SOUTH ASIA
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SABP

The South Asia Biosafety Program (SABP) is an international developmental program initiated with support from the United States Agency for International Development (USAID). The program is implemented in India and Bangladesh and aims to work with national governmental agencies to facilitate the implementation of transparent, efficient and responsive regulatory frameworks for products of modern biotechnology that meet national goals as regards the safety of novel foods and feeds and environmental protection.

SABP is working with its in-country partners to:

- Identify and respond to technical training needs for food, feed and environmental safety assessment.
- Develop a sustainable network of trained, authoritative local experts to communicate both the benefits and the concerns associated with new agricultural biotechnologies to farmers and other stakeholder groups.
- Raise the profile of biotechnology and biosafety on the policy agenda within India and Bangladesh and address policy issues within the overall context of economic development, international trade, environmental safety and sustainability.

INITIATIVES ON BIOTECHNOLOGY BY BANGLADESH MINISTRY OF SCIENCE & TECHNOLOGY

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Bangladesh is a small country burdened with a very large population. It has been struggling with its limited resources to provide basic needs to her enormous population. The fundamental needs of the ever increasing population cannot be resolved using traditional technology. Modern biotechnology holds the promise and potential to address these urgent issues by increasing food production; developing smarter drugs, vaccines and diagnostic tools; producing commercially important industrial products while securing sustainable management of the environment. Currently, several research organizations, public and private universities, private companies and NGOs are involved in biotechnology research in the country.

Through the effective use of innovative technology, the present government has been taking steps toward building a nation, free from poverty and hunger, that will generate a medium income by 2021. Biotechnology might be an indispensable tool in this regard. The Ministry of Science and Technology has taken the appropriate initiative to update the National Biotechnology Policy in consultation with other relevant ministries, researchers, policy makers and stakeholders. The implementation of the policy will help increase agricultural productivity and food security as well as contributing to poverty alleviation and ensuring a better quality of life. The policy will open a new window of opportunity for a resource-starved country like Bangladesh. The policy also emphasizes protecting indigenous community knowledge, collective innovations and community rights.

A priority plan in different areas of biotechnology will be developed by the Ministry of Science and Technology in consultation with the coordination management committee stated in the policy document. This plan would emphasize national requirements and objectives with respect to priority programmes, institutional and manpower development and funding requirements.

Following are some highlights of the policy:

1. Scientists will have freedom to carry out genetic engineering research using living cells of both plants and animals.
2. Enforcement of appropriate measures such as the introduction of the Community Knowledge Protection Act to preserve indigenous knowledge and rights and innovations established through collective community efforts.
3. The main biotech sectors that will receive immediate focus will be agriculture, health, industry and environment reflecting the urgent national needs; suitable programs will be drawn up in the immediate future for their implementation.
4. Formation of an advisory committee of internationally recognized experts to advise the government on priority areas of research and development.
5. Introduction of biotechnology and genetic engineering as a discipline at higher secondary levels and further strengthening of it at the undergraduate and post graduate levels.
6. Encouragement of biotech graduates to pursue higher academic studies at foreign universities that are well known for their advanced research output.

Strategic Road Map to Implement Biotechnology Policy

The Ministry of Science and Technology has formulated a strategic road map to implement its biotechnology policy on a priority basis to develop and nurture biotechnology in sectors such as plant biotechnology, animal biotechnology, fish biotechnology, medical biotechnology, industrial biotechnology, environmental biotechnology, biodiversity conservation, human genetics and genomics, bioinformatics, biosafety and bioethics and IPR-related issues. In addition, other important areas with opportunities include herbal plants, animal feeds, diagnostics and development of post harvest technology to minimize loss of agricultural produce. The programmes will reflect urgent national needs and requirements in terms of funding, manpower and facility.

The biotechnology roadmap represents the government's aspirations for biotechnology issues in order to meet Bangladesh's future challenges. The roadmap also sets out a scheme for a better co-ordination plan among different government bureaus. The roadmap's directions not only highlight the areas of science that need to be built but also the future skills and connections required to achieve them. Biotechnology applications can raise cultural and ethical issues and ongoing research is required to gauge how Bangladesh's citizens view them and how it can best respond to them. The key players in the roadmap are the

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Bangladesh - *continued from page 2*

government and non-governmental research communities and public and private universities involved in biotechnology research. In the long run, careful planning and execution of biotechnology research may bring significant success in agricultural, medical and industrial sectors.

Well planned exploitation of biotechnology research in Bangladesh can lessen the impact of a growing population on natural resources and support the efforts of the government to alleviate poverty. This would, however, require the immediate enhancement of national institutional capacity and human resource development.

Considering the situation and the strengths and weaknesses of existing biotechnological activities and applications, the National Executive Committee on Biotechnology (NECB) strongly believes that Bangladesh needs the guidance of a national biotechnology road map to harness the full potential of biotechnology for economic and social development. This would be achieved through promoting biotechnology-based industries driven by a strong research and development effort built on a thematic approach and supported by capacity building, adequate resources and financing.

It is also relevant to say that, globally, the development of biotechnology has received strong government patronage in initial stages owing to its multi-disciplinary nature and heavy investment costs. In Bangladesh, the activities connected with current biotechnological research come under the purview of several ministries. Therefore, the document will provide a framework for the government to work with and co-ordinate all stakeholders to obtain the benefits of biotechnology for the development of Bangladesh.

Bangladesh, identified as one of the world's biodiversity "hot spots", is rich in natural biological resources distributed in a wide range of different terrestrial and aquatic ecosystems. Many of the biological resources are endemic to the country. Biotechnology offers many opportunities to convert these biological resources into economic wealth and employment opportunities within a framework established for sustainable consumption.

Strategic Goals of the Biotechnology Road Map

- Develop and transfer the outcomes of agricultural, medical, environment and industrial biotechnology.
- Provide appropriate environment to encourage research and investment in the field of biotechnology.
- Use biotechnology to achieve sustainable agricultural development, food security and safety.
- Conserve biodiversity and environmental resources of Bangladesh through the development of appropriate biotechnology applications.
- Use biotechnology in medical diagnostics and therapeutics in Bangladesh.
- Develop infrastructure and human resource development on biotechnology.
- Strengthen public awareness programme on the recent development of biotechnology.

Directory on Biotechnology Research and Personnel

National Institute of Biotechnology (NIB) under the Ministry of Science & Technology, the focal point co-ordinator of biotechnology research, has published a Directory on Biotechnology Research and Personnel to promote biotechnological research, human resource development and technology transfer through national and international collaboration and technical assistance.

National research organizations and some private companies have segregated efforts into biotechnology research and applications. The conclusion was that the scattered efforts and research works of specialized laboratories should be brought under a national framework that would ultimately help to manage activities in an integrated manner. A national database on biotechnological research and resource persons is essential to ensure a co-ordinated and integrated web of research projects in Bangladesh. The scientific community, policy makers and government bodies have advocated for such a national database for a long time.

The national database would act as the cornerstone of such a co-ordinated research network and facilitate allied research and funding in prioritized national sectors and with international collaborators. NIB has taken initiatives to bring to light this database, which would be a kind of handbook of current Bangladesh biotechnology research programmes and the scientists behind these activities. A national database would aid in communication between scientists from different Bangladesh organizations. Another beneficiary would be the government in the sourcing of appropriate consultative scientific personnel. The database is necessary in linking multiple stakeholders including concerned ministries, universities, research institutes, private sectors, civil society, consumer groups, non-government and voluntary organizations and international bodies. Information presented would be helpful in assessing existing potential and resources and would help to create new opportunities for innovative research works with regional, national and international collaborators.

GENETICALLY MODIFIED CROPS AND AQUATIC ECOSYSTEMS: CONSIDERATIONS FOR ENVIRONMENTAL RISK ASSESSMENT AND NON-TARGET ORGANISM TESTING

Keri Carstens *et al*. have published a paper in *Transgenic Research* that examines environmental risk assessment (ERA) of GM crops in aquatic ecosystems. The purpose of this document is to demonstrate how comprehensive problem formulation can be used to develop a conceptual model and to identify potential exposure pathways, using *Bacillus thuringiensis* (Bt) maize as a case study. Within problem formulation, the insecticidal trait, the crop, the receiving environment, and protection goals were characterized, and a conceptual model was developed to identify routes through which aquatic organisms may be exposed to insecticidal proteins in maize tissue. Following a tiered approach for exposure assessment, worst-case exposures were estimated using standardized models, and factors mitigating exposure were described. Based on exposure estimates, shredders were identified as the functional group most likely to be exposed to insecticidal proteins. However, even using worst-case assumptions, the exposure of shredders to Bt maize was low and studies supporting the current risk assessments were deemed adequate. Determining if early tier toxicity studies are necessary to inform the risk assessment for a specific GM crop should be done on a case by case basis, and should be guided by thorough problem formulation and exposure assessment. The processes used to develop the Bt maize case study are intended to serve as a model for performing risk assessments on future traits and crops.

The stimulus for this paper came from the workshop "Problem Formulation for Biotech Crops and Aquatic Ecosystems" convened by the Center for Environmental Risk Assessment, ILSI Research Foundation. The paper is available through open access and can be downloaded from http://www.springerlink.com/content/176736g47165883w/fulltext.pdf.

The Reading List

. . . new and notable articles

GENETIC DIVERSITY, STRUCTURE, GENE FLOW AND EVOLUTIONARY RELATIONSHIPS WITHIN THE SORGHUM BICOLOR WILD-WEEDY-CROP COMPLEX IN A WESTERN AFRICAN REGION

Sagnard F, Deu M, Dembélé D, Leblois R, Touré L, Diakité M, Calatayud C, Vaksmann M, Bouchet S, Mallé Y, Togola S, Traoré PC.

Gene flow between domesticated plants and their wild relatives is one of the major evolutionary processes acting to shape their structure of genetic diversity. Earlier literature, in the 1970s, reported on the interfertility and the sympatry of wild, weedy and cultivated sorghum belonging to the species Sorghum bicolor in most regions of sub-Saharan Africa. However, only a few recent surveys have addressed the geographical and ecological distribution of sorghum wild relatives and their genetic structure. These features are poorly documented, especially in western Africa, a centre of diversity for this crop. We report here on an exhaustive *in situ* collection of wild, weedy and cultivated sorghum assembled in Mali and in Guinea. The extent and pattern of genetic diversity were assessed with 15 SSRs within the cultivated pool (455 accessions), the wild pool (91 wild and weedy forms) and between them. F (ST) and R (ST) statistics, distance-based trees, Bayesian clustering methods, as well as isolation by distance models, were used to infer evolutionary relationships within the wild-weedy-crop complex. Firstly, our analyses highlighted a strong racial structure of genetic diversity within cultivated sorghum (F (ST) = 0.40). Secondly, clustering analyses highlighted the introgressed nature of most of the wild and weedy sorghum and grouped them into two eco-geographical groups. Such closeness between wild and crop sorghum could be the result of both sorghum's domestication history and preferential post-domestication crop-to-wild gene flow enhanced by farmers' practices. Finally, isolation by distance analyses showed strong spatial genetic structure within each pool, due to spatially limited dispersal, and suggested consequent gene flow between the wild and the crop pools, also supported by R (ST) analyses. Our findings thus revealed important features for the collection, conservation and biosafety of domesticated and wild sorghum in their centre of diversity.

Theoretical and Applied Genetics (2011) 123:1231-46.

STRATEGIES FOR TRANSGENIC NEMATODE CONTROL IN DEVELOPED AND DEVELOPING WORLD CROPS

Atkinson HJ, Lilley CJ, Urwin PE.

Nematodes cause an estimated $118b annual losses to world crops and they are not readily controlled by pesticides or other control options. For many crops natural resistance genes are unavailable to plant breeders or progress by this approach is slow. Transgenic plants can provide nematode resistance for such crops. Two approaches have been field trialled that control a wide range of nematodes by either limiting use of their dietary protein uptake from the crop or by preventing root invasion without a direct lethality. In addition, RNA interference increasingly in tandem with genomic studies is providing a range of potential resistance traits that involve no novel protein production. Transgenic resistance can be delivered by tissue specific promoters to just root tissues where most economic nematodes invade and feed rather than the harvested yield. High efficacy and durability can be provided by stacking nematode resistance traits including any that natural resistance provides. The constraints to uptake centre on market acceptance and not the availability of appropriate biotechnology. The need to deploy nematode resistance is intensifying with loss of pesticides, an increased need to protect crop profit margins and in many developing world countries where nematodes severely damage both commodity and staple crops.

Current Opinion in Biotechnology. (2011). [Epub ahead of print]

TRANSGENIC BANANA EXPRESSING *PFLP* GENE CONFERS ENHANCED RESISTANCE TO XANTHOMONAS WILT DISEASE

Namukwaya B, Tripathi L, Tripathi JN, Arinaitwe G, Mukasa SB, Tushemereirwe WK.

Banana Xanthomonas wilt (BXW), caused by X*anthomonas campestris* pv. *musacearum*, is one of the most important diseases of banana (*Musa* sp.) and currently considered as the biggest threat to banana production in Great Lakes region of East and Central Africa. The pathogen is highly contagious and its spread has endangered the livelihood of millions of farmers who rely on banana for food and income. The development of disease resistant banana cultivars remains a high priority since farmers are reluctant to employ labor-intensive disease control measures and there is no host plant resistance among banana cultivars. In this study, we demonstrate that BXW can be efficiently controlled using transgenic technology. Transgenic bananas expressing the plant ferredoxin-like protein (*Pflp*) gene under the regulation of the constitutive CaMV35S promoter were generated using embryogenic cell suspensions of banana. These transgenic lines were characterized by molecular analysis. After challenge with *X. campestris* pv. *musacearum* transgenic lines showed high resistance. About 67% of transgenic lines evaluated were completely resistant to BXW. These transgenic lines did not show any disease symptoms after artificial inoculation of *in vitro* plants under laboratory conditions as well as potted plants in the screen-house, whereas non-transgenic control plants showed severe symptoms resulting in complete wilting. This study confirms that expression of the *Pflp* gene in banana results in enhanced resistance to BXW. This transgenic technology can provide a timely solution to the BXW pandemic.

Transgenic Research. (2011) Nov 19. [Epub ahead of print]

CALENDAR OF EVENTS

Event	Organized by	Date and Venue	Website
INDIA			
Conference on Agricultural Biotechnology	Confederation of Indian Industry	December 19 - 20, 2011 New Delhi	http://www.ciionline.org/Events.aspx
State Level Seminar on Breaking Yield Barriers in Major Field Crops	Indian Society of Agriculture (Akola Chapter) and Dr. Panjabrao Deshmukh Krishi Vidyapeeth	January 6 - 7, 2012 Akola, Maharashtra	http://www.pdkv.ac.in/Admin/pdf/agro_seminar.pdf
3rd Global Conference on Plant Pathology for Food Security	Indian Society of Mycology and Plant Pathology and Maharana Pratap University of Agriculture and Technology	January 10 - 13, 2012 Udaipur	http://isompp.org/3gc.html
8th International Safflower Conference Safflower Research and Development in the World: Status and Strategies	Indian Society of Oilseeds Research and Indian Council of Agricultural Research	January 19 - 23, 2012 Hyderabad	http://www.dor-icar.org.in/downloads/Conference1.pdf
Indian Seed Congress 2012	National Seed Association of India	February 10 - 11, 2012 Pune	http://www.indianseedcongress.com/default.htm
Second International Conference on Agrochemicals Protecting Crops, Health and Natural Environment: Role of Chemistry for Sustainable Agriculture	Indian Agricultural Research Institute, The Society for the Promotion of Sustainable Agriculture, Indian Council of Agricultural Research	February 15 - 18, 2012 New Delhi	http://www.iari.res.in/
International Conference on Plant Biotechnology for Food Security: New Frontiers	Society for Plant Biochemistry and Biotechnology, National Research Centre on Plant Biotechnology	February 21 - 24, 2012 New Delhi	http://www.spbbindia.org/
Seed Industry Program 2012	Cornell University, College of Agriculture and Life Sciences Manager - Center For Executive Education Sathguru Management Consultants	March 5 - 8, 2012 Goa	http://www.nsai.co.in/Events/upload/brochure.pdf
National Seminar on New Frontiers and Future Challenges in Horticultural Crops	College of Agriculture, PAU, Ludhiana Sponsored by National Horticulture Mission	March 6 - 8, 2012 Ludhiana	http://web.pau.edu/coa/content/userfiles/10.pdf
Biosafety Workshop on Problem Formulation: A Strategic Approach to Risk Assessment of GMOs	International Centre for Genetic Engineering and Biotechnology (ICGEB) in collaboration with the Ministry for Environment, for the Protection of the Territory and for the Sea, Government of Italy	April 16 - 20, 2012 Trieste Italy	http://www.icgeb.org/tl_files/Meetings/2012/ICGEB%20TS%20BSF%2016-20%20April%202012.pdf
Workshop on Biosafety of Genetically Engineered Crops: Best Practices from Laboratory to Farmer's Fields	ICGEB in collaboration with GENETECH, Colombo, Sri Lanka, University of Colombo, Sri Lanka, Michigan State University, USA, The National Science Foundation, Colombo, Sri Lanka and Embassy of USA, Colombo, Sri Lanka	May 21 - 25, 2012 Colombo, Sri Lanka	http://www.icgeb.org/meetings-2012.html
12th International Symposium on Biosafety of Genetically Modified Organisms (ISBGMO12)	International Society for Biosafety Research	September 17 – 20, 2012 St Louis, Missouri, USA	http://www.isbgmo.com/

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Center for Environmental Risk Assessment

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