

South Asia Biosafety Program

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INDIA

Resolutions Passed at the Meeting on Genetically Modified Crops for Nutritional Security



A round table meeting on “GM Crops for Nutritional Security” was held on February 12, 2014, at the National Academy of Agricultural Sciences, New Delhi, under the chairmanship of Prof. M.S. Swaminathan, Founder Chairman and Chief Mentor, M.S. Swaminathan Research Foundation, Chennai.

The group discussed the potential of GM crop technology in solving low farm productivity, malnutrition and hidden hunger problems in a large section of the Indian population, particularly women and children in the underprivileged sections of our society. The following resolutions were passed during the meeting:

- **GM crop technology is a promising, relevant and efficient technology for low-input, high-output agriculture where conventional breeding tools have not been effective.** GM technology will be a tool to improve agricultural crops for their nutritional value, nutrient and water use efficiency, productivity, tolerance and resistance to biotic and abiotic stresses.
- **The present de facto moratorium on the field trials of GM crops should be lifted at the earliest.** It is putting the clock back in relation to progress in harnessing the benefits of GMO technology in agriculture. Confined field trials are essential for the evaluation of productivity performance as well as food and environmental safety assessment. Not conducting regular field trials is a handicap as well as a deterrent in harnessing the benefits of a wide array of transgenic material available with different research organizations. Many of these research materials have excellent resistance to diseases, pests, drought and salinity as well as improved nutritional quality. Much of this work has been done in research organizations committed to general public good and by young researchers who are getting increasingly discouraged due to lack of clear policy on the future of GM crops.
- **The Indian biosafety regulatory system is in compliance with the international regulatory consensus based guidelines.** The system, put in place under the Environment Protection Act (1986), should dynamically evolve, update, adopt and implement the biosafety protocols and procedures. The bill on the Biotechnology Regulatory Authority of India (BRAI) introduced by the government needs to be pursued further by taking into account the observations of all stakeholders. Meanwhile, the existing three tier system of IBSC, RCGM and GEAC has done a good job and should be strengthened with adequate infrastructure and technical support to continue with the confined field trials so that the research progress is not halted.
- **The Agricultural Biotechnology Committee, chaired by Prof. M.S. Swaminathan, submitted its report in 2004 for a parliament approved regulatory agency as well as conducting all India coordinated trials with GMOs with appropriate precautions.** In the process, it is required to consider the genuine concerns of the GMO opponents on a scientific basis during risk assessments.
- **After biosafety clearance by the GEAC, ICAR should play a key role in the commercial release of GM crops** to prevent undue proliferation of a large number of hybrids and varieties.
- **The national regulatory system should integrate capacity building as a necessary operational requirement to keep pace with scientific advancement** through international collaborations with countries such as USA, Australia, Canada, Norway and Brazil.

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- **Scientists should communicate with the public and policy makers about the safety and benefits of GM crop products and remove the undue fears and apprehensions about GM crop adoption.** A media resource center may be set up for providing up-to-date scientific information to media representatives and correct any misinformation.
- **The Academy may set up two committees** based on the example by the Royal Society of London, including a committee on public understanding of science and a committee on political understanding of science.
- **Until the time an autonomous parliament approves a national biotechnology regulatory authority, RCGM and GEAC should have full time chairpersons as recommended by SAC to PM.** GEAC should issue "Decision Documents" when field trials of a GM event are allowed and when a GM event is finally released.
- **The GEAC should function like a statutory body and make final decisions on the approval of GM events for environmental release.** The "no-objection" certification from state governments for conduct of confined field trials is not required as their products will not get to farmers or consumers.
- **Agriculture is a state subject and it is important that the state agricultural universities and state departments of agriculture are involved in the implementation of the field trials but without losing time.** Some states are declaring themselves an organic state which precludes the use of GM crops. However, organic farming would require effective methods to face the challenge of pests and diseases.
- **Nutritional security involves attention to balanced diets and nutrition literacy.** The Food Security Act 2013 will ensure that all needing social protection against hunger will be able to get the needed calories. However, it is required to attend to other nutritional problems such as protein hunger and hidden hunger caused by the deficiency of micro-nutrients and vitamins.
- **There is a need for PAN-political support for promoting genetic engineering research in our country to harness its full potential.**
- **Return from investments in biotechnology research is very high.** Public and private sectors should develop a joint strategy which will help to ensure the inclusiveness of access to improved technologies among all farmers, small or large.
- **To achieve a zero hunger challenge of the United Nations by 2025, we must double the small farm productivity.** An increase like this will be possible only through the intensive applications of new technologies such as biotechnology.

IFPRI'S REPORT ON FOOD SECURITY IN A WORLD OF NATURAL RESOURCE SCARCITY IS NOW AVAILABLE

A new report by the International Food Policy Research Institute (IFPRI) measures the impacts of agricultural innovation on farm productivity, prices, hunger, and trade flows as we approach 2050 and identifies practices which could significantly benefit developing nations.

This report highlights agricultural practices and technologies including crop protection, drip irrigation, drought tolerance, heat tolerance, integrated soil fertility management, no-till farming, nutrient use efficiency, organic agriculture, precision agriculture, sprinkler irrigation and water harvesting. It showcases how these practices and technologies can be used in combinations to improve growing maize, rice and wheat around the world.

To access the full report go to www.ifpri.org/sites/default/files/publications/oc76.pdf or to view an informational video go to www.ifpri.org/pressroom/briefing/promising-agricultural-technologies-feeding-world-s-poorest

SAVE THE DATE FOR THE 13TH ISBGMO

The International Society for Biosafety Research (ISBR) and the Local Organising Committee are pleased to announce that Cape Town, South Africa, will be hosting the 13th International Symposium on the Biosafety of Genetically Modified Organisms (ISBGMO) from November 9-13, 2014.

The conference theme is advancing the environmental risk assessment of GMOs to address biosafety in a global society.

Registration and abstract submissions are now open! Submit your abstract(s) before June 6. Register by August 19 to receive early-bird rates.

For more information on ISBGMO13, please visit the official conference website at <http://isbr.info/ISBGMO13> or email the conference secretariat, Centeq Events, at isbgmo2014@allevents.co.za.



Important Dates	
Registration	OPEN
Call for Abstracts	OPEN
Call for Abstracts Deadline	June 6, 2014
Author Notifications	Mid July 2014
Early Registration Closes	September 15, 2014
Pre-Conference Registration Closes	October 31, 2014
Conference	November 9-13 2014

The Confined Field Trial of Pro-Vitamin A Enriched Golden Rice

DR. PARTHA S. BISWAS, PRINCIPAL SCIENTIFIC OFFICER, BANGLADESH RICE RESEARCH INSTITUTE, DHAKA

Many people in Bangladesh as well as in other developing countries do not have access to enough vitamin A or beta carotene from the food they eat. This contributes to a serious public health problem of vitamin A deficiency. It is a well known fact that vitamin A deficiency impairs the immune system, which increases the risk of death from certain common infections among young children. It is also the leading cause of blindness among children. In particular, vitamin A deficiency affects women who are pregnant or nursing because their nutrient needs increase. Among pregnant women, vitamin A deficiency can cause night blindness and may increase the risk of maternal mortality.

Because rice is widely grown and consumed all over Bangladesh, Golden Rice is expected to reach many consumers, including those who do not have reliable access to or cannot afford other sources of vitamin A. Golden Rice is intended to be used in combination with existing approaches to overcome vitamin A deficiency, including eating foods that are naturally high in vitamin A or beta carotene, eating foods fortified with vitamin A, taking vitamin A supplements, and implementing optimal breastfeeding practices.

Golden Rice is a new type of rice which contains beta carotene (provitamin A) giving its grain a unique golden color. Beta-carotene is converted into vitamin A as needed in the human body. Golden Rice was developed through genetic engineering with phytoene synthase (Psy) from corn and phytoene desaturase (CrtI) from a common food-grade micro-organism which together synthesize beta carotene in rice endosperm. A third gene, called phospho-mannose isomerase (PMI), was used as a selectable marker gene instead of using an antibiotic resistant gene. Initial molecular studies have shown that these three genes have no allergenic potential.

A research article published in the American Journal of Clinical Nutrition showed that eating one cup of Golden Rice would be able to supply 50% of the vitamin A needed for one adult daily¹. Another study in China with young children also showed that beta-carotene in Golden Rice is as good as beta-carotene in oil, which is what is provided to the children under the age of five in the national vitamin A supplementation program².

Bangladesh Rice Research Institute (BRRI) is working closely with International Rice Research Institute (IRRI) to develop adapted Golden Rice varieties as a viable option to decrease vitamin A deficiency. To help the adaptation of Golden Rice, BRRI has introgressed the Golden Rice trait into popular rice varieties keeping similar agronomic performance and resistance to major diseases and insect pests. BRRI is now conducting confined field trials with BRRI dhan29-Golden Rice backcross introgression lines with prior approval of the competent authority of the government following all biosafety compliance issues.

This trial is being closely monitored by the Institutional Biosafety committee headed by the Director General of BRRI and the Field Level Biosafety Committee of the National Committee on Biosafety (NCB). Biosafety compliance issues are rigorously monitored and evaluated by the Biosafety Officers of BRRI.

The following biosafety measures are being taken during the confined field trials of Golden Rice:

- A fence has been installed around the trial inside the CFT site.
- No rice variety was grown around 200 feet of the experimental site.
- Three rows of cognate variety (BBRI dhan29) and 5 rows of corn plants were grown around the experimental area to avoid pollen flow.
- A double drainage system improvised with PVC pipe capped with spider nets was used to avoid outflow of seeds and vegetative parts with water from the drainage channel.
- All plots will be covered with nets from the flowering to the ripening stages to keep away stray birds.
- Movement of any materials was/will be done in compliance of all relevant biosafety and phytosanitary requirements of Bangladesh.
- Access to the experimental site is limited to authorized people. A logbook is being maintained to record the entry and exit of visitors and personnel.
- All the crop residues, vegetative parts or excess seeds will be burned down and/or buried in a pit at the experimental area.
- Above all, security people have been deployed for all times to guard against the filtration of seeds or any vegetative parts from the trial site through any illegal means.
- Data will be recorded on the data recording formats developed by the National Committee on Biosafety (NCB).

After harvest, all stubbles will be ploughed under, burying all plant debris. The test site will be kept fallow at least 45 days and be monitored for the survival of rice plants. The site will be tilled or hand-weeded as frequently as needed during the fallow period to remove any rice plants.

A four member panel of scientists from different disciplines including plant pathology, entomology, soil science and agronomy have been working to look after safety issues and gathering relevant data. Data on agronomic and product performance will also be recorded during and after conducting the trial. All of this data will be submitted to the NCB for the approval process of next step trials.

References:

¹Tang, G., Qin, J., Dolnikowski, G., Russell, R., Grusak, M. (2009). Golden Rice is an effective source of vitamin A. *Am J Clin Nutr* 2009; 89:1776-83.

²Tang, G., Hu, Y., Wang, Y., Dallal, G., Grusak, M., Russell, R. (2012). B-Carotene in Golden Rice is as good as B-carotene in oil at providing vitamin A to children. *Am J Clin Nutr* 2012; 96:658-64.



The transplanting of Golden Rice was observed by many scientists including IBC members, NCB members, the IRRI representative for Bangladesh, and scientists from the Biotechnology Division of BARI.



Research on the Biosafety Assessment of GM Maize, Canola, Wheat and Soybeans

ZABTA K. SHINWARI, PROFESSOR & CHAIRPERSON, DEPARTMENT OF BIOTECHNOLOGY, QAUID-I-AZAM UNIVERSITY, ISLAMABAD

Pakistan's economy depends on agriculture. Over time, different methods to increase agricultural productivity have been introduced including genetically modified (GM) crops. Although Pakistan is among the top ten countries growing GM crops, the extensive commercial release of GM crops has caused concerns and debates over their biosafety, both for consumers and the environment. This situation has led Pakistani scientists to conduct biosafety assessment studies of transgenic crops cultivated in Pakistan.

One example of scientists conducting these assessments is the Molecular Systematics and Applied Ethnobotany Lab, Quaid-i-Azam University, Islamabad. This lab is equipped with all the necessary instruments and manpower required for such studies, including five post graduates. The lab initiated a project which won a research grant from the higher education commission of Pakistan for the biosafety assessment of GM crops to evaluate the effects of GM maize and canola on native weed species like gene flow to wild relatives, the effects on associated rhizospheric microbes and soil nutrient status and the effects on succeeding crop species.

The lab's project was divided into various groups. One of the groups examined bacterial diversity of GM and non-GM maize and canola rhizosphere at different developmental stages based on cultured and uncultured approaches. A second group assessed the allelopathic effect of GM and Non-GM maize and canola on wheat and soybean crops.

The results of this project indicated that 5% GM canola extract showed stimulatory effects on seed germination and reduced the mean germination time in soybean. In contrast, non-GM canola extracts at higher concentrations are inhibitory to soybean. GM canola improved the number of roots per plant in soybean. Non-GM canola showed inhibitory effects on root growth.

The second study on the effect of GM and non-GM canola on soybean was carried out for physiological and biochemical biosafety assessment of GM canola. Methanolic extracts of GM and non-GM canola were assessed on seed germination and growth of soybean

under sterilized conditions. The non-GM canola extracts at higher concentrations were inhibitory to soybean. GM canola improved the number of roots per plant in soybean. In contrast, non-GM canola showed inhibitory effects on root growth.

The final results indicated that the extract of GM canola increases the number of roots and the root fresh weight. However, root length was significantly decreased. Similarly, a significant rate of increase was observed in shoot fresh weight and shoot length of *Avena sativa* by treatment of GM canola. Emergence percentage, germination index, and emergence rate index show a significant effect of decrease when treated with GM canola.

The future plans of the lab include initiating similar studies recognizing the country's need and because they feel it is their responsibility to focus on this research. To see the results of their research, please view the following publications:

- Ibrahim, M., Ahmad N., Shinwari Z. K., Bano A. and Ullah F. (2013). Allelopathic assessment of genetically modified and non modified maize (*Zea mays L.*) on physiology of wheat (*Triticum aestivum L.*). *Pak. J. Bot.*, 45(1): 235-240
- Ibrahim, M., Shinwari Z. K., and Ullah F. (2013). Comparative impact of genetically modified and non modified maize (*Zea mays L.*) on succeeding crop and associated weed. *Toxicology and Industrial Health* 0748233713505125
- Ahmad, N., Shinwari Z. K., Bashir S. and Yasir M. (2013). Function and phylogenetic characterization of rhizospheric bacteria associated with GM and Non GM maize. *Pak. J. Bot.*, 45(5): 1781-1788
- Syed, K. and Shinwari Z.K. (2013). Physiological biosafety assessment of genetically modified canola on weed (*Avena sativa*). *Toxicology and Industrial Health* 0748233713503372
- Syed, K. and Shinwari Z.K. (2013). Allelopathic effect of methanolic extracts of genetically modified and non-genetically modified canola on soybean. *Toxicology and Industrial Health* 0748233713501366



The Molecular Systematics and Applied Ethnobotany Lab, Quaid-i-Azam University, Islamabad

Spotlight on the Biosafety Research in Pakistan Grants Program

The Biosafety Research in Pakistan Grants Program (BRPGP) supports laboratory, field, and literature research that will significantly advance knowledge relevant to the environmental risk assessment of genetically engineered plants in Pakistan.

The BRPGP is managed by the Center for Environmental Risk Assessment (CERA), ILSI Research Foundation, as part of the biosafety component of the Pakistan Strategy Support Program (PSSP). The PSSP is financially supported by the US Agency for International Development (USAID) through the International Food Policy Research Institute (IFPRI), which manages PSSP.

The Biosafety Research in Pakistan Grants Program recognizes the need for biosafety research as part of a broader effort to support science-based decision-making and policy development and will fund research aimed at addressing the effects of agricultural biotechnology, particularly transgenic crops, on the environment and biodiversity in Pakistan. Grantees come from agricultural or environmental research institutions and universities in Pakistan.

All grantees work to:

- Address the effects of genetically engineered (transgenic) crops on the environment.
- Be relevant to Pakistan and take place in Pakistan.
- Demonstrate applicability to environmental risk assessment of transgenic plants and regulatory decision-making in Pakistan.

This month, we are introducing two of our 2013 grantees, Dr. Khuda Bakhsh and Dr. Sabir Hussain.



2013 GRANTEE: Dr. Khuda Bakhsh

JOB TITLE: Associate Professor

ORGANIZATION: Institute of Agricultural and Resource Economics, University of Agriculture Faisalabad

PROJECT TITLE: "Assessing management practices and externalities of *Bt* cotton plantations in Paksitani Punjab"

PROJECT DESCRIPTION:

The overall goal of this project is to determine externalities of *Bt* cotton and examine farm operations and practices at farmers' fields having close links with biosafety guidelines for biotechnology crops, such as *Bt* cotton in Punjab.

This project intends to examine *Bt* and non-*Bt* cotton fields comparing pesticide use and abundance of non-target insects on non-*Bt* cotton and *Bt* cotton fields, in addition to the bollworm population which are target pests. It will comprise two types of data sets, including surveying the socioeconomic status and population of target and non-target insects. The plant inspection method will be used to estimate the population of bollworms and beneficial insects, such as ladybirds, lacewings and spiders. Pheromone traps will be used to estimate the population of pink bollworm, spotted bollworm and American bollworm.

2013 GRANTEE: Dr. Sabir Hussain

JOB TITLE: Associate Professor, Department of Environmental Sciences

ORGANIZATION: Government College University, Faisalabad

PROJECT TITLE: "Ecological impact of transgenic *Bt* cotton hybrids on soil biological attributes of varying agricultural soils in Pakistan"

PROJECT DESCRIPTION:

The purpose of this study is to assess the impact of hybrid *Bt* cotton on the dynamics of the soil biological attributes in three dominant varying agricultural soils in Pakistan. In order to achieve this purpose, *Bt* cotton hybrid along with its non-*Bt* counterpart will be allowed to grow on three varying agricultural soils in a greenhouse pot experiment.

At the end of the experiment, the soils will be tested for microbial abundance and diversity by targeting the microbial C biomass, microbial community structure by RISA and culturable microbial populations.

The impact of the *Bt* cotton hybrid will also be tested on the activity of urease, dehydrogenase and phosphatase enzymes involved in nitrogen, carbon and phosphorus cycles.

To view all grant projects, visit the CERA website at:

<http://bit.ly/1hVizAM>

CALENDAR OF EVENTS

EVENT	ORGANIZED BY	DATE	WEBSITE
INDIA			
National Seminar on GM Crops: Prospects and Issues	Kerala Agricultural University	March 17-18, 2014 Thrissur, Kerala	http://www.kau.edu/Seminars/national_seminar_cpmb.htm
Indian Maize Summit 2014	Federation of Indian Chambers of Commerce and Industry	March 20-21, 2014 New Delhi	http://www.ficci.com/
Seminar on "Agri Biotechnology"	Confederation of Indian Industry	March 26, 2014 Chennai	http://www.cii.in/
Global Conference on Technological Challenges & Human Resources for Climate Smart Horticulture: Issues and Strategies	ASM Foundation, New Delhi and Navsari Agricultural University	May 28-31, 2014 Navsari, Gujarat	http://nau.in/announce.php?id=12364
INTERNATIONAL & ONLINE			
Ex Post Impact Assessment of Agricultural Research: Experiences, Lessons Learned and Perspectives	The Food and Agricultural Organization of the United Nations (FAO)	May 5-June 1, 2014 Online	For more information, please contact AIS@fao.org
Risk Assessment Considerations for RNAi-Based GM plants	European Food Safety Authority (EFSA)	June 4-6, 2014 Brussels, Belgium	http://www.efsa.europa.eu/en/events/event/140604.htm
Risk Assessment: The Role of Science in GMO Decision-Making	ICGEB Biosafety Unit, Trieste, Italy	June 30 – July 4, 2014 Trieste, Italy	http://www.icgeb.org/meetings-2014.html
Theoretical and Practical Course "Plant Tissue Culture: Tool for Genetic Engineering of Plants"	ICGEB and National Biotechnology Development Agency, Abuja, Nigeria	August 10-23, 2014 Abuja, Nigeria	http://www.icgeb.org/meetings-2014.html
13th IUPAC International Congress of Pesticide Chemistry	IUPAC and ACS-AGRO	August 10-14, 2014 San Francisco, California United States	http://www.iupac2014.org/
12th Asian Conference and Expert Consultation on Maize for Food, Feed, Nutrition and Environmental Security	Asia-Pacific Association of Agricultural Research Institutions (APAARI), International Maize and Wheat Improvement Center (CIMMYT) and Vietnam Academy of Agricultural Sciences (VAAS)	October 27-29, 2014 Hanoi, Vietnam	http://www.apaari.org/events/12th-conference-on-maize.html
13th International Symposium on the Biosafety of Genetically Modified Organisms (ISBGMO13)	International Society for Biosafety Research (ISBR)	November 9-13, 2014 Cape Town, South Africa	http://isbr.info/ISBGMO13



SOUTH ASIA
BIOSAFETY PROGRAM

The South Asia Biosafety Program (SABP) is an international developmental program implemented in India, Bangladesh and Pakistan with support from the United States Agency for International Development. SABP aims to work with national governmental agencies and other public sector partners 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.


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