

# South Asia Biosafety Program

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## SOUTH ASIA

### Harmonization of International Standards for Food Safety - Part I

Dr. Bhavneet Bajaj, Agriculture & Food Systems Institute



A field in India © Dreamstime.com

This article is the first of two on harmonization initiatives to align standards for the safety assessment of genetically engineered (GE) foods in the South Asian region. Here, we'll talk about the challenges that we face in terms of food safety and security as global citizens in general and in South Asia in particular. We will also discuss initiatives to align regional standards in food safety.

#### FOOD SAFETY AND SECURITY

The United Nations' 2030 Agenda for Sustainable Development includes "Zero Hunger" as its second goal, with the aim to promote sustainable agriculture and feed every person on earth with plentiful and nutritious food. It is also estimated by the United Nations Food and Agriculture Organization (FAO) that feeding a global population approaching 9.1 billion people by 2050 would require increasing agricultural production by 70%. South Asia, with a population of 1.8 billion and fully one-third of the world's food-insecure people, is a region of paramount importance in this context. This means that innovations in agricultural technology and transformation of existing food systems in the region are essential if its pressing needs are to be met. Modern biotechnology is one such innovative technology. Plants developed using modern biotechnology have contributed to reducing gaps between actual and potential yields of crops under biotic stress, decreased applications of synthetic pesticides, and harbor the potential to yield environmental benefits in terms of reduction in greenhouse gases (National Academies of Sciences, Engineering, and Medicine 2016; ISAAA 2016; Pellegrino et al. 2018).

The global market for genetically engineered (GE) crops valued at USD 18.1 billion in 2018 is projected to more than double to USD

37.46 billion by 2027. In South Asia, India, Bangladesh, and Pakistan are cultivating a limited number of GE crops, as well as importing GE-derived foods and feeds. As more GE products enter the global food and feed supply chains, differences in national regulatory systems for GE plants and products have led to asynchronous approvals that can and have resulted in trade disruptions, including in the South Asian region.

#### REGIONAL AND NATIONAL FOOD SAFETY

##### HARMONIZATION INITIATIVES IN SOUTH ASIA

According to the World Trade Statistical Review 2019, exports in agricultural products are estimated at USD 2 trillion. Adherence to internationally accepted food standards allows coherent and efficient trade of food commodities without unnecessary interruptions. This applies to conventional foods, as well as novel foods derived from modern biotechnology. Several ongoing initiatives related to food safety standardization in the South Asian region are aimed at ensuring public health and improving food safety.

The World Health Organization, working with countries in South Asia, developed the Regional Food Safety Strategy (2013-2017) with the goal of promoting food safety among all population groups in the region. The strategy promotes the establishment of national Codex Alimentarius committees and International Food Safety Authorities Network (INFOSAN) focal points to enable information sharing, collaboration and participation of the Member States in international meetings, and to facilitate trade.

One of the strategic elements of the Regional Food Safety Strategy underscores the need for technical capacity building activities that involve harmonization of food standards and related texts with the Codex Alimentarius standards. Under this, Nepal has undertaken the

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“enhancement of the harmonization of food law and food standards with international benchmark.” Sri Lanka has engaged in efforts to “identify any gaps in the existing legal framework and revision of laws and regulations and harmonization of food safety activities carried out by various agencies.” India continues to revise food safety rules and regulations to be Codex-compliant. Bangladesh has furthered its efforts to raise public awareness and develop communication materials about food safety and food adulteration, and it has expanded training opportunities for food and sanitary inspectors in the country. Food safety activities in Bhutan under this strategy includes among others, enactment and implementation of the Food Act 2005 and Food Rules and Regulations 2007.

According to the [World Bank](#), countries like India and Pakistan continue to embrace regulatory reforms to ease trade across borders regionally as well as globally. In March 2020, the Food Safety and Standards Authority of India (FSSAI) mapped more than 1500 imported food products to align with internationally used harmonized system (HS) codes. India’s national Food Code System is based on the Codex Food Categorization System for all imported foods. The alignment with HS was done as part of developing a nationwide information network system with an objective to strengthen food safety systems. Bhutan identified the need to align inter-agency standards in 2015, when Bhutanese oranges were not allowed entry across the India-Bangladesh border due to confusion over standards.

Recognizing the need to bolster trade of food products in South Asia, the member states of the South Asian Association for Regional Cooperation (SAARC) have made attempts to harmonize food regulations through establishment of South Asian Regional Standards Organization (SARSO) in 2011. SARSO became operational in 2014 and has since been working to advance collaboration and regional cooperation. The SAARC Agriculture Center has also been instrumental in organizing regional consultations to promote harmonization in several areas across food and agriculture. Agreement on the South Asian Free Trade Area (SAFTA) in 2006 created a free trade area in the region and additionally, several countries in the South Asian region have signed bilateral agreements for trade of food products.

Since 2014, regional consultations and workshops with key stakeholders from SAARC countries have been organized under

the aegis of the [South Asia Biosafety Program \(SABP\)](#) to discuss the importance of harmonizing guidelines for safety assessment of GE foods and feeds. Next month’s *SABP Newsletter* will expand on these preliminary efforts, exploring new and ongoing initiatives that focus on the *Codex Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants* as a platform for regional and international harmonization.

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#### REGIONAL HARMONIZATION



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#### BANGLADESH

## SABP Webinar Series: Biosafety in Agriculture Biotechnology - In the Eyes of Future Researchers

Mr. Mohammad Umer Sharif Shohan, University of Dhaka

Part of the SABP Webinar Series, *Biosafety in Agriculture Biotechnology: In the Eyes of Future Researchers* was jointly organized by the Department of Biochemistry and Molecular Biology, University of Dhaka and the South Asia Biosafety Program (SABP). Prof. Dr. Zeba Islam Seraj, Chairperson, Department of Biochemistry and Molecular Biology, University of Dhaka, was the Chair of the event. Seventy students from bachelors, masters, and research fellows of Ph.D. and M.Phil. levels participated in the webinar.

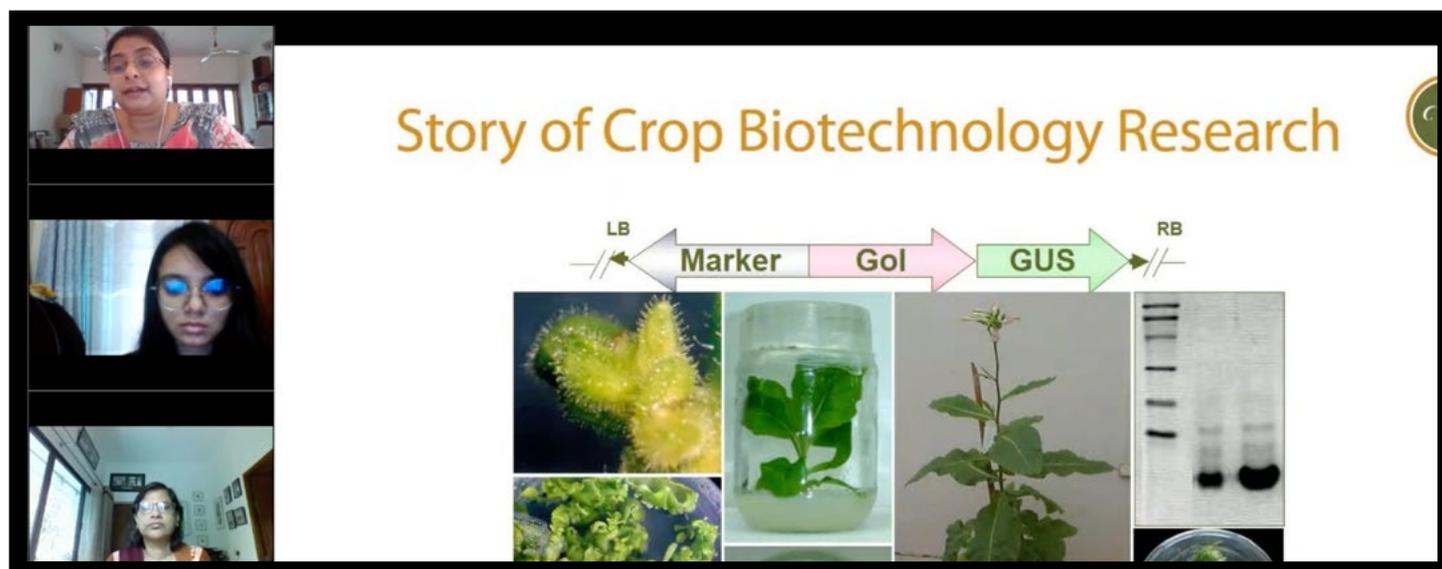
The event began with Prof Seraj’s speech, during which she elucidated numerous agricultural practices, such as using fertilizer, improved pest controls, improved plant varieties, etc., that have been adopted and resulted in magnified yield to date. Later on, she discussed the constraints of today’s agricultural productivity, such as a rising population with more mouths to feed, less land availability for agriculture, climate change, and the emergence of evolved pathogens, etc., which make it imperative to consider

**Dr. Aparna Islam, Country Manager, SABP, gave the keynote speech, where she introduced different aspects of biosafety and biosafety regimes, both around the world and in Bangladesh**

transgenic plants in addition to the traditional system to enhance crop productivity. Then, she discussed the benefits of transgenic plants and addressed opinions that are commonly voiced by people who oppose the technology and its applications. She concluded her speech by explaining how the implementation of transgenic plants will create a better future, with ample and sustainable food production.

Dr. Aparna Islam, Country Manager, SABP, gave the keynote speech, where she introduced different aspects of biosafety and biosafety regimes, both around the world and in Bangladesh, emphasizing the *Cartagena Protocol on Biosafety*. She explained *Biosafety Guidelines of Bangladesh*, especially various institutional regulatory permission requirements associated with the transgenic research and development process. She also detailed the concepts of environmental risk assessment, highlighting the monitoring of gene flow and effects on non-target organisms. Later, she explained the steps taken by SABP

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Dr. Aparna Islam, delivering the keynote presentation at the webinar (July 9, 2020).

to help maintain the safe use of modern biotechnology, considering the global convention, protocol, and Bangladesh's biosafety system. She introduced the SABP's eLearning modules to the participants and encouraged participants to look at those resources.

Finally, there was an open discussion session, during which students addressed their queries to Dr. Islam. Interesting questions were posed

by students about science communication. They expressed the need for their involvement in this sort of activity to make the consumers' perception clearer. They also seemed concerned about the timeframe to get an application processed. The entire program was facilitated by Mr. Mohammad Umer Sharif Shohan, Lecturer, Department of Biochemistry and Molecular Biology, University of Dhaka.

## BANGLADESH

### SABP Webinar Series: GM Crop Research and Biosafety Go Hand in Hand

Nur Uddin Mahmud, Nadia Afroz, S. M. Fajle Rabby, Sumaiya Talukder, Fatema, Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University

The Institute of Biotechnology and Genetic Engineering (IBGE) of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) and the South Asia Biosafety Program (SABP) jointly organized *GM Crop Research and Biosafety Go Hand in Hand* on July 23, 2020. Part of the SABP Webinar Series, the goal was to facilitate knowledge exchange on biosafety among researchers, young professionals, and students, especially those pursuing a degree in biotechnology and genetic engineering. A total of 55 students, early career researchers, and faculty members belonging to different disciplines at BSMRAU participated.

Prof. Dr. Md. Giashuddin Miah, Honorable Vice-Chancellor of BSMRAU, was present as the Chief Guest and inaugurated the event. Prof. Dr. Md. Tofazzal Islam, Director of IBGE, chaired the event. Dr. Dipali Rani Gupta, Associate Professor of IBGE, facilitated the event.

The webinar started with a welcome speech from Dr. Md. Mahbubur Rahman, Professor, IBGE. He talked about the importance of biosafety for introducing genetically modified organisms (GMOs) to the practical field. Following this, the Chair of the webinar, Prof. Dr. Md. Tofazzal Islam, stated the basic concepts and importance of GM crop research and biosafety for ensuring food security and nutrition in Bangladesh. In his speech, Chief Guest Prof. Dr. Miah emphasized the importance of genetic engineering in Bangladesh. He also praised the research contribution of IBGE to Bangladesh's agriculture and inaugurated the webinar, wishing all success.

Two interactive technical sessions were delivered during the webinar. Dr. Aparna Islam, Country Manager, SABP presented the first talk on the general biosafety requirement to conduct GM crop research in Bangladesh. She shed light on global biosafety guidelines, initiation of biosafety regulation in Bangladesh, biosafety processes for the approval of any biotech crops in Bangladesh, and risk assessment guidelines (ERA

**The webinar provided a unique opportunity to increase the knowledge of young researchers of BSMRAU about biosafety regulations.**

*Guidelines for GE Plants 2016 and Guidelines for Food Safety Assessment of GE Foods 2012*).

In the second session, Dr. Andrew F. Roberts, Vice President of the Agriculture & Food Systems Institute (AFSI) presented a talk on "Biosafety and Emerging Technologies: Gene Editing and Global Biosafety Status". He beautifully presented the background for gene editing, why people show interest in this, what gene editing does and does not do, and what types of products currently are expected to be generated by gene editing technologies. He also focused on how gene editing works,

some popular gene editing techniques, especially the CRISPR-Cas9 system, what type of changes can be done by gene editing, and a list of developed and under development products of gene editing in the USA. Finally, he gave an overview of the global regulatory status of GM crops. After his presentation, an interactive discussion session on gene editing in crops and animal and biosafety regulation for both GMOs and gene-edited products with the participants followed. The two esteemed presenters and the chair of the webinar answered all questions from the participants. At the end of the interactive session, the chair closed the webinar.

As a whole, the webinar provided a unique opportunity to increase the knowledge of young researchers of BSMRAU about biosafety regulations, manuals, and assessment guidelines to contribute to GM crop research to achieve food security for sustainable development in Bangladesh.

#### RESOURCE SPOTLIGHT

Access AFSI eLearning Courses on Biosafety and Biotechnology:  
<https://foodsystems.org/elearning>

## Research and Information System for Developing Countries Book Launch: *Socio-Economic Impact Assessment of Genetically Modified Crops - Global Implications Based on Case-Studies from India*

Dr. Amit Kumar, Research and Information System for Developing Countries



Participants at the book launch (July 6, 2020).

A webinar was organised by the Research and Information System for Developing Countries (RIS) on July 6, 2020 to launch Springer's publication of the book *Socio-Economic Impact Assessment of Genetically Modified Crops: Global Implications Based on Case-Studies from India*, edited by Prof. Sachin Chaturvedi, Director-General, RIS and Dr. K Ravi Srinivas. The book was formally released by Prof. Ramesh Chand, Member, NITI Aayog, in the virtual presence of distinguished experts, chapter contributors, and hundreds of participants from across the world.

This book is primarily based on an extensive research study undertaken by RIS in collaboration with six prominent institutions of India—IARI (New Delhi), GIDR (Ahmedabad), NAARM (Hyderabad), TNAU (Coimbatore), UAS (Dharwad), and ISEC (Bengaluru). The research study was sponsored by the Ministry of Environment, Forests and Climate Change, Government of India, under the UNEP-GEF Phase II Capacity Building Project.

The webinar began with Welcome Remarks by Prof. Sachin Chaturvedi, DG, RIS. He welcomed all the participants and extended his sincere thanks to Prof. Ramesh Chand, Member, NITI Aayog for his kind consent to release the book. He also thanked all the authors and partner institutions for their wonderful contributions and support throughout the project's execution, as well as in writing this book.

While releasing the book, Prof. Ramesh Chand, in his Keynote Address, congratulated the editors and all the authors for their scholarly analysis in dealing with the topic in a very effective and cogent manner. He stated that the book covers all the relevant dimensions and fills the gap between science policy and technology very well. He deemed the publication very timely and having the potential to help policymakers in making informed, rational, and evidence-based decisions. He stated that GM technology is a "powerful" technology, and its use in agriculture is increasing. He further stated that the future of GM Crops in India primarily depends on the gains achieved in the following three areas:

- Improvement of farm efficiency;
- Assuring sustainability in terms of optimal usage of water and land resources; and
- Ensuring food and nutrition security for the country without compromising on the issue of safety.

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After the Keynote Address, the chapter contributors presented the summary of their field surveys, which were done across six states of India, including Punjab, Haryana, Gujarat, Telangana, Tamil Nadu, and Karnataka. Their presentations were followed by a rich panel discussion. The discussion was chaired by Dr. S. R. Rao, Vice President, Sri Balaji Vidyapeeth University, Puducherry and former Senior Adviser, Department of Biotechnology, Government of India. In his remarks, Dr. Rao congratulated RIS and the whole team for coming out with this very exciting book, based on extensive research and primary surveys. All

the panellists, namely Dr. Ranjini Warriar (former Advisor, MoEF&CC), Dr. Ashwani Mahajan (Professor, Delhi University and National Co-Convener, Swadeshi Jagaran Manch), Prof. M. K. Ramesh (National Law School University, Bangalore), Shri Harish Damodaran (Editor, Rural Affairs and Agriculture, *Indian Express*), Prof. N. Chandrashekar Rao (Institute of Economic Growth, New Delhi), and Dr Koen Beumer (Utrecht University, The Netherlands), while sharing their insightful views on the topic, applauded the efforts of the editors and all the contributors in bringing out the book.

Dr. K Ravi Srinivas, RIS delivered the Vote of Thanks by thanking Prof. Ramesh Chand for releasing the book and delivering the keynote address, and to all the speakers, panellists, and participants, for their precious comments and views. He also thanked all the contributors and partner institutions, including BCIL and Springer, for their active and valuable support throughout the project and book writing.

### ABOUT THE BOOK

- Economic assessment of crops is done primarily through ex-ante and ex-post studies. Economic assessments of crops are focused on economic gains and benefits, costs and yields and benefits, impact on productivity, and welfare gains/losses for those involved.
- Socio-economic assessment as discussed in the volume is more than a mere assessment of economic gains, costs, and benefits. It takes into account inter alia, impact on the environment, health impacts, impacts on labor, impacts on women, and impacts on traditional knowledge holders/communities.
- The impacts can be assessed in terms of five key dimensions: economic, health, environmental, social, and cultural. It is obvious

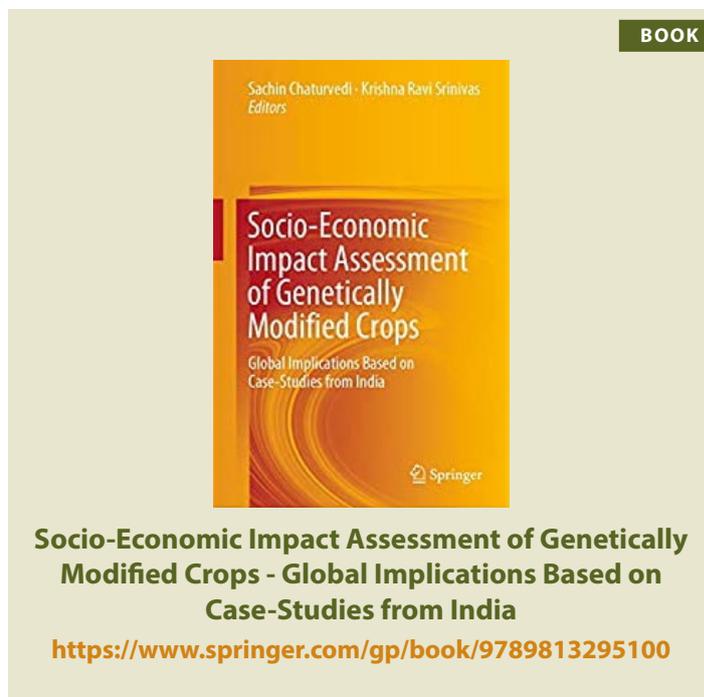
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that all impacts can be quantified or reduced to monetary terms. But, using quantitative research and qualitative research, it is possible to assess the impacts. The impacts can be assessed at different stages of the development and use of GM crops. The potential impacts can be assessed before commercialization while impacts after commercialization can also be assessed. It is a good practice to assess both, so as to understand the impacts and to know whether the expected or projected outcomes have been realized.

- In this regard, this volume takes into account Article 26.1 of *Cartagena Protocol on Biosafety* (CPB) as the guiding article. It takes neither a pro-GM stand, nor an anti-GM stand. That is beyond the purview of the volume and the research project.
- The volume discusses the literature on economic impacts of GM crops, focusing on Bt cotton in India, pointing out what studies say and what has not been given due attention. It discusses the literature on interpretation and implementation of Article 26.1 by different countries and the international debate on this.
- On socio-economic impacts, it identifies the key issues, the methodologies used, the factors to be considered, and discusses how these have been discussed in the literature. Then, based on the findings from the research, literature survey, and research done for the project, it elucidates a “Guidelines Framework for Socio-Economic Assessment of GM Crops.” It situates the findings and the framework in a larger context and states that better guidelines and frameworks can be developed.
- Globally, although there is increasing literature on Article 26.1 of CPB and socio-economic assessment of GM crops, this volume is the first to come up with “Guidelines Framework for Socio-Economic Assessment of GM Crops,” discussing inter alia, the dimensions to be considered, and the methodologies. A

questionnaire that has been tested and vetted through field data collection is also given, so that any assessment exercise can be done by adopting/adapting this questionnaire.

- Thus, the findings from this volume can be used for socio-economic assessment of GM crops, irrespective of their commercialization. We have also pointed out that socio-economic assessment will be relevant for emerging technologies and their applications, such as synthetic biology, crop genome editing, gene edited crops, and gene drives.



## INDIA

### Fertility Transition in Pigeonpea Lines

Dr. Jyoti Batra, Biotech Consortium India Limited

Pigeonpea is a key staple crop. It is a rich source of protein, highly resistant to drought, capable of improving soil health, and extremely important to small-holder farmers in India and many developing countries, such as Myanmar, Nepal, Tanzania, Kenya, etc. The mystery behind sterility among pigeonpea lines has challenged the efforts of researchers to increase its productivity to date.

Recently, researchers from International Crops Research Institute for the Semi-arid Tropics (ICRISAT) Centre of Excellence in Genomics & Systems Biology (CEGSB), in collaboration with Vienna Metabolic Centre (VIME) counterparts, were able to identify the reason behind the transition of fertile anthers to sterile anthers owing to their environmental conditions. This on-off fertility was particularly dependent on temperature, and scientists were able to reverse sterility to fertility by lowering the temperature to a critical level (24°C). Such pigeonpea lines were termed Environment-Sensitive Genic Male Sterile (EGMS) lines.

This new study sheds light on unique phenomena of fertility-sterility transition at the molecular level using the systems biology approach in the EGMS line (Pazhalama et al. 2020). A transcription factor called REVELLE1 was identified, which regulates plant growth hormone auxin levels that explains the fertility transition in response to day temperature, especially morning hours. By determining the temperature-auxin-transcription factor-pollen stage link, it was demonstrated that external auxin treatment can satisfactorily reverse sterility even when the day temperature is higher than the threshold.

**This new study sheds light on unique phenomena of fertility-sterility transition at the molecular level using the systems biology approach in the EGMS line.**

Earlier, ICRISAT and partnering institutions had developed the world's first pigeonpea hybridization technique that uses three lines to produce a hybrid. The hybrids from the three-line system posted 40% more yields than pure varieties. However, three-line hybrid seed production system is technically demanding and resource intensive. An EGMS line could be used together with any elite line for hybrid seed production in a two-line hybrid breeding system.

Detecting the key environmental 'cue', critical developmental stage(s), and genes involved and understanding the molecular mechanisms of fertility transition is critical for the success of a two-line hybrid breeding system. With an EGMS line, precise temperature control can be used for both production of hybrid seeds for farmers and to multiply the hybrid itself. Further, the exogenous application of auxin could be useful for multiplication of the male sterile line under unfavorable conditions (e.g., higher day temperatures).

In a nutshell, this study would enable the development of an effective two-line hybrid breeding system for rapid, inexpensive, and high-quality hybrid pigeonpea seed production, which would help the farming community in developing countries.

Source:

<https://www.icrisat.org/secret-to-on-off-fertility-discovered-in-pigeonpea/>

References:

Pazhamala, Lekha T., et al. (2020) "Multiomics approach unravels fertility transition in a pigeonpea line for a two-line hybrid system." *The Plant Genome*: e20028.

## CALENDAR OF EVENTS

| EVENT  | ORGANIZED BY   | DATE  | WEBSITE   |
|--|--|---|---|
| <b>INDIA</b>   |  |   |   |
| India Bio @ Bengaluru Tech Summit  | Department of Information Technology Biotechnology and Science and Technology, Government of Karnataka   | September 21-23, 2020<br>Bengaluru, Karnataka | <a href="http://www.indiabio.in/">http://www.indiabio.in/</a>   |
| 4 <sup>th</sup> International Conference on NANOFORAGRI 2020 - Application of Nanotechnology for Sustainable, Productive and Safer Agriculture and Food System | The Energy and Resources Institute   | November 5-6, 2020<br>Gurugram, Haryana       | <a href="https://www.teriin.org/event/4th-international-conference-nanoforagri-2020-application-nanotechnology-sustainable">https://www.teriin.org/event/4th-international-conference-nanoforagri-2020-application-nanotechnology-sustainable</a> |
| International Conference on Sugarcane Research   | ICAR-Sugarcane Breeding Institute, Tamil Nadu Agricultural University, and Society for Sugarcane Research and Development  | November 7-10, 2020<br>Coimbatore             | <a href="http://sugarcane.icar.gov.in">http://sugarcane.icar.gov.in</a>   |
| Indian Seed Congress 2021  | National Seed Association of India   | February 24-26, 2021<br>Bengaluru             | <a href="https://isc2021.nsai.co.in/">https://isc2021.nsai.co.in/</a>   |
| <b>INTERNATIONAL</b>   |  |   |   |
| 5 <sup>th</sup> International Conference on Genome Editing and Gene Therapy  | Meetings International   | August 19-20, 2020<br>Osaka, Japan            | <a href="https://www.meetingsint.com/conferences/genomeediting">https://www.meetingsint.com/conferences/genomeediting</a>   |
| 7 <sup>th</sup> Plant Genomics and Gene Editing Congress: Asia   | Global Engage Ltd.   | September 14-15, 2020<br>Bangkok, Thailand    | <a href="http://www.global-engage.com/event/plant-genomics-asia/">http://www.global-engage.com/event/plant-genomics-asia/</a>   |
| 24 <sup>th</sup> Meeting of the Subsidiary Body on Scientific, Technical, and Technological Advice   | Secretariat of the Convention on Biological Diversity  | November 2-7, 2020<br>Montreal, Canada        | <a href="https://www.cbd.int/meetings/?thm=CPB">https://www.cbd.int/meetings/?thm=CPB</a>   |
| 3 <sup>rd</sup> Meeting of the Subsidiary Body on Implementation   | Secretariat of the Convention on Biological Diversity  | November 9-14, 2020<br>Montreal, Canada       | <a href="https://www.cbd.int/meetings/?thm=CPB">https://www.cbd.int/meetings/?thm=CPB</a>   |
| The 3 <sup>rd</sup> Asian Horticultural Congress 2020 (AHC 2020)   | Horticultural Science Society of Thailand, International Society for Horticultural Science, Department of Agriculture, Department of Agricultural Extension, Ministry of Agriculture, Kasetsart University, and VNU Exhibitions Asia Pacific | December 15-17, 2020<br>Bangkok, Thailand     | <a href="http://ahc2020.org/">http://ahc2020.org/</a>   |



**SOUTH ASIA**  
BIOSAFETY PROGRAM

The South Asia Biosafety Program (SABP) is an international developmental program implemented in India and Bangladesh 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.



Agriculture &  
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