

# South Asia Biosafety Program

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Chickpea and Pigeonpea for  
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## Save the Date

September 15-17, 2018

Dhaka, Bangladesh

# 6<sup>th</sup> Annual South Asia Biosafety Conference

Registration Information to Follow





## Genetically Engineered (GE) Chickpea and Pigeonpea for Insect Resistant (IR) Trait

Alok Das and N. P. Singh, ICAR-Indian Institute of Pulses Research

Pulses are climate smart grain legumes consumed solely for protein content (20-25%). Chickpea and pigeonpea are India's two most important pulses, accounting for more than 60% of pulse production, and subsequently consumption and value addition. The gram pod borer (*Helicoverpa armigera* H.) is the most devastating insect pest of both pulses, leading to average annual yield losses to the tune of 30-40%. A source for resistance has not been identified in a crossable gene pool and hence, genetic engineering using the *Bacillus thuringiensis* (*Bt*) gene holds promise to alleviate insect loss and damage caused by the pest. The *Bt* gene *cry1Ac* was reported to be most efficacious against the lepidopteran insect pest.

Transgenic chickpea and pigeonpea lines were developed at the Indian Council of Agricultural Research (ICAR) Indian Institute of Pulses Research, employing synthetic *Bt* genes (*cry1Ac* and domain shuffled *cry1Aabc*) and the widely adopted Indian cultivars, under collaborative efforts with the ICAR-National Research Centre on Plant Biotechnology. The project was funded by the ICAR-Network Project on Transgenics in Crops (NPTC) and the ICAR-National Agricultural

Science Fund (NASF). *Agrobacterium tumefaciens* mediated genetic transformation of meristematic regions of chickpea and pigeonpea was achieved by induction of the direct organogenetic (shoot) pathway and establishment of shoots to plantlets via reciprocal grafting and subsequently, mature fertile plants.

**More than 500 transgenic chickpea and pigeonpea lines were generated and characterized.**

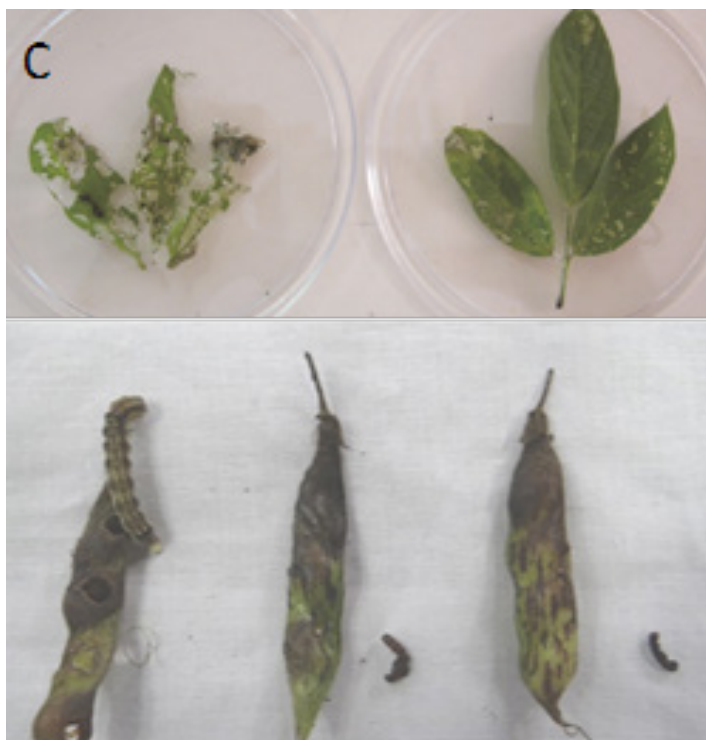
More than 500 transgenic chickpea and pigeonpea lines were generated and characterized based on gene expression and trait efficacy in laboratory conditions. Five promising transgenic chickpea and pigeonpea events were identified for the event selection trial to identify the best event for trait efficacy under field conditions, as well as to comply with Indian regulatory requirements. Regulatory approvals and guidelines were obtained from the responsible national authorities—the Genetic Engineering Appraisal Committee and the Review Committee on Genetic Manipulation—to comply with the biosafety requirements of the trial. Efforts are also in progress to generate marker free transgenics, through stacking with other insecticidal genes of proven efficacy and specifically, expression in the pod wall, to enhance the protection spectrum.



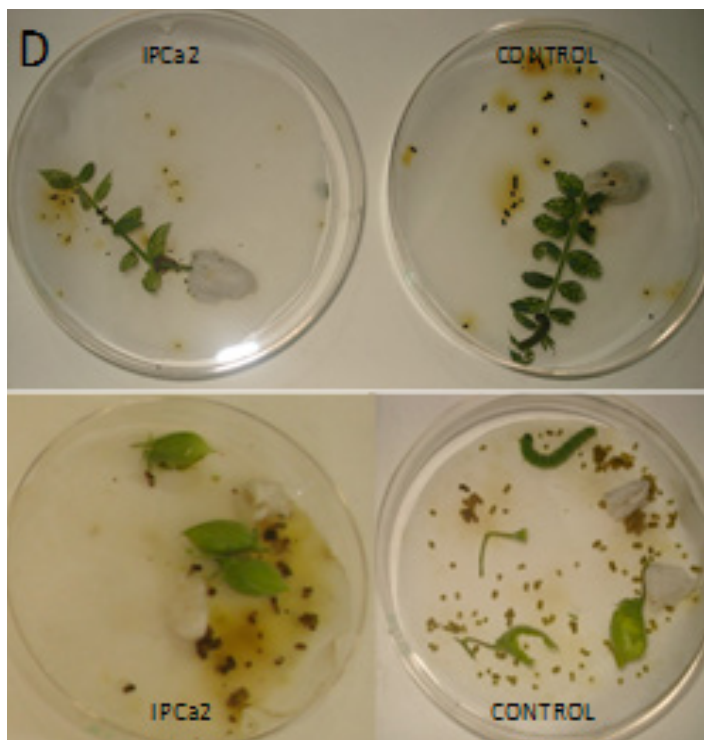
Transgenic pigeonpea lines in the transgenic containment facility.



Transgenic chickpea lines in the transgenic containment facility.



Detached leaf and pod bioassay of transgenic pigeonpea lines.



Detached leaf and pod bioassay of transgenic chickpea lines.

## Doubling Farmers' Income – Contribution Through Technology

P. Karnan, Rasi Seeds (P) Ltd.

Modern biotechnology encompasses a range of technologies, which may be grouped according to their application domains: crops, aquaculture, livestock, environment, and natural products. Biotechnology applications for crops include plant tissue culture, biopesticides, biofertilizers, bio diagnostics, marker-aided selected crop varieties, and transgenic (genetically modified) crops. At the farm level, apart from new biotech crop varieties, other inputs such as fertilizer and water and proper management practices also need to be present to maximize yield.

Agriculture remains an important area of impact for biotechnology due to the importance of food security. Agri biotechnology is one among the best tools to address each dimension of food security (availability, physical access, economic access, and utilization). Globally, 28 countries are growing biotech crops at the time of writing. The biotech crop surface area has increased more than 100-fold, from 1.7 million hectares in 1996 to 185.1 million hectares in 2016. Worldwide, among the cultivated biotech crops, soybean, followed by maize and cotton, are the three prominent transgenic crops grown extensively today. Biotech crops are the fastest adopted crop technology in recent history, reflecting farmer satisfaction and high adaptation benefits for small and large farm holds, as well as for consumers.

Bt cotton was introduced in India in 2002 and local farmers adopted this technology within a short period of time. More than 96% of the total cotton growing area in India today is dedicated to Bt cotton. Following up on the success of Bt Cotton, several institutions, both public and private, started working to develop other transgenic crops with novel traits. As a leading private seed company, Rasi Seeds would like to contribute to the Government of India's program to double farmers' income. Transgenic technology is one of the tools for revolutionizing agriculture. Rasi Seeds is developing transgenic crops such as brinjal (insect resistance), cotton (insect resistance and viral resistance), rice

(insect resistance, yield enhancement, and drought tolerance), okra (viral resistance), and cassava (viral resistance).

Other than insect resistance (Bt genes), herbicide tolerance (HT) is the next major trait for transgenic crops. RNAi technology is also used to improve crops by providing resistance against viruses and insects. New breeding technologies (genome editing), such as TALENs, ZFNs, and CRISPR-cas9, hold promise, with CRISPR-cas9 allowing for more precision, speed, and accuracy. Recently, the United States Department of Agriculture (USDA) confirmed that genome edited crops do not require regulatory approval. Under current biotechnology regulations, the USDA does not regulate plants that could otherwise have been developed through traditional breeding techniques, as long as they are not plant pests or developed using plant pests. In India, scientists are using CRISPR-cas9 technology in crops such as rice and banana.

**Transgenic technology is one of the tools for revolutionizing agriculture.**

Rasi Seeds is of the opinion that, like in the USA, the Indian government should also keep crops produced using genome editing out of regulatory approvals, so that public and private institutions would invest more in these new technologies to produce superior products, such as environmentally clean crops for the farming community. In addition to the transgenic approach, Rasi Seeds is also working on crop improvement using DNA-based molecular markers and genome wide associations (GWAS) for foreground and background selection for novel traits and genetic purity in crops such as cotton, rice, and maize. This would be made possible if institutions such as the Department of Biotechnology (DBT) and Indian Council of Agricultural Research (ICAR) give constant support to research initiatives by Indian companies. Government policies should encourage public and private partnership programs to develop models of farming systems with a focus on farm income. This would involve combining advanced technologies and best farming practices. Ultimately, these initiatives would lead to an increase in productivity to feed the growing Indian population.



Indian Farmer plowing in cotton field.



EVENT	ORGANIZED BY	DATE	WEBSITE
<b>INDIA &amp; BANGLADESH</b>			
Consortium Meeting on Breeding for Resistance to Tospo & Begomoviruses In Vegetable Crops	ICAR-Indian Institute of Horticultural Research	June 26, 2018 Bangalore, India	<a href="https://icar.org.in">https://icar.org.in</a>
International Conference on Agriculture and Allied Sciences: The Productivity, Food Security and Ecology	Bidhan Chandra Krishi Viswavidyalaya	August 13 – 14, 2018 Kalyani, India	<a href="https://www.bckv.edu.in/announcement.php">https://www.bckv.edu.in/announcement.php</a>
New Innovations in Improvement of Vegetable Crops	Dr. Y. S. Parmar University of Horticulture & Forestry	September 5 – 25, 2018 Nauni-Solan, India	<a href="http://www.yspuniversity.ac.in/trainings/Caft_Brochure_2018.pdf">http://www.yspuniversity.ac.in/trainings/Caft_Brochure_2018.pdf</a>
13 <sup>th</sup> Asian Maize Conference and Expert Consultation on “Maize for Food, Feed, Nutrition and Environmental Security”	Indian Council of Agricultural Research	October 8 – 10, 2018 Ludhiana, India	<a href="http://bit.ly/2sUAWPi">http://bit.ly/2sUAWPi</a>
2 <sup>nd</sup> National Biotechnology Conclave	Confederation of Indian Industry (CII)	November 30, 2018 New Delhi, India	<a href="http://www.cii.in/Events.aspx">http://www.cii.in/Events.aspx</a>
Second International Conference on Nanobiotechnology for Agriculture	The Energy and Resources Institute	December 6 – 7, 2018 New Delhi, India	<a href="http://www.teriin.org/event/second-international-conference-nanobiotechnology-agriculture">http://www.teriin.org/event/second-international-conference-nanobiotechnology-agriculture</a>
<b>INTERNATIONAL</b>			
2 <sup>nd</sup> World Congress & Expo on Biotechnology and Bioengineering	Biocore Conferences	June 25 – 27, 2018 Dubai, UAE	<a href="https://biocoreconferences.com/biotechnology2018/">https://biocoreconferences.com/biotechnology2018/</a>
5 <sup>th</sup> International Conference on Biotechnology Engineering (ICBioE)	Department of Biotechnology Engineering (BTE) and International Islamic University Malaysia (IIUM)	September 19 – 20, 2018 Kuala Lumpur, Malaysia	<a href="http://www.iium.edu.my/icbioe/2018/">http://www.iium.edu.my/icbioe/2018/</a>
The 3 <sup>rd</sup> International Agriculture Innovation Conference (IAIC 2018)	International Association for Agricultural Sustainability	October 12 – 13, 2018 Beijing, China	<a href="http://iaic2018.iaas.org.sg/">http://iaic2018.iaas.org.sg/</a>
5 <sup>th</sup> International Rice Congress	International Rice Research Institute	October 14 – 17, 2018 Singapore	<a href="http://ricecongress2018.irri.org/">http://ricecongress2018.irri.org/</a>



**SOUTH ASIA**  
BIOSAFETY PROGRAM

The South Asia Biosafety Program (SABP) is an international developmental program implemented in India and Bangladesh with support from the United States Agency for International Development. SABP aims to work with national governmental agencies and other public sector partners to facilitate the implementation of transparent, efficient, and responsive regulatory frameworks for products of modern biotechnology that meet national goals as regards the safety of novel foods and feeds, and environmental protection.



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