment safety, and regulatory frameworks. According to him, transgenic foods may affect the environment adversely, as well as biodiversity. He also discussed about obstacles to the introduction of new agriculturally related biotechnological products in the future, like high R&D costs, high costs for regulatory approval, intellectual property restrictions, low margins on commodity

crops, and small markets with minor crops. Chengappa concluded his speech by mentioning that ultimately it is the consumer sovereignty driving food system that is important.

Raju Barwale (Mahyco Seeds Limited, Mumbai) spoke on 'Food, agriculture and biotechnology'. The contribution of agriculture to the national economy has been constantly declining from 45.2% to 21% during 2005–06. The increase in population, improvement in national economy and subsequent impact on increasing per capita income is leading to changes in the quantity and quality of food required in the coming years, Barwale remarked. The challenge is to increase productivity in the scenario of reducing/stagnant resources of land and water, and significant losses caused due to biotic and abiotic stresses. The first step is to improve productivity. This can be done by eliminating the above losses and adopting newer techniques of hybridization, use of new plant types, etc. Development and application of such technologies need vigorous support from all sections of society, so that as a nation we can address our food, feed and nutritional needs. Such technologies offer an all-inclusive way of development farmer, trade, industry, etc., the speaker concluded. In the session 'Issue-management strategies', C. Kameswara Rao (Foundation for Biotechnology Awareness and Education, Bangalore) spoke on 'Biosecurity of genetically engineered crops'. Agricultural biotechnology, according to the speaker, aims at higher yield, biotic stress resistance, abiotic stress resistance, nutritional enhancement, and lowering inputs and cultivation costs. He also spoke about biotic and abiotic stress resistance, genetic engineering in agriculture, stability, pest specificity, biosafety of *Bt* proteins, impact of *Bt* proteins on non-target systems, etc.

A. Parida (M.S. Swaminathan Research Foundation (MSSRF), Chennai) spoke on 'Enhancing productivity of coastal agroecosystems'. According to him, improving or maintaining yield potential of crops under increased salinization is a challenge for the future. With a view to identify and isolate novel genetic

combinations offering resistance to coastal salinity, MSSRF has initiated work on mangrove species. Mangroves are salt-tolerant plant communities occupying the coastal estuarine regions of the tropics. MSSRF was the first to propose the concept that mangroves can be invaluable donors of breeding crop genotypes adapted to coastal salinity through recombinant DNA technology. Identification and isolation of novel genetic combinations with implications to abiotic stress were made from the widely distributed mangrove species, *Avicennia marina* and the wild rice *Porteresia coarctata*. Enriched gene libraries constructed from these two species are used for identification and isolation of stress-tolerant genes. Many novel genetic combinations have been identified, sequenced and characterized from these libraries, Parida stated. Efforts to identify unique genes in mangroves have also been made using large-scale genome sequencing and differential expression analysis. As many as 5000 partial gene sequences from mangroves have been deposited in worldwide databases. Some of the isolated genes from mangroves were characterized and analysed for their expression levels in varying saline conditions. Methodologies for construction of vectors for transformation and transformation systems have been established in tobacco, rice, black gram and mustard.

The speaker further stated that there is little knowledge in public domain about laboratory or field trials on GM seeds being carried out by seed producers in the agricultural biotech industry, Agricultural Universities, or State Agricultural Departments. In fact, it is possible that most of these trials have not been properly planned to yield reasonably good estimates of input costs and resulting benefits, as also the impacts on soil and other compartments of the environment, including humans and microorganisms. Also, results available from these trials have not been comprehensively analysed and that results of such analyses have not been properly interpreted. Only isolated and limited information on gross value added (value of output – cost of input) for GM crops relative to gross value

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added in the case of conventional seeds is available for *Bt* cotton cultivation, though the area under cultivation is considerable. It may be mentioned that GM seeds need more of fertilizers and less of pesticides. Regarding impact of GM technology on environment, particularly on soil health and water in the neighbour-

hood, no scientific report is available. Impact of GM foods on human health has not been studied as yet. All this implies that a lot of scientific experimentation and evaluation remains to be done before a final stand on GM technology can be adopted for commercial cultivation, nationally. Even in terms of the somewhat

prematurely set up regulatory bodies, most often there is no representation of expertise in planning of experiments and analysis and interpretation of results.

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## MEETING REPORT

# Coastal problems and mitigation measures including the effects of tsunami\*

A two-day Indo-Japan workshop on 'Coastal Problems and Mitigation Measures, including the Effects of Tsunami' was recently held at IIT Madras. About 60 engineers and scientists, including six from Japan, participated in the workshop. Twenty lectures dealing with coastal problems and mitigation measures, including the effects of tsunami were delivered in six technical sessions. A summary of the technical papers is as follows:

V. Sundar (IIT Madras) spoke on 'Protection against natural coastal hazards'. He noted that seawalls are the solutions to prevent high-value hinter-land development and protect amenity usage where other solutions are not suitable. Supply sediment to the affected areas, that reduces loads and increases the strength of the structures and bio-shielding are the other options. Another lecture was on 'Protection of Karikal coast from the sea water inundation' by R. Sundaravivelu (IIT Madras). Various protection measures have been experimented and a few – rubble mound seawalls, walls with box-type cross-section and sand-benching,

cantilever type of protection walls, sand bund with grass-topping, and training walls – are suggested for this coast.

T. Hiraishi (Port and Airport Research Institute, Japan) in his talk on 'Recent wave disaster and its mitigation', explained about large-scale (breakwaters) and small-scale (tidal barriers) mitigation tools which can be used to protect lives and property from natural hazards like the tsunami, storm surge and storm waves. K. Murali (IIT Madras) demonstrated the usefulness of mathematical models for prediction of tsunami propagation and landfall, so that stretches of coastline that are vulnerable would be identified and remedial measures taken. 'Lessons learnt from tsunami effects in reconstruction of houses and infrastructures along Tamil Nadu coast' was the topic of a lecture delivered by C. V. Sankar (Relief and Rehabilitation, Government of Tamil Nadu). He provided statistics regarding the lives and property lost in Tamil Nadu and the number of houses rebuilt by NGOs and the Tamil Nadu Government. In his opinion, retreat or 'building back better' is the suitable remedial measure to reduce loss of life and property. K. S. Neelakantan (Department of Environment, Government of Tamil Nadu) explained post-tsunami mitigation measures and future plans taken by his department. He revealed that coastal vulnerability maps, village cadastral maps and land-use maps (urban areas, ports, industries, rural settlements, agriculture and aquaculture) are prepared as part of the Integrated Coastal Zone Management (ICZM) plan. Seven parameters (elevation, geology, geomorphology, sea-level trends, hori-

zontal shoreline, displacement, and availability of land) recommended by the Swaminathan Committee are taken into consideration while preparing the plan. In his talk on 'Tsunami mitigation measures along the coast of Kalpakkam', J. S. Mani (IIT Madras) discussed characteristics of the tsunami and other parameters to be considered while designing protective measures.

A talk on 'Hydrodynamics and sediment dynamics of mudbanks off Kerala coast: Implications to coastal zone management' was delivered by A. C. Narayana (CUSAT, Cochin). According to him, formation and sustenance of mudbanks in the nearshore region of the central part of Kerala coast are an enigma and they differ from those that occur elsewhere in the world. Onset of SW monsoon waves triggers the formation of mudbanks, as the intense wave and current activity churn the bottom sediments and bring them into suspension. These mudbanks act as barriers for the later part of the SW monsoon waves, and thereby the beaches behind them are protected from erosion. Jun Sasaki (Yokohama National University, Japan), in his lecture on 'Field investigation and numerical modelling of soft mud accumulation in an estuarine embayment', explained the nature of accumulation of organic-rich soft mud associated with formation of blue tide, which is responsible for mortality of benthic animals and also causes damage to fishery in Tokyo Bay. The talk on 'Numerical study of the flow and sediment transport on intertidal flats' by Ken-ichi Uzaki (Port and Airport Research Institute, Japan) explained how intertidal

\*A report on the two-day Indo-Japan Workshop on 'Coastal Problems and Mitigation Measures, including the Effects of Tsunami' held during 16–17 July 2007 at the Department of Ocean Engineering, Indian Institute of Technology Madras, Chennai. The workshop was jointly organized by V. Sundar and S. A. Sannasiraj, Department of Ocean Engineering, IIT Madras and T. Hiraishi, Department of Maritime and Environmental Engineering, Port and Airport Research Institute, Japan.