SOUTH ASIA
BIOSAFETY PROGRAM

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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.

GOLDEN RICE FOR ADDRESSING THE VITAMIN A-DEFICIENCY PROBLEM IN BANGLADESH

Dr. Md. Alamgir Hossain, Principal Scientific Officer, Bangladesh Rice Research Institute, Gazipur, Bangladesh, Email: mahbrri@yahoo.com

Vitamin A is an essential nutrient needed in small amounts by the human body for the normal functioning of the visual system, growth and development, maintenance of epithelial cellular integrity, immune function and reproduction. Vitamin A deficiency (VAD) is a global problem. According to the World Health Organization (WHO), about 125 million children in developing countries suffer from vitamin A deficiency (VAD), causing blindness in up to 500,000 per year. VAD can cause partial or total blindness in 350,000 pre-school age children. Less severe deficiencies weaken the immune system, increasing the risk of infections such as measles and malaria. Women with VAD are more likely to die during or after childbirth.

Interventions to reduce VAD have, so far, involved (a) supplementation (*e.g.*, distribution of vitamin A capsules), (b) food fortification by adding provitamin A, and (c) dietary education and diversification. In the FAO/WHO World Declaration on Nutrition (1992) the following strategy was advocated: "Ensure that sustainable food-based strategies are given first priority particularly for populations deficient in vitamin A, favoring locally available foods and taking into account local food habits." "Supplementation should be progressively phased out as soon as micronutrient-rich food-based strategies enable adequate consumption of micronutrients." Supplementation is said to be a quick remedy for undernourished children but it is not a sustainable strategy. Since it needs to be continued every year, a country like Bangladesh needs to spend millions of dollars for the medicine and its delivery process. An economic crisis, which is a very common scenario in developing countries, may cause setbacks in other important development activities. A sustainable solution to the problem will come only when it is possible to improve the content of the missing micronutrients in the major staple crops. Rice is the staple food of most of the Asian countries providing 80% or more of daily calories. Unfortunately, rice plants do not produce beta-carotene or other forms of provitamin A in the grain as consumed by humans. Consequently VAD often occurs where rice is the major staple food.

It was under this background in early 1990 that Prof. Ingo Potrykus of the Institute of Plant Sciences at the Swiss Federal Institute of Technology took initiatives to develop a vitamin A-rich rice variety. Popularly known as "golden rice" it took eight years using genetic engineering due to the lack of necessary genes in the rice gene pool, to develop the much anticipated vitamin A-rich rice.

In Bangladesh, one in every five pre-school children is vitamin A-deficient and 23.7% of pregnant women are affected by vitamin A deficiency. About 30 000 children under age six go blind annually, and at least half of these die within weeks of the blinding episode. Recent reports indicate that night blindness among rural mothers is as high as 1.4%. National studies have confirmed widespread low intakes of vitamin A in the diet and a high prevalence of the signs and symptoms of xerophthalmia. This prevalence is well in excess of WHO threshold levels at which a major public health problem is considered to exist. Smaller, often clinically-based studies have confirmed low serum retinol levels and interactions with diarrhoea, measles and other infectious disease including the presence of enteric parasites. Risk factors in the development of xerophthalmia include diet, age, infectious disease, maternal education, socioeconomic status, seasonal variation and geographic clustering. Although short to long term prevention and control programs are to some extent in place, much remains to be done.

Golden rice can play a vital role in reducing vitamin A deficiency malnutrition. Scientists of the Bangladesh Rice Research Institute (BRRI), in collaboration with the International Rice Research Institute (IRRI), have developed a second generation golden rice GR2-R BRRI dhan 29, which is one of the best high yielding varieties of rice released by BRRI.

Golden Rice is a genetically engineered, yellow-orange rice grain that contains beta-carotene. The initial daffodil gene encoding phytoene synthase (psy) used in the earlier form of golden rice was found to be a limiting step in beta-carotene accumulation. The most recently developed golden rice varieties contain a gene (psy) from maize and the other gene, phytoene desaturate (Crt1) from a common soil bacterium (*Erwinia*). The enzyme products of these genes lead to the formation of beta-carotene and other provitamin A in the rice grain. An increase in total carotenoids of up to 23-fold (maximum 37 µg/g) compared to the original Goldn Rice has been reported.

The original transgenic parental Kaybonnet materials underwent field testing in the USA. The backcrossed GR2-IR64, GR2-PSB Rc82 and GR2-BRRI dhan29 lines were tested for several subsequent generations at IRRI for the stability of the genes and plant performance. So far no secondary genetic effects

(continued on page 4 - see Rice)

INTERNATIONAL CONFERENCE
ENVIRONMENTAL RISK ASSESSMENT (ERA) OF GENETICALLY ENGINEERED (GE) PLANTS

April 15 - 17, 2012 • BRAC Centre Inn • Dhaka • Bangladesh

The South Asia Biosafety Program and the Bangladesh Academy of Sciences, with cooperation from the Bangladesh Department of Environment, and the Pakistan Strategy Support Program will be organizing an international conference on Environmental Risk Assessment of Genetically Engineered Plants, to take place in Dhaka, Bangladesh from April 15-17, 2012. The conference represents an opportunity to interact with leading scientists from regulatory agencies, public sector institutions and the private sector, including from Australia, Bangladesh, India, Mexico, Pakistan, Sri Lanka, and the United States. Speakers will discuss the status of GE plant development and regulation in South Asia, and on current scientific issues related to environmental risk assessment.

Session I: International Experience in Environmental Risk Assessment of GE Plants

- **Introduction to Environmental Risk Assessment of GE Plants** — Dr. Andrew Roberts, Center for Environmental Risk Assessment (CERA)
- **Contributions of the OECD to International Harmonization of ERA** — Dr. Sally McCammon, USDA APHIS, Biotechnology Regulatory Services (Chair OECD Working Group)
- **Risk Assessment under the Cartagena Protocol** — Dr. Sol Ortiz-Garcia, CIBIOGEM, Mexico
- **A Comparative Review of International Requirements for ERA of GE Plants** — Dr. Vibha Ahuja, Biotech Consortium India Ltd.

Session II: National Experiences with ERA of GE Plants in South Asia

- **Status of GE Plant Research and Regulation of GE Plants in India** — Dr. Swapan Datta, Indian Council for Agricultural Research (ICAR) and Dr. Ranjini Warrier, Director, CS Division, Ministry of Environment & Forests, Member Secretary GEAC
- **Status of GE Plants Trials in Bangladesh** — Dr. Syed Nurul Alam, BARI, Joydebpur, Bangladesh
- **Trends in Research and Development of GE Plants in Bangladesh** — Prof. Dr. R.H. Sarker, Department of Botany, University of Dhaka
- **Regulation of GE Plants in Bangladesh** — Mr. Mohammed Solaiman Haider, Department of Environment (DOE), Bangladesh
- **Status of GE Plant Research and Regulation of GE Plants in Pakistan** — Dr. Yusuf Zafar, Pakistan Atomic Energy Commission (PAEC)
- **Status of GE Plant Research and Regulation of GE Plants in Sri Lanka** Dr. Chandrika Nanayakkara, Department of Plant Sciences, University of Colombo

Session III: Selected Topics in ERA

- **Differentiating Environmental Risk Assessment and Ecological Research** — Dr. Andrew Roberts, CERA
- **Evaluating Adverse Environmental Impacts on Non-Target Organisms** — Dr. Raymond Layton, Pioneer
- **Considering Gene Flow to Wild and Weedy Relatives** — TBD
- **Gene Flow in Centers of Origin and Biodiversity** — Dr. Ariel Alvarez Morales, CIBIOGEM, Mexico
- **The Challenge of Addressing Biodiversity as a Protection Goal in ERA** — TBD

Session IV: Stewardship and Resistance Management for GE Crops

- **Introduction to Product Stewardship Practices for IRM** — Dr. Michael Wach, CERA
- **Insect Resistance Management of Bt Crops** — Dr. Raymond Layton, Pioneer
- **Herbicide Resistance Management** — TBD

Session V: Panel Discussion

- **The Importance of Regulatory Process for Enhancing Credibility of ERA and Subsequent Decision Making** — Dr. Joe Smith, OGTR, Australia
- **Panel Discussion**
- **Concluding Q&A**

For more information about the conference, please contact:

Prof. Dr. M. Imdadul Hoque, Department of Botany, University of Dhaka
mimdadul07@yahoo.com

Dr. Andrew Roberts, Deputy Director, Center for Environmental Risk Assessment
aroberts@ilsi.org

The Reading List

. . . new and notable articles

FERAL GENETICALLY MODIFIED HERBICIDE TOLERANT OILSEED RAPE FROM SEED IMPORT SPILLS: ARE CONCERNS SCIENTIFICALLY JUSTIFIED?

Devos Y, Hails RS, Messéan A, Perry JN, Squire GR

One of the concerns surrounding the import (for food and feed uses or processing) of genetically modified herbicide tolerant (GMHT) oilseed rape is that, through seed spillage, the herbicide tolerance (HT) trait will escape into agricultural or semi-natural habitats, causing environmental or economic problems. Based on these concerns, three EU countries have invoked national safeguard clauses to ban the marketing of specific GMHT oilseed rape events on their territory. However, the scientific basis for the environmental and economic concerns posed by feral GMHT oilseed rape resulting from seed import spills is debatable. While oilseed rape has characteristics such as secondary dormancy and small seed size that enable it to persist and be redistributed in the landscape, the presence of ferals is not in itself an environmental or economic problem. Crucially, feral oilseed rape has not become invasive outside cultivated and ruderal habitats, and HT traits are not likely to result in increased invasiveness. Feral GMHT oilseed rape has the potential to introduce HT traits to volunteer weeds in agricultural fields, but would only be amplified if the herbicides to which HT volunteers are tolerant were used routinely in the field. However, this worst-case scenario is most unlikely, as seed import spills are mostly confined to port areas. Economic concerns revolve around the potential for feral GMHT oilseed rape to contribute to GM admixtures in non-GM crops. Since feral plants derived from cultivation (as distinct from import) occur at too low a frequency to affect the coexistence threshold of 0.9% in the EU, it can be concluded that feral GMHT plants resulting from seed import spills will have little relevance as a potential source of pollen or seed for GM admixture. This paper concludes that feral oilseed rape in Europe should not be routinely managed, and certainly not in semi-natural habitats, as the benefits of such action would not outweigh the negative effects of management.

TRANSGENIC RESEARCH ***(2012) 21(1):1-21.***

TRANSGENIC POTATOES FOR POTATO CYST NEMATODE CONTROL CAN REPLACE PESTICIDE USE WITHOUT IMPACT ON SOIL QUALITY

Green J, Wang D, Lilley CJ, Urwin PE, Atkinson HJ

Current and future global crop yields depend upon soil quality to which soil organisms make an important contribution. The European Union seeks to protect European soils and their biodiversity for instance by amending its Directive on pesticide usage. This poses a challenge for control of *Globodera pallida* (a potato cyst nematode) for which both natural resistance and rotational control are inadequate. One approach of high potential is transgenically based resistance. This work demonstrates the potential in the field of a new transgenic trait for control of *G. pallida* that suppresses root invasion. It also investigates its impact and that of a second transgenic trait on the non-target soil nematode community. We establish that a peptide that disrupts chemoreception of nematodes without a lethal effect provides resistance to *G. pallida* in both containment and a field trial when precisely targeted under control of a root tip-specific promoter. In addition we combine DNA barcoding and quantitative PCR to recognise nematode genera from soil samples without microscope-based observation and use the method for nematode faunal analysis. This approach establishes that the peptide and a cysteine proteinase inhibitor that offer distinct bases for transgenic plant resistance to *G. pallida* do so without impact on the non-target nematode soil community.

PLOS ONE ***(2012) 7(2):E30973.*** *EPUB 2012 FEB 16.*

NOVEL AND POTENTIAL APPLICATION OF CRYOPRESERVATION TO PLANT GENETIC TRANSFORMATION

Wang B, Zhang Z, Yin Z, Feng C, Wang Q

The world population now is 6.7 billion and is predicted to reach 9 billion by 2050. Such a rapid growing population has tremendously increased the challenge for food security. Obviously, it is impossible for traditional agriculture to ensure the food security, while plant biotechnology offers considerable potential to realize this goal. Over the last 15 years, great benefits have been brought to sustainable agriculture by commercial cultivation of genetically modified (GM) crops. Further development of new GM crops will with no doubt contribute to meeting the requirements for food by the increasing population. The present article provides updated comprehensive information on novel and potential application of cryopreservation to genetic transformation. The major progresses that have been achieved in this subject include (1), long-term storage of a large number of valuable plant genes, which offers a good potential for further development of novel cultivars by genetic transformation; (2), retention of regenerative capacity of embryogenic tissues and protoplasts, which ensures efficient plant regeneration system for genetic transformation; (3), improvement of transformation efficiency and plant regeneration of transformed cells; (4), long-term preservation of transgenic materials with stable expression of transgenes and productive ability of recombinant proteins, which allows transgenic materials to be stored in a safe manner before being analyzed and evaluated, and allows establishment of stable seed stocks for commercial production of homologous proteins. Data provided in this article clearly demonstrate that cryo-technique has an important role to play in the whole chain of genetic transformation. Further studies coupling cryotechnique and genetic transformation are expected to significantly improve development of new GM crops.

BIOTECHNOLOGY ADVANCES ***(2012) 30(3):604-12.***

RICE - *continued from page 1*

have been observed in any environment. The transfer of beta carotene locus into cultivated BRRI dhan29 through backcross breeding has resulted in a golden yellow colour of rice grain.

BRRI applied to the National Committee on Biosafety (NCB) for the importation of second generation golden rice (GR2-BRRI dhan29) for contained green house and net house trials at BRRI. In a recent meeting NCB approved the importation of 30 lines of *Oryza sativa* GR2-BRRI dhan29 including their recurrent parents. BRRI will import seeds following the internationally recognized biosafety guidelines as described in the Cartagena Protocol and will evaluate in a trial production in contained condition with a view to developing a golden rice version of BRRI dhan29.

CALENDAR OF EVENTS

Event	Organized by	Date and Venue	Website
INDIA			
National Seminar on Sustainable Agriculture and Food Security: Challenges in Changing Climate	Directorate of Research CCS Haryana Agricultural University and Sponsored by Department of Science and Technology, New Delhi and NICRA-AICRPAM, CRIDA, Hyderabad	March 27 - 28, 2012 Hisar	http://www.hau.ernet.in/safs.pdf
GM Trait Testing	Barwale Foundation	March 27 - 29, 2012 Hyderabad	http://www.barwalefoundation.org/html/announcement-1.htm
National Seminar on Biotechnological Approaches in Pest Management	Department of Entomology and School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana	May 4 - 5, 2012 Ludhiana	http://web.pau.edu/content/banner/292.pdf
Transgenics: Creation, Detection, Breeding and Regulation	Barwale Foundation	May 8 - 10, 2012 Hyderabad	http://www.barwalefoundation.org/html/announcement-1.htm
Silver Jubilee International Symposium on "Global Cotton Production Technologies vis-à-vis Climate Change	Cotton Research and Development Association and CCS Haryana Agricultural University, Hisar	October 10 - 12, 2012 Hisar	http://www.crdaindia.com/
International Symposium on New Paradigms in Sugarcane Research	Society for Sugarcane Research and Development and Sugarcane Breeding Institute	October 15 - 18, 2012 Coimbatore	http://www.sugarcane.res.in/images/sbi/Centenary/1st_circular_int_symposium.pdf
INTERNATIONAL			
Bangladesh Conference on Environmental Risk Assessment (ERA) of Genetically Engineered (GE) Plants	Center for Environmental Risk Assessment- ILSI Research Foundation and Bangladesh Academy of Sciences; Bangladesh Department of Environment and Bangladesh Agricultural Research Council	April 15 - 17, 2012 Dhaka, Bangladesh	
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/

SABP CONTACTS

India

Dr. Vibha Ahuja
General Manager
Biotech Consortium India Limited
Anuvrat Bhawan, 5th Floor
210, Deendayal Upadhyaya Marg
New Delhi 110 002 India
Email: vibhaahuja@biotech.co.in

Bangladesh

Prof. Dr. M. Imdadul Hoque
Department of Botany
University of Dhaka
Dhaka - 1000
Bangladesh
Email: mimdadul07@yahoo.com

Others

Center for Environmental Risk Assessment (CERA)
ILSI Research Foundation
1156 Fifteenth Street, N.W., 2nd Floor
Washington D.C.
20005-1743 USA
Email: info@cera-gmc.org

Center for Environmental Risk Assessment

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