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South Asia Biosafety Program

NEWSLETTER FOR PRIVATE CIRCULATION ONLY – NOT FOR SALE

RESOURCE

Release of Version 9.1 of the Crop Composition Database

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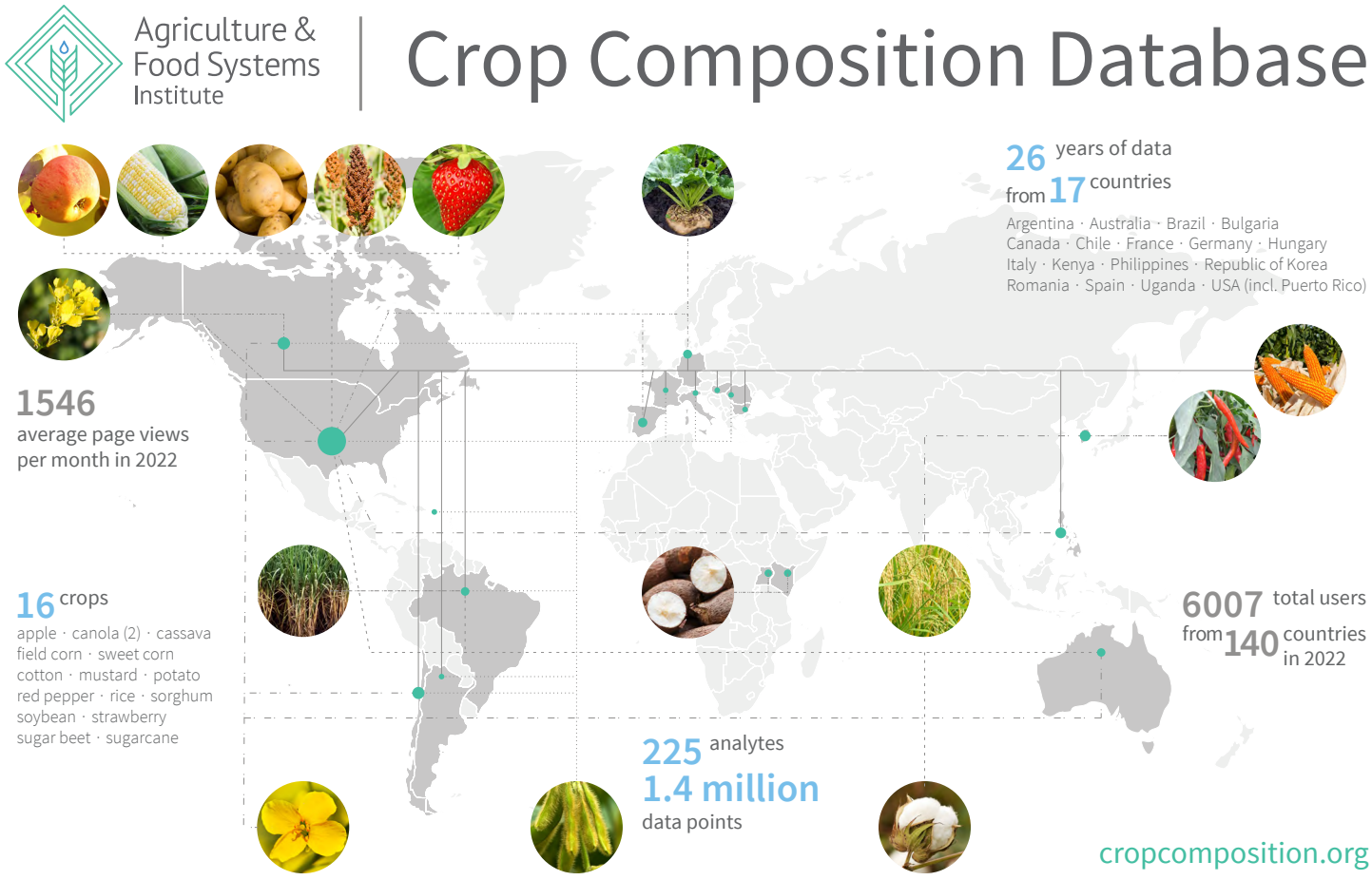

Infographic containing relevant details about the Agriculture & Foodsystems Institute's Crop Composition Database.

The Agriculture & Food Systems Institute's Crop Composition Database (CCDB) is a carefully curated, open access resource that provides compositional data on several conventionally bred crops that contribute to the world's food and feed supply. These crops include apple, canola (both *Brassica juncea* and *Brassica napus*), cassava, field corn, sweet corn, cotton, mustard, potato, red pepper, rice, sorghum, soybeans, strawberry, sugar beet, and sugarcane. The data ranges provided by this unique resource demonstrate the natural variability in key nutrients, anti-nutrients, and secondary metabolites of 16 crop species. The accompanying metadata, which include country and region of origin, year of cultivation, and analytical methodology, allow for critical insight into factors that play a role in compositional variability.

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The data from the CCDB can be applied to improve the overall knowledge of human nutrition, inform the development of diets that promote the healthy growth of livestock, and improve global datasets related to food security and nutrition modelling. The wide application of the CCDB makes it a high-quality resource of compositional data for use by scientists, government regulators, and food nutritionists. The database has been used as a reference for several OECD consensus documents on compositional considerations for new crop varieties, including those

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for cotton, rice, and soybean. Last year, over 6000 users from agriculture biotech companies, consulting firms, data crunching companies, intergovernmental organizations, public sector organizations, regulatory bodies, and universities, across 140 countries accessed the CCDB.

The CCDB contains data from varieties grown in controlled field trials across locations in 17 countries, in multiple seasons generated over 26 years. Since the first version of the CCDB was released in 2003, several improvements to the database platform and new features to improve data visualization and reporting have been integrated. The latest iteration released this month (Version 9.1) houses 1.4 million data points across 225 analytes, representing the largest collection of crop composition data in the public domain. Each data point submitted to the database is a real measurement taken from a single composite sample in a carefully designed field trial and is traceable to the data provider who submitted it. Data providers to the CCDB are public sector institutions and private sector companies that are listed on the website. All data providers adhere to a set of Data Acceptance Criteria for the data to be accepted to the database.

The data ranges across analytes can be visualized graphically and reports from the database can be exported in multiple formats. A summary format provides data ranges and the number of samples across analytes, while a detailed format provides a listing of each data point for the chosen analyte for a crop-tissue combination. A sample-specific report allows users to export data for all analytes reported for a given sample.

Please contact: ccdb@foodsystems.org if you have questions regarding the database, suggestions for improvement, or new data you would like to contribute.

LINK

Create a user account and access the CCDB's compositional data at:
www.cropcomposition.org

INDIA

Call for Proposals on Genome Editing of Crops for Enhanced Attributes by the Department of Biotechnology

The Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, has announced a call for proposals for financial support on the theme **"**Genome Editing of Crops for Enhanced Attributes" under the plant biotechnology area. It has been indicated that DBT intends to fund innovative, interdisciplinary, and collaborative research approaches for agricultural improvements by harnessing the potential of genome editing. The overarching aim is to strengthen the research, innovation, and translation in the agriculture sector and contribute to the Government's National Mission for Sustainable Agriculture (NMSA) and the UN's Sustainable Development Goals (SDGs).

There are five research and innovation priorities outlined in the call for proposals.

1. Product development through demonstrated leads available within the country at the advanced stage(s) of development.
2. Deploying trait-specific candidate gene(s) having well-established proof of concept into elite commercial cultivar(s)/variety(ies).
3. Establishing proof of concept for novel candidate gene(s) for trait improvement over and above the cultivar(s)/variety(ies) currently in use.
4. Developing novel indigenous tools (vectors, nucleases, etc.), methods, and regeneration protocols for recalcitrant crops.
5. Capacity building through familiarization of R&D tools for genome editing.

The department envisages grants-in-aid support for up to fifteen (15) ambitious and focused multi-institutional R&I projects of up to three years duration in the abovementioned priority areas.

The call for proposals will follow a two-stage submission and evaluation procedure, *viz.*, stage 1–letter of intent (LOI) and stage 2–full proposal.

The deadline for stage 1 is 27 February 2023 and the deadline for invited full proposals is May 2023.

More details can be accessed at:
https://dbtindia.gov.in/whats-new/call-for-proposals

Webinar on GM Crops and Derivatives for the Dairy Industry

Dr. Vibha Ahuja, Biotech Consortium India Limited

Dairy farm in West Bengal, India © Samrat35 | Dreamstime.com

India ranks first in milk production in the world. NITI Aayog has projected that the milk production in the country is expected to increase to more than 330 MT by 2033 from the current production of 200 MT. The demand for quality feed and fodder at affordable prices is extremely important for the growing dairy sector.

As genetically modified (GM) crops and their derivatives are extensively used for animal feed, including for dairy animals globally, Biotech Consortium India Limited (BCIL) organized a webinar on "Use of GM Crops and Derivatives for the Dairy Industry," in association with the Animal Nutrition Society of India (ANSI), on 31 January 2023. Presentations were delivered by industry experts, scientists from crop and animal research institutions, and nutritionists. About 200 participants attended the webinar.

Dr. B. M. Bhanderi, Senior Manager (Animal Nutrition), Kaira Union, Amul Dairy, presented on the "Growth of the Dairy Industry: Prospects and Challenges." He provided a comprehensive view of the dairy sector in India, the challenges of feed requirements, and the need for technological interventions. He highlighted that the Indian dairy sector is characterized by small holdings of animals by dairy farmers, less mechanized farms, crop residues, and by-product-based rations. Emphasizing the importance of feed in achieving targeted milk production and growth in the dairy market, he highlighted the challenges being faced, such as volatility in feed prices, the presence of mycotoxins, and the availability of quality feed. He indicated that technological interventions are urgently required to support the growing dairy sector. Some of these include using enzymes, minerals, YC, toxin binder, bypass protein, and fat supplements to improve feed conversion efficiency (FCE), increasing quality fodder availability in the form of silage/hay, and increasing crop yield per unit of land by using GM crops.

Bt cotton has been successfully adopted in the country, with more than 90% of the area under cultivation, and consequently, Bt cotton seed meal is already in use.

Dr. K.C. Bansal, Secretary, National Academy of Agricultural Sciences, India and Former Director, ICAR-National Bureau of Plant Genetic Resources, discussed the role of GM crops in improving the feed supply. He provided an update on GM crops being cultivated globally and their use for food, feed, and processing. He also informed participants that Bt cotton seed meal has been extensively used in cattle feed in India for the past 20 years. He apprised participants about the recent approval of GM mustard and how benefits are expected through the production of higher quantities of oil and seed meal.

Dr. Vibha Ahuja, Chief General Manager, BCIL, spoke about the safety and nutritional aspects of GM crops. In particular, she highlighted the elaborate regulatory framework and safety guidance being followed prior to the introduction of a GM crop. In addition, she clarified myths about GM crops and explained their relevance for use as animal feed.

Experts from industry, government, and academia participated in the panel discussion on strengthening the feed supply chain for a competitive dairy sector. Dr. Amrish Kumar Tyagi, Assistant Director General (Animal Nutrition and Physiology), Indian Council of Agricultural Research (ICAR), informed participants that he was involved in conducting cow feeding studies of Bt cotton seed meal during his tenure at the National Dairy Research Institute (NDRI). He indicated that Bt cotton has been successfully adopted in the country, with more than 90% of the area under cultivation, and consequently, Bt cotton seed meal is already in use. Dr. S. Anandan, Principal Scientist (Animal Nutrition), ICAR-National Institute of Animal Nutrition and Physiology, emphasized the need for expediting research and development of GM crops and expeditious approvals to ensure faster adoption of GM crops in the country, taking into consideration concerns and interests of consumers and farmers. Dr. V. Sridhar, Senior General Manager, National Dairy Development Board (NDDB), indicated that robust scientific evaluation is necessary to allay the concerns of some stakeholders regarding the impact of using GM crops as feed on the product quality of milk, meat, and animal health. Dr. Parminder Singh, Professor of Animal Sciences, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, stated that confirming the nutritional content of products derived from GM crops as feed is important. In particular, he spoke about dried distillers grains solubles (DDGS), a by-product from the distillery industry.

The experts answered queries by the participants regarding the safety, nutrition, and regulatory aspects of GM crops, highlighting the clear need for streamlining regulatory processes for the use of GM crops for the dairy sector. It was suggested that awareness programs like the present one will continue to shed light on animal feed issues and that such interactions should continue.

BANGLADESH

Biofortified Biotech Crops: A Way Forward to Tackle Malnutrition

Ifthikhar Zaman, Biotechnology Program, 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.

Workers processing paddy rice in Bangladesh © Badal Chandra Sarker | Dreamstime.com

Food is among the five basic necessities for survival, giving us the nutrients to stay alive and combat diseases. In today's world, many suffer from food scarcity and nutritional insecurity.[1] Biofortification, by which the nutritional quality of a food crop is increased, is one of the ways to tackle micronutrient deficiency worldwide.[2] There is much ongoing research on biofortification, and Golden Rice is an example. Golden rice is genetically engineered to have two additional genes than its conventional counterpart–a plant phytoene synthase (psy) and a bacterial phytoene desaturase (crt I). This enables the rice grain to produce β-carotene in its endosperm, which is converted to vitamin A when metabolized by humans.[3]

Golden Rice is a biofortified biotech crop, and the first breakthrough in research happened in 1999. However, it was only on 21 July 2021 that the Commercial Propagation Permit for Golden Rice in the Philippines was signed off.

According to UNICEF, malnutrition affects every country in the world, whether first-world or third-world.[1] Many studies have shown that our fruits, vegetables, and grains are losing protein, calcium, phosphorus, iron, riboflavin, and vitamins A and C.[4] With the growing economic crisis and foods losing nutritional value, the disease rate is going to increase. The diet we consume today has more carbohydrates and fewer other nutrients, making micronutrient supplementation necessary. People living in poverty consume micronutrient-poor staples. It is estimated that 60% of energy intake comes from only three crops–rice, corn, and wheat–because most people cannot afford diversified foods.[5] One study shows that in wheat, carbohydrate content has increased over the past 166 years, but unfortunately, protein, manganese, iron, zinc, and magnesium content has decreased.[6] A report shows a 30-50% decrease in iron, a micronutrient, in sweet corn, red-skinned potatoes, cauliflower, green beans, green peas, and chickpeas in Australia, a first-world country.[7] Moreover, as of 2013, 36% of crop calories in the world are directed toward animal feed, and as the feed itself is less nutritious, the meat harvested from the farms might also be becoming less nutritious.[8] In short, the foods we eat today are losing vital micronutrients now more than ever.

One of the most visible effects is the widespread vitamin A malnutrition among poor people, which leads to irreversible blindness and severe exacerbation of infectious diseases, even death. Most of these people's diets are primarily based on rice.[9] As a result, because of poverty, people are unable to have good, nutritious food, which in turn, makes them sick and unable to work properly, which again, causes low income, and the cycle continues.

So, to ensure micronutrients for the majority of people, a system is needed where the food price will not increase while allowing people to get the necessary micronutrients to sustain a healthy life. A good way of doing this is the biofortification of commonly eaten crops, such as rice, and Golden Rice can be a good example of this. Golden Rice is a biofortified biotech crop, and the first breakthrough in research happened in 1999. However, it was only on 21 July 2021 that the Commercial Propagation Permit for Golden Rice in the Philippines was signed off.[3] As of October 2022, from the 17 Golden Rice production sites in the country, about 67 tons of products have been harvested.[10]

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Now, there can be questions if those biofortified biotech products are safe for consumption. Every biotech product goes through thorough biosafety assessments, i.e., environmental safety assessments and food safety assessments. The risk assessment process prior to commercial cultivation release consists of answering several questions, like potential adverse effects and the likelihood that effects will be realized, possible consequences, whether the risks are acceptable or manageable, specific issues of concern, receiving environment considerations, LMO detection, identification methods, etc. For example, in the case of Golden Rice, the potential adverse effect like unwanted seed dispersal and interbreeding or genetic exchange can be managed through risk management protocols like animal barriers and retaining water movements via a levee that would surround the plots, along with overall post-harvest monitoring. Moreover, research suggests, as the genetic modification in the rice does not alter any pathway regarding the reproduction of the plant, its weediness potential will be the same as the conventional counterpart.

Furthermore, diagnostic lateral flow strips, ELISA, and PCR provide a rapid qualitative and semi-quantitative detection of transgenes, which enables the detection of any unwanted germplasm mixing. As the potential impacts on the environment during the site preparation, planting, data gathering, harvesting, and monitoring could be handled through proper management procedures, the regulatory body considered Golden Rice safe for the environment and biodiversity.[11] Furthermore, biosafety assessments were done for Golden Rice as food, feed, and for processing. No scientific evidence was found of the proteins encoded by the *ZmPSY1*, *CRT1*, and *PMI* genes to be considered allergens, and the existing database suggested no known toxicity effect of those proteins. Biosafety studies also showed that if Golden Rice is consumed in excess, the excess vitamin A is easily flushed out of the body, in feces, urine, sweat, etc.[12, 13] These assessments of Golden Rice set up an example of a comprehensive biosafety evaluation and decision-making process for biofortified biotech products.

In conclusion, staple crops biofortified with vitamins, minerals, and other nutrients can be a game changer in ensuring the equal right to a healthy life. Both the scientific community and public representatives need to come forward with solutions to make biofortified crops available because if there is no harmony in work between these two groups, the general public will suffer. The introduction of Golden Rice into commercial production can give hope and experience to tackle the problems faced today by the other biotech products. It may help decrease the time it takes a biotech product to go from the laboratory to the general public. More biofortified products are necessary all over the world to ensure an equal healthy life for all.

References

1. *2018 Global Nutrition Report reveals malnutrition is unacceptably high and affects every country in the world, but there is also an unprecedented opportunity to end it.* (n.d.). Retrieved from https://www.unicef.org/press-releases/2018-global-nutrition-report-reveals-malnutrition-unacceptably-high-and-affects
2. Saltzman, A., Birol, E., Bouis, H. E., Boy, E., De Moura, F. F., Islam, Y., & Pfeiffer, W. H. (2013). Biofortification: progress toward a more nourishing future. *Global food security*, *2*(1), 9-17.
3. Jorge Mayer. (n.d.). *The Golden Rice Project*. Copyright Golden Rice Humanitarian Board. Retrieved from- https://www.goldenrice.org/
4. *Mounting evidence shows that many of today's whole foods aren't as packed with vitamins and nutrients as they were 70 years ago, potentially putting people's health at risk.* (2022, May 3). National Geographic. Retrieved from- https://www.nationalgeographic.co.uk/environment-and-conservation/2022/05/fruits-and-vegetables-are-less-nutritious-than-they-used-to-be
5. *Dimensions of need - Staple foods: What do people eat?* (n.d.). Retrieved from https://www.fao.org/3/u8480e/u8480e07.htm
6. Mariem, S. B., Gámez, A. L., Larraya, L., Fuertes-Mendizabal, T., Cañameras, N., Araus, J. L., ... & Aranjuelo, I. (2020). Assessing the evolution of wheat grain traits during the last 166 years using archived samples. *Scientific Reports*, *10*(1), 1-13.
7. Eberl, E., Li, A. S., Zheng, Z. Y. J., Cunningham, J., & Rangan, A. (2022). Temporal Change in Iron Content of Vegetables and Legumes in Australia: A Scoping Review. *Foods*, *11*(1), 56.
8. Cassidy, E. S., West, P. C., Gerber, J. S., & Foley, J. A. (2013). Redefining agricultural yields: from tonnes to people nourished per hectare. *Environmental Research Letters*, *8*(3), 034015.
9. Holick, M. F. (2007). Vitamin D deficiency. *New England journal of medicine*, *357*(3), 266-281.
10. Nesathurai, A. (2023, January 22). *67 tons: Harvest of first commercial-quality GMO beta carotene-enriched Golden Rice nears completion in Philippines*. Genetic Literacy Project. Retrieved from https://geneticliteracyproject.org/2023/01/18/67-tons-harvest-of-first-commercial-quality-gmo-beta-carotene-enriched-golden-rice-nears-completion-in-philippines/
11. Biosafety Clearing House (n.d.). Determination for the Safety Assessment of RICE GR2E for Introduction into the Environment (Field Trial). Retrieved from https://bch.cbd.int/en/database/BCH-RA-PH-116099-1
12. Biosafety Clearing House (n.d.). Determination for the Safety Assessment of RICE GR2E for Direct Use as Food, Feed and for Processing. Retrieved from https://bch.cbd.int/en/database/BCH-RA-PH-116100-1
13. Zaman I., Shahariar M., Zilan G. M., Howlader R. R. *The Journey of Golden Rice: From Development To Approval, VOL 18 NO 10*. OCTOBER 2021 SABP newsletter. Retrieved from- SABP_10_October_2021.pdf (foodsystems.org)

Farmer harvesting rice in Bangladesh © Ruhul Amin Roni | Dreamstime.com

CALENDAR OF EVENTS

EVENT	ORGANIZED BY	DATE	WEBSITE
INDIA			
NAU-IES-IUFRO Conference: Tree Based Diversified Land-Use System - Augmenting Livelihood Security and Industrial Growth	Navsari Agricultural University, Indian Ecological Society at Punjab Agricultural University, in association with the International Union for Forest Research Organization, Austria	February 15-17, 2023 Navsari	https://nau.in/index
International Conference on Development and Promotion of Millets and Seed Spices for Livelihood Security	Agriculture University, Jodhpur and ICAR-AICRP on Pearl Millet	February 24-26, 2023 Jodhpur	https://www.aujodhpur.ac.in/
Indian Seed Congress 2023	National Seed Association of India	March 2-4, 2023 New Delhi	https://isc.nsai.co.in
International Conference on Recent Trends in Translational Research	Bharat Institute of Higher Education and Research	March 29-31, 2023 Chennai (in-person and online)	https://forms.gle/UrUjfxJNBnqpDUn89
XVI Agricultural Science Congress and ASC Expo	National Academy of Agricultural Sciences (NAAS)	October 10-13, 2023 Kochi	http://www.16asc2023.in
Training Programme on Recent Technological Advancement's in Horticulture and Forest Crops	Department of Biotechnology, College of Horticulture, Dr. Yashwant Singh Parmar University of Horticulture and Forestry	December 23-30, 2023 Solan	https://www.yspuniversity.ac.in
INTERNATIONAL			
Virtual Workshop on Building Knowledge and Regulatory Capacity in Animal Biotech in Response to Climate Change	ISAAA Inc. and the United States Department of Agriculture (USDA), under the Asia-Pacific Economic Cooperation (APEC)	February 27-28, 2023 Online	https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=20042
International Conference on GMO Analysis and New Genomic Techniques	Secretariat of the Convention on Biological Diversity	March 14-16 2023 (tentative) Berlin, Germany	https://www.cbd.int/meetings/?thm=CPB
16th ISBR Symposium	International Society for Biosafety Research	April 30-May 4, 2023 St Louis, MO, USA	https://isbr.info/symposium
BIO International Convention	Biotechnology Innovation Organization (BIO)	June 5-8, 2023 Boston, MA, USA	https://www.bio.org/events/bio-international-convention
6th International Rice Congress 2023	International Rice Research Institute and Department of Agriculture, Republic of the Philippines	October 16-19, 2023 Manila, Philippines	https://www.irri.org/IRC2023-teaser.html

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.

SOUTH ASIA BIOSAFETY PROGRAM

Agriculture & Food Systems Institute

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