Evaluation of Bt Cotton Hybrids

North Zone

2007-08

Report submitted to

Indian Council of Agricultural Research

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Submitted by

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NORTH ZONE

EVALUATION OF BT COTTON HYBRIDS

The All India Coordinated Cotton Improvement Project (AICCIP) was assigned the task of evaluating the Bt cotton hybrids during 2007-08 in the North Zone vide ICAR letter No. 2(3)/2007 dt. 14-05-2007.

FIRST YEAR TRIALS

In the first year trial, 34 Bt cotton test hybrids were evaluated along with three check hybrids viz., RCH 134 Bt (Bt check hybrid), while the Non-Bt check hybrids were CSHH 198 and LHH 144. The test hybrids and the sponsoring company are furnished below.

Name of the Company	Name of the test Entry
Ankur Seeds Ltd.	Ankur 5642 BG II
Ankur Seeds Ltd.	Ankur 8120 BG II
Bio Seeds Research India (P) Ltd.	2510-II
Bio Seeds Research India (P) Ltd.	2113-II
Emergent Genetics India (P) Ltd,	EGCH 1417 BG II
Ganga Kaveri Seeds Pvt. Ltd.	GK 212 BG II
JK Agri Genetics Ltd.	JKCH 1923 Bt
JK Agri Genetics Ltd.	JKCH 1145 Bt
Kaveri Seed Co. Ltd.	KCH 707 BG II
Krishidhan Seeds Ltd.	KDCHH 144 BG II
Mahyco	MRC 7041 BG II
Mahyco	MRC 7045 BG II
Nandi Seeds Pvt. Ltd.	SDS 9
Nandi Seeds Pvt. Ltd.	SDS 36
Nath Seeds Ltd.	NCEH 26
Nath Seeds Ltd.	NCEH 31 BG I
Navkar Seeds Pvt. Ltd.	ACH 1005 Bt BG I
Navkar Seeds Pvt. Ltd.	Navkar 5 Bt
Nuziveedu Seeds (P) Ltd	NCS 853 Bt 2
Nuziveedu Seeds (P) Ltd	NCS 851 Bt 2
Prabhat Agri Biotech Ltd.	PCH 930 Bt 2
Prabhat Agri Biotech Ltd.	PCH 2270 Bt 2
RASI Seeds (P) Ltd.,	RCH 569 BG II
Safal Seeds & Biotech Ltd.	SBCH 286 Bt
Tulasi Seeds (P) Ltd,	Tulasi 45 BG II
Uniphos Enterprises Ltd.	UPLHH 1 Bt
Vibha Agro Tech Ltd.	VBCH 1503 BG II
Vibha Agro Tech Ltd.	VBCH 1501 BG II
Vibha Agro Tech Ltd.	VBCH 1504 BG II
Vikki's Agrotech Pvt. Ltd.	VCH 601 BG II
Vikram Seeds Ltd.	VICH 11 BG II
Vikram Seeds Ltd.	VICH 9 BG II
Zuari Seeds Ltd.	ZCH 50003 Bt
Zuari Seeds Ltd.	ZCH 50023 Bt

Trial Locations:

The trial was conducted at six locations. They are

1. Punjab Agricultural University, Ludhiana, Punjab
2. Punjab Agricultural University, Faridkot, Punjab
3. Punjab Agricultural University, Abohar, Punjab
4. Choudhary Charan Singh Haryana Agricultural University, Hisar, Haryana
5. Central Institute for Cotton Research, Regional Station, Sirsa, Haryana
6. Rajasthan Agricultural University, Sriganganagar, Rajasthan

Trial Details

Number of Entries:	34+3 checks	
Number of Rows:	Yield trial 1:	6 Rows (Protected)
	Screening Trial 2 & 3:	3 Rows (Unprotected)
Row length:	6 m	
Spacing:	75 x 60 cm	
No. of replications:	Three	
Design:	Randomized Block Design	
Fertilizers:	As per Recommendations.	

TRIALS

I. EVALUATION UNDER ETL BASED PLANT PROTECTION

Weekly observations were recorded from 45 DAS against major sucking Pests and Bollworms. The insecticide sprays were based on the threshold levels of sap sucking pests and Bollworms. 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.

II. EVALUATION UNDER UNPROTECTED CONDITIONS FOR BOLLWORMS:

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

III. PATHOLOGICAL EVALUATION OF Bt COTTON HYBRIDS

All the entries in the trial were screened against Cotton Leaf Curl Virus (CLCuV) disease (CLCuD) and other fungal diseases.

Observations Recorded

The Biometrical observations recorded were germination percentage, final plant stand, ginning per cent, lint index, seed index, Seed Cotton Yield (kg/ha) and lint yield (kg/ha). The entomological observations on sap sucking pests, Bollworm damage and natural enemies were recorded under ETL based plant protection trial. The pathological observations on incidence of cotton CLCuV and other foliar diseases were recorded.

I. EVALUATION UNDER ETL BASED PLANT PROTECTION

A. BIOMETRICAL EVALUATION.

Biometrical observations were recorded in the ETL based Plant Protection Trial and are reported here.

Germination and final Plant Stand

Germination in general was good and consequently, the final plant stand was also satisfactory in all the entries (Table 1 & 2). However, the plant stand in respect of KCH 707 BG II, and RCH 569 BG II was found less at Ludhiana, Sirsa and Sriganganagar.

Boll Weight

Mean boll weight varied from 3.3 g (ZCH 50003 Bt) to 4.3 g (CSHH 198) (Table 3).

Ginning Out turn (%)

Ginning Outturn varied from 31.1 per cent (Ankur 5642 BG II) to 37.6 per cent (ZCH 50023 Bt.). The Bt check hybrid RCH 134 Bt recorded a mean ginning out turn of 34.7 per cent. The non-Bt check hybrids LHH 144 and CSHH 198 recorded a low ginning out turn of 31.3 and 31.9 per cent, respectively (Table 4).

Lint Index and Seed Index

The variation among the entries for lint and seed index was noticeable. Lint index varied from 3.7 to 5.4 g (Table 5) and the seed index from 7.3 to 10.3 g (Table 6).

Table 1. Germination (%) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Mean
2113-II	95.1	92.0	100.0	95.7
2510-II	88.3	85.8	92.7	88.9
ACH 1005 Bt BGI	93.8	93.8	100.0	95.9
Ankur 5642 BGII	96.3	92.0	100.0	96.1
Ankur 8120 BGII	92.0	90.1	100.0	94.0
CSHH 198 (c)	89.5	88.9	100.0	92.8
EGCH 1417 BGII	93.8	92.6	100.0	95.5
GK 212 BGII	91.4	90.1	93.3	91.6
JKCH 1145 Bt	94.4	92.6	100.0	95.7
JKCH 1923 Bt	92.6	89.5	96.7	92.9
KCH 707 BGII	85.2	84.0	84.7	84.6
KDCHH 144 BGII	67.9	88.9	94.0	83.6
LHH 144 (c)	90.1	94.4	100.0	94.8
MRC 7041 BGII	93.8	90.7	100.0	94.8
MRC 7045 BGII	88.3	88.3	100.0	92.2
Navkar 5 Bt	92.0	88.9	100.0	93.6
NCEH 26	93.8	85.8	100.0	93.2
NCEH 31 BGI	96.3	90.1	100.0	95.5
NCS 851 Bt 2	93.2	89.5	91.3	91.3
NCS 853 Bt 2	93.8	93.8	96.7	94.8
PCH 2270 Bt 2	88.9	87.7	100.0	92.2
PCH 930 Bt 2	95.7	86.4	96.7	92.9
RCH 134 Bt (Bt c)	94.4	95.1	100.0	96.5
RCH 569 BGII	87.7	89.5	90.0	89.1
SBCH 286 Bt	90.7	88.9	99.3	93.0
SDS 36	92.6	88.9	100.0	93.8
SDS 9	90.7	91.4	100.0	94.0
Tulasi 45 BGII	92.6	86.4	95.0	91.3
UPLHH 1 Bt	98.1	93.8	100.0	97.3
VBCH 1501 BGII	95.1	91.4	87.3	91.3
VBCH 1503 BGII	95.7	88.3	91.3	91.8
VBCH 1504 BGII	92.0	91.4	90.0	91.1
VCH 601 BGII	87.0	88.9	94.7	90.2
VICH 11 BGII	92.6	91.4	98.0	94.0
VICH 9 BGII	96.9	90.1	96.7	94.6
ZCH 50003 Bt	93.8	89.5	100.0	94.4
ZCH 50023 Bt	90.1	90.1	100.0	93.4

Table 2. Number of plants at harvest under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Srigangan agar	Mean
2113-II	50.3	50.0	36.0	60.3	51.3	48.0	49.3
2510-II	46.0	48.3	36.0	63.7	41.7	51.3	47.8
ACH 1005 Bt BGI	50.7	51.3	42.0	63.7	51.0	47.7	51.1
Ankur 5642 BGII	50.3	50.7	43.0	65.0	54.0	53.7	52.8
Ankur 8120 BGII	49.0	49.3	41.0	62.3	51.0	46.3	49.8
CSHH 198 (c)	50.0	49.3	41.0	60.3	48.0	51.3	50.0
EGCH 1417 BGII	50.3	50.0	40.0	59.7	39.3	51.7	48.5
GK 212 BGII	45.7	49.0	38.0	57.0	44.7	49.0	47.2
JKCH 1145 Bt	51.7	50.3	36.0	61.7	49.0	55.3	50.7
JKCH 1923 Bt	49.3	49.7	34.0	64.0	53.3	48.3	49.8
KCH 707 BGII	35.7	46.3	17.0	38.0	22.0	25.7	30.8
KDCHH 144 BGII	29.7	48.0	31.0	52.7	52.7	49.0	43.9
LHH 144 (c)	48.3	51.7	43.0	63.3	38.0	49.0	48.9
MRC 7041 BGII	49.7	50.7	39.0	60.0	48.7	47.7	49.3
MRC 7045 BGII	43.7	48.3	38.0	63.3	52.3	50.7	49.4
Navkar 5 Bt	46.3	48.7	40.0	64.3	47.0	43.7	48.3
NCEH 26	49.7	47.0	42.0	57.7	49.3	51.3	49.5
NCEH 31 BGI	50.0	48.7	42.0	63.0	47.0	52.0	50.5
NCS 851 Bt 2	48.7	48.7	34.0	61.3	51.0	49.0	48.8
NCS 853 Bt 2	50.0	51.0	37.0	62.7	40.7	44.3	47.6
PCH 2270 Bt 2	51.3	48.0	35.0	64.0	51.0	50.3	49.9
PCH 930 Bt 2	47.7	47.7	34.0	64.3	49.7	41.3	47.5
RCH 134 Bt (Bt c)	49.3	51.7	45.0	63.3	52.0	53.7	52.5
RCH 569 BGII	47.3	49.0	24.0	42.3	26.0	31.7	36.7
SBCH 286 Bt	49.3	49.3	38.0	62.7	50.3	44.7	49.0
SDS 36	49.0	49.0	45.0	64.3	55.3	56.3	53.2
SDS 9	48.0	51.0	46.0	64.3	49.7	52.3	51.9
Tulasi 45 BGII	50.3	47.3	35.0	59.7	51.7	46.7	48.4
UPLHH 1 Bt	51.0	51.3	43.0	62.3	54.7	47.7	51.7
VBCH 1501 BGII	51.0	50.7	40.0	59.3	56.7	54.0	52.0
VBCH 1503 BGII	50.0	49.0	38.0	63.0	54.3	53.7	51.3
VBCH 1504 BGII	49.7	50.0	32.0	60.7	54.7	43.7	48.5
VCH 601 BGII	50.0	49.0	36.0	59.3	45.7	40.7	46.8
VICH 11 BGII	49.0	50.3	38.0	60.3	49.0	50.3	49.5
VICH 9 BGII	51.7	50.0	43.0	62.7	55.7	52.3	52.6
ZCH 50003 Bt	48.0	49.0	41.0	58.3	52.3	42.0	48.4
ZCH 50023 Bt	45.3	49.0	43.0	59.3	47.7	44.3	48.1

Table 3. Boll weight (g) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
2113-II	3.4	4.3	3.6	3.5	3.7	2.8	3.6
2510-II	3.7	3.7	4.4	3.3	3.8	2.7	3.6
ACH 1005 Bt BG I	3.5	3.8	4.5	3.6	4.0	2.7	3.7
Ankur 5642 BG II	4.1	3.8	4.7	3.3	3.5	2.8	3.7
Ankur 8120 BG II	3.6	4.6	4.9	4.5	4.2	3.6	4.2
CSHH 198 (c)	5.0	4.4	5.1	4.1	4.5	2.6	4.3
EGCH 1417 BG II	3.9	3.5	5.2	3.7	3.9	3.7	4.0
GK 212 BG II	4.1	4.0	4.5	3.6	4.0	2.9	3.8
JKCH 1145 Bt	4.6	3.4	3.8	3.4	2.9	2.4	3.4
JKCH 1923 Bt	4.2	4.0	5.1	4.4	4.3	2.6	4.1
KCH 707 BG II	3.5	3.1	4.7	4.4	3.4	3.0	3.7
KDCHH 144 BG II	3.0	3.6	4.6	3.3	3.9	2.8	3.5
LHH 144 (c)	4.5	4.1	4.4	4.1	3.6	3.0	3.9
MRC 7041 BG II	4.3	4.1	4.6	4.3	4.2	3.2	4.1
MRC 7045 BG II	4.1	4.0	4.4	4.4	4.1	3.2	4.0
Navkar 5 Bt	3.1	3.0	4.0	3.5	3.3	2.8	3.3
NCEH 26	3.9	4.0	4.1	5.0	3.6	2.7	3.9
NCEH 31 BG I	3.6	3.2	3.7	3.7	3.3	2.2	3.3
NCS 851 Bt 2	3.3	4.2	4.1	3.2	3.9	3.0	3.6
NCS 853 Bt 2	3.2	3.4	4.4	3.9	4.2	3.3	3.7
PCH 2270 Bt 2	4.1	3.5	4.7	4.0	3.7	3.1	3.8
PCH 930 Bt 2	3.6	4.0	3.8	4.4	4.0	2.8	3.8
RCH 134 Bt (Bt c)	4.1	3.6	4.6	3.7	3.7	3.4	3.9
RCH 569 BG II	4.2	3.6	4.5	3.5	3.5	2.9	3.7
SBCH 286 Bt	3.6	4.2	4.7	3.5	3.6	3.2	3.8
SDS 36	3.8	3.7	4.7	3.1	3.8	2.9	3.7
SDS 9	3.7	4.5	4.7	3.4	3.7	2.6	3.8
Tulasi 45 BG II	4.0	4.2	4.8	4.2	4.2	3.0	4.1
UPLHH 1 Bt	3.6	3.4	4.4	3.8	3.8	2.7	3.6
VBCH 1501 BG II	3.4	4.1	3.9	3.6	3.7	3.4	3.7
VBCH 1503 BG II	4.1	4.1	4.6	3.7	3.4	2.8	3.8
VBCH 1504 BG II	3.7	4.1	4.2	3.8	4.1	3.6	3.9
VCH 601 BG II	4.3	4.1	4.9	4.3	4.2	3.6	4.2
VICH 11 BG II	3.1	4.0	4.3	4.4	3.6	2.8	3.7
VICH 9 BG II	3.7	3.4	4.3	3.2	3.7	2.9	3.5
ZCH 50003 Bt	3.3	3.8	3.8	3.1	3.4	2.7	3.3
ZCH 50023 Bt	3.3	3.3	3.8	3.6	3.8	2.6	3.4

Table 4. Ginning Outturn (%)under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
2113-II	35.8	31.3	33.3	36.1	34.0	34.1	34.1
2510-II	35.2	32.5	32.3	35.0	34.7	32.7	33.7
ACH 1005 Bt BGI	32.8	31.0	30.8	31.9	32.2	31.4	31.7
Ankur 5642 BGII	31.9	30.3	30.9	32.1	31.2	30.0	31.1
Ankur 8120 BGII	33.4	31.2	31.5	32.1	32.5	30.9	31.9
CSHH 198 (c)	32.1	30.2	31.6	32.0	32.5	33.3	31.9
EGCH 1417 BGII	32.4	29.5	29.8	30.3	32.3	33.3	31.3
GK 212 BGII	34.0	32.1	31.5	34.3	34.0	31.7	32.9
JKCH 1145 Bt	34.5	35.6	35.6	38.0	37.0	36.7	36.2
JKCH 1923 Bt	34.7	34.3	33.3	37.8	36.5	35.6	35.4
KCH 707 BGII	34.7	34.4	34.8	35.9	34.0	31.8	34.3
KDCHH 144 BGII	35.6	30.9	32.5	34.1	32.7	31.0	32.8
LHH 144 (c)	30.4	32.2	30.4	31.0	31.8	32.2	31.3
MRC 7041 BGII	33.8	33.0	30.6	35.0	34.7	33.6	33.4
MRC 7045 BGII	34.2	32.5	29.1	31.9	33.0	31.7	32.1
Navkar 5 Bt	32.7	31.6	31.5	32.6	32.2	35.2	32.6
NCEH 26	36.0	34.9	33.8	37.0	35.2	33.2	35.0
NCEH 31 BGI	34.8	35.5	29.8	33.6	34.5	34.6	33.8
NCS 851 Bt 2	34.4	30.6	29.8	34.1	34.5	32.4	32.6
NCS 853 Bt 2	35.8	32.1	32.8	36.4	33.0	35.0	34.2
PCH 2270 Bt 2	34.1	32.9	30.6	34.6	33.7	31.4	32.9
PCH 930 Bt 2	35.7	31.5	33.0	35.9	33.8	33.0	33.8
RCH 134 Bt (Bt c)	36.4	34.3	31.9	36.5	36.2	33.1	34.7
RCH 569 BGII	34.1	29.6	29.3	32.2	32.5	30.2	31.3
SBCH 286 Bt	36.0	32.0	31.5	36.2	35.0	34.8	34.3
SDS 36	33.3	29.4	31.3	32.4	32.7	30.5	31.6
SDS 9	34.6	31.7	30.6	36.1	34.0	36.0	33.8
Tulasi 45 BGII	32.0	29.3	31.0	30.0	33.5	33.4	31.5
UPLHH 1 Bt	36.1	33.9	33.8	36.1	35.3	35.1	35.1
VBCH 1501 BGII	35.6	34.4	32.5	35.3	37.8	36.9	35.4
VBCH 1503 BGII	34.3	32.8	31.9	34.1	34.7	35.4	33.9
VBCH 1504 BGII	34.4	32.9	33.8	34.2	35.8	33.6	34.1
VCH 601 BGII	36.0	31.6	32.0	34.5	34.8	34.6	33.9
VICH 11 BGII	35.5	32.9	32.5	36.0	36.3	33.7	34.5
VICH 9 BGII	35.6	30.2	30.4	34.6	34.5	34.2	33.2
ZCH 50003 Bt	34.9	32.1	29.3	34.5	33.2	33.0	32.8
ZCH 50023 Bt	36.6	38.8	35.6	39.9	37.8	37.2	37.6

Table 5. Lint Index (g) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
2113-II	4.6	4.7	4.0	4.8	3.4	4.3
2510-II	4.9	4.7	4.1	4.9	3.7	4.4
ACH 1005 Bt BGI	4.5	5.1	4.0	4.8	4.0	4.5
Ankur 5642 BGII	4.1	4.4	4.4	4.3	3.7	4.2
Ankur 8120 BGII	5.2	5.1	4.1	4.7	3.8	4.6
CSHH 198 (c)	4.3	4.3	3.8	4.2	4.1	4.1
EGCH 1417 BGII	5.0	4.7	4.3	4.4	4.8	4.6
GK 212 BGII	5.1	4.7	4.2	5.2	3.8	4.6
JKCH 1145 Bt	3.7	4.2	4.0	4.9	3.9	4.2
JKCH 1923 Bt	4.4	5.1	4.5	4.6	3.2	4.4
KCH 707 BGII	5.3	5.9	5.7	5.4	4.5	5.4
KDCHH 144 BGII	5.4	4.5	4.6	4.7	4.2	4.7
LHH 144 (c)	4.4	4.9	4.2	3.7	3.8	4.2
MRC 7041 BGII	4.6	4.7	4.4	5.0	3.8	4.5
MRC 7045 BGII	5.2	5.0	3.8	4.4	4.7	4.6
Navkar 5 Bt	4.0	3.4	3.7	3.4	3.8	3.7
NCEH 26	5.5	5.7	4.8	5.6	4.3	5.2
NCEH 31 BGI	4.4	5.2	3.9	4.6	4.0	4.4
NCS 851 Bt 2	5.5	5.2	4.2	4.9	4.4	4.8
NCS 853 Bt 2	5.3	5.6	4.3	5.2	4.5	5.0
PCH 2270 Bt 2	5.7	5.9	4.6	5.2	4.6	5.2
PCH 930 Bt 2	5.1	4.1	4.7	5.2	4.1	4.6
RCH 134 Bt (Bt c)	5.1	5.4	4.3	5.4	4.3	4.9
RCH 569 BGII	4.0	4.2	3.6	3.8	3.7	3.9
SBCH 286 Bt	5.1	4.5	4.3	5.2	4.7	4.8
SDS 36	5.1	4.9	4.3	4.9	3.8	4.6
SDS 9	4.9	4.8	3.9	5.4	5.0	4.8
Tulasi 45 BGII	4.8	4.7	4.0	4.2	4.3	4.4
UPLHH 1 Bt	4.7	5.0	3.9	4.3	3.5	4.3
VBCH 1501 BGII	4.8	4.6	3.9	4.5	4.8	4.5
VBCH 1503 BGII	5.2	4.6	4.4	4.7	4.4	4.7
VBCH 1504 BGII	4.9	4.5	4.9	4.5	4.4	4.6
VCH 601 BGII	5.2	5.0	5.0	5.0	5.0	5.0
VICH 11 BGII	5.0	5.8	4.8	5.2	3.8	4.9
VICH 9 BGII	4.8	4.6	4.1	4.2	4.0	4.3
ZCH 50003 Bt	4.6	4.2	3.4	4.2	3.8	4.0
ZCH 50023 Bt	4.9	5.9	4.4	6.0	5.0	5.2

Table 6. Seed Index (g) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
2113-II	8.2	10.9	8.1	8.5	8.9	6.5	8.5
2510-II	8.9	9.7	8.6	9.1	9.5	7.6	8.9
ACH 1005 Bt BGI	9.2	11.2	9.1	10.2	10.6	8.8	9.9
Ankur 5642 BGII	8.8	10.0	9.9	9.2	9.2	8.6	9.3
Ankur 8120 BGII	10.4	11.3	8.8	10.0	10.0	8.6	9.8
CSHH 198 (c)	9.1	9.9	8.2	8.9	9.3	8.3	9.0
EGCH 1417 BGII	10.5	11.1	10.1	10.1	10.2	9.6	10.3
GK 212 BGII	9.8	9.9	9.2	10.1	11.0	8.3	9.7
JKCH 1145 Bt	7.1	7.6	7.3	8.0	7.2	6.8	7.3
JKCH 1923 Bt	8.3	9.7	9.0	7.6	8.7	5.8	8.2
KCH 707 BGII	9.9	11.3	10.7	9.6	10.2	9.7	10.2
KDCHH 144 BGII	9.8	10.1	9.6	9.1	10.2	9.3	9.7
LHH 144 (c)	10.1	10.3	9.7	8.3	9.0	8.1	9.2
MRC 7041 BGII	9.0	9.5	9.9	9.3	9.1	7.6	9.1
MRC 7045 BGII	10.0	10.4	9.2	9.3	10.8	10.2	10.0
Navkar 5 Bt	8.3	7.3	8.1	7.1	8.1	7.0	7.6
NCEH 26	9.8	10.6	9.5	9.5	9.8	8.6	9.6
NCEH 31 BGI	8.3	9.4	9.2	9.0	8.4	7.6	8.6
NCS 851 Bt 2	10.5	11.7	9.9	9.5	10.8	9.2	10.3
NCS 853 Bt 2	9.5	11.7	8.9	9.1	10.6	8.4	9.7
PCH 2270 Bt 2	11.0	9.7	10.5	9.8	11.0	10.0	10.3
PCH 930 Bt 2	9.2	8.8	9.5	9.3	10.0	8.4	9.2
RCH 134 Bt (Bt c)	8.9	10.4	9.3	9.3	9.7	8.7	9.4
RCH 569 BGII	7.8	10.0	8.7	8.1	9.6	8.5	8.8
SBCH 286 Bt	9.0	9.6	9.4	9.2	9.0	8.8	9.2
SDS 36	10.1	11.8	9.4	10.3	10.4	8.7	10.1
SDS 9	9.3	10.3	8.9	9.5	9.9	8.8	9.4
Tulasi 45 BGII	10.1	11.2	8.8	9.8	9.8	8.5	9.7
UPLHH 1 Bt	8.4	9.2	7.5	7.6	8.1	6.5	7.9
VBCH 1501 BGII	8.6	8.7	8.2	8.3	9.2	8.2	8.5
VBCH 1503 BGII	10.0	9.5	9.4	9.1	10.6	8.1	9.4
VBCH 1504 BGII	9.4	10.3	9.7	8.7	9.3	8.7	9.3
VCH 601 BGII	9.3	11.2	10.5	9.5	9.0	9.4	9.8
VICH 11 BGII	9.1	11.9	10.1	9.3	9.2	7.5	9.5
VICH 9 BGII	8.7	10.6	9.4	7.9	10.4	7.6	9.1
ZCH 50003 Bt	8.5	8.9	8.3	8.1	8.8	7.8	8.4
ZCH 50023 Bt	8.4	9.4	7.9	9.1	9.8	8.4	8.8

Seed Cotton Yield

Seed cotton yield data pertaining to four centres *viz*., Ludhiana, Faridkot, Hisar and Sirsa have been taken into consideration and summarized in Table 7. The data from Abohar and Sriganganagar have not been considered due to vitiation of trials that has arisen due to water logged situation, mealy bug infestation and late sown conditions. All these cumulatively aggravated crop growth condition leading to wide fluctuation in seed cotton yield in these two centres.

Among the check hybrids, RCH 134 Bt recorded the highest yield of 2367 kg/ha. Of the 34 test hybrids evaluated, only 2510-II with 2375 kg/ha (0.4 % increase) was superior to the Bt check hybrid.

Of the two non Bt check hybrids, CSHH 198 recorded a better seed cotton yield of 1870 kg/ha. As compared to the best non Bt check hybrid, as many as 19 test hybrids were superior to it.

Lint yield

The lint yield followed the same trend as that of seed cotton yield. RCH 134 Bt with a mean lint yield of 823 kg/ha was the best check hybrid. Hybrids 2510-II and 2113-II were the next best hybrids with 796 kg/ha.

B. FIBRE QUALITY EVALUATION

The 2.5% Span length varied from 25.5 mm (ZCH 50023 Bt) to 32.6 mm (SDS 36). The Micronaire value ranged from 3.9 (NCEH 31 BG I) to 5.2 (VBCH 1501 BG II). Bundle strength varied from 20.0 (ZCH 50023 Bt) to 24.5 (Ankur 5642 BG II) g/tex (Tables 9 & 10).

Table 7. Seed cotton yield (kg/ha) under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	**Mean**	% Inc. over CSHH 198	% Inc. over RCH 134 Bt	% Inc. over LHH 144
2113-II	2454	1962	2232	2806	**2363**	30.1	-0.2	43.8
2510-II	2653	2316	2537	1995	**2375**	30.7	0.4	44.6
ACH 1005 Bt BG I	2092	1535	2398	2287	**2078**	14.4	-12.2	26.5
Ankur 5642 BG II	2212	2165	2176	2032	**2146**	18.1	-9.3	30.6
Ankur 8120 BG II	2006	1822	1834	2000	**1915**	5.4	-19.1	16.6
CSHH 198 (c)	2263	1455	2056	1495	**1817**	0.0	-23.2	10.6
EGCH 1417 BG II	1715	1988	1889	1662	**1814**	-0.2	-23.4	10.4
GK 212 BG II	2460	1411	2185	2083	**2035**	12.0	-14.0	23.8
JKCH 1145 Bt	2339	1343	2491	2398	**2143**	17.9	-9.5	30.4
JKCH 1923 Bt	2276	1414	1982	2500	**2043**	12.4	-13.7	24.3
KCH 707 BG II	914	914	1685	1120	**1158**	-36.3	-51.1	-29.5
KDCHH 144 BG II	1553	773	1269	1995	**1397**	-23.1	-41.0	-14.9
LHH 144 (c)	1790	1521	1722	1537	**1643**	-9.6	-30.6	0.0
MRC 7041 BG II	2237	1160	2760	2171	**2082**	14.6	-12.0	26.7
MRC 7045 BG II	2410	1466	2074	1819	**1942**	6.9	-17.9	18.2
Navkar 5 Bt	1900	2075	2093	2120	**2047**	12.7	-13.5	24.6
NCEH 26	1456	1788	1556	1736	**1634**	-10.1	-31.0	-0.6
NCEH 31 BG I	1501	2189	2602	2398	**2173**	19.6	-8.2	32.2
NCS 851 Bt 2	1366	1188	1908	1648	**1527**	-15.9	-35.5	-7.0
NCS 853 Bt 2	1151	1159	2037	1574	**1480**	-18.5	-37.5	-9.9
PCH 2270 Bt 2	1491	1688	2371	1389	**1735**	-4.5	-26.7	5.6
PCH 930 Bt 2	1407	1139	2232	1690	**1617**	-11.0	-31.7	-1.6
RCH 134 Bt (Bt c)	1307	2732	3093	2338	**2367**	30.3	0.0	44.1
RCH 569 BG II	2049	1719	1963	1394	**1781**	-2.0	-24.7	8.4
SBCH 286 Bt	1465	1508	1602	1079	**1414**	-22.2	-40.3	-14.0
SDS 36	2059	1759	2510	944	**1818**	0.0	-23.2	10.6
SDS 9	1424	2347	2306	1699	**1944**	7.0	-17.9	18.3
Tulasi 45 BG II	2213	1645	1834	2019	**1928**	6.1	-18.6	17.3
UPLHH 1 Bt	1755	1805	2250	2704	**2129**	17.1	-10.1	29.6
VBCH 1501 BG II	1795	1764	2278	2245	**2021**	11.2	-14.6	23.0
VBCH 1503 BG II	1706	1635	2093	1204	**1659**	-8.7	-29.9	1.0
VBCH 1504 BG II	1600	1591	2000	1486	**1669**	-8.1	-29.5	1.6
VCH 601 BG II	901	1491	1908	1356	**1414**	-22.2	-40.3	-13.9
VICH 11 BG II	1678	937	1796	1468	**1470**	-19.1	-37.9	-10.5
VICH 9 BG II	1079	1384	2213	1537	**1553**	-14.5	-34.4	-5.5
ZCH 50003 Bt	1594	1407	1713	2565	**1820**	0.2	-23.1	10.8
ZCH 50023 Bt	1194	1633	1713	1796	**1584**	-12.8	-33.1	-3.6
CD 5%	296	394	248	187				
CV%	10	15	--	6				

Table 8. Lint yield (kg/ha) under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	**Mean**	% Inc. over CSHH 198	% Inc. over RCH 134 Bt	% Inc. over LHH 144
2113-II	769	654	805	955	**796**	39.1	-3.3	54.5
2510-II	861	742	887	692	**796**	39.1	-3.3	54.5
ACH 1005 Bt BG I	649	472	764	736	**655**	14.6	-20.4	27.2
Ankur 5642 BG II	671	663	699	633	**666**	16.5	-19.0	29.4
Ankur 8120 BG II	628	574	589	650	**610**	6.7	-25.8	18.5
CSHH 198 (c)	683	460	657	486	**572**	-0.1	-30.6	11.0
EGCH 1417 BG II	506	591	572	537	**552**	-3.6	-33.0	7.1
GK 212 BG II	789	445	749	708	**673**	17.6	-18.3	30.6
JKCH 1145 Bt	834	478	946	887	**786**	37.4	-4.5	52.7
JKCH 1923 Bt	782	465	750	912	**727**	27.1	-11.6	41.2
KCH 707 BG II	316	318	606	382	**405**	-29.1	-50.7	-21.3
KDCHH 144 BG II	479	252	433	651	**454**	-20.7	-44.9	-11.9
LHH 144 (c)	576	463	534	489	**515**	-9.9	-37.4	0.1
MRC 7041 BG II	736	356	965	752	**702**	22.8	-14.7	36.4
MRC 7045 BG II	781	426	662	600	**617**	7.9	-25.0	19.8
Navkar 5 Bt	601	653	682	682	**654**	14.4	-20.5	27.1
NCEH 26	509	604	576	610	**575**	0.5	-30.2	11.6
NCEH 31 BG I	531	649	874	827	**720**	25.9	-12.5	39.9
NCS 851 Bt 2	420	349	651	569	**497**	-13.1	-39.6	-3.4
NCS 853 Bt 2	368	379	741	520	**502**	-12.2	-39.0	-2.5
PCH 2270 Bt 2	491	518	820	468	**574**	0.4	-30.2	11.5
PCH 930 Bt 2	445	376	801	571	**548**	-4.1	-33.4	6.5
RCH 134 Bt (Bt c)	446	874	1128	846	**823**	44.0	0.1	59.9
RCH 569 BG II	608	502	633	453	**549**	-4.0	-33.3	6.6
SBCH 286 Bt	470	474	580	377	**475**	-16.9	-42.3	-7.7
SDS 36	605	547	812	308	**568**	-0.7	-31.0	10.3
SDS 9	453	719	833	578	**646**	12.9	-21.5	25.4
Tulasi 45 BG II	649	510	550	701	**603**	5.3	-26.8	17.0
UPLHH 1 Bt	597	609	812	955	**743**	30.0	-9.7	44.3
VBCH 1501 BG II	617	573	803	849	**711**	24.2	-13.7	38.0
VBCH 1503 BG II	560	521	714	417	**553**	-3.3	-32.8	7.4
VBCH 1504 BG II	527	537	683	533	**570**	-0.3	-30.7	10.7
VCH 601 BG II	285	477	659	473	**473**	-17.2	-42.5	-8.1
VICH 11 BG II	552	304	647	533	**509**	-11.0	-38.1	-1.2
VICH 9 BG II	325	419	766	530	**510**	-10.9	-38.0	-1.0
ZCH 50003 Bt	512	413	591	851	**592**	3.5	-28.1	14.9
ZCH 50023 Bt	463	581	683	680	**602**	5.2	-26.9	16.8
CD 5%	100	122	87	79				
CV%	11	15	7	7				

Table 9. 2.5 % Span Length (mm) and micronaire value under protected condition

	2.5% span length (mm)					Micronaire value				
Entry	Faridkot	Hisar	Sirsa	Sriganga nagar	**Mean**	Faridkot	Hisar	Sirsa	Srigang anagar	**Mean**
2113-II	28.4	28.5	26.6	25.6	**27.3**	4.6	4.7	4.6	4.0	**4.5**
2510-II	28.9	27.6	27.5	26.0	**27.5**	5.4	4.5	4.5	4.3	**4.7**
ACH 1005 Bt BGI	28.1	29.2	29.8	26.1	**28.3**	5.5	4.7	4.7	4.0	**4.7**
Ankur 5642 BGII	30.3	32.8	32.8	30.3	**31.6**	4.9	4.3	3.8	4.1	**4.3**
Ankur 8120 BGII	30.9	30.2	32.5	29.1	**30.7**	5.1	4.1	4.0	4.0	**4.3**
CSHH 198 (c)	27.0	28.1	27.6	26.6	**27.3**	5.1	4.5	4.1	4.3	**4.5**
EGCH 1417 BGII	29.2	32.0	30.8	29.6	**30.4**	5.4	4.8	4.4	4.8	**4.9**
GK 212 BGII	28.6	28.5	30.2	28.3	**28.9**	5.1	4.5	4.9	4.6	**4.8**
JKCH 1145 Bt	25.9	26.8	25.6	24.5	**25.7**	5.4	4.6	4.5	4.4	**4.7**
JKCH 1923 Bt	27.9	28.5	28.2	26.8	**27.9**	5.5	4.9	4.9	4.1	**4.9**
KCH 707 BGII	28.6	29.6	29.2	29.4	**29.2**	5.6	4.9	4.4	4.6	**4.9**
KDCHH 144 BGII	28.8	25.7	28.7	27.4	**27.7**	5.1	4.7	4.2	4.6	**4.7**
LHH 144 (c)	28.4	26.2	28.7	24.8	**27.0**	5.1	4.5	3.9	4.0	**4.4**
MRC 7041 BGII	28.7	29.8	28.2	26.7	**28.4**	5.2	4.7	4.3	4.3	**4.6**
MRC 7045 BGII	25.6	29.3	31.1	28.9	**28.7**	6.2	3.6	4.0	3.8	**4.4**
Navkar 5 Bt	27.5	25.7	28.0	26.2	**26.9**	4.4	3.9	3.8	3.9	**4.0**
NCEH 26	28.0	29.6	28.2	28.9	**28.7**	5.1	4.2	4.1	4.0	**4.4**
NCEH 31 BGI	26.9	28.3	28.4	27.1	**27.7**	3.5	4.2	4.0	3.9	**3.9**
NCS 851 Bt 2	29.6	31.1	32.6	30.3	**30.9**	5.2	4.3	4.7	4.4	**4.7**
NCS 853 Bt 2	26.9	29.5	28.8	27.4	**28.2**	5.2	4.8	4.1	3.9	**4.5**
PCH 2270 Bt 2	32.3	30.2	33.2	32.3	**32.0**	5.0	4.4	4.6	4.1	**4.5**
PCH 930 Bt 2	27.2	29.3	28.9	27.3	**28.2**	5.4	5.2	4.4	5.0	**5.0**
RCH 134 Bt (Bt c)	26.5	28.4	26.9	26.9	**27.2**	4.0	4.8	4.6	4.6	**4.5**
RCH 569 BGII	29.8	29.7	29.4	28.0	**29.2**	5.0	5.0	4.7	4.7	**4.9**
SBCH 286 Bt	28.5	25.8	25.0	24.6	**26.0**	5.6	4.8	5.0	5.0	**5.1**
SDS 36	32.2	33.2	33.4	31.7	**32.6**	5.2	4.7	4.8	4.1	**4.7**
SDS 9	28.9	30.0	31.1	29.4	**29.9**	5.5	4.7	4.5	4.1	**4.7**
Tulasi 45 BGII	29.6	31.2	29.1	30.2	**30.0**	5.3	4.6	5.1	4.2	**4.8**
UPLHH 1 Bt	27.5	25.9	27.8	25.5	**26.7**	4.6	4.3	3.7	3.5	**4.0**
VBCH 1501 BGII	27.8	27.7	27.9	27.4	**27.7**	6.1	5.1	4.8	4.9	**5.2**
VBCH 1503 BGII	28.5	28.0	26.1	25.1	**26.9**	4.6	5.1	5.4	5.0	**5.0**
VBCH 1504 BGII	26.6	27.5	28.0	26.4	**27.1**	5.4	4.7	4.8	4.4	**4.8**
VCH 601 BGII	26.7	28.1	28.6	26.1	**27.4**	4.7	4.8	4.0	4.6	**4.5**
VICH 11 BGII	25.9	26.0	28.2	25.2	**26.3**	5.2	4.6	4.3	3.9	**4.5**
VICH 9 BGII	29.3	28.7	28.7	28.6	**28.8**	4.3	4.1	4.4	4.2	**4.3**
ZCH 50003 Bt	27.2	28.9	28.0	27.7	**28.0**	5.1	4.3	4.6	4.8	**4.7**
ZCH 50023 Bt	26.2	24.2	25.9	25.8	**25.5**	5.5	5.1	4.9	5.0	**5.1**

Table 10. Bundle Strength and Uniformity Ratio under protected condition

	Strength (g/tex)					Uniformity ratio				
Entry	Faridkot	Hisar	Sirsa	Sriganga nagar	**Mean**	Faridkot	Hisar	Sirsa	Sriganga nagar	**Mean**
2113-II	22.8	22.4	23.0	22.2	**22.6**	51.0	53.0	52.0	53.0	**52.3**
2510-II	21.5	21.3	19.5	19.2	**20.4**	52.0	49.0	53.0	50.0	**51.0**
ACH 1005 Bt BGI	21.6	21.9	22.2	20.8	**21.6**	52.0	51.0	52.0	52.0	**51.8**
Ankur 5642 BGII	24.1	24.9	25.5	23.6	**24.5**	47.0	49.0	49.0	48.0	**48.3**
Ankur 8120 BGII	21.9	23.9	23.1	21.1	**22.5**	52.0	50.0	50.0	50.0	**50.5**
CSHH 198 (c)	22.9	21.9	23.0	21.5	**22.3**	50.0	52.0	53.0	50.0	**51.3**
EGCH 1417 BGII	23.3	22.0	21.4	21.8	**22.1**	51.0	51.0	50.0	50.0	**50.5**
GK 212 BGII	21.3	21.1	21.5	20.2	**21.0**	52.0	52.0	51.0	51.0	**51.5**
JKCH 1145 Bt	21.0	20.9	20.4	20.0	**20.6**	52.0	53.0	52.0	53.0	**52.5**
JKCH 1923 Bt	22.1	21.7	21.9	21.8	**21.9**	51.0	52.0	52.0	52.0	**51.8**
KCH 707 BGII	21.9	22.8	21.9	22.3	**22.2**	49.0	50.0	50.0	51.0	**50.0**
KDCHH 144 BGII	21.8	19.9	20.5	20.3	**20.6**	48.0	52.0	51.0	52.0	**50.8**
LHH 144 (c)	24.1	21.8	23.6	21.1	**22.7**	52.0	53.0	52.0	49.0	**51.5**
MRC 7041 BGII	22.0	21.0	19.9	20.4	**20.8**	50.0	51.0	52.0	47.0	**50.0**
MRC 7045 BGII	19.0	25.0	23.9	24.0	**23.0**	45.0	52.0	51.0	49.0	**49.3**
Navkar 5 Bt	23.2	22.2	21.6	19.9	**21.7**	52.0	53.0	52.0	51.0	**52.0**
NCEH 26	24.0	24.7	23.8	23.8	**24.1**	50.0	51.0	51.0	50.0	**50.5**
NCEH 31 BGI	22.4	22.8	21.9	22.5	**22.4**	49.0	52.0	51.0	48.0	**50.0**
NCS 851 Bt 2	24.1	25.3	22.1	24.2	**23.9**	50.0	49.0	50.0	49.0	**49.5**
NCS 853 Bt 2	21.6	21.8	21.4	21.8	**21.7**	47.0	53.0	52.0	50.0	**50.5**
PCH 2270 Bt 2	23.4	24.5	24.0	24.5	**24.1**	49.0	50.0	48.0	50.0	**49.3**
PCH 930 Bt 2	21.9	23.0	21.1	21.5	**21.9**	50.0	52.0	51.0	50.0	**50.8**
RCH 134 Bt (Bt c)	21.7	23.2	22.6	21.8	**22.3**	52.0	53.0	52.0	52.0	**52.3**
RCH 569 BGII	23.9	21.3	21.7	21.4	**22.1**	51.0	52.0	51.0	52.0	**51.5**
SBCH 286 Bt	20.8	20.7	19.7	20.2	**20.4**	52.0	52.0	52.0	52.0	**52.0**
SDS 36	22.4	25.3	24.5	24.1	**24.1**	49.0	51.0	49.0	47.0	**49.0**
SDS 9	22.9	21.4	21.6	22.2	**22.0**	49.0	52.0	50.0	51.0	**50.5**
Tulasi 45 BGII	21.8	22.9	21.2	23.1	**22.3**	49.0	51.0	52.0	50.0	**50.5**
UPLHH 1 Bt	24.0	20.1	21.3	21.2	**21.7**	50.0	51.0	51.0	51.0	**50.8**
VBCH 1501 BGII	20.8	21.3	20.1	21.1	**20.8**	52.0	50.0	52.0	51.0	**51.3**
VBCH 1503 BGII	23.7	19.1	19.1	18.5	**20.1**	49.0	52.0	53.0	51.0	**51.3**
VBCH 1504 BGII	21.3	21.3	21.5	20.5	**21.2**	48.0	52.0	52.0	52.0	**51.0**
VCH 601 BGII	21.5	22.9	22.9	21.6	**22.2**	49.0	51.0	52.0	51.0	**50.8**
VICH 11 BGII	20.7	21.3	21.3	21.4	**21.2**	50.0	53.0	52.0	49.0	**51.0**
VICH 9 BGII	23.3	24.4	21.8	22.9	**23.1**	49.0	50.0	52.0	50.0	**50.3**
ZCH 50003 Bt	22.3	23.5	24.0	22.1	**23.0**	52.0	51.0	51.0	54.0	**52.0**
ZCH 50023 Bt	22.5	18.0	19.8	19.5	**20.0**	50.0	53.0	53.0	52.0	**52.0**

C. ENTOMOLOGICAL EVALUATION

I. EVALUATION UNDER ETL BASED PLANT PROTECTION

Jassids

Jassid population was high in Abohar and ranged from 2 to 3 jassids per plant (Table 11). Least jassid population of less than 1 per plant was recorded at Sirsa. Mean jassid population in the test hybrids varied from 1.1 to 1.9 as against 1.1 to 1.3 in check hybrids.

Table 11. Mean number of Jassid nymphs/3 leaves/plant under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
2113-II	2.3	0.8	1.4	0.7	0.8	1.2	1.2
2510-II	2.1	0.8	1.5	1.9	0.8	1.1	1.4
ACH 1005 Bt BGI	2.7	0.9	1.5	1.1	0.8	1.2	1.4
Ankur 5642 BGII	2.7	1.1	1.2	0.6	0.8	1.0	1.2
Ankur 8120 BGII	2.0	0.8	1.3	2.4	0.9	1.1	1.4
CSHH 198 (c)	2.3	0.9	1.8	0.7	0.8	1.3	1.3
EGCH 1417 BGII	2.3	0.9	1.5	1.1	0.9	1.1	1.3
GK 212 BGII	2.7	0.9	1.6	2.4	0.9	1.0	1.6
JKCH 1145 Bt	2.6	1.3	1.5	1.3	0.8	1.1	1.4
JKCH 1923 Bt	2.7	0.9	1.5	1.5	0.9	0.9	1.4
KCH 707 BGII	2.2	0.8	1.1	1.0	0.9	1.1	1.2
KDCHH 144 BGII	2.4	1.2	1.7	2.5	0.8	1.1	1.6
LHH 144 (c)	2.4	0.9	1.2	0.3	0.8	1.1	1.1
MRC 7041 BGII	2.2	0.8	1.6	3.5	0.9	1.0	1.7
MRC 7045 BGII	2.6	1.0	1.5	2.1	0.9	1.1	1.5
Navkar 5 Bt	2.2	1.1	1.2	1.9	0.8	1.2	1.4
NCEH 26	2.5	0.8	1.7	1.2	0.9	1.3	1.4
NCEH 31 BGI	2.3	0.8	1.1	1.1	0.9	1.2	1.2
NCS 851 Bt 2	2.6	1.0	1.4	0.6	1.0	1.1	1.3
NCS 853 Bt 2	2.6	1.0	1.3	1.1	1.0	1.0	1.3
PCH 2270 Bt 2	2.7	0.9	1.4	4.6	0.9	1.1	1.9
PCH 930 Bt 2	2.5	1.0	1.5	2.4	0.8	1.2	1.6
RCH 134 Bt (Bt c)	2.3	0.8	1.8	0.4	1.0	1.1	1.2
RCH 569 BGII	2.2	1.0	1.4	1.4	0.9	1.2	1.3
SBCH 286 Bt	2.2	1.1	1.7	3.5	0.9	1.2	1.7
SDS 36	2.4	1.1	1.3	1.8	0.9	1.1	1.4
SDS 9	2.3	0.8	2.2	1.0	0.9	1.2	1.4
Tulasi 45 BGII	3.0	0.8	1.4	0.9	0.9	1.2	1.4
UPLHH 1 Bt	2.9	0.9	1.2	1.4	0.8	1.1	1.4
VBCH 1501 BGII	2.1	0.6	1.3	2.1	0.8	1.1	1.3
VBCH 1503 BGII	2.6	0.7	1.2	1.8	0.9	1.2	1.4
VBCH 1504 BGII	2.8	1.3	1.3	1.5	1.0	1.1	1.5
VCH 601 BGII	2.8	0.9	1.8	2.1	0.8	1.3	1.6
VICH 11 BGII	2.4	1.0	1.3	1.7	0.8	1.0	1.4
VICH 9 BGII	2.5	1.2	1.4	0.7	0.9	1.0	1.3
ZCH 50003 Bt	2.9	0.9	1.3	1.2	1.0	1.3	1.4
ZCH 50023 Bt	2.4	0.9	1.2	0.5	0.8	1.2	1.2

White fly

Whitefly population was more at Hisar and Sriganganagar than at other places (Table 12). Among the check hybrids, RCH 134 Bt recorded the highest mean whitefly population 5.7 per plant. Among the test hybrids, NCS 851 Bt 2 (7.7) and PCH 2270 Bt 2 (7.1) recorded the maximum infestation.

Table 12. Mean number of Whitefly adults/3leaves/plant under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
2113-II	3.5	4.1	4.1	5.1	4.8	9.7	5.2
2510-II	2.8	4.3	4.2	6.0	5.4	10.4	5.5
ACH 1005 Bt BGI	2.8	4.3	4.1	11.1	5.2	8.3	6.0
Ankur 5642 BGII	3.1	3.4	4.1	4.9	5.1	7.9	4.8
Ankur 8120 BGII	3.2	3.8	4.3	5.4	5.2	8.4	5.0
CSHH 198 (c)	3.8	3.9	4.4	4.8	4.9	8.6	5.1
EGCH 1417 BGII	3.3	3.8	4.3	2.5	5.1	7.2	4.4
GK 212 BGII	2.9	3.0	4.0	9.2	5.3	9.4	5.6
JKCH 1145 Bt	2.7	3.5	3.9	6.9	5.1	9.3	5.2
JKCH 1923 Bt	2.9	3.7	4.7	5.1	5.0	8.5	5.0
KCH 707 BGII	3.1	4.5	4.3	8.4	5.1	8.9	5.7
KDCHH 144 BGII	2.6	2.8	3.8	8.7	5.2	7.5	5.1
LHH 144 (c)	3.3	3.9	4.5	5.8	5.1	9.2	5.3
MRC 7041 BGII	2.8	4.1	4.4	3.4	5.2	8.0	4.6
MRC 7045 BGII	3.2	4.1	4.1	11.6	5.4	8.9	6.2
Navkar 5 Bt	2.7	3.3	4.5	10.7	5.1	10.1	6.1
NCEH 26	3.2	3.5	3.9	3.5	5.2	9.1	4.7
NCEH 31 BGI	3.1	3.2	4.0	2.5	5.2	8.7	4.4
NCS 851 Bt 2	3.4	4.5	4.6	18.4	5.3	9.8	7.7
NCS 853 Bt 2	2.7	3.6	4.1	12.5	5.8	9.8	6.4
PCH 2270 Bt 2	2.7	4.0	4.8	17.0	4.8	9.3	7.1
PCH 930 Bt 2	3.2	3.6	4.3	7.8	5.3	9.0	5.5
RCH 134 Bt (Bt c)	3.0	4.7	4.0	8.0	5.4	9.2	5.7
RCH 569 BGII	2.4	5.1	3.7	7.7	5.3	8.0	5.4
SBCH 286 Bt	2.8	3.2	4.1	10.5	5.7	9.2	5.9
SDS 36	2.6	3.9	4.2	8.8	5.6	11.1	6.0
SDS 9	2.8	4.6	3.6	7.5	5.1	8.6	5.4
Tulasi 45 BGII	2.4	4.0	4.5	3.3	5.5	8.9	4.7
UPLHH 1 Bt	3.7	3.6	4.1	9.4	5.2	9.0	5.8
VBCH 1501 BGII	2.8	3.3	4.4	9.8	5.2	8.0	5.6
VBCH 1503 BGII	3.0	3.8	4.5	3.7	5.2	8.9	4.9
VBCH 1504 BGII	2.8	3.9	4.3	7.6	5.2	9.0	5.5
VCH 601 BGII	3.3	3.9	4.5	10.1	5.1	10.2	6.2
VICH 11 BGII	2.9	3.9	4.1	7.7	5.5	8.4	5.4
VICH 9 BGII	2.2	4.2	4.0	10.6	5.4	8.7	5.8
ZCH 50003 Bt	3.5	3.0	4.0	3.3	5.3	10.4	4.9
ZCH 50023 Bt	2.7	3.3	4.4	7.7	4.9	8.9	5.3

Thrips

Thrips population was maximum at Sriganganagar and Sirsa and minimum at Ludhiana(Table 13). The lowest mean thrips population was recorded in MRC 7041 BG II (3.6).

Table 13. Mean number of Thrips/plant under protected condition

Entry	Faridkot	Ludhiana	Sirsa	Sriganganagar	Mean
2113-II	1.5	0.0	7.7	11.6	5.2
2510-II	1.3	0.0	9.5	11.2	5.5
ACH 1005 Bt BGI	1.5	0.0	7.1	11.4	5.0
Ankur 5642 BGII	1.4	0.0	8.6	10.8	5.2
Ankur 8120 BGII	1.8	0.0	8.4	11.6	5.5
CSHH 198 (c)	1.3	0.0	8.1	10.7	5.0
EGCH 1417 BGII	1.5	0.0	8.0	10.3	5.0
GK 212 BGII	1.6	0.0	8.8	11.2	5.4
JKCH 1145 Bt	1.8	0.0	7.9	11.3	5.2
JKCH 1923 Bt	1.2	0.0	8.2	11.1	5.1
KCH 707 BGII	1.0	0.0	6.8	13.0	5.2
KDCHH 144 BGII	1.1	0.0	6.9	8.9	4.2
LHH 144 (c)	1.8	0.0	7.2	11.7	5.2
MRC 7041 BGII	1.4	0.0	1.4	11.5	3.6
MRC 7045 BGII	1.4	0.0	6.5	11.3	4.8
Navkar 5 Bt	1.9	0.0	7.4	10.8	5.0
NCEH 26	1.4	0.0	7.0	11.6	5.0
NCEH 31 BGI	1.1	0.0	7.4	12.2	5.2
NCS 851 Bt 2	1.5	0.0	8.5	10.7	5.2
NCS 853 Bt 2	1.5	0.0	7.2	12.1	5.2
PCH 2270 Bt 2	1.7	0.0	7.9	12.4	5.5
PCH 930 Bt 2	1.3	0.0	6.7	11.6	4.9
RCH 134 Bt (Bt c)	1.5	0.0	8.5	10.7	5.2
RCH 569 BGII	1.5	0.0	7.8	11.9	5.3
SBCH 286 Bt	0.8	0.0	6.8	10.8	4.6
SDS 36	1.6	0.0	9.0	11.7	5.6
SDS 9	1.2	0.0	7.6	10.9	4.9
Tulasi 45 BGII	1.7	0.0	8.9	11.2	5.5
UPLHH 1 Bt	1.8	0.0	7.3	10.6	4.9
VBCH 1501 BGII	1.4	0.0	7.4	11.2	5.0
VBCH 1503 BGII	1.3	0.0	8.0	9.1	4.6
VBCH 1504 BGII	1.4	0.0	9.3	11.1	5.5
VCH 601 BGII	1.8	0.0	6.0	11.5	4.8
VICH 11 BGII	1.4	0.0	7.2	11.2	4.9
VICH 9 BGII	1.7	0.0	9.0	10.0	5.2
ZCH 50003 Bt	1.6	0.0	9.2	10.5	5.3
ZCH 50023 Bt	1.0	0.0	6.8	10.4	4.6

Aphids

Aphids population was low at all the three centres in Punjab (Table 14).

Table 14. Mean number of Aphids/plant under protected condition

Entry	Abohar	Faridkot	Ludhiana	Mean
2113-II	2.6	0.0	0.9	1.2
2510-II	2.1	0.0	2.4	1.5
ACH 1005 Bt BGI	2.4	0.0	0.0	0.8
Ankur 5642 BGII	2.3	2.3	0.0	1.5
Ankur 8120 BGII	2.0	3.0	0.0	1.7
CSHH 198 (c)	1.9	0.3	0.0	0.7
EGCH 1417 BGII	1.8	3.6	0.0	1.8
GK 212 BGII	2.1	0.0	1.6	1.2
JKCH 1145 Bt	2.0	0.0	0.2	0.7
JKCH 1923 Bt	2.0	3.2	0.0	1.7
KCH 707 BGII	2.1	0.4	0.0	0.8
KDCHH 144 BGII	2.3	0.0	0.0	0.8
LHH 144 (c)	2.7	0.0	0.2	1.0
MRC 7041 BGII	1.9	1.4	1.3	1.5
MRC 7045 BGII	1.9	3.2	0.0	1.7
Navkar 5 Bt	2.5	1.4	0.0	1.3
NCEH 26	1.5	0.0	0.5	0.7
NCEH 31 BGI	2.4	0.0	0.5	1.0
NCS 851 Bt 2	2.5	1.6	1.1	1.7
NCS 853 Bt 2	2.3	0.0	0.3	0.9
PCH 2270 Bt 2	2.6	1.8	0.0	1.5
PCH 930 Bt 2	1.8	0.0	0.1	0.6
RCH 134 Bt (Bt c)	1.9	1.7	0.1	1.2
RCH 569 BGII	2.2	0.7	0.0	1.0
SBCH 286 Bt	1.9	0.0	0.0	0.6
SDS 36	2.3	0.0	0.0	0.8
SDS 9	2.5	0.9	0.3	1.2
Tulasi 45 BGII	3.1	0.0	0.0	1.0
UPLHH 1 Bt	2.9	0.0	0.0	1.0
VBCH 1501 BGII	2.2	4.1	0.0	2.1
VBCH 1503 BGII	2.1	1.0	0.1	1.1
VBCH 1504 BGII	2.9	2.8	0.3	2.0
VCH 601 BGII	2.8	3.6	0.2	2.2
VICH 11 BGII	2.1	0.4	0.0	0.8
VICH 9 BGII	2.1	0.0	0.2	0.8
ZCH 50003 Bt	2.0	0.0	0.0	0.7
ZCH 50023 Bt	2.4	0.0	0.0	0.8

Square Damage

Square damage was negligible in all the entries including the non-Bt check hybrids at Faridkot, Hisar and Sirsa (Table 15). At Ludhiana, only in non Bt check hybrids, square damage (3.6 to 5.6%) was noticed. In Sriganganagar, all the entries recorded square damage ranging from 2.8 to 5 per cent and were on par with the Bt check hybrid RCH 134 Bt (4.6%).

Table 15. Per cent square damage under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
2113-II	0.0	0.0	0.0	0.0	3.2	0.6
2510-II	0.0	0.0	0.0	0.0	4.4	0.9
ACH 1005 Bt BGI	0.0	0.0	0.0	0.0	5.0	1.0
Ankur 5642 BGII	0.6	0.0	0.0	0.0	4.3	1.0
Ankur 8120 BGII	0.0	0.0	0.0	0.0	4.5	0.9
CSHH 198 (c)	0.0	3.6	0.0	0.0	3.5	1.4
EGCH 1417 BGII	0.4	0.0	0.0	0.0	3.0	0.7
GK 212 BGII	1.1	0.0	0.0	0.0	4.7	1.2
JKCH 1145 Bt	0.9	0.0	0.0	0.0	4.3	1.1
JKCH 1923 Bt	0.7	0.0	0.0	0.0	3.3	0.8
KCH 707 BGII	0.0	0.0	0.0	0.0	3.9	0.8
KDCHH 144 BGII	0.0	0.0	0.0	0.0	4.3	0.9
LHH 144 (c)	1.2	5.6	0.0	0.0	4.0	2.2
MRC 7041 BGII	0.0	0.0	0.0	0.0	3.9	0.8
MRC 7045 BGII	0.0	0.0	0.0	0.0	3.6	0.7
Navkar 5 Bt	0.0	0.0	0.0	0.0	3.5	0.7
NCEH 26	0.0	0.0	0.0	0.0	2.8	0.6
NCEH 31 BGI	0.0	0.0	0.0	0.0	4.9	1.0
NCS 851 Bt 2	0.0	0.0	0.0	0.0	3.6	0.7
NCS 853 Bt 2	0.0	0.0	0.0	0.0	3.7	0.7
PCH 2270 Bt 2	0.0	0.0	0.0	0.0	4.0	0.8
PCH 930 Bt 2	0.0	0.0	0.0	0.0	4.0	0.8
RCH 134 Bt (Bt c)	0.0	0.0	0.0	0.0	4.6	0.9
RCH 569 BGII	0.0	0.0	0.1	0.0	3.7	0.8
SBCH 286 Bt	0.0	0.0	0.0	0.0	3.5	0.7
SDS 36	0.0	0.0	0.0	0.0	3.8	0.8
SDS 9	0.0	0.0	0.0	0.0	4.3	0.9
Tulasi 45 BGII	0.0	0.0	0.3	0.0	3.6	0.8
UPLHH 1 Bt	0.0	0.0	0.0	0.0	3.0	0.6
VBCH 1501 BGII	0.6	0.0	0.2	0.0	3.5	0.9
VBCH 1503 BGII	0.3	0.0	0.0	0.0	4.8	1.0
VBCH 1504 BGII	0.8	0.0	0.0	0.0	2.6	0.7
VCH 601 BGII	0.0	0.0	0.0	0.0	3.5	0.7
VICH 11 BGII	0.0	0.0	0.0	0.8	4.2	1.0
VICH 9 BGII	0.0	0.0	0.2	0.0	3.2	0.7
ZCH 50003 Bt	0.0	0.0	0.0	0.0	2.9	0.6
ZCH 50023 Bt	0.0	0.1	0.0	0.0	3.8	0.8

Spotted Bollworm (*Earias spp.*)

Spotted bollworm was almost nil in all the Bt entries at Faridkot (Table 16) and Ludhiana and ranged from 0.3 to 0.6 per 5 plants in the Non Bt hybrids.

Table 16. Mean number of Spotted bollworm, *Earias spp*- (No of Larvae / 5 plants) under protected condition

Entry	Faridkot	Ludhiana	Mean
2113-II	0.0	0.0	0.0
2510-II	0.1	0.0	0.1
ACH 1005 Bt BG I	0.0	0.0	0.0
Ankur 5642 BG II	0.0	0.0	0.0
Ankur 8120 BG II	0.0	0.0	0.0
CSHH 198 (c)	0.0	0.5	0.3
EGCH 1417 BG II	0.0	0.0	0.0
GK 212 BG II	0.3	0.0	0.2
JKCH 1145 Bt	0.0	0.0	0.0
JKCH 1923 Bt	0.2	0.0	0.1
KCH 707 BG II	0.0	0.0	0.0
KDCHH 144 BG II	0.0	0.0	0.0
LHH 144 (c)	0.0	1.2	0.6
MRC 7041 BG II	0.0	0.0	0.0
MRC 7045 BG II	0.0	0.0	0.0
Navkar 5 Bt	0.0	0.0	0.0
NCEH 26	0.0	0.0	0.0
NCEH 31 BG I	0.0	0.0	0.0
NCS 851 Bt 2	0.0	0.0	0.0
NCS 853 Bt 2	0.0	0.0	0.0
PCH 2270 Bt 2	0.0	0.0	0.0
PCH 930 Bt 2	0.0	0.0	0.0
RCH 134 Bt (Bt c)	0.0	0.0	0.0
RCH 569 BG II	0.0	0.0	0.0
SBCH 286 Bt	0.0	0.0	0.0
SDS 36	0.0	0.0	0.0
SDS 9	0.0	0.0	0.0
Tulasi 45 BG II	0.0	0.0	0.0
UPLHH 1 Bt	0.0	0.0	0.0
VBCH 1501 BG II	0.1	0.0	0.1
VBCH 1503 BG II	0.2	0.0	0.1
VBCH 1504 BG II	0.1	0.0	0.1
VCH 601 BG II	0.0	0.0	0.0
VICH 11 BG II	0.0	0.0	0.0
VICH 9 BG II	0.0	0.0	0.0
ZCH 50003 Bt	0.0	0.0	0.0
ZCH 50023 Bt	0.0	0.0	0.0

Pink Bollworm Larvae

Pink boll worm was nil at both Faridkot and Ludhiana on Bt entries and ranged from 0.1 to 0.2 per 20 green bolls on Non Bt check hybrids.

Open boll damage

Open boll and Locule damage was observed at harvest. Open boll damage was low at Abohar, Faridkot, Ludhiana and Sirsa in the Bt test hybrids (Table 17). But on non Bt check hybrids, it ranged from 9.6 to 12.8 per cent at Ludhiana and from 0.8 to 3 per cent at Abohar and Faridkot and 7.3 to 10.5 per cent at Hisar. Six Bt hybrids at Hisar recorded more than 10 per cent open boll damage. Open boll damage was highest at Sriganganagar. The non Bt check hybrids recorded 31.9 to 36.9 per cent open boll damage. The Bt check hybrid RCH 134 Bt recorded 33.6 per cent open boll damage. Except Navkar 5 Bt (6%) and KCH 707 BG II (8.2%), the open boll damage in other Bt hybrids was fairly high due to high incidence of pink bollworm.

Locule damage

Locule damage was low at all the three centres in Punjab (Table 18). While at Abohar and Faridkot, the damage was minimum on both the Bt and non Bt hybrids, at Ludhiana the non Bt check hybrids recorded up to 7.6 per cent locule damage. At Hisar, 12 Bt test hybrids recorded more locule damage than the check hybrids.

At Sirsa and Sriganganagar, non Bt check hybrids recorded 8.0 to 13.5 per cent locule damage. While the locule damage in RCH 134 Bt (Bt check) was 2.4 per cent at Sirsa, it was up to 12.7 per cent in Sriganganagar. The Bt test hybrids, in general, recorded less locule damage than the non Bt check hybrids.

Natural enemies

Predator population was recorded at periodic intervals. Predator population was maximum at Faridkot and least at Ludhiana and Sirsa (Table 19). There was no significant difference in mean predator population between Bt and non-Bt hybrids.

Table 17. Open boll damage (%) - Boll basis under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
2113-II	0.0	0.0	0.0	13.5	0.0	22.1	5.9
2510-II	0.0	0.0	0.0	2.1	0.0	29.5	5.3
ACH 1005 Bt BGI	0.0	0.0	0.0	3.9	0.0	25.2	4.8
Ankur 5642 BGII	0.0	0.0	0.0	3.3	0.0	18.1	3.6
Ankur 8120 BGII	0.0	0.0	0.0	15.7	0.0	11.0	4.5
CSHH 198 (c)	2.1	1.5	9.6	7.3	1.0	31.9	8.9
EGCH 1417 BGII	0.0	0.0	0.3	3.2	0.0	21.2	4.1
GK 212 BGII	0.0	0.0	0.0	5.4	0.0	12.2	2.9
JKCH 1145 Bt	0.8	0.4	0.0	2.3	0.0	28.7	5.4
JKCH 1923 Bt	3.9	2.1	0.0	2.5	0.0	17.1	4.3
KCH 707 BGII	2.6	1.5	0.0	2.7	0.0	8.2	2.5
KDCHH 144 BGII	0.0	0.0	0.0	2.3	0.0	12.9	2.5
LHH 144 (c)	3.0	0.8	12.8	10.1	0.0	36.9	10.6
MRC 7041 BGII	1.2	0.0	0.0	10.0	0.0	14.4	4.3
MRC 7045 BGII	0.4	0.0	0.0	1.8	0.0	28.1	5.1
Navkar 5 Bt	0.0	0.0	0.0	3.2	0.0	6.0	1.5
NCEH 26	0.3	0.4	0.0	2.0	0.0	36.1	6.5
NCEH 31 BGI	0.6	0.0	0.0	2.4	0.0	42.9	7.6
NCS 851 Bt 2	2.6	1.8	0.0	12.5	0.0	20.1	6.2
NCS 853 Bt 2	0.0	0.0	0.0	7.6	0.0	29.9	6.3
PCH 2270 Bt 2	0.0	1.5	0.0	11.5	0.0	26.0	6.5
PCH 930 Bt 2	0.0	0.0	0.0	4.8	0.0	28.1	5.5
RCH 134 Bt (Bt c)	1.1	1.4	0.0	3.8	0.0	33.6	6.6
RCH 569 BGII	1.0	0.0	0.0	5.6	0.0	21.4	4.7
SBCH 286 Bt	0.0	0.0	0.0	10.0	0.0	13.7	3.9
SDS 36	0.0	0.0	0.0	3.2	0.0	20.6	4.0
SDS 9	0.0	0.0	0.0	3.4	0.0	10.8	2.4
Tulasi 45 BGII	0.2	0.3	0.0	9.2	0.0	23.3	5.5
UPLHH 1 Bt	0.0	0.0	0.0	10.9	0.0	32.7	7.3
VBCH 1501 BGII	0.0	0.0	0.6	3.4	0.0	15.3	3.2
VBCH 1503 BGII	0.0	0.0	0.0	3.1	0.0	19.5	3.8
VBCH 1504 BGII	0.0	0.0	0.0	13.7	0.0	16.5	5.0
VCH 601 BGII	0.6	0.6	0.0	9.2	0.0	23.9	5.7
VICH 11 BGII	0.0	0.0	0.0	1.7	0.0	31.1	5.5
VICH 9 BGII	0.0	0.0	0.0	10.7	0.0	21.3	5.3
ZCH 50003 Bt	0.0	0.0	0.0	4.4	0.0	14.8	3.2
ZCH 50023 Bt	0.0	0.0	0.0	2.0	0.0	27.7	5.0

Table 18. Open boll damage (%) - Locule basis under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
2113-II	0.0	0.0	0.0	5.6	8.5	2.8
2510-II	0.0	0.0	0.0	0.7	10.0	2.1
ACH 1005 Bt BGI	0.0	0.0	0.0	1.2	9.6	2.2
Ankur 5642 BGII	0.0	0.0	0.0	1.2	7.4	1.7
Ankur 8120 BGII	0.0	0.0	0.0	6.3	5.5	2.4
CSHH 198 (c)	0.6	0.4	5.5	2.7	10.4	3.9
EGCH 1417 BGII	0.0	0.0	0.2	1.1	8.5	2.0
GK 212 BGII	0.0	0.0	0.0	2.0	4.1	1.2
JKCH 1145 Bt	0.2	0.1	0.0	0.7	10.9	2.4
JKCH 1923 Bt	1.1	0.5	0.0	0.8	4.1	1.3
KCH 707 BGII	0.8	0.7	0.0	0.8	3.0	1.1
KDCHH 144 BGII	0.0	0.0	0.0	0.9	6.8	1.5
LHH 144 (c)	0.6	0.4	7.6	1.4	13.5	4.7
MRC 7041 BGII	0.4	0.0	0.0	3.9	6.4	2.1
MRC 7045 BGII	0.2	0.0	0.0	0.6	7.7	1.7
Navkar 5 Bt	0.0	0.0	0.0	1.1	2.3	0.7
NCEH 26	0.1	0.1	0.0	0.6	17.4	3.6
NCEH 31 BGI	0.2	0.2	0.0	0.9	17.1	3.7
NCS 851 Bt 2	0.5	0.9	0.0	5.3	8.5	3.1
NCS 853 Bt 2	0.0	0.0	0.0	3.1	11.8	3.0
PCH 2270 Bt 2	0.0	0.4	0.0	4.0	11.0	3.1
PCH 930 Bt 2	0.0	0.0	0.0	1.6	11.4	2.6
RCH 134 Bt (Bt c)	0.8	0.5	0.0	1.7	12.7	3.1
RCH 569 BGII	0.3	0.0	0.0	2.7	7.5	2.1
SBCH 286 Bt	0.0	0.0	0.0	4.4	4.5	1.8
SDS 36	0.0	0.0	0.0	1.1	7.0	1.6
SDS 9	0.0	0.0	0.0	1.4	4.4	1.2
Tulasi 45 BGII	0.1	0.2	0.0	3.4	7.5	2.2
UPLHH 1 Bt	0.0	0.0	0.0	4.5	9.0	2.7
VBCH 1501 BGII	0.0	0.0	0.3	4.2	6.8	2.2
VBCH 1503 BGII	0.0	0.0	0.0	1.2	6.9	1.6
VBCH 1504 BGII	0.0	0.0	0.0	5.6	5.7	2.3
VCH 601 BGII	0.2	0.2	0.0	3.8	8.7	2.6
VICH 11 BGII	0.0	0.0	0.0	0.6	12.8	2.7
VICH 9 BGII	0.0	0.0	0.0	4.2	7.9	2.4
ZCH 50003 Bt	0.0	0.0	0.0	2.0	7.7	1.9
ZCH 50023 Bt	0.0	0.0	0.0	0.6	10.1	2.1

Table 19. Mean number of Predators/5 plants under protected condition

Entry	Abohar	Faridkot	Ludhiana	Sirsa	Mean
2113-II	3.9	55.2	0.4	0.2	14.9
2510-II	5.0	56.9	0.0	0.1	15.5
ACH 1005 Bt BGI	4.4	56.2	0.3	0.1	15.3
Ankur 5642 BGII	5.0	48.5	0.0	0.2	13.4
Ankur 8120 BGII	4.9	54.8	0.7	0.1	15.1
CSHH 198 (c)	4.3	56.5	0.0	0.1	15.2
EGCH 1417 BGII	3.4	51.9	0.0	0.1	13.8
GK 212 BGII	4.4	43.4	0.4	0.1	12.1
JKCH 1145 Bt	5.1	49.5	0.5	0.1	13.8
JKCH 1923 Bt	4.4	53.2	0.8	0.1	14.6
KCH 707 BGII	3.7	54.3	0.0	0.1	14.5
KDCHH 144 BGII	4.1	49.5	0.3	0.1	13.5
LHH 144 (c)	4.6	62.9	0.0	0.1	16.9
MRC 7041 BGII	4.4	56.7	0.0	0.1	15.3
MRC 7045 BGII	5.4	51.8	0.5	0.1	14.5
Navkar 5 Bt	5.0	51.3	0.8	0.2	14.3
NCEH 26	3.1	48.3	0.4	0.1	13.0
NCEH 31 BGI	4.6	56.4	0.1	0.1	15.3
NCS 851 Bt 2	3.3	53.8	0.1	0.1	14.3
NCS 853 Bt 2	4.7	55.4	0.4	0.1	15.2
PCH 2270 Bt 2	4.0	57.9	0.0	0.1	15.5
PCH 930 Bt 2	4.9	55.6	0.0	0.1	15.1
RCH 134 Bt (Bt c)	5.0	58.0	0.3	0.1	15.8
RCH 569 BGII	3.4	48.7	0.0	0.1	13.0
SBCH 286 Bt	4.7	46.8	0.1	0.1	12.9
SDS 36	3.9	53.5	0.1	0.1	14.4
SDS 9	4.9	53.8	0.5	0.1	14.8
Tulasi 45 BGII	3.6	57.3	0.4	0.1	15.3
UPLHH 1 Bt	3.6	54.6	0.4	0.1	14.7
VBCH 1501 BGII	4.3	48.8	0.0	0.1	13.3
VBCH 1503 BGII	4.9	50.0	0.5	0.1	13.9
VBCH 1504 BGII	4.1	51.7	0.0	0.1	14.0
VCH 601 BGII	2.9	55.8	0.1	0.1	14.7
VICH 11 BGII	4.3	54.0	0.0	0.1	14.6
VICH 9 BGII	3.6	55.0	0.0	0.2	14.7
ZCH 50003 Bt	3.6	46.4	0.1	0.1	12.6
ZCH 50023 Bt	4.1	43.1	0.4	0.1	11.9

II. EVALUATION UNDER UNPROTECTED CONDITIONS FOR BOLL WORMS

Germination and Plant Stand

Under unprotected conditions also, the germination and Plant stand were satisfactory. KCH 707 BG II recorded the lowest mean germination of 71.2 per cent and a mean stand of 13.1 (Tables 20 & 21).

Open boll damage

Open boll damage was maximum at Sriganganagar due to severe incidence of pink bollworm and moderate at Hisar, while Abohar, Faridkot and Ludhiana recorded the least open boll damage (Table 22). The non-Bt check hybrids recorded a mean open boll damage of 18.7 to 21.1 per cent. The Bt check hybrid RCH 134 Bt recorded a mean open boll damage of 10.9 %. The open boll damage in the Bt test hybrids ranged from 4.3 to 14.2.

Locule damage

Locule damage was also high at Sriganganagar due to pink bollworm incidence, moderate at Hisar and low at Abohar, Faridkot and Ludhiana (Table 23). The mean locule damage in non-Bt hybrids ranged from 7.2 to 7.5 per cent. The locule damage among the Bt hybrids ranged from 1.6 to 5.5 per cent.

Seed Cotton Yield

As compared to the check hybrids, nine test hybrids were superior to Bt check hybrid and twelve to the best non Bt check hybrid, CSHH 198.

Table 20. Germination Percentage under unprotected condition

Entry	Abohar	Faridkot	Ludhiana	Mean
2113-II	95.2	90.7	98.2	94.7
2510-II	95.2	90.7	94.4	93.4
ACH 1005 Bt BGI	100.0	96.3	100.0	98.8
Ankur 5642 BGII	90.5	94.4	98.2	94.4
Ankur 8120 BGII	90.5	90.7	96.3	92.5
CSHH 198 (c)	95.2	88.9	94.4	92.8
EGCH 1417 BGII	100.0	90.7	92.6	94.4
GK 212 BGII	100.0	90.7	88.9	93.2
JKCH 1145 Bt	95.2	96.3	98.2	96.6
JKCH 1923 Bt	90.5	92.6	92.6	91.9
KCH 707 BGII	85.7	85.2	42.6	71.2
KDCHH 144 BGII	90.5	92.6	92.6	91.9
LHH 144 (c)	100.0	96.3	94.4	96.9
MRC 7041 BGII	85.7	92.6	96.3	91.5
MRC 7045 BGII	85.7	87.0	94.4	89.0
Navkar 5 Bt	95.2	92.6	98.2	95.3
NCEH 26	90.5	90.7	100.0	93.7
NCEH 31 BGI	85.7	96.3	96.3	92.8
NCS 851 Bt 2	90.5	88.9	98.2	92.5
NCS 853 Bt 2	81.0	92.6	98.2	90.6
PCH 2270 Bt 2	90.5	83.3	100.0	91.3
PCH 930 Bt 2	95.2	83.3	100.0	92.8
RCH 134 Bt (Bt c)	100.0	88.9	98.2	95.7
RCH 569 BGII	90.5	94.4	70.4	85.1
SBCH 286 Bt	100.0	94.4	96.3	96.9
SDS 36	100.0	88.9	94.4	94.4
SDS 9	100.0	96.3	100.0	98.8
Tulasi 45 BGII	81.0	88.9	94.4	88.1
UPLHH 1 Bt	90.5	92.6	100.0	94.4
VBCH 1501 BGII	90.5	94.4	92.6	92.5
VBCH 1503 BGII	95.2	81.5	98.2	91.6
VBCH 1504 BGII	100.0	88.9	96.3	95.1
VCH 601 BGII	90.5	87.0	87.0	88.2
VICH 11 BGII	95.2	94.4	98.2	95.9
VICH 9 BGII	95.2	94.4	98.2	95.9
ZCH 50003 Bt	95.2	92.6	90.7	92.8
ZCH 50023 Bt	100.0	90.7	92.6	94.4

Table 21. Number of plants at harvest under unprotected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Mean
2113-II	19.0	23.5	25.0	12.3	20.0
2510-II	20.5	24.0	24.0	10.3	19.7
ACH 1005 Bt BGI	20.5	24.0	25.0	6.0	18.9
Ankur 5642 BGII	19.0	24.0	25.0	15.7	20.9
Ankur 8120 BGII	17.5	25.0	21.0	11.3	18.7
CSHH 198 (c)	20.0	25.0	23.0	6.0	18.5
EGCH 1417 BGII	19.5	24.5	24.0	6.7	18.7
GK 212 BGII	20.5	23.5	21.0	12.7	19.4
JKCH 1145 Bt	20.5	24.5	26.0	10.0	20.3
JKCH 1923 Bt	17.5	26.0	22.0	10.7	19.1
KCH 707 BGII	13.0	25.0	9.0	5.3	13.1
KDCHH 144 BGII	18.0	24.5	20.0	7.7	17.6
LHH 144 (c)	20.0	25.0	24.0	3.7	18.2
MRC 7041 BGII	17.0	25.5	19.0	13.0	18.6
MRC 7045 BGII	18.5	24.0	19.0	11.0	18.1
Navkar 5 Bt	19.0	24.5	25.0	12.7	20.3
NCEH 26	19.5	25.5	24.0	9.3	19.6
NCEH 31 BGI	17.5	24.0	26.0	14.7	20.6
NCS 851 Bt 2	18.5	23.5	23.0	11.0	19.0
NCS 853 Bt 2	15.0	25.0	23.0	9.3	18.1
PCH 2270 Bt 2	19.5	23.5	24.0	13.0	20.0
PCH 930 Bt 2	18.5	24.0	23.0	15.3	20.2
RCH 134 Bt (Bt c)	20.5	23.0	25.0	9.3	19.5
RCH 569 BGII	14.0	24.0	16.0	9.0	15.8
SBCH 286 Bt	20.5	24.0	25.0	10.0	19.9
SDS 36	21.0	25.0	24.0	7.3	19.3
SDS 9	21.0	24.0	24.0	15.3	21.1
Tulasi 45 BGII	14.0	23.0	21.0	12.7	17.7
UPLHH 1 Bt	19.5	24.0	27.0	11.3	20.5
VBCH 1501 BGII	19.0	24.5	24.0	10.7	19.6
VBCH 1503 BGII	20.0	25.0	23.0	10.7	19.7
VBCH 1504 BGII	21.0	24.0	23.0	14.0	20.5
VCH 601 BGII	19.5	24.5	17.0	11.3	18.1
VICH 11 BGII	18.5	24.0	23.0	14.3	20.0
VICH 9 BGII	20.0	24.5	23.0	12.0	19.9
ZCH 50003 Bt	18.5	25.5	22.0	9.3	18.8
ZCH 50023 Bt	20.5	23.5	22.0	9.0	18.8

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

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
2113-II	0.0	0.0	0.0	13.7	57.2	14.2
2510-II	0.0	0.0	0.0	2.2	35.6	7.6
ACH 1005 Bt BGI	0.0	0.0	0.0	4.2	33.1	7.5
Ankur 5642 BGII	1.2	0.0	0.0	3.4	42.8	9.5
Ankur 8120 BGII	2.4	0.0	0.0	15.9	26.2	8.9
CSHH 198 (c)	7.1	7.0	15.7	7.4	56.2	18.7
EGCH 1417 BGII	0.0	0.0	0.0	3.3	46.3	9.9
GK 212 BGII	0.0	0.0	0.0	5.7	26.4	6.4
JKCH 1145 Bt	0.0	0.6	0.0	2.5	63.3	13.3
JKCH 1923 Bt	6.9	6.9	0.0	2.6	27.6	8.8
KCH 707 BGII	5.6	3.1	0.0	2.9	15.4	5.4
KDCHH 144 BGII	1.3	0.0	0.0	2.5	37.1	8.2
LHH 144 (c)	10.9	8.8	17.5	10.2	58.3	21.1
MRC 7041 BGII	1.2	0.0	0.0	10.1	19.1	6.1
MRC 7045 BGII	1.7	0.0	0.0	2.1	29.0	6.6
Navkar 5 Bt	0.0	0.0	0.0	3.3	18.3	4.3
NCEH 26	0.0	0.0	0.0	2.2	63.8	13.2
NCEH 31 BGI	2.5	0.0	0.0	3.0	62.5	13.6
NCS 851 Bt 2	7.9	5.0	0.0	12.6	32.5	11.6
NCS 853 Bt 2	0.0	0.0	0.0	7.8	48.3	11.2
PCH 2270 Bt 2	0.0	2.7	0.0	11.6	37.1	10.3
PCH 930 Bt 2	0.0	0.0	0.0	4.9	45.7	10.1
RCH 134 Bt (Bt c)	2.4	2.5	0.4	4.0	45.0	10.9
RCH 569 BGII	1.6	0.0	0.0	5.7	25.4	6.5
SBCH 286 Bt	0.0	0.0	0.0	10.5	31.9	8.5
SDS 36	0.0	0.0	0.6	3.3	46.3	10.0
SDS 9	0.0	0.0	0.0	3.7	28.4	6.4
Tulasi 45 BGII	2.3	0.5	0.0	9.3	34.2	9.3
UPLHH 1 Bt	0.0	0.0	0.0	11.0	55.6	13.3
VBCH 1501 BGII	0.0	0.0	0.0	3.4	27.6	6.2
VBCH 1503 BGII	0.0	0.0	0.0	3.2	27.7	6.2
VBCH 1504 BGII	0.0	0.0	0.0	13.8	39.6	10.7
VCH 601 BGII	3.8	1.6	0.0	9.3	38.5	10.6
VICH 11 BGII	0.0	0.0	0.0	1.9	57.6	11.9
VICH 9 BGII	0.0	0.0	0.0	10.8	36.9	9.5
ZCH 50003 Bt	0.0	0.0	0.0	4.5	35.0	7.9

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

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
2113-II	0.0	0.0	0.0	5.7	22.0	5.5
2510-II	0.0	0.0	0.0	0.8	13.2	2.8
ACH 1005 Bt BGI	0.0	0.0	0.0	1.3	11.8	2.6
Ankur 5642 BGII	0.2	0.0	0.0	1.3	16.5	3.6
Ankur 8120 BGII	0.7	0.0	0.0	6.4	10.8	3.6
CSHH 198 (c)	2.6	1.7	7.9	2.9	21.0	7.2
EGCH 1417 BGII	0.0	0.0	0.0	1.2	15.8	3.4
GK 212 BGII	0.0	0.0	0.0	2.1	8.5	2.1
JKCH 1145 Bt	0.0	0.2	0.0	0.8	20.6	4.3
JKCH 1923 Bt	3.8	2.2	0.0	0.9	4.2	2.2
KCH 707 BGII	1.2	0.8	0.0	1.0	5.7	1.7
KDCHH 144 BGII	0.4	0.0	0.0	1.0	14.2	3.1
LHH 144 (c)	3.9	3.2	9.2	1.6	19.4	7.5
MRC 7041 BGII	0.4	0.0	0.0	4.0	8.3	2.5
MRC 7045 BGII	0.7	0.0	0.0	0.7	9.7	2.2
Navkar 5 Bt	0.0	0.0	0.0	1.2	6.8	1.6
NCEH 26	0.0	0.0	0.0	0.7	26.6	5.5
NCEH 31 BGI	0.7	0.0	0.0	1.1	20.8	4.5
NCS 851 Bt 2	3.6	2.3	0.0	5.4	11.2	4.5
NCS 853 Bt 2	0.0	0.0	0.0	3.3	18.6	4.4
PCH 2270 Bt 2	0.0	1.3	0.0	4.2	12.5	3.6
PCH 930 Bt 2	0.0	0.0	0.0	1.8	15.2	3.4
RCH 134 Bt (Bt c)	0.8	0.6	0.2	1.8	16.7	4.0
RCH 569 BGII	0.3	0.0	0.0	2.8	10.1	2.6
SBCH 286 Bt	0.0	0.0	0.0	4.4	11.0	3.1
SDS 36	0.0	0.0	0.2	1.2	15.9	3.5
SDS 9	0.0	0.0	0.0	1.5	10.2	2.3
Tulasi 45 BGII	0.9	0.1	0.0	3.5	11.4	3.2
UPLHH 1 Bt	0.0	0.0	0.0	4.5	18.2	4.5
VBCH 1501 BGII	0.0	0.0	0.0	4.3	9.9	2.8
VBCH 1503 BGII	0.0	0.0	0.0	1.4	9.9	2.3
VBCH 1504 BGII	0.0	0.0	0.0	5.7	14.2	4.0
VCH 601 BGII	1.2	0.5	0.0	3.9	14.0	3.9
VICH 11 BGII	0.0	0.0	0.0	0.7	19.2	4.0
VICH 9 BGII	0.0	0.0	0.0	4.2	13.8	3.6
ZCH 50003 Bt	0.0	0.0	0.0	2.1	17.5	3.9
ZCH 50023 Bt	0.0	2.0	0.0	0.7	18.4	4.2

Table 24. Seed Cotton Yield (kg/ha) under unprotected condition

Entry	Faridkot	Ludhiana	**Mean**	% Inc. over CSHH 198	% Inc. over RCH 134 Bt	% Inc. over LHH 144
2113-II	2243	2792	**2518**	65.0	59.1	184.5
2510-II	1955	1601	**1778**	16.5	12.4	100.9
ACH 1005 Bt BGI	1420	1597	**1509**	-1.1	-4.6	70.5
Ankur 5642 BGII	1667	1749	**1708**	11.9	8.0	93.0
Ankur 8120 BGII	1008	1354	**1181**	-22.6	-25.3	33.4
CSHH 198 (c)	2222	829	**1526**	0.0	-3.6	72.4
EGCH 1417 BGII	1214	1453	**1334**	-12.6	-15.7	50.7
GK 212 BGII	2027	1119	**1573**	3.1	-0.6	77.7
JKCH 1145 Bt	1173	1058	**1116**	-26.9	-29.5	26.0
JKCH 1923 Bt	2016	1560	**1788**	17.2	13.0	102.0
KCH 707 BGII	566	370	**468**	-69.3	-70.4	-47.1
KDCHH 144 BGII	494	807	**651**	-57.4	-58.9	-26.5
LHH 144 (c)	1093	677	**885**	-42.0	-44.1	0.0
MRC 7041 BGII	2202	1132	**1667**	9.2	5.4	88.4
MRC 7045 BGII	1358	852	**1105**	-27.6	-30.2	24.9
Navkar 5 Bt	1564	2564	**2064**	35.3	30.5	133.2
NCEH 26	741	959	**850**	-44.3	-46.3	-4.0
NCEH 31 BGI	1307	2348	**1828**	19.8	15.5	106.5
NCS 851 Bt 2	700	1228	**964**	-36.8	-39.1	8.9
NCS 853 Bt 2	442	827	**635**	-58.4	-59.9	-28.3
PCH 2270 Bt 2	802	1329	**1066**	-30.2	-32.6	20.4
PCH 930 Bt 2	835	1403	**1119**	-26.7	-29.3	26.4
RCH 134 Bt (Bt c)	1008	2156	**1582**	3.7	0.0	78.8
RCH 569 BGII	2064	2051	**2058**	34.8	30.1	132.5
SBCH 286 Bt	792	1560	**1176**	-22.9	-25.7	32.9
SDS 36	1111	1218	**1165**	-23.7	-26.4	31.6
SDS 9	1210	1728	**1469**	-3.7	-7.1	66.0
Tulasi 45 BGII	1214	1451	**1333**	-12.7	-15.8	50.6
UPLHH 1 Bt	988	2160	**1574**	3.1	-0.5	77.9
VBCH 1501 BGII	1163	1457	**1310**	-14.2	-17.2	48.0
VBCH 1503 BGII	967	854	**911**	-40.3	-42.4	2.9
VBCH 1504 BGII	720	1045	**883**	-42.2	-44.2	-0.3
VCH 601 BGII	494	1058	**776**	-49.1	-50.9	-12.3
VICH 11 BGII	981	1027	**1004**	-34.2	-36.5	13.4
VICH 9 BGII	1070	628	**849**	-44.4	-46.3	-4.1
ZCH 50003 Bt	1377	1815	**1596**	4.6	0.9	80.3
ZCH 50023 Bt	586	1317	**952**	-37.6	-39.9	7.5
CD @ 5%	432	368				
CV %	18	13				

D. PATHOLOGICAL EVALUATION

Thirty five Bt hybrids along with two check hybrids (CSHH 198 and LHH 144), one standard leaf curl resistant check (F1861) and one leaf curl susceptible check (RS 921) were evaluated against cotton leaf curl disease, foliar diseases and Para wilt in six centres *viz*. Faridkot, Ludhiana, Abohar, Sriganganagar, Hisar and Sirsa in the field trials. For cotton leaf curl disease, these entries were also tested under screen house in Ludhiana and in screening nursery in Sirsa. In addition, the hybrids were evaluated under poly house in Sirsa after artificial inoculation with viruliferous whiteflies.

Cotton Leaf Curl Disease

Cotton leaf curl disease was noticed on all test Bt hybrids in varying intensities. The maximum disease index across the centres was taken into consideration for assessing the performance of the hybrids. Since the field crop in Sirsa was damaged due to severe mealy bug incidence, the leaf curl assessment from field was not reported. However, the data obtained from the screening nursery and poly house trials were included for the assessment of the hybrids.

Among the Bt hybrids, the disease intensity varied from 20.0 D.I. to 400.0 D.I. The susceptible check, RS 921, had the maximum D.I. of 400.0. Only one Bt hybrid viz. 2113-11 had shown resistance to cotton leaf curl disease with a disease index of 20.0 almost similar to the check hybrid LHH 144 (D.I. 13.1) The Bt hybrid JKCH 1923 Bt had a disease index of 50.0 which was lower than the standard resistant check – F 1861 (D.I. 62.5) and the check hybrid- CSHH 198 (D.I. 69.9). The rest of the Bt hybrids were found to be highly susceptible to this disease and among these 20 hybrids had a disease index ranging from 300.0 to 400.0 (Table 25)

Foliar Diseases

Bacterial leaf blight was observed only in the Faridkot and Ludhiana centres on all test entries including the checks. The Bt hybrid KDCHH 144 BG II had shown moderate susceptibility to bacterial leaf blight in Ludhiana and the rest of the hybrids had a maximum grade of 2.0 (Table 26).

Para Wilt

Para wilt was noticed on all entries tested only in the Faridkot Centre trials (Table 26). Higher per cent of wilted plants was noticed among the four Bt hybrids *viz.* 2113-11 (84.5 %), RCH 569 BG II (51.7 %), RCH 134 Bt (41.7 %) and UPLHH I Bt (41.3 %) (Table 26).

Table 25. Incidence of Cotton Leaf Curl Disease on the hybrids

Entry	Overall Disease Index (D.I.)
2113-II	20.0
2510-II	100.0
ACH 1005 Bt BG I	350.0
Ankur 5642 BG II	187.5
Ankur 8120 BG II	300.0
CSHH 198 (c)	69.9
EGCH 1417 BG II	249.9
GK 212 BG II	300.0
JKCH 1145 Bt	216.6
JKCH 1923 Bt	50.0
KCH 707 BG II	350.0
KDCHH 144 BG II	400.0
LHH 144 (c)	13.1
MRC 7041 BG II	131.5
MRC 7045 BG II	233.3
Navkar 5 Bt	273.3
NCEH 26	250.0
NCEH 31 BG I	350.0
NCS 851 Bt 2	283.3
NCS 853 Bt 2	400.0
PCH 2270 Bt 2	329.4
PCH 930 Bt 2	400.0
RCH 134 Bt (Bt c)	300.0
RCH 569 BG II	120.0
SBCH 286 Bt	400.0
SDS 36	300.0
SDS 9	300.0
Tulasi 45 BG II	300.0
UPLHH 1 Bt	400.0
VBCH 1501 BG II	400.0
VBCH 1503 BG II	311.1
VBCH 1504 BG II	300.0
VCH 601 BG II	188.2
VICH 11 BG II	273.6
VICH 9 BG II	300.0
ZCH 50003 Bt	240.0
ZCH 50023 Bt	300.0
F 1861 (Std. Resistant Check)	62.5
RS 921 (Std. Susceptible Check)	400.0

Table 26. Evaluation of Bt hybrids against foliar diseases and para wilt

Entry	Bacterial Blight (Grade)		Fungal Foliar Diseases (Grade)		Para Wilt %
	Faridkot	Ludhiana	Faridkot	Ludhiana	Faridkot
2113-II	2.0	1.0	2.0	3.0	84.5
2510-II	2.0	0.0	2.0	3.0	23.9
ACH 1005 Bt BG I	2.0	0.0	2.0	4.0	4.2
Ankur 5642 BG II	2.0	1.0	2.0	2.0	8.6
Ankur 8120 BG II	2.0	1.0	2.0	4.0	19.2
CSHH 198 (c)	2.0	0.0	2.0	1.0	0.0
EGCH 1417 BG II	2.0	0.0	2.0	4.0	0.0
GK 212 BG II	2.0	0.0	2.0	3.0	8.7
JKCH 1145 Bt	2.0	0.0	2.0	4.0	6.8
JKCH 1923 Bt	2.0	0.0	2.0	4.0	5.0
KCH 707 BG II	2.0	0.0	2.0	3.0	11.8
KDCHH 144 BG II	2.0	3.0	2.0	3.0	2.1
LHH 144 (c)	2.0	0.0	2.0	2.0	4.3
MRC 7041 BG II	2.0	0.0	2.0	4.0	13.6
MRC 7045 BG II	2.0	2.0	2.0	3.0	6.2
Navkar 5 Bt	2.0	2.0	2.0	2.0	14.9
NCEH 26	2.0	0.0	2.0	2.0	0.0
NCEH 31 BG I	2.0	0.0	2.0	3.0	19.1
NCS 851 Bt 2	2.0	0.0	2.0	2.2	2.2
NCS 853 Bt 2	2.0	0.0	2.0	4.0	4.3
PCH 2270 Bt 2	2.0	2.0	2.0	0.0	0.0
PCH 930 Bt 2	2.0	0.0	2.0	4.0	9.6
RCH 134 Bt (Bt c)	2.0	1.0	2.0	3.0	41.7
RCH 569 BG II	2.0	1.0	3.0	3.0	51.7
SBCH 286 Bt	2.0	0.0	3.0	4.0	4.4
SDS 36	2.0	0.0	2.0	4.0	2.1
SDS 9	2.0	0.0	2.0	4.0	18.8
Tulasi 45 BG II	2.0	1.0	2.0	4.0	14.8
UPLHH 1 Bt	2.0	1.0	2.0	2.0	41.3
VBCH 1501 BG II	2.0	1.0	2.0	3.0	4.2
VBCH 1503 BG II	2.0	1.0	2.0	3.0	2.1
VBCH 1504 BG II	2.0	1.0	2.0	0.0	0.0
VCH 601 BG II	2.0	2.0	2.0	3.0	9.1
VICH 11 BG II	2.0	0.0	2.0	4.0	12.9
VICH 9 BG II	2.0	2.0	2.0	2.0	6.8
ZCH 50003 Bt	2.0	0.0	2.0	4.0	8.3
ZCH 50023 Bt	2.0	2.0	2.0	1.0	4.2
F 1861	2.0	1.0	2.0	1.0	6.8
RS 921	2.0	0.0	3.0	1.0	2.4

E. OVERALL ASSESSMENT

Thirty four Bt cotton hybrids were evaluated for the first time during 2007-08 in North Zone with RCH 134 Bt as the Bt check and CSHH 198 and LHH 144 as the non Bt checks. They were evaluated at six locations under both protected and unprotected conditions (Tables 27 - 31).

Jassids, whitefly and thrips were the major sucking pests noticed during the season. All the entries including the check hybrids were affected in varying degrees warranting chemical intervention. The overall boll infestation was low during the year. Square damage was low on Bt cotton hybrids as compared to the non Bt check hybrids. However, pink bollworm damage was considerable at Sriganganagar location.

Under protected conditions, as compared to the Bt check hybrid, only 2510-II (2375 kg/ha) was found superior in seed cotton yield. The percentage increase was of the order of 0.4 percent. The lint yield followed the same trend as that of seed cotton yield. RCH 134 Bt with a mean lint yield of 823 kg/ha was the best check hybrid. Hybrids 2510-II and 2113-II were the next best hybrids with 796 kg/ha. Nineteen test hybrids were found to be superior to the best non Bt check hybrid.

Under unprotected conditions, as compared to the Bt check hybrids, only nine hybrids were superior in seed cotton yield. Twelve Bt test hybrids recorded higher seed cotton yield than the non Bt check hybrid (CSHH 198).

The Bt test hybrids showed good variability in respect of fibre length and strength. Most of the hybrids tested were on par with fibre quality of check hybrids.

F. CONCLUSION

All the entries included in the trial were found to be susceptible to the sucking pests in varying degrees and warranted chemical intervention. Overall boll infestation and square damage was low on Bt cotton hybrids as compared to the Non Bt check hybrids.

As compared to the Bt check hybrid, only 2510-II was superior in seed cotton yield. However under unprotected conditions, nine Bt test hybrids were superior. The fibre quality of the Bt test hybrids were on par with that of check hybrids.

Table 27. Summary on the performance of Bt cotton hybrids for various agronomic characters

Protected Condition

Entry	Germination (%)	Stand at harvest	Boll weight (g)	Ginning Outturn (%)	Lint Index (g)	Seed Index (g)
2510-II	88.9	47.8	3.6	33.7	4.4	8.9
RCH 134 Bt (Bt c)	96.5	52.5	3.9	34.7	4.9	9.4
2113-II	95.7	49.3	3.6	34.1	4.3	8.5
NCEH 31 BG I	95.5	50.5	3.3	33.8	4.4	8.6
Ankur 5642 BG II	96.1	52.8	3.7	31.1	4.2	9.3
JKCH 1145 Bt	95.7	50.7	3.4	36.2	4.2	7.3
UPLHH 1 Bt	97.3	51.7	3.6	35.1	4.3	7.9
MRC 7041 BG II	94.8	49.3	4.1	33.4	4.5	9.1
ACH 1005 Bt BG I	95.9	51.1	3.7	31.7	4.5	9.9
Navkar 5 Bt	93.6	48.3	3.3	32.6	3.7	7.6
JKCH 1923 Bt	92.9	49.8	4.1	35.4	4.4	8.2
GK 212 BG II	91.6	47.2	3.8	32.9	4.6	9.7
VBCH 1501 BG II	91.3	52.0	3.7	35.4	4.5	8.5
SDS 9	94.0	51.9	3.8	33.8	4.8	9.4
MRC 7045 BG II	92.2	49.4	4.0	32.1	4.6	10.0
Tulasi 45 BG II	91.3	48.4	4.1	31.5	4.4	9.7
Ankur 8120 BG II	94.0	49.8	4.2	31.9	4.6	9.8
ZCH 50003 Bt	94.4	48.4	3.3	32.8	4.0	8.4
SDS 36	93.8	53.2	3.7	31.6	4.6	10.1
CSHH 198 (c)	92.8	50.0	4.3	31.9	4.1	9.0
EGCH 1417 BG II	95.5	48.5	4.0	31.3	4.6	10.3
RCH 569 BG II	89.1	36.7	3.7	31.3	3.9	8.8
PCH 2270 Bt 2	92.2	49.9	3.8	32.9	5.2	10.3
VBCH 1504 BG II	91.1	48.5	3.9	34.1	4.6	9.3
VBCH 1503 BG II	91.8	51.3	3.8	33.9	4.7	9.4
LHH 144 (c)	94.8	48.9	3.9	31.3	4.2	9.2
NCEH 26	93.2	49.5	3.9	35.0	5.2	9.6
PCH 930 Bt 2	92.9	47.5	3.8	33.8	4.6	9.2
ZCH 50023 Bt	93.4	48.1	3.4	37.6	5.2	8.8
VICH 9 BG II	94.6	52.6	3.5	33.2	4.3	9.1
NCS 851 Bt 2	91.3	48.8	3.6	32.6	4.8	10.3
NCS 853 Bt 2	94.8	47.6	3.7	34.2	5.0	9.7
VICH 11 BG II	94.0	49.5	3.7	34.5	4.9	9.5
VCH 601 BG II	90.2	46.8	4.2	33.9	5.0	9.8
SBCH 286 Bt	93.0	49.0	3.8	34.3	4.8	9.2
KDCHH 144 BG II	83.6	43.9	3.5	32.8	4.7	9.7
KCH 707 BG II	84.6	30.8	3.7	34.3	5.4	10.2

Table 28. Summary on the performance of Bt cotton hybrids for yield and fibre quality characters

Protected Condition

Entry	Seed cotton yield (kg/ha)	Lint yield (kg/ha)	2.5 % Span Length (mm)	Uniformity Ratio	Micronaire	Bundle Strength (g/tex)	BS/SL Ratio
2510-II	2375	796	27.5	51.0	4.7	20.4	0.74
RCH 134 Bt (Bt c)	2367	823	27.2	52.3	4.5	22.3	0.82
2113-II	2363	796	27.3	52.3	4.5	22.6	0.83
NCEH 31 BG I	2173	720	27.7	50.0	3.9	22.4	0.81
Ankur 5642 BG II	2146	666	31.6	48.3	4.3	24.5	0.78
JKCH 1145 Bt	2143	786	25.7	52.5	4.7	20.6	0.80
UPLHH 1 Bt	2129	743	26.7	50.8	4.0	21.7	0.81
MRC 7041 BG II	2082	702	28.4	50.0	4.6	20.8	0.73
ACH 1005 Bt BG I	2078	655	28.3	51.8	4.7	21.6	0.76
Navkar 5 Bt	2047	654	26.9	52.0	4.0	21.7	0.81
JKCH 1923 Bt	2043	727	27.9	51.8	4.9	21.9	0.79
GK 212 BG II	2035	673	28.9	51.5	4.8	21.0	0.73
VBCH 1501 BG II	2021	711	27.7	51.3	5.2	20.8	0.75
SDS 9	1944	646	29.9	50.5	4.7	22.0	0.74
MRC 7045 BG II	1942	617	28.7	49.3	4.4	23.0	0.80
Tulasi 45 BG II	1928	603	30.0	50.5	4.8	22.3	0.74
Ankur 8120 BG II	1915	610	30.7	50.5	4.3	22.5	0.73
ZCH 50003 Bt	1820	592	28.0	52.0	4.7	23.0	0.82
SDS 36	1818	568	32.6	49.0	4.7	24.1	0.74
CSHH 198 (c)	1817	572	27.3	51.3	4.5	22.3	0.82
EGCH 1417 BG II	1814	552	30.4	50.5	4.9	22.1	0.73
RCH 569 BG II	1781	549	29.2	51.5	4.9	22.1	0.76
PCH 2270 Bt 2	1735	574	32.0	49.3	4.5	24.1	0.75
VBCH 1504 BG II	1669	570	27.1	51.0	4.8	21.2	0.78
VBCH 1503 BG II	1659	553	26.9	51.3	5.0	20.1	0.75
LHH 144 (c)	1643	515	27.0	51.5	4.4	22.7	0.84
NCEH 26	1634	575	28.7	50.5	4.4	24.1	0.84
PCH 930 Bt 2	1617	548	28.2	50.8	5.0	21.9	0.78
ZCH 50023 Bt	1584	602	25.5	52.0	5.1	20.0	0.78
VICH 9 BG II	1553	510	28.8	50.3	4.3	23.1	0.80
NCS 851 Bt 2	1527	497	30.9	49.5	4.7	23.9	0.77
NCS 853 Bt 2	1480	502	28.2	50.5	4.5	21.7	0.77
VICH 11 BG II	1470	509	26.3	51.0	4.5	21.2	0.80
VCH 601 BG II	1414	473	27.4	50.8	4.5	22.2	0.81
SBCH 286 Bt	1414	475	26.0	52.0	5.1	20.4	0.78
KDCHH 144 BG II	1397	454	27.7	50.8	4.7	20.6	0.75
KCH 707 BG II	1158	405	29.2	50.0	4.9	22.2	0.76

Table 29. Summary on the performance of Bt cotton hybrids for entomological observations

Protected Condition

Entry	Jassid/ plant	Whitefly/ plant	Thrips/ plant	Aphid/ plant	Natural Enemies
2510-II	1.4	5.5	5.5	1.5	15.5
RCH 134 Bt (Bt c)	1.2	5.7	5.2	1.2	15.8
2113-II	1.2	5.2	5.2	1.2	14.9
NCEH 31 BG I	1.2	4.4	5.2	1.0	15.3
Ankur 5642 BG II	1.2	4.8	5.2	1.5	13.4
JKCH 1145 Bt	1.4	5.2	5.2	0.7	13.8
UPLHH 1 Bt	1.4	5.8	4.9	1.0	14.7
MRC 7041 BG II	1.7	4.6	3.6	1.5	15.3
ACH 1005 Bt BG I	1.4	6.0	5.0	0.8	15.3
Navkar 5 Bt	1.4	6.1	5.0	1.3	14.3
JKCH 1923 Bt	1.4	5.0	5.1	1.7	14.6
GK 212 BG II	1.6	5.6	5.4	1.2	12.1
VBCH 1501 BG II	1.3	5.6	5.0	2.1	13.3
SDS 9	1.4	5.4	4.9	1.2	14.8
MRC 7045 BG II	1.5	6.2	4.8	1.7	14.5
Tulasi 45 BG II	1.4	4.7	5.5	1.0	15.3
Ankur 8120 BG II	1.4	5.0	5.5	1.7	15.1
ZCH 50003 Bt	1.4	4.9	5.3	0.7	12.6
SDS 36	1.4	6.0	5.6	0.8	14.4
CSHH 198 (c)	1.3	5.1	5.0	0.7	15.2
EGCH 1417 BG II	1.3	4.4	5.0	1.8	13.8
RCH 569 BG II	1.3	5.4	5.3	1.0	13.0
PCH 2270 Bt 2	1.9	7.1	5.5	1.5	15.5
VBCH 1504 BG II	1.5	5.5	5.5	2.0	14.0
VBCH 1503 BG II	1.4	4.9	4.6	1.1	13.9
LHH 144 (c)	1.1	5.3	5.2	1.0	16.9
NCEH 26	1.4	4.7	5.0	0.7	13.0
PCH 930 Bt 2	1.6	5.5	4.9	0.6	15.1
ZCH 50023 Bt	1.2	5.3	4.6	0.8	11.9
VICH 9 BG II	1.3	5.8	5.2	0.8	14.7
NCS 851 Bt 2	1.3	7.7	5.2	1.7	14.3
NCS 853 Bt 2	1.3	6.4	5.2	0.9	15.2
VICH 11 BG II	1.4	5.4	4.9	0.8	14.6
VCH 601 BG II	1.6	6.2	4.8	2.2	14.7
SBCH 286 Bt	1.7	5.9	4.6	0.6	12.9
KDCHH 144 BG II	1.6	5.1	4.2	0.8	13.5
KCH 707 BG II	1.2	5.7	5.2	0.8	14.5

Table 30. Summary on the performance of Bt cotton hybrids for entomological observations – Bollworms

Protected Condition

Entry	% square damage	Spotted bollworm, Earias spp - (No of Larvae / 5plants)	Intact boll damage (%) by Bollworms	Open boll damage (%)	Locule damage (%)
2510-II	0.9	0.1	0.0	5.3	2.1
RCH 134 Bt (Bt c)	0.9	0.0	0.0	6.6	3.1
2113-II	0.6	0.0	0.0	5.9	2.8
NCEH 31 BG I	1.0	0.0	0.0	7.6	3.7
Ankur 5642 BG II	1.0	0.0	0.0	3.6	1.7
JKCH 1145 Bt	1.1	0.0	0.0	5.4	2.4
UPLHH 1 Bt	0.6	0.0	0.0	7.3	2.7
MRC 7041 BG II	0.8	0.0	0.0	4.3	2.1
ACH 1005 Bt BG I	1.0	0.0	0.0	4.8	2.2
Navkar 5 Bt	0.7	0.0	0.4	1.5	0.7
JKCH 1923 Bt	0.8	0.1	0.0	4.3	1.3
GK 212 BG II	1.2	0.2	0.0	2.9	1.2
VBCH 1501 BG II	0.9	0.1	0.4	3.2	2.2
SDS 9	0.9	0.0	0.3	2.4	1.2
MRC 7045 BG II	0.7	0.0	0.0	5.1	1.7
Tulasi 45 BG II	1.0	0.0	0.0	5.5	2.2
Ankur 8120 BG II	0.9	0.0	0.0	4.5	2.4
ZCH 50003 Bt	0.6	0.0	0.0	3.2	1.9
SDS 36	0.8	0.0	1.3	4.0	1.6
CSHH 198 (c)	1.4	0.3	0.0	8.9	3.9
EGCH 1417 BG II	0.7	0.0	0.0	4.1	2.0
RCH 569 BG II	0.8	0.0	0.0	4.7	2.1
PCH 2270 Bt 2	0.8	0.0	0.2	6.5	3.1
VBCH 1504 BG II	0.7	0.1	0.0	5.0	2.3
VBCH 1503 BG II	1.0	0.1	0.0	3.8	1.6
LHH 144 (c)	2.2	0.6	0.4	10.6	4.7
NCEH 26	0.6	0.0	0.0	6.5	3.6
PCH 930 Bt 2	0.8	0.0	0.0	5.5	2.6
ZCH 50023 Bt	0.8	0.0	1.7	5.0	2.1
VICH 9 BG II	0.7	0.0	0.0	5.3	2.4
NCS 851 Bt 2	0.7	0.0	0.0	6.2	3.1
NCS 853 Bt 2	0.7	0.0	0.0	6.3	3.0
VICH 11 BG II	1.0	0.0	0.0	5.5	2.7
VCH 601 BG II	0.7	0.0	0.0	5.7	2.6
SBCH 286 Bt	0.7	0.0	0.0	3.9	1.8
KDCHH 144 BG II	0.9	0.0	0.0	2.5	1.5
KCH 707 BG II	0.8	0.0	0.0	2.5	1.1

Table 31. Summary on the performance of Bt cotton hybrids for various characters

Unprotected Condition

Entry	Germination (%)	Stand at harvest (No. of plants)	Seed cotton yield (Kg/ha)	Open boll damage (%)	Locule damage (%)
2113-II	94.7	20.0	2518	14.2	5.5
Navkar 5 Bt	95.3	20.3	2064	4.3	1.6
RCH 569 BG II	85.1	15.8	2058	6.5	2.6
NCEH 31 BG I	92.8	20.6	1828	13.6	4.5
JKCH 1923 Bt	91.9	19.1	1788	8.8	2.2
2510-II	93.4	19.7	1778	7.6	2.8
Ankur 5642 BG II	94.4	20.9	1708	9.5	3.6
MRC 7041 BG II	91.5	18.6	1667	6.1	2.5
ZCH 50003 Bt	92.8	18.8	1596	7.9	3.9
RCH 134 Bt (Bt c)	95.7	19.5	1582	10.9	4.0
UPLHH 1 Bt	94.4	20.5	1574	13.3	4.5
GK 212 BG II	93.2	19.4	1573	6.4	2.1
CSHH 198 (c)	92.8	18.5	1526	18.7	7.2
ACH 1005 Bt BG I	98.8	18.9	1509	7.5	2.6
SDS 9	98.8	21.1	1469	6.4	2.3
EGCH 1417 BG II	94.4	18.7	1334	9.9	3.4
Tulasi 45 BG II	88.1	17.7	1333	9.3	3.2
VBCH 1501 BG II	92.5	19.6	1310	6.2	2.8
Ankur 8120 BG II	92.5	18.7	1181	8.9	3.6
SBCH 286 Bt	96.9	19.9	1176	8.5	3.1
SDS 36	94.4	19.3	1165	10.0	3.5
PCH 930 Bt 2	92.8	20.2	1119	10.1	3.4
JKCH 1145 Bt	96.6	20.3	1116	13.3	4.3
MRC 7045 BG II	89.0	18.1	1105	6.6	2.2
PCH 2270 Bt 2	91.3	20.0	1066	10.3	3.6
VICH 11 BG II	95.9	20.0	1004	11.9	4.0
NCS 851 Bt 2	92.5	19.0	964	11.6	4.5
ZCH 50023 Bt	94.4	18.8	952	11.2	4.2
VBCH 1503 BG II	91.6	19.7	911	6.2	2.3
LHH 144 (c)	96.9	18.2	885	21.1	7.5
VBCH 1504 BG II	95.1	20.5	883	10.7	4.0
NCEH 26	93.7	19.6	850	13.2	5.5
VICH 9 BG II	95.9	19.9	849	9.5	3.6
VCH 601 BG II	88.2	18.1	776	10.6	3.9
KDCHH 144 BG II	91.9	17.6	651	8.2	3.1
NCS 853 Bt 2	90.6	18.1	635	11.2	4.4
KCH 707 BG II	71.2	13.1	468	5.4	1.7

SECOND YEAR TRIAL

Entries

Nine Bt Cotton hybrids were evaluated for the second year in succession for confirmatory results. The hybrids evaluated were BCHH 6488-2 BG II (Bio Seeds Research India (P) Ltd), RCH 134 BG II (Rasi Seeds (P) Ltd.), Ankur Jassi BG II (Ankur Seeds (P) Ltd.), Tulasi 4 BG II (Tulasi Seeds (P) Ltd.), NCEH 9 Bt (Nath Seeds Ltd.), JKCH 1945 Bt (JK Agri Genetics Ltd.), Ankur 2226 Bt (Ankur Seeds (P) Ltd.), MLCH 315 BG II Emergent Genetics India (P) Ltd.) and KDCHH 441 BG II (Krishidhan Seeds Ltd.). There were three check hybrids viz., RCH 134 Bt (Bt check) and LHH 144 and CSHH 198 (Non Bt checks).

Trial Locations

Trial details:

Number of Entries:	9+3 checks.
Number of Rows:	Yield trial 1: 6 Rows (Protected)
	Screening Trial 2 & 3: 3 Rows (Unprotected)
Row length:	6 m
Spacing:	75 x 60 cm
No. of replications:	Three
Design:	Randomized Block Design
Fertilizers:	As per Recommendations.

Trials

I. EVALUATION UNDER ETL BASED PLANT PROTECTION

Weekly observations were recorded from 45 DAS against major sucking Pests and Bollworms. The insecticide sprays were based on the threshold levels of sap sucking pests and Bollworms. 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.

II. 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.

III. PATHOLOGICAL EVALUATION OF Bt COTTON HYBRIDS

All the entries in the trial were screened against CLCuV disease (CLCuD) and other fungal diseases.

Observations recorded

The Biometrical observations recorded were Germination Percentage, Final plant stand, Ginning per cent, Lint index, Seed index, Seed Cotton Yield (kg/ha) and Lint yield (kg/ha). The entomological observations on sap sucking pest, Boll worm damage and natural enemies were recorded under ETL based plant protection trials. The pathological observations on incidences of cotton CLCuV and other foliar diseases were recorded.

A. BIOMETRICAL EVALUATION

Biometrical evaluation of all the entries in the trial was made in the ETL based plant protection trial and are reported here.

Germination and Stand at harvest

Germination was good in all the entries in the trial and ranged from 91.6 to 96.1 per cent (Table 32). The final stand at harvest was also satisfactory in all the entries (Table 33).

Table 32. Germination (%) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Mean
Ankur 2226 Bt	95.7	95.1	95.3	95.4
Ankur Jassi BGII	94.4	93.2	93.3	93.6
BCHH 6488-2 BGII	94.4	92.0	100.0	95.5
CSHH 198 (c)	96.3	92.0	100.0	96.1
JKCH 1945 Bt	96.3	90.1	100.0	95.5
KDCHH 441 BGII	95.7	92.6	94.0	94.1
LHH 144 (c)	91.4	94.4	96.0	93.9
MLCH 315 BGII	91.4	93.2	98.0	94.2
NCEH 9 Bt	95.7	92.6	91.3	93.2
RCH 134 BGII	93.8	91.4	100.0	95.1
RCH 134 Bt (Bt c)	94.4	87.0	93.3	91.6
Tulasi 4 BGII	94.4	92.0	100.0	95.5

Table 33. Number of plants at harvest under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
BCHH 6488-2 BG II	47.3	50.0	46.0	61.0	53.0	55.0	52.1
RCH 134 Bt (Bt c)	51.3	47.7	40.0	65.0	42.3	55.7	50.3
RCH 134 BG II	52.0	50.0	48.0	64.3	49.7	56.7	53.5
Ankur Jassi BG II	51.8	51.3	44.0	64.3	52.0	57.3	53.5
CSHH 198 (c)	48.3	51.0	40.0	65.7	49.3	54.3	51.4
Tulasi 4 BG II	49.3	50.7	43.0	63.7	48.7	58.3	52.3
NCEH 9 Bt	50.8	51.0	37.0	62.0	43.3	55.3	49.9
JKCH 1945 Bt	48.5	48.7	48.0	62.3	52.0	56.3	52.6
Ankur 2226 Bt	46.3	52.0	32.0	64.0	45.0	55.3	49.1
LHH 144 (c)	49.3	51.3	50.0	62.7	43.7	55.0	52.0
MLCH 315 BG II	47.5	50.7	37.0	61.0	46.0	56.0	49.7
KDCHH 441 BG II	47.8	50.3	38.0	62.7	45.3	52.3	49.4

Boll Weight (g)

Mean boll weight of the hybrids ranged from 3 to 4.2 g (Table 34). Except NCEH 9 Bt (3.0 g) all the test hybrids were on par in boll weight with check hybrids.

Table 34. Boll weight (g) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
Ankur 2226 Bt	3.8	4.7	3.4	4.4	4.0	3.8	4.0
Ankur Jassi BG II	3.4	3.7	3.8	3.4	3.8	3.3	3.6
BCHH 6488-2 BG II	3.9	3.8	4.0	3.5	3.9	3.5	3.8
CSHH 198 (c)	4.6	4.3	4.2	4.2	4.6	3.2	4.2
JKCH 1945 Bt	3.0	3.6	3.4	3.8	3.1	3.3	3.4
KDCHH 441 BG II	3.6	3.3	3.5	3.6	3.8	3.7	3.6
LHH 144 (c)	4.0	3.8	3.5	4.4	4.5	2.7	3.8
MLCH 315 BG II	3.6	3.9	3.8	3.7	3.7	3.2	3.6
NCEH 9 Bt	2.8	3.0	2.9	3.7	3.1	2.3	3.0
RCH 134 BG II	3.8	3.4	3.6	4.2	4.0	3.5	3.7
RCH 134 Bt (Bt c)	3.7	3.6	3.8	3.9	4.0	2.4	3.6
Tulasi 4 BG II	4.3	3.6	3.9	3.5	4.2	3.2	3.8
CD 5%	0.2	0.3	0.4	0.3	0.4	0.2	
CV%	3.3	5.0	7.1	4.0	6.4	4.8	

Ginning out turn (%)

The mean ginning out turn of the hybrids ranged from 32.9 to 36.8 per cent (Table 35). JKCH 1945 Bt recorded the highest ginning out turn of 36.8per cent. All the test hybrids were on par with the check hybrids in ginning out turn.

Table 35. Ginning Outturn (%) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganganagar	Mean
Ankur 2226 Bt	36.1	32.7	32.9	37.3	35.7	35.5	35.0
Ankur Jassi BG II	33.6	31.3	35.0	32.3	33.2	32.3	32.9
BCHH 6488-2 BG II	33.6	32.3	35.0	32.5	34.5	33.8	33.6
CSHH 198 (c)	32.5	31.6	31.3	32.5	33.7	40.3	33.6
JKCH 1945 Bt	36.3	37.1	36.7	37.6	36.3	37.0	36.8
KDCHH 441 BG II	35.3	31.2	34.2	33.1	35.0	32.0	33.5
LHH 144 (c)	35.3	31.0	32.1	32.3	33.2	35.1	33.2
MLCH 315 BG II	34.7	30.9	34.2	32.6	35.0	33.2	33.4
NCEH 9 Bt	36.9	34.5	33.8	36.8	35.3	35.5	35.5
RCH 134 BG II	35.9	32.7	32.5	31.9	36.2	34.3	33.9
RCH 134 Bt (Bt c)	36.0	34.4	35.0	32.6	35.7	34.8	34.7
Tulasi 4 BG II	33.8	38.8	33.8	34.1	33.7	33.5	34.6
CD 5%	2.2	2.6	NS	0.8	1.0		
CV%	3.7	4.7	7.9	1.3	1.7		

Lint Index and Seed Index

Mean lint index of the hybrids ranged from 4.1 to 5.5g (Table 36). The mean seed index ranged from 7 to 10.4 g (Table 37). Tulasi 4 BG II recorded the highest mean lint and seed index.

Table 36. Lint Index (g) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
Ankur 2226 Bt	5.1	4.7	3.7	5.2	4.7	4.7
Ankur Jassi BG II	5.1	5.2	5.1	5.0	3.9	4.8
BCHH 6488-2 BG II	4.6	4.8	4.8	4.6	3.7	4.5
CSHH 198 (c)	4.5	4.3	4.9	4.4	5.2	4.7
JKCH 1945 Bt	4.1	4.3	4.2	4.2	3.6	4.1
KDCHH 441 BG II	5.0	4.6	4.5	5.1	4.0	4.6
LHH 144 (c)	5.3	4.8	4.6	5.0	4.1	4.8
MLCH 315 BG II	5.1	4.9	5.0	4.6	4.1	4.7
NCEH 9 Bt	4.6	4.7	3.9	4.1	4.1	4.3
RCH 134 BG II	5.0	5.4	4.0	4.2	4.2	4.6
RCH 134 Bt (Bt c)	5.2	5.7	4.8	4.6	4.6	5.0
Tulasi 4 BG II	5.6	7.4	5.0	5.0	4.6	5.5
CD 5%	0.5	0.7	NS	0.5		
CV%	6.2	8.2	16.2	5.7		

Table 37. Seed Index (g) under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
Ankur 2226 Bt	9.0	9.7	7.4	8.7	9.1	8.5	8.7
Ankur Jassi BG II	10.0	11.4	9.4	10.4	10.3	8.1	9.9
BCHH 6488-2 BG II	9.1	10.0	8.9	9.5	9.4	7.3	9.0
CSHH 198 (c)	9.3	9.3	10.7	9.1	9.3	7.6	9.2
JKCH 1945 Bt	7.2	7.3	7.2	6.9	7.4	6.1	7.0
KDCHH 441 BG II	9.1	10.1	8.6	10.4	8.5	8.4	9.2
LHH 144 (c)	9.6	10.7	9.9	10.5	9.4	7.6	9.6
MLCH 315 BG II	9.6	11.0	9.7	9.5	10.0	8.3	9.7
NCEH 9 Bt	7.8	8.8	7.3	7.1	8.0	7.4	7.7
RCH 134 BG II	8.9	11.1	8.1	9.0	9.0	8.1	9.0
RCH 134 Bt (Bt c)	9.2	10.8	8.9	9.5	9.1	8.7	9.4
Tulasi 4 BG II	10.9	11.6	9.8	9.6	11.7	9.1	10.4
CD 5%	0.6	0.4	1.6	0.8	0.8	0.2	
CV%	3.6	2.5	10.8	4.8	5.2	2.7	

Seed Cotton Yield

Seed cotton yield data pertaining to four centres *viz*., Ludhiana, Faridkot, Hisar and Sirsa have been taken into consideration and summarized in Table 38. The data from Abohar and Sriganganagar have not been considered due to vitiation of trials that has arisen due to water logged situation, mealy bug infestation and late sown conditions. All these cumulatively aggravated crop growth condition leading to wide fluctuation in seed cotton yield in these two centres.

As compared to the Bt check hybrid RCH 134 Bt (2092 kg/ha), only two hybrids were superior to the extent of 3.0 to 6.5 per cent. They are: BCHH 6488-2 BG II (2227 kg/ha; 6.5 % increase) and JKCH 1945 Bt (2156 kg/ha; 3% increase). All the Bt test hybrids were superior to the Non-Bt check hybrids (Table 38).

Lint yield

Lint yield also followed the same trend as that of seed cotton yield (Table 39). JKCH 1945 Bt (798 kg/ha; 11.2% increase) and BCHH 6488-2 BG II (746 kg/ha; 3.9% increase) were superior to the Bt check hybrid RCH 134 Bt (718 kg/ha). All the test hybrids were superior to the Non-Bt check hybrids.

Table 38. Seed cotton yield (kg/ha) under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	**Mean**	%Inc. over CSHH 198	%Inc. over RCH 134	%Inc. over LHH 144
Ankur 2226 Bt	1963	989	2584	1861	**1849**	25.1	-11.6	20.3
Ankur Jassi BGII	1698	1651	2482	1551	**1845**	24.9	-11.8	20.1
BCHH 6488-2 BGII	2310	1937	2361	2301	**2227**	50.7	6.5	44.9
CSHH 198 (c)	1773	1073	1796	1269	**1478**	0.0	-29.4	-3.8
JKCH 1945 Bt	2656	1147	2722	2097	**2156**	45.8	3.0	40.2
KDCHH 441 BGII	1940	905	2158	2162	**1791**	21.2	-14.4	16.5
LHH 144 (c)	2186	1305	1639	1019	**1537**	4.0	-26.5	0.0
MLCH 315 BGII	1743	1107	1759	1639	**1562**	5.7	-25.3	1.6
NCEH 9 Bt	1788	1027	2037	1412	**1566**	6.0	-25.1	1.9
RCH 134 BGII	2019	1436	2574	2074	**2026**	37.1	-3.2	31.8
RCH 134 Bt (Bt c)	1910	2112	2371	1977	**2092**	41.6	0.0	36.1
Tulasi 4 BGII	2156	1246	3028	1676	**2027**	37.1	-3.1	31.8
CD 5%	334	213	218	220				
CV%	10	9		7				

Table 39. Lint yield (kg/ha) under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	**Mean**	%Inc. over CSHH 198	%Inc. over RCH 134	%Inc. over LHH 144
Ankur 2226 Bt	642	324	964	664	**648**	36.2	-9.7	31.8
Ankur Jassi BGII	531	578	801	515	**606**	27.4	-15.6	23.2
BCHH 6488-2 BGII	746	676	767	794	**746**	56.7	3.9	51.6
CSHH 198 (c)	559	335	583	427	**476**	0.0	-33.7	-3.2
JKCH 1945 Bt	984	421	1024	762	**798**	67.6	11.1	62.1
KDCHH 441 BGII	605	309	714	757	**596**	25.3	-17.0	21.2
LHH 144 (c)	681	418	529	338	**492**	3.3	-31.5	-0.1
MLCH 315 BGII	538	378	574	573	**516**	8.4	-28.2	4.8
NCEH 9 Bt	617	346	749	499	**553**	16.1	-23.0	12.3
RCH 134 BGII	659	465	822	750	**674**	41.6	-6.1	37.0
RCH 134 Bt (Bt c)	655	738	774	706	**718**	50.9	0.0	46.0
Tulasi 4 BGII	836	419	1032	565	**713**	49.8	-0.7	44.9
CD 5%	123	91	74	83				
CV%	11	12	6	8				

B. FIBRE QUALITY EVALUATION

The 2.5% span length, Micronaire and Strength are furnished in Table 40. The fibre quality parameters of the test hybrids were on par with that of the non-Bt and Bt check hybrids (Tables 40 – 43). Tulasi 4 BG II recorded the highest fibre length of 31.0 mm with the comparatively high strength of 22.7 g/tex.

Table 40. 2.5 % Span Length (mm) under protected condition

Entry	Faridkot	Hisar	Sirsa	Sriganganagar	**Mean**
Ankur 2226 Bt	25.9	29.7	27.6	27.1	**27.6**
Ankur Jassi BGII	30.0	32.7	31.5	30.4	**31.2**
BCHH 6488-2 BGII	27.6	29.9	28.5	26.7	**28.2**
CSHH 198 (c)	27.8	30.0	28.7	21.6	**27.0**
JKCH 1945 Bt	26.6	26.8	26.7	25.6	**26.4**
KDCHH 441 BGII	27.8	29.5	28.0	28.0	**28.3**
LHH 144 (c)	27.6	29.2	27.8	26.7	**27.8**
MLCH 315 BGII	27.2	30.6	29.9	29.0	**29.2**
NCEH 9 Bt	27.3	29.6	29.3	27.6	**28.5**
RCH 134 BGII	27.2	28.3	27.8	26.4	**27.4**
RCH 134 Bt (Bt c)	26.4	28.9	27.8	26.3	**27.4**
Tulasi 4 BGII	28.9	32.8	32.3	29.8	**31.0**

Table 41. Micronaire under protected condition

Entry	Faridkot	Hisar	Sirsa	Sriganganagar	**Mean**
Ankur 2226 Bt	5.5	4.2	5.2	4.7	**4.9**
Ankur Jassi BGII	4.4	4.1	4.2	3.6	**4.1**
BCHH 6488-2 BGII	5.3	4.2	5.0	4.3	**4.7**
CSHH 198 (c)	5.1	4.4	4.7	5.6	**5.0**
JKCH 1945 Bt	5.5	4.4	4.7	4.4	**4.8**
KDCHH 441 BGII	5.0	4.3	4.6	4.7	**4.7**
LHH 144 (c)	5.0	4.9	4.3	3.8	**4.5**
MLCH 315 BGII	4.9	3.6	4.3	4.0	**4.2**
NCEH 9 Bt	5.0	4.7	4.6	4.5	**4.7**
RCH 134 BGII	5.1	4.3	4.2	4.5	**4.5**
RCH 134 Bt (Bt c)	4.8	4.4	4.5	4.5	**4.6**
Tulasi 4 BGII	5.2	4.5	4.6	4.4	**4.7**

Table 42. Bundle Strength under protected condition

Entry	Faridkot	Hisar	Sirsa	Sriganganagar	**Mean**
Ankur 2226 Bt	20.9	23.0	20.2	19.6	**20.9**
Ankur Jassi BGII	22.7	23.3	22.2	23.6	**23.0**
BCHH 6488-2 BGII	20.7	22.3	21.3	22.3	**21.7**
CSHH 198 (c)	22.4	24.1	21.4	17.9	**21.5**
JKCH 1945 Bt	22.1	21.5	21.9	20.3	**21.5**
KDCHH 441 BGII	20.9	21.4	19.2	20.1	**20.4**
LHH 144 (c)	21.9	22.6	23.6	22.8	**22.7**
MLCH 315 BGII	21.7	24.1	21.4	21.5	**22.2**
NCEH 9 Bt	23.1	22.1	22.3	22.5	**22.5**
RCH 134 BGII	22.0	23.1	23.4	21.2	**22.4**
RCH 134 Bt (Bt c)	21.1	23.1	23.0	21.5	**22.2**
Tulasi 4 BGII	22.0	23.6	22.7	22.6	**22.7**

Table 43. Uniformity Ratio under protected condition

Entry	Faridkot	Hisar	Sirsa	Sriganganagar	**Mean**
Ankur 2226 Bt	48.0	52.0	52.0	51.0	**50.8**
Ankur Jassi BGII	47.0	51.0	50.0	47.0	**48.8**
BCHH 6488-2 BGII	51.0	52.0	51.0	49.0	**50.8**
CSHH 198 (c)	52.0	52.0	52.0	49.0	**51.3**
JKCH 1945 Bt	52.0	52.0	52.0	52.0	**52.0**
KDCHH 441 BGII	48.0	52.0	50.0	50.0	**50.0**
LHH 144 (c)	50.0	52.0	52.0	48.0	**50.5**
MLCH 315 BGII	47.0	52.0	50.0	51.0	**50.0**
NCEH 9 Bt	40.0	52.0	51.0	51.0	**48.5**
RCH 134 BGII	51.0	52.0	52.0	51.0	**51.5**
RCH 134 Bt (Bt c)	51.0	52.0	52.0	53.0	**52.0**
Tulasi 4 BGII	48.0	51.0	50.0	51.0	**50.0**

C. ENTOMOLOGICAL EVALUATION

1. EVALUATION UNDER ETL BASED PLANT PROTECTION

Jassids

Jassid population was minimum at all the locations (Table 44). Mean jassid population ranged from 0.8 to 1.1 jassids/plant.

Table 44. Mean number of Jassid nymphs/3 leaves/plant under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
Ankur 2226 Bt	1.1	1.3	0.6	0.7	0.9	0.9
Ankur Jassi BGII	1.0	1.6	0.6	0.7	0.9	1.0
BCHH 6488-2 BGII	0.9	1.3	0.8	0.7	1.0	0.9
CSHH 198 (c)	1.0	1.5	0.4	0.6	1.0	0.9
JKCH 1945 Bt	1.2	1.7	0.7	0.7	1.1	1.1
KDCHH 441 BGII	0.9	1.5	0.7	0.7	0.7	0.9
LHH 144 (c)	0.9	1.8	0.6	0.7	0.9	1.0
MLCH 315 BGII	1.1	1.8	0.3	0.7	0.7	0.9
NCEH 9 Bt	1.0	1.5	1.3	0.7	1.0	1.1
RCH 134 BGII	1.0	1.4	0.2	0.7	0.8	0.8
RCH 134 Bt (Bt c)	0.9	1.8	0.7	0.6	0.7	0.9
Tulasi 4 BGII	1.0	1.4	0.9	0.6	0.9	1.0

White fly

Whitefly population was more at Sriganganagar and Faridkot than at other centres (Table 45). The mean whitefly population of the test hybrids were less than that recorded in the Bt check hybrid RCH 134 Bt.

Table 45. Mean number of Whitefly adults/3leaves/plant under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
Ankur 2226 Bt	5.0	4.9	3.5	2.8	9.7	5.2
Ankur Jassi BG II	6.6	5.0	3.7	3.5	10.2	5.8
BCHH 6488-2 BG II	6.1	4.6	1.5	3.3	8.8	4.9
CSHH 198 (c)	8.6	4.9	2.7	3.4	8.5	5.6
JKCH 1945 Bt	4.3	4.7	2.6	4.0	10.0	5.1
KDCHH 441 BG II	3.5	5.0	1.3	3.3	8.7	4.3
LHH 144 (c)	3.9	5.1	3.1	3.4	9.4	5.0
MLCH 315 BG II	3.8	4.8	2.0	3.6	8.4	4.5
NCEH 9 Bt	5.1	4.7	2.7	3.5	8.9	5.0
RCH 134 BG II	6.9	5.0	2.4	3.3	9.3	5.4
RCH 134 Bt (Bt c)	7.3	4.5	3.7	3.3	11.6	6.1
Tulasi 4 BG II	4.8	4.3	3.3	3.4	9.2	5.0

Thrips and Aphids

Thrips population was maximum at Sirsa and Sriganganagar and low at Faridkot and Ludhiana. Aphid population was negligible (Table 46).

Table 46. Mean number of thrips and aphids/plant under protected condition

	Number of Thrips/plant					Number of Aphids/plant		
Entry	Faridkot	Ludhiana	Sirsa	Sriganganagar	**Mean**	Faridkot	Ludhiana	**Mean**
Ankur 2226 Bt	1.8	0.1	9.7	9.0	**5.1**	0.2	0.0	**0.1**
Ankur Jassi BG II	1.1	0.1	9.3	8.4	**4.7**	0.0	0.1	**0.0**
BCHH 6488-2 BG II	1.0	0.2	9.4	9.4	**5.0**	0.0	0.2	**0.1**
CSHH 198 (c)	1.7	0.1	9.9	8.6	**5.1**	0.1	0.3	**0.2**
JKCH 1945 Bt	1.2	0.0	10.0	10.4	**5.4**	0.1	0.1	**0.1**
KDCHH 441 BG II	1.0	0.0	9.1	8.7	**4.7**	0.1	0.3	**0.2**
LHH 144 (c)	1.6	0.1	10.1	9.3	**5.3**	0.9	0.4	**0.6**
MLCH 315 BG II	1.8	0.1	9.1	9.4	**5.1**	0.0	0.0	**0.0**
NCEH 9 Bt	0.8	0.0	9.4	11.1	**5.3**	0.1	0.0	**0.1**
RCH 134 BG II	2.0	0.0	9.3	11.7	**5.8**	0.0	0.0	**0.0**
RCH 134 Bt (Bt c)	1.3	0.1	9.3	9.8	**5.1**	0.0	0.5	**0.2**
Tulasi 4 BG II	1.5	0.0	9.4	9.0	**5.0**	0.1	0.1	**0.1**

Natural enemies

The predator population was very low at all the locations (Table 47). There was no significant difference in predator population between Bt and non Bt hybrids.

Table 47. Mean number of predators under protected condition

Entry	Faridkot	Ludhiana	Sirsa	Sriganga nagar	Mean
Ankur 2226 Bt	0.6	0.5	0.1	4.2	1.3
Ankur Jassi BG II	0.0	0.7	0.2	4.0	1.2
BCHH 6488-2 BG II	0.3	0.7	0.2	3.1	1.0
CSHH 198 (c)	0.4	0.7	0.1	3.1	1.1
JKCH 1945 Bt	1.1	0.8	0.2	3.9	1.5
KDCHH 441 BG II	0.0	0.0	0.1	3.4	0.9
LHH 144 (c)	0.0	0.1	0.1	4.3	1.1
MLCH 315 BG II	0.0	0.5	0.1	4.1	1.2
NCEH 9 Bt	0.0	0.4	0.1	3.9	1.1
RCH 134 BG II	1.8	0.7	0.1	3.3	1.5
RCH 134 Bt (Bt c)	0.6	0.4	0.1	3.8	1.2
Tulasi 4 BG II	0.0	0.3	0.2	3.2	0.9

Spotted Bollworm (*Earias spp*.)

Earias spp. population was nil or negligible in most of the entries (Table 48). Tulasi 4 BG II (10.0 larvae/5 plants) and CSHH 198 (5.8 larvae/5 plants) recorded appreciable larval damage at Faridkot.

Table 48. Mean number of Spotted Bollworm (Earias spp.)/5 plants under protected condition

Entry	Faridkot	Ludhiana	Mean
Ankur 2226 Bt	0.0	0.0	0.0
Ankur Jassi BG II	3.3	0.0	1.7
BCHH 6488-2 BG II	2.2	0.0	1.1
CSHH 198 (c)	5.8	1.0	3.4
JKCH 1945 Bt	0.0	0.0	0.0
KDCHH 441 BG II	0.0	0.0	0.0
LHH 144 (c)	0.0	0.8	0.4
MLCH 315 BG II	0.0	0.0	0.0
NCEH 9 Bt	4.3	0.0	2.2
RCH 134 BG II	0.0	0.0	0.0
RCH 134 Bt (Bt c)	0.0	0.0	0.0
Tulasi 4 BG II	10.0	0.0	5.0

Per cent square damage

The non Bt check hybrid LHH 144 recorded the maximum mean square damage of 1.8 per cent (Table 49). All the test hybrids recorded very low square damage ranging from 0.1 to 0.4 %.

Table 49. Per cent square damage under protected condition

Entry	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
Ankur 2226 Bt	0.3	0.0	0.3	0.0	0.9	0.3
Ankur Jassi BGII	0.0	0.0	0.0	0.0	1.0	0.2
BCHH 6488-2 BGII	0.0	0.0	0.1	0.0	1.2	0.3
CSHH 198 (c)	0.5	6.1	0.6	0.0	0.7	1.6
JKCH 1945 Bt	0.8	0.0	0.4	0.1	0.5	0.4
KDCHH 441 BGII	0.9	0.0	0.1	0.0	1.0	0.4
LHH 144 (c)	0.6	5.9	0.0	1.7	0.8	1.8
MLCH 315 BGII	0.0	0.0	0.1	0.0	0.6	0.1
NCEH 9 Bt	0.6	0.0	0.4	0.1	1.0	0.4
RCH 134 BGII	0.0	0.0	0.1	0.0	1.1	0.2
RCH 134 Bt (Bt c)	0.0	0.0	0.0	0.0	0.8	0.2
Tulasi 4 BGII	0.0	0.0	0.0	0.0	1.2	0.2

Green boll damage

Green boll damage was high at Sriganganagar due to pink bollworm and low at other centres (Table 50). The non Bt check hybrids LHH 144© recorded the highest green boll damage of 7.2 per cent. The Bt test hybrids recorded the lower green boll damage ranging from 2.4 to 5.7 per cent.

Table 50. Per cent green boll damage under protected condition

Entry	Faridkot	Ludhiana	Hisar	Srigangan agar	Mean
Ankur 2226 Bt	0.0	0.0	1.6	17.8	4.9
Ankur Jassi BGII	0.6	0.0	0.0	12.4	3.2
BCHH 6488-2 BGII	1.1	0.0	0.1	21.6	5.7
CSHH 198 (c)	6.1	0.8	3.1	8.7	4.7
JKCH 1945 Bt	2.2	0.0	0.4	11.4	3.5
KDCHH 441 BGII	0.0	0.0	0.0	20.3	5.1
LHH 144 (c)	13.3	0.0	0.7	14.8	7.2
MLCH 315 BGII	2.2	0.0	0.0	16.4	4.7
NCEH 9 Bt	3.3	0.0	0.4	7.1	2.7
RCH 134 BGII	0.6	0.0	0.2	10.4	2.8
RCH 134 Bt (Bt c)	0.0	0.0	0.5	19.9	5.1
Tulasi 4 BGII	0.6	0.0	0.0	9.1	2.4

Pink boll worm Larvae.

Larval damage due to Pink boll worm was negligible at Faridkot and Ludhiana (Table 51).

Table 51. Mean number of pink bollworm larvae/20 green bolls under protected condition

Entry	Faridkot	Ludhiana	Mean
Ankur 2226 Bt	0.0	0.0	0.0
Ankur Jassi BG II	0.1	0.0	0.1
BCHH 6488-2 BG II	0.1	0.0	0.1
CSHH 198 (c)	0.8	0.2	0.5
JKCH 1945 Bt	0.0	0.0	0.0
KDCHH 441 BG II	0.0	0.0	0.0
LHH 144 (c)	1.2	0.0	0.6
MLCH 315 BG II	0.0	0.0	0.0
NCEH 9 Bt	0.0	0.0	0.0
RCH 134 BG II	0.0	0.0	0.0
RCH 134 Bt (Bt c)	0.0	0.0	0.0
Tulasi 4 BG II	0.0	0.0	0.0

Open boll and Locule damage

Open boll and locule damage were estimated at harvest (Tables 52 & 53). The non Bt check hybrid recorded the highest boll (10.7 per cent) and locule (7.7percent) damage. RCH134 BG II, the Bt check hybrid recorded a mean boll damage of 4.8 per cent and locule damage of 2.2 per cent. Most of the test hybrids recorded slightly higher open boll and locule damage as compared to the Bt check hybrids. Higher damage by pink bollworm has been reported at Sriganganagar in all the hybrids.

Table 52. Open boll damage (%) - Boll basis under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sirsa	Sriganga nagar	Mean
Ankur 2226 Bt	3.5	6.7	0.0	4.7	0.2	39.1	9.0
Ankur Jassi BG II	1.5	0.0	0.0	8.1	0.0	27.1	6.1
BCHH 6488-2 BG II	0.0	1.2	0.0	6.3	0.0	41.3	8.1
CSHH 198 (c)	5.2	4.5	12.3	6.9	0.5	22.7	8.7
JKCH 1945 Bt	0.0	0.0	0.0	2.0	0.5	32.0	5.7
KDCHH 441 BG II	1.2	0.0	0.0	3.2	0.4	40.5	7.6
LHH 144 (c)	6.5	4.7	9.1	11.7	0.4	31.8	10.7
MLCH 315 BG II	0.0	0.0	0.0	3.3	0.1	32.5	6.0
NCEH 9 Bt	1.9	0.0	0.0	8.0	0.3	19.1	4.9
RCH 134 BG II	0.0	0.2	0.0	2.8	0.0	26.0	4.8
RCH 134 Bt (Bt c)	0.0	0.0	0.0	4.5	0.1	43.6	8.0
Tulasi 4 BG II	0.0	0.0	0.0	2.1	0.0	27.3	4.9

Table 53. Open boll damage (%) - Loculi Basis under protected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
Ankur 2226 Bt	0.5	3.1	0.0	1.9	11.8	3.5
Ankur Jassi BGII	0.3	0.0	0.0	3.2	8.5	2.4
BCHH 6488-2 BGII	0.0	0.4	0.0	2.7	18.3	4.3
CSHH 198 (c)	1.7	1.4	6.8	3.1	8.7	4.3
JKCH 1945 Bt	0.0	0.0	0.0	0.7	10.0	2.1
KDCHH 441 BGII	0.3	0.0	0.0	1.1	16.5	3.6
LHH 144 (c)	2.6	2.3	5.8	4.2	11.4	5.3
MLCH 315 BGII	0.0	0.6	0.0	1.5	15.1	3.4
NCEH 9 Bt	0.7	0.0	0.0	3.0	6.4	2.0
RCH 134 BGII	0.0	0.1	0.0	1.3	7.6	1.8
RCH 134 Bt (Bt c)	0.0	0.0	0.0	1.8	19.9	4.3
Tulasi 4 BGII	0.0	0.0	0.0	0.6	10.8	2.3

II. EVALUATION UNDER UNPROTECTED CONDITIONS FOR BOLL WORMS

Germination and plant stand

Germination of all the entries was good at all the locations (Table 54). Consequently the plant stand was also satisfactory at all the locations (Table 55).

Table 54. Germination Percentage under unprotected condition

Entry	Abohar	Faridkot	Ludhiana	Mean
Ankur 2226 Bt	95.2	87.0	96.3	92.8
Ankur Jassi BGII	97.6	87.0	92.6	92.4
BCHH 6488-2 BGII	95.2	87.0	92.6	91.6
CSHH 198 (c)	95.2	90.7	100.0	95.3
JKCH 1945 Bt	97.6	88.9	96.3	94.3
KDCHH 441 BGII	92.9	90.7	92.6	92.1
LHH 144 (c)	92.9	88.9	94.4	92.1
MLCH 315 BGII	81.0	88.9	98.2	89.4
NCEH 9 Bt	90.5	87.0	94.4	90.6
RCH 134 BGII	90.5	90.7	94.4	91.9
RCH 134 Bt (Bt c)	95.2	90.7	98.2	94.7
Tulasi 4 BGII	90.5	88.9	98.2	92.5

Table 55. Number of plants at harvest under unprotected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Mean
Ankur 2226 Bt	20.0	24.5	12.0	20.0	19.1
Ankur Jassi BGII	20.5	23.5	21.0	20.7	21.4
BCHH 6488-2 BGII	17.5	24.5	23.0	25.0	22.5
CSHH 198 (c)	17.0	24.5	25.0	16.7	20.8
JKCH 1945 Bt	20.5	24.0	26.0	23.3	23.5
KDCHH 441 BGII	18.5	25.0	24.0	22.0	22.4
LHH 144 (c)	17.5	24.0	24.0	18.0	20.9
MLCH 315 BGII	14.0	24.5	24.0	16.7	19.8
NCEH 9 Bt	18.0	23.5	21.0	22.0	21.1
RCH 134 BGII	18.0	25.0	22.0	22.7	21.9
RCH 134 Bt (Bt c)	19.0	24.5	19.0	24.0	21.6
Tulasi 4 BGII	19.0	24.5	23.0	14.7	20.3

Open boll and locule damage

Open boll and locule damage was maximum at Sriganganagar due to severe pink bollworm attack (Table 56 & 57). The non Bt check hybrids recorded a mean open boll damage of 19.8 to 21.6 per cent and locule damage of 8.2 to 8.6 per cent. The Bt test hybrids recorded lesser open boll and locule damage than the non Bt check hybrids.

Table 56. Open boll damage (%) - Boll basis under unprotected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
Ankur 2226 Bt	5.6	3.8	0.0	5.0	64.6	15.8
Ankur Jassi BGII	2.6	0.0	0.0	8.3	49.0	12.0
BCHH 6488-2 BGII	0.0	0.0	0.0	6.4	56.1	12.5
CSHH 198 (c)	8.5	5.9	26.4	7.0	51.4	19.8
JKCH 1945 Bt	0.0	0.0	0.0	2.1	58.3	12.1
KDCHH 441 BGII	3.7	1.4	0.0	3.2	68.5	15.4
LHH 144 (c)	10.4	9.7	19.7	11.8	56.4	21.6
MLCH 315 BGII	0.0	0.0	0.0	3.5	50.9	10.9
NCEH 9 Bt	2.5	0.0	0.0	8.2	28.5	7.8
RCH 134 BGII	0.0	0.0	0.0	3.1	37.6	8.1
RCH 134 Bt (Bt c)	0.0	0.0	0.0	4.7	78.7	16.7
Tulasi 4 BGII	0.0	0.0	0.0	2.4	44.3	9.3

Table 57. Open boll damage (%) - Loculi Basis under unprotected condition

Entry	Abohar	Faridkot	Ludhiana	Hisar	Sriganga nagar	Mean
Ankur 2226 Bt	2.6	1.1	0.0	2.0	23.2	5.8
Ankur Jassi BGII	0.7	0.0	0.0	3.4	17.0	4.2
BCHH 6488-2 BGII	0.0	0.0	0.0	2.8	20.7	4.7
CSHH 198 (c)	3.9	2.0	14.2	3.3	17.7	8.2
JKCH 1945 Bt	0.0	0.0	0.0	0.8	22.4	4.6
KDCHH 441 BGII	0.5	0.4	0.0	1.1	24.2	5.2
LHH 144 (c)	4.9	3.3	10.6	4.4	19.7	8.6
MLCH 315 BGII	0.0	0.8	0.0	1.8	16.6	3.8
NCEH 9 Bt	0.9	0.0	0.0	3.1	11.2	3.0
RCH 134 BGII	0.0	0.0	0.0	1.3	15.3	3.3
RCH 134 Bt (Bt c)	0.0	0.0	0.0	1.9	25.7	5.5
Tulasi 4 BGII	0.0	0.0	0.0	0.7	14.6	3.1

Seed cotton yield

Seed cotton yield under unprotected condition are presented in Table 58. Out of nine hybrids tested as many as eight hybrids were found to be superior to both Bt and non Bt check hybrids.

Table 58. Seed Cotton Yield (kg/ha) under unprotected condition

Entry	Faridkot	Ludhiana	**Mean**	%Inc. over CSHH 198	%Inc. over RCH 134 Bt	%Inc. over LHH 144
Ankur 2226 Bt	1790	967	**1379**	6	28	30
Ankur Jassi BGII	1440	1132	**1286**	-1	19	21
BCHH 6488-2 BGII	1728	1490	**1609**	24	49	51
CSHH 198 (c)	1667	922	**1295**	0	20	22
JKCH 1945 Bt	2366	1416	**1891**	46	76	78
KDCHH 441 BGII	1852	1198	**1525**	18	42	43
LHH 144 (c)	1276	852	**1064**	-18	-1	0
MLCH 315 BGII	1502	1588	**1545**	19	43	45
NCEH 9 Bt	1728	1080	**1404**	8	30	32
RCH 134 BGII	2002	1486	**1744**	35	62	64
RCH 134 Bt (Bt c)	1080	1074	**1077**	-17	0	1
Tulasi 4 BGII	2037	1074	**1556**	20	44	46
CD 5%	343	245				
CV%	9	9				

D. PATHOLOGICAL EVALUATION OF Bt COTTON HYBRIDS

During this year 10 Bt hybrids along with two check hybrids (CSHH 198 and LHH 144) were evaluated in the second year trial. Two cultivars *viz.* F 1861 (resistant to CLCuV) and RS 921 (susceptible to CLCuV) were also included as standards for comparison in the testing of the entries against cotton leaf curl disease.

Cotton Leaf Curl Disease

Even though there was variation in the incidences of this disease in the six centres (Faridkot, Ludhiana, Abohar, Sriganganagar, Hisar and Sirsa) where the hybrids were tested,a definite picture could be arrived at by taking into consideration the over all performance of the hybrids across the centres. Due to severe mealy bug incidence in the Sirsa centre trials, no observation on cotton leaf curl disease could be taken. However, the entries were tested in the screen house and screening nursery respectively in Ludhiana and Sirsa and also in poly house in Sirsa where the hybrids were evaluated under artificial screening after allowing the feeding by viruliferous white flies. The data generated from these trials were also included for evaluation of the hybrids against this disease.

During this year, the test hybrid BCHH 6488 – 2 BG II and the check hybrid LHH 144 had shown the disese indices of 22.2 and 47.0 respectively which were less than the disease index of 62.5 seen on the standard resistant check – F 1861. All other test hybrids were found susceptible to the cotton leaf curl disease having disease indices ranging from 108.3 to 350.0. The susceptible check , RS 921, had the highest disease index of 400.0 (Table 59).

Table 59. Incidence of Cotton Leaf Curl Disease on Bt Cotton Entries during 2007-08

Entry	Overall Disease Index
Ankur 2226 Bt	300.0
Ankur Jassi BG II	200.0
BCHH 6488-2 BG II	**22.2**
CSHH 198 (c)	108.3
JKCH 1945 Bt	161.5
KDCHH 441 BG II	300.0
LHH 144 (c)	**47.0**
MLCH 315 BG II	300.0
NCEH 9 Bt	300.0
RCH 134 BG II	330.5
RCH 134 Bt (Bt c)	350.0
Tulasi 4 BG II	186.6
F 1861 (Std. Res.Check)	**62.5**
RS 921 (Sus.Check)	400.0

Other diseases

Low incidence of bacterial leaf blight was noticed on the hybrids only in the Faridkot and Ludhiana trials. Similaly, the fungal foliar diseases viz. Myrothecium leaf spot, Alternaria leaf spot, etc. were observed only in the above mentioned two centres. All test hybrids were found susceptible (grade 3.0 – 4.0) to these fungal foliar diseases (Table 60). During this year the para wilt phenomenon was noticed only in Faridkot. All hybrids have shown wilting ranging from 2.1 to 54.4 percent (Table 60).

Table 60. Performance of Bt hybrids against foliar diseases and para wilt during 2007-08

Entry	Bacterial Blight (Grade)		Fungal Foliar Diseases (Grade)		Para Wilt %
	Faridkot	Ludhiana	Faridkot	Ludhiana	Faridkot
Ankur 2226 Bt	2.0	0.0	3.0	4.0	6.5
Ankur Jassi BG II	2.0	1.0	2.0	4.0	21.6
BCHH 6488-2 BG II	2.0	0.0	2.0	4.0	35.4
CSHH 198 (c)	2.0	0.0	2.0	2.0	10.4
JKCH 1945 Bt	2.0	0.0	2.0	3.0	10.5
KDCHH 441 BG II	2.0	0.0	2.0	4.0	8.7
LHH 144 (c)	2.0	0.0	2.0	2.0	2.1
MLCH 315 BG II	2.0	0.0	2.0	4.0	13.3
NCEH 9 Bt	2.0	0.0	2.0	3.0	6.7
RCH 134 BG II	2.0	1.0	3.0	4.0	38.9
RCH 134 Bt (Bt c)	2.0	1.0	2.0	3.0	54.4
Tulasi 4 BG II	2.0	0.0	2.0	3.0	10.8
F 1861	2.0	0.0	2.0	1.0	0.0
RS 921	2.0	1.0	3.0	1.0	0.0

E. OVERALL ASSESSMENT

Nine Bt cotton hybrids were evaluated for the second year for confirmatory results. There were three checks viz., RCH 134 Bt (Bt check) and LHH 144 and CSHH 198 (Non Bt checks). The trial was conducted at six locations under both protected and unprotected conditions (Tables 61 - 65).

Among the sucking pests, Jassids, whitefly and thrips were the major ones. The population densities of these pests varied from location to location and at several centres chemical intervention was warranted to control them. Square damage was very low in all the entries. Even the non Bt check hybrid LHH 144 recorded a mean square damage of 1.8 per cent. The Bt test hybrids recorded lower green boll, open boll and locule damage than the non Bt check hybrids at all locations except Sriganganagar.

Under protected conditions, as compared to the Bt check hybrid, only two hybrids were superior in seed cotton yield. They are: BCHH 6488-2 BG II with 2227 kg/ha (7% increase) and JKCH 1945 Bt with (2156 kg/ha 3 % increase). As regards lint yield, JKCH 1945 Bt (798 kg/ha; 11% increase) and BCHH 6488-2 BG II (746 kg/ha; 4% increase) were superior to the Bt check hybrid. All the Bt test hybrids were superior to the non Bt check hybrids in both seed cotton and lint yield.

Under unprotected conditions, as many as eight hybrids out of nine tested were found to be superior in seed cotton yield to both Bt and non Bt check hybrids.

F. CONCLUSION

Under protected conditions, two test hybrids viz., BCHH 6488-2 BG II and JKCH 1945 Bt were superior to the Bt check in both seed cotton (3-7 % yield increase) and lint yield (3-7 % yield increase).

Under unprotected conditions, the eight test hybrids were found superior to both Bt and non Bt check hybrids.

Table 61. Summary on the performance of Bt cotton hybrids for various agronomic characters

Protected

Entry	Germination (%)	Stand at harvest	Boll weight (g)	Ginning Outturn (%)	Lint Index (g)	Seed Index (g)
BCHH 6488-2 BG II	95.5	52.1	3.8	33.6	4.5	9.0
JKCH 1945 Bt	95.5	52.6	3.4	36.8	4.1	7.0
RCH 134 Bt (Bt c)	91.6	50.3	3.6	34.7	5.0	9.4
Tulasi 4 BG II	95.5	52.3	3.8	34.6	5.5	10.4
RCH 134 BG II	95.1	53.5	3.7	33.9	4.6	9.0
Ankur 2226 Bt	95.4	49.1	4.0	35.0	4.7	8.7
Ankur Jassi BG II	93.6	53.5	3.6	32.9	4.8	9.9
KDCHH 441 BG II	94.1	49.4	3.6	33.5	4.6	9.2
NCEH 9 Bt	93.2	49.9	3.0	35.5	4.3	7.7
MLCH 315 BG II	94.2	49.7	3.6	33.4	4.7	9.7
LHH 144 (c)	93.9	52.0	3.8	33.2	4.8	9.6
CSHH 198 (c)	96.1	51.4	4.2	33.6	4.7	9.2

Table 62. Summary on the performance of Bt cotton hybrids for yield and fibre quality characters

Protected							
Entry	Seed cotton yield (kg/ha)	Lint yield (kg/ha)	2.5 % Span Length (mm)	Uniformity Ratio	Micronaire	Bundle Strength (g/tex)	BS/SL Ratio
BCHH 6488-2 BG II	2227	746	28.2	50.8	4.7	21.7	0.77
JKCH 1945 Bt	2156	798	26.4	52.0	4.8	21.5	0.81
RCH 134 Bt (Bt c)	2092	718	27.4	52.0	4.6	22.2	0.81
Tulasi 4 BG II	2027	713	31.0	50.0	4.7	22.7	0.73
RCH 134 BG II	2026	674	27.4	51.5	4.5	22.4	0.82
Ankur 2226 Bt	1849	648	27.6	50.8	4.9	20.9	0.76
Ankur Jassi BG II	1845	606	31.2	48.8	4.1	23.0	0.74
KDCHH 441 BG II	1791	596	28.3	50.0	4.7	20.4	0.72
NCEH 9 Bt	1566	553	28.5	48.5	4.7	22.5	0.79
MLCH 315 BG II	1562	516	29.2	50.0	4.2	22.2	0.76
LHH 144 (c)	1537	492	27.8	50.5	4.5	22.7	0.82
CSHH 198 (c)	1478	476	27.0	51.3	5.0	21.5	0.79

Table 63. Summary on the performance of Bt cotton hybrids for entomological observations

Protected					
Entry	Jassid/ plant	Whitefly/ plant	Thrips/ plant	Aphid/ plant	Natural Enemies
BCHH 6488-2 BG II	0.9	4.9	5.0	0.1	1.0
JKCH 1945 Bt	1.1	5.1	5.4	0.1	1.5
RCH 134 Bt (Bt c)	0.9	6.1	5.1	0.2	1.2
Tulasi 4 BG II	1.0	5.0	5.0	0.1	0.9
RCH 134 BG II	0.8	5.4	5.8	0.0	1.5
Ankur 2226 Bt	0.9	5.2	5.1	0.1	1.3
Ankur Jassi BG II	1.0	5.8	4.7	0.0	1.2
KDCHH 441 BG II	0.9	4.3	4.7	0.2	0.9
NCEH 9 Bt	1.1	5.0	5.3	0.1	1.1
MLCH 315 BG II	0.9	4.5	5.1	0.0	1.2
LHH 144 (c)	1.0	5.0	5.3	0.6	1.1
CSHH 198 (c)	0.9	5.6	5.1	0.2	1.1

Table 64. Summary on the performance of Bt cotton hybrids for entomological observations – Bollworms

Protected

Entry	Spotted bollworm, Earias spp- (No of Larvae / 5plants)	Damage in green bolls (%)	Larvae / 20 green bolls	% square damage by Bollworms	Open boll damage (%)	Locule damage (%)
BCHH 6488-2 BG II	1.1	5.7	0.1	0.3	8.1	4.3
JKCH 1945 Bt	0.0	3.5	0.0	0.4	5.7	2.1
RCH 134 Bt (Bt c)	0.0	5.1	0.0	0.2	8.0	4.3
Tulasi 4 BG II	5.0	2.4	0.0	0.2	4.9	2.3
RCH 134 BG II	0.0	2.8	0.0	0.2	4.8	1.8
Ankur 2226 Bt	0.0	4.9	0.0	0.3	9.0	3.5
Ankur Jassi BG II	1.7	3.2	0.1	0.2	6.1	2.4
KDCHH 441 BG II	0.0	5.1	0.0	0.4	7.6	3.6
NCEH 9 Bt	2.2	2.7	0.0	0.4	4.9	2.0
MLCH 315 BG II	0.0	4.7	0.0	0.1	6.0	3.4
LHH 144 (c)	0.4	7.2	0.6	1.8	10.7	5.3
CSHH 198 (c)	3.4	4.7	0.5	1.6	8.7	4.3

Table 65. Summary on the performance of Bt cotton hybrids for various characters

Unprotected

Entry	Germination (%)	Stand at harvest (No. of plants)	Seed cotton yield (Kg/ha)	Open boll damage (%)	Locule damage (%)
JKCH 1945 Bt	94.3	23.5	1891	12.1	4.6
RCH 134 BG II	91.9	21.9	1744	8.1	3.3
BCHH 6488-2 BG II	91.6	22.5	1609	12.5	4.7
Tulasi 4 BG II	92.5	20.3	1556	9.3	3.1
MLCH 315 BG II	89.4	19.8	1545	10.9	3.8
KDCHH 441 BG II	92.1	22.4	1525	15.4	5.2
NCEH 9 Bt	90.6	21.1	1404	7.8	3.0
Ankur 2226 Bt	92.8	19.1	1379	15.8	5.8
CSHH 198 (c)	95.3	20.8	1295	19.8	8.2
Ankur Jassi BG II	92.4	21.4	1286	12.0	4.2
RCH 134 Bt (Bt c)	94.7	21.6	1077	16.7	5.5
LHH 144 (c)	92.1	20.9	1064	21.6	8.6

COMBINED REPORT OF TWO YEARS (2006-07 & 2007-08)

Nine Bt Cotton hybrids were evaluated for two consecutive years during 2006-07 & 2007-08 in North Zone. The hybrids evaluated were Ankur 2226 Bt, Ankur Jassi BG II, BCHH 6488-2 BG II, JKCH 1945 Bt, KDCHH 441 BG II, MLCH 315 BG II, NCEH 9 Bt, RCH 134 BG II and Tulasi 4 BG II.

I. EVALUATION UNDER PROTECTED CONDITIONS

A. BIOMETRICAL EVALUATION.

Most of the Bt cotton hybrids showed consistency in boll weight across the years. Mean boll weight ranged from 3.4 to 3.9 g (Table 66). Ginning out turn was also consistent over the years. Mean ginning out turn varied from 32.9 to 36.7 per cent. JKCH 1945 Bt recorded the highest ginning out turn of 36.7 followed by NCEH 9 Bt with 36.0 per cent. Lint index and Seed Index showed minimum variation among the hybrids (Table 67).

Table 66. Combined performance of Bt cotton hybrids for boll weight and ginning outturn over 2006-07 and 2007-08

Entry	Boll weight (g)			Ginning Outturn (%)		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	3.7	3.7	**3.7**	34.0	33.9	**34.0**
RCH 134 Bt (Bt c)	3.7	3.6	**3.6**	34.6	34.7	**34.7**
BCHH 6488-2 BG II	3.4	3.8	**3.6**	36.1	33.6	**34.9**
Tulasi 4 BG II	3.7	3.8	**3.7**	34.0	34.6	**34.3**
Ankur Jassi BG II	3.6	3.6	**3.6**	33.4	32.9	**33.2**
JKCH 1945 Bt	3.5	3.4	**3.4**	36.5	36.8	**36.7**
MLCH 315 BG II	3.9	3.6	**3.8**	34.1	33.4	**33.8**
Ankur 2226 Bt	3.7	4.0	**3.9**	34.6	35.0	**34.8**
NCEH 9 Bt	3.8	3.0	**3.4**	36.5	35.5	**36.0**
KDCHH 441 BG II	3.8	3.6	**3.7**	33.9	33.5	**33.7**
LHH 144 (c)	4.0	3.8	**3.9**	32.7	33.2	**32.9**
CSHH 198 (c)	3.6	4.2	**3.9**	34.2	33.6	**33.9**

Table 67. Combined performance of Bt cotton hybrids for lint and seed indices over 2006-07 and 2007-08

Entry	Lint Index (g)			Seed Index (g)		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	4.5	4.6	**4.5**	8.8	9.0	**8.9**
RCH 134 Bt (Bt c)	4.7	5.0	**4.8**	8.8	9.4	**9.1**
BCHH 6488-2 BG II	4.5	4.5	**4.5**	8.0	9.0	**8.5**
Tulasi 4 BG II	4.8	5.5	**5.2**	9.3	10.4	**9.9**
Ankur Jassi BG II	4.7	4.8	**4.8**	9.4	9.9	**9.7**
JKCH 1945 Bt	4.4	4.1	**4.2**	7.7	7.0	**7.4**
MLCH 315 BG II	5.0	4.7	**4.9**	9.7	9.7	**9.7**
Ankur 2226 Bt	4.3	4.7	**4.5**	8.2	8.7	**8.5**
NCEH 9 Bt	4.9	4.3	**4.6**	8.5	7.7	**8.1**
KDCHH 441 BG II	4.4	4.6	**4.5**	8.6	9.2	**8.9**
LHH 144 (c)	4.6	4.8	**4.7**	9.5	9.6	**9.6**
CSHH 198 (c)	4.9	4.7	**4.8**	9.5	9.2	**9.4**

Seed Cotton and Lint yield

The Bt check hybrid RCH 134 Bt recorded a mean seed cotton yield of 2438 kg/ha. Only RCH 134 BG II (2472 kg/ha) was superior to it. The increase was of the order of 1.4 %. In lint yield the Bt check hybrid RCH 134 Bt (839 kg/ha) recorded the highest yield followed by RCH 134 BG II (833 kg/ha). All the tested hybrids were superior to the non Bt check hybrids (Table 68) in seed cotton and lint yield.

Table 68. Combined performance of Bt cotton hybrids for seed cotton and lint yield over 2006-07 and 2007-08

Entry	Seed cotton yield (kg/ha)			Lint yield (kg/ha)		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	2918	2026	**2472**	991	674	**833**
RCH 134 Bt (Bt c)	2783	2092	**2438**	960	718	**839**
BCHH 6488-2 BG II	2293	2227	**2260**	828	746	**787**
Tulasi 4 BG II	2441	2027	**2234**	828	713	**770**
Ankur Jassi BG II	2275	1845	**2060**	758	606	**682**
JKCH 1945 Bt	1962	2156	**2059**	716	798	**757**
MLCH 315 BG II	2483	1562	**2023**	844	516	**680**
Ankur 2226 Bt	2158	1849	**2004**	743	648	**696**
NCEH 9 Bt	2348	1566	**1957**	858	553	**705**
KDCHH 441 BG II	2093	1791	**1942**	702	596	**649**
LHH 144 (c)	1921	1537	**1729**	625	492	**558**
CSHH 198 (c)	1645	1478	**1561**	556	476	**516**

B. FIBRE QUALITY EVALUATION.

Most of the fibre quality parameters studied showed consistency over the years. Ankur Jassi BG II and Tulasi 4 BG II showed higher 2.5% span length than the other hybrids. In respect of other characters there was not much variation among the entries (Tables 69 & 70).

Table 69. Combined performance of Bt cotton hybrids for 2.5% span length and uniformity ratio over 2006-07 and 2007-08

Entry	2.5 % Span Length (mm)			Uniformity Ratio		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	27.1	27.4	**27.3**	51.3	51.5	**51.4**
RCH 134 Bt (Bt c)	27.5	27.4	**27.4**	51.3	52.0	**51.7**
BCHH 6488-2 BG II	26.9	28.2	**27.5**	49.3	50.8	**50.0**
Tulasi 4 BG II	29.3	31.0	**30.1**	49.0	50.0	**49.5**
Ankur Jassi BG II	30.8	31.2	**31.0**	47.8	48.8	**48.3**
JKCH 1945 Bt	26.3	26.4	**26.4**	51.5	52.0	**51.8**
MLCH 315 BG II	29.8	29.2	**29.5**	50.8	50.0	**50.4**
Ankur 2226 Bt	26.8	27.6	**27.2**	48.8	50.8	**49.8**
NCEH 9 Bt	26.9	28.5	**27.7**	51.8	48.5	**50.2**
KDCHH 441 BG II	27.0	28.3	**27.7**	48.8	50.0	**49.4**
LHH 144 (c)	27.8	27.8	**27.8**	50.3	50.5	**50.4**
CSHH 198 (c)	26.5	27.0	**26.8**	50.5	51.3	**50.9**

Table 70. Combined performance of Bt cotton hybrids for micronaire and bundle strength over 2006-07 and 2007-08

Entry	Micronaire			Bundle Strength (g/tex)		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	5.0	4.5	**4.8**	22.6	22.4	**22.5**
RCH 134 Bt (Bt c)	5.0	4.6	**4.8**	23.0	22.2	**22.6**
BCHH 6488-2 BG II	4.6	4.7	**4.7**	21.9	21.7	**21.8**
Tulasi 4 BG II	4.8	4.7	**4.7**	22.5	22.7	**22.6**
Ankur Jassi BG II	4.2	4.1	**4.1**	22.6	23.0	**22.8**
JKCH 1945 Bt	5.2	4.8	**5.0**	21.1	21.5	**21.3**
MLCH 315 BG II	4.7	4.2	**4.5**	22.9	22.2	**22.5**
Ankur 2226 Bt	4.7	4.9	**4.8**	20.7	20.9	**20.8**
NCEH 9 Bt	4.9	4.7	**4.8**	22.0	22.5	**22.3**
KDCHH 441 BG II	4.6	4.7	**4.6**	20.3	20.4	**20.4**
LHH 144 (c)	4.6	4.5	**4.6**	23.0	22.7	**22.9**
CSHH 198 (c)	4.6	5.0	**4.8**	22.0	21.5	**21.7**

C. ENTOMOLOGICAL EVALUATION

Jassids and Whitefly

Jassids and whitefly were the predominant sucking pests encountered during both the seasons (Table 71). The population of Jassids and Whitefly was found in equal numbers on both the test entries and the check hybrids.

Table 71. Combined performance of Bt cotton hybrids for number of jassids and whitefly over 2006-07 and 2007-08

Entry	Protected - Mean number of Jassid nymphs/3 leaves/plant			Protected - Mean number of Whitefly adults/3leaves/plant		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	1.7	0.8	**1.3**	5.7	5.4	**5.5**
RCH 134 Bt (Bt c)	1.6	0.9	**1.3**	5.8	6.1	**5.9**
BCHH 6488-2 BG II	1.6	0.9	**1.3**	4.9	4.9	**4.9**
Tulasi 4 BG II	1.6	1.0	**1.3**	4.5	5.0	**4.7**
Ankur Jassi BG II	1.5	1.0	**1.2**	4.8	5.8	**5.3**
JKCH 1945 Bt	1.9	1.1	**1.5**	4.5	5.1	**4.8**
MLCH 315 BG II	1.7	0.9	**1.3**	4.8	4.5	**4.7**
Ankur 2226 Bt	1.4	0.9	**1.2**	4.7	5.2	**4.9**
NCEH 9 Bt	1.7	1.1	**1.4**	4.5	5.0	**4.7**
KDCHH 441 BG II	1.4	0.9	**1.1**	5.0	4.3	**4.7**
LHH 144 (c)	1.7	1.0	**1.3**	4.6	5.0	**4.8**
CSHH 198 (c)	1.6	0.9	**1.2**	5.2	5.6	**5.4**

Per cent square damage and number of Pink bollworm

Per cent square damage was very low during both the years (Table 72). Bt cotton hybrids recorded a mean square damage of 0.1 to 0.3 per cent only whereas it was from 2.4 to 2.8 per cent in non Bt check hybrids. The mean number of pink boll worm larvae per 20 bolls and green boll damage was also minimum in Bt hybrids as compared to the non Bt check hybrids.

Natural Enemies

There was no significant variation in natural enemy population between Bt and Non Bt hybrids (Table 73).

Table 72. Combined performance of Bt cotton hybrids for per cent square damage and number of pink bollworm larvae over 2006-07 and 2007-08

Entry	Protected - Per cent square damage			Protected - Mean number of PBW larvae/20 green bolls		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	0.2	0.2	**0.2**	0.2	0.0	**0.1**
RCH 134 Bt (Bt c)	0.2	0.2	**0.2**	0.3	0.0	**0.2**
BCHH 6488-2 BG II	0.1	0.3	**0.2**	0.3	0.1	**0.2**
Tulasi 4 BG II	0.2	0.2	**0.2**	0.2	0.0	**0.1**
Ankur Jassi BG II	0.5	0.2	**0.3**	0.5	0.1	**0.3**
JKCH 1945 Bt	0.4	0.4	**0.4**	0.2	0.0	**0.1**
MLCH 315 BG II	0.1	0.1	**0.1**	0.2	0.0	**0.1**
Ankur 2226 Bt	0.1	0.3	**0.2**	0.2	0.0	**0.1**
NCEH 9 Bt	0.1	0.4	**0.3**	0.2	0.0	**0.1**
KDCHH 441 BG II	0.1	0.4	**0.3**	0.2	0.0	**0.1**
LHH 144 (c)	3.9	1.8	**2.8**	1.5	0.6	**1.1**
CSHH 198 (c)	3.2	1.6	**2.4**	2.4	0.5	**1.4**

Table 73. Combined performance of Bt cotton hybrids for number of predators / 5 plants over 2006-07 and 2007-08

Entry	2006-07	2007-08	Mean
RCH 134 BG II	4.5	1.5	**3.0**
RCH 134 Bt (Bt c)	3.3	1.2	**2.3**
BCHH 6488-2 BG II	3.7	1.0	**2.4**
Tulasi 4 BG II	3.6	0.9	**2.2**
Ankur Jassi BG II	3.6	1.2	**2.4**
JKCH 1945 Bt	3.1	1.5	**2.3**
MLCH 315 BG II	4.1	1.2	**2.6**
Ankur 2226 Bt	3.1	1.3	**2.2**
NCEH 9 Bt	3.2	1.1	**2.2**
KDCHH 441 BG II	3.7	0.9	**2.3**
LHH 144 (c)	3.4	1.1	**2.3**
CSHH 198 (c)	3.9	1.1	**2.5**

Open Boll damage

Open boll damage both in terms of boll and locule damage was high in the non Bt check hybrids (Table 74). Bt hybrids recorded lower boll and locule damage.

Table 74. Combined performance of Bt cotton hybrids for open boll damage on boll and locule basis over 2006-07 and 2007-08

Entry	Protected - Open boll damage (%) - Boll basis			Protected -Open boll damage (%) - Locule basis		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	1.0	4.8	**2.9**	0.6	1.8	**1.2**
RCH 134 Bt (Bt c)	3.0	8.0	**5.5**	1.4	4.3	**2.9**
BCHH 6488-2 BG II	1.0	8.1	**4.6**	1.5	4.3	**2.9**
Tulasi 4 BG II	0.8	4.9	**2.9**	0.5	2.3	**1.4**
Ankur Jassi BG II	1.6	6.1	**3.9**	0.9	2.4	**1.7**
JKCH 1945 Bt	0.8	5.7	**3.3**	0.5	2.1	**1.3**
MLCH 315 BG II	1.0	6.0	**3.5**	0.5	3.4	**2.0**
Ankur 2226 Bt	0.6	9.0	**4.8**	0.5	3.5	**2.0**
NCEH 9 Bt	0.5	4.9	**2.7**	0.3	2.0	**1.2**
KDCHH 441 BG II	0.9	7.6	**4.2**	0.5	3.6	**2.0**
LHH 144 (c)	10.5	10.7	**10.6**	5.1	5.3	**5.2**
CSHH 198 (c)	14.0	8.7	**11.3**	6.6	4.3	**5.5**

II. EVALUATION UNDER UNPROTECTED CONDITIONS

Germination and Plant Stand

Germination and Plant stand were satisfactory in all the entries in both the years (Table 75).

Table 75. Combined performance of Bt cotton hybrids for germination and plant stand over 2006-07 and 2007-08

Entry	Unprotected - Germination Percentage			Unprotected - Plant stand		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	86.7	91.9	**89.3**	23.0	21.9	**22.5**
JKCH 1945 Bt	92.5	94.3	**93.4**	22.1	23.5	**22.8**
MLCH 315 BG II	79.7	89.4	**84.5**	20.5	19.8	**20.2**
Tulasi 4 BG II	88.9	92.5	**90.7**	23.1	20.3	**21.7**
RCH 134 Bt (Bt c)	89.1	94.7	**91.9**	23.4	21.6	**22.5**
Ankur 2226 Bt	88.7	92.8	**90.8**	22.3	19.1	**20.7**
Ankur Jassi BG II	82.4	92.4	**87.4**	21.1	21.4	**21.3**
BCHH 6488-2 BG II	64.6	91.6	**78.1**	14.3	22.5	**18.4**
KDCHH 441 BG II	89.3	92.1	**90.7**	23.0	22.4	**22.7**
NCEH 9 Bt	91.6	90.6	**91.1**	23.9	21.1	**22.5**
LHH 144 (c)	84.7	92.1	**88.4**	23.2	20.9	**22.0**
CSHH 198 (c)	89.2	95.3	**92.3**	23.1	20.8	**22.0**

Open Boll damage

Considerable Open boll and locule damage was noticed in the non Bt check hybrids (Table 76). The Bt check hybrid RCH 134 Bt recorded a mean boll damage of 10.1 per cent and locule damage of 3.6 per cent. All the test hybrids recorded considerably low open boll damage as compared to the check hybrids.

Table 76. Combined performance of Bt cotton hybrids for open boll damage on boll and locule basis over 2006-07 and 2007-08

Entry	Unprotected - Open boll damage (%) - Boll basis			Unprotected -Open boll damage (%) - Locule basis		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
RCH 134 BG II	3.1	8.1	**5.6**	1.6	3.3	**2.5**
JKCH 1945 Bt	1.0	12.1	**6.5**	0.4	4.6	**2.5**
MLCH 315 BG II	1.5	10.9	**6.2**	0.7	3.8	**2.3**
Tulasi 4 BG II	1.2	9.3	**5.3**	0.7	3.1	**1.9**
RCH 134 Bt (Bt c)	3.6	16.7	**10.1**	1.6	5.5	**3.6**
Ankur 2226 Bt	2.1	15.8	**9.0**	1.2	5.8	**3.5**
Ankur Jassi BG II	3.8	12.0	**7.9**	1.5	4.2	**2.9**
BCHH 6488-2 BG II	3.2	12.5	**7.8**	1.3	4.7	**3.0**
KDCHH 441 BG II	1.8	15.4	**8.6**	1.1	5.2	**3.2**
NCEH 9 Bt	0.6	7.8	**4.2**	0.5	3.0	**1.8**
LHH 144 (c)	24.3	21.6	**22.9**	9.5	8.6	**9.0**
CSHH 198 (c)	27.3	19.8	**23.6**	10.4	8.2	**9.3**

Seed Cotton Yield

As compared to the Bt check hybrid RCH 134 Bt (1778 kg/ha), four hybrids were superior in seed cotton yield (Table 77). Howver, all the Bt test hybrids evaluated recorded higher seed cotton yield than the non Bt check hybrids.

Table 77. Combined performance of Bt cotton hybrids for seed cotton yield (kg/ha) over 2006-07 and 2007-08 under unprotected conditions

Entry	2006-07	2007-08	Mean
Ankur 2226 Bt	2095	1379	**1737**
Ankur Jassi BG II	2156	1286	**1721**
BCHH 6488-2 BG II	1821	1609	**1715**
CSHH 198 (c)	1337	1295	**1316**
JKCH 1945 Bt	1904	1891	**1898**
KDCHH 441 BG II	1894	1525	**1710**
LHH 144 (c)	1598	1064	**1331**
MLCH 315 BG II	2173	1545	**1859**
NCEH 9 Bt	1964	1404	**1684**
RCH 134 BG II	2565	1744	**2155**
RCH 134 Bt (Bt c)	2478	1077	**1778**
Tulasi 4 BG II	2158	1556	**1857**

D. PATHOLOGICAL EVALUATION

Cotton leaf curl disease

The combined analysis of the two year data revealed that the test hybrid BCHH 6488 -2 BG II (Mean Disease Index 47.6) and the check hybrid – LHH 144 (Mean D.I. 37.15) had lower disease indices than the Standard resistant check – F 1861 (Mean D.I. 48.75). The rest of the hybrids had diseases indices ranging from 121.75 (CSHH 198) to 277.86 (JKCH 1945 Bt) and found susceptible to the disease. The susceptible check – RS 921 had the highest possible disease index of 400.00 (Table 78).

Other Diseases

The hybrid entries have shown moderate resistance (grade 2.0) to bacterial leaf blight (Table 78). Against Alternaria leaf spot and other fungal foliar diseases, all the test Bt hybrids were found susceptible in Ludhiana (Table 79). Even though para wilt was noticed on all test hybrids, the two year results obtained from Ludhiana (2006-07) and Faridkot (2007-08) do not indicate any consistency in the prevalence of this phenomenon (Table 79).

Table 78. Performance of Bt hybrids against Cotton Leaf Curl Disease and Bacterial Blight over two year period

Entry	Overall CLCuV Disease Index			Bacterial Blight (Grade)			
				2006-07		2007-08	
	2006-07	2007-08	**Mean**	Faridkot	Ludhiana	Faridkot	Ludhiana
RCH 134 BG II	154.2	330.5	**242.4**	2.0	0.0	2.0	1.0
JKCH 1945 Bt	394.2	161.5	**277.9**	2.0	1.0	2.0	0.0
MLCH 315 BG II	211.3	300.0	**255.7**	2.0	0.0	2.0	0.0
Tulasi 4 BG II	130.3	186.6	**158.5**	2.0	0.0	2.0	0.0
RCH 134 Bt (Bt c)	155.7	350.0	**252.9**	2.0	0.0	2.0	1.0
Ankur 2226 Bt	62.5	300.0	**181.3**	2.0	0.0	2.0	0.0
Ankur Jassi BG II	123.1	200.0	**161.6**	2.0	0.0	2.0	1.0
BCHH 6488-2 BG II	73.0	22.2	**47.6**	2.0	0.0	2.0	0.0
KDCHH 441 BG II	144.9	300.0	**222.5**	2.0	0.0	2.0	0.0
NCEH 9 Bt	130.9	300.0	**215.5**	2.0	0.0	2.0	0.0
LHH 144 (c)	27.3	47.0	**37.2**	2.0	0.0	2.0	0.0
CSHH 198 (c)	135.2	108.3	**121.8**	2.0	0.0	2.0	0.0
F 1861	35.0	62.5	**48.8**	3.0	0.0	2.0	0.0
RS 921	400.0	400.0	**400.0**	2.0	0.0	2.0	1.0

Table 79. Performance of Bt hybrids against foliar diseases and para wilt over two years

Entry	Fungal Foliar diseases (Grade)				Para wilt (%)	
	2006-07		2007-08		2006- 07	2007-08
	Faridkot	Ludhiana	Faridkot	Ludhiana	Ludhiana	Faridkot
RCH 134 BG II	3.0	4.0	3.0	4.0	9.2	38.9
JKCH 1945 Bt	2.0	3.0	2.0	3.0	13.3	10.5
MLCH 315 BG II	2.0	4.0	2.0	4.0	17.1	13.3
Tulasi 4 BG II	2.0	3.0	2.0	3.0	7.6	10.8
RCH 134 Bt (Bt c)	2.0	1.0	2.0	3.0	2.0	54.4
Ankur 2226 Bt	1.0	2.0	3.0	4.0	41.5	6.5
Ankur Jassi BG II	2.0	2.0	2.0	4.0	12.6	21.6
BCHH 6488-2 BG II	2.0	2.0	2.0	4.0	24.4	35.4
KDCHH 441 BG II	2.0	3.0	2.0	4.0	12.6	8.7
NCEH 9 Bt	2.0	4.0	2.0	3.0	19.6	6.7
LHH 144 (c)	2.0	1.0	2.0	2.0	3.0	2.1
CSHH 198 (c)	2.0	4.0	2.0	2.0	0.0	10.4
F 1861	2.0	1.0	2.0	1.0	0.0	0.0
RS 921	3.0	0.0	3.0	1.0	0.0	0.0

E. OVERALL ASSESSMENT

The population of jassids and whitefly was found in equal numbers on both the test entries and the check hybrids during both the years. Per cent square damage in Bt cotton hybrids ranged from 0.1 to 0.3 per cent as against 2.4 to 2.8 per cent in non Bt check hybrids. Bt hybrids recorded lower boll and locule damage. There was no significant variation in natural enemy population between Bt and non Bt hybrids.

Under protected conditions, as compared to the Bt check hybrid, only RCH 134 BG II was superior in seed cotton yield (2472 kg/ha; 1.4 % increase). However, under unprotected conditions, four hybrids were superior (Tables 80 - 83). Under both protected and unprotected conditions, all the Bt cotton hybrids were superior to the non Bt check hybrids.

Fibre quality showed consistency over years. Ankur Jassi BG II and Tulasi 4 BG II showed higher fibre length than the other hybrids.

F. CONCLUSION

Jassid and Whitefly were the predominant sucking pests and required chemical intervention to control them in both Bt and Non Bt hybrids. Bt cotton hybrids recorded very low square damage. Green boll damage was also minimum in Bt hybrids. There was no significant variation in natural enemy population between Bt and non Bt hybrids.

RCH 134 BG II was superior to the Bt check hybrid in seed cotton yield and marginally inferior in lint yield under protected conditions. Under unprotected conditions, four hybrids were found to be superior to the Bt check hybrid in seed cotton yield.

Fibre quality showed consistency over years. Ankur Jassi BG II and Tulasi 4 BG II showed higher fibre length than the other hybrids.

Table 80. Summary on the performance of Bt cotton hybrids over two years for agronomic characters under protected condition

Entry	Germination (%)	Stand at harvest	Boll weight (g)	Ginning Outturn (%)	Lint Index (g)	Seed Index (g)
RCH 134 BG II	92.9	53.9	3.7	34.0	4.5	8.9
RCH 134 Bt (Bt c)	92.8	52.8	3.6	34.7	4.8	9.1
BCHH 6488-2 BG II	85.1	46.9	3.6	34.9	4.5	8.5
Tulasi 4 BG II	95.3	54.0	3.7	34.3	5.2	9.9
Ankur Jassi BG II	92.0	53.1	3.6	33.2	4.8	9.7
JKCH 1945 Bt	94.9	53.6	3.4	36.7	4.2	7.4
MLCH 315 BG II	92.6	50.2	3.8	33.8	4.9	9.7
Ankur 2226 Bt	93.5	51.0	3.9	34.8	4.5	8.5
NCEH 9 Bt	94.0	52.9	3.4	36.0	4.6	8.1
KDCHH 441 BG II	93.7	51.2	3.7	33.7	4.5	8.9
LHH 144 (c)	92.5	52.7	3.9	32.9	4.7	9.6
CSHH 198 (c)	94.6	52.6	3.9	33.9	4.8	9.4

Table 81. Summary on the performance of Bt cotton hybrids over two years for yield and fibre quality under protected condition

Entry	Seed cotton yield (kg/ha)	Lint yield (kg/ha)	2.5 % Span Length (mm)	Uniformity Ratio	Micronaire	Bundle Strength (g/tex)	BS/SL Ratio
RCH 134 BG II	2472	833	27.3	51.4	4.8	22.5	0.83
RCH 134 Bt (Bt c)	2438	839	27.4	51.7	4.8	22.6	0.82
BCHH 6488-2 BG II	2260	787	27.5	50.0	4.7	21.8	0.79
Tulasi 4 BG II	2234	770	30.1	49.5	4.7	22.6	0.75
Ankur Jassi BG II	2060	682	31.0	48.3	4.1	22.8	0.74
JKCH 1945 Bt	2059	757	26.4	51.8	5.0	21.3	0.81
MLCH 315 BG II	2023	680	29.5	50.4	4.5	22.5	0.76
Ankur 2226 Bt	2004	696	27.2	49.8	4.8	20.8	0.77
NCEH 9 Bt	1957	705	27.7	50.2	4.8	22.3	0.80
KDCHH 441 BG II	1942	649	27.7	49.4	4.6	20.4	0.74
LHH 144 (c)	1729	558	27.8	50.4	4.6	22.9	0.82
CSHH 198 (c)	1561	516	26.8	50.9	4.8	21.7	0.81

Table 82. Summary on the performance of Bt cotton hybrids over two years for entomological observations under protected conditions

Entry	Mean number of Jassid nymphs/ 3 leaves/ plant	Mean number of Whitefly adults/ 3 leaves/ plant	Per cent square damage	Mean number of PBW larvae/20 green bolls	Mean PBW larvae damage in green bolls (%)	Mean number of Predators/5 plants	Open boll damage (%) - Boll basis	Open boll damage (%) - Locule basis
RCH 134 BG II	1.3	5.5	0.2	0.1	1.7	3.0	2.9	1.2
RCH 134 Bt (Bt c)	1.3	5.9	0.2	0.2	4.4	2.3	5.5	2.9
BCHH 6488-2 BG II	1.3	4.9	0.2	0.2	4.7	2.4	4.6	2.9
Tulasi 4 BG II	1.3	4.7	0.2	0.1	1.4	2.2	2.9	1.4
Ankur Jassi BG II	1.2	5.3	0.3	0.3	3.3	2.4	3.9	1.7
JKCH 1945 Bt	1.5	4.8	0.4	0.1	2.5	2.3	3.3	1.3
MLCH 315 BG II	1.3	4.7	0.1	0.1	2.6	2.6	3.5	2.0
Ankur 2226 Bt	1.2	4.9	0.2	0.1	3.1	2.2	4.8	2.0
NCEH 9 Bt	1.4	4.7	0.3	0.1	1.5	2.2	2.7	1.2
KDCHH 441 BG II	1.1	4.7	0.3	0.1	2.8	2.3	4.2	2.0
LHH 144 (c)	1.3	4.8	2.8	1.1	11.6	2.3	10.6	5.2
CSHH 198 (c)	1.2	5.4	2.4	1.4	12.8	2.5	11.3	5.5

Table 83. Summary on the performance of Bt cotton hybrids over two years under unprotected conditions.

Entry	Germination Percentage	Plant stand	Open boll damage (%) - Boll basis	Open boll damage (%) - Locule basis	Seed Cotton Yield (kg/ha)
RCH 134 BG II	**89.3**	**22.5**	**5.6**	**2.5**	**2155**
JKCH 1945 Bt	**93.4**	**22.8**	**6.5**	**2.5**	**1898**
MLCH 315 BG II	**84.5**	**20.2**	**6.2**	**2.3**	**1859**
Tulasi 4 BG II	**90.7**	**21.7**	**5.3**	**1.9**	**1857**
RCH 134 Bt (Bt c)	91.9	22.5	10.1	3.6	1778
Ankur 2226 Bt	90.8	20.7	9.0	3.5	1737
Ankur Jassi BG II	87.4	21.3	7.9	2.9	1721
BCHH 6488-2 BG II	78.1	18.4	7.8	3.0	1715
KDCHH 441 BG II	90.7	22.7	8.6	3.2	1710
NCEH 9 Bt	91.1	22.5	4.2	1.8	1684
LHH 144 (c)	88.4	22.0	22.9	9.0	1331
CSHH 198 (c)	92.3	22.0	23.6	9.3	1316

***