What farmers reaped growing Bt cotton - Profits or Problem??

Kiran Sakkhari & M A Qayum

South Against Genetic Engineering
Deccan Development Society
Abstract

India ventured into commercial cultivation of genetically modified crops in 2002 amid protests and rallies both for and against, utter confusion and high hopes not just among the farming sections but also among all other stakeholders such as industry, scientific community and civil society etc. Six years have passed since its decision to join the so called elite club of countries growing GM crops. In these six years, the issue of Bt cotton hogged limelight of the media more for its unfulfilled promises, bringing in alien diseases into the cotton fields, causing death of a number of small ruminants, back-breaking shepherds’ livelihoods, allergies to farmers working in Bt fields and abetting farmers’ suicides, rather than benefiting them or substantially reducing the pesticides consumption. In spite of these facts, Bt cotton made strides into the farmers’ fields and the acreages increased by leaps and bounds, beyond the imagination of even the seed industry, leaving behind many unanswered questions or bouts of problems, except saving farmers from the reeling crisis of cotton cultivation.

In this context, a continuous, scientific and systematic study by Deccan Development Society and Andhra Pradesh Coalition in Defense of Diversity (APCIDD), right from the beginning of the release of Bt cotton on commercial scales, has helped us to figure out the ground realities that the farmers are grappling with and to bring to light some of the hidden challenges.

Cotton cultivation in Andhra Pradesh

Before we go on to the various contours of Bt cotton cultivation by the farmers in Andhra Pradesh, it is prudent to give a brief background on the cotton cultivation in Andhra Pradesh and in particular about cotton cultivation in Warangal district of Andhra Pradesh, which is the focal point of the entire study since 2002.

Indian cottons and textiles were recorded as early as four to five thousand years back and were being exported both to eastern and western countries. Cotton, the “white gold”, is a crop of hope and pride for farmers in many parts of Andhra Pradesh. Just as miners dig deeper and deeper in search of gold, cotton farmers in Andhra Pradesh, year after year, have been adding more and more areas to grow this crop, forever experimenting with new varieties / hybrids in the hope of bumper harvests and better returns. The lure of a shining future is such that it drives the farmers to pursue the dream despite the despairs they meet on their way. They continue to hope that surely a day would come when the
crop would smile upon them, and a rich harvest would make good all their losses. This faith is grounded in their belief that in a weather cycle of five years: the first two will bring normal rain, followed by one year of good rain, and two years of subnormal rain.

**Agroclimatic Zones in Andhra Pradesh**

Geographically, Andhra Pradesh has been divided into three agro-climatic regions viz., (i) Coastal Andhra Pradesh, consisting of 9 districts along the east coast line; (ii) Rayalaseema, comprising of four districts in the southern part of Andhra Pradesh; and (iii) Telangana, the central and northern parts, consisting of 9 districts.

Cotton is well suited to the heavy, black soils. Traditionally, it was cultivated only in the black cotton soils in all the three regions. Over the years, some enterprising farmers from the coastal region were attracted by the lower land rates in the other two regions, so they sold their lands at attractive prices, made profits and relocated to Telangana and Rayalaseema in quest of areas fit for cotton crops. It was these farmers who started the cotton cultivation in the non-traditional areas in the other two regions and reaped bountiful harvests. Amazed by the huge monetary gains from cotton that these migrating farmers were earning, the native farmers, who hitherto were not used to cotton cultivation, started aping them on a large scale. Initially, only the upper middle class farmers who owned black soil lands and who could bear the higher costs of cultivation took to cotton cultivation in these nontraditional areas; and sure enough, they too reaped benefits from it. Gradually, the farmers with fields of lighter soils, that were not considered to be suitable to cotton cultivation also started growing cotton. They were sold to the idea that they could rake in more returns if they preferred cotton over other dry crops such as sorghum, maize, castor etc., which were traditionally grown on their soils. This way, as time passed, there was a spurt of cotton acreage in Andhra Pradesh.

The following chart shows the increase in the percentage of acreage under cotton in the last 45 years (between 1960-61 and 2005-06). Cotton acreage exploded from 3% to almost 9% in the last 45 years, establishing its prominence as a favorite commercial crop in the agricultural scenario of Andhra Pradesh.
Easy availability of credit and loans for growing cotton from money lenders and input dealers, coupled with the poor remunerative prices of millets, resulted in the monoculture of cotton crop on a large scale, leading to pest outbreaks. As a result, the cotton farmers had to frequently resort to spraying increasingly toxic chemicals on cotton right from the 15th day of sowing the seed, which increased the cost of cotton cultivation year after year.

Till mid sixties, indigenous varieties like Gowrani (Gossypium arborium based) were cultivated. Later cross-bred varieties with the American cotton, ”Hirsutum” as one of the parents, were introduced. Higher yields from the hybrids attracted many cotton farmers and the acreage under hybrids cotton grew at a faster pace from the mid eighties.

**Constraints & challenges of cotton cultivation**

Inadequate extension services by the state department of agriculture, fake hybrid seeds, adulterated pesticides, and continuous monocropping resulted in frequent pest resurgence and outbreaks, leading to crop failures and huge losses to the farmers. The white fly outbreak that infested the coastal region around 1987, and later the bollworm outbreaks in 1992 and 1997-98 resulted in severe crop failures, followed by large scale suicides by the cotton farmers. Warangal district in Telangana region of Andhra Pradesh became a hub of hybrid seed fads, spurious seeds, pesticide rackets, and also, effectually, of farmers’ suicides. Though the farmers at times, were incurring huge economic losses by growing cotton, they could not switch over to other crops, as they were
either uneconomical or were deemed unviable for loans by the money-lenders. In the case of cotton, even after incurring losses, the farmers continued to get loans from seed and pesticide dealers (some of them being cotton traders also), both in kind and cash, in the hope that a single bumper harvest would help clear the loans.

In a desperate move, the new generation pesticides which were released after the outbreak of cotton bollworm in 1998, by the EI Du Pont (Avaunt in 2000) and DE Nocil (Tracer in 2001) were immediately and enthusiastically accepted by the cotton farmers Thus, by the time Bt cotton was approved for commercial cultivation, farmers had already begun experimenting with different hybrids, especially the new ones, year after year, trying all the new pesticides coming to the market, to tackle the twin issues of decreasing production levels and increasing pest problems.

**Factors contributing to the spread of cotton acreage**

Cotton is an important commercial crop in Andhra Pradesh occupying 7.58% (2006-07) of the gross cropped area and ranking third in terms of production and productivity of cotton in India. Ever since the pest outbreaks erupting in Andhra Pradesh, many farmers across all categories have committed suicide as they were unable to come out of the debt trap due to the escalating costs of cotton cultivation coupled with the market gimmicks (fluctuating and un-remunerative prices).

Cotton is plagued by a number of problems. Prominent among them are bollworms, and sucking pests. Farmers resort to a number of pesticide sprays to manage pest problem, which over the years has resulted in increasing their costs of cultivation. The continued dependence on chemical sprays has not only resulted in the development of resistance to these chemicals by the pests, but also in triggering secondary pest emergences, disruption of balance of natural enemies and predators, thus pushing farmers deeper into the crisis. Spurious seeds and pesticides, leading to insurmountable losses, have added further complications to their predicament. In addition to these problems, a farmer’s fate is such that it is extremely sensitive to weather aberrations. Thus, an average middle class cotton farmer is pitted against odds that loom so large that they threaten forever to make his life a constant battle for survival.

**The saga of Bt cotton in Andhra Pradesh**

While farmers were struggling with cotton pests, using every new chemical that had entered the pesticide markets, Bt cotton was introduced
into India for commercial cultivation in 2002, on the promise that it would do away with the threat of a major pest called Helicoverpa, and that it would bring high returns for the takers. Bt cotton is India’s first genetically modified crop approved for commercial cultivation. Named as Bollguard, and with an inserted Bt gene, it was touted as capable of killing the larvae of *Helicoverpa* by producing δ-endotoxin within the growing plant. GEAC (Genetic Engineering Approval Committee) under the Ministry of Environment and Forests, Government of India, accorded permission for the commercial cultivation of the Bt cotton for three hybrids released by the Mahyco-Monsanto Biotech Ltd in March 2002. For the first two years (2002 and 2003) only Mahyco had the permission to sell the Bt hybrids (MECH-12 Bt, MECH-162 Bt, and MECH-184 Bt) in the market. Following the dismal performance of one of its hybrids (MECH-162 Bt) in the first year of introduction, Mahyco reduced the sales of this hybrid in the subsequent two years (2003 and 2004).

**Ban on Bt hybrids**

Consequent to the cheerless performance of the Bt hybrids (MECH-12 Bt, MECH-162 Bt and MECH-184 Bt) in the first three years of cultivation, as reported by the studies done by APCIDD (Andhra Pradesh Coalition in Defence of Diversity) followed by many other independent studies, and by the State department of agriculture, the three hybrids were blocked from commercial sale and cultivation by the GEAC. While banning these three hybrids, GEAC approved new Bt hybrids developed by the other companies. From 2004, another company, Rasi Seeds Pvt Ltd, got permission for the commercial sale of their hybrid RCH-2. From 2005 onwards, many Cotton seed the companies have been adding to the kitty of approved hybrids; as of now, there are almost 138 hybrids available in the market. Out of these, more than 80% of the hybrids have been developed using a single event (Mon-531) patented by Monsanto. This clearly exposes how vulnerable Bt cotton is, in the event of pest developing resistance to it.

The three cotton hybrids (MECH-12Bt, MECH-162 Bt and MECH-184 Bt), which were reportedly “studied extensively” and tried at multi locations to test their comparative advantage over their peers, miserably failed in the farmers’ fields across the state of Andhra Pradesh and in some other southern states. The season-long studies taken up by the APCIDD have played a pivotal role in initiating similar studies by many independent organizations and individuals across India. The studies came up with so much evidence against the proclaimed claims of the three Bt cotton hybrids that they forced the regulatory authority to impose a ban on them. But, the mischief slipped in through the backdoor because other
companies were allowed to sneak in with their version of Bt cotton hybrids.

**Factors contributing to the spread of the Bt cotton**

The following table gives an overview of how different actors / stakeholders responded prior to as well after the introduction of the Bt cotton in India.

<table>
<thead>
<tr>
<th>S no</th>
<th>Situation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pre-release</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Predisposing situation of farmers</td>
<td>Frequent &amp; severe pest incidences, Pests resistant to many of the pesticides, Crop failures, Extreme dependence on chemicals, Spurious insecticides &amp; seeds, Mounting losses, No alternative remunerative crop, Easily available loans for all inputs coupled with the doorstep procurement (repayment of loans?) by the middlemen (often dealers), Recognition of the long term effects of hazardous pesticides, Increasing labour shortage due to migration of labour to nearby cities in search of better employment, leading to farmers looking for less labour intensive ways, Farmers exhausted with repeated pesticide sprays, and desperately looking for a miracle solution.</td>
</tr>
<tr>
<td></td>
<td>Point of purchase-Dealers</td>
<td>Aggressive Bt tech promotion. Free grant of lands for trials by the dealers.</td>
</tr>
<tr>
<td></td>
<td>Seed Industry</td>
<td>Existing organized seed production system an easy platform for Bt to take off, 75% of seed market controlled by the private proprietary hybrids, coupled with least public intervention, Multiple players with locally adaptive proprietary hybrids eager to cash in on the “new” technology</td>
</tr>
<tr>
<td>Group</td>
<td>Issues</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Political community</td>
<td>✑ Lack of vision and shifting positions. Not grounded in values but hankering after short-term political gains.</td>
<td></td>
</tr>
</tbody>
</table>
| Scientific community & regulatory systems | ✑ Over reliance of scientific system on chemical sprays  
                                  ✑ Inadequate extension services and understaffed departments  
                                  ✑ Failure of the scientific community either to evolve alternative pest management methods or to take forward the sporadic yet significant efforts by individuals or organizations on that front  
                                  ✑ Lapses in not sharing information with the extension system.  
                                  ✑ Inability to develop effective pest forecast methods through networking of different research stations. |
| NGOs                       | ✑ Initiated efforts to educate farmers on the pros and cons of the Bt technology in the context of the WTO, IPRs etc  
                                  ✑ Initiated steps to promote alternatives to pest management  
                                  ✑ Mostly isolated activities. |
| Farmers                    | ✑ Started trying out all the Bt -hybrids but failed to compare Bt hybrids with their Non Bt variants  
                                  ✑ Willingness to take risks  
                                  ✑ Peer pressure, conformist adoption (“I am planting because my neighbors are”), and fear of being isolated in the village (Stone 2007)  
                                  ✑ Feeling of increased social comfort levels while going along with rest of the farmers  
                                  ✑ Narrowed choices, with steep decrease in the availability of the Non Bt hybrids in the market  
                                  ✑ A slight reduction in sprays for managing the dreaded bollworm  
                                  ✑ Technology overlap between seed treatment chemical (to protect from sucking pests) and Bt technology --attributing the pest free situation in the first two months to Bt cotton alone |
<table>
<thead>
<tr>
<th>Category</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed industry</td>
<td>☑ Spurt in number of companies joining Bt bandwagon. Gradual reduction in Non Bt hybrid seeds. Success in creating market hype. Aggressive marketing by seed industry</td>
</tr>
<tr>
<td>Dealers</td>
<td>☑ Pushed Bt cotton candidature with caps flaunting its virtues. Message on caps after an increase in pesticide poisoning read: “Don’t use chemicals as they are harmful”. ☑ Interested more in promoting Bt hybrids as seed sales are mostly done in cash, so they need not wait till the end of season for repayments of loans; thus, reducing the risks of defaults in repayments ☑ Sweet-talking farmers into buying Bt seeds. Roping in big farmers as dealers and setting them up as examples for poor farmers to follow.</td>
</tr>
<tr>
<td>Political system</td>
<td>☑ Not displaying flexibility in response. ☑ Looking at the problem only in terms of price while ignoring the long term political, legal, IPR issues</td>
</tr>
<tr>
<td>Scientific community &amp; regulatory authority</td>
<td>☑ Still hesitant to air their views freely ☑ Shifted from case by case method of approval to event based approval, thus hastening the process of increasing the number of hybrids with the same event, while ignoring long term implications ☑ Regulatory systems and scientists brushing away field evidences as emotional statements and stray incidents, while showing least inclination to take note of early warnings.</td>
</tr>
</tbody>
</table>
Building Grassroots Capacity on Scientific Data Collection

APCIDDD (Andhra Pradesh Colition in Defense of Diversity, which is an informal network of more than 140 organizations in Andhra Pradesh, India) has followed a path-breaking methodology in documenting the experiences of farmers with Bt cotton. A season-long tracking of Bt cotton vis-à-vis Non Bt cotton was adopted to compare and contrast their performances. In this approach, farmers who were growing both Bt and Non Bt hybrids were randomly identified from the villages where cotton is extensively grown from predominantly cotton growing districts of Telangana region. In the first three years, i.e., from 2003-04 to 2005-06, the sample consisted of farmers who had grown both Bt and non Bt cottons simultaneously. However, in the last two years (2006-07 and in 2007-08), as Non bt cotton hybrids were not available freely in the markets, we could not have them as test-samples, so we compared the Bt sample with other sets of sampled farmers who had adopted Non bt hybrids, and non-pesticidal methods.

Another important aspect of this study is the involvement of the grassroots organizations which have a proven track record of working with small farmers on sustainable agricultural practices. All the organizations we collaborated with in this research project had extensive and pioneering experience in non-pesticidal management methods. A list of the NGOs who participated in this research is attached in the Annexure-1.

Locale of Study:

In Andhra Pradesh, cotton is extensively grown in districts like Adilabad, Warangal, Guntur and Prakasam. Out of all these districts, Warangal
attracted the most attention due to suicides, pest outbreaks, large volumes of pesticide use, lot of initiatives by the voluntary sector on non-pesticidal management of crops, and many cases of spurious seed sales etc. Because of all these reasons, we selected Warangal, Adilabad and Nalgonda districts, even though in 2003-04, we had collected samples from Kurnool also. The following table gives an overview of the number of villages where the study was carried out.

**Districts where the study had been taken up in Andhra Pradesh**

<table>
<thead>
<tr>
<th>S no</th>
<th>Year of study</th>
<th>No of Districts</th>
<th>No of villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2003-04</td>
<td>3 (Warangal, Adilabad &amp; Kurnool)</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>2004-05</td>
<td>3 (Warangal, Adilabad &amp; nalgonda)</td>
<td>34</td>
</tr>
<tr>
<td>3</td>
<td>2005-06</td>
<td>3 (Warangal, Adilabad &amp; nalgonda)</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>2006-07</td>
<td>3 (Warangal, Adilabad &amp; nalgonda)</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>2007-08</td>
<td>3 (Warangal, Adilabad &amp; nalgonda)</td>
<td>14</td>
</tr>
</tbody>
</table>

**Selection of villages and respondents:**

Every year villages were selected after the village level campaigns, generally in the month of the June. During the campaign period, that is, before the sowing of cotton seeds, the local organizations identified the prospective villages for carrying out the data collection programme. Once the villages were identified, farmers were selected randomly. However, small and marginal farming sections were preferred over large farmers, for they constitute more than 70% of the farming population in rural India.

Initially, in the first three years, farmers growing both Bt (marketed by Mahyco- Monsanto) and Non Bt hybrids were selected as sample farmers, so that comparison of both types of cottons would be easier. However, from 2006-07, a number of Bt cotton hybrids entered the market displacing Non Bt ones. As a result, we could not have farmers
growing both Bt and Non Bt simultaneously. So, what we did instead was to use two different sets of samples, one set growing Bt and the other set growing Non Bt but following NPM (Non Pesticidal Management) practices (see the box below, for details about NPM).

In this NPM type of cultivation, farmers had taken up Non Bt hybrids but did not use any chemical pesticides to manage the cotton pests. However, they used non synthetic organics like Neem seed kernel extract, cow dung urine mixture, tobacco decoction, setting up of pheromone traps etc, using mostly local resources, which are economical as well as environmentally safe (IN Warangal, most of the ecosensitive NGOs have been promoting this NPM cultivation on different crops like cotton, chilly, turmeric and paddy, and of late the Government sponsored VELUGU (earlier known as SERP- Society for the Elimination of Poverty) has taken up this issue and is now promoting NPM on different crops across Andhra Pradesh state).

<table>
<thead>
<tr>
<th>Non Pesticidal Management (NPM) of Pests</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPM methods were developed on the basis of farmers’ indigenous knowledge as an effective alternative pest management approach, using locally available resources and sustainable methods duly blending with latest scientific knowledge. This approach was fine-tuned by NGOs. The basic principle underlying the approach is to strengthen the natural processes and restore the ecological balance, in order to contain the pest population within a level not harmful to crop and yields. Though this approach is as yet in practice only in pockets, it is attracting farmers from all over. Facilitated by the local NGOs, the farmers have begun to successfully implement these NPM methods at the community level. Under this approach, no chemical pesticide is sprayed on the cotton crop. Alternative approaches such as spraying a mixture of fermented cattle dung and urine, neem seed kernel extract, chilly-ginger-garlic extract, erecting bird perches to attract predatory birds, pheromone traps, light traps, summer ploughing and application of NPV are practiced. All these methods are not only cost-effective but are also sustainable technologies and within the reach of all categories of farmers. The chances of insects developing resistance to these methods are very remote, whereas the chance of such resistance development is imminent in case of Bt cotton. A good rainfall provides farmers good returns from the cotton crop, whereas frequent unfavorable weather conditions make them vulnerable and push them into a debt trap. Assured market for the cotton and readily available credit on the farm inputs makes farmers to choose this crop even in the rainfed areas. In Warangal district a number of NGOs, viz., MARI, PRAGATI, CROPS and SYO are promoting NPM methodology in cotton cultivation.</td>
</tr>
</tbody>
</table>

Data collection:
Data from randomly identified farmers was collected all through the season, right from the sowing of cotton crop till it was completely harvested from the field, at fortnightly intervals. Data was collected by community researchers (CRs), using specially designed interview schedules in the local language. Community researchers, with rural background and from farming families, were identified and trained on cotton pest management, using non-pesticidal methods. These CRs went to the farmers at fortnightly intervals and collected information on the various aspects of cotton crop production and pest management. The information was collected when it was fresh in the minds of the farmers to avoid any memory bias, which helped the study to stay as close to ground realities as possible. The two scientists who worked on this project checked the correctness and completeness of the interview schedules, which were later collated farmer-wise to arrive at the costs of cultivation and other meaningful conclusions.

The interview schedule mainly consisted of two parts; the first part (schedule-1) was used at the beginning of the season, immediately after cotton sowing, while the second part (schedule-2) was used to collect information fortnightly on various heads like, weeding, pest loads, fertilizers and pesticides applied, irrigation, picking, transport etc.

**Results of the 5 season-long studies**

A preliminary study was initiated with four farmers immediately after the sowing season in 2002 in Warangal district. We documented the farmers’ aspirations, their reasons for opting this route, and their expectations from the choice of Bt cotton. We noted down all the four farmers’ experiences at monthly intervals. And as days progressed, we noticed that their aspirations and hopes began to get sour, and turned to total despair by the month of December 2002. Besides these four farmers, we had taken up a mid-season study from November in 11 villages representing various agroclimatic situations in Warangal. By the end of the season, in April and May 2003, data was collected from 225 farmers across Warangal. The total sample taken for the end-season study was almost 20% of the total number of farmers who had taken to Bt cotton in the very first year of its commercialization. All the above studies unequivocally brought out the complete failure of Bt cotton. This research inspired a number of independent groups across India to take up similar studies on the economic performance of India’s first ever GM crop. Besides, the study and the video document “Why are Warangal farmers against Bt cotton?” in 2003, attracted a lot of attention from various sections such as media, policy makers, and academia, which
ultimately compelled the Minister for Agriculture of Andhra Pradesh State to accept in the State Assembly the truth that, Bt cotton had failed miserably in the state.

Enthused by this overwhelming response, the Coalition decided to plan the season-long studies, and after a lot of deliberations, finally decided to collect information from randomly selected farmers throughout the season at fortnightly intervals so as to get the most reliable information, when it was still fresh in their minds, from the farmers

**Season long studies**

The following table gives an overview of the total sampled farmers for the season-long studies in the last five years, from 2003-04 to 2007-08.

<table>
<thead>
<tr>
<th>S no</th>
<th>Year</th>
<th>Total Sample</th>
<th>Distribution across different categories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Small</td>
</tr>
<tr>
<td>1</td>
<td>2003-04</td>
<td>Bt &amp; NBt-164</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>2004-05</td>
<td>Bt &amp; NBt-106</td>
<td>56</td>
</tr>
<tr>
<td>3</td>
<td>2005-06</td>
<td>Bt &amp; NBt-90</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NPM- 90</td>
<td>78</td>
</tr>
<tr>
<td>4</td>
<td>2006-07</td>
<td>Bt-90</td>
<td>Bt-65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NPM- 102</td>
<td>NPM- 81</td>
</tr>
<tr>
<td>6</td>
<td>2007-08</td>
<td>Bt-45</td>
<td>Bt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NPM-82</td>
<td>NPM</td>
</tr>
</tbody>
</table>

NPM: Sampled cotton farmers who followed Non Pesticidal methods

The above table explains very well that our major focus was on tracking the economics of cotton cultivation viz-a-viz small farmers, even while factoring in other segments like medium and large farming sections. Small farmers were given the highest priority while choosing the sample because, they constitute the lion’s share in the Indian farming community, and also because Bt cotton was hailed as a great savior of this section of farmers. Hence, the study’s main thrust was to investigate the situation and bring out the truth.

While introducing bt cotton, the Mahyco-Monsanto company lured the farming community with lots of propaganda, claiming that by growing Bt cotton farmers can reduce their pesticides consumption by 70%, reap 32% more yield, and get more net returns. However, the five-season-long and the first year’s studies have unequivocally proved beyond doubt that
these were false promises. A brief description of the five seasons is provided hereunder.

**Salient features of the year 2003-04**

This was the second season after the introduction of Bt cotton in India and the best ever for cotton, because the crop received rains in good amounts and at the right time. Pest load, too, was low compared to earlier seasons. As a result, farmers reaped bumper harvests at the end of the season. Besides, the weather and low pest incidence, even the price of seed cotton in the open market was the highest in the recent past-- it reached almost to Rs.3000/- per quintal of seed cotton, a rate which prevailed fairly for a fairly long period. In a way, this season helped farmers to reap bumper profits, repay their earlier dues and embrace Bt cotton with joy and expectation. This feeling of ease and optimism finally led to increased acreage under cotton in the following season (2004-05).

During this season, our research first observed a special kind of root rot called Rhizoctonia in the fields where Bollgard was grown. *Farmers came out with complaints that they were not able to grow crops like chilli after harvesting Bt crop because it had infected their soil very badly.*This case was the first of its kind in Andhra Pradesh, where a disease was causing damage not only to the cotton crop, but also to the succeeding ones.

*Pic-1:* A chilly crop sown after removing the Bt cotton affected by dry root rot

**Salient features of the year 2004-05**
This was the third year of Bt cotton cultivation in India. As the previous season had witnessed bumper returns, many farmers took to Bt cotton cultivation. Besides the three cotton hybrids marketed by the Mahyco-Monsanto, another hybrid, Rasi, had also entered the market. Prior to Bt cotton cultivation, Non Bt Rasi cotton hybrids were very popular among the cotton farmers, especially in Southern India. However, because of the spurious seeds that were marketed in Warangal a few years before the introduction of the Bt hybrid variant, they had stopped marketing the Non Bt hybrid variants for the previous 4-5 years in Andhra Pradesh. So, only Rasi-2 Bt hybrids were made available for cultivation during this year. As most cotton farmers in Warangal had reaped quite a good harvest-- in some irrigated black cotton coils, farmers reaped up to 18 quintals per acre with the Non Bt variants of this RCH-2-- they immediately preferred this cotton hybrid over the MECH bt hybrids, produced by the Mahyco-Monsanto, which proved to be a damp squib after so much hype by the industry.

This cotton season witnessed two dry spells; the first one before sowing, resulting in delayed sowings, and the second during August-September, which impacted heavily cultivation and yields. As a sequel to the earlier failures of the Mahyco-Monsanto, farmers agitated against the failure of the Bt hybrid seeds in all the southern states, where they were officially approved for commercial cultivation. During the cotton growing season, farmers in Warangal were so vexed with this corporate distortion of their misery that they held the Mahyco Monsanto representative a hostage in their village, took to the streets in violent protest in the city of Warangal, and burnt and destroyed seed stores that stocked Bt cotton. Newspapers in the district continuously reported the total ruin of tens of thousands of acres that had planted Bt cotton. Thus, Bollgard (Bt cotton) had failed miserably, leading to extensive economic losses for the farmers who had cottoned on to dreams of turning a huge profit..

Unfortunately, the company-sponsored reports did not reflect any of the above realities. They continued to play the company tunes and blow up their miniscule, manipulated successes. Bureaucrats ignored the failures, official enquiries were distorted, false data was fed to media and an unreal world under the corporate command was conjured up.

At last, GEAC took note of the abysmal performance of these hybrids and banned the country’s first ever GM cotton hybrids (MECH-162, MECH-12 & MECH-184) from commercial cultivation in South India, where they were extensively promoted as most suitable hybrids for the region. While banning these hybrids, GEAC (Genetic Engineering Approval Committee), on the other hand, approved a number of other Bt cotton hybrids
Salient features of the year 2005-06

During this season, the Andhra Pradesh government took a very strong position against Bt cotton seed marketers when it was brought to the notice of MRTPC (Monopolistic Rights and Restrictive Trade Policies Commission) that their seed price was atrociously exorbitant. The MRTPC, in its interim orders, found fault with the way in which Bt cotton was priced and ordered the companies to reduce the prices of Bt hybrids to Rs. 750 per packet of 450g of hybrid cotton seed as against the existing price of Rs 1650/- per packet. Following this decision, Ministers from 7 cotton growing states met in Hyderabad (Capital of AP) and decided to enforce the interim orders of the MRTPC, thus making Bt cotton seeds available to farmers at the reduced price of Rs 750 per packet. This unusual reduction by 45% in the seed prices, coupled with the narrowed Non Bt cotton hybrids options, resulted paradoxically in tempting a majority of the farmers to opt for Bt cotton hybrids.

This season witnessed a huge shortage of Non Bt hybrid seeds as all the seed companies began to jump on to the Bt bandwagon. More than 25 Bt cotton hybrids were approved by the GEAC for commercial cultivation, thus narrowing the options for Non Bt cotton hybrids. Rains were delayed and so also were the sowings in this season. The alternate wet and dry spells resulted in the lower incidence of Helicoverpa (American Bollworm). However, Bacterial leaf blight (black arm disease), rhizoctonia root rot and sucking pest infestation wreaked more havoc on Bt than on Non Bt hybrids.

The other important effect of the large-scale spread of Bt cotton was the death of small ruminants in large numbers. Thousands of sheep and goats died of grazing Bt cotton stumps in the fields. The common practice in cotton growing areas is, small ruminants are allowed to graze freely on the crop-stumps after the final harvest. Many flocks of small ruminants were severely affected, while many of them died.
Salient features of the year 2006-07

By July 2006, there were around 65 Bt hybrids available in the market in India. Farmers had a tough time during this season combating heavy rains. However, two heavy showers during the months of August and October, coinciding with the egg laying period of Heliothis, probably washed off the eggs of American Bollworm, thus reducing the bollworm damage not only to cotton but to other crops like chilly, tomato and other vegetables. However, the farmers faced lots of problems with the root-rot damaging their crops severely. A mid-season, fact-finding study conducted in Warangal in the Month of October 2006, found out that Bt cotton was affected by root-rot in more than 1,00,000 acres, causing a loss of not less than Rs.40 crores to farmers.

As more ruminants began to die, shepherds took out a large procession in front of the Director of Animal Husbandry Department. In response, the Director issued a circular to the entire district Joint Directors to prevent shepherds from letting their cattle graze on Bt cotton stalks.

http://www.hindu.com/2007/03/02/stories/2007030208990400.htm

Salient features of the year 2007-08

Years passed, unfolding more and more of the hidden risks of GM cotton, and the year under review was no exception. Mealy Bug, a cotton pest that people had stopped thinking about came back, like a ghost from the dead, to infest crops not only in Nalgonda and Warangal, Punjab too reported widespread damage. As if this wasn’t enough, sucking pests such as jassids, thrips and aphids took a heavier toll of Bt than of its conventional counterparts. And to pile up more trouble, small ruminants
and milch cattle grazing on cotton stubs began to die, while people working on cotton fields developed skin allergies in several villages and had to undergo treatment for more than a month. (http://www.kisanbachaoandolan.co.cc/).

Results of the five season long studies:

In the first two years (i.e., in 2003-04 and 2004-05) the sampled farmers had both Bt and Non Bt cottons. This arrangement was helpful in making a comparative estimate of both the crops in terms of cost and income patterns. However, from the third year (i.e., from 2005-06), due to the non availability of samples with both Bt and Non Bt, we compared the Bt hybrids with NPM cotton (cotton hybrids grown with out using any pesticides for managing the cotton, but using locally available resources such as neem, cow dung and urine, tobacco decoction and pheromone lures). The following charts give us an understanding of the expenditure patterns on various heads on Bt vis-à-vis Non Bt / NPM cottons.

Costs of cultivation of Bt, NBt and NPM cottons in the last five seasons
Chart-1 Cost of cultivation

Two important points emerge from the above chart. They are:

1. The cost of cultivation of NPM cotton has always been lower than the cultivation of both Bt and Non bt hybrids
2. The total cost of cultivation has been decreasing since the year 2003 and the lowest was recorded in the year 2006-07.
The decrease in the cost of cultivation was mainly due to the reduction in the seed prices as well to the lowering pest incidence that reduced the cost of pest management. During the first two season-long studies, the cost of Bt cotton seed was Rs. 1650 but from the year 2005-06, the cost of Bt seed was reduced by around 55%; and the pest management costs also reduced drastically by more than 55%. The cost of cultivation of NPM cotton in the last three season long years (Rs 7477, 7058 & 7378) support this inference as this type of cotton uses only Non Bt hybrids without using the chemical pesticides. Even the cost of cultivation of Non Bt hybrid (using chemical pesticides) in the year 2005-06 (Rs. 8074) also supports this argument.

**Cost of pest management on Bt. Non Bt / NPM cottons**

![Pest management costs chart](image)

From the above chart, we can draw the inference that,
- ✓ the pest management costs have been decreasing on all the three types of cotton
- ✓ The overall pest management costs decreased by more than 60% on Bt cotton and more than 50% in Non Bt cotton hybrids

Even after a reduction by more than 60% of cost on Bt cotton, the actual cost of pest management on Bt cotton is still 20 to 50% more compared to NPM cotton in the last three years (2005-06 to 2007-08). The lower pest incidence-- heavy showers coinciding with the egg laying periods of American Bollworm, leading to the washing down of eggs from cotton crop-- could be the main reasons for this drastic reduction in the pest management costs

**Yield of seed cotton from Bt, Non Bt / NPM cottons**
The chart on the yields of seed cotton from Bt, Non Bt and NPM hybrid cottons is presented hereunder. From the chart it is evident that, Bt cotton has never yielded more than 5% over the Non Bt hybrids and 11% over the NPM hybrids. Despite being promoted as a great savior from pests (bollworms) and a giver of higher yields, Bt cotton in reality deserves nothing but an emphatic thumbs-down.

Higher cotton yields were recorded in the year 2003-04 when the season was very favorable, pest incidence was lower, and higher price of seed cotton had encouraged more farmers to take to cotton cultivation. Even in 2007-08, farmers reaped good harvests despite some unfavorable weather.
From the above chart, it is very clear that both Non Bt and NPM were more economical than Bt cotton; the only exception being 2006-07 when Bt farmers notched up 9% higher profits that the NPM set of farmers. In 2003-04, unusually all the three factors which influence the net returns of farmers viz., favorable season, lower pest incidence, and high market rate resulted in large net profits. In the following year, though the yields were similar to the previous three years, higher investments made Bt crop uneconomical. Despite similar conditions obtaining for both the set of farmers, the ones who placed their choice on Bt could just scrape through with minimal profits.

Beginning 2005-06, Bt cotton was compared against NPM cotton. Of the three years, except in 2006-07, the NPM farmers outdid the Bt ones with 35% and 10% higher net profits. And the lone exception was mainly due to the non availability of the better hybrids as a result of which the NPM farmers spent higher amounts on the fertilizers than their Bt counterparts.
Case studies

Root rot incidence on Cotton in Warangal and Nalgonda districts of AP

Bt Cotton has brought diseases unknown previously to the farmers. ROOT ROT, a disease which cotton farmers of AP have never seen before in their life, is slowly spreading like a silent fire. This disease made its ugly debut, and was reported in just 2-3% of the cultivated area in 2002-03, the year when Bt cotton was introduced and harvested for the first time in AP. It was caused by *Rhizoctonia spp.*, a soil borne fungus. Year after year it has been spreading, reaching an alarming proportion of 40% of the area. See the following graph for the rising incidence of dry root rot in cotton from the time Bt cotton arrived on the scene in 2002-03.

The disease of dry root rot in cotton was first observed in a limited number of fields in 2003-04, the very first year of introduction of BT cotton in this village, Mustyalapalli of Nalgonda District, in AP. In 2006-07, the symptoms of dry root rot were observed from August 2006 onwards, and by the last week of September 2006, when the crop was to be in the square and boll formation stage, farmers noted the wilting of crop; square and flower dropping; and bolls not developing seed at all. Reading these ominous signs, farmers began to be alarmed. Most of them (nearly 80%) are small farmers, and 95% of them are dependent on rainfed farming. They saw the shape of things to come, of the widespread mortality of their crop, and of the heavy losses looming over them, and they panicked.

By this time, investment had reached a level of Rs 7000/- per acre, excluding their family labour. The cash investment was on external inputs, intercultivation and labour for weeding etc., which was all funded by the local money lenders. Similar reports of damage to crops were pouring in from the neighboring villages of Sikandernagar, Mutakondur, and Chemalakondur etc. A do or die situation was staring the farmers in the face. The signs looked ominous, and demanded urgent
action. The village elders and those who knew their crops well met together to pass on the message to the farmers that they should immediately replace cotton with coriander, a short-term crop ideal for that part of the year. The desperate farmers were forced to uproot their own crops in more than 700 acres. In this village 70% of the acreage was under Bt cotton. The advice to switch to coriander was well taken, with at least forty farmers pulling out the root-rot infested crops to make room for coriander. This crop did well, yielding 3 to 3.5 quintals per acre.

However, the exhaustion of the entire exercise bore down heavily upon the farmers. The total financial loss incurred on it was to the tune of Rs.52, 50,000 (INR 5.25 million). In fact, even the Government was aware of this problem. Addressing a press conference in Hyderabad in the second week of April, 2007, the Commissioner for Agriculture, Government of AP had said that “the introduction of genetically modified (GM) crops, engineered for a specific trait, was also resulting in new pest problems.’ This called for a regular monitoring and surveillance system to monitor the status of pests, an action which was a pre-requisite for effective implementation of integrated pest management.

“To counter this, the department had cautioned the GM companies to indicate the problems on the labels of their products while they were also cautioned against spurious seed”. But till today, no Bt Seed manufacturer has indicated such problems on their seed packets. This is a flagrant violation of the law of the land

**Bt cotton spells doom for cattle and small ruminants**

Small ruminants play a significant role in improving and sustaining the soil nutritional status. Normally, after the harvesting of crops, shepherds are paid to keep their flocks of sheep and goats in the fields. During this time, the small ruminants graze on the leftover plants / stalks. The excreta of these animals and their urine are a good source of plant nutrients.
In a majority of the villages cotton has become the major crop, displacing the other cereals pulses, oil seeds and millets. As a result, these small ruminants find no other crops to graze on in these cotton villages. During early 2005, some ruminants, which exclusively fed on Bt cotton stalks died and there was utter confusion as to why such large flocks were dying. The shepherds took their sheep to the nearby veterinary hospitals and got symptomatic treatment administered to them.

The major symptoms that appeared on these small ruminants were: bloating of stomach; mucous flow from nostrils-- initially mucous appeared greenish white and then turned reddish; urination, also in reddish colour; pennings (excretion) mixed with reddish mucous, watery
in texture, unlike the hard pellets of healthy goats; and sneezing. Though these animals were given the symptomatic treatment, few could get well while the others died within days of the appearance of the symptoms. The shepherds, after thorough discussions among themselves on the possible cause of death, discovered that all the animals that had died were the ones who had fed in the Bt cotton fields. To their surprise, similar observations were made even in other districts. But this was largely dismissed by the large section of veterinary doctors and agricultural scientists, who blamed it all on the huge volumes of pesticides that was said to have been sprayed on cotton. Paradoxically, the same section of agricultural scientists said that, by adopting bt cotton, the pesticide consumption on cotton crop had decreased drastically

Normally, cotton crop is sprayed between 6-10 times during the crop growth period. However, the time gap between the last spray and initial grazing by the animals was more than 2 months. The practice of grazing the animals in the harvested cotton fields is not a new one. Moreover, the farmers were spraying new generation pesticides whose USP was lower residual effect of these pesticides. It is also to be noted from the season-long study that the pest incidence was drastically low in 2005 and 2006, and this was also reflected in the very low investments on pesticide sprayings, as noted earlier. Hence, the conjecture that the sheep might have died of pesticide poisoning was way off the mark. The sequence of events, highlighting the prolonged gap between the last pesticide spray and the time when the sheep first took to grazing, as well the nature of scientific evidence with regard to the low residual nature of the pesticides, pointed their finger at Bt cotton as the main suspect.

Vemulapalle village comes under Mogullapalli Mandal of Warangal district in Andhra Pradesh. Similar to a number of other villages, this village also suffered huge economic losses. The total population of this village is 1800. More than 700 acres of area in this village was put under Bt cotton while the Non Bt was grown in just 30 acres in 2007-08 season. There are 18 shepherd families in this village managing around 5000 small ruminants in flocks of sizes ranging from 200 to 500 per flock. After cotton was harvested, these small ruminants grazed on the stalks. Out of the total 5000 animals in the village, 400 to 500 sheep died after grazing on the cotton stalks. Initially they developed symptoms similar to the ones that were noticed in sheep that died grazing on Bt cotton: swollen face, slight fever, loose motions, nasal discharge and reduced intake of food and water. Some shepherds, foreseeing misfortune, resorted to distress sale of their sheep to the nearby butchers. None of them dared to get their animals treated, because of their earlier
experience with such cases. Mr. P Kumara Swamy, one of the shepherds of this village generally purchases sheep when they are small, and sell them once they attain good age and weight. During the year under review, he purchased 42 sheep and let them out to graze on Bt cotton stalks. He did not know what was in store for him; 15 of them died showing symptoms described earlier. The remaining ones too looked like ending up the same way. He quailed at the prospect; the only way out was to get rid of them as early he could. So, he began selling them at nominal prices, hoping to save himself from utter ruin. But, his loss was too much for him to bear, and he ended up working as a coolie in the local market. Traumatized by these incidents, shepherds in the next village-- Narlapur did not even venture to allow their small ruminants to graze on cotton stalks, despite being offered higher amounts for sheep penning ( restricting the movement of sheep to a particular area so as to improve its nutritional status with inputs from their urine and excreta )

As the number of deaths was reaching alarming levels, the media also took note of the happenings. A number of cases were reported in the local media in the regional languages. Some of the following links provide information on the death of livestock after feeding on Bt cotton


When a large number of shepherds protested the inaction from the Animal Husbandry Department on the increasing number of deaths, the Director of Animal Husbandry finally directed his staff at the district level to advise the shepherds against letting their sheep graze on Bt cotton. http://www.hindustantimes.com/storypage/story.aspx?id=668d24de-52af-419a-b448-f816af960e5&MatchID1=4469&TeamID1=2&TeamID2=4&MatchType1=1&SeriesID1=1110&PrimaryID=4469&Headline=Bt+cotton+fields+can+kill+farm+animals

In the month of January 2008, 12 buffaloes and one bullock were reported to have succumbed to death on feeding the leftover stalks in the Bt cotton field in a village called Srimannarayana Puram in Raghunathpally Mandal of Warangal District. The details of this case are as under:
45 families of this village who used to make their living selling milk in this village suddenly found the world around them falling apart when 10 of their buffaloes and a cow were reported to have died of feeding on Bollgard 11 cotton stalks.

On 30th December, the person who tended cattle took them to a harvested Bollgard II cotton field belonging to Edulakanti Janardhan Reddy. The cattle were generally taken to the nearby wastelands for grazing. But on that fateful day, they fed on cotton stalks, bolls and dead leaves. On the same evening, 4 of them fell sick and died subsequently. Though this information was given to the local veterinarians, they delayed organizing a health camp in the village. In the meanwhile, another four animals succumbed to death, after showing the following symptoms:

- Normal temperature
- Bloating
- Respiration problem
- No rumination
- Slight nasal discharge
- Indigestion and
- In some cases diarrhea was observed.

Later, when the matter was reported to the District Collector, the veterinary officers organized a health camp in the village on 2nd January 2008. While the treatment was going on, another two milch cattle died on 3rd January 2008.

In a similar incident, a bullock also died after eating Bt cotton stalks in Gangadevi Pally village of Warangal District. Besides this, a few more stray incidents also took place in other parts of Warangal. As the mortality cases of the small ruminants reached an alarming stage, and there was no proper action on the part of the government, shepherds had to find their own solutions to overcome this pathetic situation. On the one hand, there were no alternative pastures in the cotton growing areas to allow their ruminants to graze upon, and on the other, their animals were dying mysteriously. Horrified by the continuous deaths of their animals day after day, the shepherds initially got them treated symptomatically. But as the number of incidents was increasing, pushing up the cost of treatment, distress selling of the animals was observed in many villages.

This development rings two important alarm bells—
- Huge economic loss to the poor shepherds and
- Possible entry of the GM contaminated meat into the human food chain.
Responding to this alarming situation, the APCIDD in collaboration with another NGO called ANTHRA, which is working on the issues of traditional methods of Animal Husbandry decided to launch a study in May 2007, and we selected two different sites - a village in Warangal, and a village in Medak. ANTHRA implemented the study in a village in Medak and APCIDD conducted the study in Warangal.

In both the villages the Bt was introduced more than 3 years ago.

APCIDD initiated this study in the Venkatapur village of Parkal Mandal and details of the observations are hereunder.

Nine sheep of the age group 6 months to one year old (the ideal age group for any study) were selected for the purpose of the experiment. All the sheep were divided into three groups consisting of three sheep each:

- Group I were fed on Bollgard I
- Group II were fed on Bollgard II and
- Group III were fed on Non Bt cotton hybrid

The controlled feeding experiment was started on 18th Feb 2008 for all the three groups. All the three groups were confined to open grazing in the respective harvested cotton fields (Bollgard I, Bollgard II and Non Bt) using a rope, so that they would not move away from their respective cotton fields. Each day, all the three groups were taken to the respective fields and allowed to graze from 10 am to 4:30 pm, with intervals for drinking water at the pond. The first symptoms of sickness manifested on 29th February (12th day of feeding) in three sheep of Group II, which fed on Bollgard II. The symptoms observed were reddening of mucous membranes (upper and lower lips), swelling of lips which showed pain on touch, frothy salivation, and a sick blackish look. A day later, similar symptoms were also noticed in Group I sheep which fed on Bollgard I. In addition to the above symptoms, nostril discharge was also observed. In both the groups, a reduction in food intake was observed.

On 2nd March, bulging of the head was observed in both groups. Group II sheep also started the nostril discharge. On 8th and 10th March, a slight fever was observed in Group I and Group II respectively, in addition to the rest of the symptoms. On 13th March, one sheep in Group I (which fed on Bollgard I) died in the evening, while the other two also fell sick. On 14th March, one sheep each from Group I and Group II died at 8.30am and 7 am respectively. Both were taken to the Department of Animal Husbandry. Unfortunately, the authorities did not perform the postmortem when told that the sheep were part of the feeding experiment! The matter was brought to the notice of the Director
telephonically, and he in turn instructed his employees in the Warangal office to avoid such lapses in future. The symptoms earlier mentioned continued until the remaining sheep in both the groups died on 18th March.

The autopsy could not be performed, because of a three-day holiday. No qualified Vet from the department was on hand for the task. The sheep that died had all the symptoms seen in earlier cases except loose motions which were observed last year. The three sheep that fed on the Non bt cotton stalks did not show any symptoms that were described (as appeared on those that were fed on both Bollgard I and Bollgard II) earlier.

In Medak, on the other hand, since, ANTHRA was directly working in the village, they could organize closer monitoring of the sheeps’ health, than what could be done done in Warangal. ANTHRA monitored the sheep flocks in the village from the beginning of the season (June 07), keeping regular health records of all the flocks. They ensured that all animals were vaccinated against all the seasonal endemic diseases (PPR, ET, Sheep pox) and then soon after the harvesting of BT cotton, purchased ten sheep of the age groups six months to one year and ensured that they grazed entirely on Bt cotton harvested fields. We were not in a position to maintain a control group grazed on only non-Bt cotton, as there was no non-Bt grown in the village. However, the sheep that were not allowed to graze on Bt cotton, acted as control flocks.

Beginning January 28th, 2008, the animals started grazing on Bt cotton fields, and kept on doing so for thirty days. Contrary to the results of the Warangal, except for one animal, none of the animals showed any abnormal symptoms of morbidity while grazing on Bt cotton fields. One animal began to show pneumonic symptoms on day 21 of grazing, its health began to deteriorate and it finally died on March 4th 2008. The post mortem was conducted immediately and the samples collected and sent to IVRI, CADRAD. Samples of the cotton bolls, and leaves were also sent to IVRI CADRAD, as per their instructions. The IVRI returned a report to the effect that the cotton bolls were tested positive for Bt, and the pods were positive for saponin, leaves for Nitrates/Nitrites. However they have yet to send us the PM results as to the cause of death.

All the other sheep survived without any complications and were subsequently returned to their owner. All other sheep in the village were also fine - those which grazed on Bt and those which did not graze on Bt.
i) Animals that grazed on Bt cotton in Medak did not show any abnormalities, yet animals that grazed on Bt cotton in Warangal seemed to be exhibiting symptoms, which are typical of another common contagious disease called blue tongue. What is the secret behind this contrasting scenario? – ? Does the soil on which Bt is grown, and the length of time for which Bt cotton is grown determine the build up of Bt toxin in the soil, seed, leaves, bolls etc?

The Bt toxin could have lowered the immunity of the sheep in Warangal, and thus they became more susceptible to blue tongue. Or were those symptoms due to Bt toxin? Symptomatically it is impossible to arrive at a definitive diagnosis.

Skin allergies to farmers

In the midst of all the above affects of the Bt cotton, another dimension of the problem emerged in the form of Skin allergies to the farmers and labourers who work in the fields of bt cotton.

Cotton is an indeterminate crop and hence harvested in a staggered manner. As has been discussed earlier, this crop requires more number of sprays to manage the pests. So farmers enter the cotton crop almost daily.

In Andhra Pradesh, these skin allergies initially appeared on small ruminants in 2005-06, when a large number of animals also died on eating bt cotton stalks. Most of the animals which suffered skin allergies lost hair on their bodies in small patches. Shepherds had to spend on medicines to cure the allergies.

Though some stray incidents of skin rashes and allergies were observed in Bt cotton fields, it happened with very few farmers. During the year 2007-08, farmers of Issipet, and Medarimetla of Mogullapally Mandal in Warangal district most of the farmers and agricultural labourers experienced this problem in a large extent. Similar incidents also were recorded in Punjab and Haryana this year in the bt cotton growing areas.

The symptoms of skin allergies: Initially rashes were developed on the unprotected areas of the body such as faces and forehands, which later developed swelling with a lot of itching and irritation. The allergy patients took symptomatic treatment from the local quack doctor, who in turn was the owner of the Bt cotton field. Later on, when more number of such persons came to him for treatment, he started advising them to cover their bodies while working in Bt cotton fields. When more numbers of
people fell victim to this kind of skin allergy after having worked daylong in Bt cotton fields, they started wearing full-sleeve shirts and covered their heads and faces with cloth before getting down to work in the fields.

http://www.i-sis.org.uk/BTAffetyNorthIndia.php

**Sucking pests feast on Bt cotton**

The general observation of the performance of Bt cotton was that, it is more susceptible to the sucking pests.

Cotton is greatly plagued by two groups of pests, one is bollworms and the others the sucking pests. Bt cotton offers protection only against the bollworms. However, after the introduction of Bt cotton, sucking pests incidence on Bt cotton has increased, a development which was also reported by a number of independent studies. The south India’s Mills Association of Cotton Development Body also expressed the same opinion and called for concerted research on this front (http://www.thehindubusinessline.com/2005/10/01/stories/2005100102131200.htm).

The season long and fact finding studies done by an NGOs also highlighted the severe damage to Bt cotton hybrids compared to Non Bt hybrids (dds report, http://www.indiagminfo.org/Independent%20studies%20&%20papers%20on%20GM%20crops%20in%20India/Civil%20society%20fact%20finding%20visit%20reports/khammam-fact%20finding.pdf).

Apart from the regular sucking pests like Aphids, Jassids and Thrips, in the year 2007, a forgotten sucking pest called the Mealybug resurfaced again in the states of Punjab and in Andhra Pradesh. This was last reported in the year 1990 and was almost forgotten (http://www.livemint.com/2007/08/31003149/Pestattack-Punjab-Bt-cotton.html). This is a new threat posed by the Bt cotton in India.


**Concerns of Dr Pushpa M Bhargava**

Dr. Pushpa M Bhargava, who is the founder director of the Hyderabad-based Centre for Cellular and Microbiology and also a special Invitee to the GEAC meetings, has alleged that "there is substantial evidence which calls for a total review of the approval of Bt cotton in India."

He said that the GEAC relied on biosafety studies by the developer which included pollen flow, seed germination, soil microbial activity, toxicity and allergenicity. “Any study done by the developer is of no value. The
GEAC has no mechanism to verify with the experimental and control groups nor is the data confirmed by a third party,” he said.

According to him, chronic toxicity studies should be conducted, particularly with reference to aflatoxin. For soil microbial studies it was not enough to have the total number of organisms determined: the bacterial profile and the effect on soil micro-nutrient were far more important. All toxicity studies should be done on the protein in the GMOs. Toxicity studies done with the surrogate protein made, for example, in E.coli should not be accepted. He even felt that, open field trials for various genetically modified crops are being conducted without first undertaking all the tests during the confined field trials.

He said that no GM crop should be released without appropriate and reliable DNA finger printing, proteomics analysis and studies on reproductive interferences in at least 3 mammalian species by a reputed, accredited and independent laboratory.

Dr. Bhargava has been highly critical of the paucity of the biosafety data apart from the way tests are being conducted by institutes that are not fully equipped to conduct such tests. In the GEAC meeting held in the month of April 2008, reiterating his earlier concerns, he said that he would not be in a position to support the release of any additional Bt cotton hybrids for commercialization without observing the biosafety data and other available alternatives. And during the May meeting of the GEAC, he called for a three- to four-year total moratorium on GM crops and their products.

Despite all his opposition, the GEAC has noted in its minutes of the April meeting that "recognizing that Bt crops expressing Cry 1Ac toxin are already under commercial cultivation, he extended his full support to the proposal [large-scale trials of Bt cotton in the northern zone] subject to the condition that additional data if required would be generated by the applicant. Further in the national interest, he suggested that as an exceptional and unique situation, the GEAC may consider commercial release at this stage."

"No, that is not what I had said. What I had said was that unless all the data are available, we must keep everything on hold," he clarified. The very fact that the minutes of the April meeting had been inconsistent while taking note of his views provides enough proof of the committee's intentions.
Contesting the many points put out in the minutes of the meetings, he said: "none of these points was mentioned in the meeting. These were their afterthoughts."


GEAC’s musings on Biosafety

Commenting on the death of sheep that had died after grazing on Bt cotton, GEAC concluded that the death might have been due to the high content of nitrates/nitrites, residues of hydrocyanide (HCN) and organophosphates, which are common constituents of pesticides used in cotton cultivation. In effect, it gave a clean chit to Bt cotton. The GEAC’s observations were based on two reports — one from the Directorate of Animal Husbandry based in Hyderabad and the other from the Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh. It also noted that the Andhra Pradesh State Government had examined the issue.

However, Dr. Bhargava, had found the reports of the two institutes as also the State Government’s letter totally contradicting the GEAC’s version. For instance, the State Government’s letter to the GEAC had stated that the samples were “negative for HCN, Nitrates, Nitrites, Alkaloids and Glycocide.”

Even the report from the Veterinary Research Institute, U.P. had clearly stated that the Bt cotton samples did not show the presence of HCN, Nitrate/Nitrite, Alkaloids and Glycocides. And in a communication to the GEAC last month, Dr. Bhargava had contested the committee’s version on HCN and noted that “HCN is not a common constituent of any pesticide


List of approved Bt cotton hybrids in India
http://www.igmoris.nic.in/files/commercially%20released%20varieties%20of%20Bt%20cotton%20hybrids_31.07.08.pdf
Annexures

Annexure-1

List of NGOs that collaborated in this field research

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