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South Asia Biosafety Program

NEWSLETTER FOR PRIVATE CIRCULATION ONLY – NOT FOR SALE

BANGLADESH

Bangladesh Biosafety Portal Aimed to Strengthen Biosafety Compliance

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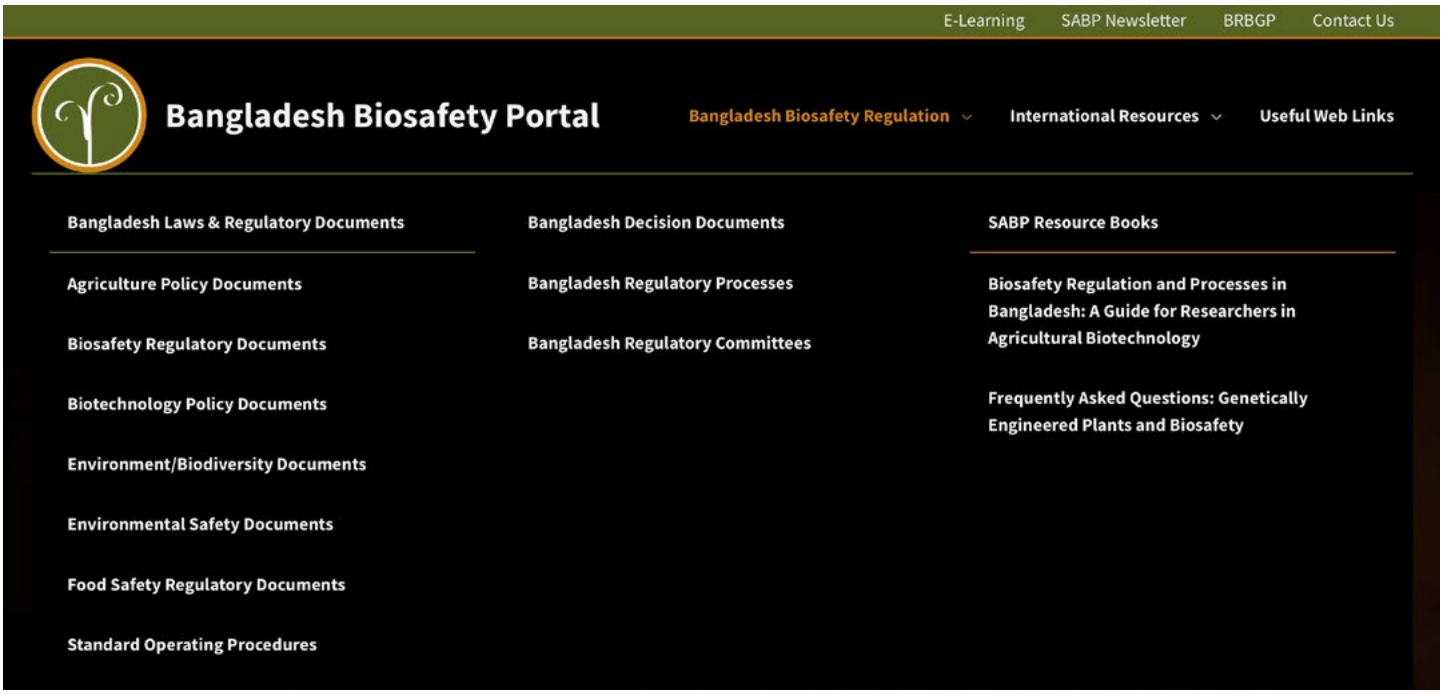

Interface of the Bangladesh Biosafety Portal (bangladeshbiosafety.org - accessed June 15, 2021).

The *Bangladesh Biosafety Portal*, accessible at *bangladeshbiosafety.org*, serves as a consolidated repository of documents that inform biosafety regulation in Bangladesh. The portal was launched in 2017 by the South Asia Biosafety Program (SABP) with the intention of providing information and links to useful national and international technical resources. In addition to biosafety laws and regulatory documents, the portal contains easy-to-understand depiction of the regulatory processes of Bangladesh and the structure and composition of Bangladesh's regulatory committees. The portal also contains various international documents and links to useful websites related to biosafety.

The portal was launched in 2017 by the South Asia Biosafety Program (SABP) with the intention of providing information and links to useful national and international technical resources.

In line with the continuous development in the field of modern biotechnology, Bangladesh has made significant progress in drafting and finalizing various guidelines, rules, frameworks, and manuals. As biosafety is a multidisciplinary arena, it interacts with various decision and regulatory documents dealing with biodiversity, environment, biotechnology, agriculture, and food safety. Therefore, the practitioners in modern biotechnology need to follow all the biosafety guidelines that are relevant to their respective research. However, it is sometimes troublesome to find all the required documents, as these documents are developed by different ministries. So, SABP took the initiative to house these documents in the portal and make it a user-friendly repository so that researchers and regulators can find all the information in one place, without much effort. Also, they can access similar documents from other countries and international resources to go forward with biosafety research and decision making.

The recently redesigned portal spotlights relevant documents and resources in three main tabs. While visiting the homepage, the user will find the main tabs for Bangladesh Biosafety Regulation, International Resources, and Useful Web Links. The Bangladesh Biosafety Regulation is further classified into specific sections. Along with these, the homepage contains fundamental informational resources, such as the *User's Guide to Biosafety Regulatory Process for GE Plants in Bangladesh*, *Biosafety Resource Books*,

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the *Regulatory Committees of Bangladesh,* and the *Regulatory Processes of Bangladesh*. In the top bar, the portal contains links to the Agriculture & Food Systems Institute's E-learning modules, SABP Newsletters, the Biosafety Research in Bangladesh Grants Program (BRBGP), and contact details, etc.

If the user clicks on the Bangladesh Biosafety Regulation tab, three sections, namely Bangladesh Laws & Regulatory Documents, Bangladesh Decision Documents, and Biosafety Resource Books, will appear. For the convenience of the user, the Bangladesh Laws & Regulatory Documents are further classified into seven categories, namely agriculture policy documents, biosafety regulatory documents, biotechnology policy documents, environment/biodiversity documents, environmental safety documents, food safety regulatory documents, and standard operating procedures (SOPs). The user can see the list of all documents in one place or filter according to the categories, as well as search using relevant keywords. In each category, the user will see the list of documents with the year and status of the document, available language, and a short description to provide necessary information on the specific document. The second section, Bangladesh Decision Documents, was designed to contain governmental decision documents on biotechnology and biosafety that have been made public. For example, the section now contains the gazette for Bt brinjal release that was announced in 2013. The third and final section is the SABP Resource Books. In 2020, SABP took an initiative to publish books to make the regulatory processes understandable to researchers and stakeholders for better compliance and conceptualization. So far, two books have been published, which are readily available in this section.

The International Resources tab not only contain the international guidelines but also acts as a repository for the crop biology documents from Australia, India, Canada, and the OECD. To date, 61 crop biology documents have been incorporated into the portal. This tab also contains a link for the comprehensive AFSI Crop Composition Database (CCDB). The Useful Web Links tab lists the websites of the governments that are concerned with the biosafety of GE crops, intergovernmental organizations assisting in biosafety issues, and other organizations dealing with biosafety and biotechnology.

Since its inception, the portal has been serving as the platform for sharing regulatory information along with the capacity building resources provided by SABP. With the recent developments, the portal is expected to assist researchers and regulators in strengthening compliance and moving agricultural biotechnology forward in Bangladesh.

BANGLADESH

Food Systems Summit Dialogue: Unleashing Innovation to Transform Local Food Systems

Dr. Aparna Islam, Brac University

Event page banner for the Independent Food Systems Summit Dialogue: Unleashing Innovation to Transform Local Food Systems (May 18, 2021)

On May 18, 2021, CropLife International (CLI), jointly with the Agriculture & Food Systems Institute (AFSI), Cornell Alliance for Science, Global Farmer Network, Inter-American Institute for Cooperation in Agriculture, and Thought for Food, organized a virtual Independent Food Systems Summit Dialogue, *Unleashing Innovation to Transform Local Food Systems*. The program aimed to identify the ways to make food systems more sustainable and equitable for all, offering stakeholders across the globe an opportunity to contribute to the United Nations Food Systems Summit.

During the discussion, challenges in innovation, especially during the covid era, opportunities, synergies, and areas of divergence that exist across major agricultural regions were shared. The discussion was divided into two sessions, one focusing on Asia and Africa and another focusing on Europe and the Americas. Dr. Vibha Ahuja, Senior Advisor, South Asia Biosafety Program served as the facilitator for the South Asia breakout group, and all AFSI scientific staff participated in the event. Dr. Aparna Islam, Professor, Brac University, and Dr. Abdullah Mohammad Shohael, Professor, Jahangirnagar University participated in the event from Bangladesh. They shared Bangladesh's initiatives in ensuring a sustainable food system through innovations, both in classical agricultural practices and in modern biotechnology research. The biosafety regulatory system of the country was also explained while discussing Bt brinjal and other GE crops. In addition to that, awareness programs that have been taken by SABP in Bangladesh for better biosafety compliance in GE crop development and to build conscious consumers were shared with other participants.

Awareness building initiatives and public-private partnerships are important to achieve effective and sustainable agriculture and food systems.

In general, the regional discussion brought out the similarities in our problems and the efforts that have been undertaken to overcome them in the region. The participants pointed out that awareness building initiatives and public-private partnerships are important to achieve effective and sustainable agriculture and food systems. Official feedback from this Independent Food Systems Summit Dialogue was submitted to the United Nations Food Systems Summit after the event and may be accessed at the link below.

DOWNLOAD

Dialogue Feedback:
https://summitdialogues.org/dialogue/23881/official-feedback-23881-en.pdf?t=1623168133

INDIA

Genomics Assisted Breeding 2.0: From Concept To Product Delivery To Designing Future-Ready Crops

Dr. Rajeev K. Varshney, Research Program Director, Genetic Gains and Director, Center of Excellence in Genomics & Systems Biology, International Crops Research Institute for the Semi-Arid Tropics

Groundnut field.

Genomics-assisted breeding (GAB) has come a long way since it was first presented as a concept in the 10th Anniversary Issue of *Trends in Plant Science, Feeding the World: Plant Biotechnology Milestones*, in 2005. "We envisioned that GAB will be a game-changer for the development and delivery of high yielding improved crops varieties resistant to pest and disease, and abiotic stresses, and it was heartening to see it come to fruition from concept to product delivery", says Dr. Rajeev K. Varshney, Research Program Director, Genetic Gains, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the lead author of the paper.

The success stories present today, thanks to GAB, speak for themselves. For instance, GAB has expedited timelines of breeding progress across a broad range of crop species, with the development of more than 130 publicly bred cultivars of different crops. The majority of the noteworthy crop products delivered by GAB applied in a variety of breeding programs include improved cultivars having elevated resistance levels against important diseases, such as bacterial blight and blast in rice and rust in wheat (*Triticum aestivum*). Among biotic stresses, tolerance to submergence, salinity, and drought remained the key target traits for improvement using GAB.

KEY PRODUCTS IN LEGUMES AND CEREALS WITH BIOTIC STRESS RESISTANCE DELIVERED THROUGH GAB:

- **Rice:** improved rice varieties with resistance to blast and bacterial blight disease
- **Wheat:** improved varieties resistant to stress response and other agronomic and quality-related traits
- **Pearl millet:** improved variety with higher resistance to downy mildew
- **Barley:** improved lines with resistance to eyespot, barley yellow mosaic viruses, and barley powdery mildew
- **Soybean:** several soybean cyst nematode and multiple disease-resistant genotypes

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- **Groundnut:** introgression lines showing higher yield and increased rust resistance
- **Chickpea:** high-yielding and Fusarium wilt and blight-resistant varieties

KEY PRODUCTS WITH ABIOTIC STRESS RESISTANCE DELIVERED THROUGH GAB:

- **Rice:** improved rice cultivars with QTL controlling submergence, salt, and drought tolerance and gall midge resistance
- **Chickpea:** improved drought tolerance variety 'Pusa 10216' GAB for quality/nutrition traits
- **Wheat:** high grain protien content cultivars
- **Rice:** improved fragrance and intermediate amylose content
- **Groundnut**: varieties with improved oil quality, i.e., high oleic acid and resistance to nematode, rust, and late leaf spot

"This all has happened just in a span of 15 years and now, in the 25th Anniversary Issue of *Trends in Plant Science*, together with scientists from the International Crops Research Institute for the Semi-Arid Tropics, Murdoch University (Australia), ICAR-Indian Institute of Pulses Research, Iowa State University (USA), Leibniz Institute of Plant Genetics & Crops Plant Research (Germany), Huazhong Agricultural University (China), and Cornell University (USA), we have presented a comprehensive approach of designing future crops in *Cell Press* entitled 'Feeding the World: The Future of Plant Breeding,' we termed this approach as 'genomic breeding' or genomics-assisted breeding (GAB) 2.0," adds Dr. Varshney. The strategy is to optimize crop genomes with the accumulation of beneficial alleles and purging of deleterious alleles for designing future crops. In the coming decades, GAB 2.0 is expected to play a crucial role in breeding more climate-smart crop cultivars with higher nutritional value in a cost-effective and timely manner while ensuring sustainable and environmental protection.

This article on GAB 2.0 presents new approaches for developing designer crops and provides a road map to deploy one or more than one of the following approaches—marker-assisted selection, marker-assisted backcrossing, marker-assisted recurrent selection, haplotype-based breeding, promotion/removal of allele through genome editing, and genomic selection in combination with speed breeding.

Development of such disease resistant, pest-resistant, abiotic stress tolerant, and better quality/nutrition varieties through GAB 2.0 is also expected to reduce application of pesticides, insecticides, and fertilizers in growing these varieties. At the same time, such varieties are also expected to deliver higher produce to farmers while ensuring sustainable agriculture and environmental protection. In summary, the plant breeding community will continue to be armed not only with a vast array of data but also with the proper tools and technologies to decipher and implement the knowledge to feed a growing world.

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"In addition to the above, as a symbolic effort to celebrate its silver jubilee, the journal invited globally recognized scientists to reflect on the changes that have occurred within the field of plant breeding during the past 25 years, as well as to contemplate what the future might hold. These reflections were published as 'Past and Future Milestones of Plant Breeding 2021,' *Trends in Plant Science*, https://doi.org/10.1016/j.tplants.2021.03.013, and it was an honor for me to share my views highlighting Next-Generation Sequencing as the past and present and data science as the future of genomic breeding," said Dr. Varshney. He also expressed that "I am optimistic these papers will serve as a great resource for the global scientific community, especially genomic scientists and plant breeding community in accelerating their efforts towards modernizing crop improvement programs and delivering higher genetic gains in smallholder farmers field."

Source article and highlighted papers:

Rajeev K. Varshney, Abhishek Bohra, Jianming Yu, Andreas Graner, Qifa Zhang, and Mark E. Sorrells (2021) Designing Future Crops: Genomics-Assisted Breeding Comes of Age. Trends in Plant Science, https://doi.org/10.1016/j.tplants.2021.03.010

Varshney, R.K. et al. (2005) Genomics-assisted breeding for crop improvement. Trends Plant Sci. 10, 621–630, https://doi.org/10.1016/j.tplants.2005.10.004

Past and Future Milestones of Plant Breeding 2021, Trends in Plant Science, https://doi.org/10.1016/j.tplants.2021.03.013

INDIA

Development of Late Leaf Spot Resistant Groundnut Genotypes Using Marker-Assisted Backcross Breeding

Prof. Ramesh S. Bhat, University of Agricultural Sciences, Dharwad

Groundnut (*Arachis hypogaea* L.) is an important legume oilseed and food crop apart from being a source of fodder. Because of its rich nutrient content in terms of oil, proteins, fibers, polyphenols, antioxidants, vitamins, and minerals, groundnut is popularly called "poor man's almond". Late leaf spot (LLS) caused by *Phaeoisariopsis personata* (Berk. & Curt) V. Arx. (Teleomorph: *Mycosphaerella arachidis*) is a major, widespread, and destructive fungal foliar disease leading to a yield loss of 50% and reduced fodder quality.

Components of resistance to LLS include longer latent period, fewer lesions per leaf, smaller lesion diameter, reduced sporulation, lower sporulation index, less leaf area damage, and marginal defoliation. Considerable efforts have been made to understand the genetic control of resistance to leaf spots and rust. Various views have been reported depending upon the genotypes used for the investigation. Although several fungicides are available to control these foliar diseases, development of resistant cultivars is desirable considering the hazardous effect of chemicals on the environment. Breeding for LLS resistance in groundnut has now reached a stage where molecular markers can be successfully employed for genotypic selection, which could enhance the breeding efficiency. This has been possible due to the identification and validation of the QTL and markers for foliar disease resistance.

Although several fungicides are available to control these foliar diseases, development of resistant cultivars is desirable considering the hazardous effect of chemicals on the environment.

Among the major peanut-growing states of India, TMV 2 and JL 24 cover a large area although they were released for commercial cultivation in 1940 and 1978, respectively, because of their wide adaptability and premium quality kernels. However, both JL 24 and TMV 2 are highly susceptible to LLS, thereby demanding the development of foliar disease-resistant lines of TMV 2 and JL 24. For this purpose, markers linked to LLS and rust were employed for transferring the two QTL regions (on A02 and A03) to JL 24 and TMV 2. At the University of Agricultural Sciences, Dharwad, marker-assisted backcrossing (MABC) from JL 24 × ICGV 86699 and TMV 2 × GPBD 4 resulted in the development of LLS resistant genotypes DBG 3 and DBG 4, respectively. During the

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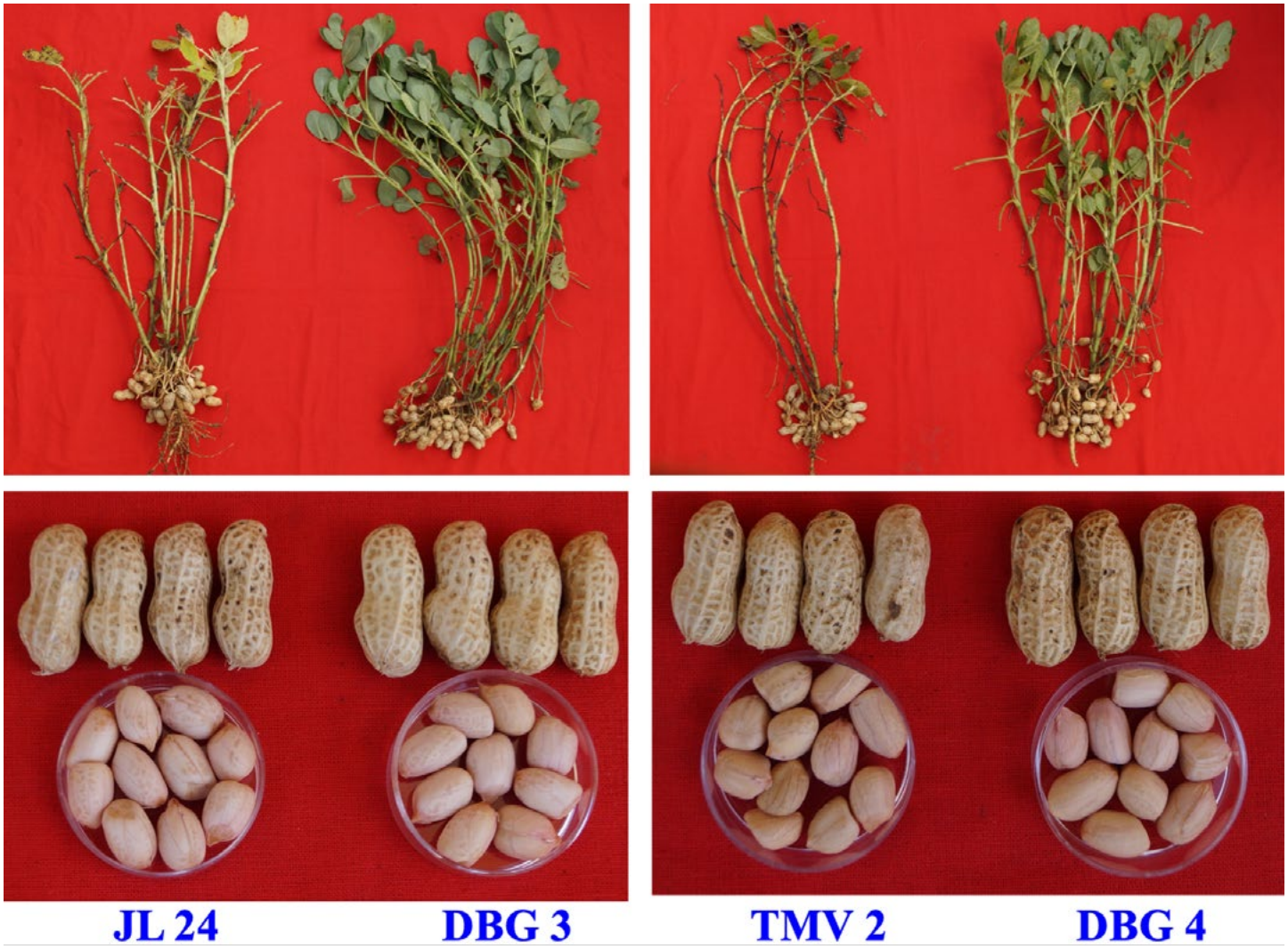
station trials from 2014-2020, DBG 3 and DBG 4 recorded LLS score of 4 as compared to JL 24 and TMV 2 (9 score; on 1-9 scale where 1 shows resistant reaction and 9 indicates susceptibility reaction). Also, DBG 3 with an average yield of 2331 kg/ha recorded 35% more yield than JL 24. Similarly, DBG 4 with an average yield of 2262 kg/ha recorded 46% more yield than TMV 2. DBG 3 and DBG 4 also performed better than their respective recurrent parents in the multi-location trial (during 2017 and 2018) and farm trial at Zone 8 of Karnataka. Scanning electron microscopic observations revealed narrow stomatal aperture and less sporulation in DBG 3 and DBG 4. ddRAD-Sequencing showed almost 99% background genome recovery among the backcross lines. Pod and kernel features, test weight, shelling percentage, and quality parameters of DBG 3 and DBG 4 were comparable to their recurrent parents. Now, the University has approved both DBG 3 and DBG 4 for release to Zone 8 of Karnataka for *kharif* cultivation.



DBG3 and DBG4 groundnut.

Station trials of DBG 3 and DBG 4 groundnut.

Insights into the Biosafety Regulations That Led To 100% GM Cotton in South Africa

Mutebi John Kenneth, BRAC University

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.

Genetically modified organisms (GMOs) in South Africa are governed by a number of national and international regulations to ensure that any activity involving such organisms is carefully assessed for potential risks to human health and the environment before it is started. Internationally, GMOs in South Africa are governed by the country's biosafety binding treaties such as the Cartagena Protocol on Biosafety, which entered into force in the country in November 2003.

It should be noted that regulations for GE crop varieties started way back in the late 1980s without any biosafety law in place. It was the good performance of such regulations that saw the country approve the commercial release of two genetically modified crops—insect resistant cotton and corn in the late 1990s—hence the transition of these regulations into a full constitutional act. South Africa, the world's eighth largest GM crop producer, today runs a vigorous regulatory regime that is based on the Genetically Modified Organisms Act of 1997 (GMO Act 1997). This Act, as well as its subsequent amendments (2006 and 2010), aim at effecting the Cartagena Protocol on Biosafety (for which South Africa is a Party) and places feasible regulations ranging from trial release, commercial release, research, production, and marketing of GMOs in the country.

South Africa, the world's eighth largest GM crop producer, today runs a vigorous regulatory regime that is based on the Genetically Modified Organisms Act of 1997.

The Act established three regulatory authorities, i.e., an Executive Council, Registrar, and the Advisory Committee, for effective GMO Biosafety. The scope of this Act includes: the genetic modification of organisms, the development, production, release, use, and application of genetically modified organisms, including viruses and bacteriophages, and the use of gene therapy.

The same Act does not apply to techniques involving human gene therapy, those in which recombinant DNA molecules or genetically modified organisms are not employed, such as in polyploidy induction or *in vitro* fertilization in humans and animals, as well as those in which genetically modified organisms as recipient or parental organisms are not employed, for example in mutagenesis.

The three authorities created by this Act are under the Department of Agriculture, Forestry and Fisheries (DAFF), and according to the Act, they are in place to ease the development and usage of GM products in the country.

According to the Act, the Executive Council serves as an advisory body to the Minister of DAFF on matters related to GMOs and is also the country's decision-making body, which rejects or approves GMO applications from researchers and importers. The body consists of seven representatives from seven departments of government, which are deemed relevant in the matters of GMO biosafety. They include:

- DAFF
- Department of Water and Environmental Affairs
- Department of Health
- Department of Trade and Industry
- Department of Science and Technology
- Department of Labor
- Department of Arts and Culture

It is a requirement for every representative on this body to have significant knowledge of biotechnology and biosafety because decisions are always taken by consensus. The body meets as long as the chairperson deems it necessary and the quorum of the meeting is a simple majority.

The Act also provides for the Advisory Council (AC), the second authority for GMO biosafety, whose members are ten scientists appointed by the Minister of DAFF, with an input of the Executive Council. The Advisory Council is further supported by subcommittee members with scientific expertise from various disciplines and, together with the AC, form a body that is responsible for risk assessments of all applications that are related to food, feed, and environmental impact. Upon evaluation, they make recommendations to the EC.

The Act also provides for the Registrar, the third and most significant authority for GMO biosafety. The Registrar is appointed by the Minister of DAFF and is responsible for the day-to-day administration of the GMO Act. The Registrar is responsible for examining all GMO applications to ascertain their conformity with the Act, issuing or withdrawing permits, monitoring all contained use facilities and trial release sites, and keeping all records in a chronological order.

For any GM crop to be commercially cultivated in South Africa, developers have to apply for permits to develop, carry out field trials, and for the commercial release through the Registrar's office. The Registrar then notifies the public about the application, hence opening doors for public participation. The Registrar then sends the GMO application, as well as all the information obtained from public participation to the Advisory Council. Upon evaluation, the Council reports to the Registrar, who then reports directly to the Executive Committee. Upon consensus, the EC makes a decision for approving or disapproving the commercial cultivation of the GE crop, hence allowing the Registrar to issue a permit to the developers or communicate to them otherwise.

Therefore, the success of the Genetically Modified Organisms Act of 1997 in ensuring GMO biosafety in South Africa has enabled the country to adopt an 85% GM corn, 95% GM soya bean and 100% GM cotton cultivation today, and to become one of the major exporters of GM cotton worldwide.

References

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Genetically Modified Organisms Act (GMO Act) No. 15 of 1997, *as amended*, 2 Butterworths Statutes of the Republic of South Africa [BSRSA] (rev. ed. 2012). The 1997 GMO Act is available on the Department of Agriculture, Forestry and Fisheries (DAFF) website, at http://www.daff.gov.za/doaDev/sideMenu/acts/15%20 GMOs%20No15%20% 281997%29.pdf.

The Genetically Modified Organisms Amendment Act No. 23 of 2006 (Apr. 17, 2007) is available on the South Africa government portal, at http://www.info.gov.za/view/DownloadFileAction?id=67850.

CALENDAR OF EVENTS

EVENT	ORGANIZED BY	DATE	WEBSITE
INDIA			
International Conference on Sugarcane Research	**ICAR-Sugarcane Breeding Institute, Tamil Nadu Agricultural University, and the Society for Sugarcane Research and Development**	**June 19-22, 2021 Coimbatore**	**https://sugarcane.icar.gov.in/images/sbi/Canecon_2020/cancon_second_circular.pdf** **https://tnau.ac.in/wp-content/uploads/2020/10/1601938688.pdf**
Webinar Series on Applications of Gene Editing in Sustainable Agriculture and Food Security in the Asia-Pacific Region Webinar 1: Genome Editing Tools and Its Applications for Targeted Plant Breeding Webinar 2: Advancing Genome Edited Plants from Lab to Land Webinar 3: Enabling Policies for Genome Editing in Agriculture	**Asia-Pacific Association of Agricultural Research Institutions, Asia-Pacific Consortium on Agricultural Biotechnology and Bioresources (APCoAB), Korea Biosafety-Clearing House, and Biotech Consortium India Limited**	**July 21-August 8, 2021 Virtual** July 21, 2021 August 4, 2021 August 8, 2021	**https://www.apaari.org/** **https://www.biotech.co.in/en**
International e-Conference on Postharvest Disease Management and Value Addition of Horticultural Crops	**ICAR-Indian Agricultural Research Institute**	**August 18-20, 2021 Virtual**	**http://www.uhsbagalkot.edu.in/**
International Horticulture Conference – Next Generation Horticulture (NEXTGEN – HORT)	**Tamil Nadu Agricultural University**	**September 16-19, 2021 Coimbatore**	**https://tnau.ac.in/news-events/**
Global Rice Conference	**Tamil Nadu Agricultural University**	**September 24–25, 2021 Thanjavur, Tamil Nadu**	**https://tnau.ac.in/news-events/**
International Conference on Future Challenges and Prospects in Plant Breeding	**Tamil Nadu Agricultural University**	**October 6-7, 2021 Coimbatore**	**https://tnau.ac.in/news-events/**
INTERNATIONAL			
International Agriculture Innovation Conference 2021	**International Association for Agricultural Sustainability and Waseda Business School**	**September 3-4, 2021 Tokyo**	**https://app.glueup.com/event/2021-international-agriculture-innovation-conference-32451/home.html**

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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