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Proprietary Technology in Agriculture: Response of civil society organizations in India

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Abstract

India has emerged as one of the leading countries in the world in promoting local R&D in agricultural biotechnology in general and GM crops in particular. Further, it has by now a fairly long experience in the functioning of comprehensive biotechnology and biosafety regimes that regulate the introduction and commercialization of GM crops and GM products. It is against this backdrop that a critical analysis of the Indian effort and its outcome would be of considerable value. Work on the GM-categories began in the late 1980s. Although many public sector R&D institutions have been actively involved in developing a core of GM-crops, with huge government support, none of these crops have yet reached the market. Private sector involvement, spearheaded by TNC joint ventures and subsidiaries, began in the mid-1990s as part of the New Economic Policy (1991) of the Government of India. In 1995, India became signatory to the WTO agreements. The Indian regulatory authorities have approved the general release and marketing of only one GM-crop, viz. GM-cotton varieties resistant to bollworm attack developed by the private sector. In this context, it is significant to understand not only the socio-economic, politico-cultural, ethical, legal, institutional and ideological factors which contribute to the transition in the methods of agricultural production in India but also the responses of civil society organizations in India to such transition.

Key words: Proprietary technology, Civil society organizations, Green revolution, Gene revolution, Farming community, Public policy

INTRODUCTION

In India though the Green Revolution helped in raising the levels of productivity of food grains substantially, the question of food security remains a problem in the context of a large size population and the limitations of the Green Revolution technology in sustaining the productivity levels achieved earlier. Agriculture still contributes about 17% to the national income of the country (Frankel 2005). While significant gains have been made in reducing absolute poverty and improving the overall quality of life over the last 50 years, within the countryside a minority of prosperous commercial farmers co-exists with growing numbers of marginal cultivators and landless labourers who have the greatest difficulty in meeting even their minimum consumption needs. Liberalization policies initiated with a 'human face' in the early 1990s have yet to show the sign of addressing the existing disparities in incomes, rural-urban disparities in infrastructure, access to quality education and employment needs of the majority of the population in the rural sector. As part of liberalization policies, entry of the Multi-National Corporations (MNCs) into India's agricultural economy has implications for organization of agriculture and agrarian relations. It is against this backdrop that the present study, from the sociology of science perspective, attempts to capture the response of the civil society organisations to proprietary technology in agriculture in India. Attempts are made to examine only one proprietary non-food crop (Bt. Cotton) in agriculture in India in the present study. The study, however, does not dwell upon proprietary food crops in agriculture. Sociology of science is a specialty that examines to what extent and in what ways various socio-economic and politico-cultural factors influence the production of knowledge and its application. The literature suggests that the earlier conception that science and technology are autonomous is no longer sustainable. Rather, what we find today is that both science and technology are influenced by various factors ranging from social, economic, political, cultural, ethical, legal, institutional, ideological, and so on. Bloor (1991) asserts: 'All knowledge including scientific knowledge is socially caused'.

MATERIALS AND METHODS

State of Agriculture in India

In the mid-1970s only a small minority of the population had been incorporated into the high productivity, high wage industrial sector of the economy. But despite the larger expansion of industrial output and social overhead capital, there was little effect on the traditional sector from the creation of more jobs. 80% of the population continued to live in rural areas and 80% of the working members of this vast

majority earned their livelihood currently from agriculture. Yet proportion of growth created by rural sector is very low. Modern agriculture, coexisting alongside much larger subsistence sectors which led development into darkness. During 1960-70, there were chronic food shortages, sharp inflationary price spirals, low availability of domestic raw materials and shortfall in industrial output, declining rates of public investment and diversion of scarce foreign exchange for imports of food grains and raw materials. These contributed to the declining growth rates which did not significantly exceed the rate of population increase. According to estimates made by the Indian Planning Commission in 1960-61, 50-60% of the rural population or approximately 211 million people could not afford minimum level of consumption. About 40-50% of rural population, about 220 million people were believed to be subsisting below the low poverty line determined by the Commission. The prospect under Indian conditions was worse as the adoption of capitalist growth models would have excluded the vast majority of the peasant population from participating in the gains of development and in addition, the impoverished peasantry was hardly equipped to take advantage of new growth opportunities inside the agricultural sector. They owned no land or small fragments of land. In the early 1960s, the Rockefeller foundation in collaboration with the Food and Agriculture Ministry's Indian Council of Agriculture Research succeeded in developing new hybrid varieties of maize suitable to Indian field conditions that were able to double the maximum yield of local varieties.

By 1964, there were also reports of a breakthrough in wheat pioneered by the Rockefeller Foundation in Mexico. Similar advances were reported for rice in the Philippines where miracle seeds produced approximately three times the maximum of local varieties. Motivated by foreign happenings, planning for the special intensive programme around the high-yielding varieties was taken on 12% of the area under food crops to provide as much as $5/6^{th}$ of the total increase necessary to meet consumption targets in 1970-71. But expectation of rapid agricultural transformation in the intensive area was realized only in the wheat region. The heartland of Green Revolution was more narrowly defined. Three states Punjab, Haryana and Western Uttar Pradesh accounted for fully 69% of the irrigated areas. Wheat production doubled between 1965-66 and 1971-72 after which production remained stable. The small and marginal farmers found it uneconomic to invest in modern agriculture techniques as their land holdings were less than the optimum area required for the efficient cultivation of high yielding varieties. Also, the high-yielding varieties dependent on the higher availabilities of chemical fertilizer could be produced by indigenous factors which were dependent upon the ability to attract foreign investment.

Transition from Green Revolution to Gene Revolution

Seed is a critical input for agricultural production. Distribution of assured quality seed is necessary for attaining higher crop yields. Before hybrid seed was introduced, the farming communities were involved in selection, breeding and conservation of seed *in situ*. In other words, farmers controlled the seed production and its use and reuse. Gregor Mendel's contribution to understand the pattern of inheritance of traits led to the development of plant breeding as a science. However, plant breeding is seen as an art (the experience of plant breeders plays an important role in plant breeding), and as a science (for improvement of crops). Over time and across space, as the genetic basis of traits and interaction between plant and its biotic and abiotic environment were understood, plant breeding became more of an applied science drawing inputs from several disciplines – botany, genetics, physiology, pathology, biochemistry, entomology, statistics, computer science and horticulture.

Beginning in the 1930s, private companies entered the hybrid seed production. The principle underlying the production of hybrid seed is that two elite parental lines of a crop with traits of interest are artificially crossed to produce the hybrid. The entry of private enterprise in plant breeding has historically faced two obstacles: one, biological and the other, institutional. The very reproducibility of seed made the farmer the commercial seed company's prime competitor and constrained private investment in plant improvement. Into this vacuum of investment moved the State to become an institutional obstacle to the expansion of commercial seed industry (Kloppenburg Jr. 2004). Hybrid seed production that began in the 1930s in the US was incorporated into capitalist industry. The seed companies kept the information about the parental line involved in hybrid seed production a trade secret and this was protected by the institutional arrangements by the State. The control over the hybrid seed became a right that is called the breeders' rights. The community of plant breeders, who were earlier located in public institutions, were drawn closer to the seed industry as consultants to start with and eventually employees of the seed industry.

Thus, the entry of private industry in hybrid seed production marks the beginning of the industrialization of seed production. The hybrids, which inherit one or more desirable traits from parental lines, also inherit the susceptibilities of parental lines. The susceptibilities relate to biotic stresses such as diseases caused by insects, bacteria and fungi, and abiotic stresses like drought, salinity, etc. It is to protect the hybrids against the stresses, a range of chemical pesticides and fungicides are used and chemical fertilizers are also part of the strategy to increase soil fertility. Hybrid seed has another problem. Repeated reuse of the hybrid leads to loss of hybrid vigour, and productivity levels decline over the years. Hence, the farmers have to buy the hybrid seed frequently, if not every season from the agency or firm that produces the hybrid seed. Hybrid seed made farmers, who were once controlling the seed production and its use, dependent on seed companies. The discovery of the double helical structure of DNA by Watson and Crick in 1953 enabled scientists to

understand the life processes at molecular level and to intervene at molecular level. The prospects of interventions at molecular level paved the way for biotechnology. Further, advances in molecular biology enabled scientists to transfer discrete genetic material from one organism to another in the 1970s, and it opened up the prospects of transferring genes, not only from one organism to another within a species, but also from one organism to another across species. This achievement ushered in recombinant DNA (r-DNA) technology or genetic engineering. The advances have implications for development of crop varieties. The seed production during the Green Revolution was based on the knowledge of traits of crop plants at phenotypic level and the genetically modified seed production is based on knowledge of traits at genotypic or molecular level. And, knowledge of traits at genotypic level created possibilities of technological interventions at a molecular level.

It involves identifying genes of interest in one organism and transferring them into another organism or a plant. For example, Bt. Cotton, which is the only genetically modified crop that is being used by farmers in India, has been developed by transferring a gene from the soil bacterium called Bacillus thuringiensis (Bt.) into cotton. The gene has the ability to produce a toxin that can kill bollworm, an insect pest that attacks cotton plant. Research and Development (R&D) in genetic engineering has been increasingly getting concentrated in big MNCs. In other words, the research process is increasingly getting privatized. While public institutions played an important role in bringing the Green Revolution technology to the farmers' fields, the private corporations have come to occupy a central place in the production of genetically modified seed. This situation brings in a new set of relations between the farmers, on the one hand, and, the State, the seed companies and fertilizer and pesticide companies, and, extension agencies, on the other. The argument that the protagonists of genetically modified seed advocate is that if the plants are made to acquire resistance against the diseases and pest attacks through genetic engineering, then we can reduce the levels of pesticide use.

However, the genetically modified seed technology has generated controversies – scientific, technological, economic, social, cultural, legal, ethical, institutional, ideological, aesthetic and environmental – because it is implicated in the interests, meaning systems and associated ethics of relevant social groups. Scientific controversies are related to the number of genes involved in controlling a trait. It is also realized that the individual trait in a plant (e.g. yield) is not only controlled by a simple gene but by several genes. As the pest and the plants are the co-evolving organisms, the pests develop resistance against the toxins (e.g. as in the case of genes), as a result of which the plant loses its existence against the pest. It is because of the feature of co-evolution, it is not possible to say how long the gene engineered into a plant can solve the problem for which it was introduced. Farming communities in India have hitherto been accessing the seed, developed by the institutions supported by public resources at a highly subsidized price. Pinstrup-Anderson and Cohen (1999) summarize the nature of problems that farmers are going to encounter with biotechnology. They point out three essential differences between Green Revolution and biotechnology, which have a bearing on the risk and benefits. One, the research efforts that led to Green Revolution was concentrated in public-sector institutions. The Intellectual Property Rights (IPR) did not extend beyond the initial release. Once the farmers acquired the seed, they could reuse it without further payment, although the reused hybrid seed reduced the yield. In contrast, modern agricultural biotechnology research is undertaken by the private-sector firms, which protect IPR through patents beyond the first release.

Farmers cannot reuse the seed without the permission of the patent holder for the next season. A second related difference between the Green Revolution and the Gene Revolution involves the patenting of processes as well as products that indicates a shift towards proprietary research process. The third difference is that while the Green Revolution technology was focused on the specific problems of the developing countries, the Gene Revolution focuses on research that is suitable for industrial countries. The transfer of genetic engineering technology from the industrial countries would ignore the socio-economic and cultural specificities of the developing countries. The two phases – the hybrid seed and the genetically modified seed – heralded a culture change that created new meaning of the seed and associated practices. The industrial seed designed in the biotechnological lab, now spreading around the world contains 'specifications and prescriptions' for labour system, planting calendar, pest-control procedures, marketing, landholding and beliefs about hunger and well-being (Haraway 1999). Barnes (1982) suggests how cultural change is assimilated. He states, 'The precise way in which a community assimilates culture change into its own self-understanding depends upon the overall system of goals and interests within it, and upon the distribution of power'.

Nonetheless, there is a demand of a second Green Revolution owing to a number of factors: (a) the slow pace of agricultural growth as compared to the other sectors, which is also accompanied by the drought years of 2000; (b) the disparity of incomes from the Green Revolution as well as the Gene Revolution. It implies that the problem lies in the questions of right, access and entitlement rather than production. Indian agricultural research is bureaucratized. With the declining budgets from central and state governments, reliance on external donors for funding has become important. The entry of multinational biotech companies to the agriculture in India has significant implications on the questions of ownership, control and access. Bt. Cotton is the only crop which the Indian farmers have experienced till date which was developed by Monsanto in collaboration with the Maharashtra Hybrid Seed Company (Mahyco). Let us discuss the

important differences between the two contrasting methods of agricultural production by the Green Revolution on the one hand, and the Gene Revolution on the other, which can be found only after examining the various key actors' motives. It is supported by both Indian government fund and international donors such as the Rockefeller Foundation. Thus, it entered into long term agricultural bureaucratic form. It is here where we can find the contract between the new and the old as the slow bureaucracy was well suited to the more leisurely, continuous process of crop breeding variety testing, crop release and monitoring but it is difficult to handle more vibrant, urgent and entrepreneurial style. In the present situation, seed houses and biotech companies seek quick return on their investment by competing for a position in the global market place for biotech product. Monsanto with Mayhco in the mid-1990s tested and later marketed the Monsanto product bollgard (Bt.) in a series of Mayhco cotton varieties which was approved by the regulatory body in 2002. Today we are situated in a different political context, interest and regulatory requirements compared to that of Green Revolution. In the Green Revolution era, there was a concern for national / geopolitical security issues, hunger and overpopulation but today a commercially driven interest is evident.

With the post-economic reforms and increasing importance of WTO-regulated international trading regime, the seed market and agricultural sector do not remain under state-controlled protected economy. In the post-liberalization era, there are new crops, new farmers, new markets and new technology demands. Thus, different interest groups identify with different versions of the biotech narrative and it is highly dependent on whose views get heard and included in policy stances. India introduced the Protection of Plant Varieties and Farmer's Right Act in 2001 to allow for plant breeder's rights in India. One reason for introducing this act was to conform to TRIPs by granting protection for new varieties. Under the environment protection Act (1986), the ministry of environment and forests notifies rules covering activities involving manufacture, use, import, export, storage and research of hazardous microorganisms or genetically engineered organisms or cells 1989 issued by the ministry of environment and forests under the environment protection act 1986. Six competent authorities, viz., Recombinant DNA Advisory Committee, Institutional Biosafety Committees, Review Committees on Genetic Manipulation, Genetic Approval Committee, State Biotechnology Coordination Committee, and District Level Committee handle various aspects of rules. Bt. Cotton is the first and only transgenic crop approved by GEAC for commercial cultivation in six states namely Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Tamil Nadu. Cotton is a leading commercial crop for valuable fiber and India rank not in the world accounting for 20% of total area planted under cotton but in spite of this it ranks third position with only 13% in the production of cotton. India average is only 319 kg/ha lintqas compared to world average of 603 kg/hac. Cotton is highly susceptible to insects and 1200 crore loss is estimated due to this. Chemical controls to these insect pests are ineffective as these pests have developed high level of resistance for most of such chemical used for the control of bollworm complex. Such a high level of resistance requires repeated application of insecticides leading to heavy expenditure, crop failures and vicious cycle of debt for the farmers. Therefore it has been argued that adoption of Bt. Cotton could help in protecting the crop against potentially the most damaging bollworms and thus reduce the risk of crop failure. The GEAC set up under the 1989 rules accorded conditional approval for introduction of the three Bt. Cotton hybrids namely BTMECH 162, BTMECH 184 and BTMECH 12 into the environment in March 2002 after detailed evaluation on the efficacy and safety of the product.

Here Dr. Suman Sahai, President of the Gene Campaign, a civil society organisation in India vehemently questioning the outcome of Bt. Cotton, shares her experience with farmers of Wardha which is situated in the cotton growing belt of Maharashtra. Talk was about Bt. Cotton both the new genetically engineered hybrids sanctioned by the Government and also the Bt. Cotton crop planted by the illegal seeds supplied by Navbharat Seed Company. Farmers mainly grow hybrid cotton and it cost between Rs 300 to Rs 450 per 450 gram. Farmers need 1 kg of seed per acre which works out to a cost of Rs.700 to Rs.900 per acre .So, let average cost be 800 per acre and depending on the variety pesticide sprayings work out to another Rs.1000 per acre and also this region is rain fed which adds to the cost. Average cotton yields are 3 quintals per acre in the region. Farmers here are demanding a monopoly price system because cotton prices have been plummeting these past few years ,the whole situation being exacerbated by the Governments ad hoc decision to import cotton, causing cotton prices to cash further .In this situation two new varieties of cotton, one legal and other illegal become available to farmers.

Let us see the economics in these two cases. The Mahyco-Monsanto varieties are to be priced at Rs.1600 per bag. The economics in this case will work out like this: cost of seed will go up to Rs.3200. If pesticide used is reduced to 60% due to Bt. toxin than saving will work out to Rs.600 and also Bt cotton has not been bred to confer a yield advantage but the advantage of the disease resistance. A total outlay of Rs. 3600 (Rs.3200 for seed +400 for pesticide) as against Rs.1800 per acre in the old system (Rs.800 for seed +1000 for pesticide).So, the economics of Mahyco-Monsanto's Bt. Cotton look very unfavorable in this manner. There are various rumours which prevail among farmer such as higher cost will be offset by higher volumes of cotton produced per acre whereas others had heard that Government made it compulsory to buy the Monsanto Cotton and seed of other varieties would only be supplied if the Monsanto variety were also bought. Also credit will be available only for the Monsanto variety otherwise credit line will be blocked .These rumors point out that the perception which the Government

adamant on pushing the Mahyco-Monsanto hybrid at all costs and which will have repercussion in various ways later. On the other hand market is awash with the illegal ,unregulated cotton variety by Navabharat's illegal seeds and GEAC had failed to take any action when Navabharat's transgression came to light .This illegal seeds being openly sold in Andhra Pradesh, Gujarat, Punjab, Haryana. Now let us look at the economies in the Navabharat seeds case. Navabharat seeds are selling at Rs.100 per bag, cost of seeds work out to be Rs 200 per acre and with some savings on pesticide costs. For few seasons, farmers enjoy the favorable economic but when it fails after some season than the victim is only one that is farmer .From the field it is found that non-standard seeds of indifferent quality are one of the biggest problems which the cotton farmers face. Failure of GEAC to regulate Navabharat is taken as an advantage by the night seed operator to take the farmer for a ride. After the Gujarat harvest large volumes of Navabharat Bt. seed arrived in the market sells through the advertisement but no single action is taken by the Government, no damage control exercise, no informal campaigns to warn the farmer against fake seed operations was done.

In this confused scenario where both science and policy have been thrown to the winds, there are those who argues that what if the varieties fails in a few years, why not let the farmers enjoy a few good harvests.The other argument goes that if the farmers find out that the variety is not profitable, they will abandon by itself. From these argument it can be said that these arguments can only be made by the city people. So, if the farmer is in debt after harvest than who bails him out then? And when the variety falls because the bollworm has become resistant to Bt. like the mosquitoes did to DDT what solutions are there to offer the farmer so that he can continue growing cotton? Unrealistic expectations have been built up assiduously promotion made by the scientific community and the Government Departments Why should farmer deny themselves the benefit from the remaining 20% of land. The scientific community and the administration have concentrated solely on promoting the new varieties. They have not bothered to educate the farmers about the drawback of the technology, its prescribed methodology and the dangers of not following proper procedure for instance, of not leaving a non-Bt refuge for the bollworm to retain susceptibility to Bt. varieties.

Civil Society Organizations in India

In the case of Bt. Cotton in India the real hindrance in adopting transgenic varieties lies in not being able to ensure institutional and actor cooperation to preserve environmental security than the technological risk .The focus was on the environmental security thought he creation of institution with the main aim of safe creation and commercialization of transgenic varieties to create state response. In Andhra Pradesh incorrect expectation about the returns of Bt. cotton led to social unrest and the result was that it mobilized local governments in some areas to demand compensation for farmers by charging pressure against Mahyco-Monsanto Biotech Ltd. The dispute was settled through an out of court settlement in 2002 where Mahyco-Monsanto Biotech Ltd. committed to serve compensation to farmers under certain condition .The consequences was that on receiving the repeated complaints from Andhra Pradesh government GEAC refused to renew licenses for the commercial cultivation of various varieties like Mech-12 Bt. Mech-162, but the sale of banned varieties of Bt cotton continue. Network of regulation agency is not yet sufficiently developed in many states including Andhra Pradesh as of 2002 as pointed out by Dr. Suman Sahai of Gene Campaign. The following table lists the CSOs in the biotechnology, biosafety and biodiversity arenas, indicating their main stated activities, objectives and constituencies. We have listed only those that have appeared in the Indian media through their *explicit and visible* involvement in agricultural biotechnology and biosafety issues. The capacities of the CSOs to fulfil their own stated objectives, ambitions and tasks differ widely in magnitude and quality.

The differing capacities and strengths are the result of a number of factors: the dynamism of leadership of the CSO, its geographical location (decisively-placed in New Delhi or in a major State capital, or marginally-located in a district remote from the state-capital), its access to and skill in interacting with the media, sources of funding, constituency and backers, vested interest, and its standing in national and international networks. Only a couple have a nation-wide reach. Most are State-capital-based or district-based. Some concentrate solely on working at the "grass-roots" level among farmers and rural and forest communities. The present study, from the sociology of science perspective, examines the responses of two civil society organisations in India, namely the Gene Campaign and the Navadanya to proprietary technology in agriculture in India. The study comprises both primary and secondary data. The primary data include in-depth personal interviews with the officials of the Gene Campaign and the Navadanya.

The secondary data include reports of the two CSOs on their activities as far as Bt. Cotton in agriculture in India is concerned; government policies; books, articles, web sources, and so on. Addressing the first objective, views were elicited from the officials of the Gene Campaign and the Navadanya. We also analysed the reports of the two CSOs. Addressing the second objective, the Industrial Policy Resolutions (1948, 1956, 1977 and 1991), the Scientific Policy Resolution (1958), the Technology Policy Statement (1983), the Science and Technology Policy (2003), reports of the World Trade Organization and the World Intellectual Property Organization were culled out. It is, in effect, the English language national press that has acted as the common platform for the GM concerned CSOs for communication and debate. It has carried articles representing various sides in the debate. A part of the press has been criticized by the scientific establishment and the government agencies for carrying the 'wrong' information and supporting the 'wrong' campaigns. Some of the CSOs have ready access to, and are also actively involving, senior scientists, retired top civil

servants and leading "grassroots" activists. Since the authorities respect these eminent individuals, it is hoped that the arguments and views advanced by them will have some impact on government policymakers and the regulatory agencies. Of the CSOs listed earlier, the present study examines differing perspectives and ideologies of the Gene Campaign and the Navadanya. It was only after the CSOs' concerns began to be publicised, in particular their campaigns and legal challenges in connection with the commercialisation of GM-cotton, and questions were raised in parliament, that the government regulatory institutions (DBT, RCGM and GEAC) began to provide some information to the public through the media. But for the vigilance of some of the leading GM-concerned CSOs and their efforts over several years, the environmental, health and socioeconomic issues linked to the introduction of GM-crops would not have emerged in the public domain at all.

RESULTS AND DISCUSSION

Differing Perspectives and Ideologies

Gene Campaign, a grassroots level organization which has worked in 17 states of India, was founded in 1993 by Dr. Suman Sahai and a group of people concerned about food and livelihood security. Gene Campaign is recognized as a leading research and advocacy organization working in the field of bioresources, farmers' and community rights, IPR and indigenous knowledge, biopiracy, regulation of GMOs and the impact of climate change on agriculture and food. It is a leading research and advocacy organization, has been working to empower local communities to retain control over their genetic resources in order to ensure food and livelihood security since 1993. Closely involved in policymaking and legislation with respect to biological resources, Gene Campaign has enabled rural and adivasi communities to participate in policies relating to these resources. Gene Campaign has been largely responsible for raising the national debate on the dangers of seed patents and its threat to food sovereignty. Its long and sustained struggle for Farmers Rights culminated in legislation, the only one of its kind so far, that grants legal rights to farmers. The Campaign has been involved in the fight against the patents granted on Basmati rice, at the national and international level, and was the first to expose the existence of the turmeric patent. Apart from this, it campaigned for a law to protect India's biodiversity and provided the first draft of a biodiversity legislation in 1997, a law that was finally passed in 2001. The Gene Campaign is working for the recognition of Indigenous Knowledge as an important technology and its potential for increasing incomes for rural and adivasi communities. An important goal is to develop a system to grant legal rights to communities over the Indigenous Knowledge that they have created and continue to create. As part of its endeavor to protecting Indigenous Knowledge, Gene Campaign has lobbied hard and has succeeded in keeping medicines and products derived from Indigenous Knowledge, out of the purview of patents so that they are exempted from the Patent law. It seeks accountability and greater competence in the regulatory systems that are in place. Gene Campaign has made the demand that unless the regulatory systems are demonstrably more competent, transparent and responsive to public concerns, there should be a moratorium on commercial release of GM crops. Navadanya's mission, on the contrary, is to promote peace and harmony, justice and sustainability. It strives to achieve these goals through the conservation, renewal and rejuvenation of the gifts of biodiversity we have received from nature and our ancestors, and to defend these gifts as commons. The setting up of community seed banks is central to our mission of regenerating nature's and people's wealth. Keeping seeds, biodiversity and traditional knowledge in people's hands to generate livelihoods and provide basic needs is its core programme for removal of poverty. Navadanya's mission focuses on improving the well being of small and marginalized rural producers through non violent biodiverse organic farming and fair trade.

Biodiverse organic farming produces more food and nutrition and brings higher incomes to farmers than monocultures and chemical farming. The vision of Earth Democracy is translated into a mission of creating biodiversity and seed sovereignty, food sovereignty and water democracy. The defense of seed, food and water sovereignty is necessary for fulfilling our mission of bringing prosperity to communities of small agricultural producers thus sowing the seeds of peace and prosperity. Therefore, Navadanya is committed to resist patents on seeds and life forms promoted by the TRIPS agreement of WTO which lead to the privatization of biodiversity and piracy of traditional knowledge. It has successfully challenged biopiracy patents on neem, basmati and wheat. It is building the living democracy movement "Jai Panchayat" to defend biodiversity as a commons. It is also committed to promote alternatives to non-sustainable agricultural technologies based on toxic chemicals and genetic engineering and committed to change the rules of unfair trade force on small peasants through the WTO Agreement on Agriculture, which are leading to destitution, debt and farmers suicides.

Navadanya's mission is to create living economies based on living democracy, with producers and consumers shaping their food cultures through participation and partnerships through cooperation and caring. It promotes organic fair trade, based on fairness to the earth and all her species, fairness to producers and fairness to consumers. It will expand its network of outlets and cafes to create another food culture, which respects diversity, local production and food quality. In partnership with similar movements like the Commission on the Future of Food and Slow Food, they are committed to create a future of food and agriculture in which small farmers prosper and biodiversity and cultural diversity thrives. Biodiverse small organic farms increase productivity, improve rural incomes and strengthen ecological security. Large-scale industrial

Civil Society Organizations	Main activities and objectives	Main constituencies catered to
Gene Campaign, New Delhi	Policy issues; Farmers' rights; Studies and research; Dissemination of information and studies through articles, seminars, workshops, etc.; Scrutiny of regulatory and policymaking bodies	Farmers; Media, policymakers and opinion-makers
Research Foundation for Science, Technology and Ecology, New Delhi	Policy issues, with focus on biodiversity, intellectual property rights and international trade; Studies and research; Dissemination of information and studies through articles, books, etc; Scrutiny of regulatory and policymaking bodies; Indigenous knowledge; Sustainability issues; Movement for people's control over their own biodiversity-related knowledge	Farmers; Media, policymakers and opinion-makers
Navadanya, Dehra Dun and New Delhi	Policy issues, with focus on biodiversity, intellectual property rights and international trade; Studies and research; Dissemination of information and studies through articles, books, etc; Scrutiny of regulatory and policymaking bodies; Indigenous knowledge; Sustainability issues; Movement for people's control over their own biodiversity-related knowledge	Farmers; Media, policymakers and opinion-makers
Forum for Biotechnology and Food Security, New Delhi	Analyses of issues and dissemination of information and studies through articles	Media, policymakers and opinion-makers
MS Swaminathan Research Foundation, Chennai	Research in sustainable agriculture and policy issues relating to sustainability	Farmers and the government
Green Foundation, Bengaluru	Organic farming and indigenous knowledge	Farmers
Shetkari Sangathana, a farmers' association, based in Maharashtra	Farmers' rights and interests; Dialogue with government	Farmers and the government
Karnataka Rajya Raitha Sangha, a farmers' association based in Karnataka	Farmers' rights and interests; High profile field campaigns	Farmers, Media, policymakers and opinion-makers
Karnataka Krishi Sangha, a farmers' association based in Karnataka	Farmers' rights and interests; Agricultural policy	Farmers, Media, policymakers and opinion-makers
Federation of Farmers' Associations, Hyderabad	Promotion of agriculture as a profitable occupation	Farmers
Centre for Science and Environment, New Delhi	Protection of the environment; Policy issues; Studies and research; Dissemination of information and studies through articles, seminars, workshops, etc.	Farmers, Media, policymakers and opinion-makers; Subscribers to CSE's journal *Down to Earth*
Greenpeace India, a member of Greenpeace International, London	High profile campaigns for the protection of the environment; Policy issues; Dissemination of information and studies through articles, workshops and seminars	Farmers, Media, policymakers and opinion-makers; Own subscribing membership; The general public
AgBioIndia, New Delhi	Network for information dissemination and campaigning	Farmers, Media, policymakers and opinion-makers
Foundation for Biotechnology Awareness and Education, Bengaluru	Dissemination of information through articles, workshops and seminars	Farmers, Media, policymakers and opinion-makers
All India Biotech Association, New Delhi	Exchange and dissemination of information through meetings, workshops and seminars; A scientific and industrial lobby	Government, research funding councils and industry
Consumer Voice, New Delhi	Food safety and consumer protection	Farmers, Media, policymakers and opinion-makers

monocultures displace and dispossess small farmers and peasants, destroy the environment and create malnutrition and public health hazards. It provide an alternatives to a global food system, which is denying one billion people access to food, and denying another 1.7 billion the right to healthy food, as they become victims of obesity and related diseases. Their mission is to provide "good food for all" through the promotion of biodiverse organic farming, food literacy and fair trade. They work with children so that future generations grow up healthy and free of disease, they can make informed food choices. The potential benefits and risks associated with the introduction and development of agricultural biotechnology (agro-biotechnology) continue to be debated both at the national and international levels by various stakeholders (government entities, agro-chemical TNCs, public and private sector seed companies and CSOs). They may be summarized as follows:

(a) The potential benefits comprise increases in crop yields and thus in farmers' net income, reductions in the use of pesticides and herbicides and corresponding decrease in environmental pollution, and improvement in the nutritional content and storage characteristics of some staple foods.
(b) The potential risks to human and animal health would arise from unexpected consequences of introducing the transgenes, such as the appearance of allergens, toxins and carcinogens in GM-food and -feed.
(c) Ecological and other environmental risks could arise from cross-pollination between GM crops and their indigenous wild relatives, leading to loss of biodiversity, and the emergence and spread of pests, diseases and weeds that could acquire the same resistances as are engineered into the GM crops.
(d) The socio-economic safety of small farmers and the peasantry may be put at risk by the potentially negative impact on their incomes and livelihoods by the trade consequences of GM-crops.
(e) There may be concerns about the dominance of agriculture by agro-chemical TNCs, and the invoking of IPR and other trade related rules overseen by WTO.

Of these many issues, only some have emerged forcefully in the public domain in India over the last few years, brought to a head by two cases. First, the field trials and commercialization of GM-cotton, and second, the transfer of the GM-rice technology aimed at vitamin A enrichment. The GM-cotton case is of particular importance, as it is the first and so far the only GM-crop to have been approved for general release and commercialization by the regulatory authority GEAC, and therefore the manner in which the controversies surrounding GM-cotton have played out is bound to strongly influence the attempts to move other GM-crops from the lab to the market. Such interaction between the lab and the market has foregrounded the differing perspectives of two CSOs under study about the debate on pro- and anti-Bt. Cotton in agriculture in India. On the one hand, according to Gene Campaign,

> Organizations like Gene Campaign are neither protagonists nor opponents. They evaluate what they see and take evidences from the field. There should not be any proprietary rights on seed. It is not bad or good as it is under dispute so it needs to be subject to regress and objective scientific review. It is irresponsible to introduce Bt. Cotton in Indian agriculture without regress scientific testing and public debate. It is both a scientific and socio-economic issue which affects small holder farmers.

On the other, according to Navadanya,

> Navadanya has opposed Bt. Cotton because they feel that it is an erosion of cotton seed biodiversity as farmer stop planting local varieties for example various colors which have been destroyed and few are left. It is also found that Bt. Cotton crops did not did well on their farm and whole farms lodged. So, after one attempt farmers abandoned it.

Pest Control, Crop Yields and Farmers' Incomes

In a joint venture, the US-based agro-chemical TNC Monsanto and the Indian seed breeding and marketing company Mahyco developed several GM-cotton cultivars, based on Monsanto's GM technology, incorporating genes from the agro-bacterium Bt. that produce toxins fatal to bollworm, the main cotton pest. Of these Bt-cotton cultivars, three were approved for commercial release by GEAC in March-April 2002. The Monsanto-Mahyco Bt-cotton seeds were bought and sown by farmers in several states, and the crop was harvested and sold in late 2002. Monsanto and Mahyco make the claim that the Bt-cotton yields per unit acreage sown were substantially higher than the yields of conventional non-GM yields, leading to higher net incomes for farmers, linking these outcomes to the success of the GM-variety in combating the bollworm. These claims have been strongly refuted by Gene Campaign (India's leading GM-activist CSO), on the basis of extensive field surveys it carried out in late 2002 and early 2003. Similar claims and counter claims have been made ab0ut the 2003 harvests, with other stakeholders (CSOs, central and state government officials, agricultural scientists, etc.) joining the contenders on both sides of the divide. For Gene Campaign,

> Indian agriculture provides a huge market and there is a large interest of Mahyco and Monsanto. 80% of seeds come from farmers and Monsanto if provide portion of seed than it can control Indian agriculture to derive profit from farmer in the form of royalty. Seed industry such as the Indian Seed Farm (ISF) has a very effective and well-financed lobbying affords which are well funded. So, they are likely to influence the Government to their interest. Thus, there are very active and aggressive potential conflicts of interest.

Similarly, for Navadanya,

> It was just for the profit making and not to feed the world or the earth.

Resistant Pests and Pest Refugia

It is conceded by pro-GM stakeholders (Monsanto-Mahyco, GEAC, etc.) that Bt-resistant bollworms are bound to emerge. As a means of preventing the resistant pest from spreading in an uncontrollable fashion, GEAC has stipulated that the farmers must sow non-Bt seeds around the Bt-plots, with the non-Bt plots being at least twenty percent of the Bt-acreage as a refuge for the Bt-vulnerable bollworm. This measure is to ensure

the survival of the Bt-vulnerable bollworm as an effective competitor against the Bt-resistant type. Gene campaign and other like-minded GM-concerned CSOs point out, based on their field research, that the cotton farmers (who are predominantly small-scale) have completely disregarded this rule, because the smallness of their plots (about an hectare or two, on an average) makes it economically impossible. The pro-GM stakeholders have remained silent on this issue.

Implications for the Farming Community in India

Countries like India that have food security concerns and have small and marginal farmers practicing an integrated type of agriculture has specific problems for which they seek solutions. GM technology has been developed for the large land holding, mechanized agriculture of industrialized countries. There is little available in the GM arsenal today that is geared to address the problems of developing country agriculture. India could use a toxin free variety of the *khesari dal* (Lathyrus sativus) grown on marginal lands and consumed by the very poor. Consumption over time leads to a form of paralysis because of the poison but sometimes it's the only food available. India could use salt tolerant and drought tolerant crop varieties that could grow on degraded lands or in arid areas where nothing much grows at present. This would help food production and bring money and food to marginal farmers living in difficult areas. Instead of crop varieties aimed at alleviating hunger, GM technology at present offers just four major crops – soybean, corn (yellow corn used for animal feed and industrial use, not white corn used for food), cotton and canola. The most prevalent characteristic for which the crops are bred is herbicide tolerance followed by insect resistance, as with Bt. Cotton. There are no crop varieties, which have enhanced nutrition, high protein cereals for example, which would be needed in India and developing countries.

The tragic fact is that the real farmers, the mass of India's farming community has no idea what Bt cotton is nor what GM crops are. All these so called farmer leaders are speaking as lobbyists, not farmers. The pro GM farm lobby asserts that the farmer, not the scientist, will decide whether Bt. Cotton technology is appropriate for Indian agriculture or not. This absurd contention displays the depth of ignorance about this new technology. When a farmer buys a pumping set or a thresher, he expects that the Indian Bureau of Standards would certify the efficiency and safety of such products after experts had tested it, because he lacks the ability to test these things himself. Whether lobbyists not farmer be considered competent to evaluate the human health and environmental safety of a complex and still unproven technology? If these people were interested in the well being of farmers, instead of just themselves, they would have been in the forefront of demanding rigorous tests so that the farming and rural community was not endangered. If resistance is going to come in just two to three years, does the variety have any relevance for the farmers? Because when the variety fails that fast, the farmers are even worse off than they were. The Bt. Cotton crop has failed in South Sulawesi, Indonesia because the pests have become resistant to the Bt. toxin. Angry farmers are protesting against Monsanto and their government because cotton yields are down to 500 kg / hectare from the promised three tons. Violent demonstrators clashing with the police are demanding that Bt. Cotton and other transgenic crops be banned. Farmers are reporting no significant yield differences between Bt. and non-Bt. Cotton. Add to this the additional cost of the expensive Bt seed (about 4-5 times the cost of non-Bt seed so far) and non- productive refuges amounting to 20% of the landholding and you do not have to be a genius to figure out that Bt. Cotton is not going to be economically viable under Indian conditions. Farmers are reporting that due to heavy pest attacks this last season when they were cultivating the illegal Bt. Cotton supplied by Navbharat, they had to resort to frequent sprayings in their fields. Monsanto itself has been spraying several times in its experimental plots. The new IPR legislation is being introduced in the area of Plant Genetic Resources (PGR) under pressure of the US government as well as the requirements of the TRIPS agreement of the WTO while WTO gives a five year transition period to introduce PGR legislation; the US' pressure was to introduce such legislation immediately.

Further, the US has been demanding monopoly protection for Transnational Corporations (TNCs) which control the seed industry. On the other hand people's organizations are fighting to protect farmers' rights to their biodiversity and their right to survival as well as the freedom of scientists to work for the removal of hunger rather than corporate profits. Farmers' organizations, biodiversity conservation groups, sustainable agriculture networks and public interest oriented scientists are trying to ensure that farmers' right are protected and through the protection of farmers 'rights sustainable use in agriculture is ensured. The conflict over PGR legislation is a conflict between farmers and the seed industry and between the public domain and private profits, between an agriculture that produces and reproduces diversity. The US government is coercing the Indian government to do is introduce hybrid varieties without proper testing through the expansion of agribusiness industry. According to Gene Campaign,

> It is expensive technology and more over pest become resistant to toxin as was in the case of mosquitoes. So, in term of farmer there must be socio-economic analysis of the impact of GM seeds. Generally speaking about the state of agriculture in India which is based on the exchange of seeds and genetic selection and improvement and GM crops undermine this history of agriculture in India.

According to Navadanya,

> Bt. Cotton was grown in extended land area which is the reason of farmer suicide

> in most of the states of India like Maharashtra, Andhra Pradesh. It has caused more harm to agriculture than it has produced any good.

Further, as a senior official of Gene Campaign puts it,

> It should not be done if we want to promote the cotton production in our country. Instead government should provide subsidy to promote the export of cotton through minimizing the economies of scale of cotton production.

The concern raised by a senior official of Navadanya is:

> Any import of anything may be Bt. Cotton is never a good idea; it will always have the adverse impact on the life of small farmers and also on the price of seeds. So, when we have local varieties there is no need to import as it causes natural hazards through emission of CO_2 and do not support sustainable economic growth. Thus, it should not be done if we want to promote the growth of cotton in India.

The proposal is to replace the small peasant and farmer based agricultural economy of India with agribusiness controlled industrial agriculture. This shift is associated a transformation of farmers as breeders and reproducers of their own seed supply to farmers as consumers of propriety seed from the seed industry. It is also a shift from a food economy based on million of farmers as autonomous producers to food system controlled by a handful of TNCs which control both inputs and output. Farmers' rights in the context of monopoly control of the food system become relevant not just for farming communities, but also consumers. They are necessary not just for survival of the people but also for the survival of the country. Without sovereign rights of farming communities to their seed and plant genetic resources, there can be no sovereignty of the country. Farmers' rights are an ecological, economic, cultural and political imperative. Without community rights, agricultural communities cannot protect agricultural biodiversity. This biodiversity is necessary not just for the ecological insurance of agriculture but right to agricultural biodiversity is also an economic imperative because without it our farmers and our country will lose their freedom and options for survival. Since biodiversity and cultural diversity are intimately linked, conservation of agricultural biodiversity is a cultural imperative also. Finally, without farmers' rights, there is no political mechanism to limit monopolies in agriculture and inevitable consequence of displacement, hunger and famine that will follow total monopoly ownership over seed. In this context, it is of considerable to capture the views of both CSOs under study.

According to Gene Campaign,

> Bt. Cotton does not provide and it has no relation with hunger. Farmers do not have water, seed and land to carry on the agricultural work, so how it can provide solution to hunger.

According to Navadanya,

> Navadanya has carried out several studies to show how organic agriculture can actually solve the hunger problem not only because it has good productivity but also it has more nutrition. Similarly, Gene Campaign also is not of the view that genetically modified food provides solution for hunger. It is misstated and false belief. It may increase productivity but not the productivity for nutritional crops which provides solution to hunger.

Implications for Public Policy in India

Traditionally in India agriculture was based on organic farming techniques including use of organic manure and locally available inputs and farmers' seed. Policy initiatives taken by the Government of India during the 1960s and 1970s for generating quality seed production and distribution of improved plant varieties developed by the scientists is one of the reasons for making the country self-sufficient in food grains. To increase the food grain production, the Green Revolution technology consisting of high yielding varieties (a high yielding variety is the off-spring of homogenous genotype derived from a cross between two inbred lines) of wheat and rice, chemical fertilizers and pesticides, irrigation and credit – was introduced in the 1960s initially in the irrigated areas and later it spread to rain-fed areas as well. Various public institutions like the Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR), etc., agricultural universities and Krishi Vigyan Kendras (Agricultural Science Centres) were established to develop new varieties of hybrid seeds as part of the extension programmes to 'educate' and deploy new technologies.

The Green Revolution technology has undoubtedly contributed to the yield increase, but such yield increase has been accompanied by far-reaching socio-economic and environmental changes. Economically well-endowed farmers could use Green Revolution technology and gain from it in terms of increase in their incomes, whereas small and marginal farmers could not gain to the same extent because of their inability to access Green Revolution technology (high input cost). This widened the socio-economic inequalities due to the differential access to Green Revolution technology. For example, canal irrigation which has been an integral component of Green Revolution technology created problems such as soil salinity. Continuous and at times excessive use of pesticides led to the problem of pesticides residues in soil and food. The Green Revolution technologies brought the farmers into complex relationships with various actors across several disciplines within sciences like plant breeding, pathology and agronomy etc., located in agricultural R&D institutions (both public and private), policy makers, seed companies and fertilizer and pesticide dealers, extension departments, financial institutions

and private moneylenders. Continuous use of chemical fertilizers depleted soil fertility, and farmers resorted to use more and more fertilizers. Similarly pesticide use also increased both in terms of range and quantity as the pests developed resistance against the pesticides over time. As a result, increasing pesticide residues were noticed in the soil and food grain. The Green Revolution technology, based on petrochemical inputs and undesirable consequences for environment, is seen as an unsustainable agriculture over time. The post-WTO regime in India witnesses the entry of several private companies in proprietary seed production based on modern agricultural biotechnology. Seed companies have become biotech companies. Several big industrial houses entered the domain of agri-biotechnology. What were hitherto produced on farms can now be produced in the laboratories. Since the mid-1990s that marked the ushering in of the WTO-regulated product patent regime, there has been a steady a shift towards trade liberalization in agriculture, as a result of the influence of the International Bank for Reconstruction and Development (IBRD), popularly known as the World Bank and the International Monetary Fund (IMF) through Structural Adjustment Policies (SAPs) and later, of the GATT/WTO through its Agreement on Agriculture have begun to adversely affect the farmers and consumers. As Shiva (2001) puts it,

> The prosperity that globalization was supposed to spread is fast proving to be elusive. Trade liberalization and globalization have resulted in thousands of farmers sacrificing their lives and livelihoods. In fact, the most prosperous state, also called the breadbasket of India, Punjab, has left behind Andhra Pradesh in the notorious distinction of farmers' suicides.

Agricultural policies that push the small and marginal farming communities to destitution, on the one hand, and, promote cash crops, on the other, have resulted in lowered food production. Growth rate in agriculture has been less than 2% during since 2003 (Shiva 2001). The quantum of food grains produced also declined. Wheat declined by about 7 million tons due to decline of 3.5 million ha in Madhya Pradesh, Rajasthan and Maharashtra. Rice declined by 4 million tonnes due to decline in 1 million ha in West Bengal (Shiva 2001). Pulses declined by 1.7 million tonnes due to fall in production in Rajasthan and Madhya Pradesh. In Punjab, the area under paddy was reduced from 26 lakh ha in 2000 to 24 lakh ha in 2001, to 16 lakh ha in 2002. One of the consequences of trade liberalization policies has been a general lowering of food consumption as well. The per capita cereal consumption has declined from 17 kg per capita per month in the 1950s to 13.5 kg per capita per month in the 1990s (Shiva 2001). The data collected by the National Nutrition Monitoring Bureau in 1997 showed a declining trend in consumption in rural India, particularly in cereal and millets, the main source of energy for the poor, from 1990 to 1995. The prominent causes for this decline in food consumption may be attributed to rising food prices, undermining livelihoods, inaccessibility of food grain under the Public Distribution System (PDS) and shift to export-oriented agriculture. According to the Directorate of Economics and Statistics, Department of Agriculture, Government of India (2003) per capita availability of rice, wheat, other cereals, gram and pulses declined during 1991-2000. The decline in agricultural production, reduced consumption and decline in the per capita availability of food grains seem to be linked to the food and agricultural policies of the government. Bt. Cotton was introduced in agriculture in India by the pressure from the Monsanto but biologically, pest cannot be controlled by a single pest. Bt. Cotton is not suitable for the conditions of Indian agriculture as it is mostly suited for the large mechanized farms in industrialized countries. Gene Revolution is a technology where farmers have to pay fee in the form of royalty as compared to Green Revolution where there was no patent or licensing. According to Navadanya, Bt. Cotton was introduced in India for the profit motive by Monsanto and Mahyco and it firmly rejects introduction of Bt. Cotton and support sustainable agriculture instead of gene technology.

Bt. Cotton does not help to increase the cotton production as compared to local varieties as it increases the cost of growing cotton since farmers have to purchase seeds every time besides the cost of refuge. Organizations like Gene campaign claim themselves as scientists as they take evidences from field and claim that Bt. Cotton should be introduced only after proper scientific testing than only it can bring any good to the small farmers. Navadanya completely opposes Bt. Cotton as it leads to erosion of cotton seed biodiversity and it did not did well as whole farm lodged. According to Navadanya Bt. Cotton is the cause of farmer suicide and it has caused harm to agriculture than any good. Gene Campaign also suggests that it undermine the history of Indian agriculture which is based on exchange of seeds and if we want to introduce it than it should be introduce only after analyzing socio-economic impact of GM seeds.

The import of anything is always a bad idea especially when we want to promote the export of that good produce in our home country as it will have negative impact on the life of cotton grower especially small farmers. Navadanya also do not support import of cotton beside above mentioned causes it takes into account other aspect of import of cotton as it causes natural hazards through the emission of CO_2. Navadanya do not support chemical agriculture and promote organic agriculture it strictly prohibit the use of such type of crops. Gene Campaign also do not support herbicide tolerant crop as it destroys weeds which have medicinal values and various other uses such as can be used as vegetables, fodder and moreover it displaces labour especially women whose life depends on weeds. Genetically modified crops do not provide solution to hunger as according to Navadanya it is less nutritional than the crops grown through the sustainable agriculture. According to gene campaign it do not

provide solution to hunger as farmers in India do not have water, land than how they can think of growing GM crops and also GM crops are less nutritional. Both Navadanya and Gene Campaign are of the view that weeds are extremely helpful for the rural communities as it has many useful values as vegetables, medicines, fodder etc. But Navadanya suggests that by following organic farming, weeds will be less which shows that all weeds are not good. Monsanto and Mahyco are effective and well-funded lobby which are likely to influence Government in their own interest for profit motive as claimed by Gene Campaign. Similarly Navadanya is of view that it is just for profit motive and not in the interest of farming communities. The protection of plant varieties is an important step taken by the Government of India but this bid has not gone forward nor been retracted and is a hanging pile. According to Navadanya, farmers' rights are a necessary component for the conservation of biodiversity since the breeding strategies are based on the production and reproduction of diversity which have to be protected if agricultural biodiversity has to be conserved.

Gene Campaign addresses that the setting up of Statutory National Bioethics Commission helps in addressing the needs of small farmers and agriculture in India as it is required for biotechnology and may this will have motive which will serve industrial needs but no baseline data are being collected to evaluate the impact of Bt. Cotton on the environment. According to Navadanya, GEAC indirectly admits that Bt. Cotton is not safe as farmer are instructed to plant 20% of their field with the non-Bt varieties to combat the adverse effect of genetic pollution and worse situation is that not GEAC nor Monsanto but farmers are made responsible to meet these requirements. Navadanya suggests farmers to follow organic farming and sustainable agriculture to produce their own local varieties which are more nutritional and environment friendly and which will liberate them from market. This will make farmers more independent. It does not support use of chemical in agriculture as it is toxic. Whereas Gene Campaign does not strictly prohibit the use of Bt.

Cotton but suggest certain remedial measures and scientific testing with which it can be used for example growing of refuge, integrated pest management. A common feature of the CSOs in India is their stated intention of working towards sustainable agriculture. Most of them seem to have direct links with farmers. Despite this commonality, there is neither any formal interaction among them, nor a common club, for meeting and sharing, on a regular basis, information and experiences and for forging alliances and joint strategies for action. However, in recent times, they have been meeting in the workshops and seminars held by Department of Biotechnology and the state level agricultural universities, as well as in other fora, aimed at increasing public awareness of biotechnology and biosafety issues (Mallick 2011).

The response of the civil society organizations to Bt. Cotton in agriculture in India varies. It is due to the fact that varying perspectives and ideologies of each civil society organization determine the actions that they undertake. It implies that 'civil society organizations' is not a homogeneous entity.

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