

Performance of Bt. Cotton Cultivation in Maharashtra
Report of
State Department of Agriculture

India ranks third in global cotton production after USA and China. India accounts for approximately 25 percent of world's total cotton area and 16 percent of global cotton production. The per hectare yield of cotton in India is lowest with 300 kg per hectare against world average of 580 kg per hectare. Pest and disease attack is one of the most important factor affecting yield levels significantly. The loss due to it is to the tune of 13 to 15%. In cotton the three most damaging lepidopteran species affecting the crop in India are American Bollworm (*Helicoverpa armigera*), Pink Bollworm (*Pectinophora gossypiella*), and Spotted Bollworm (*Earias vittella*). The number of insecticidal sprays undertaken by the Indian cotton farmers for insect control range from 6 to 15 numbers per growing season, at an average cost of Rs 5500 - 6000 per hectare. At present cotton covers just 5 percent of gross cropped area but consumes 55 percent of the pesticides utilized in the country.

In Maharashtra cotton is cultivated in 27 districts out of which Bt. Cotton seeds were distributed in 19 districts. 30485 packets (450 gm. Bt-cotton & 120 gm non Bt-cotton) of Bt-cotton varieties MECH-12 Bt., MECH-162 Bt. and MECH-184 Bt. were marketed. The area covered under Bt. cotton varieties is 12194 hectare.

In Maharashtra, for evaluation of Bt. cotton performance, a district level committee under the chairmanship of District Superintending Agriculture Officer is formulated. A trainers training was organized at Central Institute of Cotton Research (CICR), Nagpur. The proforma for evaluation was finalised and circulated by CICR, Nagpur. The performance of Bt. cotton variety is compared with its non-Bt. counter part (i.e. refuge). The following characters were studied.

1. Plant Height
2. No. of Squares
3. No. of flowers
4. No. of Green bolls
5. Jassids damage
6. Aphids damage
7. White fly damage
8. No. of Spudoptera larvae
9. No. of Helicoverpa larvae
10. No. of Pink Bollworm larvae
11. No. of Spotted Bollworm larvae

The Bt. Cotton plants are less in height ,No. of squares, No. of flowers, No. of Bolls etc. are more than non Bt. cotton. However No significant differences was observed. During Kharif

2002-2003 heavy infestation was not noticed on both Bt. and non-Bt. cotton varieties. On an average 3 to 5 sprayings were given to both Bt. and Non-Bt. cotton. The attack of sucking pest was reported on both Bt. and Non-Bt. cotton varieties. The percentage infestation is between 5 to 8. There was a marginal difference in bollworm infestation. It ranges between 5 to 7% in Bt. and 7 to 12% in non-Bt. varieties.

The Bollworm attack was reported on Bt. cotton crop at Anand Niketan College of Agriculture, Warora farm. The Principal, Anand Niketan Collage of Agriculture, Warora has suggested the need to carry out more research on quantity of ICP (Intestinal Crystal Proteins) present in leaves, flowers and bolls, so that, larva will be killed within 24 hrs.

Many complaints about wilt infestation were received from Amravati and Yeotmal and Nanded districts on Bt. cotton varieties. As per the report of CICR it was not a pathogenic wilt but a physiological disorder i.e. characteristics of parawilt. As per the feed back of the officers the Bt. cotton varieties are susceptible to wilt.

As this was the first year of Bt. cultivation and only 39000 packets were available for Maharashtra only the innovators have tried it. The packets are allotted to only a group of selected farmers.

The comparison between Bt. and its non Bt. counterpart about yield it reangaes between 16.30 to 60.07% but as per the feedback of the officers the performance of Bt. cotton as compared with other popular hybrids varieties like NCS-145 (Bunny) Ankur 651, Brahma, Paras etc. is not satisfactory. These non Bt. varieties yield better than the Bt. Varieties.

The Cost of the Bt. Cotton seed is also a major point of consideration. The Cost fixed by Mahyco is Rs. 1600/- packet which cannot be a justifiable cost

Purpose of Survey

As Kharif 2002 -2003 is the first year of the Commercial release of Bt. cotton hybrids:

1. To analyse the performance of Bt. cotton hybrids.
2. To study the farmers reactions about Bt. cotton cultivation.

Material and Methods

A trainers training was organized at CICR, Nagpur on 2nd July, 2002. A district level committee under the Chairmanship of District Superintending Agriculture Officer is constituted. The committee is instructed to take one inspection per month. From every district, few villages have been selected. 10% of the farmers cultivating Bt. cotton were selected randomly from every village. From each plot 10 plants are selected randomly and selected plants were tagged. The observations are recorded on these selected plants.

Cotton Scenario in Maharashtra

Maharashtra is the largest cotton growing State in the country. It covers about 34% of total cotton area and contributes 17% of the production. Maharashtra produces approximately 25 lakh bales per year. Main features of cotton cultivation in Maharashtra are as below.

1. About 97% of the cotton crop is cultivated under rainfed condition.

2. The cotton is mostly grown on soils, which are black in colour and called as black cotton soil. The black colour of the soil is due to presence of titanium oxide.
3. In Maharashtra two species of cotton viz *G. hirsutum* and *G. arboreum* are cultivated, besides hybrids. Mostly intrahirsutum hybrids are grown.
4. The yield level of seed cotton is very poor.
5. Most of the cotton varieties and hybrids grown in this State process medium and medium long fiber.
6. The cotton crop is grown in the Kharif season and sowing is generally done with onset of Monsoon.
7. The hybrids cotton covers about 73% of cotton area in the State; about 11% area is covered by improved hirsutum varieties and 16% by arboreum cultivars.

Cotton crop is grown in the entire State except Konkan and eastern Maharashtra. However, the cotton growing area of Maharashtra is divided into four major regions.

- (i) Vidarbha region: Yeotmal, Amravati, Akola, Buldhana, Washim, Wardha & Nagpur districts
- (ii) Marathwada region: Nanded, Hingoli, Parbhani, Aurangabad, Jalna & Beed districts.
- (iii) Khandesh region: Jalgaon, Dhule & Nandurbar districts
- (iv) Deccan canal region: A. Nagar & Satara districts

The average productivity of cotton in the State is 155 kg lint per ha as against 357 kg in Andhra Pradesh, 452 kg in Punjab, 399 kg in Haryana and 274 kg in Karnataka.

The area wise production and productivity since 1994-95 to 2001-2002 and estimated targets of area production and productivity for 2002-2003 is as below:

S. No.	Year	Area (Lakh ha)	Production (Lakh bales)	Productivity (Kg lint/ha)
1.	1995-96	30.85	29.94	165
2.	1996-97	30.85	31.43	173
3.	1997-98	31.39	17.53	95
4.	1998-99	31.99	26.18	137
5.	1999-2000	32.54	31.26	163
6.	2000-2001	27.93	14.57	89
7.	2001-2002	30.00	27.98	158
8.	2002-2003 (T)	26.17 (T)	19.22 (T)	125 (T)

The main reason for low productivity of cotton on Maharashtra is its large scale rain-fed cultivation (97%)

Bt. Cotton cultivation and its evaluation

The information about total Bt. cotton seed packets distributed and district-wise area covered under Bt. cotton is as under.

S. No.	Name of the District	Bt. cotton packets distributed (No.)	Area Covered (Ha)
1.	Jalgaon	1,964	785.6
2.	Dhule	4,132	1,652.8
3.	Nandurbar	1,650	660.0
Nasik Division		7,746	3,098.4
4.	Aurangabad	2,828	1,131.2
5.	Jalna	2,018	807.2
6.	Beed	593	237.2
Aurangabad Division		5,439	2,175.6
7.	Parbhani / Hongoli	3,153	1,261.2
8.	Nanded	3,194	1,277.6
9.	Latur	30	12.0
Latur Division		6,377	2,550.8
10.	Akola / Washim	1,006	402.4
11.	Amravati	1,090	436.0
12.	Buldhana	1,410	564.0
13.	Yotmal	5,068	2,027.2
Amravati Division		8,574	3,429.6
14.	Wardha	836	334.4
15.	Nagpur	732	292.8
16.	Chandrapur	748	299.2
Nagpur Division		2,316	926.4
17.	Others	33	13.2
Maharashtra Total		30,485	12,194

As such 30485 packets of Bt. cotton were sown on 12194 ha area in Maharashtra. At the start of Kharif 2002-2003 a one day work-shop was organized on 4th May, 2002 at Mahyco Research Centre Dawalwadi. Hon'ble District Collectors, Divisional Joint Directors, District Superintendent Agriculture Officer, Agriculture Development Officer, District Medical Officer and Divisional Technical Officer (Quality Control) of Cotton growing districts of Maharashtra were invited.

Commissionerate of Agriculture has been conducting field evaluation report of the standing crop on different characters to study usefulness of the technology.

The detailed training on package of practices and instructions regarding preparation of report was given in the training. The guidelines were also issued.

A trainers training programme was organized at Central Institute of Cotton research, Nagpur for training the trainers for taking field observation of Bt. cotton crop in every district. The trainers were instructed to conduct field level trainings. A district level committee was established at each district to prepare evaluation report. The members of the committee were as below.

1. District Superintending Agriculture Officer

Chairman

- | | | |
|----|--|--------|
| 2. | Officers who has attended training at CICR | Member |
| 3. | Agriculture Development Officer | Member |
| 4. | Sub-divisional Agriculture Officer | Member |
| 5. | University Expert | Member |
| 6. | Taluka Agriculture Officer | Member |

The observations on 904 plots were recorded through out Maharashtra.

Division-wise area under Bt. cotton and observations taken are as below:

S. No.	Division	Area under Bt. cotton in ha.	Observations recorded
1.	Nagpur	926.40	139
2.	Amravati	3429.60	217
3.	Aurangabad	2175.60	210
4.	Latur	2550.80	188
5.	Nasik	3098.40	150
6.	Others	13.20	---
	Total	12194.00	904

As per the directives of the CICR the observations are recorded on Bt. Cotton plants and its non Bt. Counter part. The results are based on these observations. The Committee was also instructed to compare the performance of Bt. cotton varieties with most popular hybrids varieties in the locality.

The highlights of the reports are as below.

1. Physical characters: The Bt. Cotton plants are less in height/ No. of squares, No. of flowers, No. of Bolls etc. are more than non Bt. cotton.

2. Disease and pest incidence: During Kharif 2002-2003 no heavy infestation was noticed on both Bt. and non-Bt. cotton varieties. On an average 3 to 4 spraying were given to both Bt. & Non Bt. Cotton varieties. No heavy infestation of bollworm was noticed.

a. Sucking Pests: The attack of sucking pests was reported on both Bt. & Non Bt. cotton varieties.

(i) Aphids and Jassid: On an average 5 to 10 % infestation was reported on both Bt. & Non Bt. Cotton varieties.

(ii) Thrips: On an average 3 to 5% infestation was reported on both Bt. & Non Bt. Cotton varieties.

(iii) White fly: On an average 5 to 8% infestation was reported on Bt. & Non Bt. cotton varieties

b. Bollworm:

(i) Till August, 2002 no infestation of bollworm was reported.

(ii) During September, October and November, 2002 infestation was reported on both Bt. and Non Bt. cotton. The level of infestation was marginally more in non Bt. cotton varieties (7 to 12%) than Bt. cotton varieties (5 to 7%). The number of larvae per plant observed on both Bt. & Non Bt. cotton varieties are as below.

S. No.	Name of Bollworm	Average No. of larvae / Plant	
		Bt. cotton varieties	Non - Bt. cotton varieties
1.	American Bollworm	1.5 to 2.5	2 to 3.5
2.	Spotted Bollworm	0.1 to 0.5	0.1 to 0.5
3.	Pink Bollworm	0.07 to 0.1	0.22 to 0.30

The Bollworm attack was reported on Bt. cotton crop at Anand Niketan College of Agriculture, Warora farm. The principal, Anand Niketan College of Agriculture, Warora has suggested the need to carry out more research on quantity of ICP (Intestinal Crystal Proteins) present in leaves. Flowers and bolls, so that, larvae will be killed within 24 hrs. As per the report of CICR committee the attack of bollworm is reported at Anandvan College of Agriculture farm. But the attack was below ETL (Economic Threshold Level)

C. Wilting

Many Complaints about Susceptibility of wilting were received from Amravati, Yeotmal and Nanded district on Bt. cotton varieties. As per the report of C ICR it was not a pathogenic wilt and is not caused by fungi, bacteria or viruses. The wilting is a characteristic of parawilt and is a physiological disorder which normally occurs when the cotton hybrids in the field are exposed to prolong dry spell followed by heavy showers.

3. **Yield:** The picking-wise yield observations recorded on Bt. cotton and its non-Bt. cotton part are as below:

Bt. Cotton

S. No.	Division	First picking (Kg. / ha.)	Second picking (Kg. / ha.)	Third picking (Kg. / ha.)	Fourth picking (Kg. / ha.)	Total Yield (Kg. / ha.)
1.	Nagpur	237.1	390.07	342.14	233.96	1,212.23
2.	Amravati	430.4	255.6	166.74	---	852.74
3.	Aurangabad	348.1	562.32	458.03	292.83	1,736.34
4.	Latur	240.63	305.5	229.38	118.00	888.5
5.	Nasik	262.73	525.19	707.31	689.46	2,184.69
	Total	1,618.96	2,038.68	2,003.06	1,337.25	6,874.5
	Average	323.79	407.74	400.72	266.85	1,374.9

Non-Bt. Cotton

S. No	Division	First picking (Kg / ha)	Second picking (Kg / ha)	Third picking (Kg / ha)	Fourth picking (Kg /ha)	Total Yield (Kg / ha)	% increase
1.	Nagpur	159.3	201.80	265.18	100.1	876.28	27.71
2.	Amravati	285.47	178.42	142.73	107.06	713.68	16.30
3.	Aurangabad	238.01	385.99	376.36	187.84	1,193.89	30.57
4.	Latur	177.75	209.38	161.25	77.25	625.63	29.57
5.	Nasik	168.65	339.85	427.38	376.42	1,312.31	60.07
	Total	1,028.78	1,315.44	1,372.90	848.67	4,721.49	164.22
	Average	205.76	263.09	274.58	169.73	944.3	32.84

From the above observations it is clear that the percentage yield increase of Bt. over its counter part ranges between 16 to 60%.

As per the feed back of the field level officers all though the performance of Bt. over its non Bt. Counter parts are better, but its performance, as compared with other popular non Bt. hybrids like (NCS- 145) (Bunny) Ankur 651, Paras, Brahma, is not better.

The feedback received from most of the farmers of the state is as follows:

- (i) The average boll weight of Mahyco Bt. Cotton Varieties is 300 gm / 100 bolls i.e. 3 gm / boll which is very less as compared with other non Bt. popular hybrids which is 550 to 600 gm / 100 bolls.
- (ii) The staple length of the Bt. cotton varieties is also short and hence it fetches fewer prices in market compared with other popular hybrids.
- (iii) The Bt. cotton varieties show more susceptibility to wilting under heavy rains compared to other popular varieties.
- (iv) There should also be a mechanism to control the cost of B. T. Cotton Seeds. In this particular year the cost of only 450 gm Packet of B.T. Cotton seeds of Mahyco is Rs 1600/- which is not justifiable in any case. In the initial years the Government should control the cost of the seeds.

ISSUES RELATED TO USE OF B. T.

The use of genetic engineering and the G. M. plants comes under Environment Protection Act and the rules and orders made there under. Under Seeds Act, 1966, seeds Rules, 1968 and Seeds Control Order, 1983 the use of Genetically modified crops varieties is not considered. To monitor this in the State:

1. The central Government should notify the minimum standards and also the methods of testing the seeds in notified laboratories.
2. The inspectors should be appointed and the duties and powers should be specified.

3. The strict provisions should be made against the sellers of spurious or fake seeds and F2 seeds of G. M. Crops.

For Commissioner of Agriculture
Government of Maharashtra

