

India's Policy on Genetically Modified Crops

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The debate on genetically modified crops in India raises questions about the strategies for economic development, impact of technology on society, and the relations between farmers, business and NGOs. While proponents of agricultural biotechnology argue that it has the potential to solve India's agricultural problems, opponents point to the negative implications of biotechnology on environment and farmer's livelihoods. Comparing the pro and anti-GM networks, this paper points out that India's policy shifts on genetically modified cotton resulted not from the application of science to development needs, but were shaped by the way actors mobilized around story lines on Bt cotton. The paper concludes that policy makers, while not getting sidelined by the discourses of either side, must carefully weigh and provide space for the viewpoints of actors, as this may lead to important insights. Farmers' perceptions on new technologies must form a part of policy making, not from a simple standard of whether farmers adopt or reject such technologies, but rather a more comprehensive assessment of farmers' overall experiences with new technologies.

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Introduction

Agricultural biotechnology is a highly contested site in India, encompassing debates on impact of technology on society, economic development, and India's future agricultural strategy. Non-governmental organizations (NGOs), firms, and farmers' lobbies are significant actors in shaping the debate. Proponents of biotechnology assert that genetically modified (GM) crops have the potential to solve India's agricultural problems, while opponents argue that it has negative implications for farmer's livelihoods. To illustrate, let us turn to two events organized simultaneously by opposing groups on April 14, 2005. The first, a meeting in India's capital New Delhi organized by Confederation of Indian Industry (CII) on the 'Regulation of Biotech Crops: Moving Beyond Single Gene Products' with presentations by representatives of multinational firm Monsanto, government and domestic industry. The second, in Hyderabad, capital of the south Indian state of Andhra Pradesh, attended by several NGOs and farmers organizations worldwide calling for a ban on 'genetic engineering and intellectual property rights on life forms'. The diametrically opposing stances between the Delhi meeting promoting further advances in genetic modification, and the Hyderabad meeting calling for a halt to the entire process are clear. Yet in stark contrast to their alternate positions, pro and anti-GM actors influence policy change in similar ways through their ability to network, nationally and internationally, and interpret issues. The government of India, after years of wrangling and rejections, permitted commercial sale of several versions of genetically modified cotton in various states, but recently withdrew permission for Monsanto-Mahyco's GM cotton in Andhra Pradesh. Networks and interpretation of issues, represented by meetings such as the ones described above, are important factors in analysing India's GM policy. It is also important to analyze how the pro and anti-GM campaigns portray farmer's views.

Genetically modified crops contain a gene or genes which have been artificially inserted instead of the plant acquiring them through pollination. Genetic modification allows selected individual genes discovered in one organism to be inserted directly into another. Genes are the functional units of heredity. The inserted gene sequence (known as the transgene) may come from another unrelated plant, or from a completely different species. The technology is also sometimes called gene technology, recombinant DNA technology or genetic engineering (Nuffield Council, 2003). Monsanto, a multinational company, produced genetically modified cotton by introducing a gene coding for *Bt*, a protein in the bacterium *Bacillus thuringiensis*, into cotton using genetic engineering methods. This protein is selectively toxic to insects. The cotton variety so developed, Bollgard, produces the toxin in all parts of the plant such that major insect pests of cotton are controlled. GM cotton has been grown in the US since 1996.

The creation and use of GM crops is the subject of intense debate worldwide. The US, where genetic modification technology in agriculture first appeared in the mid 1990s, is still the world's largest producer of GM crops. The European Union (EU) has, in effect, rejected the commercial cultivation of GM crops. EU's rejection has been analyzed by several authors who provide the following reasons for EU's policy: environmental concerns and consumer opposition arising out of the BSE crisis, differences in attitudes to food, or for economic advantage. Opposition against GM crops is also found in developing countries, but more due to concerns relating to agriculture development and farmers rather than consumer interests. Despite the opposition, some developing countries have also now introduced GM crops, including: China, Argentina, Brazil, India. In 2004, 81 million hectares of land were under the legal cultivation of GM crops in 17 countries. (Panos Institute, 2005). However, countries continue to debate internationally

and nationally, the safety of GM crops, labeling of GMOs, and their impact on environment, biodiversity, and farmer's livelihoods.

India's policy on GM crops has undergone various shifts. India set up a regulatory structure to screen GM products and showed interest in agricultural biotechnology as early as the 1980s. The first application for commercialization of a GM crop was accepted in 1996, but it was only eight years later in 2002 that the first GM crop, Bt cotton, was introduced, after being rejected just a year earlier in 2001. In 2005, more applications for Bt cotton were cleared, but no other GM crop has been approved. . In addition, in the state of Andhra Pradesh, the government reversed the decision to allow Bt cotton seeds marketed by the company MMB (Monsanto Mahyco Biotech). Approximately 1.3 million hectares of GM cotton were grown in India as of 2005 (James, 2005). The future of biotechnology in India continues to be a source of debate. The government has recently released a Draft Biotechnology Development Strategy, outlining the government's priority for biotechnology in India's future. While the strategy places emphasis on agricultural biotechnology as a potential for India's development, severe criticism against the draft's vision has been raised.

This study focuses on the GM crops debate in India to understand how policy change occurred with networks of actors and ideas. Policy outcome is viewed as the result of actor mobilization and 'framing' of issues. The paper posits the pro and anti-GM networks on a parallel plane, analysing them through a common lens. Comparing the proponents and opponents of GM enables one to examine both as competing interest groups rather than attempting to ascertain which group is 'correct' in its interpretation. This provides a background for analysing how and at what point either network was able to influence policy change. Placing the two networks side-by-side also allows us to understand how the views of farmers on the ground may be entirely different from the positions adopted by either group. This opens a window for deducing policy lessons.

The paper raises the following questions: What factors account for the shifts in India's policy on GM crops? How did pro and anti GM networks mobilize around ideas and shape policy? How do the views of proponents and opponents of GM compare with farmers on the ground and what lessons does this have for policy? The paper is organized as follows. The first section provides an explanation of the theoretical frameworks used and provides an introduction to the GM debate in India. The next section focuses on the policy shifts in India and attempts to account for the policy change. The final section compares the pro and anti-GM networks with the views of farmers, drawing policy lessons.

Policy Change, Networks and Frames

The 'stages' model of public policy where policy moves from identification of issue, agenda setting, analysis of alternatives to problem solution, is limited in explaining policy change (Sabatier and Smith, 1993). The framing of regulations is not a simple, science-based process where guidelines are developed by experts and implemented by bureaucrats, but rather emerges through a political process of negotiation (Scoones, 2003). Science policy is influenced by the choice of which scientific questions to research and which to ignore (Toke, 2004) and various ways of processing the science can lead to differences in outcomes (Hajer, 1995).

Various public policy theories have attempted to move beyond the stages model and incorporate the role of networks and ideas. The advocacy coalition framework (ACF) developed by Sabatier and Jenkins-Smith (1993), focuses on coalitions where a 'variety of actors' with 'a set of basic values....show a nontrivial degree of coordinated activity over a period of time'. They explain policy change as occurring through external shocks and success of ideas in coalitions. Kingdon (1995) argues that ideas confront each other and combine in new ways in a 'policy primeval soup'. When a policy window (opportunities for action) opens up, policy entrepreneurs (advocates) play a central role in coupling the policy stream, providing the key to policy change. In the punctuated equilibrium perspective (Baumgartner and Jones, 1993) changes in the policy image, or how the policy is understood, can lead to policy change. Policy entrepreneurs influence change by shifting issues to a policy domain that is more amenable to change (Sell and Prakash, 2004). Policy network approach (Marsh and Rhodes, 1992) claims that the structure of coalitions across the complex policy sectors determines policy outputs.

Social constructivist based theories focus on mobilization of actors through ideas. Hajer (1995) argues, in contradiction to ACF, that the starting point of analysis is the discourse rather than the interests of agents. Actors are linked loosely through 'discourse coalitions' and story-lines are seen as the vehicles for change. Keck and Sikkink (1998) evolved the transnational advocacy network approach, where networks of activists, distinguishable largely by the centrality of values, can influence policy change. These networks 'frame' issues, bring new ideas into policy debates and pressurize target groups to adopt new policies (Keck and Sikkink, 1998). Sell and Prakash (2004) demonstrate how the transnational advocacy network framework can travel quite far when applied to the business network.

This study utilizes insights from the literature on networks and discourse coalitions to explain policy making on GM crops in India. Hajer's (1995) 'story-lines' or narratives on social reality and 'discourse-coalitions' in which actors are held together by story lines find applicability in the Indian case. His contention that coalitions can be 'unconventional in the sense that actors have not necessarily met, let alone that they follow a carefully laid out and agreed upon strategy' provides a fluid and loose definition of coalitions that is useful. Insights from the transnational advocacy network as outlined by Keck and Sikkink (1998) can be utilized to focus both on the pro- and anti-GM networks in India. Both networks built new links, opened new channels and framed issues to target audiences. Both generated new norms and affected norm implementation. Both pro and anti-GM networks used information politics and symbolic politics. Although networks and frames can appear to be contradictory metaphors, a network connects around a shared story-line, so framing and networking can happen simultaneously (Purdue, 2000).

R & D and Regulation of GM Crops in India

The Indian government has shown an interest in the area of agricultural biotechnology since the 1980s (Chaturvedi, 2002). The National Biotechnology Board (NBTB) was established in 1982 to identify priority areas and develop a long-term plan in biotechnology. The NBTB was transformed in 1986 to the Department of Biotechnology, under the Ministry of Science and Technology. Several other departments also deal with biotechnology research. The public sector research institutions in India have been involved in agricultural biotechnology research into various crops including chickpea, rice, cotton, tobacco, brinjal, mustard, etc. (Ghosh and Ramaniah, 2000). Currently over twelve multinational firms and a number of domestic private companies are interested and have invested in agricultural biotechnology in India (Newell 2003). In 2004, the following private sector companies were actively working on GM crops in India:

Mahyco-Monsanto, a joint venture between the multinational company (MNC) Monsanto (USA) and MAHYCO, an Indian company; subsidiaries of MNCs Syngenta (Switzerland), Bayer /Proagro -PGS (Germany), the Tata Group/Rallis (India) and Indo-American Hybrid Seeds (USA); and wholly Indian owned smaller firms, Rasi Seeds, Navbharat Seeds, Hybrid Rice International, Ankur and Swarna Bharat Biotechnics (Indira et al, 2005). The R&D in GM crops conducted so far by the private sector in India can be described as “improvements” based on imported GM innovations (Indira et al, 2005). . Specifically, this “R&D” consists in “backcrossing” the genetically engineered traits from the imported GM-crop seeds into selected local varieties of the crop through standard breeding techniques (Indira et al, 2005). Though there are many companies involved in traditional biotechnology, only few are actually working on transgenic crops (Indira et al, 2005).

GM crops are regulated under the Indian Environment Protection Act, 1986. The biosafety regulatory framework consists of 1989 Rules issued by the Ministry of Environment and Forests (MOEF), as elaborated and revised by the 1990, 1994 and 1998 Guidelines issued by the Department of Biotechnology (DBT). These cover the entire spectrum of activities relating to genetically modified organisms (Gupta, 2000). An elaborate regulatory structure involving various departments has been set up to deal with approval for commercialization and use of GM crops. . Two main departments involved in regulation are the Department of Biotechnology (DBT) under the Ministry of Science and Technology and the Ministry of Environment and Forests (MOEF). The Genetic Engineering Approval Committee (GEAC) under the MOEF is responsible for granting approvals for commercial release of GM products. The RCGM (Review Committee on Genetic Manipulation) under the DBT authorizes controlled field experiments. The Monitoring and Environmental Committee (MEC) focuses on environmental impact. The Recombinant DNA Advisory Committee (RDAC) looks into biosafety regulations and the Institutional Biosafety Committees (ISBCs) into research. State and district level committees are to be also set up, but very few have actually been established to date.

India's Policy Shifts on GM Cotton

India is the third largest producer of cotton in the world accounting for about 13% of production (MOEF, Background Note). While India has the world's largest acreage of cotton, productivity is among the lowest in the world. One of the main factors affecting this low productivity is the fact that pesticides account for a portion of total cultivation costs. In fact, cotton accounts for more than half the money spent on pesticides in India. It is this scenario that led to the promotion of GM cotton as a means of reducing pesticides and becoming a boon for India's farmers. But NGOs and others questioned the assertions that GM cotton would be beneficial for India pointing out that resistance will eventually develop and that it would affect biodiversity. The following table summarizes the arguments for and against GM cotton in India:

Arguments for and against GM cotton

Pro	Con
Help reduce use of pesticides – environment friendly	Resistance will develop
Increase yields of higher quality due to reduction in pests	May be a threat to beneficial species and affect biodiversity
Economic advantage in reducing costs on pesticide	Costs are very high leading farmer to be dependent on company
Improved control of target pests	Corporate control of agriculture
Export potential	Terms of international trade may not be

	favourable
Expands Choice	Limits Choice

Monsanto, a multinational firm with its headquarters in the US, initially approached the Indian government for introduction of GM cotton technology in 1990, but was rejected. In 1995 MAHYCO, an Indian seed company, was allowed to import Bt cotton seed under a license from Monsanto. MAHYCO crossed the gene with selected local cultivars and the resulting hybrids were put through the regulatory process of field trials and testing. In 2001, after years of testing, when MAHYCO -Monsanto (MMB) Bt cotton came up for approval, the government refused to grant permission for commercialisation. However, just one year later in 2002, the government approved the commercial release of three Bt cotton hybrids (known as MECH 12 Bt, MECH 162 BT and MECH 184 Bt) for three years. This approval followed the news that another version of Bt cotton, marketed by a domestic company, was already being sold and planted in farmer's fields prior to legal approval of Bt cotton. In 2005, when the three year period ended and the issue of the renewal of Bt cotton for a further time period arose, the government approved of the renewal of MMB Bt in most states except for Andhra Pradesh. Commercialization and field trials of various Bt cotton hybrids were also approved. About 18 GM cotton hybrids have been cleared for commercial release and a number are in various stages of trials. The following timeline illustrates the main policy shifts:

- 1990-93 Monsanto attempts to negotiate with DBT but Bt cotton rejected
- 1995 MAHYCO allowed to import Bt cotton seed under a license from Monsanto
- 2001 Bt cotton commercial release rejected
- 2001 'Illegal' Bt cotton found in Gujarat
- 2002 Bt cotton cleared for commercial sale
- 2005 in Andhra Pradesh approval for Monsanto-Mahyco Bt cotton revoked; other Bt hybrids approved

These shifts are discussed below, with a focus on the role of networks and discourses in shaping policy. India's policy is divided into four stages. The first phase proceeds from Monsanto's initial application to introduce Bt cotton, which was rejected, to Mahyco-Monsanto's approval. Here, alliances between Monsanto and various domestic actors, and the discourse on the role of biotechnology in India were important in influencing policy. The second phase covers the period from the field tests of Bt cotton to the refusal to grant permission for Bt cotton in 2001. The framing of biotechnology by anti-GM networks is seen as a key factor in the policy during this phase. Stage three looks into the Gujarat incident and the approval to Bt cotton in 2002. The shift in discourse towards farmers and alliances between industry and farmers are focused upon here. The final phase is the approval of several Bt cotton seeds granted in 2005 along with the reversal in allowing MMB Bt cotton in Andhra Pradesh. The widening of networks and the discourse on farmer suicides are analysed here.

Stage I: Alliance Building and Framing of Biotechnology

The initial move to introduce Bt cotton in India dates back to 1990 when multinational firm Monsanto initiated talks with the Department of Biotechnology for the Bt gene. This initial negotiation was for technology transfer between Monsanto and India for two constructs containing Cry 1Ac and Cry 1Ab, transgenic cotton seeds containing Cry 1 Ac, and training for Indian personnel relevant to cotton transformation (Ghosh, 2001). Monsanto's offer was refused in 1993 because, according to the government, the technology transfer fees demanded by Monsanto were too high. In 1995, this decision was revised with the government granting permission for a large domestic seed company, MAHYCO (Maharashtra Hybrid Seed Company) to import 100 grams of transgenic cotton as part of agreement with Monsanto. MAHYCO imported the seeds in 1996 and these were used for backcrossing into Indian elite cultivars. In 1996-98 MAHYCO was granted permission by the Indian government to conduct field trials on these Bt cotton hybrids.

The government's approval of Mahyco's application at this stage compared with Monsanto's rejection in 1993 led to speculation that the crucial deciding factor was whether the applicant was a foreign or domestic company (Bharathan, 2000). Others refuted this, pointing out that the first proposal involved public funds, while the latter did not, and that this should be seen as the deciding factor (Current Science, 2001). India's interest in promoting indigenous biotechnology, rather than fostering 'dependence' on multinational companies could have influenced the decision. R & D to produce Bt cotton was underway in the Central Institute of Cotton Research (CICR), a major public sector research institute in India, and policy makers felt this deserved greater support than technology transfer (Indira, et al, 2005). Some scientists who were involved in India's biotechnology programme claimed that domestic actors had the capacity to develop Bt cotton for much less than that being offered from Monsanto. Pushpa Bhargava, an influential scientist involved in the setting up of the DBT and who founded the Centre for Cellular and Molecular Biology, for example, noted that,

".....Monsanto had tried to sell to India the Bt cotton seed technology for about Rs 60 crore. Many of us were upset about thiswhen we could have developed this technology for less than Rs 3 crore, be it in the public sector or the private sector. Eventually, DBT was prevailed upon by the hue and cry we raised not to purchase the Bt cotton seed technology at that time." (Bhargava, 2003).

Path dependence could provide a partial explanation for the outcome, particularly with India's policy for decades of promoting the public sector and being wary of foreign control. In addition, others have speculated on the possible disagreements over intellectual property that may have lead to a break down in the negotiations at the initial stage (Indira et al, 2005). The forging of alliances and actors mobilizing around story-lines influenced the policy process.

Mobilization

The 1993 rejection led to a process of alliance building for Monsanto. Mahyco and Monsanto's success in negotiating for licensing of Bt technology laid the foundation for Monsanto acquiring 26 % share of Mahyco in 1998 and setting up of a joint venture Monsanto-Mahyco Biotech (MMB) in 2002 (Gupta and Vikas, 2005). Monsanto also initiated a process of building alliances with other domestic actors. Monsanto entered into collaboration with TERI (The Energy Research Institute), a respected non-profit research institute, in 2000. The agreement was for developing 'golden mustard' which would produce a cooking oil high in beta carotene (pro-vitamin A). This was projected as a good will gesture as Monsanto did not intend to

commercialise this product (Newell, 2003). Monsanto, in collaboration with the well-known Indian Institute of Science, also established the Monsanto Research Centre in 1998 to conduct research in agricultural biotechnology (<http://www.sid.iisc.ernet.in/monsanto.html>)

These alliances were significant and strategic in influencing the policy process. Firstly, they provided an 'Indian face' to Bt cotton (Scoones, 2003) to overcome the criticism that it was a technology that only benefited foreign and not domestic companies. Secondly, the link with a domestic company enabled greater interaction for Monsanto with influential industry bodies such as Federation of Indian Chambers of Commerce and Industry (FICCI), Confederation of Indian Industry (CII) and Association of Chambers of Commerce (ASSOCHAM). Thirdly, they provided greater access to policy-making bodies. Barwale, the head of Mahyco was respected and well known with the DBT and Ministry of Agriculture (Scoones, 2003). TERI was on the committees of the Ministry of Environment and Forests and DBT (Newell, 2003). Fourthly, organizations like TERI organized 'stakeholder dialogues' inviting participants from NGOs, industry and farmers to debate biotechnology. Although these forums spoke to those who perhaps were already convinced about biotechnology (Gupta, 2000), they did provide some substance to the position that policy was being initiated with 'wide consultations'.

Framing of Biotechnology

GM crops had to be seen not only as a technology with an Indian component, but also one that delivered on the promise of meeting India's development needs. India had adopted biotechnology in the 80s precisely as a tool for promoting development, but it was not clearly spelled out how biotechnology would promote India's growth. The link between biotechnology and development was cemented with the story line of **'biotechnology for the poor'**.

Biotechnology, emerging from and largely confined to advanced nations, was not seen as a tool to fight poverty initially. This linkage between biotechnology and poverty was made when industry could not penetrate European markets (Stone, 2002). In 2000 Monsanto and six other biotech firms formed a public relations consortium known as the Council for Biotechnology Information (Stone, 2002). CBI advertising at the outset concentrated on need for GMOs for developing world and this theme quickly came to dominate industry media (Stone, 2002). In this link between biotechnology and poverty, the 'Malthus card' as paraphrased by Stone (2002) is played, warning about current and future food shortages and the need for genetic modification to avert famine. The discourse also incorporates elements of continuity with the Green Revolution, in which new hybrid technology enabled high yields in India and other developing countries. At the same time, biotechnology distances itself from the major criticism voiced against the Green Revolution, by pointing out that biotechnology reduces pesticide use, is environment friendly and will perform in marginal lands. As Stone (2002) points out this discourse blurred the public-private divide.

The 'biotechnology for the poor' frame was widely promoted both internationally and nationally. Per-Pinstrup Anderson, then head of IFPRI in an article entitled 'The Developing World Simply Can't Afford To Do Without Agricultural Biotechnology', stated, "Agricultural biotechnology can be used to help farmers in developing countries produce more by developing new crop varieties that are drought-tolerant, resistant to insects and weeds and able to capture nitrogen from the air." (International Herald Tribune October 28, 1999). Norman Borlaug, the Nobel laureate associated with the Green Revolution, stated, "We will not be able to feed the people of this millennium with the current agricultural techniques and practices. To insist that we can is a

delusion that will condemn millions to hunger, malnutrition and starvation, as well as to social, economic and political chaos..... But it cannot be attained without permitting the use of technologies now available, or without research to further improve and utilize new technologies, including biotechnology and recombinant DNA.” (Wall Street Journal, 2000).

In India, the respected scientist Swaminathan, also associated with the Green Revolution, emphasizes that GMOs have the potential to promote an ‘evergreen revolution’ rooted in the principles of ecology, economics, equality and ethics. The biotechnology for the poor could be easily fitted into India’s initial reasons for taking up biotechnology. Although biotechnology from the very initial days was seen as a tool for promoting development in India, this development was seen in terms of India’s capacity to conduct advanced research. The pro-poor focus became more fine-tuned in the later years. The paradox of plenty (that India is overproducing food) is answered with statistics that population will outstrip this production in future or that biotechnology is necessary to increase efficiency and competitiveness in global markets

A second frame promoted biotechnology in terms of India’s information technology revolution. C S Prakash, a scientist in the US, and NRI’s (Non-resident Indians) who wanted India to reach new level of development emphasized that India’s success **in information technology could be replicated in biotechnology**. Chief Ministers of states like Karnataka and Andhra Pradesh also tried to promote this view. In Karnataka a policy on biotech was formulated with C S Prakash in the group-KGANGA—Karnataka Global Advisory Group on Agriculture. Heads of biotech start-ups like Kiran Majumdar-Shaw also echoed this discourse. The then Chief Minister of Karnataka, S M Krishna, released the Millennium Biotech Policy for Karnataka 2001-02 stating,

“While Karnataka is the acknowledged leader in IT, I would like the State to lead the next revolution in Biotechnology. Karnataka already has the training and knowledge base necessary to drive the revolution. We have the critical mass of biotech companies and the best research institutions. The immediate challenge is how to nurture that innovation, promote entrepreneurship and facilitate effective technology transfer to the end users. I am happy to announce a Vision Group”

Thus biotechnology promised a two fold dream of providing food for India’s masses and transforming agriculture into a globally competitive industry. The coalitions around these story lines resemble Hajer’s discourse coalitions. These coalitions consisted of actors from various backgrounds and interests, but all promoting the need for biotechnology. The foundations of a pro-GM network begin to be assembled here with partnerships between Monsanto and domestic actors and these discourse coalitions.

Stage II: Counter Alliances and Frames

NGOs, farmers lobbies and pressure groups effectively challenged the pro-biotechnology frameworks. NGOs effectively turned around the view of biotechnology for the poor with their frame that Biotechnology = Hunger (Stone, 2002). The ‘terminator’ controversy, both in India and globally, raised enough of a protest to affect the decision on Bt cotton in India. Following the approval for MMB to import Bt cotton, a long period of testing of the technology took place. Field trials in several states including tests on out crossing, germination, weediness, food safety, allergenicity, toxicity, etc were conducted (Barwale, 2001). In spite of these elaborate

tests, MMB was refused permission to commercialise Bt cotton in June 2001 and was asked to conduct further tests.

Anti-GM activists used the 'terminator' controversy to rally fears of Monsanto's GM technology. 'Terminator' was coined by RAFI, an NGO based in Canada, for the technology known as GURT (Genetic Use Restriction Technology) that produces plant varieties whose seeds do not germinate or lack specific characteristics. The terminator controversy emerged internationally and this had an impact in India. NGOs alluded to this as if Monsanto was going to bring this technology to India. Vandana Shiva, a prominent NGO activist, for example, stated that Monsanto's technology is not terminator but they are in an ecological sense terminator which terminates biodiversity and the possibilities of ecological sustainable agriculture based on conservation of biodiversity. Sahai, who heads the NGO Gene Campaign, noted that the very fact of adopting terminator shows greed.

NGOs and farmers' lobbies questioned the views that biotechnology could be used to fight poverty or that biotechnology could transform India into a superpower. They also criticized the regulatory mechanism set up by the government for GM crops. Vandana Shiva filed a public interest litigation alleging that the government was not following the correct procedure in allowing Mahyco-Monsanto to conduct field trials. She alleged that under the regulations, the RCGM is not authorized to permit open field trials of GM crops and that this comes under the purview of the GEAC. Yet the MMB trials seem to have been permitted by RCGM and that this makes the trials illegal and illegitimate (Shiva et al, 1999). Shiva criticizes GM crops for various reasons. Firstly, she points out that biotechnology would enable corporate control and monopoly of seed. Secondly, firms are profit driven and through advertising they would trap the farmer and also enslave him through contracts. Thirdly, she raises the issue of accountability. Pointing to the farmer suicides in Andhra Pradesh and Maharashtra, she argues that monocultures further increase the vulnerability to pest attacks since the same crop of the same variety planted over large areas year after year encourages pest build ups. Fourthly, she alleges that the claims of Bt cotton to produce high yields and fight pests are unfounded.

The farmer's lobby in Karnataka, KRRS, headed by Nanjundaswamy, launched a movement against Monsanto and burnt trial fields of Bt cotton in Karnataka. This was a highly publicized move and the farmer's leader coined phrases such as 'Creamate Monsanto' and 'Stop Genetic Engineering'. The KRRS had long protested against multinationals entering agriculture in India, and had damaged offices of Cargill, a seed company, and protested against Kentucky Fried Chicken in Bangalore.

Suman Sahai of Gene Campaign, argued against Monsanto's role in India but was not against biotechnology per se. She pointed out that Monsanto and biotechnology are being equated and that is wrong—biotechnology has the potential to provide more and better food. However, technologies must be relevant to the needs of small farmers and should be introduced only after educating them. India, which has significant technical skills in the field of agriculture, must develop self-reliance in technology. There is no reason for the Indian establishment to function as the purveyors of MNC technologies, specially with their incumbent baggage of patents (Sahai, 2002).

The combined effect of these NGO protests raised concern about agricultural biotechnology in India. Particularly the 'terminator' technology led to questions both in the legislature and among the public about Monsanto's role. Monsanto had to issue a press release specifically stating that

it would not use terminator technology in India. The Indian government took the step of issuing a memo banning the entry of terminator technology and questions on the technology were raised in Parliament. . Questions were raised in both houses of Parliament on the terminator technology State governments also began to raise objections against GM crops. Karnataka and Andhra Pradesh banned field trials in their state, but later agreed to allow them with the involvement of agricultural universities in the testing particularly in Andhra Pradesh. Agriculture is a state subject, whereas biotechnology is decided at the centre. Along with these pressures from NGOs and state governments, there were also inter-ministerial differences that came into play. The Indian Council of Agricultural Research felt left out of the process at this stage and officials have pointed out that this is one factor in the delay to allow commercialisation. The fact that the GEAC called for fresh large-scale field trials under the direct supervision of committee set up by ICAR (Indian Council of Agricultural Research) while rejecting Monsanto-Mahyco's application revealed the inter-ministerial rifts. Ultimately, the government did not approve of Monsanto-Mahyco's Bt cotton in 2001.

Counter to the pro-GM network, we find here the emergence of the anti-GM network. The interesting factor in this network is that it consisted of domestic NGOs and farmers lobbies aligning themselves with international NGOs. The discourses of domestic NGOs brought them together under a story line, but only loosely. They did not always act in coordinated fashion with each other on protests, meetings, etc. The link was rather with the global actors. The Indian NGOs effectively utilized international campaigns and actors to promote their views in India. Farmers lobbies such as the KRRS linked up internationally with other farmers lobbies through Via Campesina. In 1999, farmers led an 'international caravan' throughout Europe protesting mainly against the WTO but also against intellectual property and genetic engineering. Shiva's organization linked up with international NGOs such as GRAIN, RAFI and TWN. This reflects in some senses the 'boomerang pattern' described by Keck and Sikkink (1998) where domestic NGOs bypass their state and directly search out international allies to try to bring pressure on their state.

Stage III: Reframing of Biotechnology as Farmers' Choice

In October 2001 it was reported that unlicensed Bt cotton hybrid carrying the *cry1Ac* gene was found growing on over 10,000 acres in the western state of Gujarat. This fact emerged after a severe pest attack had left all but Bt cotton devastated in Gujarat. A Hyderabad-based company, Navbharat Seeds Co. Ltd. Had been growing Bt cotton seeds and selling it in various parts of the country. Although the seed contained the same Bt-toxin gene as MMB Bt cotton it was crossed with a different hybrid and was known as Navbharat 151 (NB 151). By the time the presence of this 'illegal' Bt cotton was detected, the cotton had already been marketed. The GEAC attempted to order the state government to burn the illegal plantations, but the state government questioned this policy. Considering the cotton had already been marketed, the GEAC changed its order and asked for recovery of unpicked cotton to the extent possible and destruction of crop residue (Herring,).

Following this, on March 26, 2002, the government approved commercial release of MMB Bt cotton. The approval of Bt cotton following the Gujarat incident was seen to be inevitable after the news of 'illegal' Bt cotton appeared. However, it is not so clear that the decision was inevitable. The government could have chosen to delay the decision, or could have pushed for stronger enforcement by punishing the violators of intellectual property. For comparative lessons we can look to GM soya in Brazil, which illustrates that different policy reactions to such incidents can emerge. (See Bauer and Gaskell eds, 2006). The reasons for the decisions moving

from de facto to de jure acceptance of GM crops must be understood in terms of new networks and new discourses that changed the nature of the debate.

A powerful story line of **'GM as farmer's choice'** emerged following the Gujarat incident, which challenged the discourse of NGOs. Yamaguchi and Harris (2004) point out the shift in discourse towards farmers in 2002. News of farmers growing Bt cotton in Gujarat and other parts of the country prior to the government's approval led to shift in the way GM crops were portrayed. The rationale was then put forward that if the farmers want the technology, what right does the government have to deny them GM crops? This was a powerful logic, which the NGOs could not refute. In effect, it made the NGOs appear to be totally cut off from the real interests of the farmers they were supposed to represent. Rather than farmers being seen as victims of globalization, they were presented as decision makers and voters for the technology (See Herring, 2006).

The pro-GM lobby's strategy following the Gujarat incident was not to stress the IPR violation, but rather to stress the issue of farmer's choice. A case was registered against Navbharat Seeds Co. Ltd. in the Gujarat High Court on November 12, 2001, but it was not made a focal point of the pro-GM networks stance. The following statements by C S Prakash and by MD Monsanto, India are revealing:

"The issue of illegal Bt cotton making headlines in the Indian media provides some valuable lessons. It shows that many of our farmers would readily employ 'improved' varieties of crops when given a choice, and that biotechnology clearly offers solutions to certain agricultural problems.....Paradoxically enough, this unforeseen development is indicative of how the tide has turned in favour of biotechnology in India and debunks the myths that Indian farmers are not willing to embrace this technology or pay more for improved seeds. *This is not about patent rights or intellectual property issues but it is about the appropriate use and credible monitoring of this new technology, along with safeguarding the global interests of India's biotechnology industry*". Nov. 7, 2001 CS Prakash Hindu (italics mine)

"We have never seen the lack of patent protection as a major hurdle in launching new products. In fact, we hold Indian registrations for almost the entire complement of products held by our parent and generally do not hold back any brand from our parents' portfolio". (Hindu Dec. 31, 2002 interview with Mr Shekar Natrajan, Managing Director, Monsanto India)

Pro-biotechnology farmers lobbies demanded the approval of Bt cotton. Farmers all over the country, under the banner of Kisan Co-ordination Committee (KCC), will launch a civil disobedience movement and begin sowing of Bt Cotton seeds, if the Genetic Engineering Approval Committee (GEAC) fail to approve the commercialisation of this transgenic cotton seed, threatened Mr Sharad Joshi, founder of Shetkari Sangatana. (Financial Express 26 March 2002)

The Liberty Institute, an NGO promoting market reforms, organized a meeting on March 25 to 'Set the Indian farmer free'. The meeting was addressed by several pro-biotechnology farmers leaders including Sharad Joshi and Chengal Reddy. Barun Mitra, who heads the Liberty Institute stated, "the farmers were able to see that biotechnology worked, and they wanted it." (www.libertyindia.org). In an article on the Liberty Institute's website, it was pointed out, "Though the flouting of the law by Navbharat Seeds (the company that sold the seed to the

farmers) is regrettable, the controversy only highlighted the impatience of the farmers with government dithering on commercialising Bt Cotton. Plagued by repeated pest attacks, they were looking for some succour, which the unapproved variety of Bt Cotton provided them.” (Behind All the Fluff Clearing The Air On BT Cotton www.libertyindia.org)

The discourse on farmer’s choice essentially blurred the distinction between success of Navbharat’s NB 151 with success of MMB Bt cotton. The demand for NB 151 was due to its demonstrated ability to resist bollworm attack and the relatively low price compared to the version marketed by MMB. But in the discourse on farmer’s choice, the success of NB 151 was seen as success of MMB Bt cotton. Several farmers organization and farmers have been demanding that NB 151 to be legalized as some claimed it to be superior to MMB Bt cotton. It has been reported that the illegal Bt cotton was not a hybrid but a variety which meant farmers could save and use it for the next crop.

The discourse of farmer’s choice led to a unique alliance between industry and farmers. The industry began cultivating links with pro-GM farmers’ lobbies. This culminated in December 2002 with the launch of the Indian Farmers and Industry Alliance (IFIA), by the Confederation of Indian Industry (CII) and the Federation of Farmer’s Associations of Andhra Pradesh. This is the first time such an alliance has ever taken place. The alliance between farmers and industry can be seen as a discourse coalition around the story line of technology and agricultural development of farmers and industry. Though the alliance claims to have an interest in several areas, GM crops are an important factor in their agenda. In 2003 for example, the alliance urged the GEAC to allow GM mustard (CII, 2003). On several aspects industry and farmers are likely to have differing opinions, but the discourse on ‘farmers choice’ suited both the industry groups and the farmers’ lobbies. In the post-Gujarat scenario, the pro-GM network incorporates pro-GM farmers lobbies, NGOs, industry groups, NRIs, around the story-line of ‘GM as farmers’ choice’. The anti-GM NGOs found it difficult to refute this, and they had to content themselves with arguments about risks to health and environment safety. The government, it appeared, was not left with many options.

Stage IV: Contesting Frames and Broader Networks

Growing networks and contesting frames can be seen in the decision in 2005 to grant approval for several Bt cotton hybrids, while refusing to allow MMB Bt cotton in Andhra Pradesh. The permission for more companies to enter the Bt cotton market resulted from seed companies getting further involved in biotechnology. The Andhra Pradesh decision was influenced by the ability of NGOs to network and use the counter frame of farmer suicides.

In 2005 the renewal of MMB Bt cotton came up, as the three year period of approval drew to a close. Initially, the GEAC deferred the decision. Ultimately it renewed permission for MMB BT cotton in the central and southern zone states in which it was approved in 2002 (Maharashtra, Madhya Pradesh, Gujarat, Karnataka, Tamil Nadu) for a period of two years. However, the committee did not renew permission for MECH 12 Bt, MECH 162 BT or MECH 184 Bt for the state of Andhra Pradesh (GEAC, 2005). The GEAC further approved Bt cotton hybrids produced by several other companies.

The clearance for several new hybrids must be seen in light of the domestic seed companies who had started gearing up for the changing scenario. Some of the firms producing hybrid cotton seeds concluded licenses with Monsanto for the Bt gene which they could then cross with their seeds. A few firms also negotiated with others for the construct, such as Nath seeds with China. With this development, the pro-GM network widened to include more domestic seed companies. These seed firms called upon government regulators to relax rules on GM technology and speed up the clearances. Many new domestic actors have been able to get their Bt cotton approved for commercialisation.

Andhra Pradesh

The decision to revoke MMB Bt cotton in Andhra Pradesh appears out of tune with the green signal for so many new companies to introduce GM cotton in the rest of India. A senior member of the GEAC stated that "The decision not to allow the three hybrids in Andhra Pradesh was taken on receiving adverse reports from the State Government as well as some 20 farmers' organizations in the State" (Frontline 2005).

The years following the approval in 2002 witnessed a contest between pro and anti-GM networks to prove the success or failure of Bt cotton. A number of surveys of farmers from both sides were conducted. International actors were also involved in providing and releasing the figures from such studies. The NGO, Deccan Development Society (DDS), based in Hyderabad, Andhra Pradesh led a campaign to protest against Bt cotton. Firstly, they conducted extensive surveys of the performance of Bt cotton in Andhra Pradesh. Scientists were commissioned to conduct the surveys. Titled 'Did Bt Cotton Fail Again in 2003-04?' the report authored by agricultural scientists Abdul Qayum and Kiran Sakkhari in Adilabad, Warangal and Kurnool had a sizeable sample of nearly 164 farmers from 28 villages. The study refuted the following claims of industry that Bt cotton reduces use of pesticides and reduces the cost of cultivation. Secondly, the NGO with its international network held a massive international conference to protest against Bt cotton. Thirdly, the NGO highlighted the massive farmer suicides taking place in Warangal, Andhra Pradesh, as a sign of the failure of economic reforms and Bt cotton.

Greenpeace and other NGOs also put forward the view that Bt cotton had failed in Andhra Pradesh. Greenpeace was invited to the GEAC meeting to provide evidence of Bt cotton failure. Suman Sahai of Gene Campaign also published a field study in August 2003 showing negative results of Bt cotton in Andhra Pradesh.

One crucial factor in the decision on Andhra Pradesh was the negative report submitted by the state government to the centre on Bt cotton. There were political factors that could have come into play here. In 2004 the technology savvy Chief Minister Naidu lost the election. Many attributed his loss to ignoring the rural population. The new government did not want to be seen as anti-poor or anti-farmer, and this could have influenced its negative report on Bt cotton. It is clear that in Andhra Pradesh, the government had tried to protect cotton farmers. The government had signed an MOU with the seed companies under which Monsanto was asked to pay compensation to the farmers for losses arising from growing Bt cotton. The campaign appears targeted only at Monsanto, because the approval of Bt cotton from other companies has not led to as much protest. The role of pesticide companies in the debate also needs to be explored.

Pro and Anti-GM Networks and Discourses: Farmer's Views Compared

The mobilization of actors and ideas were important factors in the policy process on GM crops in India. Interests formed the basis of some alliances, but discourse coalitions, based on story-lines, were also evident. It is difficult to separate the role of interests or the role of ideas in shaping mobilization and both factors appear to be important. Interests, however, as pointed out by Hajer (1995) cannot be assumed as given, they are constituted.

The pro GM network consisted of business groups, NGOs and farmers lobbies. Department of Biotechnology was a strong supporter of biotechnology. The network was initiated with the alliances between Monsanto and Mahyco and with research institutes like TERI. This was further developed through Industry Association such as the Confederation of Indian Industry (CII), a strong supporter of biotechnology. Seed companies in India initially were reluctant to support GM technology, but with the opportunity for licensing Monsanto's Bt gene and crossing it with their varieties, seed companies became interested in easing regulations on biotechnology. A crucial link came with industry tying up with farmers lobbies to demand Bt cotton as 'farmer's choice'. International connections such as through Non-resident Indians (NRIs), or Indians settled abroad, played an important role in promoting biotechnology as a tool for India's development.

The anti-GM network was composed of NGOs and farmers lobbies who coordinated with international NGOs more than with each other. International NGOs such as Greenpeace were able to make representations to the government. The link up with scientists and state governments provided the NGO, DDS, an important network. The DDS was also able to link up with several national social movements and international lobbies.

Framing of the debate was crucial for both sides. While the pro-GM networks attempted to push 'biotechnology for the poor' and 'Information technology to biotechnology', these were effectively countered with 'Biotechnology = Hunger' and 'Terminator' controversy by the anti-GM lobby. But the 'GM as Farmers Choice' story line was successful and could not be easily refuted by the anti-GM network. In one state however, NGOs were able to use Farmer Suicides as a way of reframing the debate.

Both the networks placed their frames in the context of existing debates. The pro-GM network used the existing frame of biotechnology for India's development, environment and the farmer as an important decision maker. The anti-GM networks used the existing discourse on development from indigenous rather than foreign sources. They also portrayed the farmer as a victim of globalization.

The pro and anti-GM networks utilized similar strategies. Surveys, testimonies by farmers were highlighted by both sides. Both used media. Symbols such as portraying Navbharat MD as 'Robin Hood' or referring to Monsanto in terms of the struggle for Independence from the British were used by both.

The pro and anti-GM networks were effective in enabling both normative and substantive change. Through the Gujarat case, the pro-GM lobby asserted that Bt cotton is beneficial because the farmers want the technology. The anti-GM side was able to show that perhaps it was not suitable for all areas such as in Andhra Pradesh.

The following table compares the pro and anti-GM networks:

	Pro-GM	Anti-GM
New Linkages	MNC-Dom Industry Business-Research Business-NGO-Farmers NRIs-State Governments Business-Farmers	NGO-INGO NGO-Local Social Movements Farmer Lobby-International Farmer Lobby NGO-International Farmer Lobby
Frames	BT for the Poor IT to BT GM as Farmer's Choice	BT = Hunger Terminator GM as a Failure Farmer Suicide
New Ideas on to existing ones	Bt and development Farmer's choice important in decision making Environment	Development as indigenous not foreign Farmer as victim
Strategies	AC Nielsen Survey Farmer testimonies Media Robin Hood	DDS Study Farmer testimonies Media Gandhi—cotton 'Monsanto Quit India'
Normative Change	GM is beneficial because farmers want the technology	GM may not be suitable in all areas
Substantive Change	MMB Bt Cotton approved 2002 2005 Bt cotton hybrids approved	2001 Refusal of GM 2005 Refusal for MMB Bt in Andhra Pradesh

Farmer's Responses

The positions of the pro and anti-GM lobbies must be compared with the ground reality of farmers. In order to elicit the views of farmers, we undertook a field visit to two villages in the Indian state of Maharashtra. Maharashtra is the largest cotton growing state in the country. It covers about 34% of total cotton area and contributes 17% of the production. In Maharashtra cotton is cultivated in 27 districts out of which Bt. Cotton seeds were distributed in 19 districts. 30485 packets (450 gm. Bt-cotton and 120 gm non Bt-cotton) of Bt cotton varieties MECH-12 Bt., MECH-162 Bt. and MECH-184 Bt. were marketed. The area covered under Bt. cotton varieties is 12194 hectare (State Department of Agriculture). Maharashtra is also a state which has witnessed a large number of farmer suicides among cotton growing farmers. Monsanto has

its headquarters located in Maharashtra and a number of NGOs are active in the state. These factors make the state an ideal place to probe the views of farmers and compare them with the pro and anti-GM lobbies.

We conducted field visits in two villages near Nagpur. Nagpur is practically at the geographical centre of India. Located in eastern Maharashtra, it is at the centre of the Vidarbha region, and has a population of about 3.5 million. The majority of farmer suicides reported in Maharashtra are in the Vidarbha region. Nagpur is the headquarters of The Central Institute of Cotton Research (CICR), the main public sector agency for cotton research in India. Established in 1976 as a centre of excellence for carrying out long term research on fundamental problems limiting cotton production, the main mission of CICR is to improve the production, productivity and profitability of cotton cultivation in all the distinctly different agro-ecological cotton growing zones of the country (www.cicr.nic.in).

We interviewed farmers in two villages close to Nagpur. Tishti is a village that has been 'adopted' by the Central Institute of Cotton Research (CICR). By 'adopting' a village, the CICR aims to promote development of the agricultural community in the village by providing inputs, information and guidance to the farmers. The CICR has provided free MMB Bt cotton seeds to various farmers in the village on an experimental basis. Accompanied by an official from CICR, we conducted a group discussion with about thirty-five farmers in Tishti and further conducted detailed interviews with a few farmers. Both farmers growing Bt cotton and non-Bt cotton were included in the sample.

The second village, Hingani, has a population of about 14,000 with about 70% of its population engaged in farming. The crops grown there include: cotton, soyabean, chick peas. In Hingani an NGO, YUVA (Youth for Unity and Voluntary Action), has since the last six months become active in the village and is trying to convince farmers about the negative impact of Bt cotton. Accompanied by a representative of YUVA, we conducted semi-structured interviews with the farmers in Hingani.

The two villages provided interesting contrasts and comparisons. Firstly, a public sector research institute (CICR) was focusing on Tishti, whereas in the other village, an NGO that opposed Bt cotton was active. Secondly, Hingani appeared to be a much more fertile agriculturally and farmers attributed this to a dam that was constructed nearby. Thirdly, in Tishti, the farmers who were growing Bt cotton obtained Bt cotton seeds freely from the CICR whereas in Hingani, the farmers who desired to grow Bt cotton had to buy it from the market.

From the group discussions in Tishti, it appeared that Bt cotton was just another new seed or technology that had emerged. They did not see it as something radically different from the long list of new varieties which they had been experimenting with. The farmers explained that about ten farmers in the village had been given Bt cotton seeds free from the CICR. They felt that these farmers were not experiencing any side effects from growing Bt cotton. Although some of the farmers expressed interest in growing Bt cotton, they pointed out that the price of the seed was very high and that they were waiting for a fall in prices. The fact that no cheaper version of Bt cotton was available was a deterrent according to them. They emphasized that rich farmers in the village appear to be getting richer with new seeds and inputs, including Bt cotton. A clear division in the village could be perceived between those farmers who had been selected by the CICR for growing Bt cotton, and those who did not have access to the technology. The farmers stated that the CICR provides various inputs such as fertilizer, seeds, pesticides free to some farmers in the village but that the selection of farmers by CICR was not clear to them. They listed Bt cotton along with these inputs. They expressed that CICR gives these inputs only to a

few selected farmers and this was not fair. The farmers also voiced their concerns regarding access to water and credit. In their opinion, water was being diverted to the cities, depriving the villages of water and if this situation continues then the farmers would stop growing crops for the market but would only grow for household consumption. The lack of adequate facilities for providing loans and insurance were other concerns that farmers expressed. .

Fourteen semi-structured interviews were conducted among farmers who cultivated Bt cotton and those who grew non-Bt cotton. We asked several questions regarding their source of information, their experience with growing Bt cotton, and what factors influence their decision to cultivate Bt cotton. The main source of information about Bt cotton was from other farmers. Seven farmers mentioned that they heard of Bt cotton through other farmers, three said they heard of it from CICR and two farmers also mentioned TV, newspapers in addition to other farmers as their source of information. In the decision to grow Bt cotton, the experience of other farmers played an important role. Regarding the factors that influence the decision of farmers to choose to cultivate a variety, five farmers mentioned other farmers, two said they rely on their previous year's experience and one mentioned that he gathers information through newspapers and television. The farmer's experience with Bt cotton was quite mixed, with four farmers reporting higher yield from Bt cotton, two reporting same yields, three farmers reporting less pests with Bt cotton and three farmers noticed the return of bollworm after a certain period. The response to whether they would grow Bt cotton in future also varied with six farmers stating that they would grow Bt cotton in the future, four stating they would not grow Bt cotton and three saying they would consider it based on cost and other factors.

Details of the responses by farmers provide further insight into their perceptions. A progressive farmer in Hingani who was growing Bt cotton explained that he travelled to the neighbouring state (Andhra Pradesh) and he took the decision of growing Bt cotton after getting the information from there and seeing the experience of farmers in that state. He stated that he wants to grow Bt cotton in the coming year, but before that he would collect all the information he could about it and if there is any problem then he would think about whether to grow it or not in the future. He reported reduction in pests and higher yield with Bt cotton as compared to non-Bt cotton. He was using Rasi Bt -2 and not Monsanto Bt cotton. When asked how he solves his problems regarding cultivation he stated that he discusses with other farmers. Another progressive educated farmer in Hingani was growing Bt cotton and he had heard of it from other farmers and on TV. He reported that Bt cotton required more water and that he had started noticing that bollworm (the pests which Bt cotton is supposed to kill) had appeared. He had decided that he would not be growing Bt cotton in future and that he was going to switch to organic farming and farm only for household consumption and not for the market. It was clear that he had good relations with the NGO representative, but when asked about his decision he said he had made it seeing the positive and negative effects of Bt cotton, though he did admit that the NGO had influenced him in understanding the negative effect of pesticides. Another farmer in Hingani growing Bt cotton said he got the information about it from other farmers and from newspaper advertisements. He reported less pests and less use of pesticide with Bt as compared to non Bt cotton. He was planning to grow Bt cotton next year but another hybrid (Rasi 2) because he felt it would provide him better yield though the seed cost was high. He stated that other farmer's experience is what determines which variety he decides to grow. Another farmer in Hingani growing non Bt cotton said that other farmers experience determines his decision. He did report that the NGO YUVA had been telling him that Bt cotton was not good. He was not considering growing Bt cotton because he said the price was too high and that he was planning to shift to organic farming. Another farmer growing non Bt cotton in Hingani stated that other farmer's experience determines which varieties he grows. He has heard about

Bt cotton from other farmers that it does not require spraying as it reduces pests. He has heard from YUVA that Bt cotton is not good for health. Although his wife suggests that they grow Bt cotton, he doesn't want to as he feels it's a danger to their health. He plans to go for organic farming and would consider Bt cotton if he got it free. Another farmer in Hingani grows Bt cotton and he got the information about Bt cotton from newspapers, friends and from Krisi Seva Kendra. He noticed the pest bollworm the last time he grew Bt cotton. He has decided to abandon cotton farming altogether because of fluctuating returns from sale of cotton.

A farmer in Tishti farmer growing Bt cotton stated that his decision to grow a variety is determined by previous years experience and other farmers experience. He had received Bt cotton from CICR and therefore he decided to cultivate it. He noticed less pests with Bt and reported more yield. He would grow Bt cotton in future as there was more production, no spraying for pests and no side effects. A second farmer growing Bt cotton in Tishti which he had received from CICR, reported less pests and greater net returns from Bt cotton. He would consider growing Bt in future as there is less expenditure, less labour and more profit from Bt cotton. A farmer in Tishti growing non Bt cotton said his previous years experience and experiments determine his decision. He knew other farmers growing Bt but hadn't heard much about it. He had not gotten much information from NGOs or the government. . He is not thinking of growing it because of lack of information, resources and water. If he had access to these, he would consider it. Another farmer in Tishti growing non Bt heard of Bt cotton from CICR. He would consider growing it if he got it free because of more production but he is at present not thinking about it because he has very little irrigated land. Other farmers experience will determine whether he grows it in future. A farmer growing non Bt cotton had heard about Bt cotton from other farmers that there were both costs and benefits. He is thinking of growing it in future and other farmer's experience would determine his decision. A female farmer growing non Bt cotton in Tishti reported that she did not have much idea about Bt. She hasn't considered growing it because of lack of information and experience, but the decision would ultimately be taken by her son and husband. For future, they would take the final decision based on other farmers experience and if the expenditure is less they would consider it. A second female farmer in Tishti growing non Bt cotton reported that she also did not have much information about Bt cotton but she had heard from other farmers that it had benefits and that it was a good variety. Her decision to grow Bt cotton will depend on water and cost of seeds. She states that if the cost is too high for poor farmers like herself, then she could consider it only if the price was reduced.

The responses above illustrate that farmer's experiences with new technologies are varied and incorporate a number of factors. While some farmers could be influenced by the role of agencies such as NGOs, firms and government bodies, their decision-making processes do not follow fixed patterns. They base their decisions on adopting new technology by judging the experience of other farmers and by making their own cost-benefit analysis. It is clear that their experiences with Bt cotton, even within such a small sample, reflect their individual condition and perceptions. Whether Bt cotton proves beneficial to a farmer or not is dependent on a number of complex and interrelated factors that must be carefully analyzed.

The farmer's viewpoint appears to be starkly different from both the pro and anti-GM networks. Farmer's experiences with Bt cotton do not correlate with views of Bt cotton as an answer to poverty nor as a harbinger of hunger. The farmer is neither an 'autonomous entity' whose views can simply be taken out of context to make policy decisions on the need for GM technology, nor is he a 'victim' as portrayed by the NGOs. The farmer's views illustrate the importance of viewing any technology in a wholistic perspective in relation to agricultural practices and not in terms of reductionist frames.

Conclusions

The policy shifts in India on Bt cotton were not the result of a straightforward application of science to development needs. The policy was shaped by the way actors mobilized around story lines on Bt cotton. The pro-GM network contributed to the policy debate by pointing out that it is important to give farmers the options to experiment with new technology. The anti-GM network highlighted the fact that Bt cotton may not be beneficial in all areas. The extreme positions adopted by either group may not reflect reality---there may be no 'miracle seeds' or 'suicide seeds'. Biotechnology may not lead to hunger but it may not fight poverty. The pro and anti-GM networks displayed great similarity in their functioning, framing of issues, and network building. Policy makers, while not getting sidelined by the discourses of either side, must also carefully weigh and provide space for the viewpoints of actors, as this may lead to important insights. At the farmer level, it becomes important to understand that inputs, information, and the overall agricultural conditions are important, not just the technology. Farmer's experiences are extremely significant inputs for policy, not as simplistic statements about the acceptance or rejection of technology, but as comprehensive, contextual perspectives on the choice and means to utilize technologies for India's development.

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