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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.

THE LONG ROAD TO COMMERCIALIZATION OF BT BRINJAL (EGGPLANT) IN INDIA

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The potential commercialization of Bt brinjal (eggplant) in India offers the possibility of significant benefits. Among these are an estimated doubling of the yield relative to that of the non-genetically modified vegetable, economic surplus gains of $108 million per year, and an additional $3-4 million per year in health benefits from the reduced requirements for insecticide spraying (Krishna and Qaim, 2008). Bt brinjal would be the first genetically engineered food crop in India.

Despite the potential benefits, there has been staunch opposition to Bt brinjal commercialization by Greenpeace and certain other non-governmental organizations (NGOs), based on anti-biotechnology stances. The Indian film producer Mahesh Bhatt created a movie called "Poison on the Platter" to highlight the supposedly harmful effects of GM foods in general and of Bt brinjal in particular. Yogi Ramdev, a well-known Yogic guru, also openly preaches against Bt brinjal.

On the other side, biotechnology also has powerful supporters. The President of India, Smt. Pratibha Devisingh Patil, and the Prime Minister of India, Dr. Manmohan Singh, have both made statements about using biotechnology to meet the needs of the people of India. Most importantly, the data show the strong economic and environmental benefits of adopting Bt brinjal. In addition to the potential benefits mentioned above, analyses of field trials in the Central/South and East regions of India have indicated that farmers' gross margins in these areas would increase by 16,299 rupees ($361) per acre and 19,744 rupees ($437), respectively (Krishna and Qaim, 2008).

In October 2009, the Genetic Engineering Approval Committee (GEAC) of India, considered the final gatekeeper of genetically engineered crops in India, approved the commercialization of Bt brinjal. Soon after the GEAC's announcement, however, Greenpeace and other anti-biotechnology NGOs flooded the office of the Minister of Environment and Forestry (Mr. Jairam Ramesh) with faxes and emails urging him to ban the cultivation of Bt brinjal. In February 2010, Mr. Ramesh decided to impose a moratorium on Bt brinjal until "such times independent scientific studies establish, to the satisfaction of both the public and the professionals, the safety of the product from the point of view of its long-term impact on human health and environment…"

Reading through Mr. Ramesh's entire document, it appears to me that the Minister was more strongly influenced by political pressure from those opposed to biotechnology than by critical scientific and balanced judgments of the technology. Despite his statement that his decision should not be construed as discouraging "on-going R&D in using tools of modern biotechnology for crop improvement," it is hard to conceive that such discouragement will not occur and have a profound negative impact on Indian agriculture. In the meantime, other Indian scientists and agencies are attempting to reverse the Minister's decision. Thus, at this time, it is unclear what lies beyond the next bend in the road for commercialization of Bt brinjal in India.

Brinjal, along with tomato and onion, is the second most important vegetable in India and is considered the most affordable so it is consumed in a wide variety of dishes popular throughout the country. Brinjal is highly nutritious and is believed to have certain medicinal properties. It is culturally important to the Indian people, who annually consume between 8 and 9 metric tonnes of the vegetable, which is grown on more than 500,000 hectares. The most serious pest of brinjal is the fruit and shoot borer (FSB) which causes annual yield losses of 60%-70% even with repeated insecticide spraying (typically more than 40 times per season).

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CALENDAR OF EVENTS			
Event	Organized by	Date and Venue	Website
INDIA			
TERI-ITEC Courses 2010-11 - Applications of Biotechnology and its Regulation	The Energy and Resources Institute (TERI)	August 2 - 22, 2010 Gurgaon	http://www.teriin.org/index.php?option=com_events&task=details&sid=307
National Conference on Paradigm Shift in Cotton Research and Cultivation	Navsari Agricultural University	October 20 - 22, 2010	http://www.nau.in/n.pdf
INTERNATIONAL			
Workshop on the Safety Assessment of Foods Derived form Genetically Engineered Plants	Bangladesh Agricultural Research Council (BARC), Department of Environment (DOE) and South Asia Biosafety Program (SABP)	July 16 - 20, 2010 BRAC Center Inn, Dhaka, Bangladesh	http://cera-gmc.org/index.php?action=sabp_activities Contact: Prof. Dr. M. Imdadul Hoque, e-mail: mimdadul07@yahoo.com
ABIC 2010: Bridging Biology and Business	Agricultural Biotechnology International Conference	September 12 - 15, 2010 Saskatoon, Canada	http://www.abic.ca/abic2010/
IBS 2010 – 14th International Biotechnology Symposium and Exhibition	Alma Mater Studiorum – University of Bologna, ADRIA CONGREX and Elsevier	September 14 - 18, 2010 Rimini, Italy	http://www.ibs2010.org/index.asp
An Introduction to the Risk Analysis of Current Genetically Modified Organisms (GMOs) and their Products, and to Possible Issues Raised by Novel GMOs in the Future	Biosafety Unit, International Centre for Genetic Engineering and Biotechnology (ICGEB)	September 27 – October 1, 2010 Trieste, Italy	http://www.icgeb.org/meetings-and-courses.html
11th International Symposium on the Biosafety of Genetically Modified Organisms (ISBGMO)	International Society for Biosafety Research	November 15 - 20, 2010 Buenos, Argentina	http://www.isbgmo.info/
BIT's 4th Annual World Congress of GENE-2010: Gene Technology, Environment and Economic Growth	BIT Life Sciences, Inc.	December 1 - 4, 2010 Sanshui, Foshan, China	http://www.bitlifesciences.com/wcg2010/fullprogram.asp
6th International Plant Tissue Culture & Biotechnology Conference	Bangladesh Association for Plant Tissue Culture & Biotechnology (BAPTC&B) *For more information please see page 4 of this newsletter.*	December 3 - 5, 2010	http://www.baptcb.org/ptcb_Confderence_2010.pdf

Brinjal - *continued from page 1*

Bt brinjal is brinjal that has been genetically modified to express an insecticidal protein (Cry1Ac) from the bacterium *Bacillus thuringiensis*. This modification was first achieved in 2000 under a partnership between Maharashtra Hybrid Seed Company (Mahyco) and Monsanto, using Monsanto's *cry1Ac* gene which had already been widely used in Bt cotton in India. Greenhouse trials of Bt brinjal demonstrated control of FSB and subsequently, in 2003, a partnership was developed among Mahyco, Cornell University, and the USAID under the Agricultural Biotechnology Support Program II. Each group shares in the responsibility to bring Bt brinjal to market, but what is unique is that the partners have decided to have two market channels: a "pro-poor" channel for the distribution of transgenic non-hybrids and the "normal" channel through which the higher-priced transgenic hybrids would be sold and Mahyco would recover some of its investment. The "pro-poor" strategy and the shared partnership were particularly attractive to the USAID, which decided to provide funding to help the products come to market.

Some of the potential advantages of Bt brinjal with respect to reduced insecticide spraying and reduced environmental impact can be inferred from the experiences with Bt maize and Bt cotton. First commercialized in 1996, Bt maize and Bt cotton are the only insect-resistant genetically modified (IRGM) field crops presently grown around the world. With the adoption of Bt maize and Bt cotton globally, there has been a dramatic reduction in the use of traditional insecticides on these two important field crops. An analysis published in 2009 (Brookes and Barfoot, 2009) reported that since 1996, on a cumulative basis worldwide, 23% less insecticide active ingredient (ai) has been used and that this resulted in a 23.8% reduction in the environmental impact. For maize, globally since 1996, 5.9% less insecticide ai has been used and the environmental impact was reduced by 6%. While Bt maize is not grown in India, Bt cotton is, and its use has reduced insecticide load. From 2002 to 2007, the cumulative insecticide ai use was 10.4% lower and the environmental impact was 9.7% lower. In 2009, Bt cotton was grown on 8.4 million hectares in India. With specific regard to Bt brinjal, field trials have shown that the amount of insecticide used against FSB was reduced by 80%, translating into an overall insecticide reduction of 42% for the crop (Krishna and Qaim, 2008).

Maize and cotton seed oil are generally processed before entering the food chain for human consumption so these Bt crops have elicited perhaps less, although still considerable, concern about human safety. The only non-processed IRGM crop is the relatively small amount of Bt sweet corn (Burkness *et al*., 2002), which in 2008 constituted *ca*. 9% of the total fresh market sweet corn grown in the US.

This situation will change dramatically if Bt brinjal is commercialized in India and Bt rice is grown in China. I believe that both of these events will be worldwide "game-changers" because the populations in these two countries, each over one billion, constituted 36.8% of the total world population of 6.7 billion in 2009. If these IRGM crops become widely grown in China and India, they will likely open the gates for

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The Reading List

. . . new and notable articles

AN EFFICIENT METHOD FOR THE PRODUCTION OF MARKER-FREE TRANSGENIC PLANTS OF PEANUT (*ARACHIS HYPOGAEA* L.)

M. Bhatnagar, K. Prasad , P. Bhatnagar-Mathur, M.L. Narasu, F. Waliyar and K.K. Sharma

Recombinant genes conferring resistance to antibiotics or herbicides are widely used as selectable markers in plant transformation for selecting the primary transgenic events. However, these become redundant once the transgenic plants have been developed and identified. Although, there is no evidence that the selectable marker genes are unsafe for consumers and the environment, it would be desirable if the marker genes can be eliminated from the final transgenic events. The availability of efficient transformation methods can enable the possibility of developing transgenic events that are devoid of the marker gene/s upfront. Taking advantage of the high and consistent transformation potential of peanut, we report a technique for developing its transgenics without the use of any selectable marker gene. Marker-free binary vectors harboring either the phytoene synthase gene from maize (*Zmpsy1*) or the chitinase gene from rice (*Rchit*) were constructed and used for *Agrobacterium tumefaciens*-mediated transformation of peanut. The putative transgenic events growing *in vitro* were initially identified by PCR and further confirmed for gene integration and expression by dot blots assays, Southern blots, and RT-PCR where they showed a transformation frequency of over 75%. This system is simple, efficient, rapid, and does not require the complex segregation steps and analysis for selection of the transgenic events. This approach for generation of marker-free transgenic plants minimizes the risk of introducing unwanted genetic changes, allows stacking of multiple genes and can be applicable to other plant species that have high shoot regeneration efficiencies.

Plant Cell Reporter (2010) 29(5):495-502. Epub 2010 Mar 9.

GENETIC AND GENOMIC TOOLS TO IMPROVE DROUGHT TOLERANCE IN WHEAT

D. Fleury, S. Jefferies, H. Kuchel and P. Langridge

Tolerance to drought is a quantitative trait, with a complex phenotype, often confounded by plant phenology. Breeding for drought tolerance is further complicated since several types of abiotic stress, such as high temperatures, high irradiance, and nutrient toxicities or deficiencies can challenge crop plants simultaneously. Although marker-assisted selection is now widely deployed in wheat, it has not contributed significantly to cultivar improvement for adaptation to low-yielding environments and breeding has relied largely on direct phenotypic selection for improved performance in these difficult environments. The limited success of the physiological and molecular breeding approaches now suggests that a careful rethink is needed of our strategies in order to understand better and breed for drought tolerance. A research programme for increasing drought tolerance of wheat should tackle the problem in a multi-disciplinary approach, considering interaction between multiple stresses and plant phenology, and integrating the physiological dissection of drought-tolerance traits and the genetic and genomics tools, such as quantitative trait loci (QTL), microarrays, and transgenic crops. In this paper, recent advances in the genetics and genomics of drought tolerance in wheat and barley are reviewed and used as a base for revisiting approaches to analyse drought tolerance in wheat. A strategy is then described where a specific environment is targeted and appropriate germplasm adapted to the chosen environment is selected, based on extensive definition of the morpho-physiological and molecular mechanisms of tolerance of the parents. This information was used to create structured populations and develop models for QTL analysis and positional cloning.

Journal of Experimental Botany 2010 Jun 4. [Epub ahead of print]

RISK-MANAGED PRODUCTION OF BIOACTIVE RECOMBINANT PROTEINS USING A NOVEL PLANT VIRUS VECTOR WITH A HELPER PLANT TO COMPLEMENT VIRAL SYSTEMIC MOVEMENT

N. Fukuzawa, T. Ishihara, N. Itchoda, N. Tabayashi, C. Kataoka, C. Masuta and T. Matsumura

A plant viral vector has the potential to efficiently produce recombinant proteins at a low cost in a short period. Although recombinant proteins can be also produced by transgenic plants, a plant viral vector, if available, may be more convenient when urgent scale-up in production is needed. However, it is difficult to use a viral vector in open fields because of the risk of escape to the environment. In this study, we constructed a novel viral vector system using a movement-defective Cucumber mosaic virus (CMV) vector, which is theoretically localized in the inoculated cells but infects systemically only with the aid of the transgenic helper plant that complements viral movement, diminishing the risk of viral proliferation. Interestingly, the helper plant systemically infected with the vector gave strong cross-protection against challenge inoculation with wild-type CMVs. Using CMV strains belonging to two discrete CMV groups (subgroups I and II), we also improved the system to prevent recombination between the vector and the transgene transcript in the helper plant. We here demonstrate the expression of an anti-dioxin single chain variable fragment (DxscFv) and interleukin-1 receptor antagonist (IL1-Ra) in *Nicotiana benthamiana* by this viral vector confinement system, which is applicable for many useful high-quality recombinant proteins.

Plant Biotechnol J. 2010 May 17. [Epub ahead of print]

EXPOSURE AND NONTARGET EFFECTS OF TRANSGENIC BT CORN DEBRIS IN STREAMS

P.D. Jensen, G.P. Dively, C.M. Swan, W.O. Lamp

Corn (*Zea mays* L.) transformed with a gene from the bacterium *Bacillus thuringiensis* (Bt) comprises 49% of all corn in the United States. The input of senesced corn tissue expressing the Bt gene may impact stream-inhabiting invertebrates that process plant debris, especially trichopteran species related to the target group of lepidopteran pests. Our goal was to assess risk associated with transgenic corn debris entering streams. First, we show the input of corn

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India - *continued from page 2*

other GM crops in these and other countries. It remains to be seen if and when India will decide to "change the game."

References

Brookes, G., Barfoot, P., 2009. GM Crops: Global Socio-Economic and Environmental Impacts 1996-2007. PG Economics Ltd, UK, pp. 128.

Burkness, E.C., Hutchison, W.D., Weinzierl, R.A., Wedberg, J.L., Wold, S., Shaw, J.T., 2002. Efficacy and risk efficiency of sweet corn hybrids expressing a *Bacillus thuringiensis* toxin for Lepidopteran pest management in the Midwestern US. Crop Protection 21, 157-169.

Krishna, V.V., Qaim, M., 2008. Potential impacts of Bt eggplant on economic surplus and farmers' health in India. Agricultural Economics 38, 167-180.

BIOTECHNOLOGY CONFERENCE TO BE HELD IN BANGLADESH, DECEMBER 2010

On December 3 to 5, 2010 a conference organized by the Bangladesh Association for Plant Tissue Culture & Biotechnology (BAPTC&B) on the Role of Biotechnology in Food Security and Climate Change will be held at Nawab Nabab Ali Chowdhury Senate Bhavan and the Department of Botany at University of Dhaka, Bangladesh.

Arranged in collaboration with the University of Dhaka, Bangladesh; Ministry of Environment and Forests; Bangladesh Agricultural Research Council and National Institute of Biotechnology, the deadline for submission of abstracts and registration forms is September 30, 2010. Presenters and those interested in attending are encouraged to download the registration form at http://www.baptcb.org/ptcb_Confderence_2010.pdf, which also contains a list of the scientific sessions, which, among others, will include:

- Conservation of biodiversity through biotechnology
- Use of molecular markers in crop improvement
- Development of superior quality crops resistant to climate change-induced environmental stresses.
- Biosafety and public acceptance of genetically modified plants.

For more information please go to http://www.baptcb.org/ptcb_Confderence_2010.pdf or contact Prof. Dr. M. Imdadul Hoque, Secretary of the Organizing Committee, at e-mail: mimdadul07@yahoo.com.

Reading List - *continued from page 3*

tissue after harvest was extended over months in a stream. Second, using laboratory bioassays based on European corn borer [*Ostrinia nubilalis* (Hübner)], we found no bioactivity of Cry1Ab protein in senesced corn tissue after 2 weeks of exposure to terrestrial or aquatic environments. Third, we show that Bt near-isolines modify growth and survivorship of some species of invertebrates. Of the four nontarget invertebrate species fed Bt near-isolines, growth of two closely related trichopterans was not negatively affected, whereas a tipulid crane fly exhibited reduced growth rates, and an isopod exhibited reduced growth and survivorship on the Cry1Ab near-isoline but not on the stacked Cry1Ab + Cry3Bb1 near-isoline. Because of lack of evidence of bioactivity of Bt after 2 wk and because of lack of nontarget effects on the stacked near-isoline, we suggest that tissue-mediated differences, and not the presence of the Cry1Ab protein, caused the different responses among the species. Overall, our results provide evidence that adverse effects to aquatic nontarget shredders involve complex interactions arising from plant genetics and environment that cannot be ascribed to the presence of Cry1Ab proteins.

Environmental Entomology (2010) 39(2):707-14.

EU PROPOSALS ON GM CROPS MEET WITH SUPPORT AND OPPOSITION

According to a July 14 article in the Mail.com, the EU Commission proposals to give individual countries the right to decide whether to grow or ban GM crops, are meeting with both support and opposition. The European Commission said the proposals are intended to provide countries with more freedom and flexibility concerning the cultivation of GM crops. According to the Mail.com, opponents warned that the changes would speed up the approval regimen for the controversial crops and ensure that efforts by some states to block them will be side-stepped. At present, EU countries vote together on whether to approve applications to grow new GM crops. In the future, whenever scientists working for the Commission approve a new crop or food as safe, any of the 27 member states will be permitted to grow it or put it on store shelves. Other countries, which in the past might have blocked approval, will be able to implement their own boycott, the Mail.com indicated. The Commission said the proposed new regimen, which must still be approved by EU governments and the European Parliament, "seeks to achieve the right balance between maintaining an EU authorization system and the freedom for member states to decide on GM cultivation in their territory." The Mail.com quotes Mute Schimpf, Friends of the Earth Europe's food campaigner, as saying, "While the Commission is seemingly offering countries the right to implement national bans, in reality, the proposal aims to do the opposite--opening Europe's fields to GM crops. The Commission continues to fail to protect Europe's food and feed from contamination by GM crops, and we urge countries to reject this deal as it stands." The Mail.com quotes GM Freeze, a coalition of community groups and green campaigners, as saying that "the proposals have been produced to try to overcome member state opposition to the commercial cultivation approval of GM crops. Many member states are not happy with the safety assessments of GM crops for cultivation on health and environmental grounds and have demanded a tougher approach." The Mail.com said that the American agro-chemical giants behind GM farming see the move by the EU as a vital step towards getting consumers in Europe to accept their crops. Previously, the U.S. government has complained to the World Trade Organization that attempts to block GM by European governments are an illegal restraint of free trade.

http://www.dailymail.co.uk/news/article-1294513/EU-clears-way-fast-track-GM-crops.html?ito=feeds-newsxml

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