



PROFITING FROM BIOTECHNOLOGY

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From Bio-politics to Selecting Human Genes

Use of S&T is a political decision

M. Foucault's concept of bio-politics is largely derived from his own notion of **bio-power**, and the extension of state power over both the physical and political bodies of a population. These examples include "ratio of births to deaths, the rate of reproduction, the fertility of a population, and so on." other examples include the development of vaccines and medicines dealing with public hygiene allowed death to be held (and/or withheld) from certain populations.

Today, nature has become a rewritable text that is ever open to change. This is a political process. On one hand, based on genetics we are able to predict and isolate genes responsible for disabilities and offer possible cures through stem therapy or gene mutation. On the other hand, technology of prenatal sex selection tests have resulted in feticide of girls for sometime.

What kind of Scientific Selection?

Biology can no longer be considered a fundamental given. We have an ***ecology+ revolution*** happening.

Biotechnology involving cellular procedures has been there for some time. In contrast, **genetic engineering** is a powerful technique which draw on advances in molecular biology, biochemistry and genetics.



What is Biotechnology?

The OECD defines biotechnology as "the application of scientific and engineering principles to the processing of materials by biological agents"
[<http://www.europabio.org/what-biotechnology>]

Biotechnology is defined by the American Chemical Society as the application of biological organisms, systems, or processes by various industries to learning about the science of life and the improvement of the value of materials and organisms such as pharmaceuticals, crops, and livestock.

Biotechnology is the research and development in the laboratory using bioinformatics for exploration, extraction, exploitation and production from any living organisms and any source of biomass by means of biochemical engineering where high value-added products could be planned (reproduced by biosynthesis, for example), forecasted, formulated, developed, manufactured and marketed for the purpose of sustainable operations (for the return from bottomless initial investment on R & D) and gaining durable patents rights (for exclusives rights for sales, and prior to this to receive national and international approval from the results on animal experiment and human experiment, especially on the pharmaceutical branch of biotechnology to prevent any undetected side-effects or safety concerns by using the products).

Refer to <http://www.public.asu.edu/~langland/biotech-intro.html>, accessed on 13 Feb 2014.

Promise and Myth of Biotechnology

- BST [Bovine Soma Totropin] is considered the first-generation output of biotechnology. It is produced artificially by genetically engineered bacteria and injected into cows for higher milk production.

- Documentation on how BST led to deterioration of health of cows & side-effects on human consumption. Hence few countries have now banned.

“Increasing levels of this hormone boosts milk production, causing a number of problems with the milk, among them, raising levels of pus, antibiotics residues and a cancer-accelerating hormone called IGF-1” [see, <http://www.ejnet.org/bgh/nogood.html>, accessed on 13 Feb 2014].

- How do we distinguish between BST milk and non-BST milk? No tests exist.

Genetic engineering

Genetic engineering, also called genetic modification, **is the direct manipulation of an organism's genome using biotechnology.**

New DNA may be inserted in the host genome by first isolating and copying the genetic material of interest using molecular cloning methods to generate a DNA sequence, or by synthesizing the DNA, and then inserting this construct into the host organism. Genes may be removed, or "knocked out", using a nuclease.

Gene targeting is a different technique that uses homologous recombination to change an endogenous gene, and can be used to delete a gene, remove exons, add a gene, or introduce point mutations.

An organism that is generated through genetic engineering is considered to be a **genetically modified organism** (GMO). The first GMOs were bacteria in 1973; GM mice were generated in 1974. Insulin-producing bacteria were commercialized in 1982 and genetically modified food has been sold since 1994. Glofish, the first GMO designed as a pet, was first sold in the United States December in 2003.

Refer to http://en.wikipedia.org/wiki/Genetic_engineering, accessed on 13 Feb 2014.

Genomic imagination

Genomics is reformulating the relationship between the natural and the social world.

Recombinant DNA technology that allows genes to be moved around between organisms and shape novel forms has become a central focus of debate on biohazards [science fiction films such as Aliens, Resident Evil do document such anxieties].



Remodeling Humanity

New models of human are being experimented with study of gene pools, genetic engineering, isolation of genes responsible for behavior traits/mental disorders/physical disabilities/specific 'genius' abilities and gene sequencing [also Race]

Biological future might shift from chance to conscious design and choice [just like we choose computers with specific configurations we will choose our children to exhibit certain specifications] – we will be redesigning '*healthier, smarter*' humans

Bio-script may possibly be used for human manufacture



Is this desirable and ethical?

Do we need to pause and re-think?

Should there be limits and if yes, then who will set these limits?


GMOs

- Genetically modified crops have become part of our everyday consumption.
- MNCs have become major players in agri-business and are going to control our food supply and price of food. Companies like Monsanto, Ciba Geigy, Hoechst will control the economy.
- Bio-imperialism is happening and being facilitated by agribusiness MNCs such as Monsanto and pharmaceutical companies.
- There is increased demand for bio-labeling. There is demand for more research before biotechnology products are released and considered safe for consumption.
- Biotechnology will diminish genetic diversity and increase genetic vulnerability.

Truth about GMOs – are they safe?

- Genetic engineering of food - Changing nature to make it industrially productive – is this a risk worth taking?
- Need for further research and trials
- Issue of patenting rights
- Seeds of Death – truth about GMOs [tutorial activity]

<https://www.youtube.com/watch?v=a6OxbpLwEjQ>, accessed on 6 March 2023

A stylized, dark brown illustration of a plant with several large, pointed leaves and a cluster of small, round fruits or berries on a thin stem, positioned on the left side of the slide.

Biotechnology has been around for quite some time – does it represents a technological advance and example of human victory over nature – or is it an expression of another human folly?

BIOTECHNOLOGY AND ITS COMMERCIALIZATION

THE WORLD ACCORDING TO MONSANTO



**FROM DIOXIN TO
GENETICALLY MODIFIED CROPS
A MULTINATIONAL WITH YOUR
BEST INTERESTS AT HEART**

Fortune 500 Company

Headquarters: St. Louis, Missouri,
United States

Products:

Agricultural and vegetable seeds

Plant biotechnology traits

Crop protection chemicals

Globally:

21,183 employees

404 facilities in 66 countries

United States:

10,277 employees

146 facilities in 33 states

<http://www.monsanto.com/whoweare/Pages/default.aspx>, accessed on
13/2/2014

Monsanto: New Vision for Agriculture

- Monsanto is a **sustainable agriculture company**. We deliver agricultural products that support farmers all around the world.
- We are focused on empowering farmers—large and small—to produce more from their land while conserving more of our world's natural resources such as water and energy. ***We do this with our leading seed brands in crops like corn, cotton, oilseeds and fruits and vegetables.*** We also produce leading in-the-seed trait technologies for farmers, which are aimed at protecting their yield, supporting their on-farm efficiency and reducing their on-farm costs.
- We strive to make our products available to farmers throughout the world by broadly licensing our seed and trait technologies to other companies. In addition to our seeds and traits business, we also manufacture Roundup® and other herbicides used by farmers, consumers and lawn-and-garden professionals.
- Monsanto could not exist without farmers. They are our customers--the lifeblood of our company. More important, they are the support system of the world's economy, working day in and day out to feed, clothe and provide energy for our world.
- In sept 2016 acquired by Bayer [German company] and Monsanto name was discontinued.

Refer to <http://www.monsanto.com/whoweare/Pages/default.aspx>

Corporatization of Science

<http://www.monsanto.com/whoweare/Pages/monsanto-history.aspx>

We are committed to developing the technologies that enable farmers to produce more crops while conserving more of the natural resources that are essential to their success.

Producing more. Conserving more. Improving lives.

That's sustainable agriculture. And that's what Monsanto is all about.



Enhancing productivity of cash crops



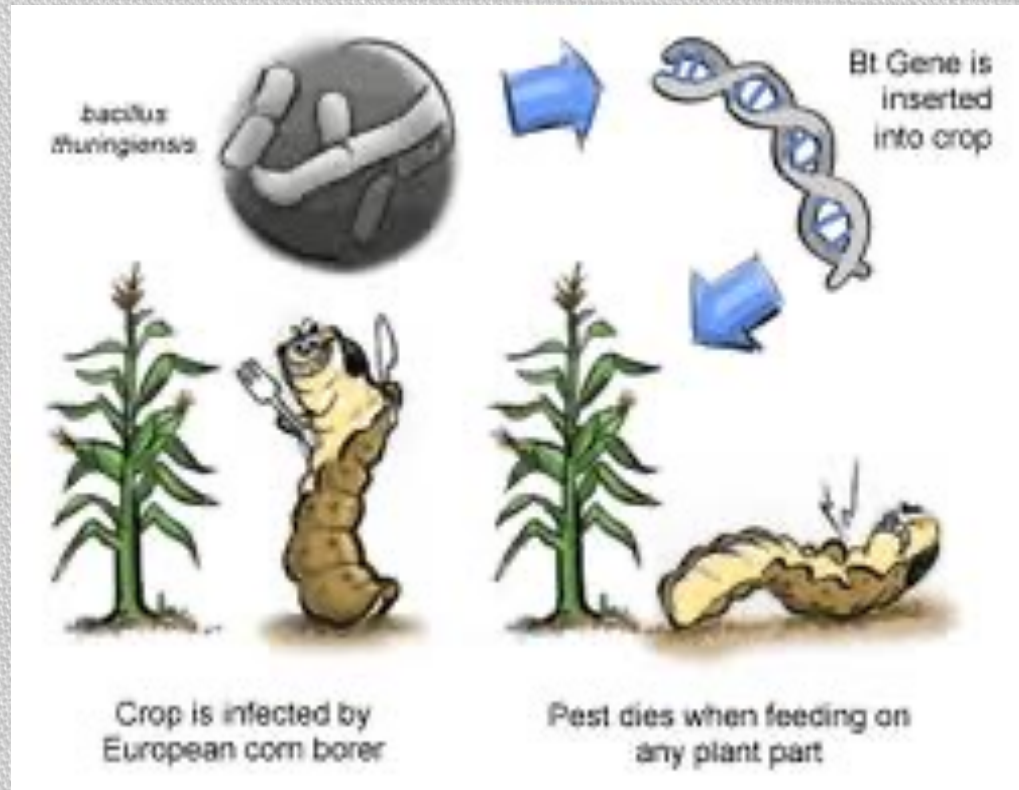
Who is a farmer in India? [P. Sainath]

- Myth: We believe more than 50% of India's population are farmers.
- Rural workers account for nearly 70% of all workers – they do consist of farmer, agricultural laborers, non-farmers, people engaged in fisheries, and artisans.
- 2012 reports reveal declining number of main workers who are farmers.
- Who officially gets counted as a farmer? Census of 2011 tells us that we have 95.8 million cultivators for whom farming is their main occupation – comprising less than 8 per cent of the total population. These people report farming as their main occupation for at least half the year, and operates a piece of land which they may or may not own themselves.
- If we include marginal cultivators (22.8 million), then that is less than 10% of the population.
- If we add agricultural laborers then number would be 263 million or 22 per cent of India's total population.

Cotton

- One of the most important cash crops of India is cotton – remember the British came to India for cotton and Manchester mills depended on India for this raw material
- India is the third largest producer of cotton after China and US
- Nearly 15 million farmers spread over 10 states are dependent on cotton cultivation for their livelihood.
- Cotton yield is low in India due to pest ravages and its production in rain-fed areas which impact productivity.
- Controlling bollworms has been a persistent problem for cotton farmers throughout the country.

Magic of Bt [Bacillus Thuringiensis] gene



2002

- 2002: India officially permitted cultivation of Bt cotton [first genetically modified crop] containing the toxin *Bacillus thuringiensis* that can resist bollworms.
- 2007: India had the largest world area under Bt cotton – approx 6.2 hectares. By 2008, Bt cotton was being cultivated in more than 10 states with Andhra Pradesh, Gujarat, and Maharashtra leading in total acreage
- From 29415 hectares in 2002, the area under Bt cultivation has expanded to 7,605,000 (7.6 Million) hectares in 2008.
- Critics accuse Bt cotton to be responsible for increasing economic distress among farmers and abetting suicides [P. Sainath]. Many such reports are under circulation and activists have launched various campaigns to educate farmers and policy makers about the impact of GMOs.

False Accusation or Truth?



Farmers suicides - statistics

- We do not have any directly reported statistics showing direct relationship between Bt cotton and farmers suicides in India.
- What are the sources of data available? Two have been cited - Indiastat and National Crime Records Bureau [NRCB].
- Use NRCB to look at suicide data – roughly annual rate is between 95,800 – 118,200 persons during 1997-2007. Of these farmers suicide lies between 13,600 – 18,300 persons annually. Figures indicate a rising trend and farmers rate is not higher than other types [Figure 2]

Linking Bt cotton to Farmers Suicides

Three hypothesis have been postulated and examined by a study:

1. Farmers suicides is a long-term phenomenon and there is no clear or direct relationship between Bt cotton and resurgence of farmers suicide during 2002-2007.
2. Bt cotton is neither a necessary nor a sufficient cause of farmers' suicides. Many other factors [other than agriculture] have played a critical role here.
3. Bt cotton is a technology and can not be blamed. It is the context in which it was introduced or planted such as specific regions and years which might have indirectly contributed to farmer indebtedness [due to crop failure] potentially leading to suicides.

Disaggregated data

- Data on suicides for four cotton producing states - Maharashtra, Madhya Pradesh, Andhra Pradesh, and Karnataka – has often been used to show the correlation between Bt Cotton and farmers suicides. These four states account for nearly 52-65 per cent of total reported farmers suicides and significant number (40 per cent in 2001) of total suicides.
- Maharashtra has a higher share among all four – total and farmers.

Rise of Bt Cotton

- Does the adoption of Bt cotton and its rapid expansion indicate its commercial success? Has Bt cotton increased productivity?
- Productivity reported reached highest levels: 300-400 kgs in 2001 to 500-700 kilograms per hectare in 2007.
- According to the Cotton Advisory Board, Bt cotton has been the major factor behind increased cotton production – rising from 15.8 million bales in 2001-02 to 31.5 million bales in 2007-07.
- Traditionally, cotton was cultivated in rain-fed areas. However, Bt cotton has been grown largely in irrigated areas partly due to high costs of seeds.
- Data on productivity indicates variability across regions and states. One of the reasons for rise of productivity could be absence of technical or climate shocks (such as monsoon failure). Regional data indicates Bt cotton had a greater impact in Maharashtra and Gujarat than other states.

Analysis of regional productivity

Disaggregated picture:

- Highly successful: Gujarat, Tamil Nadu, Madhya Pradesh
- Significant net gains: Maharashtra and Karnataka [higher production costs are offset by higher yields]
- Insignificant gains: Andhra Pradesh [high pesticide costs and not much gain due to insignificant effect on price].

Largest number of reported farmers suicides were in Maharashtra and Andhra Pradesh.

Inadequate Data

How accurate are secondary assessments?

There are no numbers on the actual share of farmers committing suicide who cultivated cotton, let alone Bt cotton, and among them, those who committed suicide because their Bt cotton crop failed.

- Case study of Maharashtra – esp due to the importance of cotton sector here. Figures indicate – growth in farmers suicides started much before Bt cotton and actually slowed down after the introduction of Bt cotton.
- Case study of Andhra Pradesh is ambiguous – linear rise in farmers suicides during the entire period – after the introduction of Bt cotton.
- Case Study of Gujarat gives a different picture – high adoption of Bt cotton while there have been low and stable suicide rates
- *Bt technology is neither a sufficient nor necessary cause of farmers suicides. What we can not reject is the potential role of Bt cotton varieties in certain states and years such as 2002, 2004, and 2006 in Andhra Pradesh and Maharashtra.*

Empirical study of 4 blocks in 2 districts of Maharashtra (A. Narayanamoorthy and S.S. Kalamkar, 2006)

- Sample of 150 Bt growers and 50 non-Bt farmers
- Bt variety is scale neutral
- Due to high costs of seeds, farmers do not want to take the risk of cultivating Bt variety in rain-fed areas where output is not assured.
- Price factor – initial investment
 - Price of seeds of Bt varieties is Rs 1450-1600 per acre
 - Price of seeds of conventional hybrid varieties is Rs 325-450 per acre

cultivating Bt seeds

- Bt is a cost-intensive crop: Higher productivity of Bt is also connected with higher use of manure and fertilizers, higher use of pesticides, costs of irrigation, and labour inputs .
- Average cost of productivity is Rs 26067 for Bt cotton and Rs 19,344 for non-Bt cotton (2006 study): difference of 34%
- Studies indicate Bt is a profitable crop – Bt yields higher profit than non-bt varieties; difference can be as high as 80 per cent.
- Bt is profitable not because of higher price of cotton but due to improved production (A. Narayanamoorthy and S.S. Kalamkar, 2006).

Adopting and Adapting to new seed-technology

Bottlenecks in adoption is lack of education & information dissemination:

- Farmers have lacked information on growing conditions, pesticide use and seed technology impacted their success in adoption of Bt cotton and the performance of BT crop.
- Farmers continued to use similar amounts of high-priced pesticides on Bt cotton further increasing costs of production and reducing their profit margins. Nearly half of what the farmers used to do was required under Bt varieties [studies indicate reduction in pesticide use and sprays by 30-40 per cent]. Farmers did not want to take any risks given the investment in purchase of Bt seeds.
- Indiscriminate spraying has led to development of resistance in bollworm and pest infestation returned lowering productivity in later years. This also created health hazards and caused environmental pollution – contamination of water table.

Spurious seeds

- Bt seeds are expensive so there exists a spurious seed market that grew up and targeted farmers wanting to save seed costs. There was no process of seed certification so many farmers were duped with spurious seeds and had crop failure.
- A large number of Bt varieties added confusion between real and fake seeds.
- If farmers planting spurious Bt seeds had low productivity or there was crop failure, then Bt can not be blamed!

conclusion

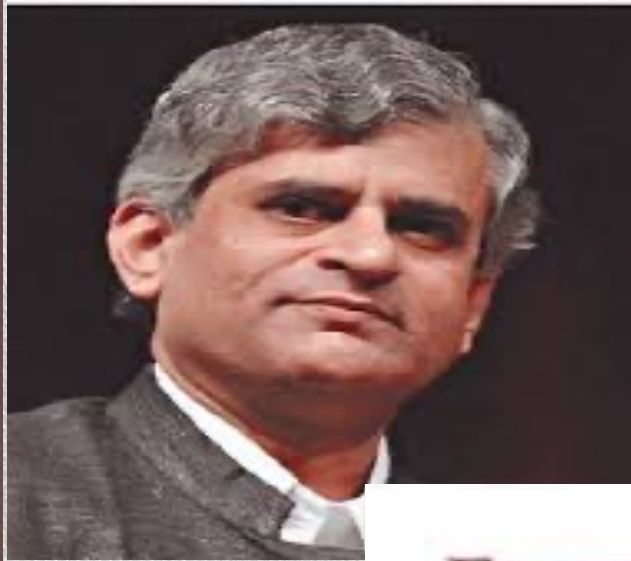
- “there is no direct connection between the suicides and adoption of expensive Bt technology”
- Marketing constraints and other socio-economic factors were directly connected rather than Bt per se.
- Farmers suicides are not new or specific to Bt technology.
- Put the blame on irresponsible journalism and media hype....

Palagummi Sainath [Rural Affairs Editor at the Hindu]

Roughly 200 exclusive field reports and news analysis and hundreds of photographs on the agrarian crises.

Amartya Sen regards him to be one of the world's great experts on famine and hunger.

This book won him the Magsaysay Award in 2007 in the category of Journalism, Literature and Creative Communication Arts



Everybody loves a good drought

Stories from India's Poorest Districts

'Journalism of a high order: pointed, well researched... alive with passion and thought... deserves the widest readership.'
—Sudh Khilwani, author of *The Idea of India*

P. Sainath

Winner of Thirteen Awards



critics

Seeds purchased from companies like Monsanto are also engineered with “terminator technology,” which means plants produce sterile seeds after only one season. Farmers, already in debt because of the high price of “superior” GM seeds, are thereby forced to buy more seeds for the next harvest. <http://www.care2.com/causes/monsanto-blamed-for-200-000-farmer-suicides.html#ixzz2ZsCrBE9p>

A study from the Union of Concerned Scientists shows that genetically engineered crops do not produce larger harvests. Crop yield increases in recent years have almost entirely been due to improved farming or traditional plant breeding, despite more than 3,000 field trials of GM crops.

<http://www.scientificamerican.com/podcast/episode.cfm?id=can-genetically-modified-crops-feed-09-04-16>

Bitter Seeds

Bitter Seeds is a 2011 documentary film by American filmmaker and director and political commentator Micha Peled.

Trailer - https://www.youtube.com/watch?v=QZtKB_KuASc

Micha Peled's documentary exposé on BT farming in India reveals the true impact of genetically modified cotton on India's farmers, with a suicide rate of over a quarter million BT cotton farmers each year due to financial stress resulting from massive crop failure and the exorbitantly high price of Monsanto's proprietary BT seed. The film also refutes false claims purported by the biotech industry that BT cotton requires less pesticide and empty promises of higher yields, as farmers discover the bitter truth that in reality BT cotton in fact requires a great deal more pesticide than organic cotton, and often suffer higher levels of infestation by Mealybug resulting in devastating crop losses, and extreme financial and psychological stress on cotton farmers. Due to the biotech seed monopoly in India, where BT cotton seed has become the ubiquitous standard, and organic seed has become absolutely unobtainable, thus coercing all cotton farmers into signing BT cotton seed purchase agreements which enforce the intellectual property interests of the biotech multinational corporation Monsanto.

The documentary film won the Green Screen Award (2011), the Oxfam Global Justice Award (2011), the Humanitas Award (2012) and the International Green Film Award (2013).

Growing Agrarian Crises

- An agrarian crises is reflected in the rising incidence of farmers suicides in the 1990s. Why?

[see - <http://www.youtube.com/watch?v=W9hAMWQU0QA>]

- P. Sainath (2011) Farmers Suicides are a consequence of the agrarian crises [<http://www.youtube.com/watch?v=RaGZHBIWpU0>]
- Excerepts: <https://www.youtube.com/watch?v=rQh56k1XtdU>

Socio-economic Causes of Farmers Suicides (1)

- Scholars argue that a complex set of socio-economic factors play a role or are responsible for farmers suicides.
- Many areas that earlier focused on rain-fed low cost food crops have shifted to high-cost cash crop cultivation with expansion or greater dependence on irrigation. Digging of wells is another cost that needs to be factored in. Charges of electricity and drawing of water has increased costs of cultivation.
- Costs of cultivation have risen considerably requiring larger investments in fertilizers, seeds, pesticides, farm equipment and labour costs. While costs of agricultural produce have not risen as much – loss of competitiveness.
- Successive bad seasons/low yields due to weather and high costs of cultivation followed by low cotton prices increased rural indebtedness significantly.

Socio-economic Causes of Farmers Suicides (2)

- Most important factor is the heavy indebtedness of farmers which is worsened by crop failure or agrarian crises (failure of monsoons, insect infestation, spread of disease and unpredictable weather). Institutional credit availability is low in the rural sector making the farmers dependent on loan sharks. Most farmers who committed suicides in Maharashtra and Andhra Pradesh had unpaid loans taken at high interest from local moneylenders. Nearly 80 per cent of the agricultural loans or credit taken come from non-institutional sources [many political parties have waived loans as part of their electoral promises]
- Breakdown of rural institutions and absence of alternate livelihood opportunities to mitigate losses have also propelled such an extreme step.

Climatic and Economic Factors played an important role

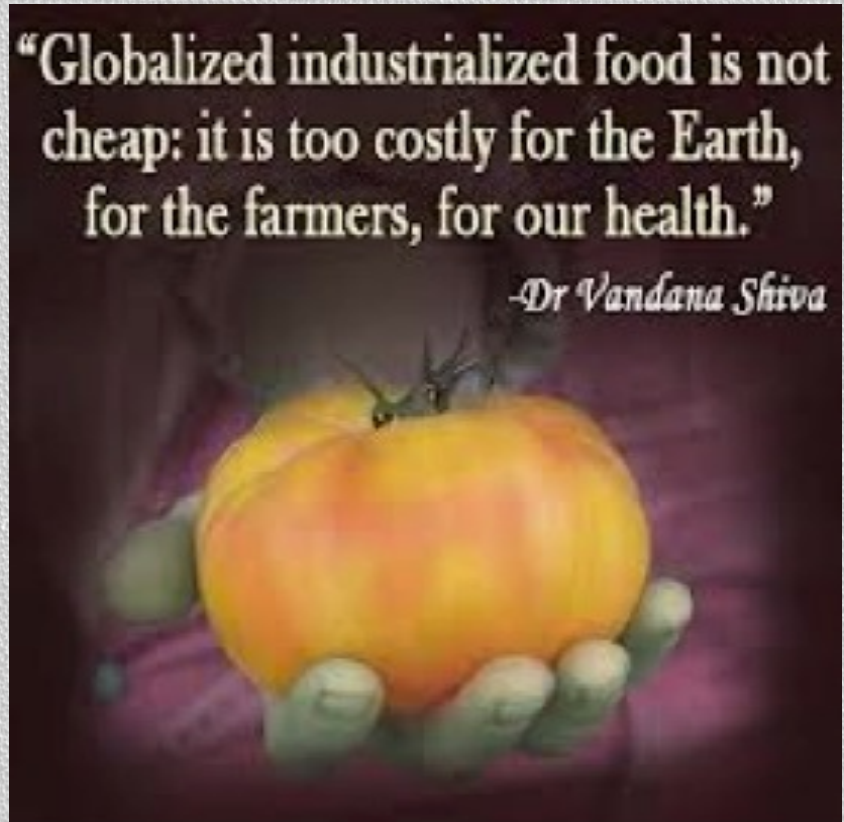
- Social factors – loss of standing and status and harassment suffered at hands of moneylenders, medical bills, and sometimes failure to meet family expectations added to the distress of farmers.
- Ex-gratia payments to families of victims by state government who committed suicides also encouraged some to take this extreme step. *Peepli Live* [A young debt-burdened farmer named Natha is talked into taking his own life after he learns that his family will be financially compensated through a government program created to alleviate the loss of farmers taking their own lives]

Loan waiver schemes for small and marginal farmers were announced by govt from time to time

Organization of Global Dissent: Vandana Shiva

**“Globalized industrialized food is not
cheap: it is too costly for the Earth,
for the farmers, for our health.”**

-Dr Vandana Shiva



25 may 2013 – discussion on GMOs

World wide march against Monsanto

[<https://www.youtube.com/watch?v=YIbl0SMryVY>]

- DTE report, more than a million people spread around in 36 countries and over 250 cities marched against the biotech giant Monsanto on 25 may 2013.
- Marches were held at Delhi and Bengaluru in India.
- Studies have shown that GM crops can lead to formation of tumors, infertility, and birth defects
- Companies like Monsanto via GM seeds are taking control of our food supply and making organic farming and small farmers incur losses making them unviable operations. Monsanto is also controlling the price of food by controlling its supply. Using legislations to get patents on seeds and genetic make-up of seeds.
- Demanding further scientific research on the health effects of GMOs.
- NGOs are urging people to buy organic food and boycott Monsanto and other companies using GMOs.

Campaign against Genetically Modified Crops

Biotechnology Regulatory of India Bill: June 2013

- BRAI would become a single window for clearance on GM seeds/crops as it would deny the right to farmers and states to decide if they want field trials or GM crops to be introduced.
- Farmers, NGOs, members of several political parties CPI(M), Aam Aadmi Party etc have been agitating against regulation of GM crops when both farmers and consumers are opposing their introduction and profit seeking companies like Monsanto.
- NGOs have filed a PIL in the Supreme Court seeking safety mechanism and regulatory measures to be put in place and sought a 10 year moratorium period before further field trials are permitted for cultivating GM crops.

World Food Prize given to GMO scientists (July 2013)

- A selection committee comprising M.S. Swaminathan awarded the World Food Prize [250000\$] for 2013 to three scientists including M.V. Montagu (the CTO of Monsanto) and R.T. Fraley (Executive Vice President of Monsanto) and Mary Dell Chilton (founder and fellow of Syngenta Biotechnology).
- Citation declared them to be pioneers in new genetics who have opened new opportunities in achieving balance between human numbers and availability of food. Insertion of genes in crops led to development of pest-resistant high yielding GM crops.
- The prize is a mockery.
- Vandana Shiva of Navdanya: it's a prize from Monsanto to Monsanto because they are one of the sponsors of the award. Data on non-chemical ecological farming indicated good productivity and better nutrition.
- Suman Sahai of Gene campaign: biotechnology firms are not the answer to food security.
- Farmers lobby/Bhartiya Kisan Union – this is like mortgaging farming to MNCs.

References

Narayanamoorthy and S.S. Kalamkar, Is Bt cotton cultivation economically viable for Indian farmers?: An empirical analysis, *Economic and Political Weekly*, 2006.

G. Gruere and d. Sengupta, Bt cotton and Farmers Suicides in India: An evidence based assessment, *The Journal of Development Studies*, 2011.