Bt Cotton - Prospects and Challenges - A Review Article

Raveesh Kumar Gangwar*
Lecturer and Head Department of Plant Protection, Facility of Agriculture, Doon College of Education, Saharanpur (U.P.) India

Abstract
India being agriculturally dominant country and over two-third of its entire working population are engaged in agriculture activities, in recent past, sectors like services. IT and manufacturing has shown smart progress but at same time progress in agriculture sectors have been sluggish. One can argue that this is more because of unpredictable climate/global warming. As the contribution of agriculture in country's GDP is dwindling with time, and the latest prediction of the decelerated food production to a very alarming rate, the planners, executers and other agencies have started realizing for a significant change/reform in agriculture sector. There is a need to boots agriculture products with new technologies which can help increasing the production.

Introduction:

India is the second most population country in the world. There is a need to increasing production of agricultural products to fulfill the stomach of population. Due to increasing population and shrinking the resources, therefore an urgent needs to boost agricultural productivity. The most viable and vibrant thinking would be to infuse new technology in Indian agriculture. The green revolution has given us the status of self reliance stature in food but those gains with times and population growth has tapered off. Additionally, use of high yielding varieties has created problems of land degradation, pesticide residue in farm produces, gene erosion, environmental pollution etc. Providing ample food grain at affordable price for the ever-growing global population is only the first part of the challenge. The second and more important part is to produce this in a way that dose not destroy the natural resources. Intensive agriculture, through provides sufficient food grains, yet treads heavily in the environment. Even after introduction of this now the yields of most crops have hit a plateau since the 90s. A new wave of technology boost is needed to ward off the stagnating yield levels. Biotech crops hold great promise in achieving this end. If transgenic technology is integrated into the traditional system of crop husbandry, probably it holds great promise in augmenting agriculture production productivity. This is quite evident from the success of the Bt-cotton, Bt Maize, Bt Brinjal, Bt corn and several other crops in several countries. In the world level developed countries growing transgenic cops successfully as maize, brinjal, corn, soyaben but in Indian condition only Bt cotton is successfully cultivated.

History of Cotton:

Cotton as a crop no needs to introduction. The fiber is used to make a soft breathable textile which is the most widely used natural fiber in clothing today. The english name derives from the Arabic word "Qutn", which began to used about 1400 AD. Cotton has a long history; it was cultivated in the Indus Valley Civilization by the 5^{th} and 4^{th} millennium BC. Hundreds of year before Christian era, cotton textiles were woven in India with matchless skills and there use was spread to Mediterranean countries. It was cultivated all over the world as a natural fiber from Peru to Mexico to Persia.

During the late medieval period, cotton became known as an imported fiber in northern Europe, without any knowledge of how it was a plant; noting its similarities to wool, people in the region could only imagine that cotton must be produced by plant-borne sheep. This aspect is retained in the name for cotton in many European languages, such as German Baumwolle, which translates as "tree wool" (Baum means "tree"; Wolle means "wool"). By the end of the 16^{th} century, cotton was cultivated throughout the warmer region as Asia and USA. Cotton sparked a decisive moment in the history of Indian independence. Angered and economically depleted by the British Indian Policy of exporting the cheap raw cotton and importing expensive lines. Today India is an important grower of cotton on a global scale. It ranks third in global cotton production after the USA and China. India accounts for approximately 25% of the world's total cotton area and 16 % of global cotton production. Most of the cotton in India is grown under rain fed conditions, and about a third is grown under irrigation. However, yields of cotton in India are low, with an average yield of 300 kg/ ha compared to the world average of 580 kg/ ha.

Bollworms (tissue borers) are the most destructive, requiring major efforts to save the crop from them. Insecticides used annually on all crops in India, of which about half are used on cotton alone **(Manjunath, 2004; Rai *et al.,* 2009).** Cotton bollworm, *Helicoverpa armigera,* spoted bollworm*, Earias vittella*, Pink bollworm *Pictinophora gossipiella. Spodoptera litura,* is mainly a foliage feeder but it also damages cotton bolls. Sucking pests such as aphids *Aphis gossyii*, jassids *Amrasca bigutulla*, and whiteflies *Bemisia tabaci,* are also a problems in terms of direct damage to the plant and the transmission of viruses. Helicoverpa armigera, is known to have developed resistance against most of the recommended insecticides **(Ramasubramanyam, 2004).** The solve

problem and create interest in farmers for growing cotton crop, developed GM cotton, which is very effected against cotton bollworm.

Bacillus therungenis

Pest associated losses in major crops varies from 52% in wheat, 58 % in soybean, 59 % in maize, 74 % in potato, 83 % in cotton .Insects not only cause direct losses to the produce but also cause indirectly due to impaired quality of the produce and their role as vectors of various plant pathogen. Bt or *Bacillus thuringiensis* is a ubiquitous soil bacterium first discovered in 1901 by Ishiwata, a Japanese microbiologist **(Kumar *et al.* 1996).** *B. thuringiensis* as biopesticide, commonly known as Bt, is a naturally occurring, gram positive, spore- forming soil bacterium. Bt has been known to be reservoir of several insecticidal proteins, such as endo toxins, catalytic proteins, vegetative insecticidal proteins, etc. among these. Endotoxins have been more efficiently utilized for protection of a variety of crops various insect-pests. Through commercial Bt formulation are being used since many decades, it needs to be applied repeatedly and it is effective only against immature stages of target insects feeing on exposed plant surface (can not against those insect-pest that feed inside the plant). Insecticidal proteins present in Bacillus thuringiensis, have been introduced I many crop employing genetic engineering technology and given the possibility of developing entirely new system of pest management that have advantages over classical biological control agents. Through Bt transgenic crops have been used successfully to provide resistance against number of insect-pests for decade or so, the year 1996 marked a milestone in agricultural biotech logy, when for the first time Bt transgenic varieties of potato, cotton and corn were released for commercial cultivation. Since then the global area of transgenic crops continued to grow at a sustained double-digit growth rate. In 2008, world wide genetically modified crops have been grown in about 125 mha **(James, 2008)** more than 125 countries are plating GM crops including India, of these Bt cotton and Bt corn. Many private and public institutions are involved in generating GM crops and research are in advanced stage of generating such crops. For insect resistance, in case of brinjal, three industries involved using *Cry*1 Ac, *Cry*1 Aabc, *Cry* 2Ab genes; cabbage, one industries using *Cry* 1Ba, *Cry* 1ca; cauliflower, two industries using *Cry* 1Ba, *Cry* 1Ca; corn, one industry using Cry1Ab: cotton, 30 industries with single and staked genes *Cry*1ac, *GFM Cry* 1A, *Vip*-3A, *Cry* 1Ac+*Cry* 2Ab are involved in generating transgenic plants. In case of rice for insect resistant three industries are using rice chitinase tobacco osmotic gene, *Cry* 1B-*Cry* 1Ac, *Cry* 1Ac, *Cry* 2Ab genes. Hence, there are ample opportunities are available to utilized the improved technology for quality products. Moreover, all these will be environmental friendly and will lead to reduction in the consumption of the environmentally harmful agriculture chemicals.

BT cotton in India:

The cultivation of Bt cotton all over the world. Bt cotton increase their production and the farmers which divert their farming practices return on growing Cotton. In India, transgenic Bt cotton, which has the in built protection against the scourge boll-worms; was approved for commercial cultivation in March 2002. It was developed by a private company. Since then, the area has grown to over 6 million ha, almost 90 percent of all hybrid cotton cultivation the country. The replacement of traditional cotton hybrids by the biotech version has had a dramatic impact on production, productivity and farm incomes. The total cotton production in the country today around 3.1 million bales (of 170 kg), second only to that China. This is more than double of what we used to produce in 2002, from about same area under this crop. The productivity of cotton in this period jumped from under 300 kg/ha to around 500 kg/ha. India today is a net exporter of cotton from being a net importer till 2003-04.

Table 1. list of the Bt cotton events approved for cultivation in India

Event name	Event number	Source company/institution	Genes	Year of approval
Bollgard I	MON 531	Monsanto	cry1Ac	2002
Bollgard II	MON 15985	Monsanto	cry1Ac and cry2Ab	2006
Event 1	Event 1	IIT, Kharagpur	Truncated cry1Ac	2006
GFM Cry 1A	GFM Cry 1A	Chines Academy of Sciences	cry1Ab+cry1Ac	2006
Dharwad event	Dharwad event	UAS, Dharwad	Truncated cry1Ac	2008
9124	9124	Metahelix	cry1C	2009

Cotton was probably the only crop whose production in the last 5 years outdid all the set targets and grew at an average rate around 20 percent annually. The success of Bt-cotton has brought a not so well-known fact that Indian farmer is a very quick adopter of technology. Country to the wise-spread perception that the Indian farmers, being illiterate and poor, is resistant to change, it now evident that the Indian farmers are quick in adoption any technology if there is real value.

References:

1. James, C. 2008. Global Status of Commercialized Biotech/GM Crops. ISAAA Briefs No. 39. International Service for the Acquisition of Agri-Biotech Applications. Ithaca, NY
2. Kumar, P. A., Sharma, R. P. and Malik, V. S. 1996. Insecticidal proteins of *Bacillus thuringiensis. Advances in Applied Microbiology,* 42: 1-43
3. Manjunath, T. M. 2004. Bt cotton in India: The technology wins as the controversy http://www.monsanto.co.uk/news/ukshowlib.html?wid
4. Rai, M., Acharya, S. S., Virmani, S. M. and Aggrawal, P. K. 2009. State of Indian Agriculture. National Academy of Agricultural Sciences, New Delhi.
5. Ramasubramanyam, T. 2004. Magnitude, mechanism and management of pyrethroids resistance in *Helicoverpa armigera* (Hubner) in India. *Journal of Entomology*, 1: 6-11.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

Academic conference: http://www.iiste.org/conference/upcoming-conferences-call-for-paper/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar