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The Chairperson & Members of the Standing  
Committee for Science & Technology, Environment & Forests,  
C/O Director, Rajya Sabha Secretariat,  
Room No. 005, Ground Floor, Parliament House Annexe,  
New Delhi 110001.

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***To: The Honourable Chairman and Members of the PSC***

I hereby submit Salim Ali Foundation's comments on the BRAI Bill 2013

The Bill is only an attempt of the Government to push the GM crops and foods to an unwilling nation. After examining the performance of GM crops in India and elsewhere, and the various studies conducted on it and published in journals of repute, we came to the conclusion that GM crops and food are not going to bring any good to our country. On the contrary, it would be disastrous to the biodiversity and ecology, apart from the adverse impacts on human and animal health, economic loss to the farmers, loss of the right of the farmers on seeds and the subsequent loss of India's food sovereignty. It is to be noted that once the GM plant is introduced in the open field, the impact of it on the biodiversity, ecosystem and environment can never be rectified; they are irrevocable.

Therefore, The Salim Ali Foundation urges the PAC to exclude GM crops and foods from the BRAI bill (as they are impregnate with dangers and of no use to the country) and make the BRAI Bill for regulating other applications of biotechnology, such as in the field of medicine.

We also request the PSC to give an opportunity to the Salim Ali Foundation to appear before the PAC and to be heard personally.

With respect and regards

Dr. V. S. Vijayan  
Chairman Salim Ali Foundation  
Formerly:  
Chairman, Kerala State Biodiversity Board  
Founder Director, Salim Ali Centre for Ornithology and Natural History  
(a centre of excellence of the MoEF)

## Submission made to the Standing Committee of Science and Technology on BRAI 2013 Bill

Dr. V. S.Vijayan  
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We greatly appreciate the Chairman and other members of the Standing Committee for giving an extension for submission of comments on the proposed BRAI (Biotechnology Regulatory Authority of India) Bill 2013.

In effect, BRAI 2013 is not much different from BRAI 2011. However, more than the various unacceptable provisions in the Bill which the Standing Committee is likely to suggest dropping or amending, what is awesome is that at the end, the dreaded GM crops and food will be regularised in our country. Therefore, in our opinion the Standing Committee should ensure that GM crops and foods are excluded from the purview of the BRAI Bill, and recommend to the Indian Parliament that India should be free of GM crops and foods.

1. The reason for the same, in the first place, is that the country does not require GM crops, secondly it is too risky to our traditional varieties, biodiversity, health of human beings and animals, economy of the farmers and, above all, it totally takes away the right of farmers on seeds and eventually would lead to the loss of the very food sovereignty of this country. We substantiate each of these in the following sections.
2. In the preamble to Bill itself, it is admitted by the Govt. of India that the introduction of Living Modified Organisms is risky to the health of the people, biodiversity and environment. It is clear from the following statements in the preamble:

“AND WHEREAS the aforesaid Convention {Convention on Biodiversity} and the Protocol {Cartegenea Protocol on Biosafety} provide that each Contracting Party {which India is } shall, as far as possible and as appropriate, establish or maintain means to regulate, manage or control the *risks associated with the use and release of living modified organisms resulting from modern biotechnology*;

AND WHEREAS the Protocol provides that the Parties to the Protocol shall ensure that the development, handling, transport, use, transfer and release of any living modified organisms are undertaken in a manner that *prevents or reduces the risks to biological diversity, taking also into account the risks involved to human health*”

- 1) Therefore, having accepted the risks involved, the most important aspect of the bill is to regulate, prevent or reduce the risks to biological diversity, human health and environment while introducing LMOs. Hence, as per the Bill, field trials have to be done to assess the risks involved before the release of the particular GM crop.
- 2) With my 45 years of experience in ecology and field ornithology, and being fortunate enough to be trained by none other than Dr. Salim Ali, I can very confidently say that such

an assessment will not bring out a scientifically convincing result, because of the following practical difficulties.

- i. To study the various pollinators and assess the distance that they fly in various climatic conditions including at various wind speed; if it is mainly a wind pollinator, the speed and direction of the wind in varying environmental factors; the influence of other pollinators on a particular pollinator in varying environmental conditions;
  - ii. The various insects, spiders, birds and other organisms which in natural conditions visit the particular plant species in different times of the day in various microclimatic conditions,
  - iii. The time each of them spend on the plant under study;
  - iv. The activities of each of them on the plant: to feed on caterpillar, insect, spider, or for nectar, fruit;
  - v. The effect of genetically modified plant's nectar on the pollinator, the effect of feeding on the caterpillar, insects, spider found on the GM plant or its fruit on the predator species;
  - vi. The long-term effect of the same on the life and population of the particular species, which include reproductive success, genetic impact, if any, in the present and at least five generations;
  - vii. Whether the roots of the GM plant produce any exudes, if so its chemical composition, presence or absence of any GM gene, the impact of the exudes on the microbial community around the root, the distance up to which the impacts exist at varying ecological and environmental conditions;
  - viii. Whether such soil with genetically contaminated exudes flows into any river or water bodies during rain; if so its impacts on the aquatic ecosystem and biodiversity
  - ix. The impact of feeding on GM plant's leaves and other parts on the grazing animals,
  - x. Whether the GM plants' leaves and other parts are driven to the neighbouring water bodies during rain, especially after harvesting. If so the impact of the same on the aquatic ecosystem and biodiversity.
- 3) I do not think any one of these could be done in the glasshouse condition. Therefore, the question of the possibility to replicate the conditions for testing under different agro ecological regions and seasons in glasshouses, though desirable, does not arise.

- 4) Open field tests would be disastrous to the biodiversity and ecology, unless tests are conducted in the glasshouse conditions which are impossible. Without such precise studies, if we go ahead with releasing GM crop, the country is taking a huge risk, an irrevocable risk. It is to be noted that once the GM plant is introduced in the open field, the impact of it on the biodiversity, ecosystem and environment can never be rectified. It would be irrevocable.
- 5) The most pertinent question now to be answered is since the Government of India, the Supreme Court and the scientists working in the field are convinced beyond doubt that the GM crop would become injurious to our biodiversity, environment and health unless bio-safety regulations are strictly followed, why should India adopt such a dangerous technology in the field of agriculture, especially when there are no proven benefits to the farmers?
- 6) The first often repeated explanation by the GM lobby is that Genetic Modification is the only solution for hunger. It may be noted that Genetic Modification is not done to increase productivity; it is only to control attack of a pest, that too only a particular one. When insect control is the only objective of the introduction of GM, the question is whether there are no alternatives to GM. Why not go in for organic cultivation which has been shown more profitable to the farmers and is also environment friendly.
- 7) The studies have shown that GM fails to control Bollworm in Bt cotton, as the Bollworm develops resistance. Moreover, sucking pests like mealy bugs have increased and as such the pesticide usage has not reduced significantly; GM is not at all economical to the farmers; GM plants genetically contaminates the native varieties leading to loss of biodiversity; GM generates health problems; GM food experiments have not only shown any convincing positive results, but have produced massive amount of data on the negative impacts ; and, adopting cultivation of GM plants would lead inevitably to surrendering the right on seeds and the food sovereignty of the nation to multinational corporate bodies.
- 8) ***If GM ensures high production and solves hunger in the world, why is it that it confines only to 28 nations in the world and, that too in five countries in a substantial way? Why is it being rejected even by some of the African countries where food scarcity is so acute?***

We have a few top level reports; all of them recommending moratorium or further studies on GM crops.

- 9) The UN Agriculture Assessment (also known as IAASTD – International Assessment of Agricultural Science and Technology for Development) sponsored by the World Bank in partnership with the UN Food and Agriculture Organisation, the UN Environment Programme, the UN Development Programme, the World Health Organisation, governments, civil society, private sector and scientific institutions [<http://www.agassessment.org>], altogether consisting of 400 agricultural scientists from various countries, says that ***“such techniques as genetic engineering are no solution for soaring food prices, hunger and poverty.”*** It further says that “there is the urgent need to move away from destructive and chemical-dependent industrial agriculture and to adopt environmental modern farming methods that champion biodiversity and benefit local communities.” The Learned opinion of 400 eminent scientists across the

world, including India, should certainly prevail over the commercial interests of multinational corporate bodies.

- 10) **The UN Special Rapporteur, Olivier de Schutter in his reports** “Agro-ecology and the Right to Food”, presented at the 16th Session of the United Nations Human Rights Council [A/HRC/16/49] and "Seed policies and the right to food: enhancing agro-biodiversity and encouraging innovation" presented to the UN General Assembly (64th session) (UN doc. A/64/170) states that ***“States should implement public policies supporting the adoption of agro-ecological practices by “making reference to agro-ecology and sustainable agriculture in national strategies...”***
- 11) **IUCN**, the largest conservation body in the world, at its World Congress in 2004 at Bangkok ***asked for a moratorium on further release of GM organisms*** until such time that they can be demonstrated, beyond any reasonable doubt, to be safe for biodiversity, human health, and animal health
- 12) **The Parliamentary Standing Committee (PSC) on Agriculture**, consisting of people’s representatives from all major political parties, in August 2012, said in no uncertain terms that ***field trials of GM crops under any garb should be discontinued forthwith.***
- 13) The **Supreme Court’s Technical Expert Committee (TEC)**, consisting of hard core scientists, recommends in its final report in July 2013 that there should be ***an indefinite stoppage of all open field trials, environmental release, of GM crops***
- 14) The report of **Shri. Jairam Remesh**, the then Minister of MoEF, prepared after an unprecedented consultation with public in eight regions, attended to by around 8000 people, and after consulting top ranking scientists of the world working in the area, and being convinced of the irrevocable damage of the GM crops, ***declared a moratorium on introducing Bt brinjal*** in the country. And that too, over the clearance of the GEAC (Genetic Engineering Approval Committee) of his own Ministry!
- 15) **Dr. M. S Swaminathan** in his Biotechnology Task Force Report of 2004, realising the adverse effects of GM crops, recommended that ***biodiversity hot-spots like the Western Ghats*** should be kept free of GM crops. The Task Force further recommended that other ***agro-biodiversity rich regions in the country should also be kept GM free.***
- 16) On December 2011, **10 prominent retired Chief Justices of the High Courts and Justices of the Supreme Court** sent a joint statement of concern to the Prime Minister ***opposing the introduction of the BRAI Bill.***
- 17) In the light of the above facts, and the scientific facts provided by international scientists of repute and, in the absence of convincing evidences to support the positive arguments put forward by the multinational corporate bodies, the resolution of the IUCN passed at its meeting in 2004 for a ban on GM crops and foods, and the continuing dispute over the issue, it

is only prudent to declare a moratorium on GM crops and foods till we could learn from the experiences of the countries which have adopted the GM crops in a large scale.

- 18) It is therefore requested that GM crops and foods must be excluded from the BRAI bill 2013, as these are not required for and dangerous to the country. The BRAI bill 2013 should be confined only to regulate the application of Biotechnology in other areas such as medicine. Even then, the provisions of the proposed Act must be drastically altered at least in the following major areas.
- 19) **Centralisation of decision making power:** The entire decision making power is vested on the 3 + 2 (3 full time and two part time members). It will decide the destiny of India's agriculture and biodiversity! Further, there is little doubt that all these members will be biotechnologists. The Inter Ministerial Governing Board, ultimately, is only to coordinate with the line departments (in other words to ensure that no departments would stand against any of the activities of the Authority) and, the Biotechnology Advisory Council is meant only to advise the Authority. And, the advice is only advice and not binding. State Biotechnology Regulatory Advisory Committee also appeared to be envisaged only to ensure that there will not be any hurdles from the States to execute the programmes of the BRAI. Therefore, there is no mechanism to control the Authority. There is absolutely no justification for such a centralized decision making system when the issue is concerned with 70% of India's population who are one way or the other related to farming and, especially when 72<sup>nd</sup> and 74<sup>th</sup> Amendments of India's Constitution enshrines devolution of power.
- 20) **Nullifying the Right to Information Act (Section 29):** As per this, "confidential commercial information shall not be given even under the Right to Information Act" and, the Authority will decide to give "If the public interest outweighs the disclosure, and if such disclosure shall not harm any person". That means, if such a disclosure will not affect the commercial interest of the company, only then will the Authority disclose the information. *This points to a larger issue whether the BRAI is for the Company or for the people of this country.* The honourable Members of the Parliament in the PSC must address this crucial issue.
- 21) **Complete lack of accountability: Section 79** intends only to ensure Immunity to the Central Government, BRAI and all officers of the BRAI when it stipulates *that "No suit, prosecution or other legal proceedings against Central Govt. or any officers of the BRAI, provided anything is done with good faith or intended to be done in good faith."* Will any officer say that he has done anything without good faith? It only means that officers responsible for implementing the GM crops will not be liable for punishment, when the negative impacts of GM crops show up. This may be alright when the negative impacts are not known. In the present case, there is a massive amount of data showing the worst impacts on human and animal health, biodiversity, environment, ecology and economic loss to the farmers. And knowing the disaster fully well it is being tried to implement with the protection of law. *Can this be allowed by the people's representatives (PSC)?*

22) **Section 69 (1) and (2)**, given in parenthesis below, try to save the senior officers of the company committed the offence, and instead try to punish the lower level officers. *Is it not a gross Violation of Article 14 of the Constitution where equality before law is enshrined?*

23) (“If the offender is Head of the Department of a Government organisation and, if he proves that the offence was committed without his knowledge or that he exercised due diligence to prevent the commission of such offence, he will not be liable for any punishment. If the offender is other than the Head of the Department, he shall be liable to be prosecuted”).

24) **Section (67)1** gives an opportunity to the offender to prove innocence that the act of offence was committed without his knowledge and that he has exercised all due diligence to prevent the commission of such offence, while **(67)2** stipulates that even if he proves innocence, if it is proved that the offence has been committed with the consent or connivance of, or is attributed to any neglect on the part of any Director/Manager/Secretary, such Director /Manager/Secretary shall be deemed to be guilty, and shall be liable for punishment. For the application of (67) 2, an inquiry has to be conducted. The reliability of this depends on who will conduct the inquiry. If it is to be done by the BRAI, the judgment will certainly go in favour of the offender who has proved his innocence. One cannot consider it the other way, because, the BRAI is only for

introducing the GM crops and foods in the country.

25) **Prohibiting the opportunities for democratic protests: Section 67** could be used against even peaceful demonstration against GM crops. It reads as “If a person, without reasonable excuse, resists, obstructs, or attempt to obstruct, impersonate, threaten or assault an officer of the Authority, he shall be imprisoned for 3 months and also fined up to Rs. 5 lakhs”. What is happening in the country is that, peaceful protests are converted to violence by ‘sponsored’ miscreants.

26) **Denies legal remedies to citizen assured by the Constitution 61 (1):** Appeal against final orders of the Appellant Tribunal in the Supreme Court shall be filed on the grounds specified in section 100 of Code of Civil Procedure, 1908 which specifies that Supreme Court can be approached “only on substantial questions on law”. In the present case, the law is the one (BRAI 2013) that is being tried to be passed. *Does it not deny the legal remedies to the citizen and also limit the Supreme Court’s powers?*

27) **Impinging on the powers of the State: Section 81** says “Provisions of this Act shall have effect, not withstanding anything inconsistent therewith contained in any other law for the time being in force or any instrument having effect by virtue of any law other than this Act”

28) **Section 87 (2).** “if there is any law for the time being in force in any State corresponding to this Act, the same shall upon commencement of this Act, stand repealed and in such cases,

*provision 6 of the General clauses Act 1897 shall apply as if such provisions of the State law has been repealed”*

- 29) Agriculture is a State subject as per the constitution of India. The BRAI 2003 will shake the very edifice of the federalism of the nation.
- 30) Apart from these, some of the other provisions that should be included in BRAI 2013 (for application other than GM crop and foods): provisions for long term risk assessment, bringing BRAI under a Ministry other than the Ministry of Science and technology, since they are interested only in the promotion of technology (conflict of interest is just natural) .
- 31) A detailed note explaining why there should be ban on GM and the BRAI 2013 should exclude GM crop and foods is annexed on page 9 below.

## **Annexure**

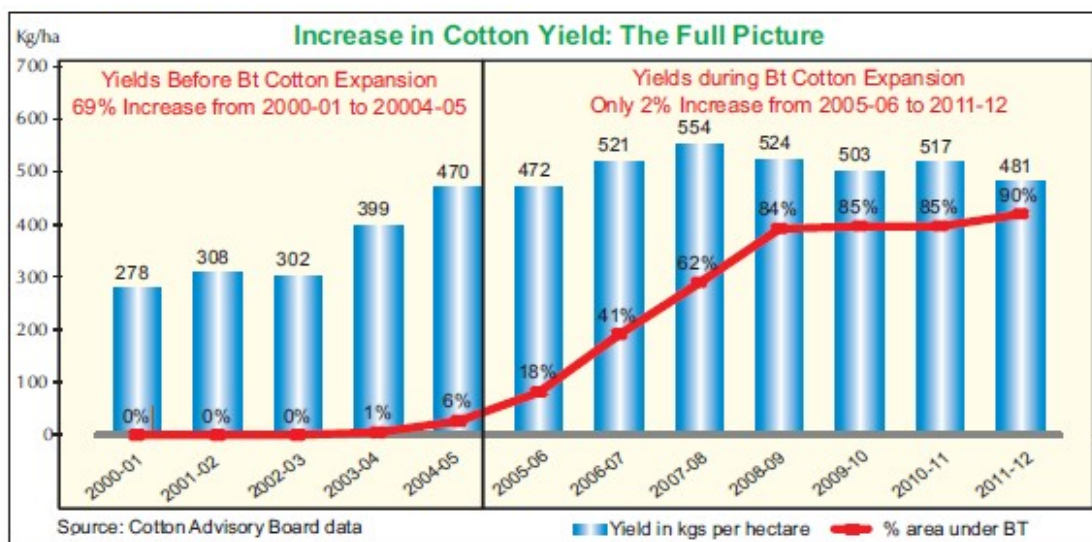
### **Why PAC should exclude GM crops and foods from BRAI Bill 2013**



- GM (Genetic Modification) is not a solution for hunger** as genetic modification is not done to increase productivity. It is done only to control attack of a pest, that too only a particular one. (For other pests farmers have to use pesticides). India has traditional time-tested organic methods to control insect pests that do not affect the biodiversity, ecology, health and environment

### I. GM does not increase productivity

- There are no convincing evidences to show that GM increases productivity in a significant way. According to Cotton Corporation of India, the yield was 470 kg/ha when the Bt cotton cultivated was only in 6% of the total (87 lakh ha) area of cotton during 2004 - 2005, while it was only 481 kg/ha when the area was extended to 95% of cotton cultivation (111.42 lakh ha) during 2011 -2012 (Cotton Corporation of India, State-wise Area, Production, Yield. <http://cotcorp.gov.in/state-operations.aspx>). It must be noted that during 1998 – 1999, prior to the introduction of Bt, the productivity of cotton was 502 kg/ha in Gujarat <http://www.expresstextile.com/20020711/edit2.shtml>).



- The findings of the CICR (Central Institute of Cotton Research) after an assessment of 10 years of *Bt* performance also show the same. “The main issue that worries stakeholders is the stagnation of productivity at an average of 500 kg lint per ha for the past seven years. The gains have been stagnant and unaffected by the increase in area of Bt cotton from 5.6% in 2004 to 85% in 2010. The yield was 463 kg per hectare when the Bt cotton area was 5.6% in 2004 and reached a mere 506 kg per hectare when the area under Bt cotton increased to 9.4 M hectares at 85% of the total 11.1 M hectares.” (Kranthi. K. 2011. Part-3: 10 year of Bt in India). <http://cotton247.com/news/ci/?storyid=2159>
- It may also be noted that the highest production during the *Bt* saga in India was 560 kg/ha when the Bt area was 60% of the total cotton area in 2006 and it started declining since then to 506 kg/ha when the Bt area increased to 85% in 2010 (Kranthi. K. 2011. Part-3: 10 year of Bt in India). <http://cotton247.com/news/ci/?storyid=2159>.
- Gujarat Government itself made it clear that *marginal increase in the yield is not solely due to Bt*: Increase in the production of cotton in Gujarat, from just 175 kg/ha in 2002 – 2003 to almost 460 kg/ha in 2004 – 2005, according to a letter to the Chairperson of the GEAC of the Gujarat Government, may not be solely due to *Bt* cotton, as Gujarat has recorded 450 kg/ha during 1998 – 1999 even when there

was no *Bt* cotton. The Government's official monitoring of the performance of the GM cotton shows that the increased productivity was because of the increased irrigation facility by massive water harvesting programmes, good monsoon, use of drip, low pest pressure among other similar factors. Because of this very factor, inclusion of Gujarat's data to the country's total production would give a distorted picture.

6. Further, an analysis of the data of the Cotton Advisory Board makes the abundant role of irrigation in production of cotton. The 'Irrigated Area' under cotton in Gujarat during 1975-76 was 21.6 per cent, while it was 36.2 per cent in 2000-01. Accordingly there has been an increase in the production; from 16.77 lakh bales in 1975 – 76 to 33.00 lakh bales in 2001-2002 (*A K Chowdhury, Cotton Advisory Board: Cotton cultivation scenario in Gujarat – I, 2002*) (<http://www.expresstextile.com/20020711/edit2.shtml>). Again, it is reported that six to seven lakh ha of groundnut area was converted for cotton which was irrigated by 1, 00,000 new check dams (*Kranthi.K.2011. Part-11: 10 year of Bt in India*). <http://cotton247.com/news/ci/?storyid=2159> .

Table 1: State –wise area, production and productivity of cotton  
Area in Lakh ha; production in bales of 170 kg; yield in kg/ha

Year	2004-05			2009-10			Yield loss/gain
	Area	Prod	Yield	Area	Prod	Yield	
Punjab	5.09	16.50	551	5.11	14.25	474	- 77
Haryana	6.21	16.50	452	5.07	14.75	495	+ 43
Rajasthan	4.38	10.00	388	4.44	11.00	421	+ 33
<b>North total</b>	<b>15.68</b>	<b>43.00</b>	<b>466</b>	<b>14.62</b>	<b>40.00</b>	<b>465</b>	- 1
Gujarat	19.06	73.00	651	26.25	98.00	635	- 14
Maharashtra	28.40	52.00	311	35.03	63.00	306	- 5
Madhya Pradesh	5.76	16.00	472	6.11	15.00	417	- 55
<b>Central total</b>	<b>53.22</b>	<b>141.00</b>	<b>450</b>	<b>67.39</b>	<b>176.00</b>	<b>444</b>	- 14
Andhra Pradesh	11.78	33.00	476	14.75	52.00	599	+ 123
Karnataka	5.21	8.00	261	4.55	9.00	336	+ 75
Tamil Nadu	1.29	5.00	659	1.04	5.00	817	+ 158
<b>South Total</b>	<b>18.28</b>	<b>46.00</b>	<b>428</b>	<b>20.34</b>	<b>66.00</b>	<b>552</b>	+ 124
Orissa	0.68	1.00	250	0.54	1.00	315	+ 65
Others				0.21	1.00		
<b>Total</b>	-	<b>231.00</b>	-	-	<b>293.00</b>	-	
Loose Cotton	-	12.00	-	-	12.00	-	
<b>Grand Total</b>	<b>87.86</b>	<b>243.00</b>	<b>470</b>	<b>103.10</b>	<b>305.00</b>	<b>503</b>	

Source: Cotton Corporation of India Ltd.: State wise distribution of area, production and productivity of Cotton

7. In Gujarat, the average productivity in irrigated area was 689 lint kg/ha whereas that in un-irrigated was a mere 247 kg/ha. The state's cotton production was 84% from the 65% irrigated cotton area and 16% from the 35 % un-irrigated area (*Kumar.V 2011. Navsari Agricultural University, Gujarat. Bt Cotton : A Gujarat experience & issues*)

8. Comparison of productivity data between 2004 – 2005 and 2009 –2010 when the *Bt* was cultivated in 6% and 85% respectively of the total cotton area shows that in Punjab, Gujarat, Maharashtra and Madhya Pradesh there was a loss in yield in various degrees, but in the other cotton grown states, namely Haryana, Rajasthan, Andhra Pradesh, Karnataka, Tamil Nadu and Orissa an increase was noted (Table 1).
9. The reasons for both the yield loss and gain have to be thoroughly analysed taking into consideration of the various ecological factors and management such as increased irrigation facilities, additional land brought under cotton, the soil types, total quantum and the pattern of rainfall, the number of rainy days, temperature, the kind of hybrid cotton used, and the type and quantity of pesticides used. Attributing increased production, although only marginal, entirely to *Bt* is unscientific and hence unacceptable. One could claim so, if the *BT* cotton was cultivated in the glasshouse with all other parameters the same.
10. **Specific loss also has been reported:** An average yield loss of about 1.75 quintals per acre (for 16,632 acres) was reported in Warangal district during 2004 – 05 by a special team constituted by the Government of AP to evaluate the performance of the *Bt* cotton. The Government ordered the *Bt* Company to give compensation of Rs. 3.3 crores to the affected farmers.
11. The Maharashtra Government is seriously considering switching over from genetically modified (GM) cotton to more conventional cotton seeds. A plan to phase out and look for alternatives of *Bacillus thuringiensis* (*Bt*) cotton is being chalked out by leading state agricultural universities with the help of private companies. (*Review Bt cotton, orders State Govt (TNN | Jul 21, 2012, 03.08AM IST)*). Further the State Government officials assert that since 2005, *Bt* is causing "crop failure", resulting in a loss of Rs 2,000 crores annually.
12. **Figures on yield of *Bt* is often blown up for obvious reasons:** A study during 2003 – 2004 in Andhra Pradesh on the performance of *Bt* cotton, undertaken separately by a market research firm, namely A. C. Nielson commissioned by Monsanto-Mahyco and, agricultural scientists of Andhra Pradesh Coalition in Defence of Diversity (APCIDD) shows this highly exaggerated claim (Table 2).

Table 2. Comparative study of *Bt* and non- *Bt*

State	Bollworm Reduction reported with <i>Bt</i> Cotton	Pesticide Usage reduction with <i>Bt</i> Cotton, compared to non- <i>Bt</i>	Yield Increase of <i>Bt</i> cotton over non- <i>Bt</i> Cotton		Increase in Net Profit – of <i>Bt</i> Cotton over non- <i>Bt</i> Cotton/acre	
	per cent	Rs	per cent	Quintals/ Acre	per cent	Rs/Acre
AP: Monsanto Study	58	1856/-	24	1.98	92	5138/-

AP: APCIDD Study	14	321/-	2	0.09	(-) 9	(-) 750/-
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Reports from other countries also show that GM does not increase productivity. For instance, in the USA, a study conducted by the Union of Concerned Scientists in 2009 on the crop yield for 13 years shows that there has been no increase either in the herbicide tolerant corn or soybeans. Only an operational yield increase of 3 to 4% was noticed in the *Bt* corn. Studies show that yield from conventional seeds are much higher with less input.

13. The European Environmental Agency in its recent report records that top down technologies like GM crops fail to address food security issues, whereas bottom-up agro-ecological approaches can do so ( David A. Quist, Jack A. Heinemann, Anne I. Myhr, Iulie Aslaksen & Silvio Funtowicz. “Late Lessons from Early Warnings”. Chapter 19, European Environmental Agency (EEA) Report. January, 2013).

### ii. GM does not reduce use of pesticides

14. **GM crops do require the application of much higher dosage of pesticides:** Contrary to the hype created while proposing the GM crops that it will not require any pesticides and thus is quite environment friendly, the data show the other way. Table 3 shows the quantum of pesticides used in the country.

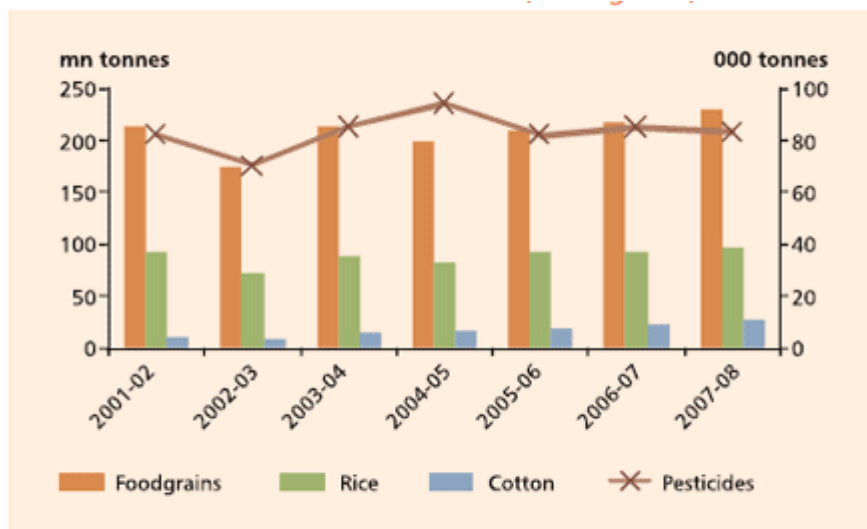
Table 3. Pesticide usage in Metric Tonnes technical grade

State	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10
Andhra Pradesh	1997	3394	1541	1381	1015
Gujarat	2700	2670	2660	2650	2750
Karnataka	1638	1362	1588	1675	1647
Maharashtra	3198	3193	3050	2400	4639
Punjab	5610	5975	6080	5760	5810
Haryana	4560	4600	4390	4288	4070
Madhya Pradesh	787	957	696	663	645
Rajasthan	1008	3567	3804	3333	3527
Total	45,341	49,682	51824	51,481	49,419

Source: Directorate of Plant Protection, Quarantine & Storage; July 2012  
(<http://ppqs.gov.in/Ipmpesticides.htm>)

15. There is no substantial decrease in the use of pesticides in the States where Cotton is being cultivated. On the other hand pesticide use in the 8 States where cotton is grown has increased to an average of 5000 MT from 2005 -2006 to 2009 – 2010 (Table 3).

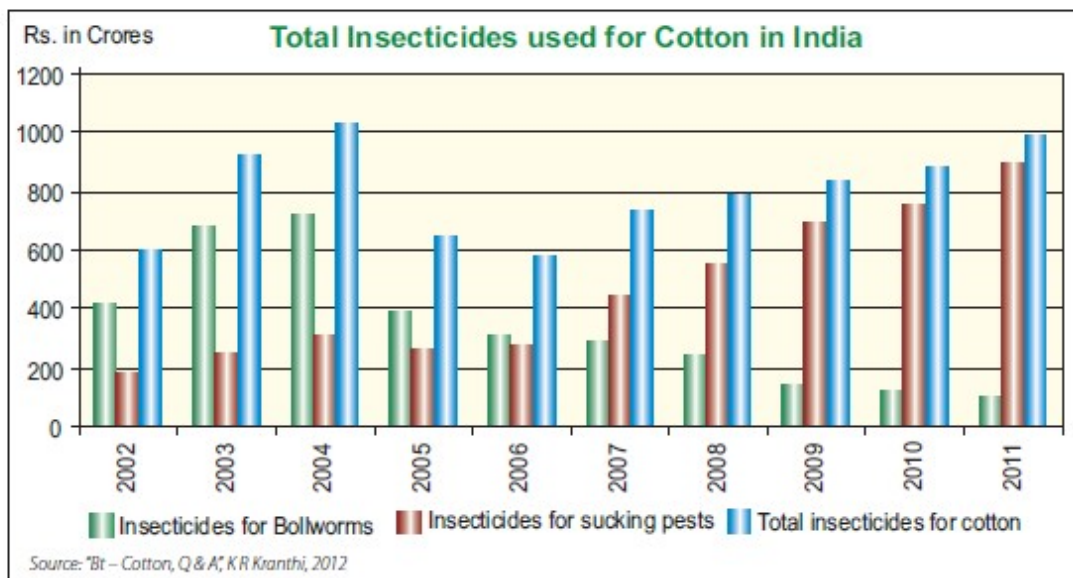
Again, the data from Ministry of Agriculture also show that there is hardly any decline in the total use of pesticides in the country from 2001 – 2002 to 2007 – 2008 (Fig 2)  
 Fig.2 Production trend, pesticides, foodgrains, rice and Cotton



Source: Ministry of Agriculture and Ministry of Chemicals & Petrochemicals (Annual Report Cotton production in million bales of 170 Kgs each)

16. The total quantum of insecticides used exclusively for cotton according to the Director, Cotton Research Centre, makes the picture clearer.

Fig.3 Status of total pesticide use in Cotton in India from 2002 - 2011



17. It may be noted that these figures do not convey a clear picture of the use of pesticides for any comparative study, as the strength of the pesticide is not the same. Low-volume pesticides require a very small quantity compared to the high volume. Therefore, the quantities shown in table 3 and Figure 1 above are misleading. It would have been quite high if they were of high volume pesticides.

### III. GM is not a viable, sustainable solution for pest control

18. **Bollworm becomes resistant to Bt:** It is widely known in pest management that pests would develop resistance to pesticides on continual use of the same brand. Bollworm is no exception. The evolutionary process could not be halted by the biotech giants. In a study of the Arizona University, published in 2008, reported for the first time the *Bt* resistant populations of Bollworm in more than a dozen crop fields in Mississippi and Arkansas between 2003 and 2006
19. Monsanto in early 2010 publicly admitted that the cotton pest -pink bollworm- has developed resistance to the Cry 1Ac toxin (*Bt*) in Bollgard I in Gujarat where *Bt* cotton was planted commercially for the first time (*Sharma, D. 2010. Bt cotton has failed, admits Monsanto (India Today, March 6, 2010) <http://indiatoday.intoday.in/site/Story/86939/India/Bt+cotton+has+failed+admits>*).
20. Resistance monitoring studies done at CICR have demonstrated that bollworm, *Helicoverpa armigera*, the target pest of cotton, has developed tolerance for it. Other studies have also shown bollworm surviving and reproducing in *Bt* cotton both single gene and double gene *Bt* (*M. T. Ranjith, A. Prabhuraj, & Y. B. Srinivasa. 2010. Survival and reproduction of natural populations of Helicoverpa armigera on Bt-cotton hybrids in Raichur, India. Current Science, 99, (11) 1602-1606*)

### (IV) Emergence of secondary pests

21. In his 2011 report Dr.Kranthi states: "Productivity in north India is likely to decline

because of the declining potential of hybrids; the emerging problem of leaf curl virus on the new susceptible Bt-hybrids; a high level of susceptibility to sucking pests (straight varieties were resistant); problems with nutrient deficiencies and physiological disorders; and mealy bugs, whiteflies and miscellaneous insect problems that are likely to increase.” (Kranthi. K. 2011. Part-3: 10 years of Bt in India). <http://www.cotton247.com/news/ci/?storyid=2171>). The use of pesticides used to control mealy bug as shown in Fig.3 corroborates this observation.

22. According to Dr.Kranthi, a mealy bug not observed in India before, has spread in the cotton regions and farmers have been spraying “extremely hazardous” pesticides to eliminate this hard-to-kill pest. The prolific spread of Bt cotton hybrids has created a conducive climate for the rapid spread of this pest (Mudur.G.S 2010. “Cotton lessons for Bt brinjal”. *The Telegraph*, February 16, 2010) [http://www.telegraphindia.com/1100216/jsp/nation/story\\_12110833.jsp](http://www.telegraphindia.com/1100216/jsp/nation/story_12110833.jsp)
23. Research Foundation for Science, Technology and Ecology reports that Monsanto’s Bt cotton not only failed to protect the plants from bollworm, but increased the attack of non-target pests such as jassids, aphids, whitefly and thrips to 250 -300 per cent.
24. Other pests like stem borer are also found on *Bt* cotton. In addition, occurrence of new diseases hitherto unknown to cotton crop, such as Tobacco Streak Virus and Bronze Wilt was also noted.
25. In China, Cornell University after a household survey, find that the quantum of pesticide use has not come down after seven years of commercial farming of *Bt* cotton. They use pesticide worth \$ 101/ha for both *Bt* and non-*Bt* cotton. Interestingly, the study further reveals that while *Bt* farmers saved 46 per cent on Bollworm pesticide, they had to spend 40 per cent more on pesticides designed to kill an emerging secondary pest. This offsets the savings made on account of the primary pest. China’s Nanjing Institute of Environmental Sciences concludes that if the *Bt* cotton was planted continuously, its resistance to bollworm will disappear within 10 years.
26. Since the GM crops failed to control the bollworm, the Australian farmers have been advised by the Transgenic and Insect Management Strategy Committee of the Australian Cotton Growers Research Association to spray additional insecticide on Monsanto’s *Bt* cotton.
27. In the USA, although the insecticide use decreased, herbicide use went up, according to study of the Washington State University. The overall increase in pesticide use was 404 million pounds from 1996 through 2011, due to GM crops (Charles Benbrook, Washington State University. “Impacts of genetically engineered crops on pesticide use in the U.S. – the first sixteen years”. *Environmental Sciences Europe journal*. 28 September, 2012)
28. The phenomenon of pesticide resistance is true for herbicide – tolerant crops also. The use of herbicide, namely Roundup Ready, the largest selling herbicide in the world and is owned by Monsanto, has always been on the increase. Weed resistance is reported



from more than 15 million acres in the USA. In a decade of herbicide use, 30 new herbicide resistant weeds have emerged. GM soy, corn, and cotton are reported to have an increase of 122-million pound pesticide use since 1996. ‘Super-weeds’ having acquired the herbicide tolerant gene have become real problem for the farmers.

29. Yet another disaster is that the left over seeds can germinate in subsequent years when different crops are grown in the same area. These “volunteer plant” would then contaminate the new crop. In some cases the volunteer plants develop resistance to more than one herbicide, reported up to three, and the farmer is forced to use stronger pesticides.
30. The irony is that four of the 10 top seed companies in the world trying to sell GM seeds are also world’s largest agro-chemical giants, namely Monsanto, Du Pont, Syngenta, and Bayer. Their commitment to solve world’s hunger and poverty is now clear!

**(V) *Bt requires more fertilizers***

31. Acharya N.G Ranga University, one of the few universities doing research on *Bt* and non-*Bt* cotton, found that *Bt* cotton requires 15% more fertilizers (*Agricultural Almanac, ANGRAU 2009*) and recommended the farmers accordingly.
32. Dr C D Mayee (ISAAA Board Member) and former Co-Chair of GEAC, reports that “If the area under advanced transgenic seeds increases to 10 per cent in a few years from the present level of 4 per cent, **the country’s fertilizer consumption will increase 107 per cent to 220 kg per hectare (ha)** from the current levels (the latest available figure 2005-06), at 106 kg per ha.” (*Jha, D. 2009. Transgenic seeds to push up fertiliser consumption. <http://www.business-standard.com/india/news/transgenic-seeds-to-pushfertiliser-consumption/00/12/350768/>*)
33. ***Bt depletes soil fertility:*** According to the study conducted by the CICR, repeated cultivation of *Bt* cotton hybrids leads to depletion of soil fertility as they draw more nutrients and water from the soil. The crop exhibits nutrient deficiency especially in rain-fed zones where wilt and leaf-reddening problems are also getting more severe over the years (*Kranthi, K. 2011. Part III- 10 year of Bt in India. <http://www.cotton247.com/news/ci/?storyid=2171>*)

**(VI) *High cost of production***

34. **Exorbitant Seed prices:** *Bt* cotton seeds in 2004 were priced between Rs 1650-1800 for 450 gm, as against Rs 350 for hybrid seeds and less than Rs 100 for desi cotton seeds. (Sainath.P, (2009). The largest wave of suicides in history. Counter-Punch, February 12, 2009. <http://www.counterpunch.org/2009/02/12/the-largest-wave-of-suicides-in-history/>) interestingly, when the seed prices were brought under control through the MRTP Act and Essential Commodities Act, Monsanto has taken the A.P. and Gujarat governments to Court to decontrol seed prices!



35. **Increasing expenditure on pesticides:** Dr. Kranthi reported to the MoEF, that with 90% of cotton area under Bt, resistance will develop sooner than later. There has been emergence of new sucking pests and pesticide expenditure has risen from Rs 597 crore in 2002 to Rs 791 crore in 2009”(*ibid*)
36. Bt cotton cultivation is more costly than organic cultivation of desi cotton; cost of production is about Rs. 8,800/ more for the former. Although the yield is slightly higher in *Bt*, by one quintal, net profit per hectare is more in organically produced cotton by Rs. 12,000/ha (an official evaluation of various cultivations by the Maharashtra Government Table 4).

Table 4: Comparison of various methods of cultivation and yield

	Traditional	IPM-based	Organic	Bt Cotton
Total cost of cultivation (in Rs.)	18,305	13,305	10,595	19,480
Yield per hectare in quintal	13	14	15	16
Gross income per hectare (in Rs.)	29,900	32,200	34,500 + 5700 (intercrop)	36,400
Net Profit per hectare (in Rs.)	11,595	18,895	29,605	17,320

37. Apart from these is the additional financial burden of royalty to be paid to Monsanto and its Indian licensees. The estimated royalty payment for Bt cotton alone is **Rs 1580 crores** (Rs 15,800 million) for 8 years, up to 2009- 2010 (*Latha Jishnu. “Battle royal over Bt cotton royalty”. Business Standard. May 28, 2010*)
38. It may be read with the farmer suicide incidents. During the same period, according to National Crime Records Bureau, as many as 1,35,756 farmers killed themselves and, for 16 years, from 1995 tragic number shot up to , 2,56,913, ‘the worst-ever recorded wave of suicides of this kind in human history’. (*P Sainath, “In 16 years farm suicides cross a quarter million”. The Hindu. 29 October, 2011*)

### (VII) GM crops are hazardous to health

39. There are indisputable evidences showing that GM food/crops are hazardous not only to human health but to animals and ecosystems
40. Most studies with GM foods indicate that they may cause hepatic, pancreatic, renal, and Reproductive effects and may alter haematological (blood), biochemical, and immunologic parameters, the significance of which remains to be solved with chronic toxicity studies.” (*Dona & IS Arvanitoyannis, “Health risks of genetically modified foods” Critical Reviews in Food Science and Nutrition, 2009*)
41. A two-year independent study, the first ever long-term study, on the toxicity of a Roundup herbicide and a Roundup tolerant genetically modified maize shows its link to premature death and cancer in rats (“*CRIIGEN Study Links GM Maize and Roundup to Premature Death and Cancer*”

*Sustainable Pulse*. 19 September, 2012. <http://sustainablepulse.com>; .. *CRIIGEN Press Release*.  
“Toxicity confirmed for a GMO and the pesticide Roundup”. 11 January, 2013)

42. The first genetically modified food that came to the market was a tomato, called “flavr savr” which was rejected even by rats! Those who ate them developed small lesions in their guts
43. GM maize fed rats had loss of weight and were less healthier than those fed with non-GM maize
44. Study at the Institute of Higher Nervous Activity and Neurophysiology of the Russian Academy of Sciences shows that 25 of the 45 (55.6 per cent) offspring of GM-soy fed rats died within three weeks, while the mortality of the non-GM fed offspring was 3 of the 33 (9 per cent). In addition, growth abnormalities were also found to be high in the GM soy fed rats. It indicates that pregnant women may endanger their unborn babies, if they eat GM food
45. Valvilov’s Agrarian University in Russia reports that GM soy (Monsanto’s herbicide –resistant Roundup Ready) fed mice showed histological changes in the liver, kidney and testes
46. A study in the University of Urbino showed damages to cells in the liver, pancreas and testes of young mice fed with GM soya
47. GM potato fed rats showed changes in the size and weight of the body organs; liver, heart and brain got smaller. Also the immune system of the rat got weakened.
48. In Australia, GM peas fed rats showed allergic reactions and lesions and hence, the team abandoned research on GM peas
49. Researchers in Nebraska in the USA found that soybean modified with the gene of Brazil nut, could induce fatal allergies in people sensitive to Brazil nuts.
50. Glyphosate from Monsanto’s herbicide (Roundup) when used on genetically engineered plants tolerant to it can eventually get into food chain. It is to be noted that Glyphosate reduces the functioning of human placental cells and blocks the synthesis of estrogens and disrupts hormonal balance.
51. L-Tryptophan, a staple dietary supplement sold in the market, when genetically modified killed 37 people within months of its introduction in the market. Further, 1535 people were permanently disabled with Eosinophilia Myalgia Syndrome.

52. The only human feeding trial on GM food was with GM soy and the results published in Nature Biotechnology shows that when GM soy products were eaten by man, the gene inserted into the soy was transferred to the bacteria in the intestine. This could lead to producing potentially allergenic proteins.
53. Britain's Food Standard Agency (FSA) reports that antibiotic resistance marker genes from GM foods can make their way into the bacteria of human intestine, just after one meal.
54. A study published in Applied and Environmental Microbiology in 1999 shows that human consumption of GM food resulted in transfer of antibiotic resistance gene present in the GM to bacteria which are normally present in human saliva and respiratory tract. These bacteria could thus become resistant to antibiotics which may lead to potentially uncontrollable epidemics.
55. Antibiotic resistant bacteria, used in most GM crops, are found in the guts of bees feeding on GM rapeseed
56. A study conducted in Madhya Pradesh by a civil society recorded that the people handling *Bt* cotton suffered allergic reactions. "23 patients, including 10 severe cases, showed symptoms of allergy within five hours of gathering, lifting and even touching the cotton"
57. Even people living around *Bt* corn field developed skin, respiratory and intestinal symptoms and fever during the period of pollination. Blood test of 39 people showed immune response to the Bt toxin.
58. In 2006, around 12,000 sheep are estimated to have died due to toxicity after grazing on *Bt* cotton in Warangal district alone.
59. In 2007 and 2008 such incidents have been reported from the districts of Adilabad, Medak and Kamam in Andhra Pradesh, in addition to Buldana and Yavatmal districts of Maharashtra.
60. Farmers in the US reports that the pigs and cows fed with GM corn became sterile; many sheep fed on GM cotton plant died; cow, chicken, water buffalos and horses also had the same effect.

61. The prestigious medical journal “Lancet” issued a warning that GM foods should never have been allowed into the food chain. Britain’s Medical Association with 100,000 physicians and Germany’s Medical Association with 325,000 physicians issued similar statements.
  
62. The National Academy of Science in the USA reports that GM products introduce into our bodies and into the environment several new allergens, toxins, disruptive chemicals, soil-polluting ingredients, mutated species and several intern protein combinations.
  
63. American Academy of Environmental Medicine calls for a Moratorium on GM foods because: GM food poses serious health risks in the area of toxicology, allergy and immune function, reproductive health, metabolic, physiologic, and genetic health
  
64. Several animal studies indicate serious health risks associated with GM food consumption including infertility, immune dysregulation, accelerated aging, dysregulation of genes associated with cholesterol synthesis, insulin regulation, cell signalling, and protein formation, and changes in the liver, kidney, spleen and gastrointestinal system” (*Amy Dean, D.O. and Jennifer Armstrong, M.D: Genetically Modified foods. American Academy of Environmental Medicine, 2009.*)
  
65. Multiple animal studies show significant immune dysregulation, including up regulation of cytokines associated with asthma, allergy, and inflammation ( *Finamore A, Roselli M, Britti S, et al. Intestinal and peripheral immune response to MON 810 maize ingestion in weaning and old mice. J Agric. Food Chem. 2008; 56(23):11533-11539; Kroghsbo S, Madsen C, Poulsen M, et al. Immunotoxicological studies of genetically modified rice expression PHA-E lectin or Bt toxin in Wistar rats. Toxicology. 2008; 245:24-34.*)
  
66. A recent 2008 study links GM corn with infertility, showing a significant decrease in offspring over time and significantly lower litter weight in mice fed on GM corn ( *Velimirov A, Binter C, Zentek J. Biological effects of transgenic maize NK603xMON810 fed in long term reproduction studies in mice. Report-Federal Ministry of Health, Family and Youth. 2008.*)
  
67. Changes in the kidney, pancreas and spleen have also been documented ( *Finamore A, Roselli M, Britti S, et al. Intestinal and peripheral immune response to MON 810 maize ingestion in weaning and old mice. J Agric. Food Chem. 2008; 56(23):11533-11539; Velimirov A, Binter C, Zentek J. Biological effects of transgenic maize NK603xMON810 fed in long term reproduction studies in mice. Report-Federal Ministry of Health, Family and*

Youth. 2008; Kilic A, Aday M. A three generational study with genetically modified Bt corn in rats: biochemical and histopathological investigation. *Food Chem. Toxicol.* 2008; 46(3):1164-1170)

68. According to the American Academy of Environmental Medicine, “There is more than a casual association between GM foods and adverse health effects ... Multiple animal studies show significant immune dysregulation, including up regulation of cytokines (protein molecules involved in immune responses) associated with asthma, allergy, and inflammation.” (Amy Dean, Jennifer Armstrong “Genetically Modified foods”. *American Academy of Environmental Medicine.* 2009).
69. Above all, it may be noted that for any meaningful assessment of the impact of the GM food on experimental animals should be done on a long term basis. Negative effects such as cancer or organ would show up only after four or five generations. In India, testing is done on rats for 90 days; it certainly is too short a period to get the true picture. In this context, it is a paradox to note that the experiment is also done by the client who wishes to introduce the GM crop/ food!
70. A comprehensive compilation of the health impacts with scientific details are available in Jeffrey M. Smith’s “Genetic Roulette” published in 2007. None of the instances of negative impacts given in the book has been challenged by Monsanto or the other GM corporate world. It by itself is a proof for its reliability and confirms beyond doubt the evidences against GM dangers.
71. Again, an excellent compilation of the negative impacts of GM foods/crops is available in “**Adverse Impacts of transgenic Crops/Food**” 2013 authored by Kavitha Kuruganti and published by the *Coalition for a GM-Free India*. It contains abstracts of about 400 papers published in peer reviewed journals. The area it covered and the number of papers included in each are given below:
  1. Imprecision & Unpredictability of science & technology of genetic engineering (56 papers)
  2. Health impacts:
    - i. Bt toxin (8 papers),
    - ii. Glyphosate & other herbicides (40 papers),
    - iii. Genetic engineering & health impacts (41 papers),
    - iv. Changes in nutritional composition (3 papers).
  3. Environmental impacts: Super weeds, Pest dynamics including resistance, Agrochemical use with GM crops, Biodiversity, Soil impacts (14 without abstracts are not referred in the text below).
  - 4 Horizontal gene transfer (24 papers)
  - 5 Gene flow, contamination & field trials’ risk (38 papers + 3 without abstracts)
  - 6 Yield myths with GM crops (13 papers)
  - 7 Other related papers (Regulation, ethics, corporate monopolies, social impacts etc.) (42 papers +3 without abstracts)
  - 8 Some unpublished but important papers (4 papers)

Major studies dealing with impacts on environment and biodiversity, and Soil are listed below for ready reference of the PAC.

## VIII. Environment & Biodiversity

72. Agro-biodiversity and agricultural sustainability are essential for the long-term interests to provide sufficient food for the growing population, but not GM crops as described by some<sup>1</sup>
73. Bt crops although advocated to be included in integrated pest management (IPM), it cannot be done as there are several problems with the Bt crops<sup>2</sup>
74. A review is available on the negative ecological impacts of GM crops, namely 1) creating new or more vigorous weeds; 2) exacerbating the effects of existing pests through hybridization with related transgenic organisms; 3) harm to non-target species such as soil organisms, non-pest insects, birds and other animals; 4) disruption of biotic communities including agro-ecosystems and 5) irreparable loss or changes in species diversity or genetic diversity<sup>3</sup> There are several individual studies on these aspects as documented below.
75. Genetically modified herbicide-tolerant (GMHT) winter oilseed rape showed less diversity of plants especially dicots while monocots increased which also resulted in less abundance of bees and butterflies<sup>4</sup>
76. There has been a reduction in biodiversity in GMHT crops<sup>5</sup>
77. Slower growth and increased mortality were observed in the monarch butterfly *Danaeus plexippus* larvae reared on milkweed *Asclepias syriaca* leaves dusted with pollen from Bt-corn grew slowly and had higher mortality<sup>6,7,8, 9, 10,</sup>
78. Further, such impact was found in monarch and black swallowtail *Papilio polyxenes*<sup>11</sup>
79. Larvae of European common swallowtail exposed to Bt-maize pollen had lower survival rate<sup>12</sup>
80. North American population of overwintering monarch butterflies in Mexico declined significantly over 15 years because of three major factors including loss of breeding habitat in the US due to GM herbicide-resistant crops<sup>13</sup>.
81. Another study had similar results with the population of monarch butterfly declining by 81% during 1999-2010 in the Midwest landscape of US when milkweed (food plant of the butterfly) decreased by 58% mainly because of the increased use of glyphosate herbicide in GM corn and soya<sup>14</sup>.
82. Increased mortality of a protected butterfly (*Inachis io*) larvae was found in Central and Southern Europe as an impact of Bt-maize pollen falling on the food plant *Urtica dioica*<sup>15</sup>.
83. Honey bees *Apis mellifera* was adversely impacted by transgenic plants<sup>16, 17</sup>

84. Non-target herbivores such as some beetles and arthropod predators contained significant quantities of the Bt endotoxin in the fields which shows its movement into higher trophic levels<sup>18</sup>.
85. Insecticidal transgenic plants inhibited growth and reduced survival of bumble bees *Bombus terrestris*<sup>19</sup>.
86. Reproduction and development of a snail *Psuedosuccinea columella* (intermediate host of *Fasciola hepatica*) was much faster when affected by glyphosate (Roundup, herbicide) which will increase infections in animals and man<sup>20</sup>.
87. Snails *Potamopyrgus antipodarum*, the intermediate host of trematode parasite *Telogaster opisthorchis* of a New Zealand freshwater fish *Galaxias anomalus*, when exposed to moderate concentrations of glyphosate produced more parasites and a combination of both glyphosate and parasites together significantly reduced fish survival<sup>21</sup>.
88. Herbivores, detritivores and many of their predators and parasitoids in arable systems are sensitive to the changes in weed communities in GM herbicide-tolerant (GMHT) beet, maize and spring oilseed rape in UK<sup>22</sup>.
89. Most surface-active invertebrate species in GMHT crops were affected with low diversity and abundance<sup>23</sup>.
90. A large range of herbivorous and predatory species showed Bt endotoxin when exposed to Bt-maize in the field; GMHT maize predicted increase of infections by root pathogens and increase in herbicide resistant weeds<sup>24</sup>.
91. Aquatic environments near Bt-corn fields showed more Bt toxins remaining in the sediment and persisted for more than 40 days, but only up to 20 days in surface water and the toxin were detected in the river 82 Km downstream from the farm<sup>25</sup>.
92. Bt-corn by-products such as pollen and detritus enter headwater streams and are subject to storage, consumption and transport to downstream water bodies which reduced growth and increased mortality of non-target stream insects and the ecosystems<sup>26</sup>.
93. Bt-maize when fed to water flea *Daphnia magna* showed higher mortality and also affected reproduction<sup>27</sup> and, that the juvenile and young adult stages are the most sensitive<sup>28</sup>.
94. Glyphosate caused extremely high rates of mortality to three species of North American tadpoles<sup>29</sup> and, it also affected the biodiversity and productivity of aquatic communities<sup>30</sup>.
95. A beneficial predator the green lacewing *Chrysoperla carnea* when fed on BT-fed herbivorous larvae had slower growth<sup>31</sup>.

96. Insect and plant biodiversity are affected in Bt-corn fields; non-target organism such as the green lacewing had higher mortality in Bt-corn <sup>32</sup> and, Bt-maize when fed on larvae of cotton leaf-worm *Spodoptera littoralis* <sup>33</sup>.
97. Similar results were obtained on green lacewing fed on cotton leaf-worm and European corn borer *Ostrinia nubilalis* <sup>34</sup>.
98. Impacts of Bt toxins on non-target organisms such as the lacewing were recorded and observed that many other organisms might be affected which needs further studies. Hilbeck A & Schmidt JEU <sup>35</sup>
99. It was reconfirmed that coccinellid biological control organism *Adalia bipunctata* larvae had increased mortality with Bt toxin which was documented earlier in 2008/2009 <sup>36</sup>.
100. Songbird densities and habitat complexity decreased in Glyphosate treated clearcuts in north-central Maine <sup>37</sup>.

### **Impacts on soil**

101. Soil in Bt- cotton fields in Vidarbha, India showed reduction in several microbial and biochemical indicators <sup>38</sup>.
102. It is recorded GM cotton affects enzyme activity and nutrient availability in sub-tropical insectisol <sup>39</sup>
103. Symbiotic arbuscular mycorrhizal fungi (AMF) colonization was reduced in Bt-maize which will have impact on non-target soil organisms <sup>40</sup>. Similar results were obtained in Bt-corn in Europe <sup>41</sup>.
104. In China, Bt-rice grown soils showed decrease in soil enzyme activities <sup>42</sup>.
105. Again in China, Bt-cotton grown soils showed decrease in soil microbial biomass carbon, microbial activities and soil enzyme activities<sup>43, 44, 45</sup>, so also in the case of transgenic papaya <sup>46</sup>.
106. Bt-induced ecological shifts in the microbial communities in the soil of Bt-maize fields were observed <sup>47,48</sup> so also in the Bt- corn soils <sup>49</sup>.
107. Bt- corn plants produced toxins through root exudates <sup>50, 51</sup>) which remained in the soil up to 200 days depending on the temperature conditions and would affect the soil organisms <sup>52</sup>.
108. Bt crops affected the soil microbial communities <sup>53, 54</sup> and, also the soil animals <sup>55</sup>
109. Glyphosate (herbicide) resistant (GR) GM crops have increased disease vulnerability in non-target plants <sup>56</sup> and even in crops <sup>57</sup>.
110. GR GM Soybean soil showed increased fungal activity which may adversely affect plant growth and biological processes in the soil and rhizosphere <sup>58</sup>.
111. Increased Fusarium (fungi) pathogens associated with glyphosate use in soybean were found in the US <sup>59,60</sup> and in cereal crops in Canada <sup>61, 62</sup>.



112. Nematode reproduction and growth were significantly reduced in soils of Bt-corn fields <sup>63</sup>.
113. Earthworm growth was reduced as an impact of herbicide resistant crops <sup>64</sup>.
114. Bt plants had higher lignin content and degraded very slowly in the soil <sup>65,66, 67</sup>.

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### References

1. **Jacobsen S, Sorensen M, Pedersen S M & Weiner J. 2013.** Feeding the world: genetically modified crops versus agricultural biodiversity. *Agronomy for sustainable development*
2. **Szekacs A & Darvas B 2012.** Chapter 10: Comparative aspects of Cry toxin usage in insect control. Pp 195-230 in "Advanced Technologies for managing insect pests". Eds. Ishaaya I, Palli SR & Howtz R. Springer Science & Business Media.
3. **Snow AA, Andow DA, Gepts P, Hallerman EM, Power A, Tiedje JM & Wolfenbarger LL 2005.** Genetically engineered organisms and the environment: current status and recommendations. *Ecological Applications* 15(2): 377-404.
4. **Bohan DA et al. 2005:** *Effects on weed and invertebrate abundance and diversity of herbicide management in genetically modified herbicide-tolerant winter-sown oilseed rape. Proc. Royal Soc. B Vol.272 (1562): 463-474.*
5. **Walkinson AR, Freckleton RP, Robinson RA & Sutherland WJ 2000:** *Predictions of biodiversity response to genetically modified herbicide-tolerant crops. Science* 289: 1554-1557.
6. **Losey JE, Rayor LS & Carter ME 1999.** Transgenic pollen harms monarch larvae. *Nature* 399 (6733): 214.
7. **Hansen JL & Obrycki JJ 2000:** *Field deposition of Bt transgenic corn pollen lethal effects on the monarch butterfly. J. Oecologia* 125 (2): 241-8.
8. **Stanley-Horn DE, Dively GP, Hellmich RL, Mattila HR, Sears MK, Rose R, Jesse LC, Losey JE, Obrycki JJ & Lewis L 2001.** Assessing the impact of CryIAb-expressing corn pollen on monarch butterfly larvae in field studies. *Proc. National Acad. Sciences* 98 (21): 11931-36.
9. **Dively GP, Rose R, Sears MK, Hellmich RL, Stanley-Horn DE, Calvin DD, Russo JM & Anderson PL 2004.** *Effects on monarch butterfly larvae (Lepidoptera: Danaidae) after continuous exposure to CryIAb-expressing corn during anthesis. Environmental Entomology* 33: 1116-25.
10. **Prasifka PL, Hellmich RL, Prasifka JR & Lewis LC 2007.** *Effects of CryIAb-expressing corn anthers on the movement of monarch butterfly larvae. Environ. Entomol.* 36: 228-33.
11. **Zangeri AR, McKenna D, Wraight CL, Carroll M, Ficarello P, Warner R & Berenbaum MR 2001.** *Effects of exposure to event 176 Bacillus thuringiensis corn pollen on monarch and black swallowtail caterpillars under field conditions. Proc. National Acad. Sci.* 98 (21): 11908-12).
12. **Lang A & Vojtech E 2006.** *The effects of pollen consumption of transgenic Bt-maize on the common swallowtail Papilio machaon L. (Lepidoptera, Papilionidae). Basic and Appl. Ecology* 7: 296-306).
13. **Brower LP, Taylor OR, Williams EH, Slayback DA, Zubieta RR & Ramirez MI 2012.** *Decline of monarch butterflies overwintering in Mexico: is the migratory phenomenon at risk? Insect Conservation and Diversity* 5(2): 95 -100).
14. **Pleasants JM & Oberhauser KS 2013.** *Milkweed loss in agricultural fields because of herbicide use: effect on the monarch butterfly population. Insect Conservation and Diversity* 6(2):135-144.
15. **Holst N, Lang A, Lovel G & Otto M 2013.** *Increased mortality is predicted of Inachis io larvae caused by Bt-maize pollen in European farmland. Ecological Modelling* 250: 126-133.
16. **Brodsgaard HF, Brodsgaard CJ, Hansen H & Lovei GL 2003.** *Environmental risk assessment of transgenic products using honey bee Apis mellifera larvae. Apidologie* 34.: 139-45.
17. **Ramirez-Romero R, Desneux N, Decourtye A, Chaffiol A & Pham-Delegue MH 2008.** *Does Cry IAb protein affect learning performances of honey bee Apis mellifera L. (Hymenoptera, Apidae)? Ecotoxicology and Environ. Safety* 70(3): 327-33.
18. **Harwood JD, Wallin WG & Obrycki JJ 2005.** *Uptake of Bt endotoxins by non-target herbivores and higher order arthropod predators: molecular evidence from a transgenic corn agroecosystem. Molecular Ecology* 14: 2815-23.
19. **Babendreier D, Reichhart B, Romeis J & Bigler F 2008.** *Impact of insecticidal proteins expressed in transgenic plants on bumble bees microcolonies. Entomol. Exp. Appl.* 126:148-57.
20. **Tate TM, Spurlock JO & Christian FA 1997.** *Effect of glyphosate on the development of Pseudosuccinea columella snails. Arch. Environ. Contam. Toxicol.* 33:286-89.

21. **Kelly DW, Poulin P, Tompkins DM & Townsend CR 2010.** Synergistic effects of glyphosate formulation and parasite infection on fish malformations and survival. *J. Appl. Ecology* 47: 498-504.
  22. **Hawes C, Haughton AJ, Osborne JL, Roy DB, Clark SJ, Perry JN, Rothery P, Bohan DA, Brooks DJ, Champion GT, Dewar AM, Heard MS, Wolwod IP, Daniels RE, Yound MW, Parish AM, Scott RJ, Firbank LG & Squire GR 2003.** Responses of plants and invertebrates trophic groups to contrasting herbicide regimes in the farm scale evaluations of genetically modified herbicide-tolerant crops. *Phil. Transactions of the Royal Soc. of London B* 358:1899-1913.
  23. **Brooks DJ, Bohan DA, Champion GT, Haughton AJ, Hawes C, Heard MS, Clark SJ, Dewar AM, Firbank LG, Perry JN, Rothery P, Scott RJ, Wolwod IP, Birchall C, Skellern MP, Walker JH, Baker P, Bell D, Brown EL, Dewar AJD, Fairfax CM, Garner BH, Haylock LA, Horne SL, Hulmes SE, Mason NS, Norton LP, Nuttall P, Randall Z, Rosall MJ, Sands RJN, Singer EJ & Walker MJ 2003.** Invertebrate responses to the management of genetically modified herbicide-tolerant and conventional spring crops. 1. Soil-surface active invertebrates. *Phil. Trans. of the Royal Soc. of London B* 358:1847-62.
  24. **Dolezel M, Heissenberger A & Gaugitsch H 2006.** Ecological effects of genetically modified maize with insect resistance and /or herbicide tolerance. *Bundesministerium fur Gesundheit und Frauen, Sektion IV Radetzkystrasse 2, 1031 Wien.*
  25. **Douville M, Gagne F, Blaise C & Andre C 2007.** Occurrence and persistence of *Bacillus thuringiensis* (Bt) and transgenic Bt-corn Cry IAb gene from an aquatic environment. *Eco-toxicology and Environ. Safety* 66(2): 195-203.
  26. **Rosi-Marshall EJ, Tank JL, Royer TV, Whiles MR, Evans-White M, Chambers C, Griffiths NA, Pokelsek J & Stephen ML 2007.** Toxins in transgenic crop byproducts may affect headwater stream ecosystems. *Proc. National Acad. of Sciences of USA* 104(41): 16204-16208.
  27. **Bohn T, Primicerio R, Hessen D & Traavik T 2008.** Reduced fitness of *Daphnia magna* fed a Bt transgenic maize variety. *Arc. of Environ. Contam. and Toxicol.*
  28. **Bohn T, Traavik T & Primicerio R & 2010.** Demographic responses of *Daphnia magna* fed transgenic Bt-maize. *Ecotoxicology* 19(2): 419-430.
  29. **Relyea 2005.** The lethal impact of Roundup on aquatic and terrestrial amphibians. *Ecol. Applications* 15(4): 1118-1124
  30. **Relyea 2005a.** The impact of insecticides and herbicides on the biodiversity and productivity of aquatic communities. *Ecol. Appl.* 15: 618-27.
  31. **Hilbeck A, Baumgartner M, Fried PM & Bigler F 1998.** Effects of transgenic *Bacillus thuringiensis* corn-fed prey on mortality and development time of immature *Chrysoperla carnea*. *Environ. Entomology* 27:480-487.
  32. **Hilbeck A 2001.** Implications of transgenic, insecticidal plants for insect and plant biodiversity. *Perspectives in Plant Ecol., Evolution and Systematics* 4(1): 43-61
  33. **Dutton A, Klein H, Romeis J & Bigler F 2002.** Uptake of Bt toxin by herbivores feeding on transgenic maize and consequences for the predator *Chrysoperla carnea*. *Ecol. Entomol.* 27:441-7.
  34. **Obrist LB, Dutton A, Romeis J & Bigler F 2006.** Biological activity of Cry IAb toxin expressed by Bt-maize following ingestion by herbivorous arthropods and exposure of the predator *Chrysoperla carnea*. *BioControl* 51:31-48.
  35. **Hilbeck A & Schmidt JEU 2006.** Another view on Bt proteins – how specific are they and what else might they do? *Biopesticides International* 2:1-50.
  36. **Hilbeck A, McMillan JM, Humbel A, Schlaepfer-Miller J & Trtikova M. 2012** (A controversy revisited: is the coccinellid *Adalia bipunctata* adversely affected by Bt toxins? *Envtl. Sciences Europe* 24(10)..
  37. **Santillo DJ, Brown PW & Leslie DM 1989.** Response of songbirds to glyphosate induced habitat changes on clearcuts. *J. Wildlife Mangement* 53: 64-71.
- Impacts on soil**
38. **Jagdish C, Tarafdar, Rathore I & Vandana Shiva 2012.** Effect of Bt transgenic cotton on soil biological health. *Appl. Biol. Res.* 14(1): 15-23).
  39. **Sarkar B, Patra AK & Purakayastha TJ 2008.** Transgenic Bt-cotton affects enzyme activity and nutrient availability in a sub-tropical inceptisol. *J. Agronomy and Crop Science.* ISSN 0931-2250.
  40. **Cheeke TE, Rosensteil TN & Cruzan MB 2012.** Evidence of arbuscular mycorrhizal fungal colonization in multiple lines of Bt-maize. *Amer. J. of Botany* 99(4):700-707.
  41. **Turrini A, Sbrana C & Giovannetti M 2008.** Experimental systems to monitor the impact of transgenic corn on keystone soil microorganisms. Paper presented during 16<sup>th</sup> IFOAM World Congress, Modena, Italy, June 16-20.
  42. **Sun C, Wu Z, Zhang Y & Zhang L 2003.** Effect of transgenic Bt-rice planting on soils enzyme activities. *Ying Yong Sheng Tai Xue Bao. J.of Appl. Ecol.* 14:2261-2264.

43. **Sun X, Chen LJ, Wu ZJ, Zhou LK, & Shimizu H 2006.** Soil persistence of *Bacillus thuringiensis* (Bt) toxin from transgenic Bt-cotton tissues and its effect on soil enzyme activities. *Biology and Fertility of Soils* 43(5): 617-620.
44. **Liu W 2009.** Effects of transgenic crops on soil ecosystems: a review. *Front. Agric. China of a 10-year research in China. Front. Agric. China* 3(2): 190-98.
45. **Chen ZH, Chen LJ, Zhang YL & Wu ZJ 2011.** Microbial properties, enzyme activities and the persistence of exogenous proteins in soil under consecutive cultivation of transgenic cotton (*Gossypium hirsutum* L.). *Plant Soil and Envnt- UZEI* 57(2): 67-74).
46. **Wei XD, Zou HL, Chu Lm, Liao B, Ye CM & Lan CY 2006.** Field-released transgenic papaya affects microbial communities and enzyme activities in soil. *J. Environ. Sci.(China)* 18(4): 734-40 as well as in *Plant and Soil* 285 (1-2): 347-358.
47. **Baumgarte S & Tebbe CC 2005.** Field studies on the environmental fate of Cry IAb BT toxin produced by transgenic maize (MON810) and its effect on bacterial communities in the maize rhizosphere. *Molecular Ecol.* 14(8): 2539-51.
48. **Mulder C, Wouterse M, Raubuch M, Roelofa W & Rutgers M 2006.** Can transgenic maize affect soil microbial communities? *Plos Computational Biol.* 2(9): 1165-72.
49. **Castaldini M, Turrini A, Sbrana C, Benedetti A, Marchionni M, Mocali S, Fabiani A, Landi S, Santomassimo F, Pietrangeli B, Nuti MP, Miclaus N & Giovannetti M 2005.** Impact of Bt-corn on rhizospheric and soil eubacterial communities and on beneficial myccorhizal symbiosis in experimental microcosms. *Appl. Environ. Microbiol.* 71(11):6719-29.
50. **Saxena D, Flores S & Stotzky G 1999.** Insecticidal toxin in root exudates from Bt-corn. *Nature* 402: 480;
51. **Saxena D, Flores S & Stotzky G 2002.** Bt toxin is released in root exudates from 12 transgenic corn hybrids representing three transformation events. *Soil Biol. & Biochemistry* 34: 133-7
52. **Zwahlen C, Hilbeck A, Gugerli P & Nentwig W 2003.** Degradation of the Cry IAb protein within transgenic *Bacillus thuringiensis* corn tissue in the field. *Molecular Ecol.* 12(3): 765-75).
53. **Dunfield KE & Germida JJ 2004.** Impact of genetically modified crops on soil and plat- associated microbial communities. *J. Environ. Qual.* 33(3): 806-815.
54. **Icoz I & Stotzky G 2008.** Fate and effects of insect-resistant Bt crops in soil ecosystems. *Soil Biol. & Biochem.* 40: 559-86.
55. **Yuan YG & Ge F 2010.** Effects of transgenic Bt crops on non-target soil animals (Chinese). *Ying Yong Sheng Tai Xue Bao. J. of Appl. Ecol.* 21(5): 1339-45).
56. **Neumann G, Kohls S, Landsberg E, Souza SK, Yamada T & Romheld V 2006.** Relevance of glyphosate transfer to non-target plants via the rhizosphere. *J. Plant Diseases & Protection* 20: 963-69.
57. **Johal DS & Huber DM 2009.** Glyphosate effects on diseases of plants. *Europ. J. Agron.* 31:144-52.
58. **Kremer RJ, Means NE & Kim S 2005.** Glyphosate affects soybean root exudation and rhizosphere microorganisms. *Int. J. of Environ. Analytical Chem.* 85(15): 1165-74.
59. **University of Missouri 2000.** MU researchers find fungi buildup in glyphosate-treated soybean fields. *University of Missouri*, 21 December.
60. **Sanogo S, Yang X & Scherm H 2000.** Effects of herbicides on *Fusarium solani* f. sp. *glycines* and development of sudden death syndrome in glyphosate-tolerant soybean. *Phytopathology* 90: 57-66.
61. **Fernandez MR, Zentner RP, DePauw RM, Gehl D & Stevenson FC 2007.** Impacts of crop production factors on common root rot of barley in Eastern Saskatchewan. *Crop Sci.*47: 1585-95.
62. **Fernandez MR, Zentner RP, Basnyat P, Gehl D, Selles F & Huber D 2009.** Glyphosate association with cereal diseases caused by *Fusarium* Spp. in the Canadian prairies. *Eur. J. Agron.* 31: 133-43.
63. **Hoss S, Arndt M, Baumgarte S, Tebbe CC, Nguyen HT & Jehle JA 2008.** Effects of transgenic corn and Cry IAb protein on nematode, *Caenorhabditis elegans*. *Ecotox. and Environ. Safety* 70(2): 334-340.
64. **Springett JA & Gray RAJ 1992.** Effect of repeated low doses of biocides on the earthworm *Aporrectodea caliginosa* in laboratory culture. *Soil Biol. Biochem.* 24:1739-44.
65. **Saxena D & Stotzky G 2001.** Bt-corn had a higher lignin content than non-Bt-corn. *Amer. J. of Botany* 88: 1704-6.
66. **Flores S, Saxena D & Stotzky G 2005.** Transgenic Bt plants decompose less in soil than non-Bt Plants. *Soil Biol. & Biochem.* 37:1073-82.
67. **Poerschmann J, Gathmann A, Augustin J, Langer U & Gorecki T 2005.** Molecular composition of leaves and stems of genetically modified Bt and near isogenic non-Bt- maize – characterization of lignin patterns. *J. Environ. Quality* 34: 1508-18.

115. Should our country require any more evidence to arrive at a decision to reject the GM crop and foods. The pro - GM lobbies' argument that the GM food is safe, based on the studies *sponsored directly or indirectly by those trying to sell the technology should be viewed critically, if not rejected. No company will ever say that its products are bad.*

### **IX. GM plants genetically contaminate the native crop and wild varieties**

116. One of the most serious dangers of GM is contamination of wild varieties and also closely related non- GM crop varieties by the gene of genetically modified plants by cross pollination, amounting to losing our original local biodiversity. FAO reported recently that this could result in the reduction of species locally and on a global scale.
117. Widespread gene contamination in the maize varieties in Mexico was reported by the Mexico's Environment Ministry; the contamination rates had gone to 80 per cent in the remote villages. Mexico, the primary centre of maize genetic diversity, has one of the world's most vital reservoirs of genetic material, both wild and developed by indigenous farmers over millennia.
118. An interesting episode that makes the bio-safety regulations laughable is the contamination of a native variety of canola by GM canola grown in the neighbouring field in Canada. The presence of GM canola in the non-GM local variety, made Monsanto to file a suit against its owner as it had no license to grow GM Canola and finally the owner had to pay penalty. The actual law breaker was the "bee" which helped in cross pollination!!
119. Gene contamination of the local long grain rice in the USA from the field trials of a GM variety, called "Liberty Link," owned by the biotech giant, Bayer, is a classical example. When Bayer was taken to the Court by the farmers in the US for contaminating their local variety, the Giant reported to have claimed that "it was an act of God." The episode caused loss of 63 per cent of US rice export, while the contamination spread to at least 30 countries. Total loss to the farmers was around \$253 million. **Protracted litigation forced Bayer CropScience to pay \$ 750 million compensation.**

120. In Texas, 500,000 bushels of soya destined for human consumption were contaminated with genes from maize genetically modified by the US firm Prodigene to produce a vaccine for treating a stomach disease afflicting pigs.
121. Biotech giants' refusal for labelling the GM products, obviously anticipating rejection in the market, makes things worse for the consumers, as they are unable to distinguish the non- GM from GM. Refusal for labelling is an acceptance of the defects of the products.
122. It is reported that there are 39 cases of gene contamination from GM crop to non-GM crop in 23 countries during 2007 and more than 200 such cases in 57 countries in the last 10 years.
123. Genetic contamination by cross pollination from GM to non-GM crops is probably a blessing in disguise for the biotech companies, because when larger areas are contaminated, they could as well argue that their crop need not be regulated as they are already in the food chain. And when most varieties are contaminated, we will be left with no other option, but to go in for GM. The same is the case with GM products also, if the GM products are widely accepted. This is clear from the statement of Don Westfall, Vice President of the US Food Industry Consultancy, Promar International, that "the hope of the (GM) industry is that over time the market will be flooded (with GM) that there's nothing you can do about it. You just surrender"

## **X. GM poses threats to non-target species and ecosystems**

124. A two year study shows that long-term exposure of Monarch butterflies to *Bt* maize pollen lead to the loss of 20 per cent of its population, as they failed to reach the adult stage. It is reported that beneficial ladybird beetles were fewer in *Bt* maize than in non-*Bt* maize, because their food sources such as aphids and pollen in the former area are contaminated by the *Bt* toxin.
125. A study reported in the Proceedings of the National Academy of Sciences, USA in 2007 shows that *Bt* toxin from pollen and agriculture wastes from *Bt* corn fields entered into adjacent streams which affected the growth of caddis flies. More detailed study by the same team shows

that high doses of pollen in the stream kill as many as 43 per cent of the caddis flies which would eventually affect the food-chain in the stream.

126. Australian CSIRO reports that the exudes from the roots of GM plants containing toxic protein into the soil alters the soil organisms and their activities. Transgenic material finds their way to soil also through crop residues such as straw or stubble left over in the field and ploughed in. *Bt* cotton exudes a toxin during decomposition. The Scientific Advisory Panel of the US Environmental Protection Agency (EPA) reports that “*Bt protein is likely to be present in the rhizosphere not only throughout the life of the crop, but perhaps long after the crop is harvested*”.
127. In a soil bacteria, antibiotic resistant gene from biotech beetroot was detected.
128. Gene transfer between closely related microorganisms is a natural phenomena in the evolution of microbial communities. Introduction of toxins at this level would mean tampering with the natural process of evolution which would be disastrous.

### **XI GM endangers the food security and sovereignty**

129. Adoption of GM crops eventually would lead to the disappearance of the country’s rich variety of cultivars evolved through centuries by our farming communities and also would endanger the wild varieties.
130. The country has already committed a mistake with the introduction of Green Revolution which disarmed farmers of their traditional asset, by introducing high yielding varieties displacing the traditional varieties and the generations of knowledge inextricably associated with them. Introduction of GM technology makes the situation still worse making the farmer a true “farm-refugee.” It would make the farmer and the food chain itself under the control of a few multinational corporate bodies like Monsanto, as the farmer has to buy the seeds, that too at exorbitant rates, only from the corporate body each season. The farmers will be denied the right to sow what he wants to sow in his own land, amounting essentially denial of the fundamental right of the farmer. It certainly is totally unacceptable to a democratic country like ours.
131. Eventually, we will be forced to restrict our food choice to a few varieties dictated and driven by the market interests of a few multinationals. Essentially colonising every Indian’s free choice of food.

132. It may be noted that royalty for Bt cotton alone to be paid to Monsanto and its Indian dealers within 8 years (up to 2009-10), is estimated at Rs 1580 crores (*Latha Jishnu. "Battle royal over Bt cotton royalty". Business Standard. May 28, 2010*). Some of the farmers having irrigated lands would have benefited. However, indebtedness and suicides among the majority of rain-fed cotton farmers have increased, after introduction of Bt cotton (*P Sainath, "In 16 years farm suicides cross a quarter million". The Hindu. 29 October, 2011*). It is also noted that 68% of the farmers' suicide occurred in the four major areas of cotton cultivation, even after 11 years of Bt cotton cultivation (*Centre for Sustainable Agriculture. 2013: Genetically Modified Foods and Crops – some facts that everyone should know*).
133. It is not only the awful draining of farmers' pocket forcing them to commit suicide, more dreadful is the irrecoverable loss of the fundamental right of the farmers on their own seeds and the subsequent disgraceful scenario of the nation prostrating its food sovereignty at the feet of multinational companies.
134. The argument that India should develop its own capabilities in GM research in crops has also to be seen on the light of the necessity for it and the immense financial commitment that it requires. According to estimates it costs a minimum of \$ 150 million to produce one GM variety and another \$5-6 million in regulatory costs to bring it in the market. Can India afford that kind of investment, that too for a research impregnate with disasters?

## **XII. GM poses threats to organic farming and sustainable agriculture**

135. Green Revolution's high yield varieties accompanied by chemical pesticides and fertilizers not only failed to offer a sustainable agriculture system, but killed the soil vitality and contaminated the air, water and food. The country is now promoting, although not adequately, organic farming. It is to the credit of the Government of Kerala that it has declared its intention to do away with chemical farming and convert the entire cultivation by organic in a phased manner to ensure food security. The State has already adopted an Organic Farming Policy. Government of Sikkim has already declared as an organic State. It is hoped that the Government of India would also declare a clear organic farming policy for the country and phase out the chemicals from the agriculture fields with a definite time frame. Irrespective of the pressures from the pesticide lobby and with a single slogan of providing poison free food and environment to India's citizens.
136. However, organic farming and GM crops are mutually incompatible. The former is sustainable, holistic in approach going with the essential rules of nature, while the latter is unsustainable, single issue approach violating all rules of nature unmindful of the perpetual irreversible adverse impacts that it would create to the system and environment.
137. Genetic contamination of organic crops by GM crops by cross pollination is the most important issue, as the pollen drifts miles together depending on the agency which carries it, birds, bees or wind.

138. It is often impossible to protect the organic products from GM products as learned from experience elsewhere.
139. According to a report of the US Environmental Protection Agency, analysed by the Union of Concerned Scientists, the loss to US organic maize growers was \$ 90 million in annual income because of the GM contamination.
140. Survey of the Organic Farming Research Foundation show that one in 12 organic farmers in the US had already suffered direct costs or damage because of GM contamination.
141. The cost involved in protecting conventional and organic crops from GM contamination is predicted to be extremely high. One such prediction shows that it would add 41 per cent to the cost of producing non-GM oilseed rape and up to 9 per cent to the cost of producing non-GM maize and potatoes.
142. Already it is reported that in the US many organic farmers have been unable to sell their produce as organic due to GM contamination. This will certainly happen in India also if we promote GM crops.

#### **XIV. GM poses threats to the traditional medical practices in India**

143. Traditional medicines are based mainly on natural products or derivatives there from. Therefore, any genetic contamination will affect the therapeutic values of the concerned item.
144. Ingredients of many Ayurveda medicines consist of rice, ragi, barley, ginger, mustard, pepper, cardamom, bitter gourd, gooseberry, brinjal, papaya, yam, and the like. Some of these are in the pipeline waiting for the GEAC's approval for field trial. If these are genetically modified, certainly their therapeutic values would change, with what dimension it would be, nobody could predict. Ayurvedic Medical Association of India has already passed a resolution against GM crops.
145. Moreover, with the notoriety that the GM has acquired the world over, its introduction will give a fatal blow to our traditional health care system and the revenue earned there from.

#### **XV. GM is not a solution for hunger and malnutrition**

146. One of the claims made by the proponents of the GM is that it is the lasting solution for hunger and malnutrition. There cannot be a more false claim than this. The GM's comparatively lower production (compared to organic cultivation), increased demand for pesticide/herbicide, health hazards to man and livestock and, the overall high production cost coupled with poor consumer choice exposes the overblown claim of the biotech giants.



147. The claim that GM crops offer increased production and genetic modification is solely responsible for the marginal increase, wherever it took place, is totally fallacious. After all, the genetic modification was done not for increasing productivity, but to avoid the yield loss due to the insect pest or the weeds. In both cases they become tolerant to GM, ineffective eventually. Therefore, the technology has failed totally, exposing the hollowness of the claim.
148. In the USA itself, one of the major promoters of GM crops, the USDA (United States Department of Agriculture) reports that there is no economic gain or loss from some of the GM crops.
149. Moreover, most of the GM crops are not meant for feeding the poor; it is meant for feeding cattle and to produce agro-fuels to run the cars. Worse still is that food producing lands in the US are being diverted to agro-fuel production with GM seeds, amongst others. It is reported that a third of Monsanto's seed sales in 2007 were from GM corn meant for production of ethanol.
150. After all, hunger is not related to production failures alone, it is more related to distribution failures, reflecting the weak commitments of the political leaderships and the bureaucrats. It is reported by agricultural policy analysts that India produces more than double the quantity of grains required to feed the entire country. There are also published reports of starvation deaths and, tonnes of grains getting rotten in the warehouses! GM crops can do nothing about it, even if we hypothetically accept the pro-GM claim that it would accelerate production.

## **XVI. GM is not a solution for malnutrition**

151. Solving malnutrition is yet another hollow claim of the biotech giants. During the past decade and half of the GM research, no solid evidence could be produced to support this claim. On the other hand, GM crop might alter nutritional composition. One of the often quoted illustrations to substantiate their claim is the Golden Rice.
152. The cultivated rice does not have a chemical, Beta Carotene, which the body converts to Vitamin A molecule. The Golden Rice is produced by inserting certain genes of daffodils and a bacterium into the rice to modify the metabolic pathways to produce Beta Carotene. However, it is reported that an adult should eat 9 kg of rice in a day to get the required Vitamin A, while this could be solved by just eating two carrots or leafy vegetables, pumpkin, mango, drumstick. And there exists

several alternatives, which are economical and non-hazardous to health and environment, to meet the Vitamin A requirement of people.

153. M. S. Swaminathan after observing that “more than half of all children under the age of five are malnourished, 30 per cent of new born are significantly underweight, and 60 of percent women are anaemic”, suggested that “we should accelerate our efforts to ensure physical, economic, social and ecological access to balanced diet and clean drinking water for all and forever.” He did not suggest that GM is the answer.

154. It is clear that GM will neither solve hunger nor malnutrition. If at all, it will aggravate hunger and change the composition of food, the impact of which would be unpredictable.

## **XVII. Bio-safety regulations**

155. Discussion on bio safety regulations is not worth the while, because even if the regulations are stringent, very often we fail to follow or seriously implement them. Cultivation of GM cotton in Gujarat prior to the approval of the GEAC in 2002 is a disastrous example. The question that lingers is that what action has been taken against this serious violation of law. Did anyone get punishment? Even if someone was made a scapegoat, the damage done to the environment remains there, and perpetuating.

156. However, insistence on bio-safety regulations itself is a clear indication that otherwise our local varieties and the non-GM crops are unsafe from GM crops. One of the regulations stipulates minimum distance to be maintained between the non- GM and GM crops which varies according to the species. For Brinjal, it was 200 m in India. Whether it was adequate is not clear. The gene contamination of Canola, from GM to non-GM in Canada mentioned earlier shows how unscientific is the regulation. Moreover, in a country like ours where most farmers have small holdings, maintaining such a distance would be just impossible.

157. Proper studies have not yet been done to frame the bio-safety regulations. The guidelines evolved from studies in the glasshouse conditions can never be adequate to assess the impact of the GM plant on the biodiversity, ecology, environment and health.
158. The duration of studies conducted to assess the GM food on experimental animals is totally inadequate to come to a scientific conclusion. It would take generations to display the impacts. A mere 90 days observation would be totally misleading.
159. Moreover, in most bio-safety decisions, the Government is depended on the data generated by the industries who supplied the seeds. It may be noted that the GEAC had approved the release of GM brinjal on the basis of the examination of the bio-safety data provided by the Mahyco. Analyses of the same data by an independent agency, namely Committee for Independent Research and Information on Genetic Engineering based in France concluded that Bt brinjal release into the environment for food, feed or cultures may present a serious risk for human and animal health and the release should be forbidden.
160. And quite incredibly, the Government accept the industry's demand for confidentiality of the data, rejecting the public demand for the same! It is relevant at this context to note that Monsanto had to publish the data on a 90 day study on rat feeding on Bt corn on orders from a German Court. Independent scientists on examination of the data found that the GM corn was toxic.
161. The most important question based on the principles of biological sciences is that what control can anyone have on the changes within an organism brought in by alteration of its gene and also those changes the new organism may cause to the ecosystem?

### **XVIII. Ethical issues concerning GM**

162. Ethical issues are yet another important point. We certainly cannot interfere with the natural process of evolution by creating new species of our choice for the benefit of a few biotech firms. By creating GM organisms for the present, purported to remove hunger from the world, we are violating the inter-species and inter-generational equity principles.

## **XIX. Whether GM can be considered as Science?**

163. GM cannot be considered as science, as it goes against the basic principles of organic evolution. Proponents of GM often say that there is nothing new in GM, because cross pollination has been taking place for millions of years and, hybrid varieties are also being produced to enrich agriculture. But they deliberately hide the essential fact that cross pollination is between closely related organisms; it is not between fish and a tomato, or between a firefly and mango!

## **XX. Public debate on GM**

164. There were no national debates involving local farmers, agricultural scientists, experts from various related disciplines on the desirability of introduction of GM crops, before the Bt cotton was approved by the GEAC in 2002. Farmers' opinion is the most vital, because it is their fundamental right to choose what they want to sow in their farmland. Similarly, consumers should also have to be consulted as the new technology denies their choice of food.
165. When the public debates were conducted in 7 cities in the country in the case of Bt Brinjal, under the direct leadership of the then Minister for Environment and Forest, Mr. Jairam Ramesh, the Indian citizens (around 8000 of them) crowded the venues and out-rightly rejected the proposal of introducing Bt Brinjal. This has to be taken as a national consensus against the GM crops and food in the country
166. Again, when the Government of Kerala conducted a national workshop on GM crop which was attended to Ministers/representatives of 11 states of India, the resolution was unanimous that India should be GM free, if not there should be a moratorium on GM for at least 50 years.

## **XXI. Forceful attempt to impose GM on an unwilling nation**

167. The Government of India by introducing the Biotechnology Regulatory Authority of India (BRAI) 2013, is essentially trying to bulldoze all the criticisms against introducing GM crops and

food in the country. Some of the provisions of the Bill are undemocratic and draconian that independent India would have never seen before. Even protest against GM can be sufficient reason for arrest, incarceration and fine!

168. According to the provisions of BRAI, the entire agriculture and, biotechnology in the country will be regulated by a three full and two part-time members which form the Biotechnology Authority. All could be biotechnologists. There is no representative of Ministries of Agriculture and, Forest and Environment, and National Biodiversity Authority.

## **XXII. Green Revolution and Gene Revolution**

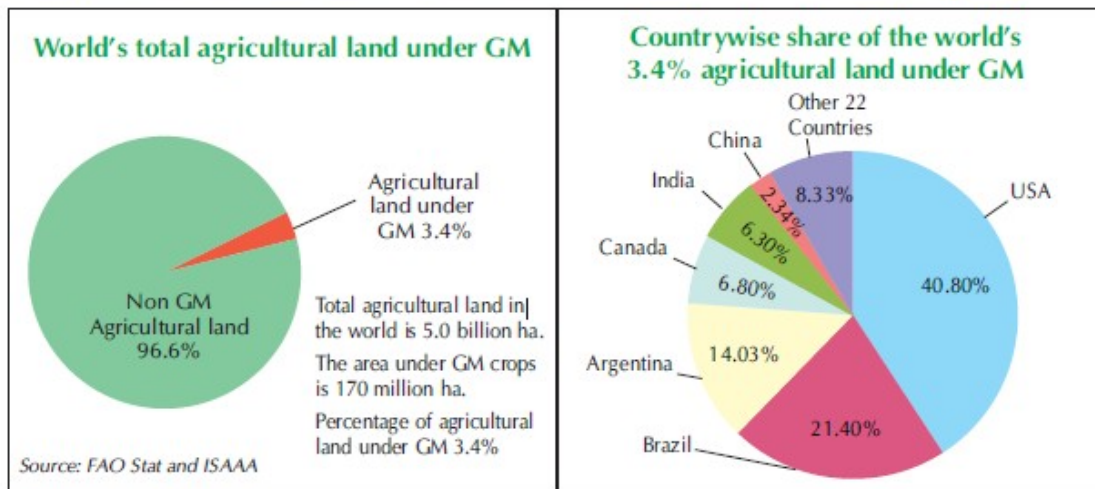
169. We made one serious intervention in the agriculture sector in the name of Green Revolution, by introducing high yield varieties. It had the desired effect; the production had gone up which was its sole motive. In the meantime, let us also accept that it was the major factor that caused destruction of our agro-biodiversity and contamination of food. It is also to be noted that grown parallel to the food grains is the increasing application of chemical pesticides and the abundance of hospitals in the country. The health impacts and the loss of biodiversity as a result of Green Revolution have not yet been assessed. However, it has become a history now. GM is the second major intervention which is at its initial stage.
170. In this context, one major point to be noted is that the soil polluted by chemical farming, if left fallow for couple of years, can be converted for organic farming. The chemicals will break down with varying periods, although some of them persist for decades. Contrary to this, genetic pollution through GM crops can alter the life in the soil forever. Therefore, potential harm from GM is more severe than from chemical farming.
171. Another striking difference between the 'green revolution' and the current 'gene revolution' of genetic engineering is that the participants of the green revolution was scientists of public research institutions and farmers of India dedicated to increase India's agricultural productions, whereas those in the gene revolution are a few multinational biotech giants from the West whose interest is only to make profitable business.

### XXIII. World organizations' and distinguished scientists' valued opinion on GM

172. IUCN, the largest conservation body in the world, at its World Congress in 2004 at Bangkok asked for a moratorium on further release of GM organisms until such time that they can be demonstrated, beyond any reasonable doubt, to be safe for biodiversity, human health, and animal health.
173. The UN Agriculture Assessment (also known as IAASTD – International Assessment of Agricultural Science and Technology for Development) sponsored by the World Bank in partnership with the UN Food and Agriculture Organisation, the UN Environment Programme, the UN Development Programme, the World Health Organisation, governments, civil society, private sector and scientific institutions [<http://www.agassessment.org>], altogether consisting of 400 agricultural scientists from various countries, says that *“such techniques as genetic engineering are no solution for soaring food prices, hunger and poverty.”* It further says that “there is the urgent need to move away from destructive and chemical-dependent industrial agriculture and to adopt environmental modern farming methods that champion biodiversity and benefit local communities.” Learned opinion of 400 eminent scientists across the world, including India should certainly prevail over the commercial interests of multinational corporate bodies.
174. **The UN Special Rapporteur, Olivier de Schutter in his reports** “Agro-ecology and the Right to Food”, presented at the 16th Session of the United Nations Human Rights Council [A/HRC/16/49] and “Seed policies and the right to food: enhancing agro-biodiversity and encouraging innovation” presented to the UN General Assembly (64th session) (UN doc. A/64/170) state that *“States should implement public policies supporting the adoption of agro-ecological practices by “making reference to agro-ecology and sustainable agriculture in national strategies...”*
175. M. S. Swaminathan while concluding his remarks on GM crops warns that “initiation of exploitive agriculture without a proper understanding of the various consequences of every one of the changes introduced into traditional agriculture, and without first building up a proper scientific and training base to sustain it, may only lead us, in the long run, into an era of agricultural disaster rather than one of agricultural prosperity.”

176. In the present context, we have substantial quantum of data to reject the GM technology in order to avoid an era of 'agricultural disaster'
177. The Biotechnology Task Force Report of 2004 by M. S Swaminathan recommended that biodiversity hot-spots like the Western Ghats should be kept free of GM crops. The Task Force further recommended that other agro-biodiversity rich regions in the country should also be kept GM free. This means most of the states have to be protected from GM contamination. Such protection of particular state surrounded by states with GM crops is just impossible and impracticable because of the inadvertent gene transfer by various means explained earlier.
178. It may be noted that the US Food and Drug Administration does not approve of any GM crop as safe for human consumption.
179. European Parliament has asked for a ban on introduction of GM organisms and evaluation of the potential threats posed by the GM introduction.
180. Nobel laureate in medicine, Dr. George Wald out-richtly rejects GM technology saying that *"Recombinant DNA technology faces our Society with problems unprecedented not only in the history of science, but of life on Earth. It places in human hands the capacity to redesign living organisms, the products of three billion years of evolution. Such intervention must not be confused with previous intrusions upon the natural order of living organisms: animal and plant breeding .....All the earlier procedures worked within single or closely related species ....Our morality up to now has been to go ahead without restriction to learn all that we can about nature. Restructuring nature was not part of the bargain. This direction may be not only unwise, but dangerous. Potentially, it could breed new animal and plant diseases, new sources of cancer, novel epidemics"*
181. The Standing Committee should consider, if the GM crops and foods are safe in all angles such as human health, environment, biodiversity, and profitability to the farmers, solution for hunger, then why is that the entire world is not accepting this magic technology? Why is it confined only to 170 million ha (3.4%) of the total agricultural area of 5 billion ha in the world?. Why is that some of the countries which have accepted it are now banning the GM crops and foods?

## Global status of GM crops



182. Many countries which have welcomed the GM crops and food have realized the dangers and banned partially or fully various GM crops/food in their which include Italy. Austria, France, Germany, Luxembourg, Portugal, Greece, Spain, Switzerland, Norway, Australia, New Zealand, Thailand, Philippines, Saudi Arabia, Egypt, Algeria, Brazil, Paraguay

183. In UK the Church of England has refused permission for GE crop trials on 60,000 ha of its land, dozens of local authorities supply GE free school lunches, the House of Commons banned GE foods for its catering



184. In the USA various bills have passed calling for moratoria on GE food in North Dakota, Montana, ban of GE crops in City of Boulder/Colorado; and also urged the federal government to ban GE food in City and County of San Francisco/California
185. Bypassing all these lessons, experiences and warnings, if we opt for GM crops, it amounts to consciously accepting a perennial disaster and evil. In other words, we are deliberately destroying our own biodiversity and diversity of food, inviting unknown diseases, and pushing farmers to increasing financial burden and, causing irrevocable damage to our farming system evolved over millennia. Above all, ushering in GM crop is synonymous with ushering in multinational corporate bodies and prostrating the nation's food sovereignty at their feet. It certainly is an insult to the conscience of this great nation.
186. In case, the Government is adamant to introduce the GM crops forcefully with the backing of the proposed draconian bill (BRAI 2013), depending totally on the unfounded claims of the multinational corporate bodies that the GM would be the solution for hunger and that it would not cause any negative impacts on agriculture, biodiversity, ecology, environment and health, while unmindful of all the deleterious impacts hitherto known and recorded, the Government must change Section 79 of the proposed bill which reads as “ *No suit, prosecution, or other legal proceedings shall lie against the Central Government, the Authority and other bodies constituted under this Act or any officer of the Central government, or any member, Chief Regulatory Officers and other employees of such Authority and bodies or any other officer acting under this Act for anything which is in good faith done or intended to be done under this Act or the rules or regulations made thereunder.*”
187. Although such provision is seen in certain Acts, the present case is totally different, because here the Bill is brought in knowing full well the adverse impacts of the GM crops, and that PAC on agriculture, Supreme Court's Technical Expert panel, some of the top most scientists and, the citizens of this country have intimated the Government against it. Therefore, the action is done here not with good faith and hence, the officers responsible are liable to be punished. Therefore, Section 79 may have to be amended as “*in the aftermath of the introduction of GM crop, if anything untoward happens, such as health problems caused by GM crop or food, loss of biodiversity, genetic contamination, poor yield compared to pre-GM period, negative impacts on environment and economic loss to the farmers due to GM crop, the officials involved in the introduction of GM crop, including the members and Chairman of the Biotechnology Regulatory*

*Authority, its senior officials and the concerned Minister should be made responsible and accountable for it and given life imprisonment and a fine amounting to the amount accumulated in the PF of the respective officers”*

188. However, whatever may be the punishment given to those who are responsible for the crime, it will not undo the damage done; as the damages are irrevocable.
  
189. In the light of the massive data on the negative impacts of the GM crops and foods, it would only be prudent for the nation to take a precautionary action: impose a moratorium on GM crops and food for the next 50 years. Let the world debate over it and come to a conclusion. Let us learn the impacts of GM in countries which have gone for it.
  
190. If the Government is very particular to push through the BRAI, Salim Ali Foundation requests the Chairman and Members of the Standing Committee to exclude GM crops and foods from the BRAI Bill 2013. It should be made to control effectively other applications of biotechnology (except GM crops and foods, as India has to be GM free).

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