

# South Asia Biosafety Program

NEWSLETTER FOR PRIVATE CIRCULATION ONLY – NOT FOR SALE



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## BANGLADESH

### The Journey of Golden Rice: From Development To Approval

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#### STUDENT SHOWCASE

To encourage written discourse on topics related to biosafety and biotechnology among the younger generation, the *SABP Newsletter* dedicates space in select issues to spotlight pieces written by students residing in South Asia. Since articles with the "Student Showcase" tag are meant to reflect the actual views and capabilities of the author(s), they are not revised for content and only lightly edited to conform with the newsletter's style guide.



People working on rice field in Bangladesh. © Badal Chandra Sarker | Dreamstime.com

The year 2021 is very important for biotech researchers as several biotech products got approval, not only to protect us from COVID-19, but also to ensure nutritional security. Golden Rice (GR) is one such success story, where rice has been genetically modified by introducing genes responsible for the biosynthesis of  $\beta$ -carotene that converts to Vitamin A when metabolized by humans. This fortified transgenic rice was developed to combat vitamin A deficiency (VAD) that prevails in third-world countries. Night blindness, delayed growth, respiratory infection, poor wound healing, and skin diseases are among the many health issues that are caused by this deficiency, which can even lead to death. For decades, this has been dealt with through Vitamin-A supplementation campaigns. However, infrastructure requirement is a great disadvantage, along with the huge cost involved. In such a case, fortification of a staple food may be a better option.

**Golden Rice (GR) is one such success story, where rice has been genetically modified by introducing genes responsible for the biosynthesis of  $\beta$ -carotene that converts to Vitamin A when metabolized by humans.**

Against this backdrop, in the 1990s, Ingo Potrykus and Peter Beyer engineered a traditional rice variety and developed GR. Rice plants possess most of the machinery to synthesize  $\beta$ -carotene and by introducing a plant phytoene synthase (*psy*) (in GR1, phytoene synthase was transferred to rice from daffodil and in GR2, it was transferred from maize) and bacterial phytoene desaturase (*crtI*) gene (from the soil bacterium *Erwinia*), the pathway was completed to effectively produce  $\beta$ -carotene that consequently, accumulates in the grain.

Safety assessment is a major part of any GMO research translation. Therefore, for GR molecular characterization of the introduced gene constructs, transgene persistency, selective advantage or disadvantage, effects on the environment and other animals, compositional analysis of the GR, toxicity, and allergenicity were assessed. For most of the assessments, for example, persistency, selective advantage or disadvantage,

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Aerial view of rice field in Bangladesh. © Md Shahanur Islam | Dreamstime.com

gene transfer, animal and environmental impacts, cultivation management, etc., researchers found GR to be comparable to the conventional counterpart. Gene expression profiling showed no unexpected changes or gross changes in the expression profile as compared to the parent material. To find out possible human impacts, several types of research have been done. The probability of allergenic potential was dismissed via bioinformatics studies by analyzing transgene proteins. Again, in a simulated gastric fluid assay, the transgenic proteins were found highly digestible. Also, the compositional analysis showed that a very little amount of carbon is diverted into carotenoids by the GR, which is within the recommended range. Trials in the USA and in China showed no adverse effects and proved that the human intestine is capable of extracting  $\beta$ -carotene out of GR efficiently. Overall, negative health effects because of the introduction of genes were zero according to small-scale trials. Other than these studies, the endosperm carotenoid biosynthetic pathway modification was subjected to in-depth investigation, which gave a clear answer for the yellow color of GR. In summary, GR is as safe as conventional rice.

These assessments of environmental and consumer safety were done over many years, and the results have been submitted to the appropriate regulatory authorities. In the Philippines, the Rice Research Institute (PhilRice) and the International Rice Research Institute (IRRI) submitted regulatory data to the Department of Agriculture-Bureau of Plant Industry (DA-BPI) in the spring of 2017, which were reviewed by several regulatory committees representing agriculture, the environment, health, science and technology, and local governments. A biosafety permit was issued to DA-PhilRice and IRRI, giving approval for food and feed use and also for processing on December 18, 2019. On July 21, 2021, the Commercial Propagation Permit for Golden Rice in the Philippines was signed off by the Director of the Philippines DA-BPI. This is a significant decision since it is the first time Golden Rice has been approved for commercial cultivation in a country where rice is the main food and VAD is a severe public health issue.

On May 24, 2018, the U.S. Food and Drug Administration (FDA) released a statement on the GR2E. In terms of safety and nutrition, the FDA statement agrees with IRRI's assessment. The U.S. FDA's announcements were followed by Food Standards Australia New Zealand (FSANZ) and Health Canada in February and March 2018, respectively. These three regulatory agencies based their assessments on concepts and principles developed by WHO, FAO, OECD, and the Codex Alimentarius Commission over the past two decades. Government regulators in Australia (in 2017), Canada (in 2018), New Zealand (in 2017), have approved

the Golden Rice genetic modification event GR2E for consumption. In August 2019, the BB PADI (Indonesia) rice research center in Sukamandi, West Java, started field testing for GR in its test fields.

The goal behind developing Golden Rice was to provide a solution to VAD, but there are many concerns over its impact in tackling VAD. There are concerns over the beta-carotene amount in Golden Rice to overcome VAD. Furthermore, there are concerns over the cost of Golden Rice. The color of Golden Rice is also an issue of concern as a yellowish color may cause disturbance in people due to traditional usage behavior. Therefore, regulators assessed the applications focusing on the relevant concerns through scientific data.

**In November 2017, the Bangladesh Rice Research Institute (BRRRI) submitted data on Golden Rice to the Ministry of Environment, Forest, and Climate Change. To date, several field trials have been conducted.**

Golden Rice promises daily supplementation of Vitamin A for people residing in developing countries. For several decades, UNICEF's Vitamin A supplementation programs have been carried out to boost children's immunity and to protect them from infection. It has been

reported that through this continuous effort, the child survival rate has improved. Vitamin A is also crucial for adults, especially for pregnant mothers. In light of that, in November 2017, the Bangladesh Rice Research Institute (BRRRI) submitted data on Golden Rice to the Ministry of Environment, Forest, and Climate Change. To date, several field trials have been conducted. Now, it is Bangladesh's turn to see a regulatory decision regarding Golden Rice.

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## Brainstorming Session: Facts and Concerns about Genetically Modified (GM) Soybean at the International Soy Conclave 2021

Dr. Sharad Tiwari, Professor and Director, Biotechnology Centre, Jawaharlal Nehru Krishi Vishwavidyalaya (JNKVV), Jabalpur and Dr. Milind B. Ratnaparkhe, Senior Scientist (Biotechnology), ICAR-Indian Institute of Soybean Research (IISR), Indore

The International Soy Conclave was organized by the Soybean Processors Association of India (SOPA), a national-level body representing soybean processors, farmers, exporters, and brokers in India, from October 9-10, 2021 in Indore. A brainstorming session on *Facts and Concerns about Genetically Modified (GM) Soybean* was held as part of the conclave. The session included presentations and discussions by scientific experts, civil society organizations, and farmers/farmer leaders. Dr. Sharad Tiwari, Professor and Director, Biotechnology Centre, Jawaharlal Nehru Krishi Vishwavidyalaya (JNKVV), Jabalpur provided an overview of GM crops, with a focus on cultivation, use, and research at the global level. Dr. Tiwari explained that GM soybean is grown in about 78% of the area under soybean cultivation globally. He also discussed innovative technologies, viz. gene editing, which can be used for improving the productivity of soybean. Dr. Milind B. Ratnaparkhe, Senior Scientist (Biotechnology), ICAR-Indian Institute of Soybean Research (IISR), Indore spoke about research initiatives underway to meet the challenges of increasing productivity. Dr. B. Dinesh Kumar, Former Scientist-G (Director Grade), National Institute of Nutrition (NIN), Hyderabad spoke about concept and principles for safety assessment of GM crops and also shared experiences of evaluating the toxicity, allergenicity, and compositional analysis of Bt brinjal, Bt cotton, GM mustard, Bt okra, etc. at NIN, Hyderabad. A presentation was made by Shri Kapil Shah, Jatan Foundation, who shared several concerns regarding the use of GM crops. Views were expressed by Dr. Ashwani Mahajan from Swadeshi Jagran Manch, and Mr. Krishna Bir Chaudhary from Bharat Krishak Samaj raised socio-economic concerns about the adoption of GM crops. Dr. Vibha Ahuja, Chief General Manager, Biotech Consortium India Limited, New Delhi spoke about analysis of concerns raised and the impact on development of GM crops. She indicated that internationally

accepted methodologies are in place for addressing scientific concerns. However, several other concerns are mostly based on apprehensions. She indicated that despite the safe use of GM crops globally and success of Bt cotton in India, there have been no further approvals of any GM crop. Coupled with a significant reduction in the number of confined field trials, and research has significantly reduced. Various speakers mentioned the recent approval for import of GM soybean meal for use in the country and also expressed concern at rising prices of edible oil and soybean meal.

**Union Minister Shri Nitin Gadkari [...] called for creating awareness about the development of GM seeds in India among different sections, including those who are opposed to GM seeds.**

A short document on *Facts and Concerns about GM Crops (with a focus on Soybean)*, prepared by BCIL with input from Dr. Sharad Tiwari, Dr. Milind B. Ratnaparkhe, and Dr. B. Dinesh Kumar, was circulated to all the participants in the conclave. The document provides information on the need

and status of GM crops, particularly GM soybean, safety issues, and the biosafety regulatory framework in India. The document also addresses some frequently asked questions about GM crops.

Union minister Shri Nitin Gadkari virtually addressed the participants of the International Soy Conclave on October 10, 2021<sup>1</sup>. The Union minister expressed concerns about the import of edible oils and high prices in the country. He indicated that India is currently importing 65 percent of the total edible oil it needs, at the cost of Rs 1.40 lakh crore every year. Shri Gadkari stressed the need to develop GM (Genetically Modified) seeds for soybean along the lines of mustard to remove its shortcomings to ensure that the country becomes self-reliant in the production of edible oil. He stated that he has discussed the issue of GM seed for soybean with the Hon'ble Prime Minister. He called for creating awareness about the development of GM seeds in India among different sections, including those who are opposed to GM seeds.

<sup>1</sup> [https://economictimes.indiatimes.com/industry/energy/oil-gas/need-to-boost-biofuel-production-to-reduce-dependence-on-import-of-crude-oil-and-fuel-gases-nitin-gadkari/articleshow/86915001.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/industry/energy/oil-gas/need-to-boost-biofuel-production-to-reduce-dependence-on-import-of-crude-oil-and-fuel-gases-nitin-gadkari/articleshow/86915001.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)



Speakers at the Brainstorming Session: Facts and Concerns about Genetically Modified (GM) Soybean, part of the International Soy Conclave 2021 (October 9, 2021).



Resources highlighted in the presentation by Dr. Vibha Ahuja (BCIL) at the brainstorming session at the International Soy Conclave 2021 (October 9, 2021).

## Realizing Potential of Commercial Plant Tissue Culture: Challenges and Way Forward

Dr. Shiv Kant Shukla, Deputy General Manager, Biotech Consortium India Limited, New Delhi



Plant tissue culture of orchid. © Pitakareekul | Dreamstime.com

Commercialization of plant tissue culture in India has attained significant growth in the last three decades, with current capacity at 500 million plants per annum starting from just 5.0 million in the late 80's, as well as increasing quality and productivity of crops. Adoption of tissue culture has created demand for producers, farmers, and nursery owners for high quality planting material of fruits, ornamentals, forest tree species, and vegetables. India has attained the top rank in banana production globally, for which tissue culture technology has played a key role. There is an urgent need to expand commercial applications to many other species, in addition to a few plants, namely banana, sugarcane, potato, pomegranate, date palm, orchids, flowering plants, etc.

In this context, the webinar on *Realizing Potential of Commercial Plant Tissue Culture: Challenges and Way Forward* was organised by Biotech Consortium India Limited (BCIL) on September 9, 2021. This webinar focused on the importance and potential of plant tissue culture technology, highlighting its current status, challenges encountered, and exploring the possibilities of establishing support systems for industry to expand applications of tissue culture for sustainable agriculture. More than 200 participants from 27 countries attended this webinar.

Following a welcome note by Dr. Purnima Sharma, Managing Director, BCIL, Dr. V.P. Kamboj, Chairman, BCIL spoke about the glorious journey of plant tissue culture from research to commercialization in India and highlighted the importance of a tissue culture quality management and certification system. Dr. Naveen Kumar Patle, Additional Commissioner (Horticulture), Ministry of Agriculture and Farmers Welfare spoke about the use of tissue culture technology in horticulture crops, particularly banana, orchids, date palm, pineapple, and papaya,

and encouraged all young entrepreneurs to take advantage of incentives/schemes provided by the government. Dr. Vidya Gupta, Former Chair and Chief Scientist, CSIR-National Chemical Laboratory, Pune spoke about opportunities and demand for plant tissue culture in new areas, such as medicinal and aromatic plants.

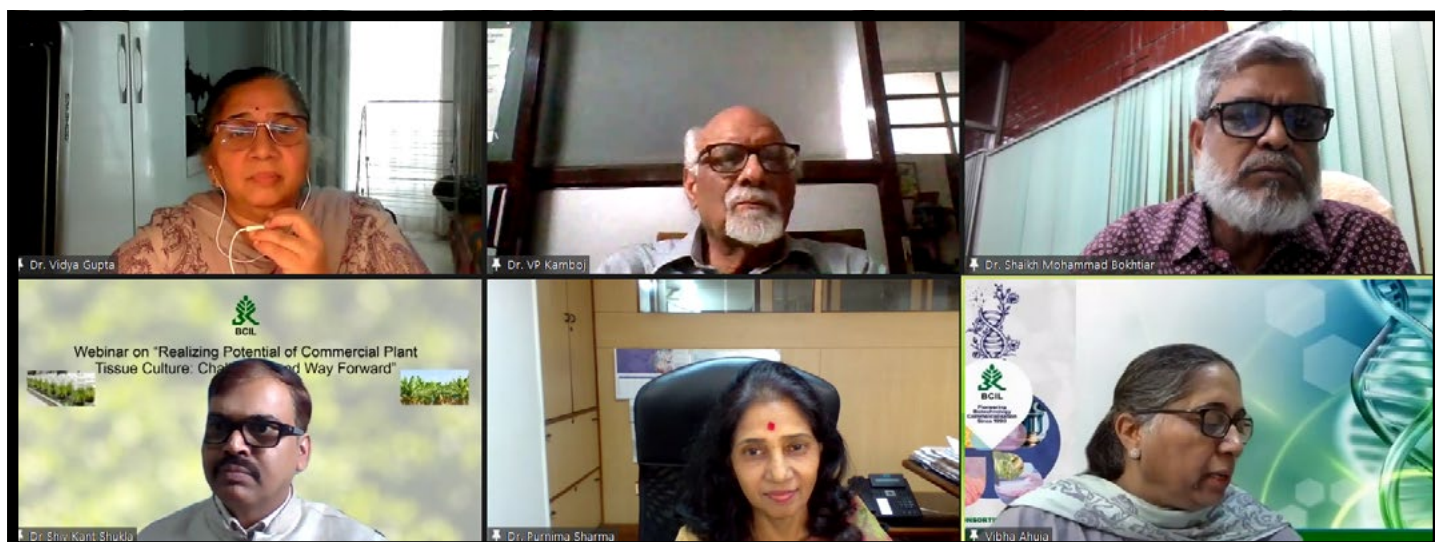
The event had presentations from esteemed experts from Bangladesh and Nigeria. Dr. Shaikh Mohammad Bokhtiar, Executive Chairman, Bangladesh Agricultural Research Council (BARC) and Former Director, SAARC Agricultural Centre (SAC), Bangladesh spoke about potential avenues for plant tissue culture in South Asia. He emphasized the need for applied research and collaborations for expanding use of

plant tissue culture to improve agricultural productivity. Discussing the potential of tissue culture technology in African countries, Dr. Olusola Sokefun, Professor, Lagos State University, Nigeria talked about the urgent need for replicating the Indian experience of a quality management system in Africa. In

the concluding presentation, Dr. Shiv Kant Shukla spoke about the challenges faced by the plant tissue culture industry. He underscored the importance of selection of explants from suitable sources, disease-free stock material, authenticity of varieties, and elimination of somaclonal variants as some of the most critical parameters for ensuring the quality of tissue culture plants. He suggested an action plan to address the need for quality stock material and robust quality control mechanism to succeed in getting recurrent demand. There was enthusiastic response from industry participants, who shared their experiences and sought clarifications from experts.

Overall, the webinar provided an excellent platform to discuss opportunities and challenges of plant tissue culture.

**Dr. Shaikh Mohammad Bokhtiar, Executive Chairman, Bangladesh Agricultural Research Council (BARC) [...] emphasized the need for applied research and collaborations for expanding use of plant tissue culture to improve agricultural productivity.**



Speakers at the webinar on *Realizing Potential of Commercial Plant Tissue Culture: Challenges and Way Forward* (September 9, 2021).



Advancing science in support of sustainable bio-innovation.

# ABSTC Student Scholarship for Attendance at the 16<sup>th</sup> ISBR Symposium

A great opportunity to showcase your work in biotechnology, network with experts in the field, and advance your career!

**Application Form:** <https://isbr.info/symposium-scholarships>

**Deadline:** **October 31, 2021**

The Agriculture Biotechnology Stewardship Technical Committee (ABSTC), in collaboration with the International Society for Biosafety Research (ISBR), is sponsoring several student scholarships for ISBR2022. In order to qualify, an abstract of yours must have been accepted for a poster or oral presentation. The scholarship will cover conference registration, up to 4 night's accommodation (at the conference hotel), and reimbursement of travel (flight) expense of up to \$2000 USD.

## Eligibility and Terms and Conditions

- To qualify, an abstract of yours must be accepted for a poster or oral presentation at ISBR2022.
- The scholarship will be presented to full-time students, younger than 35 (i.e. you must be 34 or younger on April 14, 2022).
- There are limited scholarships available, and the awardees will be selected at the discretion of the organizers. No correspondence will be entered into.
- Previous ISBR Scholarship recipients are not eligible.
- A maximum of one scholarship will be awarded per academic institution.
- Should you not arrive, you will be held responsible for all travel expenses and cancellation fees should the ISBR not be eligible for a refund.
- Airfare receipts will be required for reimbursement. Any upgrades from economy airfare or additional accommodation nights will be at your own expense. Any other travel expenses incurred will not be covered.
- Agree that your photo, name, and affiliation be published on the ISBR2022 website.

## Application Requirements:

- Submit an abstract on the official ISBR2022 website and template.
- Complete and submit the official ABSTC-ISBR scholarship application form.
- Attach a short CV (max two pages), including information on your relevant experience and publications.
- Provide proof of current enrollment as a full-time student. Acceptable proof includes an email from your advisor sent from the official university account, or a statement from the advisor on the university letterhead, or transcripts showing proof of current enrollment, or your student ID card with a valid expiry date.
- Only electronic submissions will be accepted.

**CALENDAR OF EVENTS**

EVENT	ORGANIZED BY	DATE	WEBSITE
<b>INDIA</b>			
International Conference on Agricultural Genomics - Progress and Prospects	Tamil Nadu Agricultural University	October 21–23, 2021 Coimbatore	<a href="https://tnau.ac.in/news-events/">https://tnau.ac.in/news-events/</a>
International Symposium on Plant Biotechnology Towards Improving Agri-Food Industry and Healthcare Products (ISPB-2021)	Birla Institute of Technology, Mesra, Ranchi	October 27-30, 2021 Ranchi	<a href="https://www.bitmesra.ac.in/ispbdefault?page=adminispb&amp;pid=home">https://www.bitmesra.ac.in/ispbdefault?page=adminispb&amp;pid=home</a>
9 <sup>th</sup> Indian Horticulture Congress - 2021: Horticulture for Health, Livelihoods, and Economy	Indian Academy of Horticultural Sciences and Chandra Shekhar Azad University of Agriculture and Technology	November 18-21, 2021 Kanpur	<a href="https://csauk.ac.in/9th-indian-horticulture-congress-from-18-21-november-2021/">https://csauk.ac.in/9th-indian-horticulture-congress-from-18-21-november-2021/</a>
International Potato e-Conference: New Paradigms in Food Security and Industrial Application	ICAR-Central Potato Research Institute, Shimla	November 23-26, 2021 Shimla	<a href="https://cpri.icar.gov.in/">https://cpri.icar.gov.in/</a>
SUGARCON-2022 - International Conference on Sustainability of the Sugar and Integrated Industries: Issues and Initiatives	ICAR-Indian Institute of Sugarcane Research, Lucknow	February 16-19, 2022 Lucknow	<a href="https://iisr.icar.gov.in/iisr/">https://iisr.icar.gov.in/iisr/</a>
43 <sup>rd</sup> Annual Meeting of Plant Tissue Culture Association–India (PTCA-I) & International Symposium on Advances in Plant Biotechnology and Nutritional Security (APBNS-2022)	ICAR-National Institute for Plant Biotechnology, New Delhi	February 17-19, 2022 New Delhi	<a href="http://www.nrcpb.res.in/">http://www.nrcpb.res.in/</a>
<b>INTERNATIONAL</b>			
10 <sup>th</sup> Meeting of the Conference of the Parties Serving as the Meeting of the Parties to the Cartagena Protocol on Biosafety	Secretariat of the Convention on Biological Diversity (SCBD)	October 11-15, 2021 and April 25-May 8, 2022 Kunming, China (tentative dates)	<a href="https://www.cbd.int/meetings/?thm=CPB">https://www.cbd.int/meetings/?thm=CPB</a>
Webinar on Synthetic Biology Governance and Cooperation Opportunities	Secretariat of the Convention on Biological Diversity (SCBD)	November 2, 2021	<a href="https://www.cbd.int/meetings/?thm=CPB">https://www.cbd.int/meetings/?thm=CPB</a>
Workshop on Fall Armyworm Control: Challenges and Opportunities for the Use of Biopesticides	International Centre for Genetic Engineering and Biotechnology	November 16-18, 2021 Cape Town, South Africa	<a href="https://www.icgeb.org/activities/meeting-and-courses/">https://www.icgeb.org/activities/meeting-and-courses/</a>



**SOUTH ASIA**  
BIOSAFETY PROGRAM

The South Asia Biosafety Program (SABP) is an international development program implemented in India and Bangladesh with support from the United States Agency for International Development (USAID). 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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