

GMOs Will Destroy Indian Agriculture, and Will Harm the Health of One Billion Indians and Their Animals

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Hybrid Bt cotton, the only commercialised GM crop in India, has failed conclusively. Based on this failure and the evidence on GM crops to date, the Union of India's proposal to commercialise herbicide-tolerant (HT) mustard will destroy not just Indian mustard agriculture but citizens' health.

There have been five days of intense hearings on this matter in the Supreme Court (SC) — the GMO Public Interest Writ filed almost 20 years ago in 2005 by the author, which ended on 18 January 2024.

In these last 20 years, piecemeal hearings have dealt with submissions relating to individual crops like hybrid Bt cotton, the attempted commercialisation of hybrid Bt brinjal (2010) and now the attempt to commercialise hybrid HT mustard.

The evidence provided here is a distillation of the critical inputs of those 60+ submissions based on the affidavits and studies of leading, independent scientists and experts of international renown.

However, there is a serious and proven conflict of interest among our regulators, the Ministry of Science and Technology and the Ministry of Agriculture along with the Indian Council of Agricultural Research (ICAR), which promote GMOs in Indian agriculture. This evidence reflects the findings of the TEC Report (Technical Expert Committee) appointed by the Supreme Court (SC) in 2012 and two Parliamentary Standing Committees of 2012 and 2017.

'Modern biotechnology' or genetically modified organisms (GMOs) are products where the genomes of organisms are transformed through laboratory techniques, including genetically

engineered DNA (recombinant) and its direct introduction into cells. These are techniques not used in traditional breeding and selection.

GMOs create organisms in ways that have never existed in 3.8 billion years of evolution and produce 'unintended effects' that are not immediately apparent. This is why rigorous, independent protocols for risk and hazard identification are the sine qua non of correct regulation in the public interest. The Indian 'Rules of 1989' describe GMOs as "*hazardous*".

Contamination by GMOs of the natural environment is of outstanding concern, recognised by the CBD (Convention on Biodiversity), of which India is a signatory. India is one of 17 listed international hot spots of diversity, which includes mustard, brinjal and rice. India is the centre of the world's biological diversity in brinjal with over 2500 varieties grown in the country and as many as 29 wild species.

India is a secondary centre of origin of rape-seed mustard with over 9000 accessions in our gene bank (National Bureau of Plant Genetic Resources). With a commercialised GM crop, contamination is certain. The precautionary principle must apply, is read into the Constitution and is a legal precedent in India.

Hybrid Bt cotton was introduced in 2002 and remains the only approved commercialised crop in India. It has been an abject failure.

Failure of Bt Cotton

India is the **only** country in the world to have introduced the Bt gene into hybrid Bt Cotton. It was introduced in hybrids as a 'value-capture mechanism', according to Dr Kranthi, ex director of the Central Institute for Cotton Research (CICR). The hybrid technology disallows seed saving by millions of small farmers. Conservative estimates indicate that Indian farmers may have paid an additional amount of Rs 14,000 crores for Bt cotton seeds during the period 2002-18, of which trait fees amounted to Rs 7337.37 crores, (Dr Kranthi). There was also a phenomenal three-fold increase in labour costs in hybrid cotton cultivation.

Prof. Andrew Gutierrez (University of California, Berkeley) is among the world's leading entomologists and cotton scientists and provided the ecological explanation of why hybrid Bt cotton is every bit a disaster that it is in India. Most hybrid cottons are long season (180-200-day duration). This increases the opportunities for pest resurgence and outbreaks because it links into the lifecycle of the pest. The low-density planting also increases the cost of hybrid seeds substantially.

Hybrids require stable water too (therefore, irrigation, as opposed to rain-fed) and more fertiliser. Some 90% of current Bt cotton hybrids appear susceptible to sap-sucking insects, leaf-curl virus and leaf reddening, adding to input costs and loss of yield. Most telling is that India produces only 3.3 million tonnes from its irrigated area of 4.9 million hectares compared to 6.96 million tonnes from an equivalent area in China.

Hybrid Bt cotton in India has resulted in a yield plateau, high production costs and low productivity that reduce farmer revenues, correlated with increased farmer distress and suicides. It has stymied the development of economically viable high-density short-season (HD-SS) Non-Bt high-yielding straight-line varieties. The failure of hybrid Bt cotton is an abject lesson for GMO implementation in other crops.

Yet, the regulators attempted to repeat history in the form of hybrid Bt brinjal and Hybrid HT Mustard.

Field trial solutions (CICR data) of high-density short-season (HD-SS) NON-GMO pure-line (non-hybrid), rainfed cotton varieties have been developed in India that could more than double yield and nearly triple net income.

The Central Government admitted in its affidavit in the Delhi High Court (22 Jan 2016), adding, (on 23 January 2017), that Bt “cotton seeds are now unaffordable to farmers due to high royalties charged by MMBL (Mahyco Monsanto Biotech Ltd) which has a near monopoly on Bt cotton seeds and that this has led to a market failure”.

Moreover, there is no trait for yield enhancement in the Bt technology. Any intrinsic yield increase is properly attributable to its hybridisation in both Bt cotton and Bt brinjal. Lower insecticide use is the reason for introducing the Bt technology worldwide.

The pink bollworm has developed high levels of resistance against Bollgard-II Bt cotton, leading to increased insecticide usage in India, increases in new induced secondary pests and crop failures. The annual report 2015-16 of the ICAT-CICR confirms that Bt cotton is no longer effective for bollworm control

Insecticide usage on cotton in 2002 was 0.88 kg per hectare, which increased to 0.97 kg per hectare in 2013 (Srivastav and Kolady 2016).

Matters were deliberately muddied in India, leading to any hybrid vigour being attributed to the Bt technology! Yields have stagnated despite the deployment of all available latest technologies, including the introduction of new potent GM technologies, a two-fold increase in the use of fertilisers and increased insecticide use and irrigation. And yet, India’s global rank is 30-32nd in terms of yield.

In 13 years, the cost of cultivation increased 302%. In 15 years, there was 450% increase in labour costs. The costs of hybrid seed, insecticide and fertiliser increased more than 250 to 300%.

Net profit for farmers was Rs. 5971/ha in 2003 (pre-Bt) but plummeted to net losses of Rs. 6286 in 2015 (Dr Kranthi): see [this](#).

Regulatory Failure: Bt Brinjal

Regulators tried to commercialise Bt brinjal and in hybrids in 2009. The Bt gene is proven to be undeniably toxic (Profs. Schubert of the Salk Institute; Pusztai, Seralini and others have confirmed this).

In August 2008, the regulators were forced to publish the Developers’ (Monsanto-Mahyco) self-assessed bio-safety dossier on their website, 16 months after the order of the SC to make the safety dossier data public (15 Feb 2007).

Bt brinjal was the first vegetable food crop in the world to be approved for commercialisation, by the collective regulatory body and their expert committees, virtually without oversight. When the international scientific community examined the raw data, their collective comments were scathing. Prof Jack Heinemann stated that Mahyco has failed at the first, elementary step of the safety study: “I have never seen less professionalism in the

presentation and quality assurance of molecular data than in this study”.

He criticised Mahyco for using outdated studies, testing to below acceptable standards and inappropriate and invalid test methods.

Prof David Andow, in his comprehensive critique of Monsanto’s Dossier, ‘Bt brinjal Event EE1’, listed 37 studies of which perhaps one had been conducted and reported to a satisfactory level by Monsanto. He concluded: “The GEAC set too narrow a scope for environmental risk assessment (ERA) of hybrid Bt brinjal, and it is because of this overly narrow scope that the EC-II is not an adequate ERA... most of the possible environmental risks of Bt brinjal have not been adequately evaluated; this includes risks to local varieties of brinjal and wild relatives, risks to biological diversity, and risk of resistance evolution in BFSB.”

The Central Government itself declared an unconditional and indefinite moratorium on Bt brinjal in Feb 2009 based on the collective responses of the scientific community.

Disaster in the Making: GM Hybrid HT Mustard

Like Bt, HT is a pesticidal crop (to kill weeds). These two GMO technologies represent about 98% of crops planted worldwide, with HT crops accounting for more than 80%. Neither has a trait for yield. In its 2002 Report, the United States Department for Agriculture stated: *“currently available GM crops do not increase the yield potential... In fact, yield may even decrease if the **varieties** used to carry the herbicide tolerant or insect-resistant genes are not the highest yielding cultivars... Perhaps the biggest issue raised by these results is how to explain the rapid adoption of GE crops when farm financial impacts appear to be mixed or even negative.”*

The developer’s (Centre for Genetic Manipulation of Crop Plants University of Delhi) bio-safety dossier, in contempt of the SC orders, has never made its data public. A Right to Information (RTI) request was filed in 2016 with the Directorate of Rape-Seed Mustard Research, which conducts protocols of non-GMO mustard trials for crop improvement programmes for our farmers, for varietal stability and performance. The RTI was an eye opener. Virtually all the directorate’s norms were flouted in the field trials, making them invalid. Hybrid mustard HT DMH 11 was out yielded by more than the 10% norm by non-GMO varieties and hybrids, which forced the developers to admit this fact in their formal reply affidavit in the SC.

Hybrid HT mustard DMH 11 employs three transgenes: the male sterility gene, barnase, the female restorer gene, barstar, and the bar gene that confers tolerance to Bayer’s herbicide glufosinate ammonium or BASTA. Each of the parent lines has the bar gene that makes them both HT crops along with their resulting hybrid DMH 11. The reason for employing barnase and barstar is because mustard is a closed pollinating crop (even though it out crosses pretty well, 18%+) and this technology (a male sterility technology) makes it easier to produce mustard hybrids. It is not a hybrid technology. Its counterpart in non-GMO male sterility technology is the CMS system (cytoplasmic male sterility). Employing male sterility in mustard allows it to be used more easily in already existing hybridisation technology.

It is curious the extent to which the regulators have tried to obfuscate the facts and muddy the waters. Their first response was that the acronym HT in mustard DMH 11 means ‘hybrid technology’. When this didn’t work, the next ‘try’ was that DMH 11 isn’t an HT crop!

This too was easily proved wrong because of the presence of the bar gene. Now, this fact has been admitted.

Furthermore, the regulators have failed either intentionally, or because they are simply unable to stop, illegal HT cotton being grown on a commercial scale for the last 15 years or so. This is the state of GMO regulation in India.

Bayer's own data sheet states that glufosinate causes birth defects and is damaging to most plants that it comes into contact with. Like its counterpart, glyphosate, it is a systemic, broad spectrum, non-selective herbicide (it kills indiscriminately soil organisms, beneficial insects etc) and is damaging to most plants and aquatic life. The US Environmental Protection Agency classifies glufosinate ammonium as "persistent" and "mobile" and is "expected to adversely affect non-target terrestrial plant species".

Glufosinate is not permitted in crop plants in India, under the Insecticide Act. Since it is very persistent in the environment, it will certainly contaminate water supplies in addition to food. Surfactants are used to get the active ingredients into the plant, which is engineered to withstand the herbicide, so it doesn't die when sprayed. The herbicide and surfactant are sprayed directly on the crops and significant quantities are then taken up into the plant. The weeds die — or used to!

The US Geological survey noted that while 20 million pounds/year of glyphosate was used prior to GE crops (1992), 280 million pounds/year was used in 2012, largely as a result of glyphosate-resistant crops. In the U.S. alone, glyphosate-resistant weeds were estimated to occupy an area of over 24 million hectares as of 2012. This is a failed and unsustainable technology anywhere, and for India it will be disastrous.

The stated objective by the regulators themselves for HT mustard is that the two HT parent lines (barnase and barstar each with the bar gene), will be similarly employed in India's best (non-GMO) varieties to create new crosses resulting in any number of HT hybrid mustard DMH crops. Thus, Indian mustard varieties (non-GMO) in a very short time will be contaminated and Indian mustard agriculture (which is non-GMO) destroyed.

The regulators claim that GMO HT hybrid DMH 11 will create a significant dent in India's oilseeds imports. Given that GMO mustard has no gene for yield enhancement, is significantly out yielded by non-GMO mustard hybrids and varieties, this is indeed a magic bean produced from thin air by the regulators, defying all logic and commonsense. Mustard Oil imports are virtually zero (ie rapeseed mustard as distinct from canola rape oil which is also illegal GMO).

The story of the current steep decline in oilseeds production in Indian farming must be laid at the door of a wrong policy decision that comprehensively ignored national and farmers' interest to severely slash import duties on oilseeds of around 300% to virtually zero. In 1993-94, India imported just 3% of our oil-seed demand; we were self-sufficient. Then we happily bowed to WTO pressure and now import almost 70% of our demand in edible oils! (Devinder Sharma). This is the real reason for our heavy import bill.

The TEC recommend a double bar on GM Mustard — for being an HT crop and also in a centre of mustard diversification and/or origin. It is hoped that our government will recognise the dangers of GMOs, bar HT crops, including GM mustard, and impose a moratorium on all Bt crops.

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Aruna Rodrigues is the Lead Petitioner in the GMO PIL filed in 2005 for a moratorium on GM crops.

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