

SAGE

GE Bulletin

July-2006 (second fortnight)

South Against Genetic Engineering

JK Agri Genetics to commercialise New Bt cotton technology

JK Agri Genetics Ltd, member of the leading industrial Group, JK Organisation and one of the leading companies in hybrid seed business in India has entered into an agreement with National Botanical Research Institute, Lucknow (a CSIR Institute) to commercialise their New Bt Cotton technology using Cry 1EC gene in India

JK Agri genetics has recently launched the first indigenously developed Bt Cotton in Indian Market after obtaining the clearances from GEAC during Kharif 2006, wherein the product was developed under collaborative research with BREF-IIT Kharagpur.

The new gene (Cry IEC) developed by NBRI would be pyramided with the recently released material carrying Cry 1Ac gene. This elite Bt Cotton will give broader insect resistance coverage, particularly against Spodoptera (tobacco caterpillar) and expected to provide season long uniform protection of the target pests throughout the entire field. Besides, the new product would also help in delaying the resistance development in Cotton Bollworm complex. Currently cotton varieties containing Bt do not offer acceptable control of Spodoptera.

Source: [www. Checkbiotech.org](http://www.Checkbiotech.org)

Next up for biotech: Virus-resistant trees

WASHINGTON, D.C. - When a virus was discovered in Jim Lerew's Pennsylvania peach orchard in 1999, all 160 acres of trees had to be destroyed.

He hasn't planted any replacement trees since then for fear the virus would attack them, too.

The only way to halt the spread of the virus is to destroy the entire orchard that is infected, and that's a risk a grower can't afford to take when an acre of fruit trees can be worth \$10,000.

"That's a difficult situation to get enthused about planting under," Lerew says.

But the government soon could approve the first fruit trees that have been genetically engineered to resist this virus, known as the plum pox, which attacks several types of trees, including plums, apricots, peaches and cherries.

For full report visit: checkbiotech.org

AP Govt urges Centre to consult states on transgenic varieties

Fighting a spirited legal battle against US biotech major Monsanto on its "astronomical" trait value for Bt Cotton seeds, the Andhra Pradesh government has asked the Centre to consult the states before according any approval for transgenic variety in the country.

"The Centre must give priority to local needs and ground realities before approving any genetically modified varieties and the state should be consulted," Andhra Pradesh Agriculture Minister N Raghuvveera Reddy said.

Asked whether his government would allow Bt brinjals, developed on the lines of genetically modified Bt cotton, in the state, Reddy said it was upto the Genetically Engineering Approval Committee (GEAC) to look into the issue.

"We have asked both GEAC and the Centre to consult all state agricultural universities before approving Bt brinjal," Reddy said adding these universities are aware of ground realities.

The GEAC is yet to decide on the fate of Bt brinjal, the introduction of which is opposed by various environmental and civil society groups.

"The ball is in the Centre's court and I would urge New Delhi to take any decision on that, keeping in mind local conditions," Reddy added.

The Minister made it categorical that he was not against the Bollgard technology, which is found to be effective against pest attacks, but disapproves high royalty or trait value charged by the parent company holding the technology rights.

He also clarified that the state government is waiting for reports from its affiliated agricultural universities on the long-term effectiveness of the Bollgard technology.

Source:http://www.hindustantimes.com/news/181_1754005,0002.htm

Commercialisation Of ICAR Transgenics Likely By 2008

The Indian Council of Agricultural Research (ICAR), increasingly under scrutiny for "not doing enough" in the field of genetically modified (GM) crops, claims that it is well on course towards commercialising its first set of transgenic varieties in the next couple of years.

Speaking to, Business Line, the Director-General of ICAR Dr Mangala Rai said: "There are seven GM varieties on which field trials have been completed under the supervision of the Department of Biotechnology's Review Committee on Genetic Manipulation (RCGM)."

First transgenics

He added: "This season we will be seeking the Genetic Engineering Approval Committee's (GEAC) permission to undertake large-scale trials and seed production. If all goes well, our first transgenics will reach the farmers' fields by 2008 or 2009."

The seven transgenics, which have crossed the RCGM-stage of approvals, include *Helicoverpa armigera* or American bollworm-resistant cotton, yellow stem borer-resistant rice, fruit and shoot borer-resistant brinjal, leaf curl virus-resistant tomato, protein-enriched potato, and salinity-cum-drought tolerant tomato and mustard.

GM BRINJAL

For cotton and rice, the ICAR and its public sector affiliates have used the cry1Ac gene - a variant of Monsanto's Bollgard also derived from the soil bacterium *Bacillus thuringiensis* (Bt) while the GM brinjal incorporates the cry1Ab gene.

In potato, the gene deployed is AmAl which is cloned from the protein-rich Amaranth seed (ramdana).

For imparting salinity and drought tolerance in tomato and mustard, the osmotin protein gene has been employed.

For leaf curl virus-resistant tomato, a "replicase gene in antisense construct" has been mobilised.

EXCELLENT BACKGROUNDS

According to Dr Rai, one advantage of the ICAR system's GM products would be the "excellent backgrounds" in which the alien genes are being incorporated.

"One reason for Bt cotton not performing up to expectations everywhere is the poor background of the underlying hybrids. In our case, we have chosen in-bred varieties that are certified and very popular among farmers."

For cotton, the varieties that have been genetically transformed are Bikaneri Narma LRA-5166 Sahana and RG-8; Kufri Chipsona-1 Chipsona-2 and Badshah for potato; Pusa Jaikisan for mustard; Pusa Purple Long for brinjal; and Pusa Early Dwarf and Pusa Ruby for tomato.

TO INDUCE COMPETITION

Expeditious commercialisation of GM crops in the public sector is expected to benefit farmers in the long run, as it would induce competition.

So far, the Government has approved 59 GM hybrids (all cotton) for commercial release.

Of these, 52 are based on the Bollgard gene technology of Monsanto, while the others express the gene constructs developed either by JK Agri-Genetics Ltd or Nath Seeds. "These hybrids are expensive mainly due to the high trait value or technology fee component. Things will change once publicly bred GM varieties and hybrids enter the market," industry sources said.

Source: <http://www.agbios.com/news.php>

Agent Orange study to show significant damage

A report out today was expected to show that all New Zealand Vietnam War veterans exposed to the defoliant Agent Orange may have suffered genetic damage.

The Massey University study is also expected to show that the genetic damage caused by exposure to toxins in the herbicide may affect both the children and grandchildren of servicemen.

All 25 Manawatu veterans involved in the research are believed to have had genetic degeneration, some of it significant.

Veterans and their families who have battled with serious health problems and birth defects have argued for 30 years that Agent Orange has had a genetic impact upon them and their children.

For full report visit:
http://www.nzherald.co.nz/category/story.cfm?c_id=204&ObjectID=10393422

Bollworms feeding on Bt cotton in Arkansas

Bollworms have been showing up in cotton fields across Arkansas. They're especially prevalent in south Arkansas, said Glenn Stuebaker, entomologist with the University of Arkansas Cooperative Extension Service.

They began showing up at the end of last week (July 16-22) in south Arkansas and now they're in north Arkansas," Stuebaker said. "We're seeing pretty heavy numbers."

The entomologist said insect numbers tend to "blow up" in July and August. Worms tend to get worse this time of year in cotton as do the late-season insects, plant bugs and stink bugs.

"The big problem is that farmers are finding damage in Bollgard cotton, Bt cotton genetically modified to provide protection against tobacco budworms. Usually, they provide some protection against bollworms. But this year seems to be worse. Farmers are having to spray a lot of Bt cotton for bollworms."

Stuebaker said the insects are feeding in the terminal area on the upper plant. Usually, if they survive on Bt cotton, they feed from the lower portion of the plant.

Why isn't the variety providing some degree of protection?

"It's too early to say why yet. It could be a natural cycle or it could be growing tolerance for Bt in these insects," Stuebaker said.

"Farmers have been growing Bt cotton for about 10 years. Bollworms always had some tolerance to Bt, but after 10 years, we may have been selecting for insects that are more tolerant."

He said the good news is that dual genetically protected Bt, Bollgard II, cotton is still holding up well against bollworms and tobacco budworms. This variety has two proteins that provide double protection.

The single protein Bt variety is working well to protect against budworms.

If bollworms are becoming more tolerant of Bt cotton, what will that mean to farmers?

"It could mean that more farmers will switch to Monsanto's Bollgard II or Dow's Wide Strike if we continue to see more bollworm damage to regular Bollgard," Stuebaker said. "The only problem is these are more expensive."

Meanwhile, farmers with Bt cotton being damaged by bollworms are having to spray with pyrethroid insecticides. But Stuebaker said it's never a good thing when farmers have to spray costly insecticides.

In conventional cotton that doesn't offer genetic protection, farmers are seeing budworms and bollworms. They should spray pyrethroids mixed with Tracer or Denim, Stuebaker said.

Unfortunately, it hits harder in a year like this when farmers are facing lost profit from high fuel and fertilizer prices. While spraying decreases their profits, Stuebaker said farmers can't afford to let insects steal their yields by not spraying.

He said farmers need to make sure their cotton fields are scouted for insects. He said they also need to check soybean and grain sorghum fields for bollworms, since they also feed on these crops.

Source: <http://deltafarmpress.com/news/060728-cotton-bollworms/>

Lid stays on modified rice

China, the world's top rice producer and consumer, is unlikely to give its nod for commercial production of genetically modified rice at least until next year with a government panel demanding more data to prove its safety.

Scientists in China said the biosafety committee - which examines the safety of genetically modified crops for the government - fell short of supporting large-scale production of insect resistant Bt rice at its biannual meeting last month. Instead, the panel has recommended transgenic papaya, which could become the first GMO crop in seven years to pass Beijing's scrutiny for commercialisation

"It is still far from commercialization," said Dayuan Xue, a professor from the Nanjing Institute of Environmental Sciences, referring to transgenic rice. "It's not possible this year. Maybe they may consider it next year."

The mainland scientists said it will take a year or two to collect data that the committee had now asked for to decide if Bt rice is safe for the environment and human consumption.

Early last year China looked set to approve commercial production of disease-resistant GMO rice, known as Xa21 rice, paving the way for the world's first large scale planting of a GMO crop for direct human consumption

For full report visit

http://www.thestandard.com.hk/news_detail.asp?pp_cat=5&art_id=23072&sid=8887196&con_type=1

Seven-year glitch: Cornell warns that Chinese GM cotton farmers are losing money due to 'secondary' pests

Although Chinese cotton growers were among the first farmers worldwide to plant genetically modified (GM) cotton to resist bollworms, the substantial profits they have reaped for several years by saving on pesticides have now been eroded.

The reason, as reported by Cornell University researchers at the American Agricultural Economics Association (AAEA) Annual Meeting in Long Beach, Calif., July 25, is that other pests are now attacking the GM cotton.

The GM crop is known as Bt cotton, shorthand for the *Bacillus thuringiensis* gene inserted into the seeds to produce toxins. But these toxins are lethal only to leaf-eating bollworms. After seven

years, populations of other insects -- such as mirids -- have increased so much that farmers are now having to spray their crops up to 20 times a growing season to control them, according to the study of 481 Chinese farmers in five major cotton-producing provinces.

"These results should send a very strong signal to researchers and governments that they need to come up with remedial actions for the Bt-cotton farmers. Otherwise, these farmers will stop using Bt cotton, and that would be very unfortunate," said Per Pinstrup-Andersen, the H.E. Babcock Professor of Food, Nutrition and Public Policy at Cornell, and the 2001 Food Prize laureate. Bt cotton, he said, can help reduce poverty and under nourishment problems in developing countries if properly used.

The study -- the first to look at the longer-term economic impact of Bt cotton -- found that by year, three farmers in the survey who had planted Bt cotton cut pesticide use by more than 70 percent and had earnings 36 percent higher than farmers planting conventional cotton. By 2004, however, they had to spray just as much as conventional farmers, which resulted in a net average income of 8 percent less than conventional cotton farmers because Bt seed is triple the cost of conventional seed.

In addition to Pinstrup-Andersen, the study was conducted by Shenghui Wang, Cornell Ph.D. '06 and now an economist at the World Bank, and Cornell professor David R. Just. They stress that secondary pest problems could become a major threat in countries where Bt cotton has been widely planted.

"Because of its touted efficiency, four major cotton-growing countries were quick to adopt Bt cotton: the U.S., China, India and Argentina," said Wang. Bt cotton accounts for 35 percent of cotton production worldwide. In China, more than 5 million farmers have planted Bt cotton; it is also widely planted in Mexico and South Africa.

When U.S. farmers plant Bt crops, they, unlike farmers in China, are required by contracts with seed producers to plant a refuge, a field of non-Bt crops, to maintain a bollworm population nearby to help prevent the pest from developing resistance to the Bt cotton. The pesticides used in these refuge fields help control secondary pest populations on the nearby Bt cotton fields. Researchers do not yet know if a secondary pest problem will emerge in the United States and other countries, Pinstrup-Andersen said.

"The problem in China is not due to the bollworm developing resistance to Bt cotton -- as some researchers have feared -- but is due to secondary pests that are not targeted by the Bt cotton and which previously have been controlled by the broad-spectrum pesticides used to control bollworms," added Pinstrup-Andersen, who also is serving as president of AAEA for 2007.

Wang and her co-authors conclude, "Research is urgently needed to develop and test solutions."

These include introducing natural predators to kill the secondary pests, developing Bt cotton that resists the secondary pests or enforcing the planting of refuge areas where broad-spectrum pesticides are used.

This study was jointly conducted by the Center for Chinese Agricultural Policy, Chinese Academy of Science and Cornell.

Source: <http://www.news.cornell.edu/stories/July06/Bt.cotton.China.ssl.html>

New heights for super crops

China intends to launch a satellite aimed at developing super space- enhanced fruit, vegetables and other crops, as it seeks ways to expand the nation's food production, state press said.

The Shijian-8, a recoverable satellite, will be launched on board a Long March 2C rocket in early September, for a two-week mission that will expose 2,000 seeds to cosmic radiation and micro-gravity, the China Daily reported Monday.

The "seed satellite" will enable scientists to try to cultivate high-yield and high-quality plants, Sun Laiyan, head of the China National Space Administration, told the paper.

"Exposed to special environmental factors such as cosmic radiation and micro-gravity, some seeds will mutate to such an extent that they may produce much higher yields and improved quality," the paper said.

Nine types of seeds, including grains, cash crops and forage plants, will be on board the satellite.

China has been experimenting with space-bred seeds for years, with rice and wheat exposed to the universe resulting in increased yields.

Space-bred tomato and green pepper seeds have resulted in harvests between 10 and 20 percent larger than ordinary seeds, while vegetables grown from space-bred seeds have a higher vitamin content, the paper said.

However, the satellite to be launched in September will be the first to be dedicated to cultivating seeds.

China's space seed experiments come as the nation seeks ways to feed its 1.3 billion people amid a rapid decline in farming land due to swift industrialization.

The nation has pursued some forms of genetically modified crops, with GMO tomatoes, soy beans and corn already in production. China is also mulling plans to approve the production of genetically modified rice.

Source:http://www.thestandard.com.hk/news_detail.asp?we_cat=2&art_id=23559&sid=8986615&con_type=1&d_str=20060725

Official Says China Faces 'Serious' Soil Pollution

China's top environmental official said Tuesday China faces serious soil pollution that jeopardizes the ecology, food safety, people's health and the sustainable development of agriculture.

"It is estimated that nationwide 12 million tons of grain are polluted by heavy metals that have found their way into in soil each year. Direct economic losses exceed 20 billion yuan (about US\$2.5 billion)," said Zhou Shengxian, director of the State Environmental Protection Administration (SEPA).

Addressing a national videoconference on soil pollution, Zhou said harmful substances accumulate in the soil which are then absorbed by crops that are consumed by people. This, he said, will harm people's health

<http://china.org.cn/english/features/poverty/175086.htm>

Article:

GM Cotton Fiascos Around the World

GM cotton not environmentally friendly or safe

Cotton is responsible for more than 10% of world pesticide use including some of the most hazardous, and 25% of all insecticide use. As weeds and insects become resistant, more and more pesticides are needed in a vicious circle that's a recipe for socio-economic, health and environmental disaster. About half of the GM cotton grown in the United States is herbicide resistant, and a comprehensive analysis by Dr. Charles Benbrook, a former Executive Director of the Board on Agriculture of the US National Academy of Science, confirmed that it required more herbicide than conventional varieties.

Most GM cotton crops worldwide are engineered with Bt for resistance to insect pests and promoted by firms like Monsanto as environmentally friendly, because they need less pesticide.

Monsanto's GM cotton 'Bollgard' carries the cry1Ac gene from soil bacterium, *Bacillus thuringiensis*, (Bt) to produce a toxin that kills some cotton pests including the boll weevil. However, Bollgard does not resist sucking pests, such as aphids, that might also damage the crop and will therefore require subsidiary spraying.

GM cotton not friendly to farmers

GM cottonseed prices include a 'technology fee' that can go up every year, and is calculated on supposed savings from reduced pesticide use with the Bt variety in a particular location.

All farmers growing Monsanto's Bt cotton sign a contract, called a Technology Use Agreement that is strictly applied. It stipulates that,

- Farmers cannot save seed for replanting
- Farmers are prohibited from supplying seed to anyone else
- Farmers must pay 120 times the technology fee, plus the legal fees of Monsanto, if they violate the contract.

The Indonesian experience: A cautionary tale

Indonesia was the first country in Southeast Asia to permit commercial GM farming against the warnings of scientists and activists on the environmental and socio-economic impacts. Fortunately, permission was granted only on a year-by-year basis, and the government reviewed the impact of the failed Bt crop.

The review was scathing. This "Gene Revolution", it said, seemed to be "a modern tool for cementing farmers' dependence on seeds and transnational agrochemical corporations appearing in developing countries in different guises." The evidence from Indonesia is that "GM crops are nothing more than a profit-motivated deployment of scientific power dedicated to sucking the blood of farmers."

Monsanto promised Bt cotton would return 3-4 tonnes of cotton per hectare while requiring less pesticide and fertilizer than Kanesia, the local cotton variety. The seed was given to farmers with pesticide, herbicide, (including Roundup) and fertilizer as part of a credit scheme costing sixteen times more than non-Bt cotton. In fact, the average yield was 1.1 tonnes per hectare and 74% of the area planted to Bt-cotton produced less than one tonne per hectare. About 522 hectares experienced total crop failure. Despite that, the government extended approval for Bt cotton for another year; and the results were no better.

In 2001 farmers signed contracts, but in 2002 the seed price rose and the cotton price slumped. Farmers had no choice but to shoulder the debt and sell at the company's rate; as a result, 76% of farmers who joined the credit scheme couldn't repay their debt and many burned their cotton in protest against the government and the company (see "Broken promises", SiS 22 <http://www.isis.org.uk/isisnews.php>).

In 2003, Monsanto halted operations saying that the Indonesian Government's decision to authorize Bt cotton production on a year-by-year basis had been a big obstacle to business investment. PT Monagro Kimia, a Monsanto subsidiary, was under investigation by the US Department of Justice and the Indonesian Corruption Eradication Commission on suspicion that a payment of US\$ 50 000 was made to Indonesian officials in 2002.

In January 2005, Monsanto was found guilty of authorising the bribe and fined \$1.5m (see "GM cotton: corruption, hype, half-truths and lies", this series).

Bt cotton in India: Lessons not learned

Bt cotton entered commercial production in India in 2002 without comprehensive assessment for detrimental effects, and despite fierce protests by farmers and public interest organizations. Only six of India's 29 states in the south and the west of the country have had permission to plant

Monsanto's Bt cotton. Four strains of Bt seed were available with at least one Indian variant of the licensed Monsanto varieties.

A 2002 study of Bt cotton in the Warangal district of Andhra Pradesh found a 35% reduction in the total yield of Bt cotton with a net loss of Rs 1295, compared to a net profit of Rs 5368 for non-Bt cotton. Bt cotton yield was 50% lower than that promised by Monsanto. Bollworm were predominant on both Bt and non-Bt crops showing that Bt cotton was ineffective against its target pest.

In 2003, there was 30% more rainfall than in 2002, and a new Bt hybrid compared favourably with the previous year; however it was still 9% less profitable than the non-Bt hybrids.

In 2004, farmers in the state of Andhra Pradesh grew Bt cotton on 10% of the cotton acreage. Half of the farmers growing Bt cotton bought licensed seed from Monsanto at 1 500 rupees per 400 gm packet, while the other half bought unauthorised hybrid Bt seed at between Rs 800 to 1 200 per packet. Non-Bt hybrid seed cost farmers about Rs 400.

Farmers found that, with fluctuating weather as in 2002, much of the crop showed signs of wilt, and although some Bt cotton recovered from severe moisture stress, the yield was very poor compared to non-Bt types; also the yield from the unlicensed Bt cotton was better than Monsanto's seed because drought tolerant females had been chosen for crossing to produce the hybrid. Monsanto is now demanding royalties of 70% from these seed producers.

Many Bt plants were small with few bolls that were infested with bollworm and other pests, including cercospora leaf spot, so the cotton had been neither high-yielding nor resistant to bollworm as promised by Monsanto. On 12 October, hundreds of farmers in Warangal district protested on the streets where the seed and pesticide dealer shops were located and demanded compensation for their losses, staging a sit-in on the highway. A second protest took place two days later when senior officials promised to attend; a Monsanto official was subsequently kidnapped. Meanwhile there has been a bumper harvest in non-GM cotton.

Bt cotton in China

Monsanto received a permit in 1997 for commercial production of Bt cotton in China and has since shared the Bt cotton market with domestically developed varieties that have expanded quickly over the country's cotton-growing area.

China has been held up as the success story in GM cotton, and is the key to statistics claiming benefit for small farmers from GM. However, earlier warnings of major problems have now been confirmed by a Chinese researcher who reports that the technology will not only be useless within six to seven years, but "could cause a disaster". Liu Xiaofeng, a researcher from Henan, China's second largest cotton producing province, told Reuters that the cotton bollworm is indeed developing resistance and will not be susceptible to Bt cotton after 20-30 generations, or in six to seven years. Moreover, Bt cotton does not effectively control secondary pests such as Lygus bug.

The early warnings appeared in a study published in June 2002 based on the work of scientists at a research institute funded by China's Environmental Protection Agency. It found that although Bt cotton was effective in bollworm control, it had adverse impacts on the parasitic natural enemies of bollworm, and was not effective in controlling many secondary pests that damaged the crop. The study also found the diversity indices of the insect community in Bt cotton fields to

be lower than in conventional cotton fields, and that the cotton bollworm could develop resistance to Bt cotton.

Liu's work has received further collaboration by another study published in October 2004, which found that Bt cotton did not reduce the total numbers of insecticide sprays because additional sprays were required against sucking pests.

Field trials in Africa

South Africa, already the sixth biggest producer of GM crops in the world, grows Bt cotton on large and small commercial scales, extolling the benefits to small farmers in spite of the serious debts incurred.

Although there is a glut of cotton in the world market and depressed prices caused by US subsidies to their own growers worth \$3.7 b per annum, the US government and the world's biggest agrochemical companies are putting pressure on West African countries to introduce Bt cotton, the 'trojan horse' for other GM crops waiting in the wings. In West Africa there are wild relatives of cotton that may be contaminated, but in the US, GM cotton is prohibited in Florida where wild relatives grow.

In November 2003, USAID, with the official support of the International Institute of Tropical Agriculture, declared that it wants to 'GM-ize' Africa.

Mali's National Agricultural Research Institute has been negotiating with Monsanto and Syngenta for field trials of Bt cotton. There is a plan to convert the country's crop to GM varieties over the next five years; local farmers and the public are unaware of this intention. West African farmers, already unable to sell enough natural cotton because of subsidies, are locked into a cycle of poverty with credit against next years harvest.

- Burkino Faso has been field-testing Bt cotton since July 2003 in collaboration with Monsanto. But Francois Traore, president of the National Union of Cotton Producers, says, "If we already have the means to reduce pesticide use, why look for things that are going to complicate life?"
- Benin has had a moratorium on GM products since March 2002, but is under constant pressure to introduce Bt cotton.
- Senegal ran an unofficial field trial of Monsanto's Bt cotton, but efforts were abandoned after the cotton failed to perform.
- Egypt has a pro GM policy with field trials underway for Bt cotton and many other crops.
- Kenya has many research institutes pushing GM crops, and research on GM cotton is under way.
- Uganda has just published its first biosafety policy bill, which has yet to be made law by parliament, however it is expected to take up Bt cotton soon.
- Zimbabwe: The government destroyed some unsupervised field trials of Bt cotton conducted by Monsanto some years ago.

The Americas

In the US, home of Monsanto's Bollgard first planted in 1996, there have been problems with erratic and disappointing yield, especially in Southeast Arkansas where costs were significantly higher on Bt acreage. In 2002, despite the use of supplementary pesticides, 7.5% of the Bt crop

was destroyed by bollworm and 1.4% destroyed by Spodoptera and Pseudoplusia includens caterpillars. The total insecticide use has remained relatively stable due to the increasing importance of secondary pests; it is lower in dry states such as Texas, but increasing in the Mississippi delta.

Research on Bollgard cotton adopted in North Carolina, conducted between 1996-2003 by Jack Bachelier, North Carolina State University Extension entomologist found changes in insect communities, and that while damage from bollworms decreased, stink bug problems have increased.

In 2004, Bt cotton was grown in nine states and comprised more than 75% of all cotton grown. Most varieties are Roundup Ready (RR) or RR and Bt combined [1]. The proposed 'technology fee for Bollgard II was US \$99 ha in 2004, this is to be added to the seed price.

Bt cotton is also grown in Brazil, Argentina, Mexico and Columbia. In Columbia the vice-president of the biosafety council works for Monsanto and was thus able to both apply for and grant permission for release of a Bt crop in an area that is a centre of origin for some wild cotton species. Moreover, the pest responsible for 70% of pesticide use on cotton is the picudo, which is not targeted by Monsanto's cotton. The small farmer will once again lose out due to this folly.

Overproduction of cotton devastating the environment and destroying poor farmers

World overproduction of cotton, a crop that degrades the environment by escalating requirement for pesticide, demand on scarce water resources and exhaustion of soil, is a subject for serious concern in its own right. Large commercial plantings - which attract subsidies in rich countries - create monoculture deserts and distort world markets. As a result, the poor producer in the south, who has traditionally grown a crop of one or two hectares, descends into a spiral of debt. The aggressive introduction of GM cotton will exacerbate all the problems of the conventional crop and, in developing countries, nullify centuries of successful local crop breeding by farmers, destroying their autonomy and control of seed, their livelihoods and cultural traditions.

Source: <http://www.i-sis.org.uk/>