

Central Zone

The All India Coordinated Cotton Improvement Project (AICCIP) was assigned the task of evaluating Bt cotton hybrids in the Central Zone vide ICAR letter No. F2 (5) / 2006-CCI Dt. 24th April 2006.

FIRST YEAR TRIAL (2006-07)

I. INTRA HIRSUTUM HYBRID TRIAL

Trial Entries

In the first year trial, 23 Bt cotton hybrids were evaluated along with three checks. The Bt entries were VICH 15 Bt (Vikram Seeds), NCS 929 Bt (Nuziveedu Seeds), Sigma Bt (Vibha Seeds), PCH 923 Bt (Prabhat Seeds), KCH 135 Bt (Kaveri Seeds), BS 563 Bt (Bio Seeds), Ankur Jai Bt (Ankur Seeds), Nandi 405 Bt (Nandi Seeds) IT 923 Bt (Pro Agro Seeds), Tulasi 9 Bt (Tulasi Seeds), Sudershan Bt (Emergent Genetics), Rudra Bt (Pravardhan Seeds), KDCHH 9821 Bt (Krishidhan Seeds), Dhruv Bt (Zuari Seeds), JKCH 666 Bt (JK Seeds), Tulasi 4 BG II (Tulasi Seeds), RCH 2 BG II (Rasi Seeds), NCS 207 BG II (Nuziveedu Seeds), BCHH 557 BG II (Bio Seeds), Ankur Akka BG II (Ankur Seeds), NCEH 14 Bt (Nath Seeds), Atal BG II (Emergent Genetics) and Navkar 5 Bt (Navkar Seeds). Hybrid RCH 2 Bt was the common Bt check and NHH 44 was the common Non Bt check. The local check hybrids were JK Hy-1 (Khandwa and Indore), Hybrid 10 (Surat, Junagadh and Talod), Hybrid 8 (Banswara, Bharuch and Rajkot), PKV Hy 4 (Akola, Achalpur and CICR Nagpur), PHH 316 (Nanded and Parbhani) and Bunny (Bhawanipatna).

Trial locations

The following were the trial locations:

Irrigated

1. Cotton Research Station, **Khandwa** under Jawaharlal Nehru Krishi Vishwa Vidhyala, Madhya Pradesh
2. Main Cotton Research Station, **Surat** under Navsari Agricultural University, Gujarat.
3. Cotton Research Station, **Junagadh** under Junagadh Agricultural University, Gujarat
4. Cotton Research Station, **Talod** under Krishinagar Dhantiwada Agricultural University, Gujarat
5. Agricultural Research Station, Borwat Farm, **Banswara** under Maharana Pratap University of Agriculture & Technology, Rajasthan.

Rainfed

1. Dr.Panjabrao Deshmukh Krishi Vidyapeeth, **Akola**, Maharashtra
2. Agricultural Research Station, Achalpur under Dr.PDKV, Maharashtra
3. Cotton Research Station, **Nanded** under Marathwada Agricultural University, Maharashtra
4. Cotton Research Station, Marathwada Agricultural University, **Parbhani**, Maharashtra
5. Central Institute for Cotton Research, **Nagpur**, Maharashtra
6. Cotton Research Station, Makrampur, **Bharuch** under Navsari Agricultural University, Gujarat.
7. Dry Farming Research Station, Targhadra, **Rajkot** under Junagadh Agricultural University, Gujarat
8. College of Agriculture, **Indore** under JNKVV, Madhya Pradesh
9. Regional Research Station, **Bhawanipatna** under Orissa University of Agriculture and Technology, Orissa

Trial Details

No. of Entries	:	23 + 3 checks
No. of Rows	:	Yield Trial: 6 Rows Screening Trials 2 & 3: 3 Rows
Row Length:	:	6m
Spacing:	Irrigated	: Gujarat : 120 x 45 cm Madhya Pradesh: 90 x 60 cm Rajasthan : 90 x 45 cm
	Rainfed	: Madhya Pradesh : 90 x 60 cm Maharashtra : 90 x 60 cm Gujarat : 120 x 45 cm Orissa : 90 x 45 cm
No. of Replications:	:	Three
Design	:	Randomized Block Design
Fertilizers	:	As per recommendations

Trials

Evaluation under ETL Based Plant Protection

Weekly observations were recorded from 45 DAS against major sucking pests and boll worms. The insecticide sprayings were based on the threshold levels of sap

sucking pests and boll worms. The sprayings were undertaken in all the replications of an entry even if in one of the replications, the threshold level of infestation has exceeded.

Evaluation under Unprotected Conditions for Boll worms

All the Bt Cotton hybrids and the controls were evaluated against key pests of cotton under unprotected conditions.

Pathological Evaluation

All the entries in the trial were screened against major diseases.

Observations Recorded

All the biometrical observations were recorded in the ETL based plant protection plots. The biometrical observations recorded were Germination Percentage, Final Plant Stand, Ginning Percentage, Lint Index, Seed Index, Seed Cotton Yield and Lint Yield.

The entomological observations on sap sucking pests, boll worm damages and natural enemies were recorded under ETL based plant protection trial. The pathological observations on incidence of major diseases like Alternaria leaf spot, bacterial blight and grey mildew were recorded under natural conditions.

A. BIOMETRICAL EVALUATION.

Biometrical observations were recorded in the ETL based plant protection trial and are reported here.

Germination and Final Plant Stand

The germination was in general good in all the entries and at all the locations except Indore, where the germination was average and ranged from 61.1 to 88.9 per cent (Table 1).

The stand at harvest was adequate at all the locations in all the entries (Table 2).

Boll Weight

Mean Boll weight of the Bt hybrids varied from 3.9 to 4.7 g. The non Bt check hybrids recorded a mean boll weight of 3.7 to 3.8 g. Sudershan Bt recorded the highest boll weight of 4.7g (Table 3).

Table 1. Germination (%)

Entry	Khandwa	Surat	Junagadh	Talod	Bhanswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawaniapatna	Mean
VICH 15 Bt	93.9	99.0	99.0	99.4	100.0	66.7	89.7	98.0	97.9	100.0	97.2	98.3	100.0	95.3
NCS 929 Bt	78.9	92.0	98.0	97.2	100.0	69.5	83.7	97.0	91.7	100.0	87.8	99.4	100.0	91.9
Sigma Bt	92.2	97.0	98.0	100.0	100.0	77.8	90.0	97.0	99.2	99.3	95.6	99.4	100.0	95.8
PCH 923 Bt	72.2	93.0	98.0	97.2	100.0	63.2	88.0	96.0	94.2	99.3	83.9	96.7	100.0	90.9
KCH 135 Bt	68.9	89.0	98.0	97.2	100.0	74.3	86.0	97.0	90.8	99.3	89.4	98.3	100.0	91.4
BS 563 Bt	53.9	88.0	90.0	98.9	100.0	70.1	94.0	97.0	86.7	97.0	88.3	80.6	100.0	88.0
Ankur Jai Bt	89.4	92.0	100.0	100.0	100.0	68.1	87.0	97.0	96.3	99.3	95.6	98.9	100.0	94.1
Nandi 405 Bt	93.3	96.0	99.0	100.0	100.0	72.9	92.3	96.0	96.3	99.3	96.1	98.3	100.0	95.3
IT 923 Bt	90.6	91.0	99.0	100.0	100.0	77.1	89.3	99.0	95.8	100.0	88.9	100.0	100.0	94.7
Tulasi 9 Bt	76.7	92.0	97.0	99.4	100.0	61.1	89.7	97.0	97.1	93.0	93.9	98.9	100.0	92.0
Sudershan Bt	77.2	91.0	97.0	100.0	95.0	70.8	88.7	97.0	93.8	98.5	87.8	100.0	100.0	92.1
Rudra Bt	83.3	94.0	100.0	100.0	90.0	64.5	87.3	98.0	95.8	98.6	94.4	98.3	100.0	92.6
KDCHH 9821 Bt	92.8	93.0	100.0	100.0	100.0	82.7	86.0	96.0	97.1	100.0	98.3	99.4	100.0	95.8
Dhruv Bt (GFM)	91.1	99.0	98.0	100.0	100.0	78.5	83.3	97.0	98.3	100.0	96.1	100.0	100.0	95.5
JKCH 666 Bt	92.8	96.0	99.0	100.0	95.0	88.9	85.7	98.0	95.4	98.6	95.6	99.4	100.0	95.7
Tulasi 4 BG II	90.0	95.0	99.0	100.0	100.0	65.3	92.0	98.0	96.7	100.0	96.1	100.0	100.0	94.8
RCH-2 BG II	85.6	94.0	100.0	100.0	100.0	79.9	88.7	99.0	96.3	100.0	97.2	98.9	100.0	95.3
NCS 207 BG II	54.4	91.0	96.0	97.8	93.0	63.9	87.3	97.0	89.2	98.6	85.0	90.0	100.0	87.9
BCHH 557 BG II	71.1	90.0	96.0	99.4	100.0	64.6	92.3	97.0	96.7	97.9	71.7	94.4	100.0	90.1
Ankur Akka BG II	90.0	98.0	99.0	100.0	100.0	84.0	88.3	98.0	98.8	100.0	94.4	99.4	100.0	96.2
NCEH 14 (GFM)	85.0	95.0	99.0	100.0	100.0	87.5	88.3	96.0	95.8	100.0	97.8	99.4	100.0	95.7
Atal BG II	90.6	96.0	99.0	100.0	100.0	68.1	83.3	97.0	94.2	100.0	97.2	98.9	100.0	94.2
RCH 2 Bt (Bt check)	92.2	100.0	99.0	100.0	100.0	72.9	91.7	97.0	94.6	100.0	97.8	100.0	100.0	95.8
NHH 44 (Non Bt Check)	93.3	91.0	99.0	99.4	100.0	72.2	89.0	98.0	96.3	99.3	95.0	98.3	100.0	94.7
Local check Hybrid	77.2	81.0	99.0	99.4	100.0	70.1	89.3	96.0	92.5	98.6	98.3	99.4	100.0	92.4
NAVKAR 5 Bt	85.0	99.0	-	100.0	100.0	64.3	86.7	97.0	97.9	100.0	98.3	99.4	100.0	94.0
CD @ 5%		N.S.	-	NS	3.7							3.7	33.3	
CV(%)		8.4	-	1.6	2.3							2.3	19.8	

Table 2. Stand at harvest

Entry	Surat	Junagadh	Talod	Indore	Bharuch	Achalpur	Nanded	Parbhani	Nagpur	Bhawanipatna	Mean
VICH 15 Bt	43.0	69.0	28.7	31.7	35.7	52.7	48.0	57.3	57.0	60.0	48.3
NCS 929 Bt	41.0	69.0	27.3	33.0	37.3	52.3	48.0	53.0	57.0	60.0	47.8
Sigma Bt	42.0	69.0	29.3	37.0	37.3	52.7	48.0	57.0	57.6	60.0	49.0
PCH 923 Bt	40.0	68.0	25.7	30.3	37.7	57.3	47.7	51.7	55.0	59.7	47.3
KCH 135 Bt	39.0	69.0	27.3	35.7	37.7	57.7	47.7	53.7	54.6	60.0	48.2
BS 563 Bt	41.0	63.0	28.0	33.3	37.3	56.3	46.7	54.7	54.6	60.0	47.5
Ankur Jai Bt	42.0	70.0	29.0	32.0	36.0	55.7	47.7	57.7	58.6	59.3	48.8
Nandi 405 Bt	43.0	69.0	28.7	35.0	37.7	55.7	47.3	56.7	57.0	60.0	49.0
IT 923 Bt	40.0	69.0	28.7	36.7	36.0	55.3	48.0	54.3	57.0	60.0	48.5
Tulasi 9 Bt	44.0	68.0	28.7	29.3	37.3	56.3	44.7	55.7	56.6	60.0	48.1
Sudershan Bt	42.0	68.0	29.0	33.3	36.3	55.7	45.3	54.0	56.3	59.7	48.0
Rudra Bt	42.0	70.0	29.7	31.0	36.7	55.3	47.3	57.3	57.3	60.0	48.7
KDCHH 9821 Bt	44.0	70.0	29.0	39.7	35.3	56.3	47.3	58.0	55.6	60.0	49.5
Dhruv Bt (GFM)	40.0	68.0	28.7	37.7	38.0	52.3	48.0	58.3	57.3	60.0	48.8
JKCH 666 Bt	43.0	69.0	29.0	42.7	36.3	57.0	47.3	58.0	58.0	60.0	50.0
Tulasi 4 BG II	42.0	69.0	29.3	31.3	35.7	55.0	48.0	58.0	56.6	60.0	48.5
RCH-2 BG II	44.0	70.0	29.7	38.3	36.7	58.7	48.0	58.3	56.3	60.0	50.0
NCS 207 BG II	44.0	67.0	27.0	30.0	37.7	54.0	47.0	51.3	56.0	60.0	47.4
BCHH 557 BG II	42.0	67.0	28.3	31.0	36.0	54.7	47.0	45.7	52.0	59.3	46.3
Ankur Akka BG II	40.0	69.0	29.7	40.3	35.7	53.3	48.0	55.7	56.6	60.0	48.8
NCEH 14 (GFM)	43.0	69.0	28.3	42.0	37.0	53.7	48.0	57.7	55.6	60.0	49.4
Atal BG II	44.0	69.0	28.7	32.3	36.3	54.7	48.0	57.7	55.3	59.7	48.6
RCH 2 Bt (Bt check)	44.0	69.0	28.7	35.0	38.0	57.3	47.7	58.7	59.3	60.0	49.8
NHH 44 (Non Bt Check)	44.0	69.0	29.0	34.0	38.0	54.0	47.7	56.7	59.0	59.7	49.1
Local check Hybrid	41.0	69.0	28.7	33.7	35.0	54.0	47.3	57.7	57.3	60.0	48.4
NAVKAR 5 Bt	44.0	-	29.7	31.0	36.0	55.7	47.7	58.7	58.6	60.0	46.8
CD @ 5%	N.S.	-	NS	-			2.2			19.9	
CV(%)	4.6	-	4.2	-			2.9			19.8	

Table 3. Boll weight (g)

Entry	Khandwa	Surat	Junagadh	Talod	Bhanswara	Indore	Bharuch	Akola	Nanded	Parbhani	Nagpur	Bhawanipatna	Mean
VICH 15 Bt	4.5	3.6	4.7	4.1	3.0	3.6	4.2	5.0	4.0	3.8	4.8	4.9	4.2
NCS 929 Bt	5.3	3.3	5.0	4.3	2.5	4.0	4.7	4.9	4.2	3.6	4.8	5.0	4.3
Sigma Bt	5.0	3.9	4.0	3.7	3.1	3.6	4.7	5.0	3.8	3.6	4.6	4.9	4.2
PCH 923 Bt	4.3	3.9	3.9	3.9	3.5	3.7	4.2	4.9	3.4	3.6	4.9	4.7	4.1
KCH 135 Bt	5.3	3.0	4.0	4.4	3.4	3.4	4.2	4.8	4.1	3.7	4.6	4.4	4.1
BS 563 Bt	4.2	4.0	4.5	4.6	3.7	4.2	4.5	4.8	4.3	3.6	3.9	4.6	4.2
Ankur Jai Bt	5.3	4.4	5.4	4.5	3.2	4.2	4.2	5.8	4.7	3.5	5.3	4.9	4.6
Nandi 405 Bt	5.2	3.8	4.8	4.2	3.8	3.7	4.6	5.0	4.5	3.8	4.6	4.9	4.4
IT 923 Bt	5.1	4.2	4.5	4.3	3.1	3.5	4.2	5.0	4.0	3.3	5.3	4.5	4.3
Tulasi 9 Bt	4.9	4.3	5.3	4.7	3.2	4.4	4.8	5.0	4.9	3.6	4.8	4.8	4.6
Sudershan Bt	5.3	4.4	6.5	5.5	2.9	3.7	3.8	5.9	5.4	3.5	4.9	4.6	4.7
Rudra Bt	5.5	3.6	4.5	4.4	2.8	3.4	4.3	5.1	4.6	3.5	4.7	5.0	4.3
KDCHH 9821 Bt	4.8	4.1	4.7	4.7	3.3	3.6	4.4	5.0	4.5	3.1	4.4	4.6	4.3
Dhruv Bt (GFM)	4.8	3.6	3.9	3.7	3.7	3.6	3.9	4.4	4.1	3.5	4.9	4.7	4.1
JKCH 666 Bt	4.3	3.7	4.1	3.8	4.7	3.1	4.1	4.5	3.5	3.8	4.0	4.5	4.0
Tulasi 4 BG II	5.5	3.6	4.5	4.2	4.1	4.0	5.0	4.9	4.4	3.4	4.9	4.8	4.4
RCH-2 BG II	4.7	3.5	4.0	4.2	3.1	3.5	3.9	4.3	3.9	3.5	4.0	4.5	3.9
NCS 207 BG II	5.5	3.8	5.7	4.9	4.1	3.6	3.8	4.8	4.7	3.6	5.4	4.9	4.6
BCHH 557 BG II	5.8	3.8	5.1	4.4	4.4	3.7	5.0	5.0	4.5	3.3	5.4	4.5	4.6
Ankur Akka BG II	5.0	4.2	5.3	4.2	3.0	3.7	3.5	5.4	4.6	3.4	5.0	4.8	4.3
NCEH 14 (GFM)	5.3	4.1	5.1	4.3	2.3	3.8	3.9	5.1	4.0	3.4	5.0	4.9	4.3
Atal BG II	5.3	4.1	4.9	4.5	3.8	4.2	4.5	5.2	4.6	3.7	5.1	4.8	4.6
RCH 2 Bt (Bt check)	4.8	4.1	4.4	4.1	3.0	3.9	5.0	4.4	3.7	3.9	4.5	4.2	4.2
NHH 44 (Non Bt Check)	5.3	2.3	3.8	3.7	4.4	3.4	4.1	3.3	3.3	3.6	3.6	4.1	3.7
Local check Hybrid	5.0	2.5	3.9	3.6	4.0	3.7	3.7	3.9	3.5	3.6	4.2	4.2	3.8
NAVKAR 5 Bt	4.9	3.2	-	3.5	3.0	3.4	4.5	4.4	3.3	3.4	3.9	4.9	3.9
CD @ 5%	0.5	0.8	0.4	0.3	0.5	0.2		0.7	0.3	0.3	0.9	0.1	
CV(%)	8.9	11.0	5.0	4.2	8.6	3.3		8.4	4.7	5.6	11.4	1.4	

Ginning Outturn

The mean ginning outturn of the Bt cotton hybrids varied from 32.4 to 37.7 %. Hybrid JK CHH 666 Bt recorded the highest ginning outturn of 37.7 per cent. The check hybrids RCH 2 Bt and NHH 44, recorded a mean ginning out turn of 33.7 and 34.1 percent, respectively (Table 4).

Lint Index

NHH 44 (Non Bt check) recorded the lowest lint index of 4.5. Most of the Bt entries recorded a lint index of 4.5 to 5.5 g (Table 5).

Seed Index

Navkar 5 Bt recorded the lowest seed index of 8.4 g. Twelve hybrids recorded more than 10.0 g seed index (Table 6).

B. MEAN YIELD UNDER ETL BASED PLANT PROTECTION

Mean Seed Cotton Yield

Irrigated

Twenty hybrids recorded higher seed cotton yield than the local check hybrid. As against the common non Bt check hybrid NHH 44, only seven hybrids exhibited numerical superiority of 1 to 14 per cent. The Bt check hybrid RCH 2 Bt recorded a mean seed cotton yield of 1593 kg/ha and as compared to it, 18 hybrids exhibited numerical superiority ranging from 3 to 39 per cent (Table7).

As compared to NHH 44, the best check in the Trial, the following Bt hybrids performed better: Hybrid Ankur Akka BG II (2220 kg/ha ; 14 % increase). IT 923 Bt (2153 Kg/ha; 11% increase), Sudershan Bt (2051 kg/ha; 6% increase), Rudra Bt (2027 kg/ha; 4 % increase), VICH 15 Bt (1986 kg/ha; 2% increase), Dhruv Bt (1964 kg/ha; 1% increase), Ankur Jai Bt (1960 kg/ha; 1% increase).

Rainfed

All the Bt test hybrids evaluated under Rainfed situation recorded increased yield over the non Bt check hybrids. The percentage increase in yield over NHH 44, the common non Bt check, ranged from 2 to 45 per cent. The Bt check hybrid RCH 2 Bt recorded a mean seed cotton yield of 1233 kg/ha. Sixteen Bt test hybrids were superior to it by 2 to 23 per cent (Table 8). They are:

Ankur Akka BG II (1529 kg/ha; 23 % increase), Dhruv Bt (GFM) (1525 kg/ha; 23 % increase), Rudra Bt (1511 kg/ha, 22 % increase), Tulasi 4 BG II (1504 kg/ha, 21 % increase), NCS 929 Bt (1464 kg/ha; 18 % increase), IT 923 Bt (1459 kg/ha; 18 % increase), Sigma Bt (1451 kg/ha; 17 % increase), Atal BG II (1450 kg/ha; 17 % increase), Tulasi 9 Bt (1377 kg/ha; 11% increase), BCHH 557 BG II (1359 kg/ha; 10 % increase), Ankur Jai Bt (1354 kg/ha; 9 % increase), VICH 15 (1349 kg/ha; 9 % increase), Nandi 405 Bt (1337 kg/ha; 8 % increase), JKCH 666 Bt (1269 kg/ha; 3 % increase), Sudershan Bt (1263 kg/ha; 2 % increase) and PCH 923 Bt (1261 kg/ha; 2 % increase).

Table 4. Ginning Outturn (%)														
Entry	Khandwa	Surat	Junagadh	Talod	Bhanswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawani	Mean
VICH 15 Bt	34.3	35.0	35.6	34.7	35.2	38.2	32.9	38.5	32.6	35.8	35.4	35.4	34.5	35.2
NCS 929 Bt	31.6	32.3	33.6	32.5	34.9	35.6	30.7	36.2	34.0	35.4	34.3	34.5	36.2	34.0
Sigma Bt	33.7	32.8	35.6	33.9	34.9	36.7	32.7	38.2	35.9	36.4	37.3	34.9	38.4	35.5
PCH 923 Bt	33.3	34.5	35.0	34.3	34.5	36.7	33.0	38.3	34.2	35.2	36.8	35.2	37.2	35.2
KCH 135 Bt	34.3	30.8	33.5	33.9	35.2	37.7	29.9	35.8	24.3	34.4	33.8	34.4	36.3	33.4
BS 563 Bt	32.8	36.5	34.6	33.1	31.6	37.0	31.6	37.1	32.4	34.5	35.9	35.2	30.1	34.0
Ankur Jai Bt	32.9	32.4	32.8	33.3	33.9	36.1	32.8	37.5	37.3	34.9	35.5	34.2	32.0	34.3
Nandi 405 Bt	32.4	35.8	34.4	32.9	35.1	37.3	31.5	40.6	34.5	35.5	35.3	34.9	34.3	35.0
IT 923 Bt	30.0	31.1	31.7	31.1	33.8	36.0	31.9	37.5	27.6	32.5	34.1	33.7	30.4	32.4
Tulasi 9 Bt	32.4	37.3	33.7	34.3	34.5	37.6	33.3	33.4	35.9	35.0	37.2	35.1	40.1	35.4
Sudershan Bt	32.5	32.8	32.4	32.5	35.4	35.3	29.9	31.7	32.5	32.8	38.5	33.5	32.6	33.3
Rudra Bt	33.4	34.0	34.6	34.1	34.7	37.9	31.7	34.9	34.3	35.8	36.5	35.6	36.1	34.9
KDCHH 9821 Bt	32.9	33.7	36.0	34.5	34.6	37.5	32.0	34.1	29.0	34.5	35.0	35.4	38.3	34.4
Dhruv Bt (GFM)	32.6	36.4	33.8	34.3	35.6	37.1	30.3	35.3	38.6	35.4	36.3	35.2	40.4	35.5
JKCH 666 Bt	36.5	36.9	38.3	36.7	35.7	44.5	36.3	39.5	34.0	39.5	35.9	37.6	38.4	37.7
Tulasi 4 BG II	33.4	33.4	34.3	33.4	33.8	38.1	32.9	38.5	32.6	36.9	34.9	35.9	38.4	35.1
RCH-2 BG II	32.6	35.4	34.1	32.7	33.6	36.8	31.6	33.5	38.5	34.1	33.7	34.4	36.2	34.4
NCS 207 BG II	31.7	32.1	34.5	33.0	33.8	36.8	31.6	35.9	32.4	32.4	37.7	35.0	37.5	34.2
BCHH 557 BG II	32.0	36.2	33.7	34.6	32.9	38.3	33.3	35.7	34.2	36.9	38.0	35.2	40.2	35.5
Ankur Akka BG II	34.0	32.0	31.9	31.7	33.8	35.5	30.6	36.1	27.6	34.5	33.6	33.1	37.3	33.2
NCEH 14 (GFM)	35.4	40.2	37.8	38.8	35.9	39.5	34.3	36.8	34.1	37.7	40.2	37.3	40.3	37.6
ATal BG II	33.3	30.8	33.0	31.3	32.9	34.8	29.9	35.5	32.4	35.1	35.5	32.4	35.5	33.3
RCH 2 Bt (Bt check)	32.6	33.5	34.0	31.3	33.9	35.8	30.9	33.6	34.1	35.1	34.5	34.7	34.4	33.7
NHH 44 (Non Bt Check)	32.5	34.1	32.5	32.2	35.2	35.3	30.5	30.6	38.6	33.4	33.2	34.3	40.5	34.1
Local check Hybrid	32.3	32.1	32.9	32.0	35.6	36.1	31.9	33.1	29.2	37.3	41.8	34.2	35.5	34.1
NAV KAR 5 Bt	32.6	33.7	-	34.3	35.2	37.7	32.5	31.9	30.6	34.4	34.7	34.4	35.3	33.9
CD @ 5%		1.2	1.0	NS	1.2	0.6		1.4	0.9	1.1	2.0	1.1	11.8	
CV(%)		2.1	1.7	17.7	2.1	1.1		2.5	1.7	2.0	3.5	1.9	19.3	

Table 5. Lint Index (g)												
Entry	Khandwa	Surat	Junagadh	Talod	Bhanswara	Indore	Akola	Achalpur	Nanded	Parbhani	Nagpur	Mean
VICH 15 Bt	4.3	5.0	6.0	5.2	6.3	7.1	6.7	4.3	5.8	5.7	5.7	5.7
NCS 929 Bt	4.1	3.6	5.6	5.4	5.6	6.8	6.0	4.3	5.7	4.1	4.6	5.1
Sigma Bt	3.8	3.8	5.6	4.7	5.5	6.2	5.1	4.5	5.6	5.5	4.2	5.0
PCH 923 Bt	3.8	4.7	4.9	5.2	5.1	6.8	6.2	4.8	5.9	4.0	5.3	5.1
KCH 135 Bt	4.2	2.9	5.0	5.3	5.5	6.0	6.2	2.8	4.7	4.4	4.3	4.7
BS 563 Bt	3.2	4.0	5.0	4.4	5.2	7.0	5.9	4.1	5.4	4.7	4.2	4.8
Ankur Jai Bt	4.3	4.0	5.8	4.4	5.4	7.2	7.2	5.3	6.2	5.9	5.0	5.5
Nandi 405 Bt	3.3	4.7	5.8	4.2	6.0	7.4	6.9	4.3	5.9	4.5	5.0	5.3
IT 923 Bt	4.4	3.8	4.9	4.7	4.8	7.2	6.6	3.1	4.8	3.7	4.6	4.8
Tulasi 9 Bt	5.3	5.1	6.1	5.1	5.9	7.1	5.4	5.1	6.1	5.4	4.5	5.5
Sudershan Bt	5.4	4.5	6.1	4.4	6.1	5.4	5.7	4.4	5.7	5.3	4.9	5.3
Rudra Bt	5.2	4.3	5.6	4.6	5.4	7.2	6.2	3.8	6.0	4.9	4.8	5.3
KDCHH 9821 Bt	4.5	4.0	5.3	4.8	5.2	6.6	5.5	3.1	5.6	4.5	4.6	4.9
Dhruv Bt (GFM)	4.5	4.5	5.2	5.6	4.7	6.6	6.1	5.4	5.3	5.7	4.9	5.3
JKCH 666 Bt	4.7	4.1	5.1	6.2	5.3	7.8	7.1	4.4	5.9	5.7	4.5	5.5
Tulasi 4 BG II	4.8	4.1	5.4	5.0	5.0	7.9	8.1	4.1	6.0	4.8	5.2	5.5
RCH-2 BG II	4.5	4.1	5.6	4.7	5.1	7.0	6.1	5.7	5.4	5.0	4.9	5.3
NCS 207 BG II	4.5	4.5	6.2	4.8	5.7	7.2	6.3	3.8	5.5	3.8	5.1	5.2
BCHH 557 BG II	4.6	4.7	5.6	5.5	4.9	7.2	7.0	3.7	6.3	5.0	4.8	5.4
Ankur Akka BG II	5.5	4.7	5.6	4.5	5.0	7.0	7.5	3.3	5.7	5.1	4.5	5.3
NCEH 14 (GFM)	4.5	4.8	5.7	6.6	5.5	7.0	6.1	3.7	5.6	4.5	4.5	5.3
Atal BG II	5.3	4.0	5.4	4.4	5.7	6.7	6.5	4.1	5.6	5.3	4.4	5.2
RCH 2 Bt (Bt check)	4.5	4.3	5.6	4.4	5.4	7.1	5.7	4.2	5.7	4.8	4.5	5.1
NHH 44 (Non Bt Check)	4.3	3.5	5.0	4.5	4.7	6.1	5.2	4.3	4.5	3.7	3.9	4.5
Local check Hybrid	4.3	3.6	4.7	4.6	4.9	7.0	5.6	3.5	5.5	4.8	4.8	4.8
NAVKAR 5 Bt	4.1	3.4	-	6.1	4.9	6.3	4.0	3.2	4.9	3.5	4.2	4.5
CD @ 5%		0.8	0.5	0.5	0.5	0.2	0.7	0.4	0.8	0.7	0.7	
CV(%)		11.4	5.5	6.4	5.7	1.9	6.6	5.9	9.3	9.7	9.8	

Entry	Khandwa	Surat	Junagadh	Talod	Bhanswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Mean
VICH 15 Bt	8.3	9.3	10.9	10.3	11.5	11.5	10.5	10.7	9.0	10.6	8.4	10.5	10.1
NCS 929 Bt	8.8	7.5	11.0	9.0	10.5	11.8	9.0	10.7	8.4	10.4	7.4	8.8	9.4
Sigma Bt	7.6	7.8	10.2	11.0	10.2	10.7	10.0	8.3	8.1	9.8	6.4	7.9	9.0
PCH 923 Bt	7.5	8.8	9.2	10.0	9.7	11.7	9.5	10.0	9.2	10.8	7.4	9.7	9.5
KCH 135 Bt	8.0	6.5	9.9	9.7	10.1	10.0	9.0	11.2	8.7	9.0	7.2	8.3	9.0
BS 563 Bt	6.6	7.0	9.5	11.3	11.2	11.9	9.0	10.0	8.4	10.3	7.2	7.6	9.2
Ankur Jai Bt	8.7	8.3	12.0	11.3	10.4	12.7	10.5	12.0	9.0	11.6	9.5	9.7	10.5
Nandi 405 Bt	6.9	8.3	11.1	11.7	11.0	12.4	10.5	10.2	8.3	10.7	8.5	9.4	9.9
IT 923 Bt	10.3	8.3	10.6	9.7	9.4	12.9	10.5	11.0	8.2	10.1	6.8	9.0	9.7
Tulasi 9 Bt	11.0	8.5	12.0	10.3	11.1	12.1	10.0	10.7	9.0	11.2	8.5	8.4	10.2
Sudershan Bt	11.2	9.2	12.7	11.0	11.1	9.8	11.0	12.3	9.1	11.6	7.6	9.8	10.5
Rudra Bt	10.4	8.3	10.7	11.3	10.1	11.9	10.5	11.5	7.3	10.8	7.7	8.7	9.9
KDCHH 9821 Bt	9.3	7.8	9.5	11.0	9.9	11.1	9.5	10.7	7.6	10.5	6.6	8.4	9.3
Dhruv Bt (GFM)	9.4	7.8	10.2	9.3	8.5	11.2	8.0	11.2	8.6	9.8	8.1	9.1	9.3
JKCH 666 Bt	8.2	7.0	8.2	9.3	9.5	9.8	9.5	10.8	8.6	8.8	8.5	7.5	8.8
Tulasi 4 BG II	9.6	8.2	10.3	10.0	9.8	12.8	9.5	13.0	8.6	10.8	8.1	9.4	10.0
RCH-2 BG II	9.4	7.5	10.9	10.3	10.0	12.2	10.5	12.2	9.1	10.5	8.1	9.4	10.0
NCS 207 BG II	9.7	9.5	11.8	10.3	11.3	12.5	10.5	11.2	8.0	11.4	6.6	9.5	10.2
BCHH 557 BG II	9.7	8.3	11.0	9.7	9.9	11.7	10.5	12.7	7.1	10.9	7.4	8.9	9.8
Ankur Akka BG II	10.7	10.0	11.9	10.3	9.9	12.7	10.5	13.3	8.7	11.0	9.1	9.1	10.6
NCEH 14 (GFM)	8.2	7.2	9.4	9.7	9.8	10.7	10.5	10.5	7.1	9.3	4.5	7.8	8.7
Atal BG II	10.6	8.5	11.1	10.3	11.7	12.5	10.5	11.8	8.6	11.5	9.1	9.2	10.4
RCH 2 Bt (Bt check)	9.4	8.5	10.9	10.3	10.6	12.7	9.0	11.2	8.1	10.7	8.2	8.7	9.9
NHH 44 (Non Bt Check)	9.0	6.7	10.3	10.7	8.7	11.2	8.5	11.7	6.9	9.0	6.6	7.5	8.9
Local check Hybrid	9.1	7.0	9.6	10.3	8.8	12.4	10.0	11.3	8.5	9.4	5.6	9.3	9.3
NAVKAR 5 Bt	8.4	6.7	-	8.7	9.1	10.5	11.0	8.5	7.2	8.8	5.9	8.1	8.4
CD @ 5%		1.4	0.9	1.0	0.9	0.1		0.9	0.6	0.8	1.0	1.3	
CV(%)		1.0	5.1	5.7	5.2	0.6		5.0	4.6	4.9	8.2	9.5	

Table 7. Seed cotton yield (kg/ha) - Irrigated centres								
Entry	Khandwa	Surat	Junagadh	Talod	Bhanswara	Mean (l)	% In RCH 2 Bt	% In NHH 44
VICH 15 Bt	2352	1992	2888	1613	1085	1986	24.7	2.3
NCS 929 Bt	2401	855	3658	1387	1363	1933	21.3	-0.5
Sigma Bt	2648	1413	3182	1267	712	1845	15.8	-5.0
PCH 923 Bt	1960	1497	2960	1016	998	1686	5.8	-13.2
KCH 135 Bt	2627	635	2975	1276	823	1667	4.7	-14.2
BS 563 Bt	1972	1308	3083	1757	885	1801	13.1	-7.3
Ankur Jai Bt	2202	1218	3916	1519	946	1960	23.1	0.9
Nandi 405 Bt	2031	1587	3491	1235	1024	1874	17.6	-3.5
IT 923 Bt	2531	1706	3978	1519	1029	2153	35.1	10.8
Tulasi 9 Bt	1725	1524	2553	1399	1011	1642	3.1	-15.4
Sudershan Bt	2020	1470	4072	1327	1368	2051	28.8	5.6
Rudra Bt	2287	1366	3938	1749	797	2027	27.3	4.4
KDCHH 9821 Bt	1931	1415	3299	1335	772	1750	9.9	-9.9
Dhruv Bt (GFM)	2455	1532	3447	1342	1044	1964	23.3	1.1
JKCH 666 Bt	2284	1719	2992	1333	674	1800	13.0	-7.3
Tulasi 4 BG II	2367	1448	2564	1434	674	1697	6.6	-12.6
RCH-2 BG II	2231	720	2373	1074	844	1448	-9.1	-25.4
NCS 207 BG II	1261	1087	2521	955	800	1325	-16.8	-31.8
BCHH 557 BG II	1742	1247	2483	1344	859	1535	-3.6	-21.0
Ankur Akka BG II	2560	1947	3946	1148	1497	2220	39.3	14.3
NCEH 14 (GFM)	1931	1108	2049	1200	697	1397	-12.3	-28.1
Atal BG II	1988	1568	3220	1420	1332	1906	19.6	-1.9
RCH 2 Bt (Bt check)	2722	1233	2274	1066	669	1593		
NHH 44 (Non Bt Check)	2586	818	4359	623	1322	1942		
Local check Hybrid	2213	832	3223	617	988	1575		
NAVKAR 5 Bt	1863	1421	-	1115	1132	1383	-13.2	-28.8
CD @ 5%	425	99	837	384	191			
CV(%)	17	5	16	18	12			

Table 8. Seed cotton yield (kg/ha) - Rainfed centres											
Entry	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawanipatna	Mean	% In RCH 2 Bt	% In NHH 44
VICH 15 Bt	632	2546	1699	956	1774	604	1592	986	1349	9.0	28.2
NCS 929 Bt	821	2532	1943	748	1998	827	1790	1056	1464	18.1	39.2
Sigma Bt	739	2618	1760	880	1979	947	1758	928	1451	17.0	37.9
PCH 923 Bt	429	2702	1420	764	1440	641	1849	840	1261	2.2	19.8
KCH 135 Bt	735	1969	1707	522	1646	589	1603	757	1191	-3.3	13.2
BS 563 Bt	661	2309	1350	558	1200	393	1199	753	1053	-14.1	0.1
Ankur Jai Bt	746	2422	1462	809	1774	955	1715	952	1354	9.5	28.7
Nandi 405 Bt	886	2144	1443	764	1581	904	2024	951	1337	8.1	27.1
IT 923 Bt	954	2720	1838	852	1773	841	1886	808	1459	17.6	38.7
Tulasi 9 Bt	775	2728	1326	863	1931	933	1617	840	1377	11.2	30.9
Sudershan Bt	915	2234	1478	800	1395	635	1835	811	1263	2.3	20.1
Rudra Bt	645	2593	2023	786	2317	841	1823	1056	1511	21.7	43.6
KDCHH 9821 Bt	1110	2334	1089	646	1422	402	1438	835	1159	-5.7	10.2
Dhruv Bt (GFM)	1015	2283	2169	842	2038	949	2062	846	1525	22.8	45.0
JKCH 666 Bt	960	2727	1118	751	1442	842	1543	770	1269	2.8	20.6
Tulasi 4 BG II	635	2664	1820	851	2209	816	2155	881	1504	21.1	43.0
RCH-2 BG II	824	1965	1208	878	1661	538	1643	646	1170	-4.9	11.3
NCS 207 BG II	358	2216	1131	575	1467	378	1520	910	1070	-12.8	1.7
BCHH 557 BG II	508	2445	2138	827	1949	531	1731	742	1359	9.8	29.2
Ankur Akka BG II	1192	2561	1852	862	1957	997	1901	910	1529	23.1	45.3
NCEH 14 (GFM)	865	2872	1303	691	1011	276	1106	546	1084	-11.6	3.0
Atal BG II	710	2780	1967	650	1927	1066	1612	887	1450	16.9	37.8
RCH 2 Bt (Bt check)	777	2566	1062	892	1496	786	1542	741	1233		
NHH 44 (Non Bt Check)	288	2698	1060	621	1216	679	1267	588	1052		
Local check Hybrid	282	2242	1177	707	1275	818	1335	628	1058		
NAVKAR 5 Bt	748	2608	921	713	1175	608	1483	916	1146	-6.8	9.0
CD @ 5%	47	262	384	0	354	116	518	95			
CV(%)	4	11	16	6	13	10	19	7			

Mean lint yield

Lint yield followed the same trend as that of mean seed cotton yield (Table 9).

Irrigated

The mean lint yield ranged from 441 to 725 kg/ha. As compared to the best check, eight test hybrids recorded higher lint yield ranging from 1 to 13 percent. They are:

Ankur Akka BG II (725 kg/ha; 13% increase), VICH 15 Bt (694 kg/ha; 8 % increase), Rudra Bt (693 Kg/ha; 8 % increase), Sudershan Bt (675 kg/ha; 5 % increase), IT 923 Bt (674 kg/ha; 5 % increase), Dhruv Bt (GFM) (671 kg/ha; 5 % increase), JKCH 666 Bt (668 kg/ha; 4 % increase), and Ankur Jai Bt (646 Kg/ha; 1 % increase)

Rainfed

The mean lint yield in the trials ranged from 349 to 539 kg/ha. As compared to the best check hybrid RCH2 Bt (415 kg/ha), 15 test hybrids recorded higher lint yield ranging from 7 to 30 per cent. They are:

Tulasi 4 BG II (539 kg/ha; 30% increase), Dhruv Bt (GFM) (537 kg/ha; 29% increase), Rudra Bt (526 kg/ha; 27 % increase), Sigma Bt (520 kg/ha; 25 % increase), Ankur Akka BG II (511 kg/ha; 23% increase), NCS 929 Bt (5 02 kg/ha; 21 % increase), Atal BG II (486 kg/ha; 17 % increase), BCHH 557 BG II (485 kg/ha; 17 % increase), IT 923 Bt (485 kg/ha; 17 % increase), Tulasi 9 Bt (484 kg/ha; 17 % increase), JKCH 666 Bt (483 kg/ha; 16 % increase), VICH 15 Bt (475 kg/ha; 14 % increase), Nandi 405 Bt (473 kg/ha; 14 % increase), Ankur Jai Bt (471 kg/ha; 14 % increase) and PCH 923 Bt (445 kg/ha; 7 % increase).

C. FIBRE QUALITY EVALUATION

Fibre Quality Evaluations were done location wise.

All the Bt cotton test entries were found to be superior to NHH 44 (Non Bt check) in 2.5 % span length. Several test hybrids were also superior to RCH2 Bt (Bt check). IT 923 Bt recorded the highest fibre length of 31.1 mm closely followed by NCS 929 Bt and Nandi 405 Bt with 30.9 mm (Table 10).

There was not much variation in U.R % which varied between 46.8 and 49.7 per cent only (Table 10). Micronaire varied from 3.6 to 4.3. The Bt entries did not vary significantly from the non Bt check hybrid in Micronaire (Table 11).

Fibre strength varied from 20.2 to 22.9 g/tex and was on par with the check hybrids whose strength varied from 20.5 to 20.9 g/tex (Table 11).

Table 9. Lint yield (kg/ha)															
Entry	Khandwa	Surat	Junagadh	Talod	Bhanswara	Mean (I)	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawanipatna	Mean (R)
VICH 15 Bt	806	697	1026	560	382	694	242	838	654	311	638	214	564	340	475
NCS 929 Bt	759	276	1228	451	476	638	290	777	703	254	707	283	615	382	502
Sigma Bt	893	464	1132	430	248	633	273	856	672	316	719	354	613	356	520
PCH 923 Bt	653	517	1036	348	344	580	157	892	544	261	506	235	651	313	445
KCH 135 Bt	900	196	997	433	289	563	278	589	611	127	565	199	552	275	400
BS 563 Bt	646	477	1067	581	280	610	242	730	501	181	414	141	426	227	358
Ankur Jai Bt	725	395	1285	506	321	646	273	794	548	302	620	339	587	305	471
Nandi 405 Bt	658	568	1199	406	360	638	329	675	586	263	565	319	717	326	473
IT 923 Bt	759	531	1260	472	347	674	344	868	689	235	575	287	635	246	485
Tulasi 9 Bt	558	569	861	481	349	564	288	908	443	309	675	346	566	337	484
Sudershan Bt	657	482	1320	432	484	675	323	668	468	260	457	244	614	264	412
Rudra Bt	763	464	1363	597	276	693	244	822	706	270	828	307	647	381	526
KDCHH 9821 Bt	634	477	1187	460	267	605	416	747	371	187	491	140	506	320	397
Dhruv Bt (GFM)	800	558	1165	461	371	671	377	692	766	325	720	344	729	342	537
JKCH 666 Bt	833	634	1144	489	241	668	427	990	442	255	569	303	579	296	483
Tulasi 4 BG II	791	484	880	479	228	572	249	876	701	277	814	284	774	338	539
RCH-2 BG II	727	255	810	351	283	485	303	621	405	338	646	182	566	234	412
NCS 207 BG II	400	349	869	315	270	441	132	700	406	187	475	142	535	341	365
BCHH 557 BG II	557	451	837	465	283	519	194	814	763	283	717	202	608	298	485
Ankur Akka BG II	870	623	1260	365	506	725	422	784	669	238	675	333	627	340	511
NCEH 14 (GFM)	683	445	773	465	250	523	341	985	479	236	356	110	413	220	392
Atal BG II	661	483	1062	445	438	618	256	831	698	211	676	379	524	315	486
RCH 2 Bt (Bt check)	886	413	773	334	226	527	278	793	357	304	525	271	536	255	415
NHH 44 (Non Bt Check)	840	279	1420	200	465	641	101	823	324	240	405	226	437	238	349
Local check Hybrid	714	267	1061	198	351	518	102	715	390	206	475	341	458	223	364
NAVkar 5 Bt	607	479	-	383	399	467	281	848	294	218	403	211	511	323	386
CD @ 5%		43	286	130	66		29			0	128	45	184		
CV(%)		6	16	19	12		6			6	14	11	19		

Table 10.

Entry	2.5 % Span Length (mm)							Uniformity Ratio						
	Khandwa	Surat	Indore	Bharuch	Akola	Nagpur	Mean	Khandwa	Surat	Indore	Bharuch	Akola	Nagpur	Mean
VICH 15 Bt	26.8	29.4	26.9	29.1	28.5	28.9	28.3	51.0	49.2	49.0	47.7	50.0	51.5	49.7
NCS 929 Bt	30.3	31.7	30.2	30.8	31.0	31.4	30.9	47.0	45.6	45.0	44.3	51.0	48.0	46.8
Sigma Bt	29.3	29.8	27.9	30.0	29.6	30.1	29.5	47.0	46.1	47.0	48.8	51.0	48.0	48.0
PCH 923 Bt	28.0	28.7	28.6	31.5	27.1	29.2	28.9	48.0	48.4	48.0	47.3	47.0	48.5	47.9
KCH 135 Bt	28.9	31.0	28.8	28.0	31.0	30.8	29.8	46.0	43.2	47.0	52.0	50.0	49.0	47.9
BS 563 Bt	25.5	28.2	28.9	29.2	30.5	27.0	28.2	51.0	46.2	48.0	51.5	51.0	49.0	49.5
Ankur Jai Bt	29.1	31.3	29.6	30.7	31.2	30.9	30.5	46.0	44.1	46.0	48.6	52.0	46.5	47.2
Nandi 405 Bt	29.3	32.1	29.1	32.4	32.0	30.2	30.9	48.0	45.9	46.0	48.2	52.0	48.0	48.0
IT 923 Bt	30.3	32.1	29.1	32.9	31.7	30.4	31.1	46.0	46.4	46.0	46.1	51.0	45.5	46.8
Tulasi 9 Bt	29.8	31.5	29.4	29.6	31.6	29.7	30.3	46.0	48.1	46.0	49.0	51.0	47.0	47.9
Sudershan Bt	28.8	30.4	28.5	27.5	29.1	29.1	28.9	49.0	47.0	49.0	48.9	51.0	48.0	48.8
Rudra Bt	28.7	31.1	27.9	30.9	31.3	30.8	30.1	48.0	47.8	46.0	47.1	48.0	49.5	47.7
KDCHH 9821 Bt	27.4	27.8	26.5	31.6	27.5	27.1	28.0	46.0	47.9	47.0	43.3	50.0	47.0	46.9
Dhruv Bt (GFM)	29.3	28.7	27.1	28.8	27.5	28.6	28.3	49.0	48.2	47.0	46.8	49.0	49.5	48.3
JKCH 666 Bt	29.1	29.9	25.8	32.4	27.6	27.6	28.7	47.0	47.8	48.0	47.7	49.0	49.5	48.2
Tulasi 4 BG II	29.1	32.2	28.3	32.3	27.0	29.4	29.7	47.0	45.0	45.0	43.3	50.0	51.5	47.0
RCH-2 BG II	29.3	30.9	27.9	25.3	30.0	28.4	28.6	45.0	47.4	46.0	50.2	51.0	49.5	48.2
NCS 207 BG II	29.1	31.6	28.9	27.9	29.8	30.5	29.6	48.0	46.5	44.0	50.4	50.0	44.5	47.2
BCHH 557 BG II	29.0	29.9	29.0	31.1	29.5	28.6	29.5	46.0	48.6	47.0	45.3	52.0	47.5	47.7
Ankur Akka BG II	31.4	32.8	29.1	29.1	31.3	30.9	30.8	48.0	46.3	46.0	50.2	51.0	48.0	48.3
NCEH 14 (GFM)	27.2	29.3	26.6	29.4	27.3	28.0	28.0	47.0	47.1	47.0	45.8	52.0	50.5	48.2
Atal BG II	30.7	31.8	28.4	30.0	32.4	29.9	30.5	46.0	44.9	47.0	48.5	51.0	46.5	47.3
RCH 2 Bt (Bt check)	29.4	29.2	27.4	28.5	29.1	29.2	28.8	48.0	47.1	47.0	49.2	49.0	50.0	48.4
NHH 44 (Non Bt Check)	26.1	27.6	24.2	28.5	24.4	24.2	25.8	47.0	46.5	49.0	50.9	48.0	49.5	48.5
Local check Hybrid	27.1	26.2	25.4	26.1	29.3	28.1	27.0	47.0	41.5	48.0	51.8	48.0	47.5	47.3
NAV KAR 5 Bt	25.6	26.4	25.4	29.7	25.4	27.5	26.7	48.0	47.4	47.0	44.7	51.0	50.5	48.1

Table 11.

Entry	Micronaire							Bundle Strength (g/tex)						
	Khandwa	Surat	Indore	Bharuch	Akola	Nagpur	Mean	Khandwa	Surat	Indore	Bharuch	Akola	Nagpur	Mean
VICH 15 Bt	4.8	3.6	3.7	4.9	4.3	4.3	4.3	21.3	21.6	21.9	21.1	19.8	23.0	21.5
NCS 929 Bt	4.2	2.9	3.6	4.6	3.9	3.9	3.9	22.0	23.4	23.0	22.3	22.8	24.1	22.9
Sigma Bt	4.1	3.0	3.8	4.3	3.8	4.1	3.9	21.8	22.8	21.1	23.2	21.8	22.8	22.3
PCH 923 Bt	4.1	3.5	4.3	4.4	4.6	4.8	4.3	22.2	21.4	21.6	22.6	19.8	22.6	21.7
KCH 135 Bt	4.3	3.2	3.6	4.6	4.3	3.9	4.0	21.0	20.1	20.4	21.6	20.6	23.1	21.1
BS 563 Bt	3.5	3.1	3.9	4.5	4.0	3.8	3.8	23.3	20.3	20.8	22.5	22.1	21.2	21.7
Ankur Jai Bt	4.4	3.1	4.0	4.6	4.9	4.5	4.3	21.2	21.7	21.8	22.3	20.7	22.6	21.7
Nandi 405 Bt	3.8	3.3	3.6	4.2	4.4	4.1	3.9	22.4	20.6	21.8	22.0	22.9	23.7	22.2
IT 923 Bt	4.3	3.8	3.6	4.4	4.0	4.1	4.0	22.0	23.0	20.7	23.0	23.2	21.9	22.3
Tulasi 9 Bt	4.0	3.3	3.6	4.5	4.5	3.9	4.0	23.0	22.8	22.1	22.1	20.8	21.3	22.0
Sudershan Bt	4.4	3.6	4.3	4.8	4.4	4.4	4.3	23.2	24.1	20.4	19.8	21.8	21.7	21.8
Rudra Bt	3.6	3.9	3.5	4.0	4.3	3.9	3.9	23.5	23.0	21.4	22.3	21.4	22.9	22.4
KDCHH 9821 Bt	3.9	4.1	3.8	4.0	5.4	3.6	4.1	21.2	22.6	21.2	21.4	19.8	21.0	21.2
Dhruv Bt (GFM)	4.2	4.1	4.0	4.2	5.0	4.5	4.3	23.7	22.7	20.1	20.8	19.3	23.4	21.7
JKCH 666 Bt	4.4	3.9	3.5	4.1	4.4	4.6	4.2	22.8	23.4	22.2	24.1	19.3	22.7	22.4
Tulasi 4 BG II	3.1	4.3	3.7	4.1	4.8	4.6	4.1	24.0	19.4	20.5	22.1	19.0	21.5	21.1
RCH-2 BG II	3.3	2.8	3.6	4.3	3.7	4.3	3.7	23.2	21.1	19.9	21.0	22.1	21.0	21.4
NCS 207 BG II	3.1	3.1	3.7	4.3	3.8	4.3	3.7	24.2	21.8	20.2	22.4	21.1	20.3	21.7
BCHH 557 BG II	3.6	4.3	3.5	4.4	4.7	4.0	4.1	21.7	21.4	22.2	21.9	20.3	21.4	21.5
Ankur Akka BG II	3.3	4.0	3.4	4.9	4.5	4.1	4.0	24.4	23.6	23.3	22.6	21.3	22.4	22.9
NCEH 14 (GFM)	3.8	4.1	3.7	3.7	4.8	4.6	4.1	20.4	19.3	19.9	22.2	19.0	20.5	20.2
Atal BG II	3.7	3.6	3.6	4.6	4.6	4.2	4.1	22.6	22.1	21.1	21.7	20.2	21.9	21.6
RCH 2 Bt (Bt check)	3.7	3.3	3.7	5.1	4.1	4.2	4.0	21.9	21.1	20.0	19.1	19.5	21.6	20.5
NHH 44 (Non Bt Check)	3.9	4.1	3.8	4.7	4.2	3.9	4.1	21.8	20.4	20.2	23.6	18.2	19.4	20.6
Local check Hybrid	4.0	2.6	3.7	4.2	4.1	3.9	3.8	22.5	19.5	21.9	19.7	20.0	21.8	20.9
NAVKAR 5 Bt	2.9	3.5	2.9	4.5	4.1	3.9	3.6	22.4	20.4	22.5	20.0	19.2	23.1	21.3

D. ENTOMOLOGICAL EVALUATION

1. EVALUATION UNDER PLANT PROTECTION (ETL BASED)

Sucking pests

i) Jassids

Jassid was the predominant sucking pest seen at all the test locations. However, the severity of the attack varied from center to center. Number of jassids /3 leaves was more at Khandwa and Bhavanipatna than at other centers. Mean number of jassids varied from 3.2 to 4.6/ 3 leaves (Table 12).

ii) White fly

White fly incidence was minimum during the cropping season. Several centers recorded less than 1 white fly / 3 leaves. Maximum incidence was seen at Surat, Junagadh, Indore and Bharuch. However, the mean number of whitefly / 3 leaves across different locations ranged from 2.1 to 3.3 only (Table 13).

iii) Thrips

Thrips incidence was heavy at Surat, Indore, Akola, Nanded and Parbhani for a brief period of time. The thrips population was low at other centers. There was not much variation in thrips damage between Bt and non Bt hybrids (Table 14).

iv) Aphids

Aphid population was maximum at Khandwa and Junagadh, moderate at Banswara, Indore and Akola and low at other centers. The maximum mean population was noted in the non Bt local check hybrids. There was not much variation among the hybrids for mean Aphid population (Table 15).

Natural Enemies

The natural enemies generally observed in the field were Coccinellid grub and adults, spiders and Chrysopa sp. Maximum natural enemies population was observed at Nagpur and Junagadh. At other centers, it was low and sporadic. There was no discernible difference between the non Bt check hybrids and the other Bt entries in harboring natural enemies (Table 16).

Boll worms

Larval population of *Earias spp* was very low at all the centers except Khandwa. The larval population of *Earias spp* in NHH 44 (cc) varied from 1.8 to 17.3 and that of local check hybrid from 1.2 to 8.8. The population of *Earias* larvae varied from 2.7 to 8.4 in Khandwa. But at other centers it was very low and varied from 0 to 3.8 only. The mean values also indicated that the Bt check hybrids recorded 2 to 3 times less larvae as compared to the check hybrids (Table 17).

Table 12. Mean number of Jassid nymphs/3 leaves/plant

Entry	Khandwa	Surat	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawaniapatna	Mean
VICH 15 Bt	6.4	2.9	4.3	1.0	7.9	1.5	2.4	5.9	0.6	2.6	1.5	2.3	4.2	3.3
NCS 929 Bt	7.0	3.5	5.7	0.4	9.7	1.1	2.1	5.9	0.6	2.4	2.0	1.6	3.7	3.5
Sigma Bt	6.6	3.1	5.4	2.1	9.2	2.2	2.4	5.0	0.7	2.5	2.3	1.5	4.3	3.6
PCH 923 Bt	7.4	3.9	5.5	2.3	10.4	1.3	2.2	5.5	0.7	2.5	1.7	1.6	3.4	3.7
KCH 135 Bt	6.8	3.6	7.0	0.7	8.2	2.9	1.9	5.9	0.5	2.1	1.7	2.1	4.4	3.7
BS 563 Bt	6.1	3.7	5.3	2.3	8.8	1.3	2.2	6.5	0.7	2.5	2.8	1.6	3.3	3.6
Ankur Jai Bt	5.6	3.6	3.6	2.8	12.3	2.3	1.8	5.5	0.6	2.8	3.1	1.8	4.2	3.8
Nandi 405 Bt	6.3	2.3	6.9	2.6	10.6	1.2	3.6	5.0	0.7	2.2	3.0	1.7	3.4	3.8
IT 923 Bt	6.7	2.6	5.9	1.6	9.3	2.1	3.9	5.4	0.6	2.5	2.3	1.5	3.6	3.7
Tulasi 9 Bt	6.4	2.8	5.9	0.9	9.5	1.2	2.1	4.9	0.5	2.4	2.9	1.7	3.8	3.5
Sudershan Bt	6.4	2.2	4.2	2.4	7.1	1.9	2.0	5.1	0.5	2.5	2.2	1.3	3.4	3.2
Rudra Bt	7.3	3.3	5.9	0.8	4.5	1.4	1.9	5.6	0.5	2.2	2.4	1.6	3.7	3.2
KDCHH 9821 Bt	6.4	3.4	6.5	0.9	4.8	1.3	3.8	6.1	0.6	2.1	2.9	1.8	4.8	3.5
Dhruv Bt (GFM)	7.4	2.6	5.5	1.1	4.5	1.1	3.6	4.2	0.5	2.7	2.8	1.5	3.1	3.1
JKCH 666 Bt	6.4	2.3	6.1	0.6	12.0	1.4	4.0	5.3	0.6	2.4	2.1	1.5	4.5	3.8
Tulasi 4 BG II	6.3	2.1	6.9	0.9	6.3	1.5	2.2	5.3	0.5	2.4	2.9	1.5	3.3	3.3
RCH-2 BG II	6.2	2.5	10.0	0.2	12.9	3.3	2.2	7.5	0.6	2.5	1.8	2.0	5.5	4.4
NCS 207 BG II	5.6	1.8	6.4	2.6	10.5	3.1	3.9	6.0	0.6	2.1	2.1	1.7	3.9	3.9
BCHH 557 BG II	6.9	2.9	6.8	1.5	10.8	3.5	2.2	5.0	0.6	2.4	1.8	1.8	3.8	3.9
Ankur Akka BG II	7.6	2.0	6.6	3.5	9.8	2.2	3.8	5.1	0.6	2.6	1.6	1.6	2.2	3.8
NCEH 14 (GFM)	6.6	2.0	9.3	0.5	13.1	3.1	4.2	7.7	0.6	2.3	2.3	2.3	5.1	4.6
Atal BG II	6.5	1.9	6.3	2.7	5.0	3.8	4.1	5.6	0.7	2.8	1.9	1.5	3.2	3.5
RCH 2 Bt (Bt check)	6.5	3.1	7.7	1.5	13.5	3.3	1.9	7.3	0.5	2.4	2.3	2.3	4.8	4.4
NHH 44 (Non Bt Check)	7.5	2.7	4.2	0.7	9.9	1.8	1.6	5.0	0.6	3.5	1.9	1.3	3.0	3.4
Local check Hybrid	6.4	4.4	6.7	1.5	10.2	1.4	4.1	4.4	0.5	2.3	2.9	1.5	3.0	3.8
NAVkar 5 Bt	6.8	2.6	-	1.3	10.3	1.8	3.6	5.1	0.5	2.9	1.8	1.6	2.9	3.4

Table 13. Mean number of Whitefly adults/3leaves/plant

Entry	Khandwa	Surat	Junagadh	Talod	Indore	Bharuch	Akola	Nanded	Parbhani	Bhawanipatna	Mean
VICH 15 Bt	0.4	6.9	4.9	0.3	4.6	4.5	1.7	1.9	1.9	0.0	2.7
NCS 929 Bt	0.7	2.7	4.9	0.3	4.4	4.2	1.7	2.6	0.8	0.1	2.2
Sigma Bt	0.5	3.5	4.8	0.2	4.4	5.1	1.4	2.0	1.3	0.1	2.3
PCH 923 Bt	0.3	5.6	3.7	0.2	5.1	4.4	1.6	2.1	1.2	0.0	2.4
KCH 135 Bt	0.7	1.9	4.7	0.3	4.5	4.6	1.7	2.1	0.9	0.3	2.2
BS 563 Bt	0.4	2.5	5.1	0.5	4.2	4.6	1.7	2.1	1.2	0.1	2.2
Ankur Jai Bt	0.4	7.6	7.3	0.3	5.0	6.0	1.8	2.6	1.6	0.2	3.3
Nandi 405 Bt	0.3	1.7	4.1	0.2	4.4	4.3	1.7	2.0	1.8	0.2	2.1
IT 923 Bt	0.3	3.6	5.3	0.2	4.8	3.8	1.6	2.2	1.6	0.1	2.4
Tulasi 9 Bt	0.8	7.8	4.8	0.2	4.7	4.6	1.5	2.2	1.8	0.1	2.9
Sudershan Bt	0.3	9.6	6.7	0.3	5.4	4.3	1.6	2.0	1.3	0.0	3.1
Rudra Bt	0.6	4.9	4.8	0.4	4.8	5.7	1.7	2.1	1.9	0.0	2.7
KDCHH 9821 Bt	0.3	3.4	4.9	0.4	5.3	4.1	1.8	2.0	1.7	0.1	2.4
Dhruv Bt (GFM)	0.6	3.6	4.4	0.1	4.7	4.3	1.6	2.1	2.0	0.0	2.3
JKCH 666 Bt	0.4	2.8	4.6	0.2	4.4	3.8	1.8	2.9	1.1	0.0	2.2
Tulasi 4 BG II	0.4	4.2	5.2	0.2	5.0	5.7	1.6	1.9	1.5	0.0	2.6
RCH-2 BG II	0.5	2.8	4.7	0.4	4.4	4.2	1.5	2.0	1.0	0.2	2.1
NCS 207 BG II	0.6	4.8	4.1	0.2	4.7	3.7	1.8	2.1	1.2	0.1	2.3
BCHH 557 BG II	0.5	6.5	3.9	0.2	5.4	3.8	1.5	2.3	1.1	0.0	2.5
Ankur Akka BG II	0.2	7.4	4.7	0.3	5.0	5.6	1.7	2.5	0.5	0.0	2.8
NCEH 14 (GFM)	0.4	5.9	4.3	0.2	6.1	3.6	1.6	2.1	1.5	0.1	2.6
Atal BG II	0.3	5.8	5.2	0.4	4.4	3.9	1.8	2.8	1.6	0.1	2.6
RCH 2 Bt (Bt check)	0.4	2.7	4.7	0.4	4.5	5.6	1.7	2.4	0.9	0.1	2.3
NHH 44 (Non Bt Check)	0.4	6.6	4.3	0.5	4.1	3.8	1.7	2.6	0.9	0.0	2.5
Local check Hybrid	0.3	9.9	4.5	0.3	4.4	4.5	1.7	2.2	1.7	0.0	2.9
NAVKAR 5 Bt	0.5	6.0		0.2	5.7	5.8	1.7	2.8	1.1	0.0	2.6

Table 14. Thrips/ plant

Entry	Khandwa	Surat	Junagadh	Talod	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawanipatna	Mean
VICH 15 Bt	0.9	13.3	4.6	0.1	7.9	4.1	18.9	0.4	23.9	18.2	3.4	0.6	8.0
NCS 929 Bt	0.8	6.1	5.3	0.2	7.2	4.1	17.0	0.4	25.8	19.6	3.7	0.6	7.6
Sigma Bt	0.5	7.1	5.1	0.2	8.2	4.8	17.5	0.5	22.6	18.8	3.4	0.4	7.4
PCH 923 Bt	0.9	6.5	6.4	0.1	7.6	4.1	18.3	0.4	23.6	18.4	3.0	0.5	7.5
KCH 135 Bt	0.5	10.2	6.0	0.1	8.8	4.1	18.2	0.4	23.4	19.3	2.6	0.6	7.8
BS 563 Bt	0.6	9.9	5.7	0.2	7.8	3.9	18.8	0.4	32.1	19.2	3.4	0.5	8.6
Ankur Jai Bt	0.9	8.5	5.8	0.3	6.9	5.7	17.9	0.4	24.4	20.7	3.3	0.5	7.9
Nandi 405 Bt	1.2	10.5	5.8	0.5	8.0	4.1	18.5	0.4	24.4	19.3	2.8	0.6	8.0
IT 923 Bt	0.6	12.1	6.2	0.0	9.4	4.0	17.5	0.4	21.0	20.9	3.1	0.6	8.0
Tulasi 9 Bt	1.1	10.3	5.8	0.1	7.6	4.5	17.5	0.4	23.9	19.5	2.8	0.4	7.8
Sudershan Bt	0.8	7.1	5.5	0.0	9.2	4.0	19.3	0.4	24.3	20.1	3.1	0.5	7.8
Rudra Bt	0.6	7.9	7.2	0.0	8.1	5.5	19.3	0.4	21.2	21.6	3.2	0.5	8.0
KDCHH 9821 Bt	1.5	7.7	5.7	0.1	7.9	5.9	16.1	0.4	23.1	22.6	3.2	0.5	7.9
Dhruv Bt (GFM)	0.4	10.5	5.8	0.0	8.7	5.9	18.0	0.5	23.8	21.8	2.9	0.4	8.2
JKCH 666 Bt	0.8	17.3	5.4	0.0	7.9	4.7	19.1	0.4	22.0	18.3	2.6	0.6	8.3
Tulasi 4 BG II	1.1	15.8	6.0	0.4	8.1	3.9	18.9	0.4	26.2	18.4	2.9	0.4	8.5
RCH-2 BG II	0.9	13.9	7.5	0.0	6.5	4.5	17.7	0.5	23.8	17.5	2.2	0.5	7.9
NCS 207 BG II	0.3	15.9	6.0	0.1	7.7	4.5	17.5	0.5	26.7	19.9	2.8	0.4	8.5
BCHH 557 BG II	0.7	14.2	6.0	0.2	8.0	4.8	18.7	0.5	23.7	18.2	3.1	0.7	8.2
Ankur Akka BG II	0.4	12.2	6.5	0.1	7.4	3.8	16.5	0.5	27.1	17.7	2.8	0.6	8.0
NCEH 14 (GFM)	0.8	13.4	7.3	0.6	9.5	3.8	17.4	0.5	22.3	21.6	2.5	0.3	8.3
Atal BG II	0.6	12.1	6.4	0.0	7.6	4.8	18.3	0.4	21.0	18.0	3.7	0.3	7.8
RCH 2 Bt (Bt check)	0.6	11.1	6.1	0.2	10.1	4.4	15.6	0.5	22.9	19.4	2.2	0.5	7.8
NHH 44 (Non Bt Check)	0.5	14.0	6.3	0.0	7.8	5.6	20.3	0.5	24.3	19.7	3.7	0.4	8.6
Local check Hybrid	0.4	14.5	7.0	0.1	8.5	3.9	19.7	0.4	22.4	23.2	3.1	0.5	8.6
NAVKAR 5 Bt	1.1	18.4		0.1	9.4	4.5	18.9	0.5	21.2	18.2	3.5	0.4	8.7

Table 15. Aphid/ plant

Entry	Khandwa	Junagadh	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Bhawaniapatna	Mean
VICH 15 Bt	39.0	34.3	15.3	12.2	4.8	18.3	8.8	6.4	9.1	3.8	15.2
NCS 929 Bt	35.8	30.6	11.0	14.4	3.9	16.5	9.5	5.5	9.7	6.5	14.3
Sigma Bt	31.4	27.1	6.2	12.8	4.6	12.1	9.1	5.7	8.1	5.3	12.2
PCH 923 Bt	34.7	31.6	5.3	10.6	4.4	16.1	8.9	5.8	10.0	5.6	13.3
KCH 135 Bt	29.7	24.6	7.9	13.2	4.2	17.1	9.3	5.2	9.4	8.6	12.9
BS 563 Bt	30.3	37.8	10.9	11.0	4.4	17.9	9.2	6.1	14.5	6.7	14.9
Ankur Jai Bt	29.0	31.8	14.2	16.1	5.7	14.6	8.5	6.4	10.6	4.8	14.2
Nandi 405 Bt	31.4	37.5	12.4	13.2	5.6	18.9	9.2	5.9	10.1	5.2	15.0
IT 923 Bt	26.8	41.5	14.0	12.0	4.4	13.6	9.0	5.8	9.8	9.1	14.6
Tulasi 9 Bt	24.3	38.2	5.4	12.3	4.0	18.2	9.0	6.4	12.5	8.2	13.9
Sudershan Bt	29.7	39.6	12.8	16.8	6.1	18.1	8.1	5.4	11.0	7.5	15.5
Rudra Bt	33.3	34.3	15.0	10.5	4.7	14.3	8.3	6.0	8.6	5.6	14.0
KDCHH 9821 Bt	31.3	37.1	17.7	17.2	4.6	16.7	9.8	5.8	18.2	6.0	16.4
Dhruv Bt (GFM)	31.3	35.3	17.8	11.4	4.0	14.8	9.8	6.1	6.4	5.4	14.2
JKCH 666 Bt	25.1	32.2	11.5	16.6	3.9	15.1	9.2	6.5	8.9	7.4	13.6
Tulasi 4 BG II	31.7	24.7	14.5	10.9	3.9	17.0	9.0	5.6	10.5	7.2	13.5
RCH-2 BG II	32.1	30.7	12.5	11.1	3.1	10.7	9.0	6.2	7.4	8.6	13.1
NCS 207 BG II	27.8	31.3	13.9	16.7	3.6	12.5	9.2	5.3	12.9	5.8	13.9
BCHH 557 BG II	28.3	22.2	13.2	10.1	4.2	10.5	8.3	6.5	9.9	8.1	12.1
Ankur Akka BG II	33.7	23.6	11.4	13.6	6.0	16.3	8.5	6.3	6.0	6.7	13.2
NCEH 14 (GFM)	25.4	33.2	15.1	12.5	3.8	11.6	8.9	5.7	17.5	5.6	13.9
Atal BG II	31.9	32.6	4.9	11.1	5.9	12.7	9.3	6.4	6.4	9.9	13.1
RCH 2 Bt (Bt check)	29.5	31.9	12.4	11.5	3.7	14.9	9.5	5.9	11.9	5.3	13.7
NHH 44 (Non Bt Check)	32.9	20.0	14.5	17.9	4.0	13.5	8.8	6.4	10.2	5.4	13.4
Local check Hybrid	29.1	36.9	15.3	17.5	5.8	19.1	9.5	5.8	12.4	7.6	15.9
NAV KAR 5 Bt	36.9		13.6	14.2	4.4	15.7	9.5	5.7	7.9	6.0	12.6

Table 16. Mean number of Predators/5 plants

Entry	Khandwa	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Nanded	Parbhani	Nagpur	Bhawanipatna	Mean
VICH 15 Bt	2.9	7.3	1.3	1.3	2.0	3.6	1.1	0.2	0.6	13.8	2.1	3.3
NCS 929 Bt	2.6	8.0	0.4	1.2	2.6	2.6	1.3	0.1	0.9	15.6	2.5	3.4
Sigma Bt	2.6	7.0	0.9	1.2	0.8	2.9	0.8	0.2	0.7	14.3	1.3	3.0
PCH 923 Bt	2.8	7.7	0.7	1.3	1.6	2.9	1.2	0.1	0.9	16.2	1.5	3.3
KCH 135 Bt	2.6	8.3	1.0	1.2	1.8	3.3	1.2	0.1	1.0	16.2	1.3	3.4
BS 563 Bt	3.1	7.0	0.9	1.2	4.0	2.8	1.2	0.1	2.0	12.5	1.1	3.3
Ankur Jai Bt	2.7	7.3	0.8	1.3	4.5	3.5	1.2	0.1	0.9	14.8	2.1	3.6
Nandi 405 Bt	3.3	7.7	1.5	1.2	2.1	3.3	1.2	0.2	0.7	13.3	1.3	3.3
IT 923 Bt	3.2	7.3	0.7	1.3	2.2	2.5	1.2	0.1	1.1	16.3	2.0	3.5
Tulasi 9 Bt	3.6	7.3	0.4	1.2	1.5	2.2	1.1	0.1	1.4	14.4	1.7	3.2
Sudershan Bt	3.1	7.7	1.1	1.2	4.4	3.3	1.1	0.1	0.9	13.5	2.4	3.5
Rudra Bt	3.3	7.0	0.6	2.2	1.6	3.6	1.0	0.1	1.1	14.6	2.4	3.4
KDCHH 9821 Bt	3.6	7.7	0.5	1.2	4.8	3.0	1.2	0.1	1.2	13.4	1.2	3.4
Dhruv Bt (GFM)	3.1	6.7	0.5	1.3	2.7	3.1	1.2	0.1	0.6	12.6	1.0	3.0
JKCH 666 Bt	3.0	7.7	0.3	1.3	4.6	2.6	1.2	0.1	0.8	14.9	1.4	3.4
Tulasi 4 BG II	3.5	7.0	1.0	1.3	2.7	3.5	1.1	0.1	0.9	17.7	1.5	3.7
RCH-2 BG II	3.1	7.7	0.7	1.3	2.0	2.1	1.3	0.1	1.1	13.3	2.1	3.1
NCS 207 BG II	2.6	7.3	0.6	1.3	3.5	2.0	1.2	0.1	0.4	19.5	1.2	3.6
BCHH 557 BG II	3.3	7.7	0.4	2.1	1.7	2.3	1.0	0.1	0.6	14.4	1.7	3.2
Ankur Akka BG II	2.8	7.0	0.4	1.3	0.9	3.9	1.1	0.1	0.7	13.9	1.7	3.1
NCEH 14 (GFM)	2.9	7.7	0.7	1.2	2.6	2.8	1.2	0.1	0.7	11.7	3.2	3.2
Atal BG II	3.3	7.0	1.0	1.3	1.5	3.3	1.2	0.2	0.6	13.9	1.5	3.2
RCH 2 Bt (Bt check)	2.5	7.3	0.7	1.2	2.0	2.8	1.4	0.2	1.0	17.7	1.8	3.5
NHH 44 (Non Bt Check)	2.8	7.3	1.2	1.3	4.5	2.6	1.0	0.2	0.6	14.5	1.9	3.5
Local check Hybrid	1.4	7.0	1.2	1.2	5.0	3.1	1.3	0.3	1.1	13.4	1.7	3.3
NAVKAR 5 Bt	2.4		0.8	1.2	1.6	3.5	1.1	0.1	0.6	16.6	1.5	2.9

Table 17. Spotted bollworm, Earias spp- (No of Larvae / 5plants)

Entry	Khandwa	Surat	Junagadh	Talod	Indore	Akola	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	5.6	0.0	0.3	0.0	1.7	1.3	1.1	0.0	1.0	1.2
NCS 929 Bt	5.5	0.0	0.2	0.0	1.8	0.0	1.4	0.0	1.0	1.1
Sigma Bt	5.1	0.0	0.3	0.0	1.5	0.3	2.3	0.0	0.4	1.1
PCH 923 Bt	6.2	0.0	0.2	0.0	1.8	2.4	1.4	0.3	0.6	1.4
KCH 135 Bt	4.9	0.0	0.2	0.0	1.6	0.4	1.5	0.0	1.1	1.1
BS 563 Bt	6.6	0.1	0.3	0.0	1.5	0.6	3.2	0.0	0.9	1.5
Ankur Jai Bt	5.7	0.0	0.3	0.0	2.0	1.0	1.5	0.0	0.8	1.2
Nandi 405 Bt	5.5	0.0	0.2	0.0	1.4	0.5	1.5	0.0	1.1	1.1
IT 923 Bt	3.3	0.1	0.3	0.0	1.0	0.4	1.3	0.0	0.8	0.8
Tulasi 9 Bt	8.0	0.0	0.2	0.0	1.9	0.8	1.6	0.0	0.7	1.5
Sudershan Bt	2.7	0.0	0.4	0.0	0.7	0.6	1.3	0.0	0.8	0.7
Rudra Bt	4.3	0.0	0.3	0.0	1.9	0.0	1.4	0.0	0.3	0.9
KDCHH 9821 Bt	3.9	0.0	0.3	0.0	1.6	1.1	3.8	0.0	1.3	1.3
Dhruv Bt (GFM)	8.4	0.0	0.3	0.0	1.4	1.1	0.8	0.0	1.1	1.5
JKCH 666 Bt	5.2	0.0	0.3	0.0	1.1	0.2	1.2	0.0	1.2	1.0
Tulasi 4 BG II	5.6	0.1	0.2	0.1	1.3	0.2	1.5	0.0	0.9	1.1
RCH-2 BG II	7.3	0.0	0.2	0.0	1.2	0.0	1.3	0.0	1.1	1.2
NCS 207 BG II	5.4	0.0	0.3	0.0	1.2	0.4	3.4	0.3	1.1	1.3
BCHH 557 BG II	6.3	0.0	0.2	0.0	0.8	2.9	1.3	0.0	0.5	1.3
Ankur Akka BG II	5.9	0.0	0.2	0.0	1.1	1.1	0.9	0.0	0.4	1.1
NCEH 14 (GFM)	7.2	0.1	0.3	0.0	1.4	0.6	3.6	0.0	0.6	1.5
Atal BG II	7.4	0.0	0.4	0.0	1.1	0.3	0.9	0.0	0.5	1.2
RCH 2 Bt (Bt check)	7.5	0.0	0.2	0.0	1.2	0.8	1.9	0.0	1.3	1.4
NHH 44 (Non Bt Check)	3.8	1.8	2.3	2.0	1.2	17.3	4.4	1.7	1.3	4.0
Local check Hybrid	6.8	1.8	3.2	1.5	1.2	8.8	3.1	0.6	1.2	3.1
NAVkar 5 Bt	8.3	0.6		0.0	1.1	0.3	1.4	0.3	1.1	1.6

Helicoverpa armigera was either absent or negligible in number. Even on the non Bt check hybrids, the mean larval population recorded was only 1.3 larvae / 5 plants. As against this, the Bt hybrids recorded 0.3 to 0.5 larvae / 5 plants (Table 18).

Pink boll worm larval population on non Bt Check hybrids was almost nil at Indore and Talod (Table 19). At other centers, it varied from 0.8 to 16.3 larvae/20 bolls. Maximum pink boll worm larvae was observed at Khandwa and was on par with the damage on Bt cotton hybrids. Similarly, at Banswara also, several Bt cotton hybrids recorded more pink boll worm damage than the non Bt check hybrids. The mean pink boll worm damage on Bt test entries varied from 1.5 to 2.4.

Percent Square damage

Square damage was more at Banswara, Bharuch and Khandwa than at other centers (Table 20). Several test hybrids at these locations recorded more square damage than the non Bt check hybrids. At Surat, Junagadh and Talod, the non Bt check hybrids recorded appreciable amount of square damage. The Bt test hybrids at these locations recorded very low square damage. At Indore, Parbhani and Nagpur, all the entries including the non Bt check hybrids recorded low square damage. The mean square damage in the non Bt check hybrids ranged from 7.2 to 7.7 per cent and all the Bt entries, including the Bt check hybrid, showed lesser square damage, indicating the effectiveness of Bt gene in reducing the square damage due to boll worms.

Pink boll worm damage

Pink bollworm damage was assessed by destructive sampling of green bolls. In general, the non Bt check hybrids recorded more green boll damage than the Bt hybrids (Table 21). The non Bt check hybrid NHH 44 recorded the highest mean boll damage of 6.6 percent. The Bt entries recorded a mean boll damage of 3 to 4 per cent only.

Open boll and locule damage

At harvest, the open boll and locule damage was studied. The mean open boll damage ranged from 21 to 23 per cent in non Bt Check hybrids (Table 22). The Bt check hybrid RCH 2 Bt recorded a mean damage of 8.3 per cent. The open boll damage of all the Bt test entries was on par with the Bt check hybrid and varied from 6.3 to 8.7 per cent.

The same trend was observed in locule damage also (Table 23). All the Bt hybrids recorded significantly lower locule damage than in the case of non Bt check hybrids, indicating the effectiveness of Bt gene in reducing boll damage due to boll worms.

Plant Protection

Jassids, Aphids and Thrips were seen throughout the cropping season, though at different crop growth periods and at varying intensities. Individual reaction to these pests also varied at different locations. Hence, the number of chemical interventions required to control the sucking pests also differed depending on the genotype and location. In general, two to three spraying were required to control the sucking pest. At Surat, as much as seven rounds sprayings were required to control the sucking pests (Table 24). At Bhawanipatna, minimum intervention was required.

Table 18. No of Helicoverpa Larvae / 5plants

Entry	Surat	Junagadh	Talod	Akola	Parbhani	Nagpur	Bhawanipatna	Mean
VICH 15 Bt	0.2	0.4	0.0	0.0	1.0	0.0	0.7	0.3
NCS 929 Bt	0.0	0.4	0.0	0.0	1.0	0.0	0.7	0.3
Sigma Bt	0.0	0.4	0.0	0.1	0.8	0.0	0.7	0.3
PCH 923 Bt	0.3	0.3	0.0	0.1	1.0	0.0	0.7	0.3
KCH 135 Bt	0.0	0.4	0.0	0.0	1.0	0.0	0.8	0.3
BS 563 Bt	0.2	0.4	0.0	0.1	1.3	0.0	0.7	0.4
Ankur Jai Bt	0.1	0.4	0.0	0.1	0.9	0.0	0.9	0.3
Nandi 405 Bt	0.0	0.4	0.0	0.0	1.0	0.2	0.7	0.3
IT 923 Bt	0.3	0.3	0.0	0.0	1.0	0.0	1.3	0.4
Tulasi 9 Bt	0.2	0.4	0.1	0.0	1.0	0.0	1.3	0.4
Sudershan Bt	0.3	0.4	0.0	0.0	0.9	0.2	1.4	0.5
Rudra Bt	0.0	0.3	0.0	0.0	0.9	0.0	1.5	0.4
KDCHH 9821 Bt	0.2	0.4	0.0	0.0	1.3	0.0	1.3	0.5
Dhruv Bt (GFM)	0.1	0.3	0.0	0.0	0.5	0.0	1.4	0.3
JKCH 666 Bt	0.1	0.4	0.0	0.0	1.0	0.0	1.4	0.4
Tulasi 4 BG II	0.1	0.4	0.0	0.0	1.0	0.0	0.7	0.3
RCH-2 BG II	0.0	0.3	0.0	0.0	1.0	0.0	0.8	0.3
NCS 207 BG II	0.0	0.4	0.0	0.0	1.4	0.0	0.9	0.4
BCHH 557 BG II	0.0	0.4	0.0	0.0	1.0	0.0	0.8	0.3
Ankur Akka BG II	0.0	0.4	0.0	0.0	0.4	0.4	0.7	0.3
NCEH 14 (GFM)	0.7	0.4	0.0	0.0	1.3	0.0	0.7	0.4
Atal BG II	0.0	0.3	0.0	0.0	0.5	0.0	0.7	0.2
RCH 2 Bt (Bt check)	0.1	0.4	0.0	0.0	1.1	0.0	0.7	0.3
NHH 44 (Non Bt Check)	2.0	2.3	0.9	0.1	1.4	1.5	1.0	1.3
Local check Hybrid	2.3	3.4	0.8	0.2	1.4	0.6	0.7	1.3
NAVKAR 5 Bt	1.1		0.0	0.0	0.9	0.0	0.7	0.5

Table 19. Mean number of PBW larvae/20 green bolls

Entry	Khandwa	Surat	Junagadh	Talod	Banswara	Indore	Akola	Achalpur	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	8.8	0.0	1.0	0.0	3.6	0.1	1.0	1.2	1.3	1.3	0.5	1.7
NCS 929 Bt	9.1	0.0	1.0	0.0	6.0	0.2	2.5	0.3	1.2	0.7	0.8	2.0
Sigma Bt	9.2	0.0	1.0	0.0	4.0	0.0	2.8	0.0	0.8	0.7	0.8	1.7
PCH 923 Bt	8.9	0.0	1.0	0.0	3.8	0.0	6.3	0.5	1.7	1.6	0.8	2.2
KCH 135 Bt	8.9	0.0	1.0	0.0	4.3	0.0	1.8	0.3	1.4	2.4	0.4	1.9
BS 563 Bt	9.3	0.0	0.7	0.0	4.7	0.1	4.0	0.2	0.9	1.3	1.0	2.0
Ankur Jai Bt	9.3	0.0	0.7	0.0	7.4	0.0	4.0	0.8	1.2	1.1	0.4	2.3
Nandi 405 Bt	9.2	0.0	0.7	0.0	5.2	0.0	1.8	0.5	0.9	0.4	1.3	1.8
IT 923 Bt	9.2	0.0	0.3	0.0	3.4	0.3	2.2	1.0	1.6	1.1	1.2	1.8
Tulasi 9 Bt	9.3	0.0	1.0	0.0	4.6	0.0	4.5	0.8	1.1	2.2	1.1	2.2
Sudershan Bt	9.6	0.0	0.7	0.0	3.1	0.0	2.8	0.5	1.8	0.9	0.9	1.8
Rudra Bt	8.6	0.0	0.7	0.0	3.0	0.1	2.3	0.2	1.3	1.6	1.1	1.7
KDCHH 9821 Bt	8.7	0.0	1.0	0.0	2.9	0.2	3.5	0.5	1.8	0.4	0.4	1.8
Dhruv Bt (GFM)	8.8	0.0	0.3	0.0	3.3	0.2	1.0	0.3	1.2	0.7	0.9	1.5
JKCH 666 Bt	8.7	0.0	1.0	0.0	5.6	0.0	1.7	0.7	1.1	2.7	1.1	2.0
Tulasi 4 BG II	9.3	0.0	0.7	0.0	2.7	0.0	1.0	0.2	1.1	0.9	0.9	1.5
RCH-2 BG II	8.8	0.0	0.3	0.0	6.8	0.1	1.8	0.5	0.6	1.8	0.7	1.9
NCS 207 BG II	9.4	0.0	1.0	0.0	4.0	0.0	3.2	0.3	0.9	3.6	0.9	2.1
BCHH 557 BG II	8.8	0.0	1.7	0.0	6.8	0.0	2.8	0.8	1.4	0.2	1.3	2.2
Ankur Akka BG II	9.6	0.0	0.7	0.0	6.4	0.1	2.8	0.5	1.8	3.6	1.1	2.4
NCEH 14 (GFM)	9.3	0.0	1.7	0.0	7.6	0.1	2.5	0.3	1.6	0.9	0.6	2.2
Atal BG II	9.3	0.0	1.0	0.0	2.7	0.1	0.5	0.2	1.2	2.0	1.3	1.7
RCH 2 Bt (Bt check)	9.3	0.0	1.0	0.0	7.8	0.1	2.5	0.7	1.6	1.1	1.1	2.3
NHH 44 (Non Bt Check)	9.4	1.3	3.7	0.0	4.3	0.1	16.3	0.8	1.4	6.4	1.5	4.1
Local check Hybrid	8.7	1.7	5.3	0.0	4.8	0.0	16.0	1.0	0.8	9.3	0.8	4.4
NAVkar 5 Bt	9.4	0.0		0.0	4.9	0.0	0.8	0.3	0.9	0.7	0.9	1.8

Table 20. Per cent square damage

Entry	Khandwa	Surat	Junagadh	Talod	Banswara	Indore	Bharuch	Nanded	Parbhani	Nagpur	Mean
VICH 15 Bt	7.6	0.4	1.7	3.0	8.8	1.9	15.5	3.1	0.7	0.1	4.3
NCS 929 Bt	6.8	0.0	1.7	0.0	9.0	1.9	7.8	3.4	0.7	0.3	3.2
Sigma Bt	7.7	0.2	1.8	0.0	7.7	1.8	9.7	2.6	1.3	0.3	3.3
PCH 923 Bt	8.2	1.1	1.8	4.7	8.6	1.3	12.5	3.0	0.7	0.7	4.3
KCH 135 Bt	6.6	0.2	2.0	0.0	6.8	1.6	11.9	3.6	0.8	0.2	3.4
BS 563 Bt	8.2	1.2	1.8	0.0	11.2	1.2	18.6	3.5	1.4	0.2	4.7
Ankur Jai Bt	7.5	0.2	1.6	0.0	10.4	2.0	23.4	2.8	0.9	0.1	4.9
Nandi 405 Bt	6.2	0.4	1.9	0.0	8.1	1.3	25.7	2.7	0.8	0.5	4.8
IT 923 Bt	5.9	1.3	1.8	1.7	9.4	1.0	21.1	3.0	1.2	0.3	4.7
Tulasi 9 Bt	9.0	1.4	1.9	3.3	6.6	2.0	21.7	3.2	1.4	0.9	5.1
Sudershan Bt	4.8	0.9	1.8	0.0	6.5	1.0	10.2	3.5	0.8	0.3	3.0
Rudra Bt	6.1	0.3	1.8	0.0	7.4	1.9	16.0	3.1	1.1	0.2	3.8
KDCHH 9821 Bt	6.2	0.2	1.9	1.6	6.8	1.4	20.4	3.0	1.1	0.2	4.3
Dhruv Bt (GFM)	8.4	1.2	2.0	0.0	10.6	2.0	10.8	2.9	0.7	0.8	3.9
JKCH 666 Bt	7.7	1.4	1.7	0.0	7.4	1.2	10.9	2.9	0.8	0.4	3.4
Tulasi 4 BG II	8.0	1.1	1.8	1.2	7.2	1.1	18.0	2.5	0.8	0.3	4.2
RCH-2 BG II	8.9	0.0	1.8	0.0	11.3	1.2	23.6	2.9	0.7	0.4	5.1
NCS 207 BG II	6.1	0.0	1.8	0.0	8.8	1.3	13.3	2.9	1.3	0.2	3.6
BCHH 557 BG II	8.8	0.2	1.9	0.0	11.7	0.9	10.6	2.5	0.7	0.2	3.8
Ankur Akka BG II	7.5	0.2	2.1	0.0	8.6	1.3	10.5	3.1	0.8	0.1	3.4
NCEH 14 (GFM)	9.2	3.5	1.8	0.0	7.0	1.3	13.7	2.8	2.2	0.2	4.2
Atal BG II	8.9	0.1	1.8	0.0	7.1	1.3	11.4	2.2	0.3	0.2	3.3
RCH 2 Bt (Bt check)	7.8	0.6	1.9	0.0	12.2	1.5	14.5	3.0	0.6	0.4	4.2
NHH 44 (Non Bt Check)	6.2	15.9	7.5	4.2	6.9	1.6	20.5	5.5	1.7	1.8	7.2
Local check Hybrid	8.4	13.1	10.1	3.6	7.8	1.4	24.9	4.9	1.6	1.1	7.7
NAVkar 5 Bt	8.7	4.4		0.0	8.6	1.6	8.4	3.2	1.3	0.3	4.1

Table 21. Mean PBW larvae damage in green bolls (%)

Entry	Khandwa	Surat	Junagadh	Talod	Banswara	Indore	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	7.6	10.0	1.7	0.0	5.8	0.0	0.0	11.7	10.8	2.6	5.6	2.8	4.9
NCS 929 Bt	6.7	0.0	2.2	0.0	7.6	0.1	0.0	3.3	9.2	3.0	3.3	3.9	3.3
Sigma Bt	7.6	0.0	1.7	0.0	5.2	0.0	0.0	0.0	11.7	3.0	4.4	3.9	3.1
PCH 923 Bt	7.0	3.3	1.7	0.0	5.6	0.1	0.5	5.0	10.8	2.9	5.6	3.9	3.9
KCH 135 Bt	6.3	3.3	1.7	0.0	5.4	0.1	0.0	3.3	8.3	3.2	8.9	2.2	3.6
BS 563 Bt	8.7	11.7	1.1	0.0	6.1	0.0	0.1	1.7	9.2	2.8	5.6	5.0	4.3
Ankur Jai Bt	6.4	0.0	1.1	0.0	9.7	0.0	0.0	8.3	14.2	2.7	6.7	2.2	4.3
Nandi 405 Bt	6.4	3.3	1.1	0.0	8.6	0.0	0.0	5.0	8.3	3.0	4.4	6.7	3.9
IT 923 Bt	6.5	0.0	0.6	0.0	5.4	0.2	0.0	10.0	13.3	2.7	5.6	6.1	4.2
Tulasi 9 Bt	9.9	0.0	1.7	0.0	6.2	0.0	0.1	8.3	7.5	3.2	8.9	5.6	4.3
Sudershan Bt	5.7	0.0	1.1	0.0	4.6	0.0	0.1	5.0	9.2	3.4	5.6	5.4	3.3
Rudra Bt	6.9	8.3	1.7	0.0	4.8	0.1	0.0	1.7	8.3	3.0	7.8	5.6	4.0
KDCHH 9821 Bt	6.4	0.0	1.7	0.0	5.8	0.1	0.1	5.0	10.0	2.8	2.2	2.2	3.0
Dhruv Bt (GFM)	9.0	0.0	0.6	0.0	6.0	0.2	0.0	3.3	12.5	2.8	3.3	2.4	3.3
JKCH 666 Bt	6.3	0.0	1.7	0.0	7.3	0.0	0.0	6.7	8.3	1.9	11.1	5.6	4.1
Tulasi 4 BG II	8.4	0.0	1.1	0.0	4.8	0.0	0.0	1.7	7.5	2.3	4.4	2.4	2.7
RCH-2 BG II	8.9	0.0	1.1	0.0	10.6	0.1	0.0	5.0	9.2	2.0	10.0	3.3	4.2
NCS 207 BG II	7.0	0.0	1.7	0.0	6.6	0.1	0.0	3.3	10.8	2.6	13.3	4.4	4.1
BCHH 557 BG II	8.6	0.0	2.8	0.0	9.8	0.0	0.0	8.3	10.8	3.7	1.1	6.7	4.3
Ankur Akka BG II	6.8	0.0	1.1	0.0	5.5	0.1	0.0	5.0	14.2	2.1	12.2	5.6	4.4
NCEH 14 (GFM)	9.3	6.7	2.8	0.0	5.5	0.1	0.0	3.3	9.2	2.9	4.4	3.4	4.0
Atal BG II	9.3	11.7	1.7	0.0	4.9	0.1	0.0	1.7	10.0	2.0	7.8	6.7	4.6
RCH 2 Bt (Bt check)	8.8	0.0	1.7	0.0	11.0	0.1	0.0	6.7	9.2	2.0	5.6	5.6	4.2
NHH 44 (Non Bt Check)	6.2	8.3	6.1	0.0	6.0	0.1	1.7	8.3	10.0	2.0	23.3	7.2	6.6
Local check Hybrid	8.1	16.7	9.4	0.0	5.2	0.1	1.9	10.0	9.2	2.9	30.0	3.9	8.1
NAVkar 5 Bt	9.8	0.0		0.0	5.0	0.0	0.0	3.3	10.8	1.9	4.4	4.4	3.6

Table 22. Open boll damage (%) - Boll basis

Entry	Khandwa	Surat	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	12.0	4.5	4.6	5.7	11.6	5.1	11.6	0.0	0.0	6.5	15.5	7.8	5.5	7.0
NCS 929 Bt	12.4	5.2	3.5	4.4	11.1	5.4	7.2	0.0	0.0	2.9	22.7	8.0	6.4	6.9
Sigma Bt	12.5	9.6	3.8	5.6	17.2	5.1	11.6	0.0	0.0	4.6	9.5	3.5	6.7	6.9
PCH 923 Bt	12.2	4.4	3.7	6.5	20.7	6.0	8.8	0.0	3.3	7.2	22.7	1.8	6.7	8.0
KCH 135 Bt	12.2	6.6	3.8	13.9	19.3	6.6	9.9	2.2	0.0	8.8	18.7	1.8	6.0	8.4
BS 563 Bt	12.6	6.1	3.9	7.4	23.5	6.8	10.7	0.0	0.0	7.5	15.9	7.5	7.9	8.4
Ankur Jai Bt	12.5	8.5	3.2	6.5	18.8	6.7	6.0	0.0	0.0	14.1	19.7	4.7	4.7	8.1
Nandi 405 Bt	12.5	4.8	3.7	8.0	13.3	5.8	12.8	0.0	0.0	9.1	13.3	7.8	9.6	7.7
IT 923 Bt	12.4	6.1	3.7	8.3	13.2	6.8	10.1	0.0	3.3	8.5	9.4	7.0	9.0	7.5
Tulasi 9 Bt	12.6	9.2	3.6	5.6	11.2	5.8	9.5	1.1	0.0	17.6	10.8	2.4	7.3	7.4
Sudershan Bt	11.6	6.9	3.5	7.0	9.2	6.7	7.2	0.0	0.0	9.0	10.6	3.7	6.1	6.3
Rudra Bt	11.9	8.1	3.7	7.0	10.8	5.7	5.6	0.0	0.0	8.6	15.7	7.9	8.2	7.2
KDCHH 9821 Bt	12.0	5.6	4.1	11.0	10.7	3.2	10.7	0.0	0.0	9.4	15.8	7.0	4.3	7.2
Dhruv Bt (GFM)	12.1	2.0	3.8	7.5	12.4	6.8	7.2	0.0	3.3	11.1	12.2	5.0	6.4	6.9
JKCH 666 Bt	12.0	5.6	3.9	6.8	10.9	7.8	11.2	0.0	0.0	6.3	23.1	5.6	8.6	7.8
Tulasi 4 BG II	12.5	4.5	4.1	5.9	20.1	7.3	8.6	0.0	0.0	6.6	15.3	2.7	7.1	7.3
RCH-2 BG II	12.1	8.0	3.7	9.5	17.1	2.5	4.1	0.0	0.0	5.7	17.3	1.1	5.2	6.6
NCS 207 BG II	12.7	5.5	3.6	6.2	15.1	6.4	8.7	0.0	3.3	6.9	17.4	4.6	7.8	7.5
BCHH 557 BG II	12.1	12.5	3.9	11.0	13.2	7.1	7.7	3.3	0.0	4.7	10.2	1.4	9.3	7.4
Ankur Akka BG II	12.9	10.6	3.6	5.9	11.6	7.2	12.0	0.0	6.7	11.6	19.1	4.3	8.2	8.7
NCEH 14 (GFM)	12.6	11.0	3.6	7.7	10.3	2.4	10.1	7.8	3.3	8.5	11.5	10.8	5.2	8.1
Atal BG II	12.6	4.2	3.8	9.1	18.5	6.8	9.0	0.0	6.7	2.8	16.2	1.5	9.4	7.7
RCH 2 Bt (Bt check)	12.5	5.9	4.0	10.0	17.1	6.0	7.9	3.3	3.3	6.5	15.6	6.5	8.7	8.3
NHH 44 (Non Bt Check)	12.6	56.6	12.2	13.4	9.7	11.9	15.4	66.7	6.7	17.9	17.3	22.2	10.1	21.0
Local check Hybrid	12.0	73.1	13.8	20.1	15.9	13.5	19.8	82.2	3.3	9.9	19.1	9.4	7.3	23.0
NAVKAR 5 Bt	12.7	5.1		5.0	13.2	2.2	10.4	0.0	0.0	7.2	21.2	7.0	7.8	7.6

Table 23. Open boll damage (%) - Locule basis

Entry	Khandwa	Surat	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	11.8	2.7	2.7	5.7	21.2	5.1	8.6	0.0	0.0	4.4	13.7	3.4	4.1	6.4
NCS 929 Bt	13.3	2.4	2.4	4.4	18.9	5.3	6.3	0.0	0.0	4.3	14.3	3.3	5.9	6.2
Sigma Bt	9.6	5.3	2.2	5.6	15.7	5.2	9.4	0.0	0.0	5.3	12.0	1.2	5.6	5.9
PCH 923 Bt	13.1	2.9	1.8	6.5	19.2	5.9	6.5	0.0	3.3	6.0	12.0	0.7	6.0	6.5
KCH 135 Bt	13.1	4.5	2.4	13.9	24.8	6.4	8.3	1.0	0.0	4.2	12.2	0.6	4.9	7.4
BS 563 Bt	13.5	3.3	2.5	7.4	23.1	6.8	8.4	0.0	0.0	4.0	10.6	2.6	6.6	6.8
Ankur Jai Bt	13.4	4.5	2.1	6.5	31.7	6.9	5.5	0.0	0.0	5.4	14.2	2.1	3.3	7.4
Nandi 405 Bt	13.4	1.7	2.2	8.0	27.3	5.9	8.3	0.0	0.0	4.6	11.9	4.1	7.3	7.3
IT 923 Bt	13.3	3.7	1.6	8.3	23.1	6.5	7.4	0.0	3.3	4.4	13.9	3.7	8.1	7.5
Tulasi 9 Bt	13.5	7.0	2.6	5.6	23.5	5.8	7.4	0.3	0.0	4.6	13.1	1.0	6.1	7.0
Sudershan Bt	15.8	5.7	2.0	7.0	15.6	6.5	6.2	0.0	0.0	5.9	13.0	1.7	5.9	6.6
Rudra Bt	12.8	6.6	2.1	7.0	15.2	5.7	6.0	0.0	0.0	3.5	15.3	3.4	6.4	6.5
KDCHH 9821 Bt	12.9	3.7	2.7	11.0	16.6	3.1	8.4	0.0	3.3	3.5	13.7	1.8	3.5	6.5
Dhruv Bt (GFM)	13.0	1.1	2.2	7.5	15.4	7.5	5.5	0.0	6.7	3.6	13.3	1.4	4.6	6.3
JKCH 666 Bt	12.9	4.4	2.4	6.8	23.5	2.5	8.7	0.0	0.0	5.1	17.1	1.4	6.1	7.0
Tulasi 4 BG II	13.4	2.6	2.7	5.9	19.5	7.4	16.9	0.0	0.0	4.1	16.1	1.5	5.9	7.4
RCH-2 BG II	13.0	3.1	2.3	9.5	35.3	2.8	4.1	0.0	0.0	4.5	14.0	0.3	5.2	7.2
NCS 207 BG II	13.6	2.3	1.9	6.2	22.0	6.7	6.5	0.0	6.7	5.3	14.9	1.4	5.4	7.1
BCHH 557 BG II	13.0	10.1	2.5	11.0	28.0	6.8	5.5	1.6	0.0	3.9	17.7	0.5	7.2	8.3
Ankur Akka BG II	13.8	6.6	1.9	5.9	23.7	7.5	9.3	0.0	10.0	5.3	13.6	1.9	6.6	8.2
NCEH 14 (GFM)	13.5	7.6	2.5	7.7	17.1	2.5	8.3	2.7	3.3	4.1	8.9	5.0	4.7	6.8
Atal BG II	13.5	2.1	2.6	9.1	14.6	7.0	6.3	0.0	13.3	4.7	13.0	0.4	8.9	7.3
RCH 2 Bt (Bt check)	13.4	7.1	2.3	10.0	27.9	6.5	7.0	0.8	6.7	5.3	16.9	4.6	8.2	9.0
NHH 44 (Non Bt Check)	13.5	43.5	7.3	13.4	27.7	11.5	17.6	30.7	10.0	6.9	19.3	9.5	9.6	17.0
Local check Hybrid	12.9	46.1	9.9	20.1	25.8	13.2	18.8	36.7	6.7	3.7	15.8	4.0	6.8	17.0

Table 24. Number of Sprays given - for Sucking Pests Control

Entry	Khandwa	Surat	Junagadh	Talod	Indore	Akola	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	2.8
NCS 929 Bt	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	2.8
Sigma Bt	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	0.0	2.7
PCH 923 Bt	1.0	7.0	6.0	1.0	2.0	4.0	2.0	2.0	3.0	0.0	2.8
KCH 135 Bt	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	2.8
BS 563 Bt	1.0	7.0	6.0	1.0	2.0	4.0	2.0	2.0	3.0	0.0	2.8
Ankur Jai Bt	1.0	7.0	5.0	1.0	1.0	4.0	2.0	2.0	3.0	0.0	2.6
Nandi 405 Bt	1.0	7.0	6.0	1.0	2.0	4.0	2.0	2.0	3.0	0.0	2.8
IT 923 Bt	1.0	7.0	6.0	0.0	1.0	4.0	2.0	2.0	3.0	0.0	2.6
Tulasi 9 Bt	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	2.8
Sudershan Bt	1.0	7.0	5.0	1.0	1.0	4.0	2.0	2.0	3.0	0.0	2.6
Rudra Bt	1.0	7.0	6.0	0.0	1.0	4.0	2.0	2.0	3.0	0.0	2.6
KDCHH 9821 Bt	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	2.8
Dhruv Bt (GFM)	1.0	7.0	6.0	0.0	1.0	4.0	2.0	2.0	3.0	0.0	2.6
JKCH 666 Bt	2.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	2.9
Tulasi 4 BG II	2.0	7.0	6.0	0.0	1.0	4.0	2.0	2.0	3.0	0.0	2.7
RCH-2 BG II	3.0	7.0	7.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	3.1
NCS 207 BG II	1.0	7.0	6.0	1.0	2.0	4.0	2.0	2.0	3.0	1.0	2.9
BCHH 557 BG II	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	0.0	2.7
Ankur Akka BG II	1.0	7.0	6.0	1.0	1.0	4.0	2.0	2.0	3.0	0.0	2.7
NCEH 14 (GFM)	3.0	7.0	7.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	3.1
Atal BG II	1.0	7.0	6.0	1.0	2.0	4.0	2.0	2.0	3.0	0.0	2.8
RCH 2 Bt (Bt check)	3.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	1.0	3.0
NHH 44 (Non Bt Check)	1.0	7.0	5.0	0.0	1.0	4.0	2.0	2.0	3.0	0.0	2.5
Local check Hybrid	1.0	7.0	6.0	0.0	2.0	4.0	2.0	2.0	3.0	0.0	2.7
NAVKAR 5 Bt	1.0	7.0		0.0	1.0	4.0	2.0	2.0	3.0	0.0	2.2

Bollworm incidence was moderate throughout Central Zone (Table 25). An average of two rounds of chemical intervention was required to control the boll worms in non Bt check hybrids. The Bt hybrids required less than one round of chemical intervention. At Khandwa and Nagpur, no chemical intervention was given either for the Bt Cotton hybrids or for the non Bt check hybrids. At Junagadh, 3 to 4 sprayings were given to control the bollworms in non Bt check hybrids but no spraying was given for the Bt cotton hybrids. At Bhawanipatna, one spraying was given uniformly to all the entries in the trial. At Nanded and Indore, one to two sprays were given for Bt cotton hybrids while three sprays were warranted for non Bt check hybrids.

2. EVALUATION UNDER UNPROTECTED CONDITIONS

All the twenty six entries were also evaluated under unprotected conditions for boll worms at fourteen locations. The data from Rajkot was received very late and the trial at Surat was affected by floods. Hence, the results from twelve locations alone are discussed here.

Germination and Plant Stand

The germination in all the entries across locations was satisfactory (Table 26). The mean germination was above 80 per cent in all the entries.

Plant stand was adequate at all centers with a mean stand of 26.4 to 31.5 plants (Table 27).

Open boll and Locule damage

The open boll and locule damage was assessed at harvest. The mean open boll damage was 20.5 to 22.7 per cent in the non Bt check hybrids (Table 28). In Bt test entries, the boll damage varied from 7.6 to 11.4 per cent. The Bt check hybrid RCH 2 recorded a mean boll damage of 9.2 per cent. Akola reported a maximum boll damage of 66.7 to 82.2 per cent on non Bt check hybrids, whereas on Bt entries the damage was very low and ranged from 0 to 7.8 per cent only. At Khandwa, the boll damage on both Bt and Non Bt hybrids were on par with each other. Banswara, Bharuch, Nanded and Parbhani centers also recorded appreciable boll damage on Bt cotton entries and few Bt entries recorded more boll worm damage than the non Bt checks.

The same trend was observed for locule damage also (Table 29). In general, locule damage was low on Bt entries as compared to non Bt check hybrids. However, few entries at select locations recorded more locule damage than Non Bt check.

D. MEAN YIELD UNDER UNPROTECTED CONDITIONS

Mean Seed Cotton Yield – Irrigated Condition

Among the Non Bt check hybrids, the local check hybrid (1164 kg/ha) out yielded the zonal check NHH 44 (1071 kg/ha). The local check hybrid was even superior to the Bt check hybrid RCH 2 Bt (940 kg/ha). Seventeen Bt test hybrids were superior to the local check hybrid (Table 30). They are Ankur Akka BG II (1532 kg/ha; 32% increase),

Table 25. Number of Sprays given - for Boll Worm control

Entry	Khandwa	Surat	Junagadh	Talod	Indore	Akola	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.5
NCS 929 Bt	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.5
Sigma Bt	0.0	0.0	0.0	0.0	2.0	0.0	2.0	2.0	0.0	1.0	0.7
PCH 923 Bt	0.0	1.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.6
KCH 135 Bt	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.5
BS 563 Bt	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.5
Ankur Jai Bt	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.5
Nandi 405 Bt	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	1.0	0.4
IT 923 Bt	0.0	1.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.6
Tulasi 9 Bt	0.0	1.0	0.0	0.0	2.0	0.0	2.0	2.0	0.0	1.0	0.8
Sudershan Bt	0.0	1.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.6
Rudra Bt	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	1.0	0.4
KDCHH 9821 Bt	0.0	0.0	0.0	0.0	2.0	0.0	2.0	2.0	0.0	1.0	0.7
Dhruv Bt (GFM)	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.5
JKCH 666 Bt	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	1.0	0.4
Tulasi 4 BG II	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	1.0	0.4
RCH-2 BG II	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	1.0	0.4
NCS 207 BG II	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	1.0	0.5
BCHH 557 BG II	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	1.0	0.4
Ankur Akka BG II	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	1.0	0.4
NCEH 14 (GFM)	0.0	1.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	1.0	0.4
Atal BG II	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	1.0	0.4
RCH 2 Bt (Bt check)	0.0	1.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	1.0	0.5
NHH 44 (Non Bt Check)	0.0	3.0	3.0	2.0	3.0	4.0	3.0	2.0	0.0	1.0	2.1
Local check Hybrid	0.0	3.0	4.0	2.0	3.0	1.0	3.0	2.0	0.0	1.0	1.9
NAVKAR 5 Bt	0.0	2.0		0.0	1.0	0.0	2.0	2.0	0.0	1.0	0.9

Table 26. Germination Percentage

Entry	Khandwa	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	82.2	98.2	100.0	100.0	68.1	97.0	98.9	96.7	59.3	91.1	98.9	60.0	87.5
NCS 929 Bt	72.2	96.3	100.0	100.0	62.5	87.4	97.8	84.4	57.4	95.5	97.8	100.0	87.6
Sigma Bt	81.1	97.2	100.0	100.0	77.8	91.8	98.9	95.6	61.1	96.7	100.0	100.0	91.7
PCH 923 Bt	70.0	96.3	93.5	100.0	65.3	71.8	96.7	84.4	51.9	75.5	98.9	100.0	83.7
KCH 135 Bt	68.9	97.2	100.0	100.0	68.1	82.9	97.8	85.6	61.1	92.2	98.9	100.0	87.7
BS 563 Bt	54.4	96.3	100.0	100.0	63.9	58.5	96.7	82.2	70.4	90.0	96.7	100.0	84.1
Ankur Jai Bt	81.1	100.0	100.0	100.0	69.4	91.8	94.4	90.0	42.6	95.5	100.0	100.0	88.7
Nandi 405 Bt	81.1	98.2	100.0	100.0	63.9	86.6	100.0	94.4	51.9	94.4	100.0	100.0	89.2
IT 923 Bt	82.2	96.3	100.0	100.0	62.5	82.9	98.9	88.9	59.3	91.1	98.9	100.0	88.4
Tulasi 9 Bt	67.8	95.4	100.0	100.0	68.1	85.1	98.9	82.2	66.7	86.7	100.0	100.0	87.6
Sudershan Bt	64.4	96.3	100.0	97.0	65.3	74.8	95.6	92.2	79.6	90.0	100.0	100.0	87.9
Rudra Bt	73.3	100.0	100.0	92.0	65.3	89.6	98.9	91.1	68.5	86.7	100.0	100.0	88.8
KDCHH 9821 Bt	71.1	98.2	100.0	100.0	84.7	97.7	96.7	98.9	50.0	97.8	100.0	100.0	91.2
Dhruv Bt (GFM)	75.6	99.1	100.0	100.0	63.9	88.1	98.9	90.0	40.7	94.4	100.0	100.0	87.6
JKCH 666 Bt	82.2	98.2	100.0	95.0	70.8	92.5	98.9	88.9	51.9	92.2	100.0	100.0	89.2
Tulasi 4 BG II	84.4	99.1	100.0	100.0	81.9	85.9	100.0	88.9	59.3	95.5	100.0	100.0	91.3
RCH-2 BG II	82.2	99.1	100.0	100.0	62.5	92.5	97.8	95.6	57.4	94.4	100.0	100.0	90.1
NCS 207 BG II	58.9	95.4	100.0	95.0	61.1	70.3	81.1	80.0	61.1	82.2	98.9	100.0	82.0
BCHH 557 BG II	67.8	95.4	97.2	100.0	66.7	70.3	92.2	91.1	51.9	68.9	98.9	100.0	83.4
Ankur Akka BG II	70.0	97.2	100.0	100.0	70.8	91.8	98.9	94.4	61.1	87.8	100.0	100.0	89.3
NCEH 14 (GFM)	87.8	99.1	100.0	100.0	62.5	83.7	97.8	93.3	70.4	94.4	98.9	100.0	90.7
Atal BG II	77.8	99.1	100.0	100.0	75.0	87.4	98.9	84.4	42.6	93.3	97.8	100.0	88.0
RCH 2 Bt (Bt check)	75.6	98.2	100.0	100.0	66.7	94.0	100.0	76.7	51.9	94.4	100.0	100.0	88.1
NHH 44 (Non Bt Check)	81.1	98.2	100.0	100.0	68.1	85.9	93.3	85.6	59.3	86.7	98.9	100.0	88.1
Local check Hybrid	74.4	98.2	100.0	100.0	63.9	82.2	97.8	80.0	66.7	90.0	95.6	100.0	87.4
NAVKAR 5 Bt	82.2		100.0	100.0	72.2	85.1	100.0	86.7	79.6	97.8	100.0	100.0	91.2

Table 27. Plant stand

Entry	Junagadh	Talod	Banswara	Indore	Bharuch	Achalpur	Parbhani	Nagpur	Mean
VICH 15 Bt	35.3	28.6	30.0	16.0	43.6	24.7	27.3	29.7	29.4
NCS 929 Bt	33.7	28.1	36.0	15.0	39.3	22.3	27.3	29.3	28.9
Sigma Bt	34.7	28.9	38.3	19.0	41.3	24.3	29.0	30.0	30.7
PCH 923 Bt	34.7	24.9	30.0	13.0	32.3	25.0	21.7	29.7	26.4
KCH 135 Bt	34.3	27.5	33.0	16.0	37.3	26.0	26.7	29.7	28.8
BS 563 Bt	33.7	28.6	42.0	15.0	26.3	27.0	26.0	29.0	28.4
Ankur Jai Bt	35.7	29.4	41.7	17.0	41.3	27.7	28.0	30.0	31.3
Nandi 405 Bt	35.0	28.6	39.7	15.0	39.0	25.3	27.0	30.0	30.0
IT 923 Bt	34.3	29.7	39.7	15.0	37.3	22.7	28.0	29.7	29.5
Tulasi 9 Bt	34.0	28.9	34.0	15.0	38.3	25.3	26.0	30.0	28.9
Sudershan Bt	34.0	28.6	36.0	14.0	33.6	28.3	26.7	30.0	28.9
Rudra Bt	35.0	28.1	40.7	16.0	40.3	23.7	21.3	30.0	29.4
KDCHH 9821 Bt	35.0	28.3	34.3	20.0	44.0	26.3	28.3	30.0	30.8
Dhruv Bt (GFM)	35.7	28.9	29.7	15.0	39.6	27.7	28.3	30.0	29.4
JKCH 666 Bt	35.0	27.5	30.0	17.0	41.6	27.7	27.0	30.0	29.5
Tulasi 4 BG II	35.0	29.2	36.0	20.0	38.6	23.3	28.0	30.0	30.0
RCH-2 BG II	34.7	28.9	39.0	15.0	41.6	26.7	28.0	30.0	30.5
NCS 207 BG II	34.0	24.2	40.7	14.0	33.3	26.3	24.3	29.7	28.3
BCHH 557 BG II	33.7	25.0	42.7	14.0	31.6	28.7	20.3	29.7	28.2
Ankur Akka BG II	34.3	29.7	43.3	17.0	41.3	27.7	28.7	30.0	31.5
NCEH 14 (GFM)	35.0	26.9	34.0	15.0	37.6	25.0	28.3	29.7	28.9
Atal BG II	35.3	28.1	36.0	18.0	39.3	28.0	26.0	29.3	30.0
RCH 2 Bt (Bt check)	34.7	28.1	33.7	16.0	42.3	27.7	28.7	30.0	30.1
NHH 44 (Non Bt Check)	34.3	27.5	40.3	16.0	38.6	28.7	25.0	29.7	30.0
Local check Hybrid	34.7	28.6	37.3	13.0	37.0	27.3	26.7	28.7	29.2
NAVKAR 5 Bt		29.4	35.7	17.0	38.3	27.3	28.0	30.0	29.4

Table 28. Open boll damage (%) - Boll basis

Entry	Khandwa	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	12.5	5.3	6.9	12.4	2.6	15.1	0.0	3.3	16.0	7.8	3.1	6.2	7.6
NCS 929 Bt	14.0	5.0	8.0	12.5	3.9	18.5	0.0	3.3	16.3	23.0	3.8	7.0	9.6
Sigma Bt	10.3	4.7	5.9	19.2	6.0	14.4	0.0	3.3	15.6	20.1	3.0	7.5	9.2
PCH 923 Bt	13.8	4.9	8.1	22.3	5.5	19.0	0.0	3.3	15.5	17.1	1.7	7.3	9.9
KCH 135 Bt	13.8	4.7	10.8	19.9	6.8	22.4	2.2	0.0	16.3	28.2	4.0	6.6	11.3
BS 563 Bt	14.2	4.7	6.4	24.3	5.9	18.3	0.0	13.3	17.6	12.2	2.5	8.4	10.7
Ankur Jai Bt	14.1	4.7	9.3	20.1	6.0	12.7	0.0	0.0	12.6	9.3	2.9	5.3	8.1
Nandi 405 Bt	14.0	5.2	6.2	15.4	6.7	18.3	0.0	6.7	16.7	4.8	5.7	10.5	9.2
IT 923 Bt	14.0	5.0	5.0	14.4	5.7	17.2	0.0	6.7	32.8	22.0	4.0	9.8	11.4
Tulasi 9 Bt	14.1	4.9	6.9	12.4	7.4	17.3	1.1	3.3	24.5	19.5	4.6	8.1	10.3
Sudershan Bt	16.5	4.6	8.9	9.7	6.6	21.3	0.0	10.0	21.2	22.2	1.7	6.9	10.8
Rudra Bt	13.5	4.6	9.2	10.9	3.8	15.2	0.0	3.3	17.9	11.7	4.7	8.9	8.7
KDCHH 9821 Bt	13.5	4.5	8.8	11.6	4.1	23.2	0.0	6.7	14.5	2.4	4.5	5.3	8.2
Dhruv Bt (GFM)	13.6	5.3	6.4	13.2	5.8	18.4	0.0	6.7	28.0	20.4	3.0	7.2	10.7
JKCH 666 Bt	13.5	4.5	7.2	14.8	6.2	17.4	0.0	3.3	16.8	11.2	2.0	9.6	8.9
Tulasi 4 BG II	14.1	4.7	7.3	13.4	7.9	15.5	0.0	10.0	16.3	19.2	3.5	8.1	10.0
RCH-2 BG II	13.7	4.3	8.8	23.9	2.9	13.4	0.0	3.3	19.7	16.2	1.8	5.7	9.5
NCS 207 BG II	14.2	4.9	7.0	17.5	6.6	15.3	0.0	3.3	22.2	7.7	0.7	8.3	9.0
BCHH 557 BG II	13.7	4.8	8.7	23.2	6.1	15.1	3.3	13.3	19.8	32.3	3.9	10.6	12.9
Ankur Akka BG II	14.4	4.5	6.5	21.6	7.0	16.7	0.0	0.0	23.7	25.0	1.7	9.1	10.8
NCEH 14 (GFM)	14.1	4.9	7.0	21.1	3.6	16.7	7.8	6.7	22.7	10.0	1.4	6.2	10.2
Atal BG II	14.1	4.9	7.0	15.1	6.8	15.2	0.0	0.0	15.5	18.3	0.9	10.4	9.0
RCH 2 Bt (Bt check)	14.1	4.8	5.7	19.3	5.8	16.5	3.3	0.0	19.4	9.7	1.8	9.6	9.2
NHH 44 (Non Bt Check)	14.2	14.1	6.4	16.9	14.6	40.6	66.7	16.7	18.8	17.4	9.1	11.3	20.5
Local check Hybrid	13.5	16.4	6.2	16.8	16.0	21.1	82.2	23.3	34.1	16.2	18.6	8.1	22.7
NAVKAR 5 Bt	14.2		6.6	14.5	3.0	17.2	0.0	10.0	19.6	14.4	3.2	8.3	10.1

Table 29. Open boll damage (%) - Locule basis

Entry	Khandwa	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawani patna	Mean
VICH 15 Bt	13.8	3.2	6.9	24.0	2.6	11.6	0.0	3.3	5.9	8.5	2.1	4.7	7.2
NCS 929 Bt	15.3	3.7	8.0	18.6	3.9	14.1	0.0	6.7	5.7	17.0	1.8	6.2	8.4
Sigma Bt	11.6	2.7	5.9	16.1	5.9	11.1	0.0	3.3	6.5	16.7	1.1	12.8	7.8
PCH 923 Bt	15.1	2.8	8.1	24.6	5.5	14.5	1.3	3.3	5.7	20.4	0.6	6.4	9.0
KCH 135 Bt	15.1	3.6	10.8	24.5	6.8	16.7	0.0	0.0	5.7	20.7	1.5	5.6	9.2
BS 563 Bt	15.5	3.3	6.4	32.6	6.0	14.0	0.5	13.3	5.9	11.6	1.0	7.3	9.8
Ankur Jai Bt	15.4	2.5	9.3	23.9	5.9	9.9	0.8	0.0	6.0	8.1	2.0	4.1	7.3
Nandi 405 Bt	15.3	2.9	6.2	19.9	6.8	13.8	0.3	13.3	6.1	17.6	2.2	8.0	9.4
IT 923 Bt	15.3	3.0	5.0	16.6	5.9	13.5	0.0	6.7	6.0	13.3	1.6	8.6	8.0
Tulasi 9 Bt	15.4	2.6	6.9	17.4	7.2	13.3	0.0	3.3	5.2	16.4	1.4	6.8	8.0
Sudershan Bt	17.8	2.8	8.9	12.7	6.6	15.9	1.1	16.7	5.7	20.7	0.7	6.0	9.6
Rudra Bt	14.8	2.9	9.2	13.0	3.9	11.6	0.3	6.7	5.5	8.5	2.3	7.2	7.2
KDCHH 9821 Bt	14.8	2.7	8.8	13.4	4.2	15.6	0.0	6.7	4.4	12.1	1.5	4.4	7.4
Dhruv Bt (GFM)	14.9	2.7	6.4	14.6	5.9	14.3	0.0	10.0	5.3	17.1	1.5	5.1	8.1
JKCH 666 Bt	14.8	3.2	7.2	19.5	6.2	13.2	0.0	6.7	5.4	5.4	0.7	7.1	7.4
Tulasi 4 BG II	15.4	3.2	7.3	14.9	7.9	10.7	0.0	13.3	5.9	18.9	1.7	6.4	8.8
RCH-2 BG II	15.0	2.8	8.8	25.7	3.0	11.0	0.0	6.7	5.3	13.7	0.9	5.3	8.2
NCS 207 BG II	15.5	2.9	7.0	18.3	6.7	12.1	0.0	3.3	5.9	11.1	0.2	6.5	7.5
BCHH 557 BG II	15.0	2.8	8.7	23.7	6.0	11.9	0.0	20.0	4.8	14.7	1.5	8.5	9.8
Ankur Akka BG II	15.7	2.8	6.5	19.0	7.0	12.8	0.8	0.0	5.0	13.9	0.5	7.3	7.6
NCEH 14 (GFM)	15.4	3.4	7.0	23.0	3.7	13.0	2.2	6.7	7.0	13.2	0.5	5.1	8.3
Atal BG II	15.4	2.9	7.0	13.3	6.6	11.7	0.0	0.0	5.8	15.0	0.6	9.4	7.3
RCH 2 Bt (Bt check)	15.4	3.2	5.7	24.0	5.8	12.5	0.0	0.0	5.9	11.7	1.0	8.9	7.8
NHH 44 (Non Bt Check)	15.5	10.5	6.4	17.7	14.5	27.5	18.1	20.0	6.0	10.5	4.2	10.4	13.4
Local check Hybrid	14.8	12.9	6.2	19.0	16.0	16.1	18.7	30.0	5.3	21.6	11.2	7.3	14.9
NAVKAR 5 Bt	15.5		6.6	18.6	3.1	13.2	0.0	13.3	5.1	9.4	1.9	7.1	8.5

Table 30. Seed Cotton Yield (kg/ha)

Entry	Khandwa	Junagadh	Talod	Banswara	Indore	Bharuch	Akola	Achalpur	Nanded	Parbhani	Nagpur	Bhawanipatna	Mean (I)	% inc over RCH 2 Bt	% Inc over LC Hybrid	Mean (R)	% inc over RCH 2 Bt	% Inc over LC Hybrid
VICH 15 Bt	1545	1373	1406	936	382	1469	1186	992	1630	777	1829	1838	1315	40	13	1263	31	51
NCS 929 Bt	1514	1291	1409	1255	215	733	1488	874	1852	852	2232	1738	1367	45	17	1248	30	49
Sigma Bt	1460	1237	1405	700	481	1016	1576	868	1531	881	1946	1522	1200	28	3	1228	27	47
PCH 923 Bt	1380	1378	1402	921	142	1313	1566	925	1914	610	1683	-	1270	35	9	1165	21	39
KCH 135 Bt	1212	1158	1067	751	244	1092	1202	864	1296	606	1975	1851	1047	11	-10	1141	19	36
BS 563 Bt	1464	1463	1282	833	235	877	894	704	1765	424	1679	1594	1260	34	8	1021	6	22
Ankur Jai Bt	1624	1991	1277	885	439	1707	1433	852	1605	807	1845	2412	1444	54	24	1387	44	66
Nandi 405 Bt	1515	1483	1600	947	537	1215	1689	794	1704	684	1808	1768	1386	47	19	1275	32	52
IT 923 Bt	1618	1607	1383	983	484	1423	1350	984	1333	792	1984	2098	1398	49	20	1306	36	56
Tulasi 9 Bt	1225	1307	1534	988	210	1335	1324	949	1099	767	2132	1373	1263	34	9	1149	19	37
Sudershan Bt	1562	1656	1547	1281	410	1319	1405	992	1235	473	1904	1789	1511	61	30	1191	24	42
Rudra Bt	1299	1492	1439	725	351	1397	1836	951	1765	689	2218	1521	1239	32	6	1341	39	60
KDCHH 9821 Bt	897	1120	1126	730	579	1428	521	835	1457	387	1297	1465	968	3	-17	996	3	19
Dhruv Bt (GFM)	1086	1429	1515	1065	466	1181	1280	1023	1395	893	2303	1634	1274	35	9	1272	32	52
JKCH 666 Bt	1635	1195	1460	648	612	1367	899	928	1352	496	1798	1429	1235	31	6	1110	15	33
Tulasi 4 BG II	1481	1288	1662	633	407	1232	1626	977	1580	692	2137	1758	1266	35	9	1301	35	55
RCH-2 BG II	1753	902	1352	838	283	1604	911	1053	1778	831	1884	977	1211	29	4	1165	21	39
NCS 207 BG II	1469	1306	1094	710	165	879	864	794	1481	384	1751	1367	1145	22	-2	961	0	15
BCHH 557 BG II	926	1281	1272	700	194	1204	1785	870	1296	530	1750	1738	1045	11	-10	1171	22	40
Ankur Akka BG II	1419	1989	1414	1307	450	1591	1547	975	1901	749	2012	1573	1532	63	32	1350	40	61
NCEH 14 (GFM)	1189	1035	805	638	269	1377	827	815	1395	355	1041	950	917	-2	-21	879	-9	5
Atal BG II	1323	1502	1637	1291	353	1594	1288	905	2062	914	1707	1639	1438	53	24	1308	36	56
RCH 2 Bt (Bt check)	852	1077	1236	597	230	555	824	1046	1605	573	2009	864	940	0	-19	963	0	15
NHH 44 (Non Bt Check)	1037	1123	963	1163	185	283	1019	749	1111	508	1500	987	1071	14	-8	793	-18	-5
Local check Hybrid	1477	1026	1215	936	194	588	1211	685	1247	495	1510	763	1164	24	0	837	-13	0
NAV KAR 5 Bt	1079		1213	1013	441	1163	833	733	1432	307	1351	1584	1102	17	-5	980	2	17
CD @ 5 %	481	271	117	217	7	340	439	0	547	137		277						
CV %		12	16	15	37	29	22	10	22	14		11						

Sudershan Bt (1511 kg/ha; 30% increase), Ankur Jai Bt (1444 kg/ha; 24% increase), Atal BG II (1438 kg/ha; 24% increase), IT 923 Bt (1398 kg/ha; 20 % increase), Nandi 405 Bt (1386 kg/ha 19 % increase), NCS 929 Bt (1367 kg/ha; 17 % increase), VICH 15 Bt (1315 kg/ha; 13 % increase), Dhruv Bt (1274 kg/ha; 9 % increase), PCH 923 Bt (1270 kg/ha; 9 % increase), Tulasi 4 BG II (1266 kg/ha; 9 % increase), Tulasi 9 Bt (1263 kg/ha; 9 % increase), BS 563 Bt (1260 kg/ha; 8 % increase), Rudra Bt (1239 kg/ha; 6 % increase), JKCH 666 Bt (1235 kg/ha; 6 % increase), RCH 2 BG II (1211 kg/ha; 4% increase), and Sigma Bt (1200 kg/ha; 3% increase).

Rainfed

Under Rainfed situation, RCH 2 Bt (963 kg/ha) was marginally superior to the local check hybrid (837 kg/ha) and NHH 44 (793 kg/ha). Twenty-one Bt test hybrids were superior to RCH 2 Bt (Table 30). They are: Ankur Jai Bt (1387 kg/ha; 44 % increase), Ankur Akka BG II (1350 kg/ha; 40 % increase), Rudra Bt (1341 kg/ha; 39% increase), Atal BG II (1308 kg/ha; 36% increase), IT 923 Bt (1306 kg/ha; 36% increase), Tulasi 4 BG II (1301 kg/ha; 35% increase), Nandi 405 Bt (1275 kg/ha; 32% increase), Dhruv Bt (1272 kg/ha; 32% increase), VICH 15 Bt (1263 kg/ha; 31% increase), NCS 929 Bt (1248 kg/ha; 30% increase), Sigma Bt (1228 kg/ha; 27% increase), Sudershan Bt (1191 kg/ha; 24% increase), BCHH 557 BG II (1171 kg/ha; 22% increase), RCH 2 BG II (1165 kg/ha; 21% increase), PCH 923 Bt (1165 kg/ha; 21% increase), Tulasi 9 Bt (1149 kg/ha; 19% increase), KCH 135 Bt (1141 kg/ha; 19% increase), JKCH 666 Bt (1110 kg/ha; 15% increase), BS 563 Bt (1021 kg/ha; 6% increase), KDCHH 9821 Bt (996 kg/ha; 3% increase) and Navkar 5 Bt (980 kg/ha; 2% increase).

F. PATHOLOGICAL EVALUATIONS

During this year, 23 Bt hybrids along with one Bt check (RCH 2 Bt), one non Bt Check (NHH 44) and one local hybrid were evaluated for their reaction against various foliar diseases at six different centres of Central Zone *viz.* Akola, Junagadh, Khandwa, Nagpur, Nanded and Parbhani. The diseases that were observed in these centres were bacterial leaf blight, alternaria leaf spot, myrothecium leaf spot, grey mildew and para wilt. The following are the details of the investigation.

Alternaria leaf spot:

High incidence of the disease was observed only at Nagpur and the disease incidence was low at Junagadh and Nanded. Among the test Bt hybrids, NAVKAR 5 Bt had the highest mean disease incidence of 16.65 per cent followed by the local hybrid check (14.76 per cent). PCH 923 Bt had the lowest disease incidence of 4.65 per cent (Table 31).

Table 31. Reaction of Bt hybrids to Alternaria Leaf Spot and Grey Mildew

Entry	Alternaria Leaf Spot (PDI)				Grey Mildew (PDI)					
	Junagadh	Nanded	Nagpur	Mean	Junagadh	Nanded	Parbhani	Nagpur	Akola	Mean
VICH 15 Bt	5.0	4.0	28.6	12.5	6.2	4.8	...	23.9	13.0	12.0
NCS 929 Bt	4.5	2.0	24.6	10.4	6.3	19.3	...	5.9	23.0	13.6
Sigma Bt	4.2	4.5	14.5	7.8	6.3	15.0	...	25.5	16.5	15.8
PCH 923 Bt	3.7	5.0	5.3	4.7	7.7	10.0	...	11.5	17.8	11.8
KCH 135 Bt	4.0	3.3	16.9	8.1	7.5	20.0	4.2	19.6	22.2	14.7
BS 563 Bt	6.0	11.5	14.8	10.8	6.0	25.0	4.0	6.3	23.0	12.9
Ankur Jai Bt	4.3	11.1	14.6	10.0	7.3	15.0	4.0	22.0	18.5	13.4
Nandi 405 Bt	5.5	5.0	21.7	10.7	5.3	12.0	4.0	25.7	19.3	13.3
IT 923 Bt	5.7	3.0	8.9	5.9	6.0	12.2	...	23.9	19.6	15.4
Tulasi 9 Bt	5.5	3.6	7.3	5.4	3.7	5.0	...	9.4	21.9	10.0
Sudershan Bt	4.7	4.3	12.4	7.1	4.8	4.3	...	13.5	17.8	10.1
Rudra Bt	4.2	5.0	19.6	9.6	5.5	5.0	...	20.1	22.6	13.3
KDCHH 9821 Bt	4.8	4.3	6.6	5.2	3.8	15.3	...	15.8	24.1	14.7
Dhruv Bt (GFM)	3.7	3.2	14.8	7.2	3.2	15.0	...	16.7	24.8	14.9
JKCH 666 Bt	3.8	2.2	10.5	5.5	5.3	15.2	...	22.5	20.0	15.7
Tulasi 4 BG II	4.3	3.3	21.3	9.6	5.7	15.2	...	7.5	20.4	12.2
RCH-2 BG II	3.7	2.0	18.6	8.1	5.2	10.0	...	8.0	20.0	10.8
NCS 207 BG II	3.8	10.0	12.7	8.8	6.7	4.0	4.8	24.4	16.3	11.2
BCHH 557 BG II	4.0	3.0	12.1	6.4	6.0	17.0	...	10.8	18.9	13.2
Ankur Akka BG II	3.5	11.0	7.8	7.4	3.0	2.3	4.0	21.2	21.1	10.3
NCEH 14 (GFM)	3.7	6.3	18.3	9.4	2.5	10.3	4.0	15.4	22.2	10.9
Atal BG II	3.7	15.0	4.1	7.6	6.2	10.0	...	12.3	20.0	12.1
RCH 2 Bt (Bt check)	6.2	5.3	3.1	4.9	3.8	9.3	...	21.6	22.6	14.3
NHH 44 (Non Bt Check)	3.3	2.0	18.2	7.8	4.5	5.0	...	19.2	15.6	11.1
Local check Hybrid	3.7	19.0	21.6	14.8	3.8	15.0	...	25.5	18.2	15.6
NAVKAR 5 Bt	-	15.0	18.3	16.7	-		...	23.8	15.9	19.9

Grey mildew:

This disease was noticed at five centres. At Khandwa, this disease was not observed. The highest disease incidence was noticed on all hybrids at Akola and the next high incidence at Nagpur. Dhruv Bt (GFM) had shown highest susceptibility at Akola with a disease incidence of 24.82 per cent and the lowest incidence was seen on VICH 15 Bt (12.96 per cent). When overall mean is taken, NAVKAR 5 Bt had the highest disease incidence of 19.86 per cent and Tulasi 9 Bt had the lowest (10.00 per cent) and the rest in between this range only. These results, therefore, indicate that all entries are susceptible to grey mildew (Table 31).

Myrothecium leaf spot:

This leaf spot was seen only at Khandwa and Nagpur. Very high incidence of the disease was observed at Khandwa with all Bt entries showing high susceptibility to the disease. When over all mean of the disease incidence was taken, PCH 923 Bt had the highest disease incidence (42.45 per cent), followed by Sigma Bt (40.31 per cent) and the lowest incidence on Tulasi 9 Bt (23.00 per cent) The check Bt hybrid (RCH 2 Bt), non Bt hybrid (NHH 44) and the local hybrid were also highly susceptible with a disease range of 43.80 to 45.49 per cent (Table 32).

Bacterial leaf blight:

Bacterial leaf blight was observed in all six centres where the hybrids were evaluated for their reaction to various diseases. Very high incidence was seen at Akola and Khandwa, moderate incidence at Nagpur and Junagadh and low incidence at Nanded and Parbhani. All test Bt hybrids have shown susceptibility to this disease. NAVKAR 5 Bt had the highest disease incidence (76.67 per cent) at Khandwa followed by the local check hybrid (70.83 per cent), IT 923 Bt (69.17 per cent) and BS 563 Bt (68.33 per cent) The least incidence of 37.55 per cent was noticed on Dhruv Bt (GFM) and NHH 44 (35.80 per cent). The over all mean of the disease incidence has also shown the susceptibility of all hybrids to bacterial leaf blight (Table 32).

Para wilt:

During this year, the para wilt was seen only at Junagadh and Nagpur with higher number of plants showing wilting at Junagadh. KDCHH 9821 Bt had the highest percent of plants with wilt symptoms both at Junagadh (51.40 per cent) and Nagpur (10.27 per cent) and the mean per cent of wilt was 30.82. Ankur Jai Bt had the least number of plants (5.1 per cent) wilting (Table 32).

Table 32. Reaction of Bt hybrids to Myrothecium Leaf Spot, Bacterial Blight and Para Wilt

Entry	Myrothecium leaf spot (PDI)			Bacterial Blight (PDI)							Para Wilt %		
	Khandwa	Nagpur	Mean	Junagadh	Nanded	Nagpur	Parbhani	Akola	Khandwa	Mean	Nagpur	Junagadh	Mean
VICH 15 Bt	60.8	9.6	35.2	17.0	5.0	3.6	...	17.5	46.7	18.0	4.5	12.9	8.7
NCS 929 Bt	62.5	3.5	33.0	17.2	3.0	8.1	4.5	33.5	59.2	20.9	8.2	3.3	5.7
Sigma Bt	69.2	11.5	40.3	19.5	2.0	10.7	...	34.1	61.7	25.6	3.5	35.2	19.3
PCH 923 Bt	78.3	6.6	42.4	19.2	2.3	17.2	4.8	28.3	45.0	19.4	8.0	35.6	21.8
KCH 135 Bt	70.0	3.3	36.7	20.0	17.0	0.0	...	26.7	42.5	21.2	5.8	23.3	14.5
BS 563 Bt	57.5	12.7	35.1	18.7	6.0	14.6	...	17.5	68.3	25.0	8.0	24.3	16.2
Ankur Jai Bt	66.7	7.3	37.0	19.2	2.0	9.1	4.0	8.4	55.0	16.3	3.5	6.7	5.1
Nandi 405 Bt	62.5	17.4	39.9	19.2	2.0	11.8	3.8	34.1	51.7	20.4	2.4	28.6	15.5
IT 923 Bt	60.8	11.0	35.9	18.5	5.1	6.3	4.0	38.7	69.2	23.6	3.4	20.5	12.0
Tulasi 9 Bt	42.5	3.5	23.0	19.2	3.0	19.8	5.0	17.6	55.0	19.9	4.6	11.0	7.8
Sudershan Bt	48.3	8.9	28.6	17.7	12.3	15.6	4.0	34.9	65.8	25.0	4.8	19.0	11.9
Rudra Bt	62.5	11.4	36.9	18.0	15.0	16.8	...	36.4	59.2	29.1	7.9	23.8	15.9
KDCHH 9821 Bt	70.0	9.1	39.6	19.3	6.0	0.0	...	34.8	43.3	20.7	10.3	51.4	30.8
Dhruv Bt (GFM)	64.2	12.0	38.1	18.5	3.0	12.6	4.2	37.3	37.5	18.8	2.4	14.3	8.3
JKCH 666 Bt	70.0	7.7	38.9	19.0	12.3	18.7	4.4	35.9	58.3	24.8	4.7	26.7	15.7
Tulasi 4 BG II	57.5	4.7	31.1	17.8	5.3	11.6	4.0	36.4	63.3	23.1	7.9	36.7	22.3
RCH-2 BG II	59.2	9.2	34.2	18.5	3.0	22.7	4.2	39.1	40.8	21.4	3.5	41.0	22.2
NCS 207 BG II	70.8	5.8	38.3	18.7	5.0	20.4	4.2	37.6	57.5	23.9	4.7	33.3	19.0
BCHH 557 BG II	55.0	5.3	30.1	18.5	5.0	20.8	4.4	38.6	65.0	25.4	7.9	20.5	14.2
Ankur Akka BG II	53.3	7.2	30.3	10.2	4.9	13.7	4.2	30.5	67.5	21.8	6.9	11.0	8.9
NCEH 14 (GFM)	72.5	3.6	38.0	18.3	15.0	17.8	...	12.1	55.0	23.6	3.5	35.2	19.3
Atal BG II	62.5	5.9	34.2	18.7	2.0	12.4	4.8	32.2	56.7	21.1	7.2	43.3	25.3
RCH 2 Bt (Bt check)	77.5	13.4	45.4	18.8	5.0	15.4	4.2	37.3	49.2	21.6	4.6	26.2	15.4
NHH 44 (Non Bt Check)	75.0	16.0	45.5	17.0	12.0	5.5	4.6	28.7	35.8	17.3	8.0	6.7	7.3
Local check Hybrid	73.3	14.3	43.8	16.7	5.0	11.1	4.2	31.8	70.8	23.3	5.8	15.7	10.8
NAV KAR 5 Bt	61.7	10.6	36.1	-	19.0	9.6	4.2	35.4	76.7	29.0	2.4	12.9	7.7

G. OVERALL ASSESSMENT

Twenty three Bt cotton hybrids were evaluated under both protected and unprotected conditions. The trial data from five irrigated centers and eight rainfed centers were analysed to study the effectiveness of Bt gene in controlling the bollworms and adaptability of these genotypes to various agroclimatic situations in Central Zone (Table 33).

The incidence of *Earias spp.* and *H. armigera* was very low. Pink bollworm incidence was low at several centers, but at Khandwa and Banswara, the damage was considerable. The damage on some of the Bt test hybrids was on par with that on non-Bt hybrids. Similarly, square damage at Banswara, Bharuch and Khandwa was more as compared to other centers. But, overall, the mean larval population and square damage on Bt cotton hybrids was less as compared to non-Bt check hybrids. Open boll and locule damage on Bt test hybrids were found to be on par with that of the Bt check hybrid but much lower than that seen in non-Bt check hybrid.

Jassid was the main sucking pest, apart from Aphids and Thrips at certain locations. Most of the hybrids evaluated showed varying degrees of susceptibility to sucking pests warranting chemical intervention more than once. Bt hybrids required less than one round of chemical intervention to control the bollworms.

The test Bt hybrids have been found susceptible to the four foliar diseases *viz.*, alternaria leaf spot, grey mildew, myrothecium leaf spot and bacterial leaf blight. With timely and proper interventions, these diseases can be managed.

As regards mean seed cotton yield, seven Bt test hybrids were found to be superior to the check hybrids under both **irrigated and rainfed** situations. They are: Ankur Akka BG II, IT 923 Bt, Sudershan Bt, Rudra Bt, VICH 15 Bt, Dhruv Bt and Ankur Jai Bt. Under unprotected conditions also, they were found to be superior to the check hybrids.

Nine Bt test hybrids were found to be superior to the check hybrids under **rainfed** conditions only. They are: Tulasi 4 BG II, NCS 929 Bt, Sigma Bt, Atal BG II, Tulasi 9 Bt, BCHH 557 BG II, Nandi 405 Bt, JKCH 666 Bt and PCH 923 Bt. These hybrids established their yield superiority, both under protected and unprotected conditions.

Fibre quality-wise, all the entries were found to be superior to NHH 44 (non-Bt check) and were on par with the Bt check hybrid. The highest fibre length was recorded by IT 923 Bt.

Table 33. Summary Table

Entry	Seed cotton yield (kg/ha) Irrigated centres	% Inc over RCH 2 Bt	Seed cotton yield (kg/ha) Rainfed centres	% Inc over RCH 2 Bt	Lint yield (kg/ha)	2.5 % Span Length (mm)	Uniformity Ratio	Micro-naire	Bundle Strength (g/tex)	Mean number of Jassid nymphs/ 3 leaves/ plant	Mean number of Whitefly adults/ 3 leaves/ plant	Mean PBW larvae damage in green bolls (%)	Open boll damage (%) - Boll basis	Open boll damage (%) - Locule basis	Alter-naria Leaf Spot (PDI)	Grey Mildew (PDI)	Myrotheci um leaf spot (PDI)	Bacter-ial Blight (PDI)	Para Wilt %
VICH 15 Bt	1986	25	1349	9	559	28.3	49.7	4.3	21.5	3.3	2.7	4.9	7.0	6.4	12.5	12.0	35.2	18.0	8.7
NCS 929 Bt	1933	21	1464	18	554	30.9	46.8	3.9	22.9	3.5	2.2	3.3	6.9	6.2	10.4	13.6	33.0	20.9	5.7
Sigma Bt	1845	16	1451	17	564	29.5	48.0	3.9	22.3	3.6	2.3	3.1	6.9	5.9	7.8	15.8	40.3	25.6	19.3
PCH 923 Bt	1686	6	1261	2	497	28.9	47.9	4.3	21.7	3.7	2.4	3.9	8.0	6.5	4.7	11.8	42.4	19.4	21.8
KCH 135 Bt	1667	5	1191	-3	462	29.8	47.9	4.0	21.1	3.7	2.2	3.6	8.4	7.4	8.1	14.7	36.7	21.2	14.5
BS 563 Bt	1801	13	1053	-14	455	28.2	49.5	3.8	21.7	3.6	2.2	4.3	8.4	6.8	10.8	12.9	35.1	25.0	16.2
Ankur Jai Bt	1960	23	1354	9	539	30.5	47.2	4.3	21.7	3.8	3.3	4.3	8.1	7.4	10.0	13.4	37.0	16.3	5.1
Nandi 405 Bt	1874	18	1337	8	536	30.9	48.0	3.9	22.2	3.8	2.1	3.9	7.7	7.3	10.7	13.3	39.9	20.4	15.5
IT 923 Bt	2153	35	1459	18	557	31.1	46.8	4.0	22.3	3.7	2.4	4.2	7.5	7.5	5.9	15.4	35.9	23.6	12.0
Tulasi 9 Bt	1642	3	1377	11	515	30.3	47.9	4.0	22.0	3.5	2.9	4.3	7.4	7.0	5.4	10.0	23.0	19.9	7.8
Sudershan Bt	2051	29	1263	2	513	28.9	48.8	4.3	21.8	3.2	3.1	3.3	6.3	6.6	7.1	10.1	28.6	25.0	11.9
Rudra Bt	2027	27	1511	22	590	30.1	47.7	3.9	22.4	3.2	2.7	4.0	7.2	6.5	9.6	13.3	36.9	29.1	15.9
KDCHH 9821 Bt	1750	10	1159	-6	477	28.0	46.9	4.1	21.2	3.5	2.4	3.0	7.2	6.5	5.2	14.7	39.6	20.7	30.8
Dhruv Bt (GFM)	1964	23	1525	23	588	28.3	48.3	4.3	21.7	3.1	2.3	3.3	6.9	6.3	7.2	14.9	38.1	18.8	8.3
JKCH 666 Bt	1800	13	1269	3	554	28.7	48.2	4.2	22.4	3.8	2.2	4.1	7.8	7.0	5.5	15.7	38.9	24.8	15.7
Tulasi 4 BG II	1697	7	1504	21	552	29.7	47.0	4.1	21.1	3.3	2.6	2.7	7.3	7.4	9.6	12.2	31.1	23.1	22.3
RCH-2 BG II	1448	-9	1170	-5	440	28.6	48.2	3.7	21.4	4.4	2.1	4.2	6.6	7.2	8.1	10.8	34.2	21.4	22.2
NCS 207 BG II	1325	-17	1070	-13	394	29.6	47.2	3.7	21.7	3.9	2.3	4.1	7.5	7.1	8.8	11.2	38.3	23.9	19.0
BCHH 557 BG II	1535	-4	1359	10	498	29.5	47.7	4.1	21.5	3.9	2.5	4.3	7.4	8.3	6.4	13.2	30.1	25.4	14.2
Ankur Akka BG II	2220	39	1529	23	593	30.8	48.3	4.0	22.9	3.8	2.8	4.4	8.7	8.2	7.4	10.3	30.3	21.8	8.9
NCEH 14 (GFM)	1397	-12	1084	-12	443	28.0	48.2	4.1	20.2	4.6	2.6	4.0	8.1	6.8	9.4	10.9	38.0	23.6	19.3
Atal BG II	1906	20	1450	17	537	30.5	47.3	4.1	21.6	3.5	2.6	4.6	7.7	7.3	7.6	12.1	34.2	21.1	25.3
RCH 2 Bt (Bt check)	1593		1233		458	28.8	48.4	4.0	20.5	4.4	2.3	4.2	8.3	9.0	4.9	14.3	45.4	21.6	15.4
NHH 44 (Non Bt Check)	1942		1052		461	25.8	48.5	4.1	20.6	3.4	2.5	6.6	21.0	17.0	7.8	11.1	45.5	17.3	7.3
Local check Hybrid	1575		1058		423	27.0	47.3	3.8	20.9	3.8	2.9	8.1	23.0	17.0	14.8	15.6	43.8	23.3	10.8
NAVKAR 5 Bt	1383	-13	1146	-7	413	26.7	48.1	3.6	21.3	3.4	2.6	3.6	7.6	6.9	16.7	19.9	36.1	29.0	7.7

II. EVALUATION OF INTERSPECIFIC (*G. HIRSUTUM X G. BARBADENSE*) HYBRIDS

Trial entries

In the first year trial, three Bt hybrids of interspecific origin viz., NCHB 945 Bt (Nuziveedu seeds), Kasinath Bt (Nath seeds) and Paraslaxmi Bt (Emergent Genetics) were evaluated along with MRC 6918 Bt (Bt check) and DCH 32 (non Bt check).

Trial Locations

The trial was conducted at two locations

1. College of Agriculture, **Indore** under JNKVV, Madhya Pradesh
2. Agricultural Research Station, Borwat Farm, **Banswara** under Maharana Pratap University of Agriculture & Technology, Rajasthan.

Trial Details

No. of Entries	: 3 + 2 check	
No. of Rows	: Yield Trial	: 5 Rows
	: Screening trials	: 2 Rows
Row length	: 6 m	
Spacing:	: 90 x 60 cm/120 x 60 cm	
No. of Replications	: Four	
Design	: Randomized Block Design	
Fertilizers	: As per recommendations	

Trials

Evaluation under ETL Based Plant Protection

Weekly observations were recorded from 45 DAS against major sucking pests and boll worms. The insecticide sprayings were based on the threshold levels of sap sucking pests and boll worms. The sprayings were under taken in all the replications of an entry even if in one of the replications, the threshold level of infestation has exceeded.

Evaluation under Unprotected Conditions for Boll worms

All the Bt Cotton hybrids and the controls were evaluated against key pests of cotton under unprotected conditions.

Observations Recorded

All the biometrical observations were recorded in the ETL based plant protection plots. The biometrical observations recorded were germination percentage, Final Plant Stand, Ginning Percentage, Lint Index, Seed Index, Seed Cotton Yield and Lint Yield. The entomological observations on sap sucking pests, boll worm damages and natural enemies were recorded under ETL based plant protection trial.

A. BIOMETRICAL EVALUATION.

Biometrical observations were recorded in the ETL based plant protection trial and are reported here.

Germination and Plant stand

Germination and plant stand was satisfactory at both the locations (Table 34). However, the number of plants per plot varied due to different spacing adopted.

Table 34. Germination and Plant stand

Entry	Germination (%)			Stand at harvest		
	Banswara	Indore	Mean	Banswara	Indore	Mean
NCHB 945 Bt	100.0	65.3	82.6	53.3	25.5	39.4
Kasinath Bt	100.0	92.4	96.2	55.0	36.3	45.6
Paraslaxmi	100.0	65.8	82.9	52.3	26.3	39.3
MRC 6918 Bt (Bt check)	100.0	66.4	83.2	52.5	25.8	39.1
DCH 32	86.3	63.8	75.0	42.0	23.8	32.9

Boll weight

Hybrid NCHB 945 Bt recorded the highest boll weight of 3.8 g followed by Kasinath Bt (3.4 g) and Paraslaxmi (3.2g). The Bt check hybrid MRC 6918 recorded a mean boll weight of 3.3 g (Table 35).

Table 35. Boll Weight (g)

Entry	Banswara	Indore	Mean
NCHB 945 Bt	4.5	3.1	3.8
Kasinath Bt	3.8	3.1	3.4
Paraslaxmi	3.5	2.8	3.2
MRC 6918 Bt (Bt check)	3.5	3.0	3.3
DCH 32	4.3	2.7	3.5
CD @ 5%	0.2	0.2	
CV(%)	4.3	3.7	

Ginning out turn

There was not much variation in ginning out turn which varied from 32.8 to 34.0 per cent in different entries (Table 36).

Table 36. Ginning Outturn (%)

Entry	Ginning Outturn (%)		
	Banswara	Indore	Mean
NCHB 945 Bt	33.9	33.3	33.6
Kasinath Bt	32.1	35.3	33.7
Paraslaxmi	31.8	33.8	32.8
MRC 6918 Bt (Bt check)	32.5	34.1	33.3
DCH 32	35.6	32.3	34.0
CD @ 5%	0.6	0.5	
CV(%)	1.2	1.1	

Lint Index

The Lint index varied from 4.4 to 5.0 g with Kasinath Bt and Paraslaxmi Bt recording the highest index of 5.0 g (Table 37).

Table 37. Lint Index (g)

Entry	Banswara	Indore	Mean
NCHB 945 Bt	4.2	4.8	4.5
Kasinath Bt	4.4	5.5	5.0
Paraslaxmi	4.7	5.2	5.0
MRC 6918 Bt (Bt check)	4.5	4.6	4.6
DCH 32	4.6	4.2	4.4
CD @ 5%	0.2	0.1	
CV(%)	3.2	1.7	

Seed Index

Paraslaxmi with 10.2 g recorded the highest seed index (Table 38), while DCH 32 recorded the lowest (8.6 g).

Table 38. Seed Index (g)

Entry	Banswara	Indore	Mean
NCHB 945 Bt	8.1	9.6	8.9
Kasinath Bt	9.4	10.1	9.8
Paraslaxmi	10.1	10.3	10.2
MRC 6918 Bt (Bt check)	9.3	8.9	9.1
DCH 32	8.4	8.8	8.6
CD @ 5%	0.3	0.1	
CV(%)	2.2	0.5	

B. MEAN SEED COTTON YIELD UNDER ETL BASED PLANT PROTECTION

Non Bt check hybrid DCH 32 recorded the lowest seed cotton yield of 316 kg/ha (Table 39). The Bt check hybrid MRC 6918 Bt recorded a mean seed cotton yield of 700 kg/ha. Only Kasinath Bt with a mean seed cotton yield of 1075 kg/ha was superior to both the checks. The increase in seed cotton yield over the Bt check hybrid MRC 6918 was of the order of 54 percent.

Table 39. Seed Cotton yield (kg/ha)

Entry	Banswara	Indore	Mean	% Inc over MRC 6918 Bt	% Inc over DCH 32
NCHB 945 Bt	926	405	665	-5.0	110.5
Kasinath Bt	1083	1067	1075	53.6	240.2
Paraslaxmi	970	423	696	-0.5	120.4
MRC 6918 Bt (Bt check)	852	548	700		
DCH 32	417	216	316		
CD @ 5%	213	48			
CV(%)	18	6			

Lint Yield.

The lint yield also followed the same trend of seed cotton yield and only Kasinath Bt (362 kg/ha) was superior to both the check hybrids. The increase in lint yield over the Bt check hybrid MRC 6918 was of the order of 56 percent (Table 40).

Table 40. Lint yield (kg/ha)

Entry	Banswara	Indore	Mean
NCHB 945 Bt	314	135	224
Kasinath Bt	347	377	362
Paraslaxmi	308	143	225
MRC 6918 Bt (Bt check)	277	187	232
DCH 32	148	70	109
CD @ 5%	68	3	
CV(%)	17	1	

C. FIBRE QUALITY EVALUATION

All the test entries were found to be on par with the non Bt check hybrid DCH 32. Bt check hybrid MRC 6918 Bt recorded the highest fibre strength of 24.8 g/tex (Table 41).

Table 41. Fibre Quality

Hybrid	2.5% span length (mm)	U.R %	Micronaire	Strength (g/tex)
NCHB 945 Bt	30.1	45.0	2.8	22.9
Kasinath Bt	30.6	44.0	2.8	23.4
Paraslakshmi	30.8	45.0	2.9	23.7
MRC 6918 Bt (Bt check)	29.5	46.0	2.5	24.8
DCH 32 (Non Bt check)	30.6	44.0	2.6	23.2

D. ENTOMOLOGICAL EVALUATION

1. EVALUATION UNDER PLANT PROTECTION (ETL BASED)

Sucking pests (Jassids, Thrips and Whitefly population)

All the entries in the trial were found to be susceptible to Jassids. The mean incidence of Jassids was more at Banswara as compared to Indore. Kasinath Bt recorded the lowest incidence of Jassids per plant, as compared to other entries (Table 42).

Thrips population was uniform on all the entries in the trial and was on par with the check hybrids (Table 42).

Whitefly population was low at Indore and was not reported at Banswara (Table 42).

Table 42. Entry	Jassid /plant			Thrips/ plant	Whitefly /plant
	Banswara	Indore	Mean	Indore	Indore
NCHB 945 Bt	13.7	4.0	8.9	7.6	4.7
Kasinath Bt	9.1	2.4	5.7	7.8	5.0
Paraslaxmi	14.1	3.0	8.6	7.5	5.9
MRC 6918 Bt (Bt check)	15.0	3.6	9.3	7.8	5.9
DCH 32	14.3	4.0	9.2	8.1	5.6

Natural Enemies

Natural Enemy population was also very low at both the locations and there was no difference in harboring the natural enemy population between Bt and Non Bt hybrids (Table 43).

Table 43. Population of Natural enemies

Entry	Banswara	Indore	Mean
NCHB 945 Bt	1.1	2.3	1.7
Kasinath Bt	1.2	3.0	2.1
Paraslaxmi	1.2	2.5	1.8
MRC 6918 Bt (Bt check)	1.2	2.6	1.9
DCH 32	0.8	2.5	1.6

Boll worms

Larval population of Bollworm was not reported from Banswara and was low at Indore. However, square damage up to 15.2 per cent was noticed at Banswara. Kasinath Bt recorded the lowest square damage of 9.1 per cent at Banswara. At Indore, all the entries were on par with the check hybrid DCH 32 (Table 44).

Table 44. Entry	Spotted bollworm, Earias spp- (No of Larvae / 5 plants)	Per cent square damage		
	Indore	Banswara	Indore	Mean
NCHB 945 Bt	1.2	11.4	1.3	6.3
Kasinath Bt	1.2	9.1	1.3	5.2
Paraslaxmi	1.9	14.6	2.0	8.3
MRC 6918 Bt (Bt check)	1.6	14.8	1.8	8.3
DCH 32	1.3	15.2	1.4	8.3

Pink Bollworm damage

Pink Bollworm damage was assessed both in terms of larval population and green boll damage (Table 45).

Larval population on green bolls was very low at Indore and moderate at Banswara. Consequently, the green boll damage was also low at Indore and moderate at Banswara. Kasinath Bt recorded the lowest damage as compared to other entries in the trial (Table 45).

Table 45	Mean number of PBW larvae/20 green bolls			Mean PBW larvae damage in green bolls (%)		
	Entry	Banswara	Indore	Mean	Banswara	Indore
NCHB 945 Bt	3.8	0.1	1.9	7.6	0.0	3.8
Kasinath Bt	2.2	0.0	1.1	5.0	0.0	2.5
Paraslaxmi	3.2	0.1	1.6	9.5	0.5	5.0
MRC 6918 Bt (Bt check)	2.3	0.1	1.2	9.8	0.0	4.9
DCH 32	2.4	0.1	1.2	10.1	0.0	5.1

Open Boll and locule damage

Open boll and locule damage was also assessed at harvest. Both open boll and locule damage was low at Indore and moderate at Banswara. Kasinath Bt recorded the lowest open boll and locule damage and was superior to other entries in the trial (Table 46).

Table 46	Open boll damage (%) - Boll basis			Open boll damage (%) - Locule basis		
	Entry	Banswara	Indore	Mean	Banswara	Indore
NCHB 945 Bt	12.5	3.5	8.0	14.8	3.5	9.1
Kasinath Bt	6.3	4.0	5.1	8.9	4.1	6.5
Paraslaxmi	13.8	3.7	8.7	14.5	3.8	9.1
MRC 6918 Bt (Bt check)	12.5	3.4	8.0	15.8	3.5	9.7
DCH 32	13.8	3.7	8.7	14.9	3.7	9.3

Plant Protection

For sucking pest

At Indore, Kasinath Bt required 1.0 round and NCHB 945 Bt required 3.0 rounds of chemical intervention to control sucking pests. Other entries including check hybrids required two rounds of spray.

For Boll worms

All the entries required two rounds of chemical intervention at Indore.

2. EVALUATION UNDER UNPROTECTED CONDITIONS

Germination and Plant Stand

Germination was very good at Banswara and was moderate at Indore. Stand was also adequate at both the locations. DCH 32 recorded low stand at Banswara (Table 47).

Table 47	Germination Percentage			Plant stand		
	Entry	Banswara	Indore	Mean	Banswara	Indore
NCHB 945 Bt	100.0	66.5	83.3	23.0	10.5	16.8
Kasinath Bt	100.0	91.0	95.5	21.5	14.5	18.0
Paraslaxmi	100.0	66.2	83.1	22.8	10.0	16.4
MRC 6918 Bt (Bt check)	100.0	65.9	83.0	23.3	10.3	16.8
DCH 32	82.5	62.6	72.5	15.8	9.3	12.5

Open boll and locule damage

Open boll and locule damage was assessed at harvest. Open boll and locule damage were the lowest in Kasinath Bt as compared to other entries in the trial. The other entries in the trial were on par with the check hybrids DCH 32 and MRC 6918 Bt (Table 48).

Table 48 Entry	Open boll damage (%) - Boll basis			Open boll damage (%) - Locule basis		
	Banswara	Indore	Mean	Banswara	Indore	Mean
NCHB 945 Bt	13.8	6.0	9.9	17.9	6.1	12.0
Kasinath Bt	6.3	5.5	5.9	10.2	5.5	7.8
Paraslaxmi	12.5	5.5	9.0	16.5	5.5	11.0
MRC 6918 Bt (Bt check)	12.5	5.5	9.0	17.2	5.4	11.3
DCH 32	16.3	5.4	10.8	17.3	5.4	11.3

E. MEAN SEED COTTON YIELD UNDER UNPROTECTED CONDITIONS

The Non Bt check hybrid DCH 32 recorded the lowest yield of 261 kg/ha (Table 49). The Bt check hybrid MRC 6918 recorded a mean seed cotton yield of 570 kg/ha. All the three test hybrids recorded higher seed cotton yield than the check hybrids. As compared to the best check MRC 6918 Bt, Kasinath Bt recorded the highest yield increase of 54 per cent (878 kg/ha) followed by Paraslaxmi Bt with 12 per cent increase (644 kg/ha) and NCHB 945 Bt with 4 per cent increase (597 kg/ha).

Table 49. Mean seed cotton yield (kg/ha)

Entry	Banswara	Indore	Mean	% Inc. over MRC 6918 Bt	% Inc. over DCH 32
NCHB 945 Bt	891	302	597	5	129
Kasinath Bt	1019	738	878	54	236
Paraslaxmi	1007	282	644	13	147
MRC 6918 Bt (Bt check)	775	365	570		
DCH 32	336	186	261		

G. OVERALL ASSESSMENT

Three interspecific (*G.hirsutum* x *G.barbadense*) hybrids were evaluated at two locations with DCH 32 and MRC 6918 Bt as non-Bt and Bt check hybrids, respectively. Among the three inter specific hybrids evaluated, bollworm and square damage was the lowest in hybrid Kasinath Bt. It also recorded the lowest jassid incidence. With a mean seed cotton yield of 878 kg/ha, Kasinath Bt was superior to the best check MRC 6918 by 54 per cent. Quality wise it was on par with DCH 32, the non Bt check (Table 50).

TABLE 50. SUMMARY TABLE

Entry	Seed cotton yield (kg/ha)	% Inc over MRC 6918 Bt	% Inc over DCH 32	Lint yield (kg/ha)	2.5 % Span Length (mm)	Uniformity Ratio	Micro-naire	Bundle Strength (g/tex)
NCHB 945 Bt	665	-5	111	224	30.1	45.0	2.8	22.9
Kasinath Bt	1075	54	240	362	30.6	44.0	2.8	23.4
Paraslaxmi	696	-1	120	225	30.8	45.0	2.9	23.7
MRC 6918 Bt (Bt check)	700			232	29.5	46.0	2.5	24.8
DCH 32	316			109	30.6	44.0	2.6	23.2

TABLE 50. SUMMARY TABLE

Entry	Jassid / plant	Whitefly /plant	PBW larvae damage in green bolls (%)	Open boll damage (%) - Boll basis	Open boll damage (%) - Locule basis
NCHB 945 Bt	8.9	4.7	3.8	8.0	9.1
Kasinath Bt	5.7	5.0	2.5	5.1	6.5
Paraslaxmi	8.6	5.9	5.0	8.7	9.1
MRC 6918 Bt (Bt check)	9.3	5.9	4.9	8.0	9.7
DCH 32	9.2	5.6	5.1	8.7	9.3

SECOND YEAR TRIALS (2006-07)

I. INTRA HIRSUTUM HYBRID TRIAL

Entries:

Nine Bt Cotton hybrids were evaluated for the second year in succession for confirmatory results. The hybrids evaluated were KDCHH 9810 Bt (Krishidhan seeds), RCH 386 Bt (Rasi Seeds), JKCH 99 Bt (JK Seeds), NCS 913 Bt (Nuziveedu seeds), KDCHH 621 BG II (Krishidhan seeds), MRC 7351 BG II and MRC 7341 BG II (Mahyco Seeds), ACH 155-2 BG II (Ajeet Seeds) and RCH 515 BG II (Rasi Seeds)

Trial Locations:

The following were the trial locations.

Irrigated trials

1. Cotton Research Station, **Khandwa** under JNKVV, Madhya Pradesh
2. Cotton Research Station, **Surat** under Navsari Agricultural University, Gujarat

Rainfed trials.

3. Dr. Panjabrao Deshmukh Krishividyapeeth, **Akola**, Maharashtra
4. Cotton Research Station, **Nanded**, Marathwada Agricultural University, Maharashtra
5. Central Institute for Cotton Research, **Nagpur**, Maharashtra

Of the two locations under irrigated conditions, the trial at Surat was vitiated due to floods. The yield levels at Khandwa was poor. Hence, all the four trials were considered together to study the suitability of the Bt test hybrids for the zone.

The trial details:

Number of Entries	: 9+ 3 checks
Number of rows	: Six
Row length	: 6m
Spacing	: 90 x 60 cm
No. of Replications	: Three
Design	: Randomized Block Design
Fertilizers	: As per local recommendation

Trials

Evaluation under ETL Based Plant Protection

Weekly observations were recorded from 45 DAS against major sucking pests and boll worms. The insecticide sprayings were based on the threshold levels of sap sucking pests and boll worms. The sprayings were under taken in all the replications of an entry even if in one of the replications, the threshold level of infestation has exceeded. All the entries in the trial were screened against major diseases.

Evaluation under Unprotected Conditions for Boll worms

All the Bt Cotton hybrids and the controls were evaluated against key pests of cotton under unprotected conditions.

Observations Recorded

All the biometrical observations were recorded in the ETL based plant protection plots. The biometrical observations recorded were germination percentage, Final Plant Stand, Ginning Percentage, Lint Index, Seed Index, Seed Cotton Yield and Lint Yield.

The entomological observations on sap sucking pests, boll worm damages and natural enemies were recorded under ETL based plant protection trial. The pathological observations on incidence of major diseases like Alternaria leaf spot, bacterial blight and grey mildew were recorded under natural conditions.

A. BIOMETRICAL EVALUATION

Biometrical evaluation of all the entries was made in the ETL based plant protection trial. The trial was conducted at five locations. The results from four locations are discussed below.

Germination and Plant Stand

Field germination of all the entries was good at all locations (Table 51). The stand at harvest was also satisfactory at all the locations (Table 52).

Table 51. Germination (%)					
Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	90.0	95.0	99.3	100.0	96.1
RCH 386 Bt	80.6	97.0	100.0	100.0	94.4
JKCH 99 Bt	81.7	100.0	98.6	100.0	95.1
NCS 913 Bt	81.1	98.0	99.3	99.4	94.5
KDCHH 621 BG II	87.2	100.0	98.6	97.8	95.9
MRC 7351 BG II	91.7	99.0	100.0	100.0	97.7
MRC 7341 BG II	88.3	100.0	99.3	98.9	96.6
ACH 155-2 BG II	75.0	93.0	99.3	100.0	91.8
RCH 515 BG II	94.4	98.0	100.0	98.3	97.7
RCH 2 Bt (Bt check)	76.1	99.0	100.0	99.7	93.7
RCH 138 Bt (Bt check)	90.6	84.0	89.5	83.9	87.0
NHH 44 (Non Bt check)	70.6	98.0	99.0	98.9	91.6
CD @ 5%				3.06	
CV(%)				1.84	

Table 52. Stand at harvest

Entry	Nanded	Nagpur	Mean
KDCHH 9810 Bt	47.7	56.0	51.9
RCH 386 Bt	48.0	53.0	50.5
JKCH 99 Bt	47.0	58.0	52.5
NCS 913 Bt	47.3	57.3	52.3
KDCHH 621 BG II	46.7	57.0	51.9
MRC 7351 BG II	48.0	57.3	52.7
MRC 7341 BG II	47.7	58.3	53.0
ACH 155-2 BG II	47.7	59.0	53.4
RCH 515 BG II	48.0	56.3	52.2
RCH 2 Bt (Bt check)	48.0	53.6	50.8
RCH 138 Bt (Bt check)	42.3	51.3	46.8
NHH 44 (Non Bt check)	48.0	57.3	52.7
CD @ 5%	1.0		
CV(%)	1.2		

Boll Weight

Hybrid MRC 7351 BG II recorded the highest boll weight of 4.9 g. The non Bt check hybrid NHH 44 recorded the lowest boll weight of 3.6 g. As compared to other centers, boll weight was low at Khandwa (Table 53).

Table 53. Boll weight (g)

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	3.2	4.6	4.6	4.0	4.1
RCH 386 Bt	2.7	4.7	4.4	4.8	4.2
JKCH 99 Bt	3.2	4.4	4.2	4.4	4.1
NCS 913 Bt	2.9	3.9	3.5	4.7	3.8
KDCHH 621 BG II	4.1	4.1	4.5	4.4	4.3
MRC 7351 BG II	3.2	6.0	5.4	5.2	4.9
MRC 7341 BG II	4.1	4.9	4.5	4.8	4.6
ACH 155-2 BG II	3.7	4.3	4.1	4.2	4.1
RCH 515 BG II	3.3	4.0	3.4	4.0	3.7
RCH 2 Bt (Bt check)	3.5	4.0	4.0	3.9	3.9
RCH 138 Bt (Bt check)	4.1	4.3	3.7	4.1	4.0
NHH 44 (Non Bt check)	3.8	3.9	3.1	3.4	3.6
CD @ 5%	0.5	0.6	0.4	0.9	
CV(%)	12.0	7.4	5.8	11.8	

Ginning out turn

Ginning outturn varied from 33.9 per cent (KDCHH 9810 Bt, KDCHH 621 BG II) to 37.1 per cent (NCS 913 Bt). The ginning out turn of check hybrids varied from 34.2 to 34.5 per cent (Table 54).

Table 54. Ginning Outturn (%)					
Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	32.1	33.2	35.3	35.0	33.9
RCH 386 Bt	33.8	36.7	34.7	33.7	34.7
JKCH 99 Bt	29.0	40.4	35.1	36.3	35.2
NCS 913 Bt	35.8	37.5	37.5	37.6	37.1
KDCHH 621 BG II	30.5	33.7	35.9	35.5	33.9
MRC 7351 BG II	37.1	35.1	35.5	35.0	35.7
MRC 7341 BG II	34.3	36.7	35.4	34.7	35.3
ACH 155-2 BG II	34.7	38.4	36.7	36.5	36.6
RCH 515 BG II	30.6	39.8	35.3	37.5	35.8
RCH 2 Bt (Bt check)	34.3	34.6	34.7	34.2	34.5
RCH 138 Bt (Bt check)	31.5	38.6	33.7	33.9	34.4
NHH 44 (Non Bt check)	32.9	37.1	32.8	33.8	34.2
CD @ 5%		1.2	1.2	2.0	
CV(%)		1.9	1.9	3.4	

Lint Index

Among the check hybrids, RCH 2 Bt recorded the highest lint index of 4.9 g (Table 55). The test hybrid MRC 7351 BG II recorded the highest lint index of 6.1 g followed by MRC 7341 BG II (5.6 g) and ACH 155-2 BG II (5.2 g).

Table 55. Lint Index (g)					
Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	3.5	4.6	5.2	4.6	4.5
RCH 386 Bt	3.6	4.7	5.7	5.4	4.9
JKCH 99 Bt	3.0	4.4	5.8	5.8	4.8
NCS 913 Bt	4.5	3.9	5.3	4.8	4.6
KDCHH 621 BG II	4.0	4.1	5.7	5.0	4.7
MRC 7351 BG II	6.2	6.0	6.4	5.6	6.1
MRC 7341 BG II	6.2	4.9	6.5	5.0	5.6
ACH 155-2 BG II	5.6	4.3	6.1	4.8	5.2
RCH 515 BG II	3.3	4.0	5.4	5.4	4.5
RCH 2 Bt (Bt check)	5.4	4.0	5.5	4.7	4.9
RCH 138 Bt (Bt check)	4.4	4.3	4.8	3.8	4.3
NHH 44 (Non Bt check)	4.7	3.9	4.2	3.8	4.1
CD @ 5%		0.6	0.5	0.7	
CV(%)		6.7	4.8	8.9	

Seed Index

Seed Index varied from 9.3 g (KDCHH 9810 Bt) to 10.9 g (MRC 7351 BG II). Hybrid RCH 386 Bt and MRC 7341 BG II also recorded high seed index of 10.0 g and above (Table 56).

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	7.4	11.7	9.6	8.7	9.3
RCH 386 Bt	7.0	11.5	10.9	10.6	10.0
JKCH 99 Bt	7.4	11.2	10.9	10.1	9.9
NCS 913 Bt	8.0	8.5	8.9	7.9	8.3
KDCHH 621 BG II	9.0	9.2	10.3	9.2	9.4
MRC 7351 BG II	10.5	10.8	11.7	10.5	10.9
MRC 7341 BG II	11.8	8.0	12.0	9.4	10.3
ACH 155-2 BG II	10.5	8.3	10.5	8.4	9.4
RCH 515 BG II	7.6	7.8	10.0	9.0	8.6
RCH 2 Bt (Bt check)	10.4	8.3	10.4	9.2	9.6
RCH 138 Bt (Bt check)	9.5	10.9	9.6	7.4	9.4
NHH 44 (Non Bt check)	9.6	8.8	8.5	7.4	8.6
CD @ 5%		1.0	2.8	1.2	
CV(%)		6.0	18.3	8.4	

B. MEAN SEED COTTON YIELD UNDER ETL BASED PLANT PROTECTION

All the test hybrids recorded higher seed cotton yield than the non Bt check hybrid NHH 44. The increase in seed cotton yield varied from 8 to 46 per cent.

Among the Bt check hybrids tested, RCH 138 Bt recorded highest yield (1268 kg/ha). Seven test hybrids recorded better yield than the best check RCH 138 Bt (Table 57). The yield increases ranged from 1 to 26 per cent. They are RCH 386 Bt (1595 kg/ha; 26 % increase), MRC 7351 BG II (1525 kg/ha, 20 % increase) KDCHH 621 BG II (1409 kg/ha, 11 % increase), JKCH 99 Bt (1409 kg/ha; 11 % increase), ACH 155-2 BG II (1381 kg/ha; 9 % increase), MRC 7341 BG II (1337 kg/ha; 6 % increase), KDCHH 9810 Bt (1275 kg/ha; 1 % increase).

Table 57. Mean Seed cotton yield (kg/ha)

Entry	Khandwa	Akola	Nanded	Nagpur	Mean	% In RCH 138	% In NHH 44
KDCHH 9810 Bt	1279	1254	1188	1379	1275	1	17
RCH 386 Bt	1034	1715	2218	1413	1595	26	46
JKCH 99 Bt	945	1411	1732	1547	1409	11	29
NCS 913 Bt	951	1132	1466	1178	1182	-7	8
KDCHH 621 BG II	1360	1198	1894	1185	1409	11	29
MRC 7351 BG II	1178	1769	1697	1456	1525	20	40
MRC 7341 BG II	1173	1344	1585	1247	1337	5	23
ACH 155-2 BG II	1063	1468	1597	1396	1381	9	27
RCH 515 BG II	981	1187	1481	1266	1229	-3	13
RCH 2 Bt (Bt check)	758	1236	1685	846	1131		
RCH 138 Bt (Bt check)	983	1111	1435	1544	1268		
NHH 44 (Non Bt check)	971	1185	1273	935	1091		
CD @ 5%	225	307	293	516			
CV(%)	18	14	11	24			

C. FIBRE QUALITY EVALUATION

All the entries were found to be superior to non Bt check hybrid NHH 44 in fibre length. However, as compared to the Bt check hybrid RCH 2 Bt (28.7 mm), RCH 386 Bt (30.6 mm) and MRC 7351 BG II (29.5 mm) were found to be better (Table 58).

Table 58. 2.5 % Span Length (mm)

Entry	Khandwa	Akola	Nagpur	Mean
KDCHH 9810 Bt	28.7	27.6	27.4	27.9
RCH 386 Bt	30.3	30.6	30.9	30.6
JKCH 99 Bt	27.8	25.3	26.0	26.4
NCS 913 Bt	28.6	27.8	29.5	28.6
KDCHH 621 BG II	27.5	26.0	28.4	27.3
MRC 7351 BG II	29.4	28.4	30.6	29.5
MRC 7341 BG II	28.8	26.6	30.3	28.6
ACH 155-2 BG II	29.0	29.7	27.5	28.7
RCH 515 BG II	26.8	26.5	27.3	26.9
RCH 2 Bt (Bt check)	28.8	27.6	29.6	28.7
RCH 138 Bt (Bt check)	26.8	24.5	27.5	26.3
NHH 44 (Non Bt check)	25.5	24.9	26.3	25.6

JKCH 99 Bt and MRC 7341 BG II were marginally superior to the check hybrids in uniformity ratio (Table 59). Micronaire values showed variation across locations. RCH 138 Bt (Bt hybrid check) recorded the lowest Micronaire of 3.3 (Table 60). As regards fibre strength, all the Bt test entries were superior to the non Bt check hybrid NHH 44 (Table 61). Hybrid KDCHH 621 BG II recorded the lowest fibre strength of 19.3 g/tex. Hybrid KDCHH 9810 Bt, RCH 386 Bt, MRC 7351 BG II and MRC 7341 BG II were on par with the Bt check hybrids.

Table 59. Uniformity Ratio

Entry	Khandwa	Akola	Nagpur	Mean
KDCHH 9810 Bt	47.0	49.0	49.5	48.5
RCH 386 Bt	46.0	48.0	44.5	46.2
JKCH 99 Bt	50.0	51.0	48.5	49.8
NCS 913 Bt	47.0	51.0	48.5	48.8
KDCHH 621 BG II	46.0	49.0	47.0	47.3
MRC 7351 BG II	46.0	48.0	49.0	47.7
MRC 7341 BG II	49.0	50.0	51.0	50.0
ACH 155-2 BG II	45.0	49.0	49.0	47.7
RCH 515 BG II	48.0	50.0	47.0	48.3
RCH 2 Bt (Bt check)	47.0	48.0	49.0	48.0
RCH 138 Bt (Bt check)	47.0	50.0	48.5	48.5
NHH 44 (Non Bt check)	49.0	48.0	46.5	47.8

Table 60. Micronaire

Entry	Khandwa	Akola	Nagpur	Mean
KDCHH 9810 Bt	3.6	5.2	4.5	4.4
RCH 386 Bt	3.9	4.1	4.1	4.0
JKCH 99 Bt	4.8	5.3	5.2	5.1
NCS 913 Bt	4.0	4.7	4.3	4.3
KDCHH 621 BG II	3.1	4.5	4.2	3.9
MRC 7351 BG II	4.0	4.6	4.5	4.4
MRC 7341 BG II	3.6	4.2	3.9	3.9
ACH 155-2 BG II	3.4	3.9	4.0	3.8
RCH 515 BG II	3.2	5.0	4.5	4.2
RCH 2 Bt (Bt check)	3.0	4.5	4.3	3.9
RCH 138 Bt (Bt check)	2.7	3.9	3.3	3.3
NHH 44 (Non Bt check)	3.7	4.2	4.2	4.0

Table 61. Bundle Strength (g/tex)

Entry	Khandwa	Akola	Nagpur	Mean
KDCHH 9810 Bt	23.7	20.1	22.5	22.1
RCH 386 Bt	23.6	21.0	22.6	22.4
JKCH 99 Bt	21.6	20.0	20.0	20.5
NCS 913 Bt	20.6	20.8	22.0	21.1
KDCHH 621 BG II	20.1	17.8	20.1	19.3
MRC 7351 BG II	22.4	19.5	24.7	22.2
MRC 7341 BG II	22.4	21.2	23.1	22.2
ACH 155-2 BG II	22.3	21.6	21.7	21.9
RCH 515 BG II	23.8	18.0	20.5	20.8
RCH 2 Bt (Bt check)	23.0	18.8	22.6	21.5
RCH 138 Bt (Bt check)	24.1	20.5	22.5	22.4
NHH 44 (Non Bt check)	19.1	17.8	19.6	18.8

D. ENTOMOLOGICAL EVALUATION

1. EVALUATION UNDER PLANT PROTECTION (ETL BASED)

Jassids

Jassid population was low at Nagpur and Nanded and moderate at Akola and Khandwa. All the Bt cotton hybrids were equally susceptible to Jassids as is the case of non Bt check hybrids (Table 62).

Table 62. Mean number of Jassid nymphs/3 leaves/plant

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	6.6	3.9	2.6	2.0	3.8
RCH 386 Bt	6.9	5.1	2.9	2.0	4.2
JKCH 99 Bt	6.3	6.8	2.6	2.7	4.6
NCS 913 Bt	6.4	6.7	3.7	2.5	4.8
KDCHH 621 BG II	6.6	4.8	2.9	1.9	4.1
MRC 7351 BG II	7.2	4.7	2.8	1.7	4.1
MRC 7341 BG II	6.3	5.0	2.6	1.9	3.9
ACH 155-2 BG II	7.0	5.4	2.8	1.8	4.2
RCH 515 BG II	7.0	6.3	2.6	2.1	4.5
RCH 2 Bt (Bt check)	7.2	7.2	2.7	2.3	4.9
RCH 138 Bt (Bt check)	6.4	5.8	2.9	1.8	4.2
NHH 44 (Non Bt check)	6.5	5.5	2.5	1.8	4.1

Whitefly population

Whitefly population was low through out the crop growth period at all the locations (Table 63).

Table 63. Mean number of Whitefly adults/ 3 leaves / plant

Entry	Khandwa	Akola	Nanded	Mean
KDCHH 9810 Bt	0.5	1.5	3.4	1.8
RCH 386 Bt	0.6	1.7	3.1	1.8
JKCH 99 Bt	0.5	1.7	2.6	1.6
NCS 913 Bt	0.6	1.6	3.0	1.8
KDCHH 621 BG II	0.5	1.8	2.4	1.6
MRC 7351 BG II	0.7	1.6	2.8	1.7
MRC 7341 BG II	0.6	1.7	2.6	1.6
ACH 155-2 BG II	0.6	1.6	2.7	1.6
RCH 515 BG II	0.5	1.6	2.9	1.7
RCH 2 Bt (Bt check)	0.6	1.8	2.3	1.6
RCH 138 Bt (Bt check)	0.8	1.8	3.2	1.9
NHH 44 (Non Bt check)	1.1	1.7	2.6	1.8

Thrips

Thrips population was low at Khandwa and Nagpur and ranged from 0.5 to 3.1 per plant. At Akola and Nanded, it was high and ranged from 10.0 to 30.1 per plant (Table 64).

Table 64. Thrips/ plant

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	1.0	19.0	25.8	3.1	12.2
RCH 386 Bt	0.5	20.0	27.8	2.7	12.7
JKCH 99 Bt	0.4	17.9	21.6	2.2	10.5
NCS 913 Bt	0.6	19.1	30.1	2.2	13.0
KDCHH 621 BG II	1.2	15.9	24.9	2.8	11.2
MRC 7351 BG II	0.9	18.0	23.7	2.6	11.3
MRC 7341 BG II	0.5	21.0	27.4	2.9	13.0
ACH 155-2 BG II	1.4	18.9	26.4	2.9	12.4
RCH 515 BG II	0.5	20.4	23.7	3.0	11.9
RCH 2 Bt (Bt check)	0.5	19.3	24.7	1.7	11.5
RCH 138 Bt (Bt check)	0.9	19.8	25.5	2.4	12.1
NHH 44 (Non Bt check)	1.8	19.3	24.9	3.4	12.3

Aphid

Aphid was not reported from Nagpur and low at Nanded. At Khandwa and Akola it was high and warranted chemical intervention to control them (Table 65).

Table 65. Aphid/ plant

Entry	Khandwa	Akola	Nanded	Mean
KDCHH 9810 Bt	32.2	33.5	5.4	23.7
RCH 386 Bt	32.5	24.6	5.0	20.7
JKCH 99 Bt	30.0	32.6	5.6	22.7
NCS 913 Bt	29.7	40.3	6.1	25.3
KDCHH 621 BG II	29.6	43.5	5.5	26.2
MRC 7351 BG II	29.6	45.0	5.4	26.7
MRC 7341 BG II	28.4	49.7	5.2	27.8
ACH 155-2 BG II	27.9	39.1	5.5	24.2
RCH 515 BG II	27.8	41.5	5.4	24.9
RCH 2 Bt (Bt check)	31.9	34.9	5.5	24.1
RCH 138 Bt (Bt check)	31.3	37.4	5.8	24.8
NHH 44 (Non Bt check)	30.1	44.9	5.8	26.9

Natural Enemy

Natural Enemy population was more at Nanded and Nagpur as compared to Khandwa and Akola. Among the entries, there was not much difference in harboring natural enemies (Table 66).

Table 66. Mean number of Predators / 5 plants

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	1.0	0.9	11.5	12.8	6.6
RCH 386 Bt	1.2	1.2	12.0	13.2	6.9
JKCH 99 Bt	0.9	1.2	9.9	16.0	7.0
NCS 913 Bt	2.8	1.1	13.1	12.7	7.4
KDCHH 621 BG II	1.0	1.1	10.9	11.5	6.1
MRC 7351 BG II	1.4	0.9	10.6	15.3	7.1
MRC 7341 BG II	1.2	1.0	11.7	16.9	7.7
ACH 155-2 BG II	1.4	0.9	11.5	12.7	6.6
RCH 515 BG II	1.1	0.9	10.7	14.9	6.9
RCH 2 Bt (Bt check)	1.0	0.9	10.8	12.4	6.3
RCH 138 Bt (Bt check)	2.8	1.0	11.5	13.2	7.1
NHH 44 (Non Bt check)	1.2	1.1	11.1	12.4	6.4

Bollworm

Helicoverpa armigera was noticed only on NHH 44 (Non Bt check) at Akola and Nagpur to an extent of 0.5 larvae / 5 plants (Table 67). It was absent in the Bt cotton hybrids. *Earias* spp larval population was the highest in NHH 44 (Non Bt check) with 10.3 larvae/5 Plants. On Bt test entries it ranged from 1.1 to 2.3 larvae/ 5 Plants. The Bt check hybrid recorded 1.6 larvae/ 5 Plants (Table 68).

Table 67. No of *Helicoverpa* Larvae / 5 plants

Entry	Akola	Nagpur	Mean
KDCHH 9810 Bt	0.0	0.0	0.0
RCH 386 Bt	0.0	0.0	0.0
JKCH 99 Bt	0.0	0.0	0.0
NCS 913 Bt	0.0	0.0	0.0
KDCHH 621 BG II	0.0	0.0	0.0
MRC 7351 BG II	0.0	0.0	0.0
MRC 7341 BG II	0.0	0.0	0.0
ACH 155-2 BG II	0.0	0.0	0.0
RCH 515 BG II	0.0	0.0	0.0
RCH 2 Bt (Bt check)	0.0	0.0	0.0
RCH 138 Bt (Bt check)	0.0	0.0	0.0
NHH 44 (Non Bt check)	0.2	0.8	0.5

Table 68. Spotted bollworm, *Earias* spp- (No of Larvae / 5plants)

Entry	Khandwa	Akola	Nagpur	Mean
KDCHH 9810 Bt	2.5	3.0	0.0	1.8
RCH 386 Bt	3.4	0.7	0.0	1.3
JKCH 99 Bt	3.3	0.6	0.1	1.3
NCS 913 Bt	3.0	1.6	0.0	1.5
KDCHH 621 BG II	5.4	1.2	0.1	2.3
MRC 7351 BG II	3.2	0.2	0.0	1.1
MRC 7341 BG II	2.7	0.5	0.0	1.1
ACH 155-2 BG II	4.2	1.8	0.1	2.0
RCH 515 BG II	2.8	1.3	0.1	1.4
RCH 2 Bt (Bt check)	3.0	1.8	0.0	1.6
RCH 138 Bt (Bt check)	4.1	2.4	0.0	2.2
NHH 44 (Non Bt check)	6.0	23.8	1.2	10.3

Square damage was minimum at Nagpur and moderate at Khandwa. Square damage on Bt hybrids varied from 2.3 to 4.0 percent as against 5.7 percent in the non Bt check hybrid NHH 44 (Table 69).

Table 69. Per cent square damage

Entry	Khandwa	Nanded	Nagpur	Mean
KDCHH 9810 Bt	4.7	2.3	0.1	2.4
RCH 386 Bt	4.6	2.3	0.4	2.4
JKCH 99 Bt	5.5	1.7	0.6	2.6
NCS 913 Bt	5.7	2.8	0.4	3.0
KDCHH 621 BG II	8.9	2.3	0.0	3.7
MRC 7351 BG II	4.3	1.8	0.0	2.0
MRC 7341 BG II	9.1	1.9	0.2	3.7
ACH 155-2 BG II	4.9	1.9	0.2	2.3
RCH 515 BG II	10.4	1.7	0.0	4.0
RCH 2 Bt (Bt check)	5.2	1.9	0.3	2.5
RCH 138 Bt (Bt check)	7.1	1.9	0.2	3.1
NHH 44 (Non Bt check)	10.0	3.7	3.5	5.7

Pink bollworm damage both in terms of larve/boll and green boll damage was assessed from 20 green bolls by destructive sampling (Table 70).

Table 70. Mean number of PBW larvae/20 green bolls

Entry	Khandwa	Akola	Nagpur	Mean
KDCHH 9810 Bt	6.9	2.7	1.3	3.6
RCH 386 Bt	6.6	0.5	1.1	2.7
JKCH 99 Bt	7.9	0.8	2.0	3.6
NCS 913 Bt	6.4	1.3	1.8	3.2
KDCHH 621 BG II	8.0	0.3	0.0	2.8
MRC 7351 BG II	5.4	0.7	0.2	2.1
MRC 7341 BG II	5.8	0.2	2.0	2.6
ACH 155-2 BG II	7.3	1.0	2.9	3.7
RCH 515 BG II	5.0	0.5	1.6	2.4
RCH 2 Bt (Bt check)	5.6	1.0	0.4	2.4
RCH 138 Bt (Bt check)	8.4	1.0	1.1	3.5
NHH 44 (Non Bt check)	7.8	9.5	4.7	7.3

Pink bollworm larval damage varied from 0.2 to 8.4 larvae/20 bolls at individual locations in respect of Bt cotton hybrids. The non Bt check hybrid NHH 44 recorded the highest mean damage of 7.3 larvae/20 bolls and it varied from 2.4 to 3.7 larvae/20 bolls in the Bt test hybrids. RCH 138 Bt check hybrid recorded a mean damage of 3.5 larvae per 20 bolls. Green boll damage due to Pink bollworm varied from 3.4 to 7.7 in the Bt hybrids, while it was 17.6 percent in the non Bt check hybrid NHH 44 (Table 71).

Table 71. Mean PBW larvae damage in green bolls (%)

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	3.8	0.0	10.8	6.7	5.3
RCH 386 Bt	3.3	0.0	10.8	4.4	4.6
JKCH 99 Bt	3.4	1.7	15.8	10.0	7.7
NCS 913 Bt	4.0	0.8	8.3	6.7	4.9
KDCHH 621 BG II	4.9	0.0	7.5	1.1	3.4
MRC 7351 BG II	4.3	0.0	10.8	2.2	4.3
MRC 7341 BG II	4.7	0.8	8.3	8.9	5.7
ACH 155-2 BG II	4.6	1.7	10.8	13.3	7.6
RCH 515 BG II	4.9	0.0	10.0	5.6	5.1
RCH 2 Bt (Bt check)	5.1	0.0	10.8	2.2	4.5
RCH 138 Bt (Bt check)	5.0	0.8	10.8	2.2	4.7
NHH 44 (Non Bt check)	6.1	34.2	13.3	16.7	17.6

Green boll damage was minimum at Akola and maximum at Nanded. However, all the Bt test hybrids recorded less green boll damage than the non Bt check hybrid NHH 44.

Open Boll Damage

Open boll and locule damage were also assessed at harvest. Open boll damage in Bt cotton hybrid was lowest at Akola. The highest boll damage on non Bt check hybrid was also recorded at Akola. Boll damage on Non Bt hybrids ranged from 12.1 to 46.7 per cent. The highest boll damage on Bt hybrid was only 12.4 per cent (Table 72).

Table 72. Open boll damage (%) – Boll basis

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	10.2	1.1	9.1	7.9	7.1
RCH 386 Bt	10.1	0.0	9.0	3.5	5.6
JKCH 99 Bt	11.7	1.1	8.1	1.5	5.6
NCS 913 Bt	10.1	1.1	3.8	1.9	4.2
KDCHH 621 BG II	11.7	0.0	6.1	0.0	4.5
MRC 7351 BG II	9.1	0.0	6.2	0.8	4.0
MRC 7341 BG II	9.5	0.0	11.1	1.3	5.5
ACH 155-2 BG II	10.7	0.0	12.4	7.0	7.5
RCH 515 BG II	8.8	0.0	11.4	3.5	5.9
RCH 2 Bt (Bt check)	9.4	0.0	8.0	2.7	5.0
RCH 138 Bt (Bt check)	12.1	0.0	10.3	6.2	7.2
NHH 44 (Non Bt check)	12.1	46.7	23.2	24.6	26.6

The locule damage also followed the same trend. The non Bt check hybrid recorded a mean locule damage of 11.9 per cent. On the other hand, the locule damage in Bt test hybrids ranged from 3.6 to 4.5 per cent. RCH 2 Bt, the Bt check hybrid recorded a mean locule damage of 3.8 per cent (Table 73).

Table 73. Open boll damage (%) – Locule basis

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	10.5	0.3	3.9	3.1	4.4
RCH 386 Bt	10.3	0.0	4.6	1.3	4.1
JKCH 99 Bt	12.0	0.3	5.5	0.4	4.5
NCS 913 Bt	10.4	0.3	3.9	1.3	3.9
KDCHH 621 BG II	12.0	0.0	4.9	0.0	4.2
MRC 7351 BG II	9.4	0.0	4.1	0.4	3.5
MRC 7341 BG II	9.8	0.0	6.0	0.7	4.1
ACH 155-2 BG II	11.0	0.0	4.3	2.8	4.5
RCH 515 BG II	9.1	0.0	4.4	1.4	3.7
RCH 2 Bt (Bt check)	9.7	0.0	5.0	0.7	3.8
RCH 138 Bt (Bt check)	12.4	0.0	3.9	4.1	5.1
NHH 44 (Non Bt check)	12.4	19.8	6.6	9.0	11.9

Plant protection**Sucking pests**

All the entries in the trial required plant protection at some part of the growing period to control the sucking pests. The maximum intervention was required at Akola and the least at Khandwa (Table 74).

Table 74. Number of Sprays given for Sucking Pests Control

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	1.0	3.0	2.0	3.0	2.3
RCH 386 Bt	1.0	3.0	2.0	3.0	2.3
JKCH 99 Bt	3.0	4.0	2.0	3.0	3.0
NCS 913 Bt	1.0	4.0	2.0	3.0	2.5
KDCHH 621 BG II	1.0	3.0	2.0	3.0	2.3
MRC 7351 BG II	1.0	3.0	2.0	3.0	2.3
MRC 7341 BG II	1.0	4.0	2.0	3.0	2.5
ACH 155-2 BG II	1.0	4.0	2.0	3.0	2.5
RCH 515 BG II	1.0	4.0	2.0	3.0	2.5
RCH 2 Bt (Bt check)	2.0	4.0	2.0	3.0	2.8
RCH 138 Bt (Bt check)	2.0	3.0	2.0	3.0	2.5
NHH 44 (Non Bt check)	1.0	3.0	2.0	3.0	2.3

Bollworm

At Akola and Nagpur, no chemical intervention was required to control bollworms on Bt hybrids. The non Bt check hybrid required four rounds of chemical intervention at Akola and Nil at Nagpur. At Nanded, only three Bt test hybrids required one round of chemical intervention, while the other entries including non Bt check hybrids required two rounds to control boll worms (Table 75).

Table 75. Number of Sprays given for Boll Worm control

Entry	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	1.0	2.0	0.0	1.0
RCH 386 Bt	0.0	1.0	0.0	0.3
JKCH 99 Bt	0.0	1.0	0.0	0.3
NCS 913 Bt	0.0	2.0	0.0	0.7
KDCHH 621 BG II	0.0	2.0	0.0	0.7
MRC 7351 BG II	0.0	2.0	0.0	0.7
MRC 7341 BG II	0.0	2.0	0.0	0.7
ACH 155-2 BG II	0.0	2.0	0.0	0.7
RCH 515 BG II	0.0	2.0	0.0	0.7
RCH 2 Bt (Bt check)	0.0	1.0	0.0	0.3
RCH 138 Bt (Bt check)	0.0	2.0	0.0	0.7
NHH 44 (Non Bt check)	4.0	2.0	0.0	2.0

2. EVALUATION UNDER UNPROTECTED CONDITIONS

Germination was satisfactory at all the locations with mean germination ranging from 76.4 to 94.8 per cent. (Table 76)

Table 76. Germination Percentage

Entry	Khandwa	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	83.3	98.6	96.5	98.9	94.3
RCH 386 Bt	82.2	100.0	96.5	97.8	94.1
JKCH 99 Bt	83.3	100.0	93.8	100.0	94.3
NCS 913 Bt	78.9	100.0	95.1	97.8	93.0
KDCHH 621 BG II	72.2	98.6	91.7	96.7	89.8
MRC 7351 BG II	88.9	99.5	92.4	97.8	94.6
MRC 7341 BG II	81.1	99.5	95.8	98.9	93.8
ACH 155-2 BG II	85.6	99.5	90.3	96.7	93.0
RCH 515 BG II	85.6	100.0	93.8	100.0	94.8
RCH 2 Bt (Bt check)	84.4	98.6	96.5	98.9	94.6
RCH 138 Bt (Bt check)	65.6	91.7	69.4	78.9	76.4
NHH 44 (Non Bt check)	83.3	99.5	93.8	98.9	93.9

Open boll damage and locule damage was distinctly more in non Bt check hybrid NHH 44 as compared to the damage on Bt hybrids (Table 77 & 78).

Table 77. Open boll damage (boll basis)

Entry	Khandwa	Akola	Nagpur	Mean
KDCHH 9810 Bt	10.6	1.1	7.9	6.5
RCH 386 Bt	10.5	0.0	3.5	4.7
JKCH 99 Bt	12.1	4.4	1.5	6.0
NCS 913 Bt	10.5	1.1	1.9	4.5
KDCHH 621 BG II	12.1	6.7	0.0	6.3
MRC 7351 BG II	9.5	0.0	0.8	3.4
MRC 7341 BG II	9.9	0.0	1.3	3.7
ACH 155-2 BG II	11.1	2.2	7.0	6.8
RCH 515 BG II	9.2	0.0	3.5	4.2
RCH 2 Bt (Bt check)	9.8	0.0	2.7	4.2
RCH 138 Bt (Bt check)	12.5	4.4	6.2	7.7
NHH 44 (Non Bt check)	12.5	33.3	24.6	23.5

Table 78. Open boll damage (locule basis)

Entry	Akola	Nagpur	Mean
KDCHH 9810 Bt	0.3	3.1	1.7
RCH 386 Bt	0.0	1.3	0.7
JKCH 99 Bt	0.8	0.4	0.6
NCS 913 Bt	0.3	1.3	0.8
KDCHH 621 BG II	2.7	0.0	1.3
MRC 7351 BG II	0.0	0.4	0.2
MRC 7341 BG II	0.0	0.7	0.3
ACH 155-2 BG II	0.8	2.8	1.8
RCH 515 BG II	0.0	1.4	0.7
RCH 2 Bt (Bt check)	0.0	0.7	0.3
RCH 138 Bt (Bt check)	1.3	4.1	2.7
NHH 44 (Non Bt check)	13.2	9.0	11.1

E. MEAN SEED COTTON YIELD UNDER UNPROTECTED CONDITIONS

All the Bt test hybrids recorded higher seed cotton yield over the non Bt check hybrid (Table 79). The yield increases ranged from 15 to 67 per cent. Among the Bt check hybrids RCH 2 Bt recorded the highest yield of 1502 kg/ha. As compared to RCH 2 Bt, only four Bt test hybrids, recorded higher yield. They are RCH 386 Bt (1782 kg/ha; 19 per cent increase), MRC 7351 BG II (1758 kg/ha; 17 per cent increase), ACH 155-2 BG II (1581 kg/ha; 5 per cent increase) and JKCH 99 Bt (1518 kg/ha; 1 per cent increase).

Table 79. Seed cotton yield (kg/ha) under unprotected condition

Entry	Khandwa	Akola	Nanded	Nagpur	Mean	% Inc. over RCH 2 Bt	% Inc over NHH 44
KDCHH 9810 Bt	1502	1249	858	1650	1315	-12	24
RCH 386 Bt	1548	1740	1109	2730	1782	19	68
JKCH 99 Bt	1447	1599	913	2112	1518	1	43
NCS 913 Bt	1308	1258	1196	1494	1314	-13	24
KDCHH 621 BG II	1282	1133	986	1485	1222	-19	15
MRC 7351 BG II	1415	1952	1357	2307	1758	17	65
MRC 7341 BG II	1267	1360	1214	1753	1399	-7	32
ACH 155-2 BG II	1560	1586	1177	2001	1581	5	49
RCH 515 BG II	1293	1254	1003	1809	1340	-11	26
RCH 2 Bt (Bt check)	1465	1492	1115	1936	1502	0	41
RCH 138 Bt (Bt check)	1347	1136	795	776	1013	-33	-5
NHH 44 (Non Bt check)	1170	1079	207	1797	1063	-29	0
CD @ 5%	347	244	247				
CV(%)		10	15				

F. PATHOLOGICAL EVALUATIONS

The pathological evaluation of the nine test hybrids was carried out for the second year at four centres *viz.* Akola, Khandwa, Nagpur and Nanded. These hybrids were compared with two Bt checks (RCH 2 Bt and RCH 138 Bt) and a non Bt hybrid (NHH 44). *Alternaria* leaf spot was observed on these hybrids only at Nagpur and Nanded, grey mildew at Akola, Nagpur and Nanded, myrothecium leaf spot at Khandwa and Nagpur and bacterial leaf blight in all four centres . Para wilt has been reported only from Nagpur.

Alternaria leaf spot:

Among the test hybrids, JKCH 99 Bt had the highest mean disease incidence of 23.81 per cent, followed by ACH 155-2 BG II (21.56 per cent), NCS 913 Bt (19.26 per cent) and KDCHH 9810 Bt (19.22 per cent). KDCHH 621 BG II had the least incidence of 7.14 per cent, while the rest of the test Bt hybrids had disease incidence in between this range. The check Bt hybrids RCH 2 Bt had disease incidence of 8.19 per cent, with RCH 138 Bt and the non-Bt check NHH 44 showing 15.48 per cent and 10.66 per cent, respectively. (Table 80).

Grey mildew:

Highest grey mildew disease incidence was noticed at Akola and Nagpur, where all the hybrids including the check hybrids have shown susceptibility to this disease. The highest mean disease incidence was seen in MRC 7351 BG II (22.38 per cent), followed by RCH 386 Bt (21.87 per cent) and the least on the check Bt hybrid RCH 138 Bt (16.17 per cent) (Table 80).

Myrothecium leaf spot:

Very high disease incidence was observed in Khandwa and at a lower level in Nagpur. All the entries including the checks have been found highly susceptible to this disease with mean disease incidence ranging from 28.99 per cent (KDCHH 9810 Bt) to 50.87 per cent (RCH 2 Bt) (Table 81).

Bacterial Blight:

Highest bacterial blight disease incidence was observed at Khandwa centre and lowest in Nanded. All entries have been found susceptible to this disease at Khandwa. When overall mean of the results of four centres was taken up, among the Bt hybrids, NCS 913 Bt had a disease incidence of 24.55 per cent, followed by MRC 7351 BG II (23.96 per cent) and the check Bt hybrid RCH 2 Bt had 23.64 per cent. The non-Bt check NHH 44 had the highest disease incidence of 25.34 per cent. (Table 81).

Para wilt:

Para wilt has been noticed only at Nagpur during this year at a low level. Among the test Bt hybrids, RCH 386 Bt had the highest number of plants wilting (8.01 per cent) and the least of 3.45 per cent in KDCHH 9810 Bt and MRC 7341 BG II. The check hybrids also had a low incidence (3.53 – 5.83 per cent) (Table 81).

Table 80. Reaction of Bt hybrids to alternaria leaf spot and grey mildew

Entry	Alternaria Leaf Spot (PDI)			Grey Mildew (PDI)			
	Nanded	Nagpur	Mean	Akola	Nanded	Nagpur	Mean
KDCHH 9810 Bt	15.9	22.5	19.2	25.3	5.0	31.8	20.7
RCH 386 Bt	12.1	7.4	9.7	23.6	15.2	26.9	21.9
JKCH 99 Bt	21.0	26.7	23.8	27.8	10.2	17.9	18.6
NCS 913 Bt	20.0	18.5	19.3	25.3	10.0	28.8	21.4
KDCHH 621 BG II	10.0	4.3	7.1	22.8	5.0	26.5	18.1
MRC 7351 BG II	5.3	24.8	15.0	21.4	16.0	29.8	22.4
MRC 7341 BG II	10.0	10.1	10.0	24.5	10.0	25.3	19.9
ACH 155-2 BG II	18.3	24.9	21.6	24.7	13.0	17.8	18.5
RCH 515 BG II	15.3	8.6	11.9	23.1	15.3	19.0	19.1
RCH 2 Bt (Bt check)	9.8	6.6	8.2	25.3	20.0	13.1	19.5
RCH 138 Bt (Bt check)	15.1	15.9	15.5	20.0	5.0	23.5	16.2
NHH 44 (Non Bt check)	5.0	16.3	10.7	25.6	16.0	17.4	19.6

Table 81. Reaction of Bt hybrids to myrothecium leaf spot, bacterial leaf blight and para wilt

Entry	Myrothecium Leaf Spot (PDI)			Bacterial Leaf Blight (PDI)					Para Wilt %
	Khandwa	Nagpur	Mean	Khandwa	Akola	Nagpur	Nanded	Mean	Nagpur
KDCHH 9810 Bt	46.7	11.3	29.0	45.0	5.6	31.8	2.0	21.1	3.5
RCH 386 Bt	74.2	9.2	41.7	56.7	4.3	26.9	1.5	22.3	8.0
JKCH 99 Bt	79.2	15.4	47.3	38.3	8.4	17.9	3.3	17.0	5.8
NCS 913 Bt	79.2	9.1	44.2	61.7	2.5	28.8	5.2	24.5	4.8
KDCHH 621 BG II	55.0	12.9	34.0	42.5	4.1	26.5	5.2	19.6	7.2
MRC 7351 BG II	82.5	13.5	48.0	56.7	6.2	29.8	3.2	24.0	4.7
MRC 7341 BG II	67.5	15.6	41.6	55.0	7.1	25.3	3.0	22.6	3.5
ACH 155-2 BG II	78.3	17.6	48.0	60.0	3.5	17.8	1.5	20.7	6.0
RCH 515 BG II	85.0	7.4	46.2	44.2	5.4	19.0	1.5	17.5	6.9
RCH 2 Bt (Bt check)	84.2	17.6	50.9	68.3	10.9	13.1	2.2	23.6	3.5
RCH 138 Bt (Bt check)	84.2	11.0	47.6	50.0	2.6	23.5	2.3	19.6	4.7
NHH 44 (Non Bt check)	73.3	12.7	43.0	76.7	4.3	17.4	3.0	25.3	5.8

G. OVERALL ASSESSMENT

Nine Bt cotton hybrids were evaluated at four locations. Boll worm damage in terms of larval population, square damage, open boll and locule damage was minimum during the year. Even under low infestation levels, the non Bt hybrid NHH 44 recorded considerable damage. The Bt test hybrids recorded very low levels of damage and was on par with the Bt check hybrids (Table 82).

Even though the test Bt hybrids have shown susceptibility to the foliar diseases prevalent in the particular area, through proper management techniques, damage to the crop can be averted.

In seed cotton yield, seven Bt test hybrids were superior to the check hybrids. Of these four hybrids viz., RCH 386 Bt, MRC 7351 BG II, JKCH 99 BT and ACH 155-2 BG II were superior under both protected and unprotected conditions. Hybrids KD CHH 621 BG II, MRC 7341 BG II and KDCHH 9810 Bt were superior under protected conditions only.

Hybrids RCH 386 Bt and MRC 7351 BG II were superior in fibre length. Hybrid KDCHH 621 BG II recorded the lowest fibre strength. Micronaire showed variation across locations. RCH 138 Bt (Check) recorded the lowest Micronaire.

Table 82. SUMMARY TABLE

Entry	Seed cotton yield (kg/ha) Irrigated centres	% Inc over RCH 138 (Bt)	Seed cotton yield (kg/ha) Rainfed centres	% Inc over RCH 138 (Bt)	Lint yield (kg/ha)	2.5 % Span Length (mm)	Uniformity Ratio	Micro-naire	Bundle Strength (g/tex)
KDCHH 9810 Bt	1279	1	1273	-7	432	27.4	49.5	4.5	22.5
RCH 386 Bt	1595	26	1782	31	553	30.9	44.5	4.1	22.6
JKCH 99 Bt	1409	11	1563	15	504	26.0	48.5	5.2	20.0
NCS 913 Bt	1182	-7	1259	-8	439	29.5	48.5	4.3	22.0
KDCHH 621 BG II	1409	11	1426	5	462	28.4	47.0	4.2	20.1
MRC 7351 BG II	1525	20	1640	20	543	30.6	49.0	4.5	24.7
MRC 7341 BG II	1337	5	1392	2	473	30.3	51.0	3.9	23.1
ACH 155-2 BG II	1381	9	1487	9	506	27.5	49.0	4.0	21.7
RCH 515 BG II	1229	-3	1311	-4	441	27.3	47.0	4.5	20.5
RCH 2 Bt (Bt check)	1131		1256		390	29.6	49.0	4.3	22.6
RCH 138 Bt (Bt check)	1268		1363		425	27.5	48.5	3.3	22.5
NHH 44 (Non Bt check)	1091		1131		376	26.3	46.5	4.2	19.6

Table 82. SUMMARY TABLE

Entry	Jassid / plant	White fly /plant	Mean PBW larvae damage in green bolls (%)	Open boll damage (%) - Boll basis	Open boll damage (%) - Locule basis	Alternaria Leaf Spot (PDI)	Grey Mildew (PDI)	Myrothecium Leaf Spot (PDI)	Bacterial Leaf Blight (PDI)	Para Wilt %
KDCHH 9810 Bt	3.8	1.8	5.3	7.1	4.4	19.2	20.7	29.0	21.1	3.5
RCH 386 Bt	4.2	1.8	4.6	5.6	4.1	9.7	21.9	41.7	22.3	8.0
JKCH 99 Bt	4.6	1.6	7.7	5.6	4.5	23.8	18.6	47.3	17.0	5.8
NCS 913 Bt	4.8	1.8	4.9	4.2	3.9	19.3	21.4	44.2	24.5	4.8
KDCHH 621 BG II	4.1	1.6	3.4	4.5	4.2	7.1	18.1	34.0	19.6	7.2
MRC 7351 BG II	4.1	1.7	4.3	4.0	3.5	15.0	22.4	48.0	24.0	4.7
MRC 7341 BG II	3.9	1.6	5.7	5.5	4.1	10.0	19.9	41.6	22.6	3.5
ACH 155-2 BG II	4.2	1.6	7.6	7.5	4.5	21.6	18.5	48.0	20.7	6.0
RCH 515 BG II	4.5	1.7	5.1	5.9	3.7	11.9	19.1	46.2	17.5	6.9
RCH 2 Bt (Bt check)	4.9	1.6	4.5	5.0	3.8	8.2	19.5	50.9	23.6	3.5
RCH 138 Bt (Bt check)	4.2	1.9	4.7	7.2	5.1	15.5	16.2	47.6	19.6	4.7
NHH 44 (Non Bt check)	4.1	1.8	17.6	26.6	11.9	10.7	19.6	43.0	25.3	5.8

COMBINED REPORT OF TWO YEAR TRIALS (2005-06 & 2006-07)

I. INTRA HIRSUTUM HYBRID TRIAL

Nine Bt cotton hybrids were evaluated for two successive years during 2005-06 and 2006-07 in Central Zone. The hybrids were evaluated at five locations in Khandwa, Surat, Akola, Nanded and Nagpur. The crop at Surat during the second year was affected due to floods and was not taken for analysis. The hybrids evaluated were KDCHH 9810 Bt, KDCHH 621 BG II (Krishidhan Seeds), RCH 386 Bt, RCH 515 BG II (Rasi Seeds), JKCH 99 Bt (JK Seeds), NCS 913 Bt (Nuziveedu Seeds), MRC 7351 BG II, MRC 7341 BG II (Mahyco Seeds) and ACH 155-2 BG II (Ajeet Seeds).

A. BIOMETRICAL EVALUATION

Germination and Plant Stand

Germination and Plant Stand were satisfactory at all the locations during the two years (Table 83).

Table 83. Germination Percentage and Plant Stand

Hybrid	Germination (%)			Stand at harvest		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	95.0	96.1	95.5	51.0	51.9	51.4
RCH 386 Bt	90.0	94.4	92.2	49.3	50.5	49.9
JKCH 99 Bt	93.0	95.1	94.0	48.9	52.5	50.7
NCS 913 Bt	92.0	94.5	93.2	49.8	52.3	51.1
KDCHH 621 BG II	93.0	95.9	94.4	48.7	51.9	50.3
MRC 7351 BG II	94.0	97.7	95.8	49.5	52.7	51.1
MRC 7341 BG II	88.0	96.6	92.3	49.4	53.0	51.2
ACH 155-2 BG II	93.0	91.8	92.4	49.7	53.4	51.5
RCH 515 BG II	88.0	97.7	92.8	48.1	52.2	50.1
RCH 2 Bt (Bt check)	90.0	93.7	91.8	51.0	50.8	50.9
RCH 138 Bt (Bt check)	92.0	87.0	89.5	50.2	46.8	48.5
NHH 44 (Non Bt check)	90.0	91.6	90.8	50.3	52.7	51.5

Boll Weight

Boll development during 2005-06 season was better with the mean boll weight of different entries ranging from 3.7 to 5.7 g. On the other hand, it ranged from 3.6 to 4.9 g during 2006-07 season. Hybrid MRC 7351 BG II recorded the highest mean boll weight of 5.3 g, followed by KDCHH 621 BG II and MRC 7341 BG II with 5.0 g (Table 84).

Ginning out turn

Ginning out turn was consistent during both the years. NCS 913 Bt recorded the highest ginning out turn of 36.8 per cent (Table 84).

Table 84. Boll weight (g) and Ginning Outturn (%)

Hybrid	Boll weight (g)			Ginning Outturn (%)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	4.8	4.1	4.5	34.4	33.9	34.2
RCH 386 Bt	4.9	4.2	4.5	33.6	34.7	34.2
JKCH 99 Bt	4.5	4.1	4.3	36.4	35.2	35.8
NCS 913 Bt	4.5	3.8	4.1	36.6	37.1	36.8
KDCHH 621 BG II	5.7	4.3	5.0	36.1	33.9	35.0
MRC 7351 BG II	5.7	4.9	5.3	35.7	35.7	35.7
MRC 7341 BG II	5.5	4.6	5.0	34.4	35.3	34.8
ACH 155-2 BG II	4.9	4.1	4.5	35.2	36.6	35.9
RCH 515 BG II	5.2	3.7	4.4	36.8	35.8	36.3
RCH 2 Bt (Bt check)	4.6	3.9	4.2	34.5	34.5	34.5
RCH 138 Bt (Bt check)	4.1	4.0	4.1	33.8	34.4	34.1
NHH 44 (Non Bt check)	3.7	3.6	3.6	33.8	34.2	34.0

Lint Index

Lint Index was found to be better during the first year. However, all the entries tested recorded a mean lint index of 5.0 g and above (Table 85).

Seed Index

Seed Index was also found to be higher during the first year and the mean seed index varied from 8.8 g g to 11.0 g. Five Bt test entries recorded a seed index of more than 10g (Table 85).

Table 85. Lint index (g) and Seed Index (g)

Hybrid	Lint Index (g)			Seed Index (g)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	5.5	4.5	5.0	10.2	9.3	9.8
RCH 386 Bt	6.3	4.9	5.6	11.3	10.0	10.7
JKCH 99 Bt	6.4	4.8	5.6	11.3	9.9	10.6
NCS 913 Bt	5.5	4.6	5.1	9.3	8.3	8.8
KDCHH 621 BG II	6.4	4.7	5.5	10.3	9.4	9.9
MRC 7351 BG II	5.9	6.1	6.0	10.2	10.9	10.5
MRC 7341 BG II	6.9	5.6	6.3	11.7	10.3	11.0
ACH 155-2 BG II	5.5	5.2	5.3	10.5	9.4	10.0
RCH 515 BG II	6.0	4.5	5.3	10.0	8.6	9.3
RCH 2 Bt (Bt check)	5.9	4.9	5.4	10.6	9.6	10.1
RCH 138 Bt (Bt check)	4.7	4.3	4.5	9.0	9.4	9.2
NHH 44 (Non Bt check)	4.3	4.1	4.2	9.5	8.6	9.0

B. MEAN SEED COTTON YIELD UNDER ETL BASED PLANT PROTECTION

All the nine test entries evaluated for two consecutive years showed consistently improved performance over the non Bt check hybrid NHH 44. The yield increase ranged from 21 to 51 percent (Table 86).

Among the check hybrids, RCH 2 bt (1833 kg/ha) was the best and only two test hybrids showed better performance. They are RCH 386 Bt (1971 kg/ha; and 8 % increase) and JKCH 99 Bt (1888 kg/ha; 3 % increase).

Table 86. Seed cotton yield (kg/ha)

Hybrid	Seed cotton yield (kg/ha)				
	2005-06	2006-07	Mean	% Inc. over RCH2 Bt	% Inc. over NHH 44
KDCHH 9810 Bt	2198	1275	1736	-5	33
RCH 386 Bt	2347	1595	1971	8	51
JKCH 99 Bt	2368	1409	1888	3	45
NCS 913 Bt	2054	1182	1618	-12	24
KDCHH 621 BG II	1739	1409	1574	-14	21
MRC 7351 BG II	2105	1525	1815	-1	39
MRC 7341 BG II	2069	1337	1703	-7	31
ACH 155-2 BG II	2269	1381	1825	0	40
RCH 515 BG II	2213	1229	1721	-6	32
RCH 2 Bt (Bt check)	2534	1131	1833	0	41
RCH 138 Bt (Bt check)	2305	1268	1787	-3	37
NHH 44 (Non Bt check)	1512	1091	1301	-29	0

C. FIBRE QUALITY EVALUATION

Across the years, there was not much variation in fibre length. RCH 386 Bt recorded 31.4 mm fibre length followed by MRC 7341 BG II with 30.3 mm (Table 87).

Uniformity ratio showed a slight decline during the second year and overall the test entries were on par with the check hybrids (Table 87).

Table 87. 2.5% Span length (mm) and Uniformity Ratio (%)

Hybrid	2.5% Span length (mm)			Uniformity Ratio (%)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	28.6	27.9	28.3	51.0	48.5	49.8
RCH 386 Bt	32.2	30.6	31.4	49.0	46.2	47.6
JKCH 99 Bt	26.7	26.4	26.5	52.0	49.8	50.9
NCS 913 Bt	29.3	28.6	29.0	49.0	48.8	48.9
KDCHH 621 BG II	28.9	27.3	28.1	48.0	47.3	47.7
MRC 7351 BG II	29.2	29.5	29.3	49.0	47.7	48.3
MRC 7341 BG II	32.0	28.6	30.3	50.0	50.0	50.0
ACH 155-2 BG II	27.9	28.7	28.3	50.0	47.7	48.8
RCH 515 BG II	28.3	26.9	27.6	50.0	48.3	49.2
RCH 2 Bt (Bt check)	30.0	28.7	29.3	50.0	48.0	49.0
RCH 138 Bt (Bt check)	28.2	26.3	27.2	50.0	48.5	49.3
NHH 44 (Non Bt check)	25.9	25.6	25.7	50.0	47.8	48.9

Micronaire did not show much variation across the years. The Bt check hybrid RCH 138 Bt recorded the lowest Micronaire during both the years. JKCH 99 Bt recorded the highest Micronaire of 5.0 coupled with a low length of 26.5 mm. Rest of the Bt test entries were on par with RCH 2 Bt and NHH 44 (Table 88).

All the Bt test entries were better than the non Bt check NHH 44 in fibre strength and were on par with RCH 2 Bt (Bt check hybrid). Hybrids RCH 386 Bt and MRC 7341 BG II recorded a fibre strength of 22.5 and 22.7 g / tex, respectively (Table 88).

Table 88. Micronaire ($\mu\text{g}/\text{inch}$) and Fibre Strength (g/tex)

Hybrid	Micronaire ($\mu\text{g}/\text{inch}$)			Fibre Strength (g/tex)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	4.2	4.4	4.3	22.1	22.1	22.1
RCH 386 Bt	3.9	4.0	4.0	22.6	22.4	22.5
JKCH 99 Bt	4.8	5.1	5.0	20.4	20.5	20.5
NCS 913 Bt	4.6	4.3	4.5	21.3	21.1	21.2
KDCHH 621 BG II	4.4	3.9	4.2	20.8	19.3	20.1
MRC 7351 BG II	4.2	4.4	4.3	22.1	22.2	22.2
MRC 7341 BG II	4.2	3.9	4.1	23.2	22.2	22.7
ACH 155-2 BG II	4.4	3.8	4.1	20.6	21.9	21.2
RCH 515 BG II	4.6	4.2	4.4	21.3	20.8	21.0
RCH 2 Bt (Bt check)	4.1	3.9	4.0	21.0	21.5	21.2
RCH 138 Bt (Bt check)	3.5	3.3	3.4	22.1	22.4	22.2
NHH 44 (Non Bt check)	4.0	4.0	4.0	20.1	18.8	19.5

D. ENTOMOLOGICAL EVALUATION

1. EVALUATION UNDER PLANT PROTECTION (ETL BASED)

Sucking pests

Jassids, White Flies, Thrips and Aphids were the main sucking pests. All the hybrids evaluated harboured these insects at varying intensities at different times and exhibited susceptible reaction at varying grades (Table 89 & 90). Chemical intervention was required at varying intervals to control the sucking pests.

Table 89. Number of Jassids / plant and White flies / plant

Protected Hybrid	Mean number of Jassid nymphs/3 leaves/plant			Mean number of Whitefly adults/3leaves/plant		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	3.2	3.8	3.5	2.5	1.8	2.1
RCH 386 Bt	2.9	4.2	3.6	2.4	1.8	2.1
JKCH 99 Bt	3.3	4.6	4.0	2.8	1.6	2.2
NCS 913 Bt	3.4	4.8	4.1	2.3	1.8	2.0
KDCHH 621 BG II	3.0	4.1	3.5	2.5	1.6	2.0
MRC 7351 BG II	3.2	4.1	3.6	2.5	1.7	2.1
MRC 7341 BG II	3.5	3.9	3.7	2.3	1.6	2.0
ACH 155-2 BG II	2.5	4.2	3.4	2.5	1.6	2.1
RCH 515 BG II	3.4	4.5	3.9	2.3	1.7	2.0
RCH 2 Bt (Bt check)	3.5	4.9	4.2	2.1	1.6	1.8
RCH 138 Bt (Bt check)	2.8	4.2	3.5	2.4	1.9	2.2
NHH 44 (Non Bt check)	2.7	4.1	3.4	2.0	1.8	1.9

Table 90. Number of Thrips / plant and Aphids / plant

Protected	Thrips/ plant			Aphid/ plant		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
Hybrid						
KDCHH 9810 Bt	7.9	12.2	10.1	6.5	23.7	15.1
RCH 386 Bt	9.8	12.7	11.3	6.9	20.7	13.8
JKCH 99 Bt	6.9	10.5	8.7	5.0	22.7	13.9
NCS 913 Bt	9.1	13.0	11.1	5.9	25.3	15.6
KDCHH 621 BG II	8.2	11.2	9.7	5.2	26.2	15.7
MRC 7351 BG II	9.4	11.3	10.3	6.3	26.7	16.5
MRC 7341 BG II	11.3	13.0	12.1	7.9	27.8	17.8
ACH 155-2 BG II	11.9	12.4	12.1	6.7	24.2	15.4
RCH 515 BG II	10.3	11.9	11.1	6.2	24.9	15.5
RCH 2 Bt (Bt check)	7.8	11.5	9.7	4.5	24.1	14.3
RCH 138 Bt (Bt check)	11.1	12.1	11.6	7.2	24.8	16.0
NHH 44 (Non Bt check)	11.8	12.3	12.1	6.6	26.9	16.8

Natural Enemies

There was no discernible difference between Bt hybrids and non Bt check hybrid in harbouring natural enemies (Table 91).

Table 91. Number of Predators / 5 plants

Protected	Mean number of Predators/5 plants		
	2005-06	2006-07	Mean
Hybrid			
KDCHH 9810 Bt	1.8	6.6	4.2
RCH 386 Bt	2.3	6.9	4.6
JKCH 99 Bt	0.8	7.0	3.9
NCS 913 Bt	1.1	7.4	4.3
KDCHH 621 BG II	1.7	6.1	3.9
MRC 7351 BG II	1.6	7.1	4.3
MRC 7341 BG II	1.5	7.7	4.6
ACH 155-2 BG II	0.7	6.6	3.7
RCH 515 BG II	0.7	6.9	3.8
RCH 2 Bt (Bt check)	0.7	6.3	3.5
RCH 138 Bt (Bt check)	1.2	7.1	4.2
NHH 44 (Non Bt check)	1.1	6.4	3.8

Boll worms

The larval population of *Earis spp.* was more during 2006-07 than during 2005 - 06. The non Bt check hybrid NHH 44 recorded a mean population of 6.2 larvae/ 5 Plants. The number of larvae on Bt hybrids ranged from 0.7 to 1.3 larvae/ 5 Plants only (Table 92).

Larval population of *H. armigera* was very less during both years and even in non Bt check hybrid it varied from 0.5 to 0.6 larvae/5 plants. The larval population on Bt cotton hybrid was almost nil (Table 92).

Table 92. Number of Larvae / 5 plants (*Earias* spp and *Helicoverpa*)

Protected	Spotted bollworm, <i>Earias</i> spp- (No of Larvae / 5 plants)			No of <i>Helicoverpa</i> Larvae / 5 plants		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
Hybrid						
KDCHH 9810 Bt	0.0	1.8	0.9	0.1	0.0	0.0
RCH 386 Bt	0.0	1.3	0.7	0.0	0.0	0.0
JKCH 99 Bt	0.0	1.3	0.7	0.0	0.0	0.0
NCS 913 Bt	0.0	1.5	0.8	0.1	0.0	0.0
KDCHH 621 BG II	0.0	2.3	1.1	0.0	0.0	0.0
MRC 7351 BG II	0.0	1.1	0.6	0.0	0.0	0.0
MRC 7341 BG II	0.0	1.1	0.5	0.0	0.0	0.0
ACH 155-2 BG II	0.5	2.0	1.3	0.3	0.0	0.1
RCH 515 BG II	0.5	1.4	1.0	0.0	0.0	0.0
RCH 2 Bt (Bt check)	0.0	1.6	0.8	0.1	0.0	0.1
RCH 138 Bt (Bt check)	0.0	2.2	1.1	0.0	0.0	0.0
NHH 44 (Non Bt check)	2.0	10.3	6.2	0.6	0.5	0.5

Percent square damage was also minimum on Bt hybrids as compared to the check hybrid NHH 44. Similarly, green boll damage and larval population of Pink boll worm was also less on Bt entries (Table 93).

Table 93. Per cent square damage, number of Pink boll worm larvae / 20 bolls and Pink boll worm larvae damage in green bolls (%)

Protected	Per cent square damage			Mean number of PBW larvae/20 green bolls			Mean PBW larvae damage in green bolls (%)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean	2005-06	2006-07	Mean
Hybrid									
KDCHH 9810 Bt	3.0	2.4	2.7	0.2	3.6	1.9	1.6	5.3	3.5
RCH 386 Bt	2.8	2.4	2.6	0.0	2.7	1.4	2.9	4.6	3.8
JKCH 99 Bt	2.1	2.6	2.3	0.2	3.6	1.9	3.0	7.7	5.4
NCS 913 Bt	2.6	3.0	2.8	0.2	3.2	1.7	3.1	4.9	4.0
KDCHH 621 BG II	2.4	3.7	3.1	0.1	2.8	1.4	3.7	3.4	3.5
MRC 7351 BG II	2.3	2.0	2.2	0.1	2.1	1.1	1.0	4.3	2.7
MRC 7341 BG II	1.4	3.7	2.6	0.2	2.6	1.4	1.0	5.7	3.3
ACH 155-2 BG II	5.2	2.3	3.8	0.1	3.7	1.9	3.5	7.6	5.6
RCH 515 BG II	2.9	4.0	3.5	0.2	2.4	1.3	1.4	5.1	3.3
RCH 2 Bt (Bt check)	2.8	2.5	2.6	0.2	2.4	1.3	1.0	4.5	2.8
RCH 138 Bt (Bt check)	2.5	3.1	2.8	0.1	3.5	1.8	1.4	4.7	3.1
NHH 44 (Non Bt check)	14.2	5.7	9.9	1.7	7.3	4.5	7.8	17.6	12.7

Open boll and locule damage during both the years was high on non Bt check hybrid NHH 44 as compared to Bt hybrids (Table 94).

Table 94. Open boll damage (%) - Boll and locule basis

Protected	Open boll damage (%) - Boll basis			Open boll damage (%) - Locule basis		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
Hybrid						
KDCHH 9810 Bt	8.8	7.1	7.9	5.7	4.4	5.1
RCH 386 Bt	9.7	5.6	7.7	6.8	4.1	5.4
JKCH 99 Bt	6.6	5.6	6.1	4.8	4.5	4.7
NCS 913 Bt	7.8	4.2	6.0	5.8	3.9	4.9
KDCHH 621 BG II	9.4	4.5	6.9	5.9	4.2	5.1
MRC 7351 BG II	7.1	4.0	5.6	5.0	3.5	4.2
MRC 7341 BG II	7.8	5.5	6.6	5.3	4.1	4.7
ACH 155-2 BG II	9.2	7.5	8.4	6.3	4.5	5.4
RCH 515 BG II	7.1	5.9	6.5	5.0	3.7	4.4
RCH 2 Bt (Bt check)	6.8	5.0	5.9	4.7	3.8	4.3
RCH 138 Bt (Bt check)	6.1	7.2	6.6	4.2	5.1	4.7
NHH 44 (Non Bt check)	15.1	26.6	20.9	9.8	11.9	10.9

Plant Protection

All the entries in the trial showed susceptibility to sucking pests and required 2 to 3 rounds of chemical intervention to effectively control them (Table 95).

For bollworm control, NHH 44 the non Bt check hybrid, required 2 to 3 rounds of chemical interventions. On the other hand, the Bt check entries, barring ACH 155-2 BG, II required less than one round of chemical intervention (Table 95).

Table 95. Number of sprays for sucking pest and for boll worm control

Hybrid	For Sucking Pests Control			For Boll Worm control		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	2.2	2.3	2.2	0.6	1.0	0.8
RCH 386 Bt	2.2	2.3	2.2	0.4	0.3	0.4
JKCH 99 Bt	2.4	3.0	2.7	0.0	0.3	0.2
NCS 913 Bt	2.4	2.5	2.5	0.6	0.7	0.6
KDCHH 621 BG II	2.4	2.3	2.3	0.0	0.7	0.3
MRC 7351 BG II	2.6	2.3	2.4	0.0	0.7	0.3
MRC 7341 BG II	2.6	2.5	2.6	0.0	0.7	0.3
ACH 155-2 BG II	2.4	2.5	2.5	1.8	0.7	1.2
RCH 515 BG II	2.4	2.5	2.5	0.6	0.7	0.6
RCH 2 Bt (Bt check)	2.4	2.8	2.6	0.6	0.3	0.5
RCH 138 Bt (Bt check)	2.4	2.5	2.5	0.6	0.7	0.6
NHH 44 (Non Bt check)	2.0	2.3	2.1	3.0	2.0	2.5

2. EVALUATION UNDER UNPROTECTED CONDITIONS

Under unprotected conditions, the non Bt check hybrid recorded a mean boll damage of 21.9 per cent and locule damage of 12.4 per cent. The Bt check hybrid RCH 2 Bt recorded a mean boll damage of 8.1 per cent and locule damage of 3.6 per cent. Most of the Bt test hybrids recorded a slightly higher boll and locule damage than RCH 2 Bt (Table 96).

Table 96. Open boll damage (%) - Boll and locule basis

Unprotected	Open boll damage (%) - Boll basis			Open boll damage (%) - Locule basis			
	Hybrid	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt		15.9	6.5	11.2	10.8	1.7	6.2
RCH 386 Bt		15.0	4.7	9.8	11.4	0.7	6.0
JKCH 99 Bt		12.2	6.0	9.1	8.3	0.6	4.5
NCS 913 Bt		12.7	4.5	8.6	9.9	0.8	5.3
KDCHH 621 BG II		14.2	6.3	10.2	10.0	1.3	5.7
MRC 7351 BG II		12.5	3.4	8.0	8.7	0.2	4.4
MRC 7341 BG II		14.0	3.7	8.9	8.5	0.3	4.4
ACH 155-2 BG II		12.7	6.8	9.7	8.6	1.8	5.2
RCH 515 BG II		12.0	4.2	8.1	8.7	0.7	4.7
RCH 2 Bt (Bt check)		12.0	4.2	8.1	6.8	0.3	3.6
RCH 138 Bt (Bt check)		12.0	7.7	9.9	7.6	2.7	5.2
NHH 44 (Non Bt check)		20.4	23.5	21.9	13.7	11.1	12.4

E. MEAN SEED COTTON YIELD UNDER UNPROTECTED CONDITIONS

Under unprotected conditions, all the Bt test entries recorded higher yield than the non Bt check hybrid NHH 44 (Table 97). The percentage increase ranged from 43 to 85. However, as compared to the best Bt check hybrid RCH 2 Bt (1773 kg/ha), only three hybrids recorded higher yield. They are MRC 7351 BG II (1953 kg/ha; 10% increase), RCH 386 BG II (1921 kg/ha; 8% increase) and ACH 155-2 BG II (1868 kg/ha; 5% increase).

Table 97. Mean seed cotton yield (kg/ha)

Unprotected	Seed Cotton Yield (kg/ha)					
	Hybrid	2005-06	2006-07	Mean	% Inc. over RCH 2 Bt	% Inc. over NHH 44
KDCHH 9810 Bt		2090	1315	1702	-4	61
RCH 386 Bt		2061	1782	1921	8	82
JKCH 99 Bt		1989	1518	1753	-1	66
NCS 913 Bt		1907	1314	1610	-9	53
KDCHH 621 BG II		1786	1222	1504	-15	43
MRC 7351 BG II		2148	1758	1953	10	85
MRC 7341 BG II		1955	1399	1677	-5	59
ACH 155-2 BG II		2155	1581	1868	5	77
RCH 515 BG II		2010	1340	1675	-6	59
RCH 2 Bt (Bt check)		2045	1502	1773	0	68
RCH 138 Bt (Bt check)		2022	1013	1517	-14	44
NHH 44 (Non Bt check)		1048	1063	1055	-40	0

F. PATHOLOGICAL EVALUATIONS

Compared to the year 2005-06, the incidences of all four foliar disease viz., alternaria leaf spot, grey mildew, myrothecium leaf spot and bacterial leaf blight were higher during 2006-07. Para wilt was not noticed at Khandwa during 2006-07, but was seen in Nagpur. The overall mean of the occurrence of the five diseases over the two year period is presented here and discussed.

Alternaria leaf spot:

When two year data were taken into consideration for assessment, among the test entries NCS 913 Bt had the highest mean disease incidence (15.9 per cent), followed by ACH 155-2 BG II (15.41 per cent) and the least on MRC 7341 BG II (7.19 per cent), followed by RCH 386 Bt (7.53 per cent) and KDCHH 9810 Bt (7.78 per cent). The check hybrids had a disease incidence range of 8.54 to 9.87 per cent. Eventhough the mean disease incidence was low during 2005-06, the mean disease incidence of 2006-07 has shown the susceptibility of the Bt entries for this disease. (Table 98).

Grey mildew:

Higher incidence of grey mildew was seen during 2006-07 on all test hybrids compared to the year 2005-06, indicating their susceptibility to this disease. Even the check hybrids were also found susceptible. The overall mean of two years has shown that among the Bt test entries , RCH 386 Bt has the highest disease incidence of 16.03 per cent, followed by JKCH 99 (15.86 per cent), MRC 7351 BG II and MRC 7341 BG II (12. 75 per cent). The check hybrids had a disease incidence in the range of 9.73 to 13.75 per cent (Table 98).

Table 98. Reaction of Bt hybrids to Alternaria Leaf Spot and Grey mildew

Hybrid	Alternaria Leaf Spot (PDI)			Grey Mildew (PDI)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	6.3	19.2	7.8	6.5	20.7	13.6
KDCHH 621 BG II	16.1	7.1	11.6	12.3	18.1	15.2
RCH 386 Bt	5.3	9.8	7.5	11.2	21.9	16.0
RCH 515 BG II	10.9	11.9	11.4	6.4	19.1	12.8
NCS 913 Bt	11.6	19.3	15.9	7.0	21.4	14.2
MRC 7351 BG II	4.4	15.1	9.8	8.6	22.4	15.5
MRC 7341 BG II	4.4	10.0	7.2	11.0	19.9	15.5
JKCH 99 Bt	5.5	23.8	14.2	13.1	18.6	15.9
ACH 155-2 BG II	9.3	21.6	15.4	10.8	18.5	14.7
NHH 44 (C.Hy)	6.5	10.7	8.5	7.9	19.7	13.8
RCH 2 Bt (Bt.C.hy)	4.3	15.5	9.9	3.0	19.5	11.2
RCH 138 Bt (Bt.C.hy)	6.9	10.7	8.8	3.3	16.2	9.7

Myrothecium leaf spot:

Even though Myrothecium leaf spot was observed at a very low level during 2005-06, very high incidence of the disease at Khandwa indicated the susceptibility of all test entries including the checks to this disease. The overall mean has shown that among

the test entries MRC 7351 BG II had the highest mean disease incidence (25.02 per cent) and KDCHH 9810 Bt had the least incidence of 15.13 per cent. Both the Bt checks, RCH 2 Bt and RCH 138 Bt had 30.04 per cent and 29.21 per cent, respectively and non-Bt NHH 44 had an incidence of 22.56 percent (Table 99).

Bacterial leaf blight:

During the two years of evaluation of the test entries, high incidence of bacterial leaf blight was observed on all the entries. All the test Bt entries and as well as the check hybrids have been found susceptible at varying levels. The overall mean of two years has shown that among the test hybrids, the highest susceptibility of NCS 913 Bt with average incidence of 20.13 per cent and the least of RCH 575 BG II (14.35 per cent). The rest of the Bt entries had incidence in between the two. The check hybrids had incidences of 18.22 per cent (RCH 2 Bt), 16.51 per cent (NHH 44) and 16.15 per cent (RCH 138 Bt) (Table 99).

Para wilt :

Overall assessment of two years on para wilt indicated variability on the occurrence of this wilt with no incidence of this phenomenon at Khandwa during 2006-07. This has been observed only at Nagpur during 2006-07. The combined mean of two years indicated very low incidence of the wilt phenomenon (Table 99).

Table 99. Reaction of Bt hybrids to Bacterial Leaf Blight and Myrothecium Leaf Spot (PDI) and Para Wilt (%)

Hybrid	Bacterial Leaf Blight (PDI)			Myrothecium Leaf Spot (PDI)			Para wilt (%)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean	2005-06	2006-07	Mean
KDCHH 9810 Bt	9.6	21.1	15.3	1.1	29.0	15.1	8.9	3.5	6.2
KDCHH 621 BG II	11.2	19.6	15.8	1.5	34.0	17.8	1.1	7.2	4.1
RCH 386 Bt	11.1	22.3	16.7	1.9	41.7	21.8	0.0	8.0	4.0
RCH 515 BG II	11.2	17.5	14.4	2.0	46.2	24.1	8.9	6.9	7.9
NCS 913 Bt	15.7	24.6	20.1	2.4	44.2	23.8	3.3	4.8	4.1
MRC 7351 BG II	12.4	24.0	18.2	2.0	48.0	25.0	8.9	4.7	6.8
MRC 7341 BG II	14.7	22.6	18.7	1.8	41.6	21.7	1.1	3.5	2.3
JKCH 99 Bt	13.6	17.0	14.8	1.4	47.3	24.4	12.2	5.8	9.0
ACH 155-2 BG II	8.1	20.7	14.4	2.0	48.0	25.0	2.2	6.0	4.1
NHH 44 (C.Hy)	7.7	25.3	16.5	2.1	43.0	22.6	0.0	5.8	3.0
RCH 2 Bt (Bt.C.hy)	12.8	23.6	18.2	9.2	50.9	30.0	0.0	3.5	1.8
RCH 138 Bt (Bt.C.hy)	12.7	19.6	16.2	10.8	47.6	29.2	6.7	4.7	5.7

G. OVERALL ASSESSMENT

Nine Bt cotton hybrids were evaluated for two successive years during 2005-06 and 2006-07 in Central Zone (Table 100). The hybrids were evaluated at five locations in Khandwa, Surat, Akola, Nanded and Nagpur. The crop at Surat during the second year was affected due to floods and was not taken for analysis.

Jassids, Thrips and Aphids were the main sucking pests. All the Bt hybrids evaluated were susceptible to sucking pests at varying intensities and grades. Chemical intervention was required to control them. The Bt hybrids showed minimum damage to bollworm with reduced green boll and locule damage.

The onset and severity of the foliar disease varied both years. The Bt hybrids have been found susceptible to these diseases. However, proper and timely plant protection measures can reduce the damage to the crop.

In terms of mean seed cotton yield, under protected conditions, only two hybrids *viz.*, RCH 386 Bt and JKCH 99 BT were found to be superior to the check hybrids. However, under unprotected conditions, apart from RCH 386 Bt, hybrids MRC 7351 BG II and ACH 155-2 BG II were also superior to the check hybrids.

Fibre quality wise the Bt test hybrids were superior to the non Bt check hybrid NHH 44 and were on par with the BT check hybrids.

Table 100. SUMMARY TABLE

Hybrid	Seed cotton yield (kg/ha)	% Inc. over RCH 2 Bt	% Inc. over NHH 44	2.5 % Span Length (mm)	Uniformity Ratio	Micronaire	Bundle Strength (g/tex)
KDCHH 9810 Bt	1702	-4	61	28.3	49.8	4.3	22.1
RCH 386 Bt	1921	8	82	31.4	47.6	4.0	22.5
JKCH 99 Bt	1753	-1	66	26.5	50.9	5.0	20.5
NCS 913 Bt	1610	-9	53	29.0	48.9	4.5	21.2
KDCHH 621 BG II	1504	-15	43	28.1	47.7	4.2	20.1
MRC 7351 BG II	1953	10	85	29.3	48.3	4.3	22.2
MRC 7341 BG II	1677	-5	59	30.3	50.0	4.1	22.7
ACH 155-2 BG II	1868	5	77	28.3	48.8	4.1	21.2
RCH 515 BG II	1675	-6	59	27.6	49.2	4.4	21.0
RCH 2 Bt (Bt check)	1773	0	68	29.3	49.0	4.0	21.2
RCH 138 Bt (Bt check)	1517	-14	44	27.2	49.3	3.4	22.2
NHH 44 (Non Bt check)	1055	-40	0	25.7	48.9	4.0	19.5

Table . SUMMARY TABLE

Hybrid	Jassid / plant	White fly /plant	Mean PBW larvae damage in green bolls (%)	Open boll damage (%) - Boll basis	Open boll damage (%) - Locule basis	No of Helicoverpa Larvae / 5plants	Bacterial Leaf Blight (PDI)	Myrothecium Leaf Spot (PDI)	Para wilt (%)	Alternaria Leaf Spot (PDI)	Grey Mildew (PDI)
KDCHH 9810 Bt	3.5	2.1	3.5	7.9	5.1	0.0	15.3	15.1	6.2	7.8	13.6
RCH 386 Bt	3.6	2.1	3.8	7.7	5.4	0.0	16.7	21.8	4.0	7.5	16.0
JKCH 99 Bt	4.0	2.2	5.4	6.1	4.7	0.0	14.8	24.4	9.0	14.2	15.9
NCS 913 Bt	4.1	2.0	4.0	6.0	4.9	0.0	20.1	23.8	4.1	15.9	14.2
KDCHH 621 BG II	3.5	2.0	3.5	6.9	5.1	0.0	15.8	17.8	4.1	11.6	15.2
MRC 7351 BG II	3.6	2.1	2.7	5.6	4.2	0.0	18.2	25.0	6.8	9.8	15.5
MRC 7341 BG II	3.7	2.0	3.3	6.6	4.7	0.0	18.7	21.7	2.3	7.2	15.5
ACH 155-2 BG II	3.4	2.1	5.6	8.4	5.4	0.1	14.4	25.0	4.1	15.4	14.7
RCH 515 BG II	3.9	2.0	3.3	6.5	4.4	0.0	14.4	24.1	7.9	11.4	12.8
RCH 2 Bt (Bt check)	4.2	1.8	2.8	5.9	4.3	0.1	18.2	30	1.8	9.9	11.2
RCH 138 Bt (Bt check)	3.5	2.2	3.1	6.6	4.7	0.0	16.2	29.2	5.7	8.8	9.7
NHH 44 (Non Bt check)	3.4	1.9	12.7	20.9	10.9	0.5	16.5	22.6	3.0	8.5	13.8