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BIOSAFETY Newsletter

A Quarterly Newsletter

In this Issue

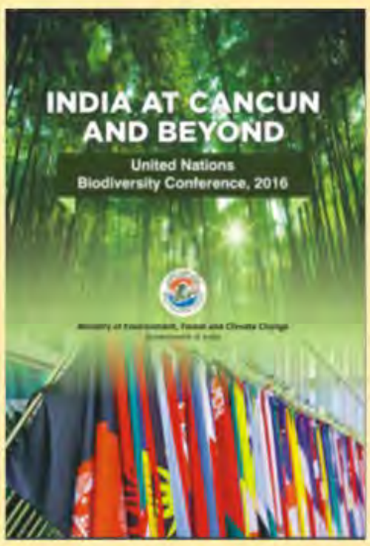
From the Desk of Editor

As you are aware, India has a well-defined regulatory framework under the Rules for manufacture, use, import, export and storage of hazardous microorganisms, genetically engineered organisms or cells (Rules, 1989) notified under the Environment (Protection) Act, 1986. A range of activities are regulated at various levels by competent authorities as per the Rules, 1989.

A brief overview of the regulatory evaluation process of genetically engineered (GE) mustard has been included in this issue of the newsletter for information of our readers.

Training and capacity building initiatives are continuing under the Phase II Capacity Building Project on Biosafety for various stakeholders. These workshops have been completed for customs & plant enforcement officials and more are planned. Series of Biosafety Capacity Building workshops have also been initiated at state level with the State Agriculture Departments and State Agriculture Universities for sharing the project outputs particularly in different languages. We encourage all to participate and share your experiences this platform.

Amita Prasad
Additional Secretary
Ministry of Environment, Forests and Climate Change



Publication: India at Cancun and Beyond

The Ministry of Environment, Forest and Climate Change has published a booklet titled "India at Cancun and Beyond" with support from the Centre for Biodiversity Policy and Law (CEBPOL), National Biodiversity Authority. The booklet was released on the International Day for Biodiversity on May 22, 2017 celebrated at Goa, with the Hon'able Chief Minister of Goa, ShriManoharParrikar as the chief guest.

The booklet provides an overview of deliberations held during the United Nations Biodiversity Conference 2016, held from December 2-17, 2016 at Cancun, Mexico. The United Nations Biodiversity Conference includes meetings of the governing bodies of the Convention on Biological Diversity and its two Protocols viz., Cartagena Protocol on Biosafety and the Nagoya Protocol on Access and Benefit Sharing.

Prepared by Ministry of Environment, Forest and Climate Change (MoEF&CC) in association with Biotech Consortium India Limited (BCIL)

Regulatory Review of Genetically Engineered (GE) Mustard (*Brassica juncea*) at Different Stages of Product Development

(Ministry of Environment, Forest and Climate Change: Dr Amita Prasad, Additional Secretary; Shri Gyanesh Bharti, Joint Secretary; Dr Murali Krishna Chimata, Joint Director and Dr P. Saranya, Deputy Director)

Indian Biosafety Regulatory Framework

In India, the regulation of Genetically Engineered (GE) products are governed by "Rules for the Manufacture/ Use/Import/ Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms or Cells" notified on 5th December, 1989 (Rules 1989) under the Environment (Protection) Act, 1986 through the Ministry of Environment, Forest & Climate Change (MoEF&CC).

The Rules 1989 have defined Six Competent Authorities for handling of various biosafety aspects viz:

1. Recombinant DNA Advisory Committee (RDAC)- Advisory (DBT)
2. Institutional Biosafety Committee (IBSC)- Regulatory (Institutes)
3. Review Committee on Genetic Manipulation (RCGM) - Regulatory (DBT)
4. Genetic Engineering Appraisal Committee (GEAC)- Regulatory (MoEF&CC)
5. State Biotechnology Coordination Committee (SBCC)- Monitoring (State)
6. District Level Committee (DLC)- Monitoring (State)

To be in consensus with international best practices and protocols followed, all over the world, Government of India several Guidelines and Manuals from time to time for safety assessment of GMOs including GE plants. Some of the key guidelines developed over a period of time are as follows:

A. Contained Use (DBT)

- Recombinant DNA Safety Guidelines, 1990
- Recombinant DNA Safety Guidelines and Regulations, 1994
- Revised Guidelines for Research in Transgenic Plants, 1998

B. Confined Field Trials (MoEF&CC and DBT)

- Guidelines for Conduct of Confined Field Trials of Regulated GE Plants, 2008
- Standard Operating Procedures (SOPs) for CFTs of Regulated, GE Plants, 2008
- Guidelines for Monitoring of Confined Field Trials of Regulated GE Plants, 2008

C. Food Safety Assessment (DBT and ICMR)

- Guidelines for the Safety Assessment of Foods Derived from Genetically Engineered Plants, 2008 (Updated in 2012)
- Protocols for Food and Feed Safety Assessment of GE Crops, 2008

D. Environmental Safety Assessment (MoEF&CC and DBT)

- Guidelines for Environmental Risk Assessment (ERA) of GE Plants, 2016
- Risk Analysis Framework, 2016
- ERA of GE Plants: A Guide for Stakeholders, 2016
- The process of development of a GE crop starts at the Institute level and the following are the different stages at which the applicant needs to obtain approvals from various agencies.

Rationale For Development of GE Mustard using *Barnase-Barstar* Technology

Brassica juncea (Indian Mustard), an important species of family *Brassicaceaeor Cruciferae*, is an annual rabi oilseed crop in India. It is a major oilseed crop of India and contains high oil content (36-42%). Traditionally mustard seeds are used for edible oil mainly as a cooking medium, oilcake as animal feed and seed as a spice and the leaves are used as vegetable for consumption.

India is the third largest rapeseed/mustard producer in the world, accounting for 12% of the global production. The crop accounts for nearly one third of the oil produced in India, making it the country's second most important edible oil crop after groundnut. Improved yield and oil quality in the rapeseed/mustard has been achieved through breeding as well as processing techniques.

The consumption of edible oil in India is approximately 21 Million tons, out of which domestic edible oil production is 5.5-6.5 Million Tons and the remaining requirements are met through imports only whose value accounts to approx..Rs. 70000 crores.. Despite various initiatives to increase the production and productivity of oilseeds to make the country self-reliant the productivity has remained in the range of 700-1000 kg/hectare which is quite less than some of the best oil producing varieties in the world.

Indian Council of Agricultural Research (ICAR) started an All-India Coordinated Research Project (AICRP) on Oilseed crops in 1967 covering groundnut, rapeseed-mustard, sesame, linseed and castor. Activities of the AICRP on Rapeseed-Mustard is operational under the umbrella of Directorate of Rapeseed Mustard Research (DRMR) since 1993 with 21 research centers and 11 verification centers across the country and is working on addressing challenges of low yields in Mustard.

However there exists a gap between production potential and actual realization in comparison to other countries like European Union, China and Canada. One of the major reasons for lower productivity in India is the non-availability of quality hybrids.

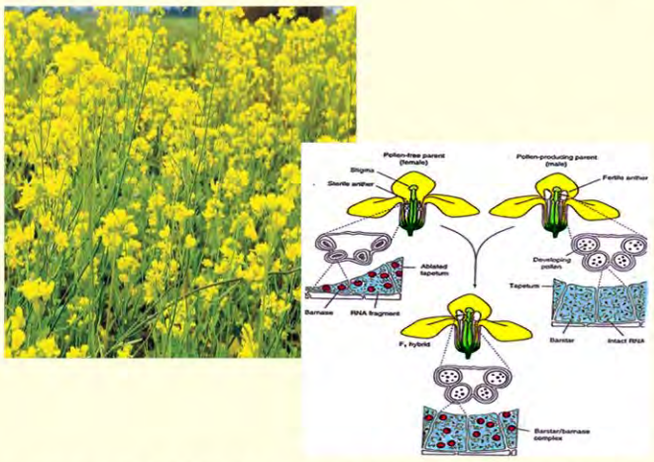
The Centre for Genetic Manipulation of Crop Plants

(CGMCP), University of Delhi, South Campus, New Delhi initiated research and development (R&D) activities way back in 2003 with an objective of development of new generation hybrids (DMH-11) by use of parental events (*Varunabn 3.6 and EH-2 Modbs 2.99*).

Barnase- Barstar Technology

Mustard flowers contain both male and female organs and the crop is pre-dominantly self-pollinating. Therefore, a pollination control mechanism is required to disallow self-pollination and encourage cross-pollination for hybrid seed production. For this, one of the two parental lines of a hybrid has to be made male sterile so that it receives pollen from the other parent to set seed. Seeds harvested from the male sterile line are hybrid seeds which can be used to reap the benefit of higher productivity of the hybrids.

Male sterile lines can be developed by using cytoplasmic male sterility (CMS) through conventional breeding or by genetic engineering using transgenes. A number of CMS systems have been tested in mustard. However, CMS/ restorer systems have been found to be inadequate for large scale hybrid seed production with high purity. CMS systems are either unstable or their restoration to fertility is inadequate. A more versatile hybrid seed production system is based on the use of transgenes – barnase and barstar genes.

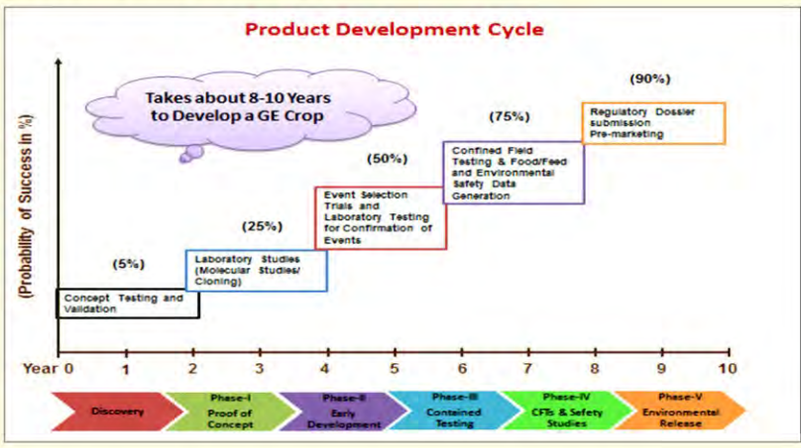


A novel way to developing male sterile (MS) lines through genetic engineering can be done through the use of two genes - barnase and barstar from soil bacterium *Bacillus amyloliquefaciens*. In nature, bacterium excretes a defense protein called Barnase (a type of ribonuclease) which degrades the RNA of competing bacteria in an ecological niche. To protect itself from Barnase, the bacterium produces another protein called Barstar which tightly binds with Barnase and renders it ineffective. Bacterial genes can only express in plants if these are expressed under plant promoters. Both Barnase and Barstar encoding genes were expressed under a tapetum specific promoter. Tapetum is a layer of cells in the male organs called anthers present in the flower.

Tapetum produces metabolites which are essential for the development of mature pollen. In the barnase gene containing lines, the tapetum tissue ablates (dies) as a consequence developing pollen degenerate, providing MS lines. The other parental line, called restorer of fertility (RF) line, contains barstar gene that also expresses in the tapetum cells. The MS line receives pollen from the RF line through wind pollination or bee pollination, resulting in the production of hybrid seed that has both the barnase and the barstar genes. When hybrids are grown by the farmer these are fully fertile. Thus the MS/ RF system ensures that the MS line will only produce hybrid seeds by outcrossing with RF lines thereby providing an efficient system of pollination control for production of hybrid seed. The system is thus referred to as barnase-barstar system.

In addition, to the barnase-barstar genes, a third gene *bar* helps for the *in vitro* selection of transgenic plants through herbicide phosphinothricin resistance. The bar gene is also derived from a soil bacteria *Streptomyces hygroscopicus* and is not pathogenic to plants, humans or animals.

Product Development Process



The process of development of any new Genetically Engineered (GE) crop takes about 8-10 years after scrutiny at multiple stages through a thorough Risk Assessment process. The Risk Assessment evaluation of any new GE product starts at institute level itself, where in through an Institutional Biosafety Safety Committee (IBSC), consisting of 7-8 experts reviews the basic application and accords necessary approval for initiating R&D activities in its institutional premises. This stage is also called as the Discovery or Proof of Concept (PoC) Stage.

Pursuant to having enough PoC, Early Development stages begins wherein the applicant obtains necessary approvals from Review Committee on Genetic Manipulation (RCGM) housed in Department of Biotechnology for research till contained/ laboratory conditions. RCGM consists of about 25-30 subject specific experts as its Members and each application is thoroughly reviewed for its completeness in terms of Risk Assessment.

After generating adequate amount of data in contained conditions, generation of date in real environmental scenario in a limited confined area is undertaken by the applicant and the GE plant is tested for its performance in contained conditions through Event Selection Trials (ESTs) and in Confined Field Trial (CFTs) conditions like Biosafety Research Trial (BRL)-I & BRL-II wherein certain restrictions on extent of area and location of the trials also needs to be adhered. The applicant needs to obtain approval from

RCGM and Genetic Engineering Appraisal Committee (GEAC), housed in MoEF&CC for undertaking such CFT studies. GEAC has about 25-30 subject specialist experts as Members of the Committee.

During the conduct of each trial, a Central Compliance Committee (CCC) visits each trial site atleast twice. The Members of the CCC would consist of a Chairman, 1-2 Subject Experts, Representative of RCGM/GEAC, representative of State Department of Agriculture not less than the rank of Deputy Director (Agriculture), Director of Research of concerned State Agricultural University (SAU), based on the trait selected an Entomologist/ Agronomist from the concerned state SAU.

In parallel or sometimes after completion of CFTs, the applicant needs to generate adequate amount of health and environmental safety data to ascertain the safety of the newly developed GE Crop. All the health and environmental safety assessment studies stipulated to the applicant are in line with the internationally well-established protocols and in harmonization with best practices being adopted and followed by many well established regulatory agencies around the world. Details of the health and environmental safety assessment studies undertaken in case of development of GE Mustard by CGMCP, University of Delhi are as below:

HEALTH SAFETY ASSESSMENT

Compositional Analysis
- Alteration in Nutrient Composition of Leaf and Seed
- Alteration in Toxin/ Anti-Nutrient Composition in Leaf and Seed

Toxicity Potential
- Expression Levels of Introduced Protein
- Acute Oral Toxicity of Purified Protein
- Sub-Chronic Toxicity with edible parts

Allergenicity Potential
- Bioinformatics Analysis of Proteins
- Peps in Digestibility
- Thermal Stability

ENVIRONMENTAL SAFETY ASSESSMENT

Weediness Potential
- Seed Germination & Speed of Seed Germination
- Seedling Vigour & Seed size
- Long Continuous Seed Production
- Pod Shattering

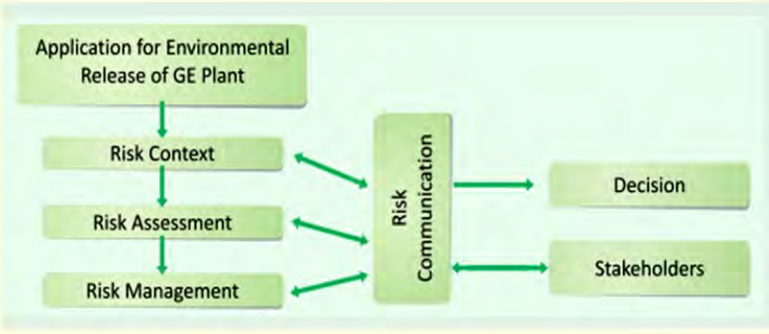
Crossability and Gene Flow
- Extent of Cross Pollination with related species
- Extent of Cross Pollination with other plant species
- Alteration in Pollen Viability
- Alteration in Pollen Production

Effect on Soil Microflora
- Alteration in abundance (CFU/gram)
- Alteration in predominant species in the region

Effect on Pests, Disease and Beneficial Insects
- Change in the susceptibility for insets and diseases
- Change in predoctor abundance
- Change in receptibility towards honey bees and any toxicity to honey bees

Application of Risk Analysis and Environmental Risk Assessment (ERA) Principles in Evaluation of GE Mustard Application by Indian Regulators

India is one of the first few countries to have established guidelines for Environmental Risk Assessment (ERA) and Risk Analysis Framework (RAF). As part of this strategy,



pursuant to receipt of GE Mustard dossier encompassing all the health and environmental safety data seeking permission for environmental release to GEAC in September 2015, GEAC has constituted a Sub-Committee to review thoroughly the entire dossier and key aspects of the application. The Sub-Committee consisting of inter-disciplinary experts through wide consultations through online and also in face to face meetings prepared an Assessment of Food and Environmental Safety (AFES) document highlighting key aspects of the application and made their recommendations.

Accordingly, pursuant to discussion of AFES document in GEAC, it was decided to keep the AFES document in MoEF&CC website for a period of 30 days from September 05, 2016 to October 07, 2016 inviting comments from Public. And the entire dossier was also made available in Ministry for review by the public who wished to review the same. Accordingly, a total of 759 comments were received from public and 29 people visited the Ministry to review the dossier in person.

Pursuant to compilation of all the comments received from public at large, the Sub-Committee reviewed individual comments and deliberated on each and every concern rose by the public and accordingly submitted their final recommendations to GEAC. Further, GEAC in its 133rd meeting held on May 11, 2017 recommended the environmental release of GE Mustard, which is awaiting the final approval from the Government.

Conclusion

India through its well established and robust regulatory mechanism in harmony with international best practices and regulatory guidelines reviewed the development of GE Mustard application at various stages of product development cycle over a period of 15 yearswhich is also in consensus with the newly adopted ERA Guidelines for GE Plants, 2016.

Celebrations of International Day for Biodiversity in Goa

The International Day for Biodiversity 2017 was celebrated all over the country by different states and various organizations on 22 May 2017. The national level celebrations of the day were held at Dinanath Mangeshkar Auditorium, Kala Academy, Goa, with the enthusiastic participation of all stakeholders. Organized by the Ministry of Environment, Forests and Climate Change, Government of India, and the National Biodiversity Authority (NBA), with support from the Goa State Biodiversity Board, in partnership with the United Nations Development Programme (UNDP), the event had Hon'ble Chief Minister of Goa Shri Manohar Parrikar as chief guest.

The event was organised in the gracious presence of Dr Amita Prasad, Additional Secretary, MoEFCC, Government of India; Shri Dharmendra Sharma, Chief Secretary, Government of Goa; Dr. Ranbir Singh, Principal Secretary, Department of Environment & Forests, Goa; Dr. B. Meenakumari, Chairperson, National Biodiversity Authority, and Ms. Marina Walter, Deputy Country Director, UNDP. Other representatives from the Ministry of Environment Forest and Climate Change, NBA, Goa State Biodiversity Board, UNDP, other states, specialized central and state government institutes, state forest departments, civil society organizations, academic institutes, students, local communities and biodiversity enthusiasts also attended the event.

Tributes were paid to and two minutes silence was observed in the memory of Shri Anil Madhav Dave, Union Minister of State (Independent Charge) for Environment, Forests and Climate Change, who was to preside over this event, but who passed away suddenly on 18 May 2017.

The Hon'ble Chief Minister of Goa inaugurated an exhibition on the day's theme, alongside a "green haat" that had exhibits from 12 states, including Sikkim, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh and Chhattisgarh, besides stalls from UNDP, GIZ, the Zoological Survey of India, Botanical Survey of India, Goa Forest Department, Goa State Biodiversity Board and NBA. In his address, he stressed on the community connect and people's participation for biodiversity conservation. He also spoke on afforestation and called for responsible development through an effective and scientific pollution control system by citing the experiences of solid waste disposal in Goa, a model system for others to emulate.

Dr. Amita Prasad in her opening remarks, referring to the theme and key objective of the day (biodiversity and sustainable tourism), highlighted the important role played by biodiversity in various economic sectors. Referring to the intrinsic linkages between biodiversity and tourism, she stated that the country has succeeded in making the crucial paradigm shift from development and environment being seen as two ends of a spectrum, to having development while protecting the environment. Noting the contribution of tourism industry in creating jobs, promoting local culture and fueling development, she highlighted the challenges and opportunities that sustainable tourism presents while supporting nature conservation.

Recalling the teachings and preachings of ancient texts and philosophers on environment and biodiversity, Dr B. Meenakumari exhorted people to contribute towards biodiversity conservation and sustainable tourism. Referring to the diversity in gastronomic tourism in different parts of the country, she in particular highlighted the delightful and unique culture and cuisine of Goa.

Ms. Marina Walter in her remarks mentioned that protection of biodiversity and ecosystem services is a shared responsibility that requires coordinated action among several actors -- the industry, policymakers, civil society and local communities.

During the event, Call for 2018 India Biodiversity Awards, and a newsletter 'Biodiversity Matters' was launched. The dignitaries presented awards to the winners of a photography contest organized as a pre-event to celebrate India's incredible biodiversity. Also released were some knowledge products and communication material.

A two-day exhibition on the theme of the day and a "green haat" were also organized at the venue, which was inaugurated by the chief guest. Interesting exhibits, posters and other material highlighting the role of biodiversity in sustaining livelihoods were displayed at the exhibition. Several students and others interested participated enthusiastically in the exhibition. The dignitaries too walked through the exhibition.

In India, a recognized megadiverse country rich in biodiversity, nearly 300 million people are dependent on biodiversity for subsistence and livelihoods. Across India, people, communities, governments and civil society organizations are demonstrating ways to conserve biodiversity, sustain livelihoods, and contribute to sustainable development.

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Training Workshops on

Strengthening Capacities of Enforcement Agencies on Transboundary Movement of Living Modified Organisms

The Ministry of Environment, Forest and Climate Change (MoEFCC) in association with the National Bureau of Plant Genetic Resources (NBPGR) organized three "Training Workshops on Strengthening Capacities of Enforcement agencies on Transboundary Movement of living modified organisms (LMOs)", under the UNEP/GEF supported Phase II Capacity Building Project on Biosafety. The three training workshops were convened on May 4-5, 2017 at Kandla, Gujarat, May 25-26, 2017 at Shillong, Meghalaya and June 6-7, 2017 at Attari, Amritsar.

The workshops have been organized for strengthening the enforcement officials by updating them about the latest biosafety regulations as well as the technological developments. The two day training workshops were attended by more than 90 officials from the Plant Quarantine and Customs Departments including Deputy Commissioners, Assistant Commissioners, Preventive Officers, Superintendents, Inspectors from Customs and Assistant Director, Plant Protection officers and Assistant Plant Quarantine officers etc.

The two day workshop program apprised the participants about the biosafety regulations at national level, India's commitment under the Cartagena Protocol on Biosafety (CPB) and demonstration of detection of living modified organisms (LMOs) by a simple, efficient and accurate technique viz., Lateral Flow Strip Test for detection of Cry1Ac in Bt cotton seeds. The role of enforcement officials towards facilitating the effective implementation of CPB by checking of documentation involved during transboundary movement of LMOs was presented besides introduction to sampling and detection techniques of LMOs. The participants were apprised about the use of Biosafety Clearing House which is an online information database for LMOs.

The faculty of the training workshops included regulators and eminent scientists i.e, Dr. Madhumita Biswas, Director, MoEFCC, Dr. Murali Krishna, Joint Director from MoEF&CC, Dr. Ranjini Warrier, Former Adviser, MoEFCC, Dr. AjitDua, Senior Scientist, Punjab Biotechnology Incubator, Mohali, Punjab, Dr. VibhaAhuja, Chief General Manager, Biotech Consortium India Limited, New Delhi, Dr. Gurinder Jit Randhawa, Principal Scientist, Genomic Resources Division, NBPGR, Dr Shashi Bhalla, Principal Scientist, Division of Plant Quarantine, NBPGR; Dr. V. Celia Chalam, Principal Scientist, Division of Plant Quarantine, NBPGR, Dr. Monika Singh, Scientist, NBPGR.

The workshops have been organized in association with Custom Departments at Kandla and Mundra, Gujarat, Custom Departments at Amritsar and Customs, Integrated Check Post (ICP), Attari, Punjab and National Academy of Customs, Excise and Narcotics (NACEN), Regional Training Institute (RTI), Shillong, Meghalaya.

Training Workshop on Risk Analysis for the Release of Genetically Modifed Organisms in the Environment

A Training workshop on "Risk Analysis for the Release of Genetically Modified Organisms (GMOs) into the Environment", was organized by the International Centre for Genetic Engineering and Biotechnology (ICGEB) with support from the Ministry of Environment and Protection of Land and Sea from May 22-26, 2017 at Trieste, Italy. The one week training workshop was aimed towards understanding the principles of risk analysis under its three components viz., risk assessment, risk management and risk communication that form part of the environmental safety assessment process and decision making of GMOs.

The workshop was attended by participants from 12 countries viz., Argentina, Brazil, Bangladesh, Colombia, Eucador, India, Italy, Islamic Republic of Iran, Kenya, Peru, South Africa, consisting of regulators, scientists etc attended the one week training workshop. The representatives from India included Dr Murali Krishna Chimata, Joint Director/ Scientist-D, Ministry of Environment, Forest and Climate Change (MoEFCC), Govt. of India (GoI) Dr P. Saranya, Deputy Director/Scientist-C, MoEFCC, GoI and Ms Sonia Kaushik, Assistant Manager, Biotech Consortium India Limited. The workshop facilitated a platform for sharing of information among participants from different countries.

The workshop program included presentations and practical sessions in break out groups on the following topics

- GMO Risk Analysis: Risk Assessment, Risk Management and Risk Communication
- Food and Feed Assessment
- Environmental Risk Assessment
- Socio-economic Considerations
- Finding Risk Analysis Resources and Data on the Internet
- Risk Communication Methodology- Data Deficit Letters
- Applying Risk Management Methodology -Key Tools
- Decision making risk communication and drafting a final report document
- Problem Formulation: Constructing and Challenging Pathways to Harm
- Hypothetical Insect Resistant, Herbicide Tolerant Maize for Mexico
- Applying Risk Assessment Methodology to the Hypothetical Case Study
- Drafting Data Deficit Letters
- Applying Risk Management Methodology to specific case studies
- Decision making and final recommendations for the specific case studies assigned to groups

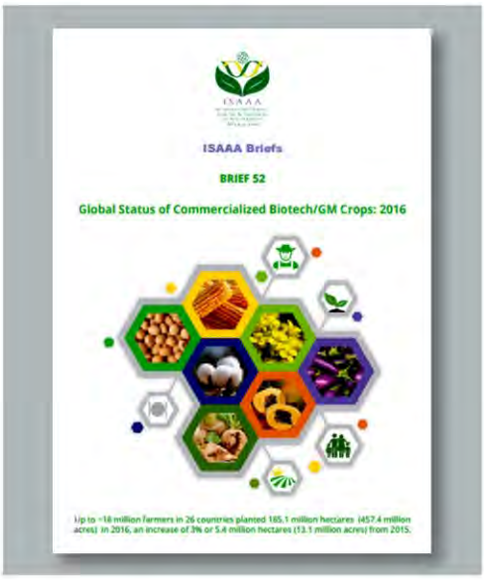
The faculty of the training workshops included members from ICGEB Biosafety Group i.e., Dr Wendy Craig, Mr Francesco Paladini, Marco Baccani, Dennis Ndolo and Andre Rosado and an independent consultant from USA, Dr Michael Wach,

ISAAA Brief 52-2016: Executive Summary

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) published the 21 issue of the Annual Global Review of Biotech Crops Commercialization that provides the latest information on biotech crops, global database on the adoption and distribution of biotech crops in 2016 as well as the accumulative data since 1996 (the first year of commercialization). It also provides country situations, trends in approval of biotech crops and future prospects of the technology in the biotech crop growing countries and the world. It has been indicated that in 2016, 26 countries grew 185.1 million hectares of biotech crops with an increase of 5.4 million hectares or 3% from 179.7 million hectares in 2015.

Further biotech crops have expanded beyond the big four (corn, soybean, cotton, and canola) to give more choices for many of the world's consumers. These biotech crops include sugar beet, papaya, squash, eggplant, potatoes that are already in the market, as well as apples which will be in the market in 2017. Potato is the fourth important staple crop in the world and eggplant is the number one vegetable consumed in Asia.

Additionally, research done by public sector institutions include crops such as rice, banana, potato, wheat, chickpea, pigeon pea, mustard and sugarcane at advanced stages of evaluation, and are likely to provide even more diverse offerings to consumers, especially those in developing countries.



The ISAAA brief can be viewed at http://www.isaaa.org/

Biodiversity Matters: An e-Newsletter

The National Biodiversity Authority (NBA), has initiated a quarterly electronic newsletter titled "Biodiversity Matters". The first issue of the newsletter was released at the International Day for Biodiversity that was held on May 22, 2017 at Goa, with Hon'ble Chief Minister of Goa, Shri Manohar Parrikar as the chief guest.

The newsletter is expected to cover salient features on activities covered out by the NBA and developments/activities on biodiversity that take place around us. The important events by the state biodiversity boards and biodiversity management committees (BMC) would be covered in the newsletter for creating awareness. The awareness generated is expected to serve accomplish the tasks of NBA and ensure effective implementation of the provisions of the Biological Diversity Act.

For submission of articles, photographs along with brief write ups on biodiversity may be submitted to the Secretary, NBA at ccbcebpol@nbaindia.org or support@nbaindia.org

Upcoming Events

Title	Organized/hosted by	Date & Venue	Website
National			
Series of Training Workshop for Customs officials and Plant Quarantine officials on Transboundary movement of Living Modified Organisms	Ministry of Environment, Forest and Climate Change (MoEFCC), ICAR-National Bureau of Plant Genetic Resources (NBPGR), Directorate of Plant Protection, Quarantine & Storage (DPPQS) and National Academy of Customs, Excise and Narcotics (NACEN)	i) May 4-5, 2017, Kandla, Gujarat: ii) May 25-26, 2017 Shillong iii) June 6-7, 2017, Amritsar	-
International conference on "Recent trends in agriculture, biotechnology and food processing"	College of agriculture, Hassan, Karnataka	July 5-7, 2017, Hassan, Karnataka	-
International Symposium on Horticulture: Priorities & Emerging Trends	Indian Council of Agricultural Research (ICAR), New Delhi, Indian Institute of Horticultural Research, Bengaluru, India Society for Promotion of Horticulture, IIHR, Bengaluru, India International Society for Horticultural Science (ISHS), Belgium	September 5-8, 2017, Bangalore	http://www.iihr.res.in/content/international-symposium-horticulture-priorities-emerging-trends
International Conference & Expo on Biotechnology & Healthcare	Centre for Good Governance and Prof. Jayashankar Telangana State Agricultural University (PJTSAU)	October 26-27, 2017, Hyderabad	http://biotech conference.org/
International			
Genome Editing & Advances in Transgenic Technology USA Congress	Oxford Global	10-11 May 2017, Boston, USA	http://www.genomeeditingusa-congress.com/
International Training Workshop on "Risk Analysis for the release of GMOs into the environment"	International Centre for Genetic Engineering and Biotechnology (ICGEB)	May 22-26, 2017, Trieste, Italy	http://www.icgeb.org/biosafety-2017.html
BIO International Convention	Biotechnology Innovation Organization	June 19-22, 2017, San Diego, CA, USA	http://convention.bio.org/
14th International Symposium on the Biosafety of Genetically Modified Organisms (ISBGMO14)	The International Society for Biosafety Research (ISBR)	June 4-8 , 2017, Guadalajara, México	http://isbr.info/ISBGMO14/HOME
Plant Transformation & Biotechnology IV	Vienna International Science Conferences & Events Association (VISCEA)	June 29-30, 2017, Vienna, Austria	http://viscea.org/index.php/plant-trans-biotech
5th Annual South Asia Biosafety Conference	South Asia Biosafety Programme (SABP), Center for Environmental Risk Assessment (CERA), ILSI Research Foundation and Biotech Consortium India Limited (BCIL)	September 11-13, 2017, Bangalore, India	http://sabc.biotech.co.in/

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