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South Asia Biosafety Program

BANGLADESH

Actualizing the Gene Revolution: Hands-On Training on Genome Editing, Gene Cloning, and Recombinant DNA Technology

Mst. Muslima Khatun, Senior Scientific Officer and Tahia Anan Rahman, Scientific Officer, National Institute of Biotechnology

Participants during the National Institute of Biotechnology's Hands-On Training on Genome Editing, Gene Cloning, and Recombinant DNA Technology (May 16-25, 2022).

In 1943, four million people died of hunger in eastern India, which includes today's Bangladesh. This catastrophe, known as the Bengal Famine, was attributed to an acute shortfall in food production because the food supply was a low priority for the British rulers. When the British left India in 1947, the Indian subcontinent continued to be haunted by food security problems until about 1967. To combat this, the government largely concentrated on expanding farming areas, but soon enough, it was realized that the population was growing at a much faster rate than food production. This called for an immediate and drastic action to increase yield. That drastic action came in the form of the Green Revolution.

The Green Revolution was responsible for an extraordinary period of growth in food crop productivity in the developing world over the last few decades. A combination of high rates of investment in crop research, infrastructure, and market development, and appropriate policy support powered this land productivity. It was associated with chemical fertilizers, agrochemicals, controlled water supply, and newer methods of cultivation. Despite increasing land scarcity and high land values, these elements of a Green Revolution strategy improved productivity growth. But, with the ever-rising population rate, as well as imminent climate change and the concern over excess and inappropriate use of chemical fertilizers, the development of new crop varieties through selective breeding has reached its limits. This had led scientists to turn to the creation of improved strains of crops via genome editing, giving birth to a phenomenon known as the Gene Revolution.

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Genome editing technologies, the main weapon of the Gene Revolution, has enabled targeted and precise changes to genomes, which can improve a wide range of crop plants, including those that underpin food security in low- and middle-income countries. These cutting-edge technologies offer a level of accuracy and predictability that was previously unavailable when attempting to modify crop genomes. Proper

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Group photo of participants at the NIB's Hands-On Training on Genome Editing, Gene Cloning, and Recombinant DNA Technology (May 16-25, 2022).

application of these techniques has the potential for widespread benefits, including nutritional enhancement, resistance to disease, weeds, and pests, greater seed affordability due to cheaper seed production, and enhanced climate resilience, such as drought tolerance. The CRISPR/Cas technology is the latest tool that has revolutionized the field and has greatly expedited the progress of gene editing from concept to practice. On the other hand, recombinant DNA technology has shown multifaceted applications with extraordinary potential in a variety of fields, ranging from basic research to applied biotechnology and biomedical research. For instance, by the virtue of this technology, crucial proteins required for health problems and dietary purposes can be produced safely, affordably, and sufficiently. As a result, recombinant pharmaceuticals are now being used confidently and rapidly attaining commercial approvals.

In light of such momentousness, the "establishment of advanced laboratory facilities for transgenic and space biology research project," the National Institute of Biotechnology (NIB), Dhaka, Bangladesh organized a ten-day intensive hands-on training program on genome editing and gene cloning, gene expression, and recombinant DNA technology, with experts in the field from the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi, India. Dr. M. K. Reddy, Former Group Leader, Plant Biology: Plant Molecular Biology Laboratory, current Arturo Falaschi Emeritus Scientist and Group Leader of the Crop Improvement Group, ICGEB, New Delhi, India, and Dr. Hemangini Parmar, Research Scientist, Crop Improvement Group, ICGEB, New Delhi, India were present as erudite trainers for the program. The inaugural ceremony was held on May 16, 2022, where Mst. Muslima Khatun, Director of the Transgenic Space Research Project and Senior Scientific Officer at the Molecular Biotechnology Division, NIB welcomed the delegates and spoke about the importance of learning such advanced gene-editing technologies, as well as applying this efficiently and skillfully for the progress of research at the institute. Dr. Md. Salimullah, Director General, NIB, the Chief Guest of the ceremony, expressed his hopes that the scientists at the institute would reap the utmost benefit from the training and bid the trainees luck for the days ahead.

A total of 30 scientific officers at the NIB received the training. Although initially, they were divided into two groups, one for hands-on training on the CRISPR/Cas9 technique and the other for training on gene cloning using recombinant DNA technology, members of both groups were present during each training, taking turns conducting the experiments.

On the first day, Dr. M. K. Reddy delivered a thorough and detailed presentation on the theoretical aspects of genome editing, along with the know-how of computational biology required for the design of a g-RNA construct, a prerequisite for the CRISPR/Cas9 method. The following days were filled with rigorous hands-on laboratory experiments that taught the participants how to prepare a CRISPR cloning vector for the g-RNA insert, how to clone the vector using competent cells, and subsequently, how to confirm whether or not the desired sequence is present in the vector. Over the next few days, trainees were taught to concoct an expression vector via gateway cloning, which would be able to express the protein of interest. Along with the laboratory exercises, the trainers have wonderfully presented some of the current projects undertaken by ICGEB, India, including the development of abiotic stress-tolerance, as well as high-amylose rice varieties.

Genome editing technologies, such as CRISPR/Cas9, bring hopes of a new dawn where no child will know the pangs and pain of hunger.

The closing ceremony on the final day of the training hosted the Additional Secretary of the Ministry of Science and Technology, the Government of the People's Republic of Bangladesh, Abdul Momin, as the Chief Guest. Having a member representing the government at a scientific conference not only helped to narrow the gap between scientists and policymakers but also encouraged government funding for essential research areas, such as the development of improved food crops. The session ended with a fantastic presentation by Dr. M. K. Reddy on the importance of genome editing and the significant role it can play in ensuring food security, facilitating the success of one of the most significant Sustainable Development Goals (SDGs) of the United Nations, i.e., eradication of hunger.

According to a recent report by the World Health Organization (WHO), around 45% of infant mortality results from malnutrition in low and middle-income countries. The fact that malnutrition due to food shortages is so widespread in today's era is truly devastating. To combat malnutrition, healthcare costs increase, productivity reduces, and economic growth gets staggered, which in turn, perpetuates the cycle of ill health and poverty. Thus, this is not only a public health concern but an impediment to global poverty eradication, productivity, and economic growth. By eliminating malnutrition, it is estimated that 32% of the global disease burden would be removed. Genome editing technologies, such as CRISPR/Cas9, bring hopes of a new dawn where no child will know the pangs and pain of hunger.

BANGLADESH

Inception Webinar on Genetically Modified Foods: Context and Safety Assessment

Sium Ahmed, South Asia Biosafety Program

The South Asia Biosafety Program (SABP) and Bangladesh Food Safety Authority (BFSA) have taken an initiative to increase the operational capacity to implement safety assessments for foods derived from genetically engineered (GE) plants in accordance with the guidelines. To achieve this, a series of sensitization activities, followed by in-depth technical training for officers or committee members who will be responsible for technical reviews, have been planned. The introductory workshop of that series, *Inception Webinar on Genetically Modified (GM) Foods: Context and Safety Assessment*, was held on May 17, 2022. Dr. Mosammat Nazmanara Khanum, Honorable Secretary, Ministry of Food, Government of the People's Republic of Bangladesh graced the webinar as the Chief Guest. Mr. Md. Abdul Kayowm Sarker, Chairman, BFSA was present in the webinar as the Special Guest.

This webinar was arranged to discuss the status and background of genetically modified foods and how to ensure their safety. 48 participants, including officials and scientists from BFSA, national research institutes, universities, government organizations, and representatives from private institutes attended this webinar. Dr. Andrew F. Roberts, Chief Executive Officer, Agriculture and Food Systems Institute (AFSI) and Dr. Bhavneet Bajaj, Manger–Scientific Programs, AFSI joined the webinar as resource persons. Also, Mr. Monzur Morshed Ahmed, Member (Public Health & Nutrition), BFSA gave a presentation as a local resource person. Prof. Dr. Rakha Hari Sarker, Country Coordinator, SABP moderated the webinar.

48 participants, including officials and scientists from BFSA, national research institutes, universities, government organizations, and representatives from private institutes attended this webinar.

At the beginning of the webinar, Prof. Dr. Sarker welcomed all the participants and introduced the guests and speakers. In his remarks as the Special Guest, Mr. Sarker mentioned the BFSA's mandate, which is to ensure the safety of food starting from production to consumption. He said that with the enactment of the Food Safety Act, 2013, officers, staff, and members of the regulatory committee must understand the current status of GM foods and their safety assessment process. A clear understanding of the biosafety requirements will help BFSA to ensure fair, transparent, and effective regulatory processes for GM foods. He observed that the attendees would benefit from the workshop, and he thanked SABP for coming forward with this initiative.

While addressing participants as the Chief Guest, Dr. Khanum highlighted the relentless effort by the Ministry of Food to formulate and properly implement the necessary food policy. She mentioned that adequate knowledge, with appropriate information regarding GM foods, will help in the functionalization of an effective regulatory system. She said that this workshop will help build the capacity of scientists and officials toward the safe utilization of GM foods.

The technical session started with the presentation "GM Foods: Introduction and Global Status" by Dr. Roberts. In the deliberations, he discussed the history and current global status of GM foods, followed by common myths and misperceptions about the GM foods that prevail. As the local resource person, Mr. Ahmed discussed the "Status of GM Foods in Bangladesh and Mandates of BFSA." He mentioned the provisions for GM foods in the Food Safety Act, 2013 and in other biosafety regimes. He highlighted the documents developed to support biosafety regulations in Bangladesh and compliance and implementation through the biosafety administrative structure. Mr. Ahmed spoke about the structure and function of BFSA and areas where further strengthening is required. As the final speaker of the technical session, Dr. Bajaj delivered the presentation "Safety Assessment Paradigm for GM Foods." She elaborated on the history of safe use, whole food safety assessment, Codex Alimentarius, and risk analysis. She discussed the framework for safety assessment of GM foods, which has been established per Codex guidelines, is based upon comparison of the GM food with its conventional counterpart, and focuses on both intentional and unintentional differences between the GM food and its comparator.

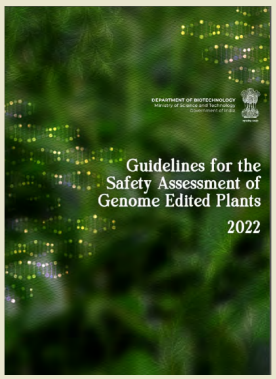
After the technical session, there was a lively discussion and question and answer session. Discussions elaborated on the guidelines, safety trials, and fate of the DNA after ingestion of GM foods. Prof. Sarker gave the concluding remarks and thanked all the participants for their enthusiastic involvement. The follow-up in-person technical training took place on June 12, 2022.

INDIA

Guidelines for Safety Assessment of Genome Edited Plants, 2022 by DBT

Dr. Vibha Ahuja, Chief General Manager, Biotech Consortium India Limited

The Ministry of Environment, Forest and Climate Change (MoEFCC), vide Office Memorandum (F. No. C-12013/3/2020-CS-III) dated March 30, 2022, exempted genome edited plants falling under the SDN-1 and SDN-2 categories of genome edited plants from the provision of "Rules for the Manufacture, Use/Import/Export and Storage of Hazardous Micro Organisms/Genetically Engineered Organisms or Cells, 1989." Subsequent to the notification, the Department of Biotechnology, Ministry of Science & Technology, Government of India issued *Guidelines for Safety Assessment of Genome Edited Plants, 2022*. The scope of the guidelines is limited to plants and products thereof developed using genome editing techniques employing Site Directed Nucleases (SDNs) such as Zinc Finger Nucleases (ZFNs), Transcription Activator-like Effector Nucleases (TALENs), other nucleases with similar functions, and Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)-associated proteins. These guidelines provide for the definition of three categories of genome edited plants, *viz.* SDN-1, SDN-2, and SDN-3.



The process flow chart for regulations is included along with roles and responsibilities of regulatory committees, *viz.* Institutional Biosafety Committees and Review Committee on Genetic Manipulation. Information and data requirements for various categories of genome edited plants have been provided for guidance to the applicants and regulatory committees.

A copy of the guidelines can be accessed at:
https://dbtindia.gov.in/latest-announcement/guidelines-safety-assessment-genome-edited-plants2022

INDIA

State Level Workshops on Genome Editing in Agriculture in India

Dr. Vibha Ahuja, Chief General Manager, Biotech Consortium India Limited

Participants at the Workshop on Genome Editing in Agriculture: Principles, Applications, and Policies in Bangalore (May 23, 2022).

Recognizing the immense potential of gene editing in plants and recent policies issued by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, Biotech Consortium India Limited (BCIL) initiated a series of workshops to create awareness among stakeholders, with support from the Federation of Seed Industry of India (FSII). The workshops are being organized jointly with leading state agricultural universities (SAUs) in different states for outreach at the state level. The stakeholders include scientists/faculty from SAUs, officials from state agriculture departments, scientists/researchers from other research institutions, universities, etc. in respective states, and industry representatives.

The workshops were structured such that information about scientific advances and recent regulatory developments in India can be shared effectively to harness the benefits of gene editing in dealing with challenges in agriculture. Technical presentations were made by experts on the basics of gene editing in plants, technological advances, applications for crop improvement, including ongoing research at institutions and products approved, and emerging regulatory policies. Discussions were held with eminent experts from stakeholder groups on ways forward for gene editing in plants in the respective states. A brochure on "Frequently Asked Questions About Gene Edited Plants" was prepared and circulated to all participants. A brief overview of the three workshops held thus far is given below:

The workshops were structured such that information about scientific advances and recent regulatory developments in India can be shared effectively to harness the benefits of gene editing in dealing with challenges in agriculture.

1. WORKSHOP ON GENOME EDITING FOR CROP IMPROVEMENT: POTENTIAL, AND POLICY – HYDERABAD

This workshop was organized jointly with Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad on May 6, 2022. The workshop was inaugurated by Dr. V. Praveen Rao, Vice Chancellor, PJTSAU and the keynote address was delivered by Dr. R.M. Sundaram, Director, ICAR-Indian Institute of Rice Research (IIRR), Hyderabad. Shri Hanumantha Rao, Commissioner (Agriculture), Government of Telangana appreciated the initiative. Scientists from IIRR presented their research for the development of gene edited varieties of fine grain rice cultivar Samba Mahsuri (BPT5204). Leading experts, including Dr. M. Ramasami, Managing Director, Rasi Seeds, Mr. Ram Kaundinya, President, FSII, and Dr. Paresh Verma, Executive Director, DCM Shriram Limited shared their views in different sessions. Scientists from ICAR institutions in Hyderabad also participated. Dr. M. Sujatha, Director, ICAR-Indian Institute of Oilseed Research and Dr. R. Jagadeeshwar, Director of Research, PJTSAU chaired the sessions. Members of the Genetic Engineering Appraisal Committee (GEAC), *viz.* Dr. B. Venkateswarlu, Former Vice Chancellor, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and Dr. S.J. Rahman, Professor & Head–Entomology, PJTSAU enlightened the participants on regulatory issues in the panel discussion on "Targeting Crop Improvement Using Gene Editing: Way Forward." The workshop was attended by over 300 participants.

2. WORKSHOP ON GENOME EDITING IN AGRICULTURE: SCIENCE, POTENTIAL, AND POLICIES – LUDHIANA

This workshop was organized jointly with Punjab Agricultural University (PAU), Ludhiana and the National Agri-Food Biotechnology Institute (NABI), Mohali on May 11, 2022. The Keynote Address was given by Prof. Ashwani Pareek, Executive Director, NABI and the Opening Address by Dr. Ajmer Singh Dhatt, Director of Research, PAU. In addition to the

Speakers at the Workshop on Genome Editing for Crop Improvement: Potential and Policy – Hyderabad (May 6, 2022).

Speakers at the Workshop on Genome Editing in Agriculture: Science, Potential, and Policies – Ludhiana (May 11, 2022).

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three lead presentations, scientists from PAU and NABI shared ongoing research at the two institutions. These included a range of crops and traits, *viz.* increasing β-carotene content in banana, reducing the acrylamide content in potato, increasing shelf life in tomato, and increasing iron content and starch resistance in wheat. About 400 participants, including a large number of students across Punjab, attended the workshop.

3. WORKSHOP ON GENOME EDITING IN AGRICULTURE: PRINCIPLES, APPLICATIONS, AND POLICIES – BANGALORE

This workshop was organized jointly with the University of Agricultural Sciences (UAS), Bengaluru on May 23, 2022. The workshop was inaugurated by Shri Shivayogi C. Kalasad, Principal Secretary (Agriculture) to the Government of Karnataka and Dr. S. Rajendra Prasad, Vice Chancellor, UAS, Bangalore. The Keynote Address was given by Dr. Rakesh Mishra, Director, Tata Institute of Genetics and Society. The program at Bangalore included presentations on key topics related to principles and applications, status (global and national), and requirements for taking gene edited plants forward from the laboratory to commercial use. The expert panel on the way forward for targeted crop improvement using gene editing included Dr. I.S. Katageri, UAS, Dharwad, Dr. Lalitha Gowda, Member, GEAC, and Dr. Shivendra Bajaj, Executive Director, FSII. Scientists from the public and private sector also shared their views. More than 300 participants, including a large number of students across Karnataka, attended the workshop.

All three workshops were widely covered in national and local newspapers and participants immensely benefitted from the interaction with the speakers.

INDIA

Participation in the Workshop on Genome Editing in Agriculture at Ludhiana

Dr. Vinay Yadav, Assistant Professor, Department of Botany, Central University of Punjab

Participants at the Workshop on Genome Editing in Agriculture: Science, Potential, and Policies (May 11, 2022).

Twenty-four postgraduate students, along with faculty members Dr. Prashant, Dr. Nirmal, and Dr. Vinay Yadav from the Department of Botany, Central University of Punjab, Bathinda, participated in the "Workshop on Genome Editing in Agriculture: Science, Potential, and Policies," organised in the sprawling green campus of Punjab Agricultural University, Ludhiana on May 11, 2022. The event was jointly organised with the National Agri-Food Biotechnology Institute, Mohali and Biotech Consortium India Limited (BCIL), New Delhi.

This was the first outing for the students after the COVID-19 pandemic and everyone was very much impassioned to join the workshop to gain knowledge about genome editing technology and recent policies for the application of this technology. The workshop was inaugurated with a very warm welcome by Prof. Praveen Chhuneja, an eminent scientist, and then the keynote address was delivered by Prof. Ashwani Parikh, CEO, NABI. He highlighted the major problems in agriculture and discussed possible solutions including genome editing.

Students were extremely happy to learn that India exempted genome editing products developed using certain methods from GM regulation and guidelines in a timely fashion.

The lectures in the first technical session began with the basics of gene editing, followed by potential applications, after which the global and national status of gene edited plants was discussed, including a talk on relevant requirements in various countries by Dr. Vibha Ahuja, Chief General Manager, BCIL. These lectures conveyed a wealth of information and offered a better understanding of the whole concept to the attendees. Students came to know that India adopted the best policy for the benefit of researchers and farmers, after considering different policies in various countries (lecture delivered by Dr. Vibha Ahuja). Students were extremely happy to learn that India exempted genome editing products developed using certain methods from GM regulation and guidelines in a timely fashion. These lectures were very thought-provoking and sparked curiosity among the delegates. The most interesting part of this session was a question and answer discussion round, when students were free to raise their queries and were delighted to receive answers from all the eminent speakers.

The second technical session started after a delicious lunch and students were much more excited to listen to the rest of the talks on ongoing research on genome editing, especially in Punjab. Students enjoyed lectures by Dr. Jagdeep, Dr. Ajay Pandey, Dr. Siddharth Tiwari, Dr. Pooja Manchanda, Dr. Prashant Mohanpuria, and Dr. Santosh. Then, the final question and answer round concluded with many interesting discussions by the speakers. All these research-oriented lectures ignited passion among the students to take science as a career in the future. Students realized that the Indian government and policymakers, along with researchers, are working deliberately for the benefit of the farmers of the country and contributing to future sustainability. All students also had a golden opportunity to learn about the emerging techniques on gene editing in plants, possibilities of gene editing, CRISPR techniques, and policies. All students were also very much obliged and grateful to the honorable Vice Chancellor, Prof. Raghavendra Prasad Tiwari of the Central University of Punjab, for approving the trip.

BANGLADESH

Impact of Information Sharing in Building Consumer Trust in Genetically Modified Crops

Naushin Ahmed Khan, Independent University Bangladesh (IUB)

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.

Monarch butterfly on a corn leaf © Micklo09 | Dreamstime.com

Until now, 32 genetically engineered crops have been allowed for production in different parts of the world, amounting to a net profit of $18.2 billion in 2016.[1] The term "genetically modified (GM) crops" has had negative connotations for the past few decades, despite the fact that plants have been genetically modified for thousands of years through methods such as selective breeding. This is the aftermath of poor understanding of the term itself and the circulation of misinformation by the media.[2,3]

One example of this is the Monarch Butterfly Experiment, which claimed that genetically modified N4640-Bt maize is responsible for higher mortality rate of the insects. However, further studies have demonstrated that large scale production of the Bt-maize was not a threat to the butterfly population. Unfortunately, the media was slow to pick up on these peer reviews. They also failed to mention the shortcoming of the experimentation, such as the small sample that the original experiment was working with and faulty experimental design, which meant that the findings were only preliminary and not enough to draw a sound conclusion. Despite the attenuation, the monarch butterfly controversy still surrounds the world as an example of human beings going too far and the monarch butterfly still stands as the label for the GMO-skeptical group, The Non-GMO Project.[4,5]

The good news is that, when it comes to overall GM crop adoption, we can observe an upward trend. By 2018, over 192 million hectares worldwide were growing GM crops,[3,6] which is a 113-fold increase since the commercialization of GM crops in the 90s[6]. Despite having the highest rate of population growth, Africa in particular is taking longer to embrace GM crops due to lack of political support. However seven nations have received the green light when it comes to GM crop release—South Africa, Ethiopia, Kenya, Sudan, Eswatini, Malawi, and Nigeria[7] (Figure 1). Low yielding crop varieties, drought, pests, poor irrigation, and absence of modern technologies are among the many agricultural problems that affect African economies. This can benefit smallholder farmers' productivity and make Africa a food production hub, provided that there is effective communication and access to markets for them[3,8-10].

Seven nations [in Africa] have received the green light when it comes to GM crop release—South Africa, Ethiopia, Kenya, Sudan, Eswatini, Malawi, and Nigeria.

On top of this growing adoption of GM crops in Africa, a survey conducted in Nairobi, Kenya indicated that the majority of consumers (68%) were willing to buy GM food and, that too, in the same price as their regular food. Besides this positive progress, it is to be noted that only 38% were knowledgeable on what a GM crop is. For example, in Nigeria, the majority of farmers (52.07%) were unaware of the benefits of GM crops and over 85% did not source their seeds from credible sources.[11,12]

In the US and UK, press coverage of GM crops were solely focused on the potential risks or unethical uses rather than its numerous benefits[13]. European nations in general have a greater resistance to the deployment of genetically engineered food compared to the US[14,15]. As a result of fear mongering narratives, public perception of GM crops and food have largely been negative[2]. This becomes a barrier for food security in general, since GM crops and intensification of land can be a sustainable

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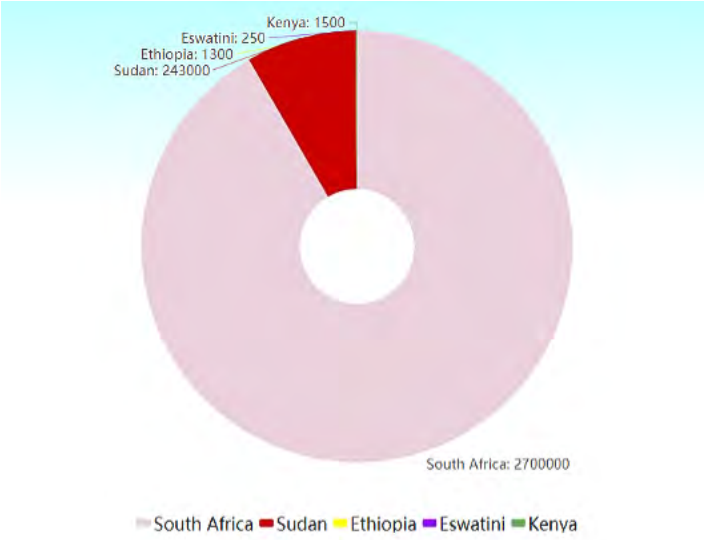

Figure 1: Land in hectares (ha) used in Africa for GM crop production. (Source: Kedisso, E. G., Maredia, K., Guenthner, J. & Koch, M. Commercialization of genetically modified crops in Africa: Opportunities and challenges. Afr J Biotechnol 10. DOI: 10.5897/AJB2021.17434.10)

way to feed the growing population, which is projected to grow to almost 10 billion by 2050[16].

So, what is to be done to bridge the gap between consumers and GM crops?

To start, less research has been done on communication strategies to improve the public image of GM crops. A recent survey carried out in Paraguay showed that among the 1207 individuals who were surveyed, the majority (57.28%) did not answer the question "Do you consume genetically engineered food?". Among those who answered it, most responded that they believe these modified crops are harmful. Another study done with Dutch people found that individuals who were not open to seeking new knowledge to demystify their prejudice against GM crops were also more likely to resist the advances and growth of GM applications, especially in food.

The researchers of the study[17] theorized that this rejection may be due to three main factors:

1. The belief that organisms have a core that should not be tempered with.
2. Preferring "natural" crops over GM crops, thinking that scientists are going too far and "playing God."
3. An emotional response to genetically modified food, which is not seen in other applications of the same technique, such as a genetically modified organisms for lab tests. This avoidance probably stems from a human being's natural need to avoid pathogens and toxins.[18]

It is to be noted that a similar study in Murcia, Spain also had similar results. Overall, the public showed little to no knowledge of genetically modified crops, with almost half of the respondents not even knowing if there is a gene in GM crops and over half not knowing if they even consume GM food.

Another concern besides public health and the environment is the fear that GM crops may put local farmers out of business, as they may see patented GM seeds as a way for large companies to monopolize food production. The public were more open to receiving information from doctors and scientists rather than politicians and media or business personalities.[17]

Findings like these indicate that a communication model where mistrust rather than ignorance is addressed may be more effective. When consumers' preferences were studied in an experiment, their findings implied that negative information can be as vague and generic to cause a stir, whereas positive information of GM food has to be specific in order to build trust and influence people's food choices[19]. It is also necessary to act swiftly since consumers who had no prior knowledge regarding GM food are much more willing to accept genetically modified food and can be more willing to pay for them.[20] Trust campaigns can be designed by governments that set out to connect regulators and consumers, allowing people to make their daily food choices out of proper knowledge rather than misinformation.

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CALENDAR OF EVENTS

EVENT	ORGANIZED BY	DATE	WEBSITE
INDIA			
International Conference on Advances in Agriculture and Food System Towards Sustainable Development Goals	All India Agricultural Students Association, Indian Council of Agricultural Research, and University of Agricultural Sciences, Bangalore	August 24-22, 2022 Bengaluru	https://aafs2022.org.in/
National Symposium on Emerging Innovations in Plant Molecules for Achieving Food and Nutritional Security (EIPMAFNS-2022)	Department of Plant Molecular Biology and Biotechnology, ACHF, NAU and Division of Biochemistry, ICAR-IARI, in association with the Society for Plant Biochemistry and Biotechnology, IARI	September 22-23, 2022 Navsari (in person & online)	https://nau.in/index
31st National Conference on Innovative Resource Management Approaches for Coastal and Inland Ecosystems to Sustain Productivity and Climate Resilience	Soil Conservation Society of India (SCSI), Navsari Agricultural University and Gujarat State Chapter of SCSI, NAU	October 13-15, 2022 Navsari	https://nau.in/index
The Indian Ecological Society International Conference 2022 (IESIC 2022)	Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu	October 13-15, 2022 Jammu	http://www.skuast.org/ https://iesconf.in/
INTERNATIONAL			
Webinar Series for Popularizing Plant Tissue Culture in Asia-Pacific Region and African Countries Towards Realizing its Potential - Webinar 2: Perennial Fruits/ Cash Crops (Date Palm, Pomegranate, and Sugarcane)	Asia-Pacific Association of Agricultural Research Institutions (APAARI)	June 30, 2022 Online	https://www.apaari.org/ https://zoom.us/webinar/register/WN_IMRWAUnDS3i1n6ME1prGCQ
Webinar Series for Popularizing Plant Tissue Culture in Asia-Pacific Region and African Countries Towards Realizing its Potential - Webinar 3: Tree/ Woody Plants (Bamboo and Teak)	Asia-Pacific Association of Agricultural Research Institutions (APAARI)	July 29, 2022 Online	https://www.apaari.org/ https://zoom.us/webinar/register/WN_g5-HqPS-QSGm49HioepD6Q
Webinar Series for Popularizing Plant Tissue Culture in Asia-Pacific Region and African Countries Towards Realizing its Potential - Webinar 4: Ornamental Plants	Asia-Pacific Association of Agricultural Research Institutions (APAARI)	August 26, 2022 Online	https://www.apaari.org/ https://zoom.us/webinar/register/WN_rL1D4CpFRU2nyOz4b3Uknw
8th Plant Genomics and Gene Editing Congress: Asia	Global Engage Ltd.	October 12-13, 2022 Kuala Lumpur, Malaysia	https://www.global-engage.com/event/plant-genomics-asia/

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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