

Cultivation of Bt Cotton Pakistan's Experience



Cultivation of Bt Cotton - Pakistan's Experience

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ACRONYMS

AAPk	ActionAid-Pakistan
ABI	Agricultural Biotechnology Institute
AIDS	Acquired Immune Deficiency Syndrome
BBW	Bollworm Budworm
Bt	<i>Bacillus thuringiensis</i>
CBD	Convention on Biological Diversity
CLCV	Cotton Leaf Curl Virus
DNA	Deoxyribonucleic Acid
GDP	Gross Domestic Product
GE	Genetic Engineering
GM	Genetically Modified
GMOs	Genetically Modified Organisms
GOP	Government of Pakistan
HIV	Human Immunodeficiency Virus
HT	Herbicide Tolerant
IABGR	Institute of Agricultural Biotechnology and Genetic Resources
IFOAM	International Federation of Organic Agriculture Movements
IPM	Integrated Pest Management
IT	Information Technology
MAF	Million Acre Feet
NARC	National Agricultural Research Centre
NCEMB	National Centre of Excellence in Molecular Biology
NIAB	Nuclear Institute for Agriculture and Biology
NIBGE	National Institute of Biotechnology and Genetic Engineering
NWFP	North West Frontier Province
R&D	Research and Development
RRA	Rapid Rural Appraisal
USA	United States of America
WMD	Weapons of Mass Destruction

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Chapter 1

AGRICULTURE IN THE NATIONAL ECONOMY

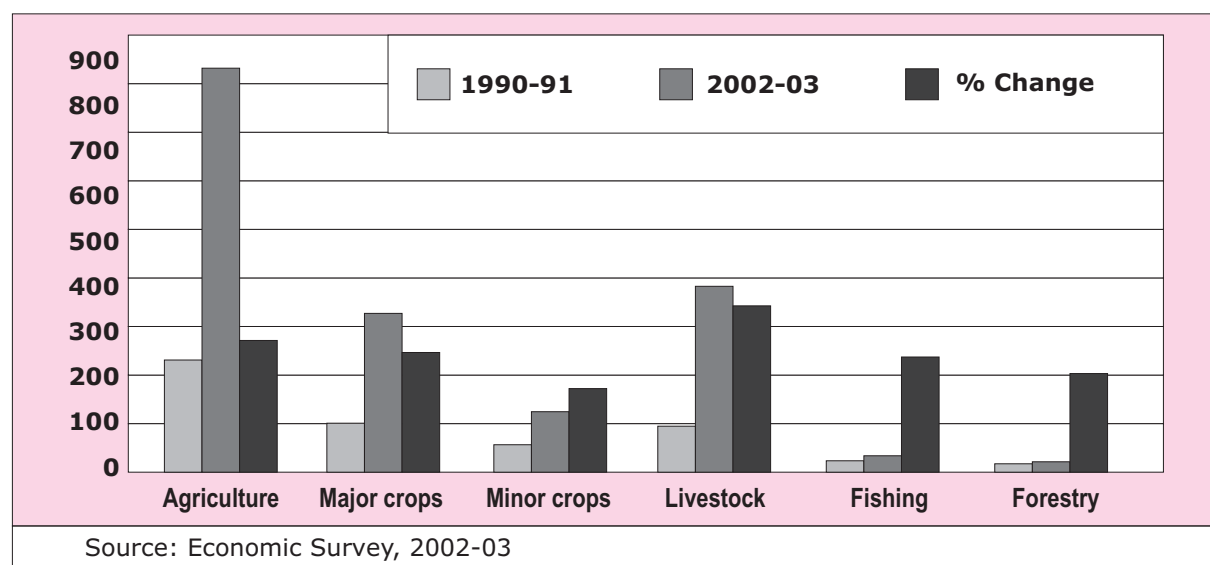
1.1 Introduction

Agriculture is the largest sector of Pakistan's economy and contributes about 24 percent to national GDP. It employs 44 percent of the total labour force of the country (GOP, 2002). It provides directly and indirectly sustenance to two-thirds of population living in rural areas. About 50 percent of the total value of industrial production comes from agro-based industries, including textile and sugar. More than 55 percent of total export earnings come from export of agro-based raw and processed products.

Within agriculture sector, the crop sub-sector plays pivotal role. Its contribution to agricultural GDP remained the highest over time followed by livestock, fishing and forestry. In 2002, the composition of agricultural GDP was 51 percent from crops, 46 percent from livestock and the remaining 3 percent from fisheries and forestry sub-sectors (GOP, 2002). Of the total export earnings of Rs.452 billion in 2001-02, the earnings from export of rice, cotton and cotton products alone amounted to Rs.112 billion or 25 percent of the total exports. There have been some structural changes over time resulting in shifts on account of national and international events but this position more or less remained the same. There are therefore, not many shifts in the traditional exports, notwithstanding the fact that future lies in diversified agricultural trade.

Sources of increased agriculture production and productivity growth in Pakistan have been more intensive use of land and water resources in combination with new interventions from research. Pakistan's average annual growth in agricultural production since 1959-60 has been impressive with a three percent growth and compares favorably with growth rates of comparable countries (World Bank, 1994). The growth rate fell to 2.3 percent during 1969-70 to 1979-80 period due to several years of severe weather conditions and a cotton virus that depressed production.

Agricultural growth rate in 1995-96 increased to 11.7 percent as compared to 6.6 percent in 1994-95. This increase was due to increase in the production of cotton, rice and gram. In 1996-97, mainly due to decrease in production of major crops, the growth rate achieved was 0.1 percent. In the subsequent year, however, the production of major crops picked up which resulted in achieving a growth rate of 3.8 percent. During 1998-99, performance of the sector was again beset with decrease in production of wheat and cotton and resultantly, the growth rate achieved was two percent. Later, the major crops showed a remarkable recovery with a growth rate of 15.1 percent during 1999-00. Despite poor performance of minor crops, the average agriculture growth rate was 6.1 percent. Since 2000-01 till now the performance of major crops growth rate was in negative (GOP, 2002).

Figure 1.1 GDP Share of Agriculture Sub Sectors

1.2 Importance of Cotton Crop

It is very pertinent to highlight the importance of cotton crop in the economy of the country to bring the gravity of the issue to limelight. Cotton crop is grown on area of 2.9 million hectares with a total production of 10.7 million bales during the year 2000-01. However, cotton production decreased by 1.1 percent from 2000-01 to 2001-02. Some 1.31 million farmers grow cotton as per 1990 Agriculture Census. Area and production of cotton in various periods is given in Table 1.1.

Table 1.1 Area, Production and Yield of Cotton

Year	Area ^a (Million Hectare)	Production ^a (Million Bales)	Yield ^a (Kg/hectare)	Value of Cotton ^a (billion Rupees)	GDP ^b (billion Rupees)	Cotton Share in GDP (%)
1990-91	2.66	9.63	615	37	908	4.07
1991-92	2.83	12.82	769	51	1078	5.62
1992-93	2.83	9.05	543	40	1200	4.41
1993-94	2.80	8.04	488	54	1413	5.95
1994-95	2.65	8.70	557	72	1688	7.93
1995-96	3.0	10.59	601	91	1952	10.02
1996-97	3.15	9.37	506	93	2256	10.24
1997-98	2.96	9.18	528	93	2481	10.24
1998-99	2.92	8.79	512	94	2736	10.35
1999-00	2.98	11.24	641	98	2952	10.79
2000-01	2.93	10.73	624	112	3167	12.33
2001-02	3.12	10.61	570	97	3377	10.68

Source: a Agricultural Statistics of Pakistan (various issues)

b Economic Survey 2002-2003 (GDP at factor cost)

Cotton contributes 2.7 percent to the total GDP of the country (GOP, 2002). It plays major role in the economy of Pakistan as it generates significant proportion of foreign exchange. It accounted for 11.5 percent of the value added in agriculture sector. Textile, ready-made garments and other cotton based industries are generating major employment in the country. Edible oil industry is also heavily dependent on cotton crop as 35 percent total edible oil comes from cottonseed. In other words the national GDP growth is heavily dependent on the cotton, production in the country. The statistics presented in Table 1.2 indicate that in the years of low cotton production GDP growth rate has drastically gone down and vice versa.

Considering such a high importance of the cotton crop in the national economy, the problems and issues pertaining to this crop should be very carefully evaluated and monitored. Any new intervention involving some degree of risk should be taken seriously and therefore extreme degree of precautionary measure must be adopted to avoid any serious losses to crop, farmer, and to the economy of Pakistan.

Table: 1.2 Cotton Production and GDP Growth Rate (1990-2001)

Year	Cotton Production (Million bales)	Agriculture Growth Rate (%)	GDP Growth Rate (%)
1990-91	9.6	4.96	5.42
1991-92	12.8	9.50	7.57
1992-93	9.0	-5.29	2.10
1993-94	8.0	5.23	4.37
1994-95	8.7	6.57	5.06
1995-96	10.6	11.72	6.60
1996-97	9.4	0.12	1.70
1997-98	9.2	4.52	3.49
1998-99	8.8	1.95	4.18
1999-00	11.2	6.09	3.91
2000-01	10.7	-2.64	2.45
2001-02	10.6	-0.07	3.61

Source: Economic Survey 2002-03

1.3 Why Cotton becomes a Problematic Crop?

With the introduction of green revolution and application of modern inputs combined with improved varieties of cotton production touched to the highest level of 12.82 million bales in year 1991-92. Thereafter the production went drastically down and fell to 8.0 million bales despite heavy doses of pesticides.

This abrupt reduction was attributed to the severe attack of cotton leaf curl virus (CLCV), which spread through the attack of whitefly a very common pest of cotton in Pakistan. In the following years the

researchers introduced resistance in their varieties against the existing strains of the CLCV.

It has been reported that another strain (Burewala) of CLCV has become active and has started creating havoc in some of the cotton growing areas of Punjab particularly Burewala as the common name given to this strain by the scientists. As per latest research five strains of CLCV have been discovered. The contrast in reduction of cotton production and increased pesticide use over the years indicates that the major pest-affecting cotton crop was not bollworm but it was the whitefly that was spreading CLCV.

Chapter 2

BIOTECHNOLOGY AND ITS APPLICATION IN PAKISTAN

2.1 Definition of Biotechnology

Bt cotton is a product of modern biotechnology and the term biotechnology was defined as products arising from cellular or molecular biology and the resulting techniques produced by these disciplines for improving the genetic makeup and agronomic management of crops and animals (Cohen, 1999). This definition allowed a focus on products arising from both traditional and modern biotechnology.

Biotechnology by its proponents, is termed as the technology of new millennium and equated to the information technology (IT), and has been declared as the technology with immense potential. Biotechnology is product of many technologies, viz. tissue culture, molecular marker assisted breeding, genetic engineering and its simplest form is making of yogurts, cheese and wines and the complex forms are gene transfer from one specie or genera to the other and cloning. These all forms have vast potential for application in agriculture.

2.2 The Critique of GMO Technology

Since its inception, biotechnology has been bathed in an aura of both awe and suspicion. Consumer advocates, environmentalists, religious leaders, and even some scientists are critical of the potential dangers, and the ethical questions surrounding, genetic engineering. Initially, the sheer novelty of transgenic organisms made it difficult to determine what effects they would have on ecological stability and public health. For these reasons, the commercial progress for biotechnology in many fields has been slower than initially expected.

A lot of criticism has been generated through debates, press and media reports about the misnomer of the technology. The opponents of the technology have supported their criticism on scientific basis. The major criticism is the impoverish ness of GMOs as a transgenic line results from gene insertion events in a single original cell out of which the entire line is produced. The transformed plant cells are often kept in tissue culture, a procedure known to generate uncontrollable (somaclonal) variation that frequently change the plant genome, a major source of unpredictability. Therefore the process is uncontrollable, unreliable and unpredictable and has hardly improved since the first GMOs were made (ISIS, 2002).

2.3 What is the Bt Cotton?

The initial successes in plant genetic engineering marked a significant turning point in crop research. Particularly in the 1990s, there has been an upsurge of private sector investment in agricultural

biotechnology. Some of the first products were plant strains capable of synthesizing an insecticidal protein encoded by a gene (Bt) isolated from the bacterium *Bacillus thuringiensis*. Bt cotton, maize, and other crops are now commercially grown. There are also crop varieties tolerant to or capable of degradation herbicides. Proponents stress the value of these crops in minimum-tillage and soil conservation (James, 1998).

The soil micro-organism *Bacillus thuringiensis* (Bt) occurs naturally and ubiquitously in the environment. Different strains of the Bt bacterium can kill different types of insect. The strains used in Bt cotton target caterpillar pests (lepidopterans), especially cotton bollworm, of which there are several species in different continents. The Bt bacterium produces a toxin which, after ingestion by susceptible insects, binds to their guts and disrupts feeding and digestion, eventually causing death. When an insect pest feeds on a GM crop expressing the toxin gene, it ingests a dose of the toxin. Feeding is suppressed after about 18 hours and death occurs within three days. Bt cotton plants target the early larval stages of bollworms, which are far more susceptible to the bacterial toxin than the mature larvae.

2.4 Biotechnology in Pakistan

Pakistan has a history of slowly developing industrial sector hence its economy mainly relies on agricultural sector. The growth of agricultural sector shows that it excelled successfully from 1970s to 2002 with some declining trend in 90s. The country has produced food crops less than its requirements and mainly attributed to outbreak of crop diseases like rust and viruses during the flopped years. Over the years scientists have evolved new crop varieties resistant to these diseases, through conventional breeding methods, and kept on doing so to avoid any reoccurrence and outbreak of these epidemic diseases. The process of evolving a new crop variety normally requires a period of 10-12 years but with the diverse climatic condition of Pakistan, scientists were able to evolve a new variety like of wheat in half of the normal time period.

As a first step to achieve this objective the National Centre of Excellence in Molecular Biology (NCEMB) was established in 1985 and later the National Institute of Biotechnology and Genetic Engineering (NIBGE), was established in 1992. NCEMB's main strength is plant transformation for the development of transgenic crop varieties, whereas NIBGE specializes in plant biotechnology, biofertilizers, biomas, bioleaching and biotech-nitrogen fixation.

In 1995 an Agricultural Biotechnology Institute (ABI) was established at the National Agricultural Research Centre, Islamabad. The ABI is working on Plant Tissue Culture for virus free plants and genetic engineering for disease resistance. This institute has now been merged with another institute and renamed as Institute of Agricultural Biotechnology and Genetic Resources (IABGR). Nuclear Institute for Agriculture and Biology (NIAB) established in 1972 is working on mutation breeding and introduced famous variety of cotton NIAB-78. A list of these institutes is depicted in the Table 2.1.

Table 2.1 Major Research Institutes of Biotechnology in Pakistan

S.No.	Research Institute	Established in	Major Research Areas
1.	Agricultural Biotechnology Institute (at the National Agricultural Research Centre, Islamabad.	1995	Plant tissue culture in potato, datepalm, banana, jojoba, rice and ornamental. Genetic Engineering for disease resistance in tomato and sunflower.
2.	National Center of Excellence in Molecular Biology University of the Punjab, Lahore.	1987	Cotton, chickpea and rice transformation.
3.	National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad.	1992	Biofertilizers, transgenic cotton and rice transformation.
4.	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	1972	Mutation Breeding, salt tolerance in plants, soil sciences.

Source: Zafar, 2000.

2.5 Is there a Need to Grow Bt Cotton in Pakistan?

In 1960s, Pakistan's population was 96.32 million, which grew to 122.49 million in 1990s. By 2001-02, the Pakistan's population has grown to 145.9 million. The population growth rate was 2.16 percent by mid of year 2002. The future growth in food demand will require increase in productivity from a decreasing stock of arable land. The challenge, therefore, is not only to feed more people, but to do so with less available resources, less water, fewer renewable resources and fewer people engaged in agriculture.

These population and resource facts, combined with a renewable commitment to fighting poverty, indicate that the main thrust of national policies aimed at solving issues of rural poverty and food insecurity must include broader agricultural and rural development objectives, such as significant increase in food production. To escape from poverty, rural population depends directly or indirectly on increased agricultural productivity and an innovation that increases productivity will have a major impact on food-security efforts.

Biotechnology by many writers is considered to help poor farmers, increase productivity and contribute to addressing poverty issues in developing countries. But question arises, should agricultural development strategies for developing countries include biotechnology as one of their priorities? What's the impact of biotechnology on the environment, human health and the livelihood of rural poor? Should developing countries consider biotechnology at all debates surrounding these questions have generated passionate exchanges and controversies in many forums. It is, however, extremely important to ask these questions in the situation of declining public investment in agricultural research. In part of criticism directed at biotechnology, in particular genetically modified (GM) crops, is that poor

farmers and consumers stand to benefit very little from biotechnology. There is also very little information about the long-term costs, benefits, and risks associated with biotechnology especially for the poor.

An area of great concern that should not be neglected is the issue of public perception for environmental hazards due to the release of transgenic plants. Some scientists noted that, though the effects of the release of genetically transformed organisms on biodiversity may be no different from the introduction of exotic species or other cultivars. It is essential to note that introduced species/cultivars are one of the main causes of loss of variation in nature and/or farm and argued for risk-assessment field experiments. Even for the release of material developed by traditional methods. There are some proponents of early release so that the benefits of use of plant genetic resources reach everyone quickly. If one takes the analogy of safety of drugs, then due care needs to be taken in the case of transgenic plants.

So far no any genetically modified crop seed has been claimed to be released. Most of the work carried out on rice and cotton crop is in the laboratory and limited to restricted field trials. So far no indigenous GM crop seed has been released or introduced in the market except one by a government agency. Not a single GM crop has been patented by any of the research organization in the country. Therefore, whatever GM crop(s) being grown at the farmers' field has no approval of the government of Pakistan or authorization to any seed company to release the seeds of GM crops. Therefore, their introduction, testing and use being carried out is illegal and hence unauthorized. As per reports appeared in the press some Bt cotton seed was smuggled by some private company and growers, this seed was multiplied and distributed among some of the cotton growers in Sindh.

Hence, there is a pressing need to document both the positive and the negative effects of biotechnology and its resultant products such as Bt cotton on rural communities. This will be of value in the on-going debate about biotechnology and GM crops with specific reference to introduction of Bt Cotton in Pakistan in the past few years. The documentation will provide essential information to policy makers, research managers, elected representatives and community leaders.

To address this need and to advance thinking on the subject the ActionAid-Pakistan (AAPk) has planned a research study on the illegal introduction of Bt cotton in the Sindh and Punjab provinces of Pakistan.

Chapter 3

METHODOLOGY

3.1 Background

During the organizational activities of ActionAid-Pakistan (AAPk), Bhandar Hari Sangat Volunteers (a farmers' Association in Sindh) reported that exotic and genetically modified (Bt) cotton was being introduced in the area, which was said to give a higher average yield per acre and was claimed to be completely resistant against bollworm attack. This inspired ActionAid-Pakistan (AAPk) to carry out a preliminary survey of the area where this exotic GM cotton was being introduced in order to know the experiences of these local farmers with the Bt cotton. The survey was conducted in Union Council Maldassi, Taluka Shahdadpur, District Sanghar and Union Council Bhitshah, Taluka Hala, District Hyderabad. The farmers who had grown the Bt cotton were contacted and their cotton fields were also inspected. During this preliminary survey growers told that the seed they are growing is Bt cotton. Agriculture experts of the area also confirmed that the said seed is Bt cotton, a genetically modified seed having gene of bacteria *Bacillus thuringiensis* commonly known as *Bt*, which can be hazardous for human and animal health and also for the environment.

With the apprehension of adverse effects of Bt cotton on animal and human health and environment, ActionAid-Pakistan (AAPk) planned an extensive survey and launched an awareness campaign about Bt cotton. For this purpose contacts were made with GO's, NGO's and cotton growers of the area. During this struggle it was revealed that Bt cotton was for the very first time cultivated in Umerkot in 2000. However, due to reddening, wilting and defoliation, the crop was destroyed and consequently farmers faced severe financial losses and discontinued further cultivation of Bt cotton. Later on various seed companies started growing Bt cotton in other areas comprising Taluka Matiaree and Hala, District Hyderabad, Taluka Shahdadpur and Tando Adam of District: Sanghar and Taluka Nawab Shah. Farmers of the said area were not aware of merits and demerits of Bt cotton but were convinced by the false propaganda of seed companies about higher average yield and reduced expenses on sprays. This motivated the farmers who started cultivating Bt cotton on their farms. The companies paid huge amount of credit for the purchase of seed to farmers as well.

Few of the Government officials belonging to Agriculture Department were aware of the adverse effects of Bt cotton seed and illegal business of seed, but they kept their eyes closed on the matter. They neither intimidated the growers nor informed higher authorities. When the problem of Bt was exposed to people of the area, few government officials and agents of the private seed companies tried to hush up the problem. The news of failure of Bt cotton crop started pouring in press reports which stated that fields of other varieties of cotton, standing beside Bt cotton are also being severely effected by reddening, wilting and CLCV. Bhandar Hari Sangat, in collaboration with ActionAid-Pakistan (AAPk) started a survey with the following main objectives:

- a) To explore the distributional channel of *Bt* cotton seed in the area;
- b) To record farmers' views on *Bt* cotton characterization;
- c) To calculate cost of production of *Bt* cotton;
- d) To observe effects of *Bt* cotton on disease/pest and predators; and
- e) To suggest policy recommendations.

3.2 Survey Design

Cultivation of *Bt* cotton was reported in two cotton producing provinces of Pakistan viz; Punjab and Sindh. Therefore, the survey was conducted in two steps:

First step: Looking at the severity of the problem, Rapid Rural Appraisal (RRA) approach was adopted and key informants of the villages, where sowing of *Bt* cotton was reported, were contacted through local farmers' associations. In total four districts (viz Nawab Shah, Sanghar, Mirpur Khas and Hyderabad) were surveyed in Sindh province and five districts (viz Sahiwal, Toba Tek Singh, Khanewal, Multan and Lodhran) in Punjab.

The information regarding *Bt* cotton cultivation was collected and used for detailed survey and structuring the questionnaires.

Second Step: In light of the information gathered through RRA survey, it was observed that *Bt* cotton was mainly distributed and cultivated in Sindh province, therefore, two out of four districts were selected for detailed survey and collection of data. Detailed survey was not undertaken in the Punjab province due to low intensity of *Bt* cotton cultivation in the area.

However, an informal checklist was prepared during the RRA to collect information and the farmers played central role in digging out the realities. Many interviews, informal group discussions, field visits, data exchange were also carried out to gather the required data.

3.3 Sampling Design

3.3.1 The universe

The RRA confirmed that in total 138 farmers from all four districts had cultivated *BT* cotton on 4249 acres (Table-2.1). Therefore, these 138 farmers were taken as the universe of the study.

3.3.2 Sample size

Out of four districts, two districts Hyderabad and Sanghar were selected as they were containing most of the farmers (115 of 138) growing *Bt* cotton. Therefore, out of the 115 of total growers with *Bt* cotton in these two districts, 38 farmers making total sample size (35 percent of universe was randomly selected for detailed interviews and field surveys. Details of these are given in Table-2.1.

Table: 3.1 Sample Distribution

District	Number of Growers (for partial survey)	Number of Growers (for detailed survey)	Area under Bt Cotton in the District
Nawab Shah	7	-	97
Sanghar	77	27	3043
Mirpurkhas	16	-	291
Hyderabad	38	11	818
Total	138	38	4249

3.3.3 Survey team

A team of 11 members comprising of agricultural experts and volunteers of Bhandar Hari Sangat, Sindh was formed to carry out the survey. A well-structured questionnaire was used to collect the information (Annex-1).

3.4 Data Analysis

Collected data were reviewed and cleaned by experts and entered in the computer for further analysis. Tabulation and cross comparisons were made for the discussion of results. It is important to mention that result and discussions are supplemented with the information collected during informal survey visits. The results of the study are presented in this report.

Chapter 4

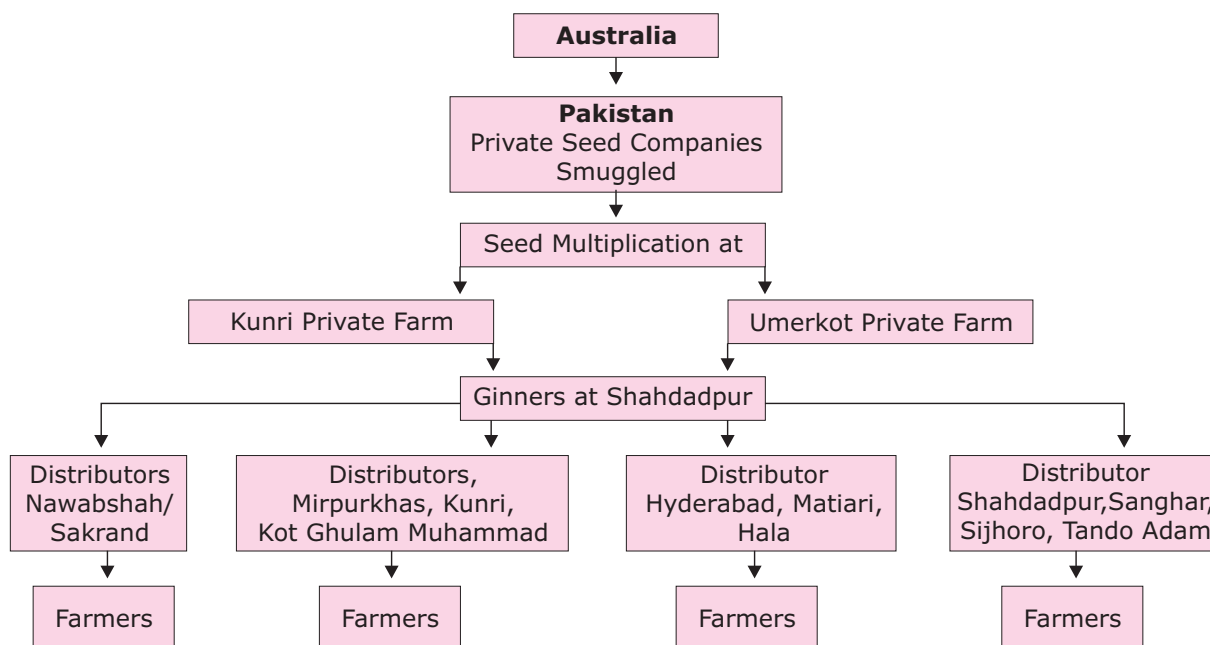
CULTIVATION OF Bt COTTON SEED IN SINDH

It has been observed that Bt cotton seed was smuggled in Pakistan from Australia and it was cultivated at few private farms in Umerkot and Kunri in Sindh province as reported by the Agriculture Officers of the area. These seeds were multiplied there and then shifted to two ginning factories viz; Al-Rehman and Al-Basit Cotton Ginning factories at Shahdadpur. The owner of these ginning factories distributed this Bt cotton seed to the farmers of Union Council Maldasi in Tehsil Shahdadpur. The collected information revealed that staff of Zarai Markaz, Hala and Bayer's Sales Manager, Shahdadpur also played their role in distribution of Bt cotton in Pakistan.

The above marketing channel indicated that the whole process of introducing Bt cotton was illegal and without any proper approval of the provincial or federal departments of Government of Pakistan. Moreover, no field trials for their suitability (agronomically and environmentally) were undertaken before the release of Bt cotton to farmers. A flow chart of this informal marketing channel is depicted in the Figure 4.1

The Shahdadpur ginning factories supplied the seeds of Bt cotton to distributors of the four districts viz; Nawabshah, Mirpurkhas, Hyderabad and Sanghar. Those distributors further disseminated the seed to farmers through their dealers in Nawabshah, Sakrand, Mirpurkhas, Kunri, Kot Ghulam Muhammad, Hyderabad, Mititari, Hala, Shahdadpur, Sanghar, Sijhoro and Tando Adam. One thing is very clear while looking at the whole chain of intermediaries that supplier of Bt cotton had adopted already established marketing channels for distribution of seed and created havoc in some areas.

Figure 4.1 Distributional Channels of Bt Cotton Seed in Pakistan



4.1 Quantity of Bt Cotton Seed Imported and Distributed

Since the seeds of Bt cotton were not brought in the country through the legal import channel, therefore, the quantity of the seed smuggled was not known precisely. However, the seed was further multiplied at private farms in Kunri and Umerkot and then taken over by the ginners of Shahdadpur. Despite all efforts, the exact quantity of seed smuggled and multiplied in Pakistan was not known. Therefore, an indirect or backtracked approach was applied to arrive at the estimated volume of seed. It was known that multiplied seed was distributed to 138 farmers who cultivated the total land area of 4249 acres under Bt cotton. If, they had applied seed rate of 10 kg per acre then the total seed used was 42490 kg. or roughly speaking 50-60 thousand kilograms (keeping in view the allowance for seed rate variations at different farms/area) of Bt seed have been distributed for sale to farmers in Sindh only. According to the survey conducted in Sindh, the average price paid for Bt cotton was Rs.100 per kg as compared to Rs.30 per kg for local variety of cotton (N-78). With this sale price, the volume of Bt cotton seed business was between Rs.50 to 60 million approximately, which is expected to grow at an increasing rate if it is not checked and stopped. If we include seed distributed in Punjab this amount might cross the figure of Rs.100 million.

4.2 Area Cultivated under Bt Cotton

It was estimated that in Sindh province only an area of 4249 acre was cultivated under Bt cotton in the four districts in year 2002 cotton crop. It is assumed that more or less same amount of area is cultivated in Punjab. However exact and precise figures of area cultivated under Bt cotton in Punjab could not be known.

District wise breakdown of the area cultivated with Bt cotton in Sindh province is given in Table 4.2. The table shows that the highest area of 3043 acres was cultivated with Bt cotton by 77 farmers in Sanghar. Hyderabad stood second with an area of 818 acres by 38 farmers.

Table 4.2 Distribution of Area and Growers in Various Districts of Pakistan

District	Number of Growers	Area under Bt Cotton
Nawabshah	07	97
Sanghar	77	3043
Mirpurkhas	16	291
Hyderabad	38	818
Total	138	4249

Chapter 5

PERFORMANCE OF Bt COTTON

5.1 Introduction

In this section of report results of the analysis of field data is presented on the economic parameters:

- a) Cost of production comparison of Bt cotton with local variety i.e. NIAB-78
- b) Yield comparison of Bt cotton and non-Bt local variety of cotton
- c) Profitability of Bt cotton compared with local variety

It is once again reminded to the readers that the detailed filed survey of 38 farms was conducted out of 138 growers who cultivated Bt cotton. The farmers covered under detailed survey were located in Sanghar district (27) and Hyderabad district (11) with total area under Bt cotton 3043 acres and 818 acres respectively. Details of the target population are given in the Table 5.1.

Table: 5.1 Number of Growers and Area under Bt Cotton

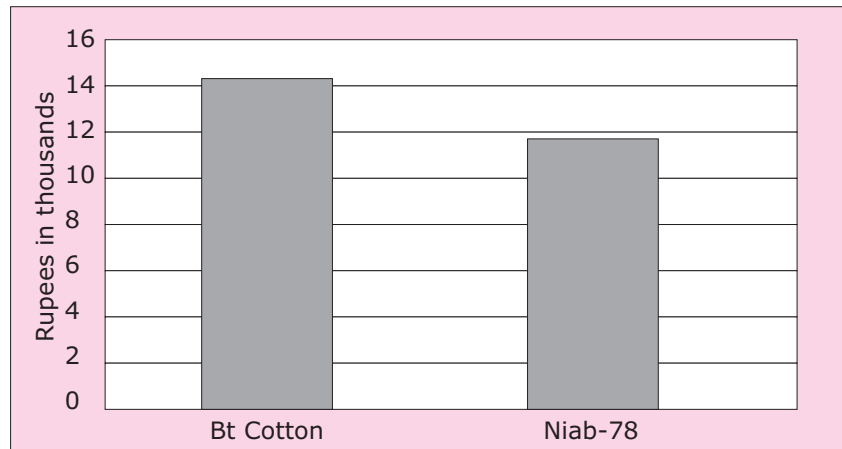
District	Number of Growers (for partial survey)	Number of Growers (for detailed survey)	Area under Bt Cotton in the District
Nawab Shah	7	-	97
Sanghar	77	27	3043
Mirpurkhas	16	-	291
Hyderabad	38	11	818
Total	138	38	4249

5.2 Cost of Production

Using the survey data, cost of production of both Bt and non-Bt cotton was analyzed. The data revealed that per acre production cost of Bt cotton is more than the non-Bt (i.e. Niab-78) cotton. On overall basis, Bt cotton cost was Rs.15,525 per acre whereas non-Bt cotton cost of production was Rs. 12, 725 per acre. A sizeable gap of Rs 2800 on per acre basis made it difficult for the majority of farmers to adopt the Bt variety of cotton (see Figure 5.1). The detailed break up of the production cost showed a significant difference in price of the Bt seed versus non-Bt cotton varieties. The other major cost component was the higher requirement of irrigation water than the non-Bt varieties. The Bt cotton required five more irrigation these inflating the cost of production of Bt cotton by Rs 1750. The Bt cotton required less number of insecticide spray resulting a saving of Rs 800 per acre which was offset by an increased cost of more urea requirement costing Rs 950 per acre.

The cost of production results imply that the net saving yielded from the reduction of insecticides cost is not a favourable proposition as Bt cotton requires more irrigation water and urea. Furthermore, ten times higher price of Bt cotton seed than non-Bt cotton (expected to rise if demand for Bt cotton seed rises) is the additional factor to increase the cost of production of Bt-cotton. .

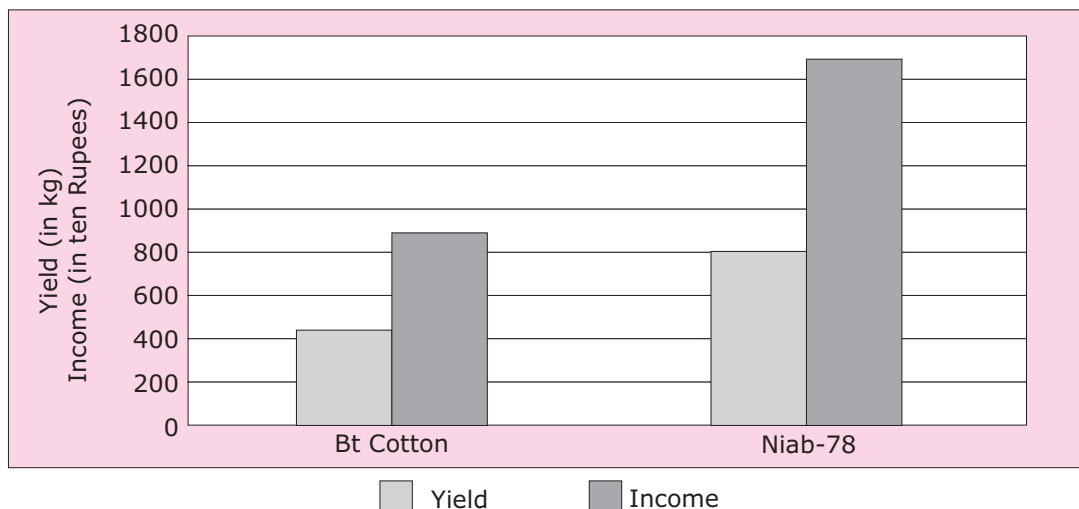
Figure 5.1 Cost of Production of Bt Cotton and Niab-78



5.3 Yield Difference

The yield of Bt cotton is one of the most important factor which farmers take very seriously as they are too sensitive to yield of their crop. The productivity of Bt Cotton at farmers' field in Sindh was found very discouraging. The yield of Bt cotton was found almost half (420 kg/acre) of the non-Bt-cotton variety (i.e. Niab-78). Therefore, in monetary term the return to farmers' effort was also left half (Rs 8925) of the total fiscal receipt of the non-Bt cotton at similar market price (see Figure 5.2). The results revealed that despite higher cost of production the Bt-cotton did not pay back a reasonable profit to the farmers rather the net return of Bt cotton was less than non-Bt cotton due to lower yields.

Figure: 5.2 Yield and Total Income of Bt Cotton and Niab-78
(Per acre basis)



5.4 Economic Profitability

Considering the cost of production (per acre) and productivity of Bt cotton at farmers' field in Sindh, an economic analysis was made to arrive at the net benefit to farmers. It was emerged that growers of Bt Cotton were worst off in economic gain and suffered a loss of Rs.6,600 on every acre of the cotton area. Whereas, cultivators of Niab-78 variety of cotton enjoyed a handsome amount of profit (i.e. Rs. 4275) on per acre basis (Table 5.2). Consequently the experience of Bt cotton left the farmers in ditch of debt as it was the normal practices of the farmers that they buy agricultural crop inputs on credit basis. The survey also revealed that about 95 percent of the Bt cotton growers were unable to grow next crop and/or to pay the wages of their labourers.

Table5.2 Economic Loss in Cultivation of Bt Cotton in Sindh

(Rupees per acre)

Crop	Total Cost	Total Return	Net Loss/Profit
BT Cotton	15,525	8,925	(-) 6,600
Niab-78	12,725	17,000	(+) 4,275

Chapter 6

VULNERABILITY OF Bt COTTON TO INSECT PEST ATTACK AND DISEASES

6.1 Introduction

The other important factors of studies are the insect pest attack on Bt cotton in the cotton field of Pakistan where Bt cotton was grown. In addition occurrence of disease and agronomic performance of Bt cotton are discussed in this section of the report.

6.2 Vulnerability against Insect Pests Attack

Cotton is one of the important cash crops of Pakistan and is highly sensitive to insects/pests attack. Due to the reasons farmers are compelled to use heavy doses of insecticides to their crop. Therefore, it is direly required that such a cotton variety may be developed that has resistance against insect/pest attack.

Bt cotton variety is claimed having substantial resistance against the insect/pests attack and required less number of insecticidal spray. However, the results showed that Bt cotton did not perform well and in both the districts of Hyderabad and Sanghar. On average one or more than one sucking insect per plant was observed in Hyderabad and Sanghar district respectively (Table 6.1). This indicates that with target insects non-target insects and bollworm predators have also been eliminated by the Bt toxin present in the Bt cotton.

Presence of natural enemy of insects in cotton crop is blessing and they prevent crop from any big losses. During the study survey it was also kept in mind to observe the presence of natural enemy or bollworm predator in farmers' field. The data showed that predator such as insects, spiders or birds were not present in the Bt cotton fields (See Table- 6.1).

Table: 6.I Insects/Pests Attack and Occurrence of Predators in Bt Cotton Fields

Nature of Incidence	District	
	Hyderabad	Sanghar
Sucking Insect (average number per plant)	1	1.4
<i>Boll Worm Predator</i>		
Insects	Nil	Nil
Spiders	Nil	Nil
Birds	Nil	Nil

6.3 Occurrence of Cotton Leaf Curl Virus (CLCV)

Cotton leaf curl virus (CLCV) was a serious disease in 1990s which damaged Pakistani cotton badly in 2-3 years and production of cotton fell from record of more than 12 million bales to 8 million bales, which resulted in negative GDP growth of agriculture. Therefore, during the survey special attention was paid to observe the incidence of CLCV in the fields. The data showed that Bt cotton fields located in Hyderabad district had not reported any case of CLCV. However, about 19 percent of the total Bt cotton farms in Sanghar district had reported incidence of CLCV in their fields. This indicates that Bt cotton is not effective against larvae of whitefly that spreads the CLCV in the cotton fields. Therefore, farmers have to spray insecticides to control whitefly in their fields.

6.4 Low Agronomic Performance

The agronomic characteristics of any crop depict the health and vigor of the plants. If the crop health is not good, certain abnormalities appear in the crop. The survey revealed that crop damages due to reddening, wilting or defoliation were observed through out the crop life in Bt cotton. On overall basis, the data showed that such damages started appearing right before the first picking and showed an increasing trend up to second picking. One third (34 percent) of total sample farms had reported such problem after second picking and the problem subsided in the subsequent picking (Table 6.2). The damages caused by reddening, wilting and defoliation were reported in both the districts.

Table: 6.2 Number of Farms Reporting Damages by Reddening, Wilting and Defoliation in Bt Cotton

Timing of Crop Damage	District		All
	Hyderabad	Sanghar	
Before 1 st Picking	4 (36 %)	5 (18 %)	9 (24%)
After 1 st Picking	2 (18 %)	8 (30 %)	10 (26%)
After 2 nd Picking	5 (46 %)	8 (30 %)	13 (34%)
After 3	0 (0 %)	6 (22 %)	6 (16%)
All	11 (100%)	27 (100%)	38 (100%)

Figures in parenthesis show column percentages.

Box. 6.1 Comments of Agricultural Experts about Bt Cotton in Sindh

They said " Bt is susceptible to heat stress, cotton leaf curl virus (CLCV), and wilt disease". They also opined that the poisonous effect of Bt cotton some time cause drastic reduction in bollworm predators' population. The experts showed their anxiety over the gradual increase of immunity in bollworms against Bt toxin and can lead to crop disasters at one stage. Furthermore, spread of any Bt cotton disease may destroy neighbouring cotton fields as well.

Regarding spread of disease in Bt cotton fields, a famous peasant leader mentioned that a black circle appeared around one or two cotton plants in the beginning, then progressing to patches and finally spread to whole field.

On health front, the agricultural experts are scared that Bt cottonseed cake and its oil may pose serious threat to human and animal health.

6.5 Farmers' Views about Bt Cotton

The best judge of any new crop variety are the growers who very closely watch the performance of their crop and evaluate them. During the survey farmers were particularly asked to evaluate performance of Bt cotton at their farms. The only common factor in both cotton varieties viz., Bt cotton and Niab-78 was the germination rate. Whereas, key inputs such as seed, fertilizer, water were costing more to farmers for Bt-cotton than the Niab-78 and giving low yield to farmers. The ostensible characteristic of Bt cotton i.e. resistance against pest attack was undermined in the field however farmers admitted that Bt cotton showed some resistance against bollworm (Table 6.3). Conclusively, failure of Bt cotton severely shaken the confidence of farmers over Bt cotton and decided not to grow this cotton variety in future.

Table 6.3 Farmers' Response about Bt Cotton and Niab-78

Characteristics	Bt Cotton	Niab-78
Seed	Costly	Cheaper
Germination Rate	80 percent	80 percent
Fertilizer	Approximately Double	Lower than Bt
Water	Up to 12 irrigation	6 irrigation
Pest Attack	Reported	Reported
Resistance about Bollworm Attack	Yes	No
Yield Performance	Hopeless	Moderate - Good

Chapter 7

PUNJAB'S EXPERIENCE IN Bt COTTON CULTIVATION

7.1 Introduction

Punjab is the leading province of Pakistan with respect to cotton production. About 80 percent (i.e. 2.4 million) cotton area was located in Punjab during 1999-2000. The southern part of the Punjab is the main cotton cultivating area in the province. Nuclear Institute of Agriculture and Biology (NIAB) Faisalabad and Cotton Research Institute, Multan are the important cotton research institutions in the province. Recently, another National Institute of Biotechnology and Genetic Engineering (NIBGE), Faisalabad has emerged as a center of excellence for research on cotton genetics and genome. Cotton growers of the Punjab province are always enthusiastic and eager to cultivate new varieties of cotton to minimize cost of insecticides and earn more profit. Therefore, they are looking towards these institutions for better and improved cotton varieties.

7.2 Farmers' Interest in Bt Cotton Cultivation

The Bt cotton survey, conducted in Punjab, revealed that cotton growers from Sahiwal, Toba Tek Singh, Kanewal, Multan, and Lodhran districts cultivated Bt cotton during the surveyed year. It is usually observed that decreasing farm returns forced farmers, particularly small farmers, to adopt cost saving technologies and plant varieties. The survey revealed similar results and noticed that 72 percent of the total sample farmers were small with a land holding of less than 10 acres. Large farmers having more than 50 acres were only five percent who were cultivating Bt cotton. This implies that economies of scale kept large farmers least interested in Bt cotton cultivation (see Figure 7.1)

7.3 Area under Bt Cotton in Punjab

The staggering prices of pesticides and other crop inputs compelled small farmers to cultivate more area under Bt cotton than medium or large farmers. It was observed that on average large farmers only allocated 0.25 acres to this variety as a trial (see Figure 7.2). The area under Bt cotton reflects the suspicion, farmers had in their minds, about the performance of new variety in their field.

Figure 7.1 Farmers' Interest in Bt Cotton by Farm Size

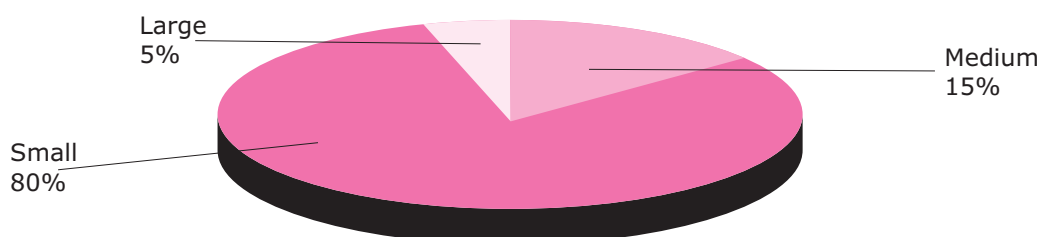
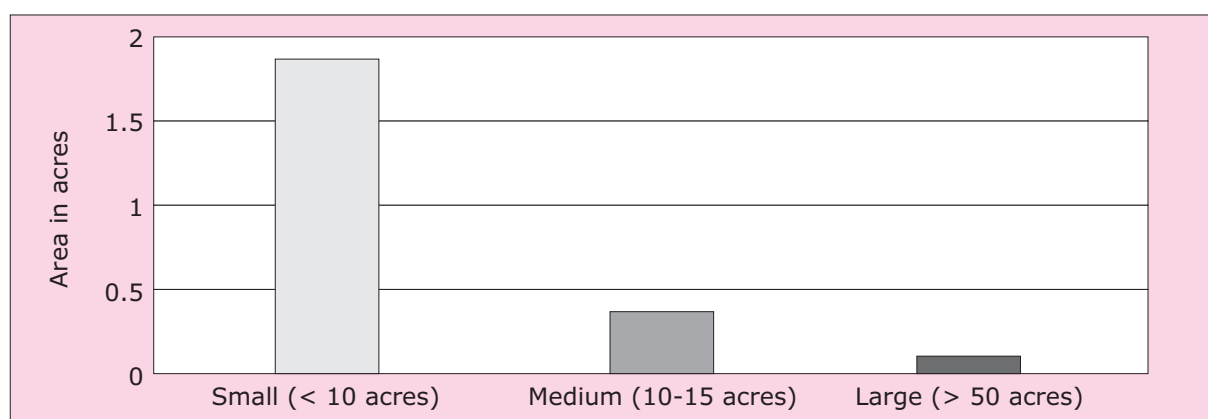


Figure 7.2 Average Area under Bt Cotton by Farm Size

7.4 Sources of Seed

The sample farmers reported different sources of Bt seed acquisition. Local market was the main source of seed supply where local pesticide dealers took the benefit of farmers' trust and sold Bt seed to 60 percent of the sample farmers. Local dealers also manage to convince the farmers by extending 2-3 months credit for buying the seed. Fallow farmers, bonded with each other on the basis of caste and creed, were the other source of seed in the surveyed area. Thirty percent of the Bt seed recipients were the large farmers who received seed from NIBGE as a gift and cultivated on experimental basis only (Table 7.1).

Table: 7.1 Sources of Seed of Bt Cotton

S.No.	Source of Seed	Percentage of Farmers
1.	Local Market	60
2.	National Institute of Biotechnology and Genetic Engineering (NIBGE), Faisalabad	30
3.	Fallow Farmers (on mutual exchange basis)	10

7.5 Cost of Production of Bt Cotton

Cost of production is the basic criteria of farmers to adopt different farming practices in order to manage their resources. Input cost comparison was made to observe the cost effectiveness of the Bt cotton at farmers' fields. The data depicted that costs of three major crop inputs viz. land preparation, seed and water were higher in case of Bt cotton than the non-Bt cotton. Among these seed cost was the highest at the rate of Rs 1800 per acre, which farmers have to bear. On the other hand, fertilizer and pesticides costs were low in case of Bt cotton at the rate of Rs 200 and Rs 2600 per acre. (see Table 7.2). Comparing and contrasting the costs incurred on both varieties showed that by adopting the Bt-

cotton farmers only capable to save Rs 100 per acre without knowing the externalities costs to them or society due to health hazards, if any.

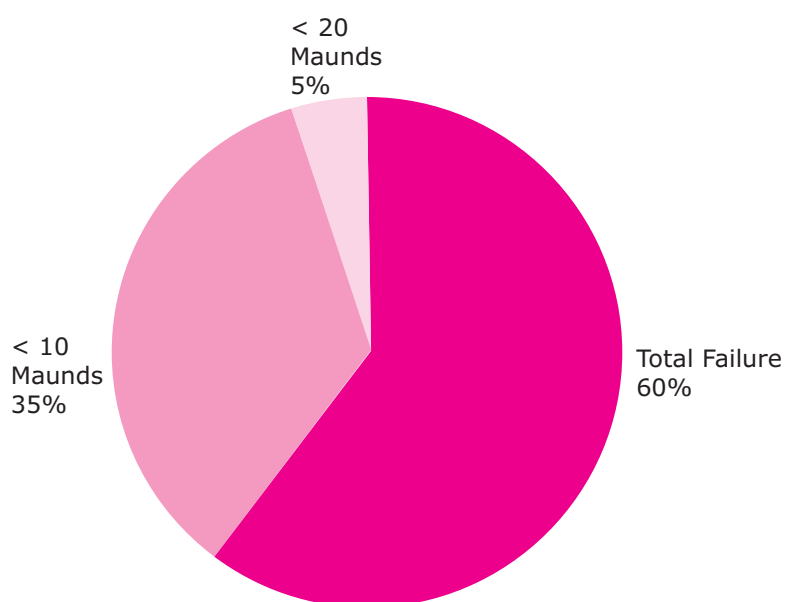
Table 7.2 Input Cost Comparison for Bt and Non-Bt Cotton
(Rupees per acre)

Crop Input	Bt Cotton	Non- Bt Cotton	Difference
Land Preparation	1300	900	+ 400
Seed	2200	400	+ 1800
Water	2600	2100	+ 500
Fertilizers	800	1000	- 200
Pesticides	1400	4000	- 2600

7.6 Farmers' Views about Bt Cotton in Punjab

Like farmers of Sindh, the Bt cotton growers in Punjab were also not satisfied with the performance of Bt cotton crop. Sixty percent of the surveyed Bt cotton growers reported attack of cotton leaf curl virus (CLCV) in their fields that destroyed almost all the crop. According to a very careful estimate, made by farmers, total loss of Rs 20,000 per acre incurred to them. Some farmers mentioned that the damage forced them to destroy the whole Bt cotton fields even after two months of the cultivation of crop. Thirty five percent farmers reported their yield less than 10 maunds (i.e about 400 kg.) and only small number (5 %) of farmers reported their yield less than 20 maunds (i.e. 800 kg.). Overall farmers were not satisfied with the productivity of Bt-cotton (see Figure 7.3).

Figure 7.3 Farmers' Views about Bt Cotton Yield



Box 7.1 A Case Study in Punjab

Master Rehmat Ali, 40, is a resident of Kamalia district Toba Tek Singh. He is a well known progressive farmer of the area. He used to produce vegetables and was fortunate enough that he never lost his crop. His farming experience and innovativeness tempted him to grow Bt cotton, as he had learnt about it through his reliable friend, employee of a pesticide company.

Forced by his temptation and motivated by his friend, Master Rehmat Ali got 6.5 acres of land on lease and cultivated Bt Cotton in the field. His friend took benefit of his decision and announced organizing a seminar, in his field, at the time of sowing. In presence of hundreds of small farmers, his friend announced that he would purchase 1/3 portion of the entire produce at the price of seed, he was providing.

The case study of Master Rehmat is not a new story of innocent farmers who were betrayed by their friends and number of farmers are blindly following their advice and cultivating untested varieties.

Chapter 8

CONCLUSIONS AND RECOMMENDATIONS

The study revealed that illegal import and multiplication of Bt cotton seed in Sindh and Punjab created havoc at farmers' fields. Absence of biosafety guidelines at government level and awareness at farms level further complicated the issue. Those were the civil society organizations that brought the problem at national as well as government level and attempted to protect the national biodiversity and farmers' interests. To mitigate the issue in future, following recommendations may be considered.

RECOMMENDATIONS

In view of the significance of the biosafety guidelines and the work on transgenic crops in Pakistan following steps seem important:

- There is a need to create awareness at public as well as private level regarding safe use of biotechnology, its allied issues and their impact on various elements of our ecosystems. It will also facilitate to develop a common stance to be adopted by various components of the society viz. public, private and civil society.
- Capacity building in the areas of biosafety conservation, regulations and their effective implementation. For the purpose technical, financial and institutional support is necessary.
- Establishment of National Biosafety Implementation and Monitoring Committee, comprising biological scientists, social, political and legal personnel for effective implementation of the biosafety guidelines at national level.
- Intellectual property rights (IPR), biosafety and ethics needs be addressed at public and private level and must be openly debated by all the stakeholders.
- Scientific research may be conducted on long-term effects of biotechnology along with ethical and safety principle.
- Considering the potential risks involved in development, release and use of transgenic organisms in the open environment, safety of users and the environment must be ensured. There is need to develop and adopt safety protocols during laboratory experiments as well as during eventual use of GMOs and products derived thereof.
- As a rule, research on GMOs must be carried out the competent researchers who are fully conscious of good laboratory procedures and the acceptable safety of releasing the GMOs in to the environment.

- Pharma crops using HIV-1, AIDS virus should be banned from the open fields, as they will contaminate our food supply with dangerous consequences, not only for human beings also for the other organisms in the food chain.
- Physical separation through the use of a distance or buffer zones would have to be developed for reducing the potential risks of contamination.
- Certification bodies and standardization organizations shall set standards and make every effort including relevant documentation to ensure that no genetically engineered organisms or products thereof are used in organic production and processing. There is need of systems of strict controls to avoid contamination at any stage and these should also enable farmers to get uncontaminated seeds.

Box 8.1 Cultivation of Bt Cotton in views of Criminologists

Professor Dr. Shakeel-ur-Rehman a reknowned criminologist while addressing a seminar on "Future Crime" at University of Sindh said that a refuge crop is must around the Bt field for insects, birds and predators according to the scientists who developed the Bt seed. Contrary to that recommendation, the Pakistan's farmers are having small land holding and it is difficult for them to grow refuge crop around the Bt fields. Therefore, cultivation of Bt cotton without a refuge crop is a crime in future and criminologists have to keep an eye on this type of crime.

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QUESTIONNAIRE

To know the channels, production Technique, Cost of production, Yield per acre as compare to other varieties grown in B.T effected areas.

Name of grower: _____

Status of grower: _____

Area under cultivation: _____

Name of interviewer: _____

Date of interview: _____

Place of interview: _____

Village: _____ Deh: _____

Union Council: _____

Taluka: _____

District: _____

Distance from market/city: _____ kilometers.

Knowledge about Channels

1. Where you got from cottonseed variety? _____
2. Name of the seed sales man/agency? _____
3. Quantity purchased Place of purchased seed: _____

Production Technique

1. By which method you grow cotton (Drilling / Dibbling)
2. (i) Nos. of watering in B.T.: _____
(ii) Nos. of watering in other variety? _____
3. Nos. of inter-culturing in season: _____
4. Method of inter-culturing you adopted? _____

Cost of Production

1. Land Related Taxes? _____ / acre

2. Quantity of seed _____/kg. In Rupees _____/kg

3. (i) In land Preparation No. Ploughing and leveling _____

(ii) Cost over Ploughing and leveling _____

4. Cost on method you adopted to grow _____ (Drilling / Dibbling)

5. Fertilizer

(i) DAP _____ bags

(ii) Urea _____ bags

(iii) Potash _____ bags

6. Pesticide:

(i) Name of pesticide _____ Cost of Pesticide Rs. _____

(ii) Nos. of spray _____ Labor cost on spray Rs. _____

7. Watering:

(i) How much watering you gave? Nos. _____

(ii) Cost over watering in Rs. _____

(iii) Labor cost on watering Rs. _____

8. Picking Cost:

(i) Cost per 40kgs Rs: _____

(ii) Totals pick cost Rs: _____

9. Yield of crop in 40 kgs: Rs. _____

Total price of yield in Rs. _____

10. Comments of grower about Variety:

FIELD SURVEY OF B.T COTTON GROWERS IN SOME SELECTED AREAS OF LOWER SINDH

S.No.	Name of Growers	Address	Acreage Under B.T
<i>Union Council Bhitshah, Distt: Hyderabad</i>			
1.	Mohammad Salik Lakho	Wassi Murad, Deh Ghogat	20
2.	A. Qasim Sangrias	Wassi Murad, Deh Ghogat	03
3.	A Sattar Rajput	Deh Bhit Shah	15
4.	Syed Jamal Shah	Wassi Murad, Deh Ghogat	04
5.	Khan Mohd Nizamani	Wassi Murad, Deh Ghogat	05
6.	Shabir Ahmed Ansari	Wassi Murad, Deh Ghogat	06
7.	Shahan Lakho	Goth Lakho Deh Ghogat	140
8.	A. Wahid Lakho	Goth Lakho Deh Ghogat	35
9.	Nawab Ali Lakho	Goth Lakho Deh Ghogat	73
10.	Pappu Sangrasi	Deh Narli	08
11.	Noor uddin Sangrasi	Deh Narli	25
12.	Suleman Khoso	Deh Ghogat	10
13.	Ali Nawaz Lakho	Goth Lakho Deh Ghogat	05
14.	Mohd Rimzan Lakho	Goth Lakho Deh Ghogat	04
15.	Mohabbat Lakho	Goth Lakho Deh Ghogat	06
16.	Shafi Mohd Lakho	Goth Lakho Deh Ghogat	02
17.	Ghulam Nabi Lakho	Goth Lakho Deh Ghogat	15
18.	Hussain Bux Lakho	Goth Lakho Deh Ghogat	04
19.	Malook Khan Lakho	Goth Lakho Deh Ghogat	06
20.	Anwar Khan Lakho	Goth Lakho Deh Ghogat	02
21.	Taj Mohd Bughio	Deh Ghogat	04
22.	Haji Pandhi Ahpan	Chaudagi	02
23.	Sono Khan Sangrasi	Chaudagi	06
24.	Shah Dino	Chaudagi, Deh Dalri and Ghogat	170
Total:			576
<i>Union Council Karam Khan Nizamani, Distt. Hyderabad</i>			
1.	Khuda Bux Bughio	Goth Karam Khan Nizamani	04
2.	Mubarak Nizamani	Goth Karam Khan Nizamani	05
3.	Mohd bux Bughio	Goth Karam Khan Nizamani	06
Total:			15

Union Council Hala, Distt. Hyderabad

1.	Makhdoom Saeed du Zaman	Deh Mauhari	18
2.	Ghulam Mohammad Memon	Deh Akabar	02
3.	Syed Aftab Shah	Deh Surha pur	02
4.	A. Aleem Burero	Deh Giss	04
5.	Aaro Khan Burero	Deh Giss	02
6.	M. Ayub Unar	Deh Ujjan / Khato	60
7.	Syed Ahmed Shah	Deh Giss / Zairpir	52
8.	Ali Mohd Shah	Deh Giss / Zairpir	45

Total: 185

Union Council Saeedabad

1.	Pir Fatehullah Shah	Saeedabad	38
2.	Syed Zahid Hussain	Saeedabad	04

Total: 42

Union Council Bernai, Distt. Sanghar

1.	Qalandar Bux Sangrasi	Berani	07
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Total: 07

Union Council Maldassi, District Sanghar

1.	Ahsan Ali Leghari	Goth Ghulam M. Leghari, Deh Maldassi	02
2.	Mohabbat Ali Leghari	-- do --	10
3.	Dr. Imdad Ali Leghari	-- do --	01
4.	Nabi Bux Da	Golo Pir, Deh Jamma	30
5.	Raza Mohammad Bughio	-- do --	01
6.	Muhammad Ali Shah	-- do --	05
7.	Shafi Muhammad Shah	-- do --	03
8.	Muhammad Alam	Goth Lal Khan Jalalani, Deh Jamma	03.5
9.	Ghulam Hyder Jalalani	-- do --	16
10.	Muhammad Azeem Jalalani	-- do --	15
11.	Muhammad Khan Jalalani	-- do --	09
12.	Muhammad Khan Jalalani	-- do --	12
13.	Qaim Khaskheli	-- do --	04
14.	Janib Khaskheli	Goth Sarwar Khaskheli, Deh Jamma	09
15.	Mohammad Ali Talpur	Deh Dabhro	500
16.	Mir Hassan Bughio	Golo Pir, Deh Jamma	40
17.	Mohammad Ismile Nizamani	Deh Maldassi	05

18.	Ali Nawaz Leghari	-- do --	06
19.	Ali Bux Leghari	-- do --	04
20.	Ali Muhammad Leghari	-- do --	01.5
21.	Iiahi Bux Leghari	-- do --	15
22.	Muhammad Ismael Leghari	-- do --	07
23.	Nawab Leghari	-- do --	05
24.	Majnu Leghari	-- do --	03
25.	Zanwar Tagaio	Goth Ghulam Muhammad Leghari	04
26.	Jaan Muhammad Jamali	-- do --	12
27.	Rais Ali Muhammad Bughio	Golo Pir Deh Jamma	50
28.	Muala Bux Bughio	-- do --	10
29.	Raza Muhammad Bughio	-- do --	01
30.	Malear Dal	-- do --	15
31.	Tayyab Bughio	-- do --	05
32.	Sohaib Bughio	-- do --	20
33.	Ghulam Mustafa Bughio	-- do --	35
34.	A. Salam Kerio	Village Maldassi	175
35.	Sarwar Khaskheli	Goth Hashim Khaskheli Jamma	300
36.	Ghulam Hyder Jalalani	Goth Lal Khan Jalalani Deh Jamma	44
37.	Mureed Khan Khaskheli	Goth Hashim Khaskheli Deh Jamma	04
38.	Mehrab Khan Jalalani	Goth Lala Khan Jalalani	18
39.	A. Sataar Jalalani	-- do --	20
40.	Abdullah Jalalani	-- do --	15
41.	Jaan Muhammad Jalalani	-- do --	16
42.	Mohammad Azeem Jalalani	-- do --	15
43.	Badal Bughio	-- do --	08
44.	Yaar Muhammad Bughio	Goth Ahmed Bughio, Deh Jamma	40
45.	Amir Bughio	-- do --	22
		Total	1536

Union Council Manak Thaheem, District Sanghar

1.	Nizam Din Leghari	Deb / Bago Wadadani	01
2.	Mohammad Akthar Arani	Goth Ch.Khushi Mohammad Deb Manak Thaheem	06
3.	Haji Hoat Junejo	Goth Deh Bgo Wadadani	08
4.	Ali Gulam Nizamani	-- do --	03.5
5.	Aijaz Ahmed Junejo	-- do --	20
6.	Muhammad Khan Kubbar	-- do --	05
7.	Wajid Ali Mangrio	-- do --	03
8.	Rab Dino Kubbar	-- do --	02.5
9.	Muhammad Khan S/o Haji Lemoon	-- do --	08
10.	Mahi Khan Wasan	Deh Chitori/King Patti/Kubbar	270
		Total	327

Union Council Fiqir Shoro, District Sanghar

1.	Khalil Rajput	Coth Ch. Samshad, Deh Burera	02
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Union Council Sarhari, District Sanghar

1.	Rais Iqbal Magsi	Sarhari	12
2.	Jaan Mohammad Kerio	-- do --	02
3.	Barkatullah Shah	-- do --	04
	Total		18

Union Council Maqsoodo, District Sanghar

1.	Ali Hyder Jamali	Goth Mannmo Jamali	08
2.	Mohammad Alam Dero	-- do --	20
	Total		28

Union Council Lundo, District Sanghar

1.	Akhtar Hussain Zardari	Deh Lundo	70
2.	Faisal Wasan	-- do --	42
	Total		112

Union Council Sanjhero, District Sanghar

1.	Ibrahim Kerio	Sanghero	36
----	---------------	----------	----

Union Council Shadad Pur, District Sanghar

1.	Hasan Ali	Deh Nizamani	02
2.	Raza Muhammad	Deh Kalri	12
3.	Mohammad Bux Nizamani	-- do --	02
4.	Ali Nawaz Leghari	Deh Panno Leghari	40
5.	Ali Mohammad Leghari	-- do --	08
6.	Haji Allah Bux Leghari	-- do --	15
7.	Abdul Qadir Rajpar	-- do --	30
8.	Umaid Ali	Deh Hungoro	40
9.	Niyaz Hussain	Deh Barhoon	106
10.	Habibullah Sanjrani	Deh Bahji	400
11.	Ibrahim Sanjrani	-- do --	200
12.	Abdul Latif	-- do --	60
13.	Mir Ghulam Hussain Talpur	Shahdadpur	60
	Total		975

Taluka Kunri, District Mir Pur Khas

1.	Mir Amanullah Talpur	Deh Morey Jhungo	85
2.	Jam Memon	Deh Kunri Memon	20

3.	Ch. Mohammad Hanif	Deh Toban Wari	10
4.	Ch. Mohammad Riaz	-- do --	20
5.	Mohammad Amin	Deh Manjhakar	10
6.	Haji Abdullah	Deh Kunri	20
7.	Nasar Shah Mohammad	Deh Deraloo	10
		Total	175

Taluka Mir Pur Khas, District Mir Pur Khas

1.	Abdul Jabar Dars	Deh Chargo	12
2.	Haji Shaukat	-- do --	04
3.	Kaqir Sufi Nazir Ali	Deh Dadhro	12
4.	Haji Nisar Ali	Deh Deraloo	14
5.	Mohammad Ismile	Deh Dadhro	03
6.	Dur Mohammad Memon	-- do --	08
7.	Ghulam Hussain Nohri	Deh Chhar	24
8.	Haji Mohammad Amin Arain	-- do --	04
9.	Haji Ali Murad	Deh Soofi	35
		Total	116

Taluka Nawab Shah, District Nawab Shah

1.	Mohammad Yaqub S/o M. Ashraf Ali Arain	Deh 24-N, Village 68-Mori	03
2.	Arbab Ali S/o M. Alam Berohi	-- do --	08
3.	Seth Ali Akbar Berohi	Deh 23-N, Village 68-Mori	40
4.	Mohammad Razman Chandio	Deh 24-N, Village 68-Mori	10
5.	Lutuf Ali Talpur Ali Talpur	Deh 24-N, Village Mir Imdad	04
6.	Malik Iftikhar Hussain	3-Chak, UC Suhelo	12
7.	Shoukat Ali Arani	-- do --	20
		Total	95

SUMMARY

1.	District Nawab Shah	=	97	Acres
2.	District Sanghar	=	3043	Acres
3.	District Mir Pur Khas	=	291	Acres
4.	District Hyderabad	=	818	Acres
Grand Total:		=	4249	Acres

Annex-III

PRELIMINARY REPORT ON REDDENING, WILTING AND DEFOLIATION IN COTTON FIELDS OF DISTRICT SANGHAR, HYDERABAD AND MIRPURKHAS, COORDINATED BY ACTIONAID-PAKISTAN (AAPK) PAK & BHANDAR HARI SANGAT HYDERABAD, DATED 03-10-2002

BACKGROUND

As the part of project, Bhandar team carried out extensive survey of Cotton fields of district Sanghar, Hyderabad and Mirpur Khas. It was observed that Reddening, Wilting and Defoliation is wide spread on thousands of acres in referred districts and growers have suffered huge yield losses. Accordingly the matter was reported to Federal and Provincial Governments and related departments for proper analysis and recommendations.

As the part of project, Bhandar Hari Sangat, requested PCCC, Agriculture Research Sindh, FSC & RD, Private Seed Companies Association (ASPSCA), Farmers' Organizations (RKZT & HRC) to join a survey of BT cotton fields on 03-10-2002. The request was very kindly accepted by all authorities, for which Bhandar Hari Sangat is highly thankful to Mr. Dr. Barkat Ali Soomro, VP, PCCCC, Mr. Dr. Qazi Suleman Memon, DG, ARS, Mr. Dr. Syed Akhlaq Hussain, DG, FSC & RD and Mr. Muhammad Tariq Khanzada, GS, ASPSCA for cooperation in materializing this survey.

PROCEEDINGS

1. All the participants assembled at C-8 Phase II Qasimabad the Office of Bandar Hari Sangat in the morning of 03-10-2002.
2. A brief meeting was held in the office of Bhandar to review and exchange information on various surveys already done by Bandar ARS, PCCC and FSC & RD.
3. Then all the participants started traveling on national High Way from Hyderabad to Hala. Cotton fields on both sides of the road, as far as eyes see, was giving a red burning look show in severity of the problem. The participants extensively checked some fields and growers were interviewed. Field symptoms were observed and mutually discussed by the participants.
4. In the Cotton area of Hyderabad to Hala, the crop remains green with full flowering and fruiting up-to January but now situation was contrary, crop finished by the end of September and cutting of sticks started at many places.
5. Then participants traveled along Hala to Shahdadpur Road up-to Chaudagi and observed cotton fields on both sides of road, which also was giving burning and dying look. At Chaudagi nearby growers gathered to meet the participants. Most of the growers had planted Bt-Cotton. The farmers fold about 50% to 100% yield losses due to Reddening, Wilting and defoliation.
6. From Chaudagi, participants turned to inside road link and traveled through village Karam Khan Nizamani, village Ghulam Muhammad Leghari, Village Golo Pir, Maldassi to Shahdadpur. Cotton fields alongside the road were observed and checked, growers' interviewed and mutual discussions continued. Photography of fields and audio recording of discussions and farmers' interviews was also done.
7. The participants covered Taluka Matiari and Hala of District Hyderabad and Taluka Shahdadpur of District Sanghar. Due to limitation of time other areas could not be surveyed.
8. In the end at Shahdadpur, the participants held closing session to review and sum up field observations.

SUMMARY OF THE OBSERVATIONS

1. All the participants were unanimous on the following points:

- a) The Reddening, Wilting and Defoliation in cotton fields in wide spread on thousands of acres, beyond the expectations.
 - b) Cotton growers have suffered sizeable yield losses due to the problem.
 - c) Wide spread Reddening, Wilting and Defoliation is restricted to Lower Sindh Districts of Sanghar, Hyderabad and Mirpur Khas whereas such severe problem is not yet appeared in Upper Sindh.
2. Mr. Khushi Muhammad Khurshid, Dy. Director FSC & RD (Plant Pathologist) pointed out that most of the area covered by the Travelling Seminar was affected by the problem irrespective of the variety sown, but intensity was severe in Bt-Cotton fields. He added that Wilt symptoms have been observed which may be further confirmed by researchers through laboratory studies. Mr. Muhammad Boota, Dy. Director FSC & RD also agreed with the same observations.
3. Mr. Dr. Abdus Sattar Burero (Entomologist) ARI, Tando Jam expressed following points:
- i) Reddening and Defoliation has become serious problem this year in cotton fields of Lower Sindh but it is not Wilt disease but a management problem of irrigation and fertilizer doses, keeping in view the increased wind velocity.
 - ii) Organizing team has cleverly chosen the route from Hala to Shahdadpur via Maldassi, which area is mainly planted with B.T. Cotton, as B.T Cotton plantation in Taluka Shahdadpur alone is nearly 10,000/= acres. So Organizing team wants to involve Agriculture Research Sindh in B.T. Cotton and GMO issue. Whereas Bt Cotton and GM Crops issues and controversies are actually some dispute between Europe and USA and we should not indulge in this issue.
 - iii) The farmers like B.T. Cotton and from researchers view point, there is no demerit of Bt Cotton but it is not yet approved by the government hence its distribution is illegal. Its seed may be distributed after formal approval of the variety by Seed Council.
4. Mr. Aftab Alam Khan, Action-Aid Pakistan, Islamabad explained that Bt Cotton or other Generically Modified Crops are not simply another variety which may be approved by Seed Council but these are different category crops having genes of non-related species, bacteria and virus. Hence special Bio-safety rules and measures are needed to assess hazards for human & animal health and for the environment. Whereas, in Pakistan there is no technical infrastructure or work in this respect. In this context it is not advisable to commercially release Bt cotton or other GM Crops just on the basis of few agronomic characters.
- He further added that Government officers seem reluctant to frankly talk on Bt cotton. They are requested to come forward in the interest of nation. He also requested that in future seminars, meetings & surveys on general agricultural problems and issues, the Civil Society may also be allowed to participate.
- He also gave his observation that although the Reddening, Wilting and Defoliation problem seems general but Bt Cotton fields are severely affected.
5. The small farmers representatives, Mr. Mitho Khan Malokani. President Roshan Khayal Zamindar Tanzeem, Mr. Nabi Bakhsh Bugio (Roshan Khayal) and Mr. Ghulam Hussain Malokani, General Secretary Hari Rabita Council were of the opinion that most of the area of Union Council Bhit Shah, UC. Karam Nizamani, UC, Maldassi and UC dabhro, comprising thousands of acres, was planted with Bt cotton seed, distributed by Ch. Irshad & Khalil Malik of Shahdadpur Mandi through Al-Rehman CGF & Al-Basit CGF. Most of this area is badly devastated due to Reddening and Wilting, as compared to NIAB-78. It is apprehended that Bt cotton plantation has flared up the epidemic in the whole area. The growers demand compensation for their losses in shape of waiver of land revenue and Bank loans.

6. Mr. Muhammad Tariq Khanzada, General Secretary ASPSCA appreciated APRAC for taking such initiative of joint field visit of Government and Non-Government organizations to address the burning issue of Reddening and Wilting in cotton fields. He proposed that such traveling seminars comprising Government and Civil Society participants may be regularly organized by Govt. Departments.

7. He gave his observation that Bt Cotton is being cultivated in Lower Sindh since last 3 years and government knows the same. He said that cotton crop management is better in Lower Sindh as compared to Uppen Sindh and the higher average yield per area in Lower Sindh is proof of the fact. But Reddening and Wilting epidemic has appeared only in Lower Sindh where Bt Cotton has been extensively planted.

He called that 3 years back, Bt cotton was commercialized in Umer Kot district and cotton Wilt problem coincided in that area. Plant and soil samples were drawn by Agriculture Research Sindh and analyzed by Agriclture University Tando Jam where Wilt disease was confirmed. Now Bt cotton has been planted in Sanghar District, more extensively in Taluka Shahdadpur and Matiari, District Hyderabad and again Reddening and Wilting has gained epidemic status in cotton field of whole area. So it is not merely a problem of crop management problem lies somewhere else which the researchers are reluctant to admit despite seeing clear symptoms of Wilt.

He proposed that Bt cotton might be strictly banned for few years till researchers come up with proper research.

Mr. Murtaza Soomro, Press Secretary ASPSCA seconded the views of Mr. Khanzada.

8. Mr. Dr. Gul Muhammad Baloch, Cotton Botanist, ARI, Tando Jam expressed the view that Reddening, Wilting and Defoliation problem is serious and wide spread irrespective of the variety and let our pathologists study the problem and conclude their findings.

He clarified that Reddening and Wilting of cotton leaves due to improper crop management or nutrient / irrigation deficiencies can occur in small patches, not on thousands of acres. So we fell that it is a serious problem. Wilt symptoms have been observed but we can provide detailed finding after laboratory studies.

He further added that at some spots Reddening and Wilting was severe in Bt cotton as compared to NIAB-78 but at some other spots it was severe in NIAB-78.

Mr. Khalid Iqbal Rajput (Pathologist) seconded the views of Mr. Khaskheli.

9. Mr. Ghulam Akbar Panhwar (Senior Plant Pathologist) CCRI, Sakrand gave following observations as a senior expert of the team.

- i. Verticillium and Fusarium species are main casual organisms of cotton wilt in Pakistan.
- ii. Excessive irrigation, rians, nitrogenous fertilizer increase the build up of Verticillium. So it is not simply a crop management problem.
- iii. Wilt symptoms have been observed which are more severe in Bt cotton. However details coul dbe provided after laboratory studies.
- iv. In previous years he visited Bt cotton fields in Dsistrict Mirpur Khas and observed Reddening and Wilting in cotton fields. The laboratory analyses then confirmed the attack of Fusarium Wilt. But at that time it was out of imagination that the problem will become so widespread and serious as we have seen today.
- v. This year I have visited field of Federal Minister of Agriculture, Rais Khair Muhammad Junejo, where a plot was planted with Bt cotton variety of NIBGE for trais. The same was beadle affected with Reddening and Wilting and suddenly destroyed by the disease. The

report was submitted to worthy Minister.

- vi. Inoculum of Wilt exists in our cotton fields, which build up in favorable conditions or with susceptible variety.
 - vii. I have seen more Reddening and Wilting in Bt cotton as compared to NIAB-78. Plant samples have been drawn for laboratory analysis and findings will be shared with all participants.
 - viii. In future joint surveys, NIBGE representatives may also participate because they have also released Bt cotton varieties for field trials.
10. Mr. Abdul Wahid Soomro, Plant Physiologist, CCRI, Sakrand told that in his view Reddening and Wilting problem is more severe in Bt cotton which needs further investigations.
11. Mr. Muhammad Hussain Khushk, Soil Chemist, ARI, Tando Jam said that he admits that the Reddening problem is serious and widespread. Plant samples have been drawn which will be checked for nutrient deficiency.

He further added that the problem is equally present in Bt cotton and NIAB-78. However he will communicate the views and proposals of all participants to the Director General Agriculture Research, as our participation is on the directive of DG, ARS.

12. Mr. Aijaz Ali Malik Prefect Coordinator Bhandar Hari Sangat extended cordial thanks to all the participants for joining the field visit on short notice. He added that government officers are not habitual of interaction. With Civil Society and some times feel hurt by hot discussions with conflicting viewpoints. He regretted for any thing, which may have been felt undesirable by any participant. He hoped that government officers and researchers would become use to with sharp differences of opinion if such interaction with Civil Society sustains. Cooperation and interaction of policy makers, researchers and Civil Society is sure to yield successes in solving problems of agriculture and farming community at large. He again thanked all participants for their kind cooperation.

CONCLUDING REMARKS

Keeping in view the extent and seriousness of the cotton problems such as reddening, wilting and defoliation in cotton fields of Lower Sindh, and the consensus of the Pathologists of Agricultural Research (Sindh), PCCC and FSC & RD on the issue, it is proposed that a comprehensive research project may be started at Central Cotton Research Institute, Sakrand to study and solve the problem.

This Actionaid Pakistan report was written by Dr. Abdul Hayee, who is a well known expert on the issue of Biotechnology in Pakistan.

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