

Bt COTTON EVALUATION REPORT

02-26.VIP	JKCH.1050	MRC.6029	NECH.3R
02-42.VIP	JKCH.1947	NCS.138	NECH.6R
02-50.VIP	MRC.6021	NCS.570	RCH.308
JKCH226	MRC.6025	NCS.913	RCH.314

(16 Bt hybrids)

NORTH ZONE

Submitted to
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

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2004 *kharif* season

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Executive Summary

- ❖ The All India Coordinated Cotton Improvement Project (AICCIP) undertook the evaluation of Sixteen Bt cotton hybrids possessing the Cry 1 A(c) gene (vide ICAR letter No. 2(2)/04 dated 19.04.04) in the North Zone AICCIP centers of Hisar, Sriganaganagar, Ludhiana, Faridkot and CICR Regional Station, Sirsa. The untreated, acid de-linted seeds of the relevant test hybrid were provided the M/S **Syngenta Pvt. Ltd., JK Seeds Pvt. Ltd., Mahyco Seeds Pvt. Ltd., Nuziveedu Seeds Pvt. Ltd., Nath seeds Pvt. Ltd. & Rasi Seeds Pvt. Ltd.**
- ❖ The evaluations in the five centres compared the performance of Bt hybrids with the Bt check hybrid as well as variety check. The significant point that emerged is that both RCH hybrids, viz. 308 Bt and RCH.314 Bt stood on top with mean yields respectively of 3352 kg/ha for RCH. 308, 3265 kg/ha for RCH.314, while MRC.6029 (2947 kg/ha) was at the third position under protected condition of Breeding evaluation. However, the Seed cotton yield under unprotected condition was the highest in RCH.314 (3103kg/ha) and RCH.308 (2982 kg/ha). NCS.913 recorded 2520 kg/ha while MTRC.6025 and MRC.6021 yielded 2482 and 2479 respectively. Due to parawilt syndrome in Ludhiana, the crop was affected. If we delete Ludhiana yield data, the picture of performance of the sixteen hybrids is as: RCH.314 Bt (3642 kg/ha) > RCH.308 Bt (3541 kg/ha) > MRC.6025 (3330 kg/ha) > MRC.6029 Bt (3294 kg/ha) > NCS.913 Bt (3238 kg/ha) > MRC.6021 (3229 kg/ha) > JKCH.226 (3127 kg/ha).
- ❖ A comparative study of the seed cotton yield of these sixteen Bt hybrids show that some hybrids such as RCH.308 and RCH.314, MRC.6025 and 6021 have stable performance across all the centres, in spite of various biotic stresses of the season other than bollworms.
- ❖ Generally, the North zone states had a low build up of *Helicoverpa armigera* as well as Spotted bollworms. Hence, the gene action was not evaluated completely. However, based on the seed cotton yield, it is found that these test hybrids were superior over the check Bt hybrid and variety. The Pink bollworm damage, as measured through open boll damage assessment at Ludhiana and Sriganaganagar, indicates that these Bt hybrids were damaged by this pest and hence they may require plant protection against this pest.

- ❖ Due to affliction of parawilt syndrome as well as jassid incidence, the yield data of Ludhiana centre is not expressive of the actual potential of the test hybrids. Excluding the data sets, the yield data of the test hybrids under protected condition, shows that RCH.309Bt (3663 kg/ha) and RCH.314Bt (3477 kg/ha) followed by NCS.913 (3133 kg/ha) and MRC hybrids yielded seed cotton to the maximum out of the sixteen tested hybrids. Similarly, under unprotected condition, the picture of performance of the sixteen hybrids is as: RCH.314Bt (3505 kg/ha)>RCH.308Bt (3377 kg/ha)>MRC.6021 (3302 kg/ha)>MRC.6021Bt (3188 kg/ha)>MRC.6029 (3164 kg/ha)>NCS.913 (3136 kg/ha)>JKCH.226 (3072 kg/ha). MECH.162Bt yielded 1834 kg/ha while the average yield from variety check for the zone was 2051 kg/ha.
- ❖ The fibre property of these sixteen hybrids was better than the check hybrids. However, the fineness of the fibre was not good in most of the hybrids. In general, their lint was with weak fibre. The tenacity fibre to length ratio was 0.8, as per CIRCOT norms and as accepted by the industry, in case of RCH.308, MRC.6029 and JKCh.226.
- ❖ Another observation is in regard to the incidence of Cotton Leaf curl virus disease which was very expressive during this season only at Sriganaganagar. The significantly higher whitefly vector population that was recorded here in comparison to other four centres also indicates that the disease epidemiology has to be regulated right from early season for the suppression of whitefly build up.
- ❖ All Bt hybrids, except MRC 6021 (grade 2) and MRC 6025 (grade 1) rest of the test hybrids showed Grade 3 or 4 reaction at Sriganaganagar. Among the hybrids only NECH 3R had maximum number of plants (12.67 %) infected by CLCuV followed by MECH 162 Bt (11.0%) and the least in MRC 6025 (1.81%). All other centres there were negligible CLCuV disease incidence. However, in the screening nursery at CICR-RS, Sirsa three hybrids viz., MECH 162 Bt, RCH 314 and MRC 6029 had 16.6, 10.0 and 50.0 per cent plants infected respectively with CLCuV at grade 2. However, those Bt hybrids showing 3 to 4 grade reaction could suffer yield loss under heavy disease pressure.

EVALUATION REPORT FOR FIRST YEAR (2004 SEASON)

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Introduction

The All India Coordinated Cotton Improvement Project (AICCIP) undertook the evaluation of Sixteen Bt cotton hybrids possessing the Cry 1 A(c) gene (vide ICAR letter No. 2(2)/04 dated 19.04.04) in the North Zone AICCIP centers of Hisar, Sriganaganar, Ludhiana, Faridkot and CICR Regional Station, Sirsa. The untreated, acid de-linted seeds of the relevant test hybrid were provided the M/S **Syngenta Pvt. Ltd., JK Seeds Pvt. Ltd., Mahyco Seeds Pvt. Ltd., Nuziveedu Seeds Pvt. Ltd., Nath seeds Pvt. Ltd. & Rasi Seeds Pvt. Ltd.** The season was good in this zone; however, the sap sucking pests (jassids and aphids) were noticed to be moderate to severe in most of the entries while the incidence of three bollworm species was low to moderate in all the centres. In general, the Whitefly population was not quite high in the experimental plots except at Sriganaganar.

Locations:

Punjab Agricultural University, Regional Agricultural Research Station, Faridkot
Punjab Agricultural University, Ludhiana
Chourdary Charan Singh Haryana Agricultural University, Hisar
Rajasthan Agricultural University, Regional Agricultural Research Station,
Sriganaganar
Central Institute for Cotton Research, Regional Station, Sirsa

Test Bt hybrids

The following sixteen Bt hybrids were tested in this study. MECH.162 Bt hybrid was the check in addition to respective zonal check variety.

02-26.VIP, 02-42.VIP, 02-50.VIP of **Syngenta Pvt. Ltd.**, JKCH.226, JKCH.1050, JKCH.1947 of **JK Seeds Pvt. Ltd.**, MRC.6021, MRC.6025, MRC.6029 of **Mahyco Seeds Pvt. Ltd.**, NCS.138, NCS. 570, NCS.913 of **Nuziveedu Seeds Pvt. Ltd.**, NECH.3R, NECH.6R of **Nath seeds Pvt. Ltd.** and RCH.314, RCH.308 of **Rasi Seeds Pvt. Ltd.**

Check hybrid: MECH.162 Bt, Check variety: F.1861 (Faridkot, Ludhiana)/H.1117 (Sirsa/Hisar/RS.2013 (Sriganganagar)

Date of sowing and final harvest

Dates	Faridkot	Ludhiana	Hisar	Sriganganagar	Sirsa
Date of sowing	8.5.2004	15.5.2004	31.5.2004	20.5.2004	11.5.2004
Date of final harvest	10.11.2004	13.11.2004	15.11.2004	18.11.2004	28.11.2004

BREEDING EVALUATION

DESIGN: Randomised Block Design 3 Replications – 3 ROWS each of 6 metre length. Plant protection by adopting the recommended package of practices of the respective centres after close weekly monitoring of the incidence and damage by all pests and diseases at the prescribed economic threshold levels (for each of those biotic stresses) in the concerned entries from time to time, based on close monitoring for their incidence and damage.

PLANT PROTECTION EVALUATION

DESIGN: Randomised Block design 3 Replications – 3 ROWS each of 6 metre length with no plant protection measures against prevalent bollworms and diseases. However, protection against sap sucking pests of respective entries, based on the recommended practices of respective centres was made.

BREEDING EVALUATION

The breeding evaluation concentrated on various observations on plant biometric characters such as number of monopodia per plant, number of sympodia per plant, nodes per plant, mean length of sympodia, number of fruiting points per sympodium, number of green bolls per plant at harvest, number of burst bolls per plant at harvest, mean boll weight, seed index, lint index, mean seed cotton yield per plant and per plot and seed cotton yield per hectare (calculated from plot yields) in addition to lint parameters such as length, strength and micronaire of the entries tested.

The germination of seeds of all entries was satisfactory at Faridkot and Ludhiana. However, it did not cross 50% in Hisar, Sirsa and Sriganganagar. The average germination in the zone has been thus reduced to a range of 58 to 60% in the test hybrids, as is shown below. This is important since the evaluations are done only in small plots.

Plant Stand

Entry	Faridkot	Ludhiana	Sriganganagar	Hisar	Sirsa	Mean
02-26.VIP	93.8	95.0	38.9	42.4	28.3	59.7
02-42.VIP	97.5	94.0	38.4	42.4	30.7	60.6
02-50.VIP	93.8	95.0	37.9	40.9	31.3	59.8
JKCH226	97.5	94.0	38.4	39.9	31.0	60.2
JKCH.1050	96.3	98.0	36.9	42.9	32.0	61.2
JKCH.1947	88.9	94.0	35.9	38.9	26.0	56.7
MRC.6021	97.5	98.0	38.9	40.9	29.0	60.9
MRC.6025	96.3	94.0	39.4	41.9	28.0	59.9
MRC.6029	93.8	93.0	40.4	43.9	23.3	58.9
NCS.138	87.7	94.0	39.4	37.9	20.0	55.8
NCS.570	93.8	90.0	34.3	38.9	29.3	57.3
NCS.913	93.8	97.0	38.9	40.4	31.3	60.3
NECH.3R	93.8	94.0	33.3	39.9	31.7	58.6
NECH.6R	90.1	100.0	42.4	38.9	29.0	60.1
RCH.308	96.3	94.0	39.4	43.9	25.7	59.9
RCH.314	95.1	97.0	40.9	43.4	30.3	61.3
MECH.162Bt Check	93.8	93.0	38.9	38.9	29.3	58.8
Variety Check	97.8	94.0	70.7	41.4	51.0	71.0

FIRST SYMPODIAL NODE:

Based on the data available, the Bt hybrids, at Faridkot, had significantly more sympodial nodes than that recorded at Ludhiana and Sirsa. The respective check variety recorded more than that of test hybrids.

Number of nodes on the First Sympodium

Entry	Faridkot	Ludhiana	Sirsa	mean
02-26.VIP	8.4	3.2	3.7	5.1
02-42.VIP	8.9	3.0	3.7	5.2
02-50.VIP	8.6	3.1	3.5	5.1
JKCH226	8.4	3.2	4.2	5.3
JKCH.1050	9.3	3.0	3.7	5.3
JKCH.1947	9.1	3.2	3.2	5.2
MRC.6021	9.7	2.9	3.1	5.2
MRC.6025	8.8	3.1	3.5	5.2
MRC.6029	8.2	3.0	2.7	4.6
NCS.138	8.8	3.1	3.4	5.1
NCS.570	9.5	3.0	3.8	5.4
NCS.913	7.9	3.1	3.9	5.0
NECH.3R	7.3	3.1	3.8	4.7
NECH.6R	7.5	3.0	3.3	4.6
RCH.308	9.6	3.2	3.6	5.5
RCH.314	9.0	3.1	3.4	5.2
MECH.162Bt Check	9.7	3.0	3.8	5.5
Variety Check	10.7	3.0	3.9	5.8
CD at 5 %	1.8	-	0.7	
CV %	12.0	-	12.1	

MEAN LENGTH OF FIRST SYMPODIUM (cm):

The mean length of the first sympodium was longer at Ludhiana and Sirsa in comparison to that recorded at Faridkot.

Length of First Sympodia (cm)

Entry	Faridkot	Ludhiana	Sirsa	Mean
02-26.VIP	16.3	22.4	32.6	23.8
02-42.VIP	14.7	12.1	35.6	20.8
02-50.VIP	19.1	28.1	32.2	26.5
JKCH226	15.6	28.2	32.0	25.3
JKCH.1050	20.4	25.2	32.8	26.1
JKCH.1947	21.0	19.1	30.4	23.5
MRC.6021	14.8	20.7	31.8	22.4
MRC.6025	13.9	23.6	34.5	24.0
MRC.6029	16.6	27.7	28.9	24.4
NCS.138	18.4	25.3	33.1	25.6

NCS.570	17.7	30.2	34.0	27.3
NCS.913	16.9	29.5	33.6	26.7
NECH.3R	18.5	26.3	34.2	26.4
NECH.6R	16.1	27.2	30.8	24.7
RCH.308	18.7	30.5	32.7	27.3
RCH.314	24.6	27.5	31.6	27.9
MECH.162Bt Check	29.2	24.8	33.3	29.1
Variety Check	20.8	31.3	33.7	28.6
CD at 5 %	4.0	5.7	3.0	
CV %	13.2	13.4	5.6	

Fruiting points /plant

The total fruiting points per plant was in the range of 56 to 76 per plant. However, the highest fruiting points were seen in check Bt hybrid as well as in NECH.3R (73.7) and NECH.6R (72.1).

Fruiting points/Plant

Name of entry	Faridkot	Ludhiana	Sriganganagar	Hisar	Sirsa	Mean
02-26.VIP	60.6	55.2	41.6	85.7	59.7	60.5
02-42.VIP	43.6	55.8	42.53	67.7	64.7	54.9
02-50.VIP	58.6	55.0	46.67	68.1	53.8	56.4
JKCH226	48.6	54.1	35.2	110.6	53.53	60.4
JKCH.1050	67.7	60.6	51.67	83.2	59.0	64.4
JKCH.1947	58.1	50.8	31.06	74.0	59.2	54.6
MRC.6021	64.4	57.8	37.6	65.7	51.5	55.4
MRC.6025	65.4	56.4	30.46	82.2	60.3	58.9
MRC.6029	53.1	65.0	44.54	63.8	65.3	58.3
NCS.138	56.6	56.2	44.47	84.9	56.5	59.7
NCS.570	52.4	67.0	45.47	100.2	53.7	63.7
NCS.913	58.8	61.9	43.14	93.5	58.1	63.1
NECH.3R	96.8	59.9	47.53	120.6	43.6	73.7
NECH.6R	54.3	65.2	30.46	165.3	45.3	72.1
RCH.308	47.6	59.5	39.67	98.5	56.2	60.3
RCH.314	62.1	58.5	35.74	80.6	55.3	58.4
MECH.162Bt Check	50.7	57.8	43	173.8	54.1	75.9
Variety Check	55.1	64.8	33.67	112.5	34.9	60.2
CD at 5%	12.9	8.2			7.2	
CV %	13.2	8.4			7.9	

Bolls/plant:

The maximum number of bolls was seen in NCS.138 hybrid. The range was between 37 to 45 in Bt hybrids, as compared to variety check (28).

Total Bolls/plant

Entry	Faridkot	Ludhiana	Sriganga nagar	Hisar	Sirsa	Mean
02-26.VIP	43.9	13	41.6	34.7	65.3	39.7
02-42.VIP	32.4	12	42.5	33.7	68.5	37.8
02-50.VIP	48.8	18	46.7	35.6	56.9	41.2
JKCH226	39.4	24	35.2	34.6	59.2	38.5
JKCH.1050	32.5	31	51.7	26.6	66.3	41.6
JKCH.1947	42.9	12	31.1	37.9	64.4	37.6
MRC.6021	40.4	17	37.6	36.8	57.2	37.8
MRC.6025	44.0	13	30.5	33.3	64.4	37.0
MRC.6029	43.2	35	44.5	26.6	70.4	44.0
NCS.138	42.7	26	44.5	48.0	62.7	44.8
NCS.570	35.2	23	45.5	42.4	61.1	41.4
NCS.913	44.5	25	43.1	34.3	62.1	41.8
NECH.3R	32.8	29	47.5	47.3	50.7	41.5
NECH.6R	30.1	27	30.5	32.4	51.8	34.4
RCH.308	28.3	37	39.7	33.9	60.9	39.9
RCH.314	54.4	36	35.7	33.8	60.3	44.0
MECH.162 Bt Check	31.2	23	43.0	51.6	60.1	41.8
Variety Check	27.8	8	33.7	28.4	39.6	27.5
CD at 5 %	7.5	5.9				
CV %	11.7	15.77				

BOLL WEIGHT (g):

All the entries recorded boll weight ranging from 3.0 to 4.5 g in the five centres, while that in the check variety was ranging from 3.0 to 3.7.

Entry	Faridkot	Ludhiana	Sriganga nagar	Hisar	Sirsa	Mean
02-26.VIP	4.0	4.2	4.0	4.4	4.3	4.2
02-42.VIP	4.4	3.1	3.3	4.6	3.8	3.9
02-50.VIP	3.7	4.3	3.1	4.0	3.6	3.7
JKCH226	4.0	4.1	3.1	3.6	3.4	3.6
JKCH.1050	3.2	4.1	2.4	3.7	3.5	3.4
JKCH.1947	3.6	3.1	2.4	3.5	3.6	3.2
MRC.6021	5.2	4.0	4.3	4.8	4.0	4.4
MRC.6025	5.0	4.6	3.7	4.6	4.4	4.5
MRC.6029	4.1	4.0	1.8	3.8	3.7	3.5
NCS.138	4.5	4.2	3.6	4.5	4.1	4.2
NCS.570	3.6	3.6	3.2	3.1	3.2	3.3
NCS.913	3.9	3.6	3.1	3.7	3.6	3.6
NECH.3R	3.4	4.1	3.0	3.9	3.6	3.6
NECH.6R	5.2	4.5	3.0	3.9	3.7	4.1

RCH.308	3.7	4.5	3.0	4.0	4.0	3.8
RCH.314	5.3	3.7	2.9	3.8	4.2	4.0
MECH.162Bt check	3.7	3.6	3.1	3.9	3.3	3.5
Variety Check	3.7	3.6	1.9	3.3	3.0	3.1
CD at 5 %	0.8	0.4			0.3	
CV %	11.7	6.0			5.3	

PERCENT GINNING OUT TURN:

The ginning outturn (GOT) ranged from 33 to 37 per cent. The zonal mean of test hybrids was similar to respective check variety.

PERCENT GINNING OUT TURN

Entry	Faridkot	Ludhiana	Sriganganagar	Hisar	Sirsa	Mean
02-26.VIP	33.8	33.2	36.2	33.3	34.6	34.2
02-42.VIP	36.3	34.4	36.9	35.2	35.6	35.7
02-50.VIP	34.4	34.6	36.9	35.1	38.0	35.8
JKCH226	36.4	35.3	35.5	37.2	39.5	36.8
JKCH.1050	39.8	35.2	36.4	41.4	42.1	39.0
JKCH.1947	34.7	35.2	36.5	35.9	39.1	36.3
MRC.6021	34.3	33.2	33.8	33.4	34.2	33.8
MRC.6025	33.2	32.8	37.3	32.7	34.1	34.0
MRC.6029	31.6	33.6	37.2	33.6	35.2	34.2
NCS.138	32.5	34.7	35.2	34.3	34.1	34.2
NCS.570	35.7	33.9	36.1	36.4	38.7	36.2
NCS.913	35.5	35.1	30.9	36.2	37.8	35.1
NECH.3R	32.6	33.7	37.7	34.1	35.5	34.7
NECH.6R	37.3	34.8	37.0	36.3	38.6	36.8
RCH.308	35.6	34.3	36.4	34.4	35.2	35.2
RCH.314	33.6	34.8	37.5	32.6	36.3	35.0
MECH.162Bt Check	33.9	33.3	36.0	35.5	35.6	34.9
Variety Check	33.3	32.5	34.7	34.4	37.3	34.4
CD at 5 %	0.7	0.7				
CV %	1.2	1.2				

MEAN LINT INDEX (g):

This parameter for fibre yield also followed similar trend as that of GOT. The test hybrids recorded similar lint index as that of respective check variety, as the case may be.

LINT INDEX (g)

Entry	Faridkot	Ludhiana	Hisar	Sirsa	Mean
02-26.VIP	4.8	4.4	5.0	4.0	4.5
02-42.VIP	5.5	3.6	5.1	4.2	4.6
02-50.VIP	5.1	4.9	5.1	4.8	5.0
JKCH.226	5.2	4.6	5.0	4.7	4.9
JKCH.1050	5.2	4.7	5.4	5.3	5.1
JKCH.1947	4.0	3.5	4.2	4.1	4.0
MRC.6021	5.7	5.2	5.2	4.4	5.1
MRC.6025	4.9	5.6	5.4	4.5	5.1
MRC.6029	4.0	4.3	4.3	3.7	4.1
NCS.138	5.0	4.7	5.2	5.1	5.0
NCS.570	4.7	4.7	4.9	4.2	4.6
NCS.913	5.3	4.3	5.1	4.5	4.8
NECH.3R	4.4	4.7	4.7	4.3	4.5
NECH.6R	5.5	4.9	5.3	5.5	5.3
RCH.308	4.8	5.4	4.9	4.3	4.9
RCH.314	5.3	5.6	4.6	4.8	5.1
MECH.162Bt Check	4.9	4.6	4.9	4.2	4.7
Variety Check	4.2	4.3	4.1	3.7	4.1
CD at 5 %	0.2	0.8		0.5	
CV %	2.0	9.8		6.1	

MEAN SEED INDEX (g):

The Seed index ranged from 7.1 to 10.5 g in various entries. There has been, however, significantly high seed index recorded in MRC.6021 as well as in MRC.6029.

Seed Index (g)

Entry	Faridkot	Ludhiana	Sriganganagar	Hisar	Sirsa	Mean
02-26.VIP	9.5	8.9	10.3	9.9	7.5	9.2
02-42.VIP	9.6	6.8	8.9	9.4	7.5	8.4
02-50.VIP	9.8	9.2	9.1	9.3	7.8	9
JKCH226	9.1	8.4	8.2	8.4	7.2	8.3
JKCH.1050	7.8	8.7	8.2	7.6	7.3	7.9
JKCH.1947	7.6	6.5	7.4	7.4	6.4	7.1
MRC.6021	11	10.4	12.3	10.4	8.4	10.5
MRC.6025	9.8	11.4	10.8	11.2	8.7	10.4
MRC.6029	8.6	8.5	7.6	8.6	6.7	8
NCS.138	10.4	8.8	10.5	9.9	9.9	9.9
NCS.570	8.5	9.2	8.9	8.6	6.6	8.4
NCS.913	9.6	8	9.9	9	7.3	8.8
NECH.3R	9.1	9.3	9.2	9	7.8	8.9
NECH.6R	9.2	9.2	9.6	9.4	8.8	9.2
RCH.308	8.8	10.4	9.8	9.3	7.9	9.2

RCH.314	10.5	10.5	10	9.5	8.4	9.8
MECH.162Bt Check	9.6	9.1	7	8.9	7.6	8.4
Variety Check	8.5	9	6.7	7.8	6.3	7.6
CD at 5 %	0.3	1.4			0.4	
CV %	1.8	9.4			3.1	

SEED COTTON YIELD

Both RCH hybrids, viz. RCH.308Bt (3352 kg/ha) and RCH.314Bt (3265 kg/ha) stood on top in seed cotton yield, while MRC.6029Bt (2947kg/ha) was in the third position. Numerical superiority in yield was seen in MRC.6025 Bt (2833 kg/ha), JKCH.226 Bt (2727 kg/ha), MRC.6021 Bt (2742 kg/ha) and NCS.138 Bt (2712 kg/ha), while MECH.162Bt check hybrid yielded 1834 kg/ha.

Due to parawilt syndrome in Ludhiana, the crop was affected. If we delete Ludhiana yield data, the picture of performance of the sixteen hybrids is as: RCH.314 Bt (3642 kg/ha) > RCH.308 Bt (3541 kg/ha) > MRC.6025 (3330 kg/ha) > MRC.6029 Bt (3294 kg/ha) > NCS.913 Bt (3238 kg/ha) > MRC.6021 (3229 kg/ha) > JKCH.226 (3127 kg/ha).

SEED COTTON YIELD (Kg/ha) -protected condition

Entry	Faridkot	Ludhiana	Srigan-ganagar	Hisar	Sirsa	Mean	Mean without Ludhiana data
02-26.VIP	2848	778	1926	2140	3717	2282	2658
02-42.VIP	3459	346	1812	1481	3099	2040	2463
02-50.VIP	3028	738	2148	1701	4177	2358	2763
JKCH.226	3906	1127	2370	2305	3926	2727	3127
JKCH.1050	2816	1730	2222	2112	4122	2600	2818
JKCH.1947	4341	581	2185	1975	3479	2512	2995
MRC.6021	4625	792	2457	2414	3419	2742	3229
MRC.6025	4036	844	2864	1975	4444	2833	3330
MRC.6029	4464	1560	2679	2167	3867	2947	3294
NCS.138	4357	1305	2531	2332	3033	2712	3063
NCS.570	3421	1276	1605	1948	3312	2312	2571
NCS.913	3630	759	2802	2359	4163	2743	3238
NECH.3R	3120	1720	914	1344	1672	1754	1762
NECH.6R	3558	1873	1543	2140	4176	2658	2854

RCH.308	4399	2594	2630	3237	3898	3352	3541
RCH.314	4483	1757	2395	3045	4643	3265	3642
MECH.162Bt Check	2784	1347	1049	1481	2509	1834	1956
Variety Check	3346	827	1926	1207	2950	2051	2357
CD at 5 %	528	314	213	230	615		
CV %	8.60	15.5	12.59	14.1	10		

Stability of seed cotton yield of the second year trial of the candidate entries was analysed by the given formula: $\text{mean} - \text{SD} / \text{max. value} \times 100$. This measures the effect of environment (location) on the genotypes. RCH.308Bt (68.53%), JK.226Bt (66.06%), RCH.314 (63.67%) and MRC.6029 (59.85%) have shown good stability for seed cotton in the zone. However, NCS.570Bt (61.32%) showed the stability in the zone, although its yield was less than the earlier cited hybrids, as seen in the following table.

Stability Parameter of Bt hybrids over five locations

Genotype	Sirsa	Farid kot	Ludhi ana	Hisar	Sriganaganagar	Mean	Mean Square	Stability Parameter (%)
RCH.308	3898	4399	2594	3237	2630	3352	11374	68.53
JKCH226	3926	3906	1126	2305	2370	2727	17822	66.06
RCH.314	4643	4483	1757	3045	2395	3265	95316	63.67
NCS.570	3312	3421	1276	1948	1605	2312	45858	61.32
MRC.6029	3867	4464	1561	2167	2679	2948	76271	59.85
NCS.913	4163	3630	759	2359	2802	2743	262159*	53.59
MRC.6025	4444	4036	844	1975	2864	2833	210506*	53.42
02-42.VIP	3099	3459	346	1481	1812	2040	42521	53.02
MECH.162Bt Check	2509	2784	1348	1481	1049	1834	145694	52.17
Varietal Check	2950	3346	827	1207	1926	2051	94366	52.12
NCS.138	3033	4357	1305	2332	2531	2712	275817*	50.19
JKCH.1947	3479	4341	581	1976	2185	2512	119716	49.90
NECH.6R	4176	3558	1873	2140	1543	2658	348215*	49.52
JKCH.1050	4121	2816	1730	2113	2222	2600	335003*	49.05
02-26.VIP	3718	2848	778	2140	1926	2282	211774*	49.00
MRC.6021	3419	4625	792	2414	2457	2742	267675*	48.10
02-50.VIP	4177	3028	737	1701	2148	2358	306969*	43.19
NECH.3R	1672	3120	1720	1344	914	1754	597615*	31.44

Fibre property data

Mean staple length, tenacity and ratio of fibre tenacity and length in various test entries are given below. The major observation was that all entries had superior length over the Bt check hybrid. However, most of the entries have coarse fibre with high micronaire value for the given span length and tenacity values. RCH.314 and MRC.6029 as well as JKCH.226 had approved value of the ratio of length and tenacity.

Mean Fibre Quality Data

Name of entry	(L) Span length (mm)	(T) Tenacity (g/tex)	T/L	Micronaire	Uniformity ratio (%)
02-26.VIP	31.1	22.9	0.74	4.6	45
02-42.VIP	26.3	20.3	0.77	4.3	47
02-50.VIP	28.3	21.6	0.76	5.3	48
JKCH226	28.6	23.1	0.81	4.5	49
JKCH.1050	27.0	21.0	0.78	5.0	49
JKCH.1947	27.6	21.6	0.78	4.7	50
MRC.6021	30.3	23.2	0.77	4.8	48
MRC.6025	29.4	22.6	0.77	4.5	47
MRC.6029	27.5	22.6	0.82	4.1	48
NCS.138	27.4	22.8	0.83	4.7	48
NCS.570	25.9	20.6	0.80	5.1	50
NCS.913	28.1	21.8	0.80	4.7	47
NECH.3R	30.2	23.1	0.76	4.5	46
NECH.6R	28.8	22.4	0.78	4.7	48
RCH.308	28.0	21.7	0.78	4.4	47
RCH.314	27.5	22.5	0.82	4.0	47
MECH.162Bt Check	25.9	20.1	0.78	5.0	49
Variety Check	25.0	20.5	0.82	4.8	50

Plant protection against insect pests in breeding trials

The general pressure of pests seemed to be low, since it can be seen that the sprayings of insecticides in any hybrid test plot was taken up only up to 70-80 days. Both sap sucking pests and bollworms built up even on non-Bt hybrids and check varieties at later stages only. The gene action of Cry 1 A(c) is known to be up to 90-100 days after germination of the crop in Bt hybrids. Hence, it is difficult to assess critically the exact effectiveness of gene action of these genetically modified hybrids in north zone under the pest-free season.

The pesticide application at Faridkot was seen to be targeted to manage the jassids in the entries up to 90 days of crop growth. In some entries, Endosulfan was sprayed as third application in the middle of August, as in NCS.570 and check variety.

The Bt test entries were not sprayed at Faridkot with any insecticides for bollworm management through out the experimental duration as the damage did not cross ETL. However, at Ludhiana, there was high incidence of sap sucking insects and all Bt test entries were subjected to two applications of Imidachloprid 200 SL in June and July followed by Methyl demeton in September. The Bt entries were sprayed with Thiodan 35 EC in the middle of August; Quinalphos 25 EC in the first week of September, followed by Indoxacarb 15 EC for NCS.570 on 13th September amongst test entries.

At Hisar, Quinalphos 25 EC was applied in MRC.6304Bt, RCH.317Bt, Ankur-651Bt (which also had a spray of Fenvalerate on 13th September) in the last week of September. The details are given in the table. The Bt entries were affected by Tobacco caterpillar (*Spodoptera litura*) against which there is no protection from Cry 1 A(c) protein. While Bt entries had one round of spray against this pest, there was no need for any insecticide for their protection against bollworms, due to their low incidence in these entries. However, non-Bt entries had to be protected with four rounds of insecticides, according to their incidence and damage above economic threshold.

At Sriganaganagar, the sap sucking pest management was the first round of spray followed by Acetamiprid + Neem or Endosulfan in the second round of spray in Bt entries. The third and fourth rounds of sprayings were only for non-Bt and check hybrids.

At Sirsa, no spray was given for the management of sucking pests as they did not cross ETL. NECH.6 was sprayed on 04.9.04 with Spinosad 75 g ai/ha (170 days after sowing), while check hybrid and variety had a spray of Endosulfan @ 2l/ha on 18.8.04 (100 days after sowing).

PLANT PROTECTION EVALUATION

Under un-protected conditions, the performance of test hybrids against prominent pests such as leaf hoppers (jassids) and whitefly amongst sap sucking insects and all the bollworm species in addition to other minor pests such a leaf feeding caterpillars was evaluated. Amongst diseases, the presence of Cotton Leaf Curl Virus (CLCuV) disease was the most important as this threatens the cultivation of American (hirsutum) cottons in the northern states. The AICCIP has decided that none of the hirsutum entries susceptible to this pest shall be introduced for commercial cultivation in the three states of this zone.

Entomology Evaluation

The Entomology evaluation was targeted primarily to test the action of Cry 1A (c) gene in sixteen Bt trial hybrids against the following bollworms.

SPOTTED BOLLWORM- *Earias vittella* Fabricius

SPINY BOLLWORM – *Earias insulana* Boisduval

AMERICAN BOLLWORM – *Heliothis virescens* Hubner

PINK BOLLWORM – *Pectinophora gossypiella* (Saunders)

This was undertaken in sprayed and unsprayed plots in all the five locations. The insecticides sprayings were decided based on the threshold levels of sap sucking pest species and bollworms that invaded the various test hybrids. The sprayings were undertaken in both the plots of the two replications, once it is made sure that one of the plots in a replication has crossed the threshold level of bollworm infestation in respect of the candidate hybrid. The incidence of American bollworm was low in almost all AICCIP centres in the North Zone during the entire season. However, the following data on damage to fruiting bodies of these sixteen hybrids bring out the impact of bollworm damage.

Square damage:

The percent square damage in the following table shows that the highest incidence was at Sriganaganagar during 2004 season out of the five centres. The

lowest mean damage of one and below percentage was recorded in 02-26.VIP, 02-42.VIP and MRC.6025Bt. Other Bt hybrids had appreciably low damage to squares in comparison with variety check and Bt check hybrid.

PERCENTAGE SQUARE DAMAGE

Name	Faridkot	Ludhiana	Sriganganagar	Sirsa	Mean
02-26.VIP	0.7	0.0	2.0	0.6	0.8
02-42.VIP	0.9	0.1	2.1	0.8	1.0
02-50.VIP	3.4	0.1	2.2	1.2	1.7
JKCH226	2.4	0.5	3.0	0.6	1.6
JKCH.1050	6.8	0.2	2.0	1.5	2.6
JKCH.1947	6.1	0.3	2.1	1.1	2.4
MRC.6021	5.2	0.2	2.3	0.6	2.1
MRC.6025	1.9	0.0	1.3	0.7	1.0
MRC.6029	7.2	0.0	1.4	1.0	2.4
NCS.138	9.6	0.0	2.5	0.7	3.2
NCS.570	15.0	0.6	2.0	1.4	4.8
NCS.913	4.4	0.0	2.1	0.5	1.7
NECH.3R	2.6	1.3	1.0	1.3	1.5
NECH.6R	8.7	0.8	1.3	1.2	3.0
RCH.308	5.4	0.8	1.3	0.9	2.1
RCH.314	6.1	0.1	1.6	1.0	2.2
MECH.162Bt Check	15.1	1.6	2.6	1.7	5.2
Variety Check	20.7	1.9	5.4	2.6	7.6

Green boll damage:

The Green boll damage was recorded in the five test centres in these Bt test entries. The highest damage was recorded at Sriganganagar. The lowest per cent damage was 6.6 to 7.2%, as observed in NCS.138, MRC.6025, JKCH.1050, RCH.314 and JKCH.226.

Green boll damage (%)

Name	Faridkot	Ludhiana	Sriganganagar	Hisar	Sirsa	Mean
02-26.VIP	2.2	0	40.3	4.4	1.2	9.6
02-42.VIP	0	4.2	50.2	6.7	1.3	12.5
02-50.VIP	1.1	0	55.3	7	1.3	12.9
JKCH.226	0	0	33.8	1.6	0.8	7.2
JKCH.1050	0	0	30.5	2.4	1.4	6.8
JKCH.1947	0	0	39.0	5.7	0.9	9.1

MRC.6021	0	0	59.5	7.6	1.9	13.8
MRC.6025	0	0	25.5	7.6	0.7	6.7
MRC.6029	0	0	40.5	3.6	0.9	9.0
NCS.138	1.1	0	22.7	8.3	0.9	6.6
NCS.570	0	0	64.7	8	1.8	14.9
NCS.913	0	0	69.8	5.9	1.3	15.4
NECH.3R	0	0	53.1	0.0	0.9	10.8
NECH.6R	0	0	40.8	6.2	1.2	9.6
RCH.308	1.1	0	66.3	6.4	1.3	15.0
RCH.314	0	0	29.0	5.1	1.0	7.0
MECH.162Bt Check	5.6	5	56.2	5.5	1.3	14.7
Variety Check	6.7	0	55.8	7.6	1.8	14.4

Locule damage:

The percent locule damage was noticed to be maximum at Ludhiana and Sriganaganagar centres. Most of the hybrids recorded lower damage than that in check variety and check Bt hybrid.

Percent Locule Damage

Entry	Faridkot	Ludhiana	Sriganganagar	Hisar	Sirsa	Mean
02-26.VIP	1.8	17.6	10.9	3.2	3.6	7.4
02-42.VIP	1.0	10.0	12.4	4.5	1.9	6.0
02-50.VIP	1.3	9.4	8.2	2.2	1.3	4.5
JKCH226	0.1	7.6	10.6	1.4	0.5	4.0
JKCH.1050	1.0	11.6	1.0	1.4	1.3	3.2
JKCH.1947	0.1	13.4	2.3	3.3	1.3	4.1
MRC.6021	0.4	10.7	12.1	3.2	1.3	5.5
MRC.6025	0.2	8.4	9.2	1.9	0.5	4.0
MRC.6029	0.2	4.5	4.3	2.7	0.5	2.4
NCS.138	0.8	5.3	10.6	3.2	2.9	4.5
NCS.570	3.1	15.8	10.4	3	5.5	7.6
NCS.913	0.7	7.9	1.0	2.7	0.5	2.6
NECH.3R	2.1	15.8	23	1.4	1.9	8.8
NECH.6R	0.9	8.8	9.5	1.1	1.3	4.3
RCH.308	1.0	8.1	2.4	1.6	1.3	2.9
RCH.314	0.4	9.9	4.4	1.1	1.2	3.4
MECH.162Bt Check	2.1	11.1	11.1	3.3	4	6.3
Variety Check	7.7	27.6	8.8	7.4	6.1	11.5

Open Boll damage:

The percent open boll damage was also seen to be maximum at Ludhiana and Sriganganagar. The minimum damage was recorded in MRC.6029, JKCH.1050, RCH.308 and RCH.314 Bt hybrids.

Percent Open Boll Damage

Entry	Faridkot	Ludhiana	Sriganganagar	Hisar	Sirsa	Mean
02-26.VIP	4.2	38.2	28.3	8.9	0.5	16.0
02-42.VIP	2.0	27.7	26.7	11.5	0.5	13.7
02-50.VIP	2.7	22.6	26.7	6.0	3.3	12.2
JKCH226	0.3	24.3	13.3	4.2	0.5	8.5
JKCH.1050	2.0	31.5	1.7	3.6	0.5	7.8
JKCH.1947	0.3	32.3	18.3	7.7	0.5	11.8
MRC.6021	1.0	23.5	18.3	8.9	0.5	10.4
MRC.6025	0.6	22.6	23.3	4.9	0.5	10.4
MRC.6029	0.6	12.4	15.0	7.2	0.5	7.1
NCS.138	1.9	15.3	25.0	7.4	0.5	10.0
NCS.570	7.4	36.5	30.0	7.1	0.5	16.3
NCS.913	1.7	21.8	1.8	6.9	0.5	6.5
NECH.3R	4.8	42.4	31.7	3.9	0.5	16.7
NECH.6R	2.4	30.2	21.7	5.6	0.5	12.1
RCH.308	3.2	22.1	6.7	4.2	0.5	7.3
RCH.314	1.2	29.6	8.3	3.7	0.5	8.6
MECH.162Bt Check	5.7	21.3	26.7	9.5	0.5	12.7
Variety Check	16.7	53.5	21.7	15.8	0.5	21.6

The following table provides the damage picture due to Pink bollworm at Sriganganagar in the sixteen Bt entries. It is found that all the test hybrids had similar larval numbers per the sampled green bolls as well as percentage of green boll damage. NCS.570 and RCH.308 recorded the lowest boll damage due to this pest.

Pink bollworm (PBW) damage at Sriganganagar

Name of entry	Mean PBW/20 green bolls	% green boll damage
02-26.VIP	1.33	40.33
02-42.VIP	1.99	59.49
02-50.VIP	1.83	40.50
JKCH.226	1.99	33.83

JKCH.1050	1.16	30.50
JKCH.1947	2.66	64.66
MRC.6021	1.66	39.00
MRC.6025	1.99	25.49
MRC.6029	1.16	50.16
NECH.3R	1.50	53.14
NECH.6R	2.83	55.33
NCS.138	1.50	56.16
NCS. 570	1.33	22.66
NCS.913	1.0	69.83
RCH.308	1.66	66.33
RCH.314	1.23	28.99
Mech.162 Bt (Check)	1.66	40.83
F.1861(Faridkot, Ludhiana)/H.1117 (Sirsa/Hisar/RS.2013 (Sriganganagar) (Check variety)	2.66	55.83

Sap Sucking pests

The centres reported that there has been low population of sap sucking pests in the test hybrids. However, there has been high population of both jassids and whitefly at Sriganganagar. The following data shows that there has been similar response to the test hybrids towards the incidence and damage of these two insects. Comparative analysis of their population shows that at Sriganganagar, the whitefly population was unusually high. Their levels were 13 to 17 times more than that of the other centres. The significance of this is in the potential disease transmission and builds up of Cotton Leaf Curl virus disease.

Sap sucking insect population

Entry	Faridkot		Ludhiana		Sriganganagar		Hisar		Sirsa	
	Jassid	Whitefly	Jassid	Whitefly	Jassid	Whitefly	Jassid	Whitefly	Jassid	Whitefly
NECH.3R	0.75	1.54	1.90	2.65	1.53	15.50	1.40		0.91	2.06
JKCH226	1.29	0.98	2.06	2.52	2.13	13.75	1.49		0.96	1.96
02-26.VIP	2.22	0.89	2.39	2.55	1.76	15.18	1.49		1.05	1.98
RCH.314	0.79	1.20	1.76	2.58	0.88	15.45	0.96		0.79	1.86
02-50.VIP	1.41	1.35	2.47	2.54	1.09	13.90	1.47		0.92	1.81
MRC.6025	0.96	1.28	2.10	2.43	0.90	14.17	1.33		0.79	1.61
JKCH.1050	1.58	1.40	3.11	2.70	1.75	17.14	1.36		1.30	2.33
RCH.308	0.95	0.98	1.93	2.55	1.23	12.68	2.19		0.89	2.09
NECH.6R	1.63	1.66	2.15	2.79	1.12	14.28	1.43		1.03	2.24
NCS.570	1.02	1.18	2.37	2.78	1.05	11.09	1.22	*	0.82	1.96
JKCH.1947	1.06	1.89	2.09	2.75	0.73	10.04	1.18		0.72	1.78
MRC.6021	0.82	1.00	2.09	2.75	1.04	11.43	1.28		0.80	1.68
02-42.VIP	1.63	1.25	2.87	2.72	0.98	10.11	1.06		0.81	1.61
MECH.162Bt Check	0.77	1.68	2.03	2.86	0.86	12.61	1.43		0.98	1.99
MRC.6029	0.81	1.64	1.83	2.73	0.95	10.65	0.90		0.68	1.75
NCS.138	1.04	1.17	2.13	2.64	0.89	14.62	1.07		0.84	1.90
NCS.913	1.41	1.08	3.02	2.44	1.48	16.24	1.58		0.86	1.91
Variety Check	0.78	1.36	2.11	2.78	0.77	10.46	1.39		0.77	1.91

* Hisar - Population of whitefly in different genotypes ranged between 0.8-3.5 adults per leaf and remained below economic threshold through out the crop season

Whitefly population/3 leaves at Sriganaganagar

Entry code	No. of observations										Mean
	Ob.1 55 DAS (15/7/04)	2 22/7	3 5/8	4 13/8	5 22/8	6 31/8	7 8/9	8 16/9	9 22/9/04		
02-26.VIP	3.33 (1.80)	3.32 (1.80)	4.99 (2.16)	13.66 (3.69)	15.33 (3.91)	28.26(5.31)	27.06 (5.20)	22.66 4.76	17.46 (4.14)	15.18	
02-42.VIP	3.08 (1.74)	3.86 (1.94)	6.33 (2.49)	11.33 (3.35)	11.26 (3.35)	15.53(3.93)	14.60 (3.82)	11.20 3.34	13.80 (3.71)	10.11	
02-50.VIP	2.22 (1.35)	4.10 (2.01)	7.22 (2.68)	14.11 (3.75)	11.06 (3.32)	38.86(6.22)	14.80 (3.84)	15.40 3.92	17.40 (4.16)	13.90	
JKCH.226	2.11 (1.45)	3.33 (1.82)	12.66 (3.45)	10.88 (3.29)	13.46 (3.66)	40.33(6.34)	16.73 (4.11)	13.33 3.65	10.93 (3.29)	13.75	
JKCH.1050	2.44 (1.56)	2.88 (2.36)	5.77 (2.39)	12.77 (3.57)	9.60 (3.09)	25.66(5.00)	23.46 (4.74)	31.33 5.59	40.40 (3.52)	17.14	
JKCH.1947	2.22 (1.47)	3.44 (1.84)	6.66 (2.58)	14.44 (3.80)	12.80 (3.57)	12.80(3.57)	13.46 (3.67)	11.20 3.34	13.40 (3.65)	10.04	
MRC.6021	2.88 (1.69)	3.21 (1.74)	6.99 (2.64)	9.66 (3.14)	11.60 (3.40)	17.53(4.23)	17.26 (5.15)	18.23 4.16	15.53 (3.84)	11.43	
MRC.6025	1.53 (1.23)	3.21 (1.94)	7.10 (2.66)	10.44 (3.26)	14.13 (3.75)	34.20(5.84)	17.93 (4.22)	19.00 4.35	20.60 (4.53)	14.17	
MRC.6029	2.66 (1.62)	3.99 (1.99)	7.55 (2.74)	11.33 (3.36)	9.53 (3.08)	20.06(4.47)	14.80 (3.87)	12.33 3.51	13.66 (3.68)	10.65	
NCS.138	2.77 (1.69)	3.33 (1.82)	21.44 (4.63)	18.99 (4.35)	12.13 (3.47)	17.06(4.08)	15.80 (3.97)	19.44 4.40	20.66 (4.53)	14.62	
NCS.570	2.99 (1.72)	2.77 (1.69)	7.55 (2.74)	13.88 (3.71)	14.06 (3.74)	19.26(4.38)	14.66 (6.36)	13.30 3.64	11.40 (3.37)	11.09	
NCS.913	3.44 (1.84)	2.33 (1.52)	11.77 (3.39)	10.11 (3.27)	29.53 (5.40)	19.13(4.37)	27.26 (5.27)	22.53 4.74	20.13 (4.48)	16.24	
NECH.3R	3.77 (1.92)	2.88 (1.70)	7.55 (2.74)	17.33 (3.69)	22.06 (4.86)	24.26(4.92)	27.93 (5.28)	19.00 4.35	14.80 (4.61)	15.50	
NECH.6R	1.33 (1.15)	2.88 (1.69)	21.21 (4.60)	9.33 (3.07)	16.13 (4.01)	15.40(3.92)	25.93 (5.08)	22.00 4.69	14.33 (3.78)	14.28	
RCH.308	3.77 (1.92)	3.99 (2.15)	21.55 (4.64)	10.55 (3.28)	11.80 (3.43)	19.8 (4.44)	16.46 (4.05)	13.40 3.66	12.80 (3.57)	12.68	
RCH.314	2.99 (1.72)	2.99 (1.72)	6.66 (2.57)	8.99 (3.01)	21.73 (4.65)	39.66(6.29)	26.06 (5.10)	18.33 4.28	11.66 (3.41)	15.45	
MECH.162Bt Check	1.99 (1.40)	3.32 (1.82)	5.66 (2.37)	16.44 (4.05)	16.53 (4.03)	22.33(4.72)	16.66 (4.08)	15.70 3.96	14.86 (3.82)	12.61	
Variety Check	1.33 (1.14)	3.22 (1.79)	6.44 (2.56)	11.77 (3.43)	11.26 (3.35)	14.13(3.75)	16.73 (4.08)	15.06 3.88	14.26 (3.77)	10.46	

In the detailed table on the sixty days' observation, it is found that the build up has been gradual from the mid-August and was quite high up to end of September in all the genotypes. This indicates that the effective whitefly management is important to contain the spread of this viral disease.

Seed cotton yield

The Seed cotton yield under unprotected condition was the highest in RCH.314 (3103kg/ha) and RCH.308 (2982 kg/ha). NCS.913 recorded 2520 kg/ha while MTRC.6025 and MRC.6021 yielded 2482 and 2479 respectively. Due to affliction of parawilt syndrome as well as jassid incidence, the yield data of Ludhiana centre is not expressive of the actual potential of the test hybrids. By excluding these data, the yield data of the test hybrids shows that RCH.309Bt (3663 kg/ha) and RCH.314Bt (3477 kg/ha) followed by NCS.913 (3133 kg/ha) and MRC hybrids yielded seed cotton to the maximum out of the sixteen tested hybrids.

Seed cotton yield (kg/ha) under unprotected condition

Entry	Faridkot	Ludhiana	Sriganga-nagar	Hisar	Sirsa	Mean	Mean yield without Ludhiana data
02-26.VIP	2390	610	2493	1399	3546	2088	2642
02-42.VIP	2625	558	1703	1070	3340	1859	2287
02-50.VIP	2402	453	1455	1043	3560	1782	2279
JKCH226	3182	1488	1925	2085	3574	2451	2746
JKCH.1050	2417	1036	2491	2003	3669	2323	2672
JKCH.1947	3551	612	2139	1838	3190	2266	2714
MRC.6021	3816	913	1726	2250	2574	2256	2632
MRC.6025	3411	559	2864	1866	3710	2482	2990
MRC.6029	3783	1068	2407	1646	3491	2479	2962
NCS.138	3774	885	1543	2112	3176	2298	2706
NCS.570	2460	726	1185	1811	2675	1771	2067
NCS.913	3158	479	2703	1948	4313	2520	3133
NECH.3R	2259	1230	678	1097	2492	1551	1693
NECH.6R	2411	1550	1567	2003	4074	2321	2548
RCH.314	4140	1411	2580	2497	4887	3103	3477
RCH.308	3877	1661	2592	2579	4203	2982	3663
MECH.162Bt Check	1942	1025	824	1235	2547	1514	1699
Variety Check	2082	352	1061	823	2977	1459	1832
CD at 5%	428	1.79	4.17	329	1332		
CV %	8.65	11.71	12.49	14.32	12.30		

PLANT PATHOLOGY EVALUATION

Performance of Bt hybrids against diseases

The Bt hybrids grown under both protected (Breeding evaluation) and unprotected (Entomology evaluation) conditions were assessed for their performance against various diseases prevalent in the five North zone centres.

Cotton Leaf Curl Virus (CLCuV) Disease

Even though cotton leaf curl virus disease has been a major source of concern for cotton cultivation in this zone for the past many years, during this year there was very little damage due to this disease in most of the centres.

In this trial with 16 new Bt hybrids, except MRC 6021 (grade 2) and MRC 6025 (grade 1) rest of the test hybrids showed 3/4 reaction at Sriganagar. Among the hybrids only NECH 3R had maximum number of plants (12.67 %) infected by CLCuV followed by MECH 162 Bt (11.0%) and the least in MRC 6025 (1.81%), as given in the Table below. All other centres there were negligible CLCuV disease incidence. However, in the screening nursery at CICR-RS, Sirsa three hybrids viz., MECH 162 Bt, RCH 314 and MRC 6029 had 16.6, 10.0 and 50.0 per cent plants infected respectively with CLCuV at grade 2. However, all the hybrids showing 3 to 4 grade reaction could suffer yield loss under heavy disease pressure.

The early August population of Sriganagar was noticed to be at a range between 8 to 17 per three leaves and it continued to build up to a maximum range of 20 to 42 within next 40 days in the unsprayed plots. Triazophos spraying to contain whitefly in the test entries of protected plots (Breeding evaluation) was begun from the second spray schedule in August at this centre. It is likely that the increased whitefly population might have led to the increased incidence of Cotton leaf curl virus in the test entries at this centre.

Cotton Leaf curl disease incidence

Name	Faridkot		Ludhiana		Sriganganagar		Hisar		Sirsa*
	Plant infected %	Grade	Plant infected %	Grade	Plant infected %	Grade	Plant infected %	Grade	Plant infected %
02-26.VIP	0	0	0	0	7.45	4	-	0	0
02-42.VIP	0	0	0	0	5.63	4	3.85	2	0
02-50.VIP	0	0	0	0	4.97	4	-	0	0
JKCH.226	0	0	0	0	7.55	4	5.56	2	0
JKCH.1050	0	0	6.3	2	10.9	4	3.33	1	0
JKCH.1947	0	0	0	0	5.71	4	-	0	0
MRC.6021	0	0	0	0	2.58	2	-	0	0
MRC.6025	0	0	0	0	1.81	1	3.45	1	0
MRC.6029	0	0	15.4	3	9.2	4	11.58	3	0
NCS.138	2.5	3	0	0	5.66	4	-	0	0
NCS. 570	0	0	0	0	9.68	4	5.26	1	0
NCS.913	0	0	0	0	7.88	3	-	0	0
NECH.3R	1.3	3	18.2	3	12.67	4	-	0	0
NECH.6R	0	0	0	0	5.66	3	-	0	0
RCH.314	0	0	5.7	2	5.98	4	4.17	1	0
RCH.308	0	0	0	0	4.43	3	-	0	0
MECH.162 Bt	1.3	3	11	2	11.91	4	3.51	3	
F.1861/ Lda)/H.1117 (Srs/Hsr/ RS.2013 (Sng)	0	0	0	0	2.67	3	11.45	3	0

*At CICR, Sirsa, the incidence of CLCuV was observed in three hybrids MECH 162 Bt (16.6%), RCH 314 (10.0%) and MRC 6029 (50%) in screening nursery, where as no Name of entry showed the disease in field. All the entries showed disease in grade-2.

Parawilt

Parawilt was observed on the hybrids only at the Ludhiana centre. Due to this phenomenon, the seed cotton yields of all hybrids were very much reduced in both protected and unprotected trials.

The Bt hybrid MRC 6025 (55.4 % under protected condition and 71.4 % under unprotected condition) followed by MRC 6029 (54.6 % and 31.9 %) had the maximum wilting. The least incidence of wilting was observed in NECH 3R (4.6 % and 3.2 %).

All entries had grade 2 infection to **bacterial blight** only at Faridkot.

Parawilt incidence and seed cotton yield at PAU, Ludhiana

Entry	Protected		Unprotected	
	Wilt (%)	Seed Cotton Yield (Kg/ ha)	Wilt (%)	Seed Cotton Yield (Kg/ ha)
02-26.VIP	27.5	778	28.4	610
02-42.VIP	35.3	792	22.5	913
02-50.VIP	30.2	1560	28.6	1068
JKCH.226	17.0	1127	12.6	1488
JKCH.1050	9.7	1730	18.7	1036
JKCH.1947	12.0	1276	11.5	726
MRC.6021	35.4	581	30.8	612
MRC.6025	55.4	844	71.4	559
MRC.6029	54.6	346	31.9	558
NCS.138	5.8	1347	8.5	1025
NCS. 570	31.5	1305	23.8	885
NCS.913	39.6	759	44.0	479
NECH.3R	4.6	1720	3.2	1230
NECH.6R	34.3	738	38.5	453
RCH.314	33.3	1757	12.7	1411
RCH.308	5.5	2594	5.8	1661
MECH.162 Bt	10.8	1873	12.6	1550
F.1861	0.0	827	1.1	352
CD at 5%	--	314	--	179
CV (%)	--	16.0	--	12.0

OVERALL ASSESSMENT OF BT COTTON PERFORMANCE

The sixteen Bt test hybrids have performed well in this season in the North zone. The seed cotton yield performance shows that under protected and unprotected environments, RCH.308 and RCH.314 Bt hybrids were better than the rest of the hybrids.

Comparative seed cotton yield amongst test hybrids in north zone

Name of entry	Breeding		Entomology	
	Mean	Mean without Ludhiana data	Mean	Mean excluding Ludhiana data
02-26.VIP	2282	2658	2088	2642
02-42.VIP	2040	2463	1859	2287
02-50.VIP	2358	2763	1782	2279
JKCH.226	2727	3127	2451	2746
JKCH.1050	2600	2818	2323	2672
JKCH.1947	2512	2995	2266	2714
MRC.6021	2742	3229	2256	2632
MRC.6025	2833	3330	2482	2990
MRC.6029	2947	3294	2479	2962
NCS.138	2712	3063	2298	2706
NCS.570	2312	2571	1771	2067
NCS.913	2743	3238	2520	3133
NECH.3R	1754	1762	1551	1693
NECH.6R	2658	2854	2321	2548
RCH.308	3352	3541	3103	3477
RCH.314	3265	3642	2982	3663
MECH.162Bt Check	1834	1956	1514	1699
Variety Check	2051	2357	1459	1832

The fibre property of these hybrids was better than the check hybrids. However, the fineness of the fibre was not good in most of the hybrids. They had also weak fibre in general.

The Pink bollworm damage, as measured through open boll damage assessment at Ludhiana and Sriganaganagar, indicates that these Bt hybrids may necessitate special plant protection attention against this pest. Another observation is in regard to the incidence of Cotton Leaf curl virus disease which was very expressive during this season only at Sriganaganagar. The significantly higher whitefly population that was recorded here in comparison to other four centres also indicates that the disease epidemiology has to be regulated right from early season for the suppression of whitefly build up. The disease could be appropriately managed in case there is an effective planning to contain the vector population in the crop under normal conditions.

Yet another dimension that emerged in Pathological observations was of the incidence of Parawilt at Ludhiana in almost all entries due to abnormal climatic conditions.

Conclusions:

It is concluded that amongst the sixteen Bt hybrids under evaluation during this season RCH Bt hybrids and MRC.6029 are promising due to their better fibre property and seed cotton yield in addition adaptation at all trial locations.

The data needs confirmation from the next year's evaluation for meaningful conclusions.

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