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The Farmer Suicides in Maharashtra: Social and Environmental Perspective of GM Crops

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Abstract:
The suicide rate among farmers in India continues to rise in human history. According to the report titled "Every Thirty Minutes: Farmer Suicides, Human Rights, and the Agrarian Crisis in India" by the Center for Human Rights and Global Justice (CHRGJ)[1] at New York University estimates that on average, one farmer commits suicide every 30 minutes in India. The report focuses on the repeated failure of Genetically Modified (GM) crops responsible for the agrarian dilemma in recent years in certain states of Northern, Central and Southern India. The GM seeds are dominated by many protectionist designed multinational corporations such as Monsanto, Syngenta, Bayer, BASF, DuPont, and Dow Chemical.
The objectives of the paper are presented: *Firstly*, to analysis how the use of GM seeds and agrochemicals in cultivation has become a contentious issue, leading to farmers' suicides due to its detrimental impact on socio-economic structures. *Secondly*, to review how have GM crops and excessive use of agrochemicals have added a new aspect to the issue of environmental impact that occurred in the cotton cultivating region in past decades in Maharashtra.
Thirdly, the paper also investigates the important role played by an environmental non-governmental organisation (NGOs) like 'Navdanya' to resist the agri-business of GM seed and chemical insecticides. Navdanya undertook seed activism as the farmer's rights over seeds through the 'Seeds Sovereignty' campaigns. They also drew public and governmental attention towards environmental governance through several campaigns and initiatives.
The research study is based upon the hypothesis that the shift to the neoliberal model of agriculture has been contributed economic marginalization of Indian farmers as a form of 'social injustice'. This is reflected in the continued unsustainable cropping practices which have certainly increased the economic distress of farmers. On the other hand, the agriculture sector is fundamentally linked to the environment and is strongly interdependent. Hence, the adoption of extensive monoculture which was combined with the excessive application of pesticides has contributed to the negative agro-environmental impact through exposures to toxic residues which pose a hazard to humans and ecological integrity like soil and water.

Keywords: Environmental Justice, Globalisation, GM Crops, Farmer, Monsanto, Pesticide Seeds, Suicides

INTRODUCTION

The higher instance of suicide among farmers in India can be traced back to the early 1990s as one of the most debated issues. According to National Crime Records Bureau's (NCRB) report on 'Accidental Deaths & Suicides in India (ADSI), more than 300,000 farmers ended their lives from the period of 1995 to 2015—an average rate of 16,000 farmers every year. In recent years, the spurt in farmer suicides and an ecological problem around GM crop been reported in Maharashtra followed by a steady rise in Karnataka, Andhra Pradesh, Madhya Pradesh, Telangana and Punjab. Thus it is evident that most of the deaths occurred in cotton-growing states.

In particular, the NCRB data show that Maharashtra is the worst-hit state remains a grim state as the heartland continues to face an agrarian crisis and farmer suicides. The NCRB recorded a total of 55,266 farmers and agricultural labourers have committed suicides across rural India during the past five years. Maharashtra reported 19,174 farmers suicide from 2015-20.

The factors include GM seed, crop failure, excessive use of chemicals and fertilizers, bankruptcy or indebtedness, environmental problems, poor prices for crops produce, lack of new techniques and irrigation facilities. There are additional reasons such as drug abuse/alcoholic addiction, illness, and family problems as pointed out by NCRB.

Moreover, 'Navdanya' blames hybrid GM seeds Bt cotton became the conflicting reasons for farmers' suicides that have been driven by agribusiness companies - notably Multinational Companies (MNCs) like Monsanto which undermine farmers' interests. The farmer purchases its patented expensive cotton seeds which undermine farmers' rights over seed therefore named it 'Seed of Suicide'. Moreover, unsustainable agricultural practices cause many problems such as crop failure especially in cotton-growing belts resulted in farmers' suicides and environmental distress in the hinterland.

In the light of the above arguments, the paper examines the changing nature of farming patterns through the Green Revolution which subsequently deteriorated the situation since the mid-1990s by adopting Gene Revolution in agriculture. Is GM Bt cotton seed to be blamed for social and environmental injustices? Hence, the below section attempts to answer the above questions.

CHANGE OF FARMING PATTERN

Miracle Seed

Nobel Laureate Dr. Norman E Borlaug, an agricultural scientist was called "the father of the Green Revolution". He was awarded the 'Nobel Peace Prize' in 1970 for his contribution to developing HYVs of wheat.

Post-independence agricultural policy

India started industrial agricultural monoculture in the early 1950s and late 1960s. The objective was to attain food production, eliminate hunger, poverty reduction and foster India's economic development. Resultantly, the "Green Revolution", initiated by Borlaug, has changed India's image internationally as "a begging bowl to a bread basket" by increasing agricultural yields.

Later, this was intensified in the 1970s which was derived from the world order of globalisation. Thus, crop yields were increased considerably during its early years. Many High-yielding varieties (HYVs) of rice and wheat were acquainted by adopting modern methods and technology in agriculture. Hereinafter, by the 1970s, food grain production almost doubled and ensured food security in India.

The strive where it was first introduced in Punjab which is known as the 'Granary of India' or "India's bread-basket". However, there was an initial breakthrough witnessed in the region as showcased by the first wave of the Green Revolution. After a while, the region experience far-reaching consequences of monoculture cropping. The home of healthy and wealthy farmers was hit by unprecedented agrarian distress which is associated with increasing cases of farmer suicides in Punjab.

Poisoned Punjab and Health risk

In Punjab, the Malwa region cotton belt has been long labelled as India's "cancer capital" due to heavy metal toxicity and has the highest number of cancer cases. Studies have linked unusually high rates of cancer in this cotton-growing region due to the use of pesticides by cotton farmers. According to reports, Bhatinda's cancer institute revealed the number of cancer patients rise from 6,233 in 2016 to 10,109 in 2017 and then 10,648 in 2018 respectively. The region has a significant increase in many other pesticide-related diseases such as learning disability and reproductive disorders.

Even in the following years of endeavor, the repercussion was visible and has led to an unintended negative impact on the people's health and the environment worrisome indeed.

The present scenario in terms of health is the cause of serious concern with the application of pesticides. A wide range of health problems in this region is reported from neurological and reproductive disorders to chronic diseases like cancer especially, as evident in the Malwa region of Punjab.

On the other hand, the environmentally harmful agricultural practices like GM seed and overuse of chemicals also contributed to environmental and toxic damage to the soil and water- both surface and groundwater, vegetation, and wildlife of the region. A report from Bhabha Atomic Research Centre (BARC) in 2013[2] analysed fertiliser and soil samples from the Malwa region and discovered a heavy concentration of Uranium. According to the report, Uranium concentration in Diammonium Phosphate was about 91.77 parts per million, much more than the permissible limit. Hence, the state had fallen victim to the unforeseen social, environmental, and economic effects of the Green Revolution.

Besides this, other small cereal grains from cultivation such as millets and pulses have declined over the years. Furthermore, the widespread adoption of high-yielding crops also caused the disappearance of native seeds and local rice varieties, which took many generations to preserve this traditional knowledge. This has severely affected food security.

The region has witnessed widespread instances of suicide rates by farmers due to the increasing expenses on cultivating crops, indebtedness and crop loss. From 2015 and 2019, more than 1,320 farmers and agricultural labourers committed suicide in the region as per NCRB data.

Liberalisation in the agriculture sector in the 1990s

The Indian economy was entered a new phase of economic development in the early 1990s. The government liberalised the agricultural sector through significant policy reforms initiated by the World Bank and International Monetary Fund's structural adjustment program under the World Trade Organisation (WTO) thereby, opening up its markets for corporate goods. Hence, Green Revolution once again catalyzes through liberalisation of agriculture which was markedly different from the earlier phases. Thereby, Indian agriculture rapidly turned into an industrial system. This implies a shift towards commercial crops whereby the agriculture production patterns have changed from a grain-based production system toward high-value crops to achieve higher growth rates in productivity. Hence, the traditionally grown Indian crops have been increasingly diversified under neoliberal transformation.

Most importantly, under the neo-liberal economic order, a profit-driven corporation like Monsanto entered the Indian agriculture sector, wherein in the subsequent years, agricultural marketing has expanded from the Northern region to other agro-ecological areas like the Central and Southern regions of India.

Notably, the agro-giants caused hardship to farmers through their monopolistic practices of farming such as patented GM seeds and pesticides. Herein, India witnessed a Gene Revolution through GM Bt cotton, with the long-term goals of commercial food production, it has rather become the cause of misery for farmers in rural India. Instead of reducing crop failure and addressing the hazards to human health and the natural environment, it has acted in the reverse direction and threatens food security. Thus, this is the gradual economic marginalisation of the agricultural sector in the national policy that results in social

injustice due to widespread poverty. Whereas, high-cost GM seeds and continuous application of pesticides in the agricultural sector have given rise to various environmental problems.
Hence, unfortunately, both are collectively the cause of suicides in the countryside. These Bt cotton-growing regions now have tuned into suicide belts" triggered by the policies of globalisation and trade liberalisation. This has contributed to a crisis of livelihood, rising levels of suicide, destruction of diversity and environment, self-reliant agriculture deteriorated, and recurring hunger and malnutrition.

MONOPOLISATION OF THE GM SEED SECTOR

The opening of market-oriented agriculture from the 1990s led to the establishment of a seed monopoly in India. The agri-business is now dominated by a few major private entities. India is controlled by six multinationals agricultural biotechnology companies such as Monsanto, Syngenta, Bayer, BASF, DuPont, and Dow Chemical — accounting for 75% of the world's high-tech GM seeds and agrochemicals. According to Greenpeace, Monsanto and its GMO seeds have a 90% market share globally. These business giants push for hybrid seeds because of the potential for extract profits such as 'royalties' through seed trading.
Currently, there are more than 20 GM crops namely brinjal, mustard, potato, cauliflower, wheat, etc. are at the various stages of transgenic research and field trials for genetic modification. These Biotech crops are waiting for commercial agricultural production. At present, Bt. cotton is the only GM crop approved for commercial cultivation by the Genetic Engineering Appraisal Committee (GEAC) in 2002 in three different agro-ecological zones like southern and central zones of the country. The proportions of farmers growing cotton is high in regions, where Bt cotton is the most common GM crop.

GM CROP AND ADOPTION OF BT COTTON

Currently, India is the largest producer of cotton in the world and ranks first in its consumption and export. India's volume was about 6.42 million metric tons in the crop year 2019-2020. Other major cotton-producing countries include China 5.93, US 4.33, Brazil 2.91, Pakistan 1.35, Uzbekistan 7.62, Turkey 7.51, Greece 3.65, Mexico 3.42, and Argentina 3.05 respectively.

Table 1: Seed Sector: Penetration of GM Seeds (%) by Crop, India, 2018

Crop	GM Seed Penetration
Cotton	90-95%
Corn	60%
Maize	50%
Paddy and Wheat	5%
Vegetables	70%

Source: Mordor Intelligence Analysis, DAC, GoI

However, penetration is still very low at 5% in major cereals, such as paddy and wheat. According to the Ministry of Agriculture, since 2005, Bt cotton adoption has increased to 81% in 2007, and 93% in 2011, accounting for 90-95% of total cotton area and production in 2018, as shown in Table 1. At present, Bt hybrids cotton is grown mainly in the states[3] of Punjab, Haryana, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh Andhra Pradesh, Tamil Nadu and Karnataka.

Table 2 shows the year-wise cultivation of GM Crops of Bt cotton in India. The area under Bt cotton has increased from 106.83 lakh hectares in 2015 to 117.47 lakh hectares from 2015-20. This signifies that there has been a steady increase in the area and production of Bt cotton except for minor fluctuations over a few years.

Table 2: Cultivation of GM Crops

Year	Area under cotton (in lakh hectare)	Area under Bt. cotton (in lakh hectare)	Production (in lakh bales)	Yield (kg per hectare)
2015-16	122.92	106.83	300.05	415
2016-17	108.28	89.43	325.77	511
2017-18	124.29	110.76	328.05	477
2018-19	126.58	117.81	287.08	386
2019-20*	125.84	117.47	322.67	436

Source: Ministry of Agriculture & Farmers Welfare, Government of India. * Directorate of Economics and Statistics

PESTICIDE USE IN AGRICULTURE

Despite widespread adoption of GM crops failed to control the pest attack and caused crop failure. It further contributed to social and economic hardship to farmers. Consequently, entailed the additional application of pesticides. This resulted in double jeopardy to our farmers through additional expenditure on high-cost Bt seeds and pesticides, wreaking havoc on the Indian cotton industry. There is now overwhelming evidence of a large amount of toxic pesticide consumption in cotton cultivation. According to the report, 'Body Burden 2015: State of India's Health' published by the Centre for Science and Environment mentioned that Maharashtra, Punjab, Andhra Pradesh, and Haryana are the top agricultural regions for the use of pesticides in search of agricultural produce in India. But, the pattern and consumption of agrochemicals usage in India are not similar under tropical climatic conditions.

The Indian plant protection market can be categorised into insecticides, herbicides, fungicides and others[4]. According to the Ministry of Chemical & Petrochemical Statistics, the Indian crop protection market is dominated by insecticides, which account for about 60% of the total demand, followed by fungicides and herbicides accounting for 18% and 16% of the agrochemicals market in India. Other agrochemicals mainly include fumigants, nematicides, etc. comprise 6% of the market share.

However, the data in Table 3 shows that there has been a noteworthy increase in the total and per hectare consumption of pesticides in India from 2015 to 2020. According to the Directorate of Plant Protection, consumption of pesticides in the country the total consumption of pesticides in the country increased from 58,221 MT (Tech. grade) during 2015-16 to 60,599 MT (Tech. Grade) during 2019-20.

Table 3: Year-wise chemical pesticide consumption in India
(Unit: Quantity in MT Tech. Grade)

Year	2015-16	2016-17	2017-18	2018-19	2019-20
The total chemical pesticide consumption in India	58,221	52,755	62,183	53,453	60,599

Source: Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Directorate Of Plant Protection, Quarantine & Storage, Government of India

Thus, the use of pesticides in agriculture has been an integral part of crop production in many regions, often at very high levels. The major applications are found in rice, wheat and cotton crops. Crop-wise, cotton accounts for the maximum share of pesticide consumption e.g around 45% and 22% followed by paddy, vegetable, pulses and wheat. The intensity of agrochemical usage has been found in different agro-climatic regions like Maharashtra, Andhra Pradesh and Punjab.

THE GM PACKAGE FAILED IN MAHARASHTRA

Access to Seed
Mahyco (Maharashtra Hybrid Seed Company), in collaboration with Monsanto, a US-based company has introduced Bt cotton technology into India. Mahyco Monsanto Biotech (India) (MMB) sells Bt technology to cottonseed companies under sub-licensed agreements. Maharashtra, Gujarat and Andhra Pradesh were early adopters of Bt Cotton.

This cotton contains genes from the bacterium Bacillus thuringiensis, and is, therefore, called Bt cotton. The long-awaited GM crop or three Bt cotton hybrids (MECH-12, MECH-162 and MECH-184) was officially commercialised in six cotton-growing states from 2002 namely Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, and Maharashtra and Tamil Nadu.

Bt cotton dominates 99.53% of the cotton-cropped area in Maharashtra. Bt gene as a 'Miracle Crop' was developed to combat pests that attack cotton, thereby increasing yields and reducing insecticide spray on the cotton plant. Thus, it was designed that would bring hope, promise, and expectations. However, the opposite happened in Maharashtra. Today, the most prosperous state from the Western region is facing a perpetual agrarian setback.

Table 4: State-wise area under Bt cotton cultivation
(Area in lakh hectare)

State	2015-16	2016-17	2017-18
Andhra Pradesh	6.50	4.59	6.41
Gujarat	26.23	20.25	22.49
Haryana	5.27	3.64	6.21
Karnataka	4.87	3.03	4.50
Maharashtra	34.40	32.35	37.86
Madhya Pradesh	4.86	5.39	4.82
Punjab	3.33	2.43	2.86
Rajasthan	3.56	2.87	4.96
Tamil Nadu	0.99	1.08	1.80
Total Area	**106.62**	**89.43**	**110.75**

Source: Ministry of Agriculture & Farmers Welfare

While state-wise Bt cotton cultivation in 2017-18, as shown by Table 4, Maharashtra stood first in area coverage with 37.86 lakh ha followed by Gujarat with 22.49 lakh ha as the second-highest area under Bt cotton during 2017-18.

Specifically, Vidarbha is the highest producer of cotton in the state, followed by Marathwada and Khandesh according to Table 5.

Table 5: Cotton Production In Maharashtra, 2016-17

Region	Production (in million bales)
Vidarbha (9 eastern and northeastern districts)	4.73
Marathwada (8 central and south-central districts)	3.76
Khandesh (5 northern and north-central districts)	2.26

Source: Department of Agriculture, Maharashtra

State-wise Maharashtra per hectare consumed the most pesticides in India as shown by Table 6. In the past five years at 73,921 tonnes, followed by Punjab at 33,648 tonnes and Haryana at 24,460 tonnes, according to the Ministry of Chemical and Fertilizers, Government of India. Thereby, the cotton industry relies heavily on chemicals, such as fertilizers, insecticides and herbicides.

Table 6: Consumption of chemical pesticides in various states/UTs (Unit: Metric Ton Technical Grade)						
States	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**Total**
Andhra Pradesh	2713	2015	1738	1689	1559	13,764
Gujarat	1980	1713	1692	1608	1784	10,507
Haryana	4100	4050	4025	4015	4200	24,460
Karnataka	1434	1288	1502	1524	1568	9,109
Maharashtra	11665	13496	15568	11746	12783	73,921
Madhya Pradesh	732	694	502	540	540	3,704
Punjab	5743	5843	5835	5543	4995	33,648
Rajasthan	2475	2269	2307	2290	2088	14,123
Tamil Nadu	2096	2092	1929	1901	2225	12,339
Source: Ministry of Chemical and Fertilizers, Government of India.						

Thus, crop failure led to a complex agricultural predicament in the region, but, if we look at it from the prism of health and environmental concerns, the debate on pesticide use continues.

SOCIAL AND ENVIRONMENTAL COST OF GM CROPS

Maharashtra is facing an unprecedented socio-economic catastrophe due to 'Gene Revolution' technologies. The 'Miracle Crop' became a 'Suicide Crop' as cotton became an input-intensive crop. The section examines the economic and ecological condition of Maharashtra through the lens of social and environmental justice.

Social justice

Although it has been more than eighteen years since the adoption of Bt cotton, it still oscillates between success and failure. The introduction of GM crops is associated with agronomy and as a source of livelihood for the farmers. In other words, besides an economic dimension, it also has a social dimension as an important factor of farmer suicides as a manifestation of social injustice.

Pest attack: Pink bollworm

In the year 2018, about 40 lakh hectares of the cotton crop in Vidarbha and Marathwada were destroyed by the pink bollworm. A study released in 2018 by the Central Institute of Cotton Research (CICR) showed that the proportion of pink bollworm on green bolls of BT cotton plants in Maharashtra, Gujarat and Madhya Pradesh increased from 5.71% in 2010 to 73.82% in 2017[5]. About 14.91 lakh hectares of land were destroyed in Vidarbha and 17.25 lakh hectares in Marathwada due to the outbreak.[6] 104 farmers committed suicide in Vidarbha in 2018. [7]

In the past years, it has been scrutinized for several reasons and one of them is there has been a series of crop failures reported in the region. Maharashtra is the largest producer of cotton in India, but over the years, large quantities of Bt cotton production have been destroyed. Bt cotton has become ineffective in controlling pest attacks such as pink bollworm which resulted in crop failures. Resultantly, the arrival of cotton in the market has come down due to low yields. Therefore, due to the decreasing yield of cotton, the problems of farmers have increased even more.

The Cotton Advisory Board (CAB) has estimated cotton acreage and production in Maharashtra grew steadily. Table 7 shows the fluctuations in cotton yield in Maharashtra during 2015-20. The cotton yield has been either low or inconsistent in the region. The average cotton yield for the season is the lowest in three years. During the crop year 2017-18, the yield was reported at 344 kgs per hectare. The cotton yields declined further by 340 kgs per hectare during the crop year 2018-19. This has fallen by 337 kgs per hectare in 2019. In desperation, the farmer began injecting more pesticides into their fields and thus, spending even more on agrochemicals. Thereby, the increased cost of production entangled them in a vicious cycle of debt and caused farmers suicide. Especially, the prevailing economically vulnerable Maharastra has been stated as the epicenter of farmer's suicides. Many farmers end their lives in the districts of Vidarbha, Marathwada and Khandesh. The majority of suicide recorded are cotton producers. The use of costly Bt cotton seeds and pesticides expenses led to indebtedness in the region. Additionally, in the absence of a bank credit system farmers are dependent to take large loans at a higher interest rates from moneylenders. This led to a multitude of hardships for the farmers as they have left with very little income due to hefty interest and particularly during the crop failure. Hence, they committed suicide owing to their inability to repay the loans.

Table 7: Area, Production, and Yield of cotton in Maharashtra

	2015-16	2016-17	2017-18	2018-19	2019-20
A	42.07	38.00	41.98	41.23	44.05
P	76.00	88.50	85.00	83.30	88.0
Y	307	396	344	340	337

A=Area (Area in lakh ha), P=Production (Production in lakh bales), Y=Yield (kg lint/ha)

Source: Cotton Advisory Board

Statistics of farmer suicide

According to a report by the National Crime Records Bureau (NCRB), the states with the highest number of farmer suicide in 2019 were Maharashtra (3927) followed by Karnataka (1,992), Andhra Pradesh (1,029), Madhya Pradesh (541), Telangana (499), and Punjab (302). A total of 10,281 persons involved in agriculture, including 5,957 farmers and 4,324 agricultural labourers who have committed suicides during 2019-20.

In 2019, the most number of farmer suicides were reportedly in Maharashtra continue to lead with over 3,927 among farmers and agricultural labourers. The trend was quite similar to previous years also. In 2018, 3,594 farmers committed suicide against 3,701 in 2017. This number was 3,661 in 2016 and 4,291 in 2015 respectively. Most of these cases have been reported in Vidarbha, Marathwada, and Khandesh district which are known for GM crops, Bt cotton cultivation. From 2001 and 2018, a total of 6,154 farmers from Marathwada died by suicide, while the number for Vidarbha is 17,547.[8]

Environmental justice

GM seeds and Bt toxins have transformed the rural landscape into toxic terrain. A study published in a peer-reviewed journal suggests that the valuable soil organisms have been declined in the Bt Cotton-growing regions of Vidarbha. The result exposed a significant decline in actinobacteria (17%), bacterial count (14%), acid phosphatases (27%), phytase (18%), nitrogenase (23%), and dehydrogenase (12%) activities in the Bt cotton-growing areas as compared to non-Bt cotton regions[9]. Likewise in 2015, the study revealed that the range of soil microorganisms further declined between 6% and 77% on different parameters. Thus due to poisonous substances, affects water, soil health and pollinators. This indicates the severe effect of Bt Cotton on soil biological conditions[10]. Under Bt Cotton, growing districts between 51-77% of bacterial populations were detected in the samples. So investigations revealed a decrease in the percentage of the bacterial population. Research has shown that transgenic Bt cotton destroys soil biodiversity within food webs in the ecosystem which is linked to the excessive spray of pesticides. As a result, environmental concerns were raised through activism by NGOs such as the Gene Campaign, Greenpeace, and Navdanya, etc.

ENVIRONMENT'S ACTIVISM AND SEED SOVEREIGNTY

Environmental and legal activism is associated with seed sovereignty activist Dr. Vandana Shiva and her organisations. Thus, deeply inspired by the Gandhian model, in 1982, Research Foundation for Science and Technology (RFSTE) was founded and Navdanya (Nine Seeds) was created in 1984. She has been also known as "Gandhi of grain" for her strong opposition against high-yielding seeds and the anti-GMO movement. Dr. Shiva promotes farmer's rights, seed freedom and biodiversity in agriculture e.g organic farming. According to the report titled 'Seed Freedom A Global Citizens' published in 2012 by Navdanya, these seeds are become 'seeds of suicide' as they push farmers to take their own lives. [11] In line with this, through participatory research initiatives, they organised numerous conferences, food awareness seminars, media debates, workshops, boycotts, yantras, and policy advocacy campaigns to create awareness amongst the farmers. Also to sensitize and draw the attention of the policymakers and government attention about ecological agroecology.

Hence, a unique initiative led by Navdanya was the *Bija Satyagraha* (Seed Freedom) movement, organised at Cuban's Park, Bangalore, in 1993 following Gandhi's Salt Satyagraha in response to the deepening agrarian upheaval and farmer suicides. This was the first international anti-globalsation protest against WTO. Several lakh farmers participated in this campaign. This mass movement aims to protest anti-GMO companies like Monsanto and patenting of its seeds as well as unjust royalty collection. On the other hand, to protect the rights of farmers to save, exchange, manage, grow, breed organic plants, select and sell the seeds.

Similarly, *Jaiv Panchayat* (Living Democracy) movement in Agastyamuni village in district Rudraprayag, Garhwal, Uttarakhand on World Environment Day on June 5, 1999. As a result, a large number of local people participated in this movement to fight against biopiracy. These were conservationist activities to establish communities' sovereignty over biodiversity resources. This movement aimed to protect the farm from the threat posed by Intellectual property Rights monopolies. And also to restore agriculture through organic farming.

Another act of civil disobedience to end Seed Slavery, in the year 2000, initiated and organized a "Monsanto Quit India" *Bija Yatra* (Seed Pilgrimage) in the countryside including Madhya Pradesh, Uttarakhand, Uttar Pradesh, Rajasthan, Karnataka, and Haryana. In which three suicide belts of the country, namely, Maharashtra and Andhra Pradesh are included. They draw attention to seed rights, promote conservation of local seed and biodiversity by organizing various events and initiatives like seed fairs or seed festivals or Haat, *community seed banks* and awareness programs.

Furthermore, the remarkable contribution of NGOs was *Bija Panchayat* (Seed Tribunal) launched in 2000 against GM cotton, IPRs laws, e.g Patent Act, Seed Act, Plant Variety Protection Act, and Biodiversity Act, etc. Around 400 farmers gathered to prevent suicides among farmers. This attracted huge media coverage nationally and internationally.

Community Seed Bank[12]

Navdanya has established 150 community seed banks in 22 states of India in the last 38 years. These banks help farmers and communities from different agro-ecological zones to conserve the traditional agrobiodiversity. Farmers are being given training in organic farming. Additionally, it provides seeds in the seed banks at early stage efforts in farm conservation. These seed banks involve the community in a participatory process of storing and managing the seed bank. Farmers are called *Seed Keeper* because they specifically restore, regenerate, strengthen, and managed the seed system, especially the conservation of traditional seed varieties.

Likewise, the *Bija Swaraj* (Seed Sovereignty) campaign is self-organized and self-governed by and for the farmer's communities. The campaign aimed first and foremost to consolidate seed sovereignty. As well as to protect and conserve our seeds as these seeds are the foundation of food chain systems, so that to grow food independently. Moreover, spread ***desi seeds*** and promote organic agriculture. This will also help to end MNCs' domination because these corporations are a threat to our Seed Sovereignty.

The global campaign on Seed Freedom is another contemporary environmental movement carried out by NGOs.[13] An action-intensive event organised around the world from October 2, Gandhi's birthday to October 16, World Food Day, 2012, to build a coalition of global citizens, diverse groups, and organisations on the issue of seed freedom, food sovereignty, promoting sustainable agriculture, saving and exchanging seeds, and opposing increased seed privatisation. Despite spraying chemical insecticides 10-15 times in Punjab's Malwa belt in October 2015, a whitefly attack on BT cotton affected 1.2 lakh acres of standing cotton crops and destroyed nearly two-third of the crops in the state. As a result, 18 farmers committed suicide due to extensive loss. Thus, another campaign was launched in Punjab in support of the *farmer's victims of BT cotton failure*. The short film was also captured about the plague and grief of the farmers through this documentary. It also shows that the lives and livelihoods of our farmers matter.

Dr. Shiva opposed big agrochemicals corporations' and termed it as the 'Poison Cartel'[14] as they control the Indian food and agriculture sector. It resulted in the fast disappearance of biodiversity, farmers are losing their land and livelihoods, contaminated with high levels of pesticide and chemical fertilizers, health risks associated with pesticide residues that enter through food and water and are consumed by people. Therefore, a remarkable campaign *Poison Free Food and Farming 2030* was launched in March 2019. The campaign was an invitation to farmers, citizens, groups, communities and institutions to join the worldwide movement to create free organic zones for future generations to come. In addition, protecting the earth and biodiversity for all living beings.
They also oppose the use of public policies on the community that harms people or are contrary to the public interest. Currently, these campaigns have now expanded through a large number of networks of community-based organisations and groups across the country.

THE MOVE FORWARD

The following section provides some of the key ways forward to account for the agrarian crisis that surrounds farmer suicides and the potential risk of long-term effects on the ecosystem and human health.
Firstly, initiatives like Seed Support Schemes especially require government intervention. Thus, there is a need to set up Seed Saving Banks as an effective supplier of seed to the farmers and store the ancient varieties of seeds. There is also a need to introduce a cost-effective method for mapping plant species and conservation. In this regard, partnerships between state governments and NGOs can enable farmers to obtain seeds.
Secondly, the cropping pattern of mixed cropping and crop rotation methods of farming in India is as old as agriculture. Therefore, as a key to strengthening sustainable biodiversity-based food production, we need to return to our traditional practice of intercropping**.** This will not only help to meet hunger, malnutrition and food security but will also improve to restore soil structure and fertility and reduce environmental problems. These practices will increase crop production of other food grains like pulses, cereals, oilseeds, fruits, and vegetables. *Lastly*, the practice of monoculture has also been criticized for its environmental impacts through the food chain and the contaminants of soil and water with high levels of pesticide residues. However, they can remain active in the environment for a long time. The latter persisted for a long time and with repeated exposure can lead to many adverse health problems. It is therefore imperative to go back to indigenous knowledge of cropping systems and sustainable farming practices. To free agriculture from toxins in the food system and conserve biodiversity, thus, a forward solution is to promote a community-based approach to organic farming which regenerates seeds of local varieties.

CONCLUSION

This study has shown that a combination of the unsustainable Green Revolution practices and WTO trade liberalisation policies has led to changes in the agriculture sector such as monopolising the supply

of GMO seeds and agrochemicals. Lastly, through the lens of social and environmental justice, we should counter back against the existing monopoly of the corporate model of agriculture. Thus, there is an urgent need to accelerate the legal and regulatory framework for environmental governance. In addition, take necessary measures to formulate and implement policies to promote greenways for sustainable agriculture.

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