

Bt brinjal

frequently asked questions

Q: What is Bt brinjal?

A: In Bangladesh, eggplant is known as “brinjal.” It’s also known as “talong” in the Philippines and “aubergine” in Europe. “Bt brinjal,” a genetically engineered variety of eggplant, provides effective protection against the devastating eggplant fruit and shoot borer (FSB) *without the application of pesticides*. Bt brinjal-4—the variety studied by the International Food Policy Research Institute (IFPRI)—can produce an insecticidal protein that is toxic to FSB.

Q: Who developed Bt brinjal?

A: Bt brinjal was developed through a collaborative partnership funded by USAID and managed by Cornell University and its India-based Sathguru Management Consultants. India-based Maharashtra Hybrid Seed Co. (Mahyco) did the first work to establish that Bt genes could effectively deter the eggplant fruit and shoot borer. The Bangladesh Agricultural Research Institute (BARI) teamed up with Mahyco to insert the protective Bt genes into four brinjal cultivars that are popular in Bangladesh. BARI conducted research trials in different locations around Bangladesh, which generated the necessary information for the four varieties to go through the government approval process. BARI initially shared the improved seeds at no charge with smallholder farmers. Meanwhile, the University of the Philippines-Los Baños has been conducting similar research on its local cultivars.

Q: Why was Bt brinjal developed?

A: Brinjal is a very popular fruit in South Asia. However, it is subject to frequent and intense attacks by the FSB. To control the destructive pest, smallholder farmers typically buy and apply large quantities of insecticide sprays that they often use right up to the time of harvest. Farmers may apply as many as 23-140 insecticidal sprays per season to control the FSB and other pests. This practice exposes farmers, consumers, and the environment to high levels of hazardous pesticides. It also represents a substantial expense that smallholder farmers cannot easily afford. Worse, farmers often experience significant losses even after applying pesticides.

Q: Where is Bt brinjal available?

A: Bt brinjal is currently under cultivation in Bangladesh. Recently, there has been progress towards establishing appropriate regulatory structures for testing and possible commercialization in the Philippines. In India, the Genetic Engineering Appraisal Committee (GEAC) approved its commercialization in 2009 following field trials and safety evaluations. However, the seeds have not yet been released to farmers.

Q: How does Bt brinjal work?

A: Researchers inserted insecticidal crystal (CryI Ac) proteins from the *Bacillus thuringiensis* (Bt) bacterium into the genetic code of brinjal cultivars. This gives the plant and each fruit it produces inherent resistance to attacks by FSB. The Bt approach to insect control has been safely and effectively used globally in other crops, such as maize, for over two decades.

Q: Does this mean farmers no longer need any pesticide?

A: Some spraying is still required to control other insects, such as whiteflies, thrips, and mites, that attack brinjal but are not affected by CryI Ac. Scientists from the Bangladesh Agricultural Research Institute are now developing treatment guidelines for addressing “sucking insects,” which can reduce plant vigor and subsequent fruit weight.

Q: What is unique about Bt brinjal?

A: Bt brinjal is the first genetically engineered food crop created specifically for smallholder farmers in a developing nation, and the first genetically engineered food crop adopted for cultivation in Bangladesh. It is a sustainable, environmentally-friendly crop that significantly reduces pesticide use and improves the livelihoods and lives of the smallholder farmers who grow it.

Q: Can farmers save Bt brinjal seeds?

A: Farmers can save Bt brinjal seeds because the approved varieties of Bt brinjal are open-pollinated. This is best done when farmers follow best practice guidelines, such as using conventional brinjal borders around the plot for growing Bt brinjal. To meet farmer demand, BARI is expanding its capacity to produce high-quality seed at prices affordable to smallholder farmers. Bangladeshi farmers cannot export seed or share it with farmers in other countries because the varieties they grow are approved for use only in Bangladesh.

Q: Who owns the technology behind Bt brinjal? Is it the property of a multinational company?

A: Bt brinjal technology is not owned by any company. Mahyco initially developed an eggplant that expresses CryI Ac (EE-1) to control eggplant fruit and shoot borer. This was provided to BARI, a government agency, through a public-private partnership between Mahyco, USAID, Sathguru Management Consultants, Cornell University, and BARI. Under the partnership, BARI subsequently introgressed the EE-1 event into its own local eggplant lines, which it manages and controls.

Q: What is being done to prevent insects from developing resistance to Bt?

A: Farmers and agricultural extension officials in Bangladesh are thoroughly trained in internationally recognized stewardship practices for cultivating Bt brinjal. This includes growing a non-Bt brinjal border around Bt brinjal plants, where insects can feed. This strategy helps to prevent insects from developing resistance to Bt.

Q: Is Bt brinjal safe?

A: Extensive international research has documented that CryI Ac proteins are safe for human food and livestock feed. Appropriate and qualified agencies in Bangladesh have evaluated Bt brinjal and determined that it is as safe to eat as conventional brinjal. Rigorous food and feed safety studies, including toxicity and allergenicity evaluation and nutritional studies, confirmed that Bt brinjal is as safe as its non-Bt varieties. Other studies have found Bt brinjal has no adverse environmental effects. These include studies conducted on pollen flow, effects on soil microflora, agronomy, germination, and weediness. These extensive studies indicate that Bt brinjal has no unintended effects. It also has no negative impact on beneficial insects, which instead benefit from the reduced use of pesticides.

Q: How was Bt brinjal tested for safety before it was approved?

A: In Bangladesh, BARI tested the Bt brinjal lines under contained, confined and open field conditions for seven consecutive seasons, after which BARI applied to the National Technical Committee on Crop Biotechnology (NTCCB) for their release. Scientists in the Philippines conducted contained use experiments on Bt talong from 2007 to 2009 and then received a biosafety permit to pursue confined field testing at four approved trial sites, all of which were completed in August 2012. India conducted extensive field tests of Bt eggplant between 2004-2008, using more than 50 trial locations and documenting a 77 percent reduction in pesticide use. Following safety evaluations conducted by the Indian biosafety body, the Genetic Engineering Appraisal Committee (GEAC) approved its commercialization of Bt brinjal in 2009.

Q: What is BARI doing to improve Bt brinjal in Bangladesh?

A: Farmer adoption continues to increase in Bangladesh. Based on growing evidence on the positive effects of Bt brinjal, additional newer lines that offer increased disease resistance and are better suited to specific locations may be added to the four initial varieties already approved for cultivation in the country. BARI has applied for commercial cultivation of three new varieties that are based on cultivars that are very popular among farmers. These new varieties are better performing and less susceptible to wilt disease. BARI is also following internationally approved practices to expand its production of quality Bt brinjal seed to ensure farmers have an adequate supply.



Q:What is the outlook for Bt brinjal in South Asia?

A: In Bangladesh, three additional Bt varieties that have been developed for different regional conditions, seasons, and consumer preferences are pending regulatory approval. It is estimated that there are over 150,000 farmers growing brinjal on over 50,000 hectares of land producing over 450,000 tons of brinjal, which speaks to the popularity of the crop across the country.

While the impact study results were subject to growing conditions during the years assessed (2017-2018), and both year-to-year and geographical variations in weather, precipitation, and other factors influence brinjal performance, if those estimates are extrapolated to a national level, pesticide cost savings could be over \$2.7 million and net profits could increase by over \$14 million.

Given that FSB can cause up to 80 percent crop loss in India and the Philippines, it is anticipated that the adoption of Bt brinjal in India and the Philippines would result in economic and health benefits similar to those documented in Bangladesh. The Feed the Future South Asia Eggplant Improvement Partnership, which includes the University of the Philippines-Los Baños, is now preparing to submit a regulatory dossier for the Philippines. This is the first step toward availability to farmers in that country.

Following safety evaluations conducted by the Indian biosafety body, India approved the commercialization of Bt brinjal in 2009. The Indian Minister of Environment and Forests imposed a moratorium on release in 2010 that remains in effect today. Bt cotton is the only genetically engineered crop currently allowed in India and has been widely adopted by farmers.

FAQ on the Feed the Future-funded Bt brinjal study in Bangladesh

Q:Who are the study partners and what were their roles under this study?

A: The Bt brinjal study was a collaborative effort between the government, academia, and research institutions. The Bangladesh Government authorized and implemented the study under the Ministry of Agriculture, with support from the Bangladesh Agricultural Research Institute and the Department of Agricultural Extension.

BARI is an autonomous organization under the Ministry of Agriculture that conducts research on non-rice crops. BARI developed the treatment crop assessed under this study (BARI Bt brinjal-4), conducted a training of trainers of DAE officials in the study districts, certified the Bt brinjal seeds supplied to DAE, packaged and supplied sufficient Bt brinjal-4 seeds for treatment and ISD-006 seeds for control farmers to each cultivate a 10-decimal plot, provided conventional brinjal seeds (ISD-006) for the refuge border to abide by biosafety rules and guidelines, and monitored seedling production and cultivation throughout the study.





DAE mobilized extension officials in the study areas to participate in the BARI-led training of trainers, organized farmer trainings at the subdistrict-level, provided input support to the farmers, coordinated and monitored seedling distribution, and monitored the overall implementation of the study.

IFPRI designed and evaluated the study, coordinated various activities between partners, supervised the survey enumerator and supervisor trainings and survey administration, and monitored field activities throughout study implementation.

John Hoddinott from Cornell University provided technical support to the evaluation.

Data Analysis and Technical Assistance (DATA) is a Bangladeshi survey firm that conducted the baseline and endline surveys for this evaluation.

Q: Who funded the study?

A: The study was funded jointly by the Government of the People's Republic of Bangladesh and USAID, with support from the CGIAR Research Program for Policies, Institutions, and Markets (PIM).

Q: Is it correct to assume that the results from this study will extend to all of Bangladesh?

A: No, this study assesses the impacts of Bt brinjal-4 cultivation in four districts across 1,200 farmers in Northwest Bangladesh, and was subject to the growing conditions during the years assessed (2017-2018), and both year to year and geographical variation in weather, precipitation and other factors influence brinjal performance. Therefore, we cannot use the results of this single study to extend across all of Bangladesh. However, the findings from this study are consistent with a growing body of evidence in Bangladesh, which suggests that there are benefits of growing Bt brinjal.

Q: Do authors recommend Bt brinjal?

A: As a research institution, IFPRI's mandate is to generate and communicate study findings objectively to inform policy options, not to advocate for any specific actions.

Q: What is IFPRI's stance on genetically engineered crops?

A: As a research institution, IFPRI assesses the impacts of new varieties of crops through rigorous studies and evaluations, but does not advocate for or have an official stance on genetically engineered crops.

Q: How are genetically engineered crops like Bt brinjal regulated in Bangladesh?

A: In Bangladesh they are strictly regulated by the National Committee on Biosafety (NCB), which oversees biosafety policy and decision-making, and is chaired by the Secretary of the Ministry of Environment and Forests. The Biosafety Core Committee supports the NCB in reviewing the technical information submitted with





applications of these crops and advising the NCB. The NCB is governed by the Biosafety Rules of Bangladesh, promulgated under the 1995 Environment Conservation Act and published in the National Gazette in 2012. The Biosafety Rules codified the regulatory structures and processes under the 2008 Biosafety Guidelines of Bangladesh.

The Bangladesh Government has a regulatory process for confined field trials, which enable limited cultivation of genetically engineered crops to document evidence, and a regulatory process for commercial cultivation of the crops.

On October 28, 2013, the NCB approved cultivation of four indigenous varieties of Bt brinjal developed by the Bangladesh Agricultural Research Institute, one of which being Bt brinjal-4—the treatment crop assessed under this study. BARI conducted research and demonstration trials, which found various positive impacts of Bt brinjal compared with non-Bt brinjal. The NCB approved Bt brinjal for use, stating that the genetically engineered crop would significantly reduce the need to use pesticides.

Q: What benefits did this study find associated with Bt brinjal cultivation?

A: Farmers growing Bt brinjal saw 95 percent less infestation of the fruit and shoot borer, and had 42 percent higher yields leading to approximately \$400 per hectare increased profits. Additionally, there was a 56 percent reduction in pesticide toxicity and 10 percent fewer symptoms associated with pesticide exposure. These findings have been submitted to a peer-reviewed journal for publication.

Q: Where can I get more information?

- Feed the Future South Asia Eggplant Improvement Partnership — bteggplant.cornell.edu
- IFPRI-Bangladesh Assessing the Impacts of Bt Brinjal Landing Page — <http://bangladesh.ifpri.info/tag/bt-brinjal/>
- "Bt Brinjal in Bangladesh: The First Genetically Engineered Food Crop in a Developing Country" <http://cshperspectives.cshlp.org>
- "Bt eggplant (*Solanum melongena* L.) in Bangladesh: Fruit production and control of eggplant fruit and shoot borer (*Leucinodes orbonalis* Guenee), effects on non-target arthropods and economic returns" <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0205713>
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- "A review of the food and feed safety of the CryI Ac protein." https://ilsirf.org/wp-content/uploads/sites/5/2017/02/cryIac_en_ffs.pdf
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