ANNUAL REPORT-2014-15

COTTON RESEARCH STATION, VEHARI

WEATHER (2014)

Average data for temperature, relative humidity and precipitation during the crop season is as under:-

Month	Temperature (^{0}c)		Mean Relative Humidity (%)		Rain Fall (mm)
	Mean Maximum	Mean Minimum	8AM	4PM	
January	17.38	4.32	86.83	48.77	Nil
February	19.0	5.42	86.39	48.9	2.0
March	22.29	10.06	84.019	43.41	9.0
April	31.56	17.76	73.16	36.21	2.0
May	39.90	24.54	55.61	34.64	30.0
June	44.71	30.14	36.85	23.57	Nil
July	39.77	29.06	53.0	37.5	39.0
August	37.8	28.4	56.62	39.1	8.0
Sep	36.7	28.17	67.7	41.2	31.0
Oct	34.39	24.75	76.29	45.0	9.0
Nov	28.8	18.2	84.1	42.0	NIL
Dec	18.87	5.61	85.51	47.96	Nil
Total					

1. BREEDING PHASE

1.1 MAINTENANCE AND ENRICHMENT OF GENEPOOL

175 local and exotic genotypes were maintained at CRS, Vehari during 2014-15. Data were recorded for CLCuV intensity and other parameters also. All the entries showed CLCuV symptoms but the intensity varied.

The rating of the genotypes was done according to the follower scale:-

Table 1.1 Characters of gene pool entries along with their range

Character	Range
Plant Yield (g)	40 – 375
Plant Height (cm)	45 – 220
No. of Bolls/Plant	5 – 150
Boll weight (g)	2.0 - 6.0
CLCuV infection (Rating)	0 – 4
No. of Monopodial Branches	0 – 5
No. of Sympodial Branches	4 – 42
Nodes to first fruiting branch	4 – 10
Leaf Shape	Okra – Broad
Leaf size	Small – Large
GOT %	30 – 50
Staple Length (mm)	22 – 33
Fiber Fineness (µg/inch)	3.6 – 6
Fiber Strength (g/tex)	27-34

List of gene pool entries given as Annexure-1

1.2 STUDY OF FILIAL GENERATIONS

The following F_1 to F_6 filial generations were studied in breeding area of Cotton Research Station, Vehari during the year 2014-15. Selection was done keeping in view yield performance, CLCv incidence and fiber quality traits.

Table 1.2 BREEDING MATERIAL STUDIED DURING THE YEAR 2013-14

Sr. No.	Generations	Crosses	
		Entries Studied	Crosses/PSS Selected
1	F_1	60	62 Crosses
2	F_2	58	135 plants
3	F_3	170	139 plants
4	F_4	18	18 families

5	F_5	14	14 families
6	F_6	8	6 families in PYT

2. EVALUATION PHASE

1.1 PRELIMINARY YIELD TRIALS

Preliminary Yield Trials were conducted for yield tests of the superior lines that have gone through the process of selection following Pedigree method. These lines were selected from filial generations keeping in view several improved features like disease resistance, better yield performance in diverse conditions, insect resistance and quality traits. During 2014-15, 16 lines were evaluated for their yield performance against the check MNH-886 in two trials. Several lines performed better than check variety not only in terms of yield but also with respect to CLCuV and fiber traits. The variety which showed comparative edge in Preliminary Yield Trials during 2014-15 is VH-363 (2620 Kg/ha) over check MNH-886 (1747 Kg/ha). The summarized results are given in Table 2.1.

Table 2.3 SUMMARIZED YIELD RESULTS OF PRELIMINARY YIELD TRIALS DURING THE YEAR 2013-14

TRIAL	STRAINS / VARIETIES	YIELD (kg/ha)	CLCuV % age
PYT-1	VH-338	1061.6	100.0
	VH-341	862.5	100.0
	VH-343	1267.8	100.0
	VH-344	1383.7	100.0
	VH-349	935.5	100.0
	VH-359	1568.8	100.0
	VH-360	1397.4	100.0
	VH-361	742.8	100.0
	MNH-886 (Std)	1615.1	100.0
	LSD(0.05)	**391.22**	
PYT-2	VH-351	679.4	100.0
	VH-354	1346.6	86.9
	VH-355	136.6	100.0
	VH-362	644.6	100.0
	VH-363	2620.3	75.0
	VH-364	467.5	100.0
	VH-365	500.9	85.7
	VH-366	1054.3	92.5
	MNH-886 (Std)	1747.6	84.1
	LSD(0.05)	**482.73**	

1.2 ADVANCED YIELD TRIALS

The advanced Yield Trials were conducted at the station during 2014-15 to check the performance of previously selected lines from Preliminary Yield Trials. Various promising lines were included in the trials. The results of Advanced Yield Trials indicated superiority of several lines over check variety. In AYT VH-305 (1757Kg/ha), VH-327 (2028kg/ha) and VH-357 (1948Kg/ha) yielded higher than MNH-886 (1651Kg/ha) and FH-142 (1659kg/ha). Among these lines, some may be recommended for Provincial and National trials for further testing. Summarized results are given in.

Table 2.2 SUMMARIZED YIELD RESULTS OF ADVANCED YIELD TRIALS DURING THE YEAR 2013-14

TRIAL	STRAINS / VARIETIES	YIELD (Kg/ha)	Av Dis severity	Disease Index
AYT	VH-305	1757	1.0	28.2
	VH-311	1152	1.1	25.9
	VH-319	1137	1.3	29.9
	VH-324	988	1.3	30.8
	VH-326	592	1.3	31.3

	VH-327	2028	1.0	23.7
	VH-335	1347	1.1	26.6
	VH-340	1113	1.4	34.5
	VH-348	1947	1.7	40.3
	VH-356	1046	1.1	21.6
	VH-357	1948	1.1	23.0
	VH-358	1556	1.4	26.8
	FH-142	1659	1.2	27.9
	VH-259	1659	1.5	33.4
	LSD (0.05)	**601.43**		

3. EVALUATION OF OUT STATION RESEARCH TRIALS

2.3 PROVINCIAL COORDINATED COTTON TRIALS

The Provincial Coordinated Cotton Trial (PCCT) comprised several genotypes from various research centers of Punjab. Thirty entries (29 lines + one check MNH-886) were tested in PCCT set A, twelve entries (11 lines + one check MNH-886) in set b, four entries of Non Bt. in set C and four entries of desi cotton were studied during 2014-15. Among new varieties developed at Cotton Research Station, Vehari included in PCCT were VH-305 and VH-327. The results of trial are given below:-

Table 2.3 SUMMARIZED SEED COTTON YIELD RESULTS OF ENTRIES INCLUDED IN PCCT DURING THE YEAR 2013-14
PCCT(Bt) SET-A

SR. No.	Variety	PCCT Code	Yield (kg/ha)	CLCuV %
18	VH-327	PC-18	3031.8	100
17	MNH-992	PC-17	2985.7	98.8
1	AGC-999	PC-1	2834.6	97.1
28	CIM-616	PC-28	2746.2	91.7
2	BS-52	PC-2	2500	95
11	FH-326	PC-11	2493.6	100
22	BH-185	PC-22	2483.5	94.8
15	AGC-NAZIR	PC-15	2308.3	108.6
5	IUB-2013	PC-5	2291.9	98.7
12	FH-142	PC-12	2217.3	98.9
27	FH-312	PC-27	2153.1	100
19	MNH-988	PC-19	2096.8	98.6
20	NIAB-878B	PC-20	2080.6	100
9	FH-LALAZAR	PC-9	2063	91.8
21	FH-NOOR	PC-21	2045.1	97.7
25	MNH-886	PC-25	2032.7	98.5
23	AGC-501	PC-23	2010.7	98.6
3	CYTO-177	PC-3	1957.6	98.7
30	AA-926	PC-30	1885.1	97.3
14	IUB-63	PC-14	1799	95.7
13	NIAB-878B	PC-13	1781.6	97.3
10	VH-305	PC-10	1618.1	100
8	BH-184	PC-8	1488.8	100

7	SLH-8	PC-7	1388	98.5
16	IR-NIBGE-6	PC-16	1228.1	100
24	IR-NIBGE-7	PC-24	1216.5	96.7
4	RH-647	PC-4	1202.7	100
6	AA-919	PC-6	953.7	100
29	IUB-75	PC-29	739.1	98
26	NIAB-Bt-2	PC-26	536	97.6

LSD(0.05)= 668.0

PCCT(Bt) SET-B

SR. No.	Varieties	PCCT Code	Yield (kg/ha)	CLCuV %
10	SAHARA-133	PC-10	2587	91.3
1	CRYSTAL	PC-1	2464.7	95.1
8	MNH-886	PC-8	2249.2	93.6
4	FH-142	PC-4	2211.9	94
6	EAGLE-1	PC-6	2140	89.6
5	SAHARA-120	PC-5	1976.9	84.2
3	AL-SEEMI H-209	PC-3	1935.8	95.7
11	NIAB-414	PC-11	1458.3	84.7
7	S-14	PC-7	988.6	97.1
2	S-13	PC-2	864.5	100
12	TARZEN-4	PC-12	593.8	100
9	GS-433	PC-9	410.8	100

LSD (0.05): 277.34

PCCT (Non Bt)

SR.NO.	Varieties	PCCT Code	Yield (kg/ha)	CLCuV %
2	FH-942	V-2	2446.7	100
1	MNH-994	V-1	1885.4	95.8
3	BH-177	V-3	1242.3	100
4	RH-650	V-4	1202.1	100

LSD (0.05): 620.19 Unreliable results due to fault in HVI system

PCCT Desi Cotton

SR. NO.	Varieties	PCCT Code	Yield (kg/ha)
4	FDH-502	V-4	3983
2	FDH-512	V-2	3842
1	FDH-228	V-1	3796
3	FDH-170	V-3	3760

LSD (0.05)= 2720.9

2.4 NATIONAL COORDINATED VARIETAL TRIAL (NCVT A&B)

National Coordinated Varietal Trials are governed by Pakistan Central Cotton Committee (PCCC), which receives the delinted cotton seed from public sector Research Institutes all over the country and from interested

private sector organizations. PCCC codes of the candidate strains and send seed to different Research Station for evaluation. Cotton Research Station, Vehari also received the seed of 37 coded strains in two sets (A & B) with their sowing plan and protocol during the year 2014-15.The strains were sown according to plan and normal agronomic practices were adopted throughout the season. The results of Cotton Research Station, Vehari are given below:-

Table 2.4.1 AVERAGE YIELD KG/HA AND FIBRE TRAITS OF NCVT (SET A)

Rank	Code	Varieties Name	Source	Av. Yield Kg/ha	CLCuV %age
1.	A-9	TH-120	ARI, Tandojam	2252	99.5
2.	A-8	DNH-40	CRS, DI. Khan	2030	99.4
3.	A-11	CIM-620	CCRI, Multan	2017	61.9
4.	A-4	MPS-27	CRS, M Khas	1763	98.7
5.	A-3	BH-177	CRS, Bahawalpur	1648	99.7
6.	A-12	AA-132	Ali Akbar Group	1386	97.9
7.	A-7	CIM-573*	CCRI, Multan	1372	98.9
8.	A-10	IUB-75	IUB, Bahawalpur	1261	100
9.	A-6	NIAB-414	NIAB, FSD	1218	99.7
10.	A-1	CRIS-533	CCRI, Sakrand	1213	99
11.	A-5	CRIS-585	CCRI, Sakrand	1184	100
12.	A-13	GS-433	Gohar Seeds	573	100
13.	A-2	TH-112/05	ARI, Tandojam	136	100

LSD (0.05)= 352.16

Table 2.4.2 AVERAGE YIELD KG/HA AND FIBRE TRAITS OF NCVT (SET B)

Rank	Code	Varieties Name	Source	Av. Yield (kg/ha)	CLCuV %age
1.	B-18	VH-327	CRS, Vehari	3332	80.4
2.	B-4	FH-Lalazar	CRI, Faisalabad	3108	71.6
3.	B-13	CEMB-77	CEMB Lahore	2767	93.9
4.	B-20	Baghdadi	CRS, Ghotki	2726	93.2
5.	B-11	CEMB-66	CEMB-Lahore	2458	97.3
6.	B-9	MNH-988	CRS, Multan	2256	95.5
7.	B-7	SLH-8	CRS, Sahiwal	2226	97.3
8.	B-6	VH-305	CRS, Vehari	2224	98.5
9.	B-10	CIM-616	CCRI, Multan	2209	89.5
10.	B-1	FH-142*	CRI, FSD	2165	96.3
11.	B-15	Cyto-178	CCRI, Multan	2130	96.5
12.	B-2	IUB-13	IUB, Bhawalpur	2082	92.9
13.	B-8	BH-184	CRS, Bahawalpur	2040	96.6
14.	B-19	NIAB-874B	NIAB, FSD	1993	93.8
15.	B-16	BH-185	CRS, Bahawalpur	1987	92.7
16.	B-5	Cyto-177	CCRI, Multan	1888	98.8
17.	B-17	FH-Noor	CRI, FSD	1861	90.7
18.	B-24	IUB-63	IUB, Bahawalpur	1763	99
19.	B-14	IR-NIBGE-7	NIBGE, FSD	1440	98.8
20.	B-3	IR-NIBGE-6	NIBGE, FSD	1436	96.9
21.	B-22	TH-21/9	ARI, Tandojam	1385	97.7
22.	B-23	CIM-602*	CCRI, Multan	1296	96.4
23.	B-12	CIM-622	CCRI, Multan	1282	82
24.	B-21	RH-647	CRI, RY Khan	893	94

LSD (0.05) =642

* Check Variety

3 AGRONOMIC PHASE

3.1 VARIETAL BEHAVIOUR UNDER DIFFERENT SOWING DATES

After various testing procedures, estimation of appropriate sowing time for a particular variety is necessary. In this trial three new strains namely VH-305, VH-319 and VH-327 were tested on 8 different sowing dates i.e. **16-02-2013 to 01-06-2013** with an interval of 15 days. The yield data of the trial is given below:-

Table 3.1.1 RESULTS OF VARIETAL BEHAVIOR UNDER DIFFERENT SOWING DATES

S. No.	Sowing Dates	Yield (Kg)/ha		
		VH-305	VH-319	VH-327
1.	D1 (16 February)	2752	2396	2662
2.	D2 (1 March)	1862	1820	2890
3.	D3 (16 March)	2311	2293	3520
4.	D4 (1 April)	1623	1539	2836
5.	D5 (16 April)	1961	1760	1746
6.	D6 (1 May)	495	786	822
7.	D7 (16 May)	393	572	564
8.	D8 (1 June)	350	342	342
Average		**1468**	**1439**	**1923**

LSD (0.05)= 837.52

VH-305 and VH-319 performed better during early sowing dates whereas, VH-327 gave highest yield in normal sowing.

3.2 PLANT SPACING EFFECT ON SEED COTTON YIELD

Depending upon the growth habit of the cotton plant, it is necessary to optimize the plant to plant and row to row planting distance of different varieties. In this trial, two new strains namely VH-305 and VH-327 were tested at 4 different plant to plant spacing's i.e. 15 cm, 30 cm, 45 cm and 60 cm. The yield data of trial is given below:-

Table 3.2.1 PLANT SPACING EFFECT ON SEED COTTON YIELD

Treatment	Yield (kg/ha)		CLCuV %age	
	VH-327	VH-305	VH-327	VH-305
T_1 (15 cm)	3402.55	2810.44	100	100
T_2 (30 cm)	2802.79	2158.66	100	99.0
T_3 (45 cm)	3070.08	2194.30	97	100
T_4 (60 cm)	2803.39	1665.58	96.6	98.5

LSD (0.05) 628.15

3.3 EFFECT OF BT GENE AND SOWING TIME ON COTTON SEED GERMINATION PERCENTAGE AND YIELD

Table 4.2.2 EFFECT OF BT GENE AND SOWING TIME ON GERMINATION PERCENTAGE AND YIELD

Sr. No.	Variety	Germination %age		Yield (kg/ha)	
		SET-A(16-4-2013)	SET-B(16-5-2014)	SET-A	SET-B)
1	VH-289 (Non Bt)	32	43	2363	1082
2	VH-300 (Non Bt)	51	56	1573	835
3	VH-303 (Bt)	35	41	2582	1153
4	VH-306 (Bt)	40	44	2725	752
5	MNH-886 (Bt)	31	40	1451	379

All the varieties showed significant results in March sowing as compared to May showing that all these verities are suitable for early sowing.

3.4 FACILITATING TESTING OF OUT STATION GERMPLASM AGAINST CLCUV

As Vehari is considered to be a hot spot for CLCUV and thus the most suitable place for the screening of Cotton genotypes against CLCUV, therefore the Station provides facilitation to other cotton research organizations in

testing/screening of their advanced lines at Vehari. During 2014-15, facilitation to test 2296 genotypes from different organizations was provided. The detail is as under:-

Table 3.4 DETAIL OF COTTON LINES TESTED DURING 2013-14

R&D ORGANIZATION	No. of entries
USDA Material	650
Cotton Research Institute, Faisalabad	12
IAGS, Punjab University, Lahore	08
Entomological Research Institute, Faisalabad	46
NIBGE, Faisalabad	1479
CRS, Multan	5
CEMB	96
TOTAL	2296

4 GREEN HOUSE STUDIES

4.1 Crosses

Fifty two single crosses were sown in pots as F_1 material in green house conditions at cotton research station Vehari during Nov, 2014-15. Kanamycin sulphate (1%) was applied on 5 days leaves of hybrids to check BT gene expression. As a result of kanamycin application data was collected after 7 days of treatment, it showed that 37 out of 52 hybrids were transgenic and rest were Non-Bt. Picked seed cotton of 76 hybrids was ginned and sown in field to get succeeding generations F2. Some phenotypic markers i-e, naked seed, petal spot, profusely hairy leaf, Red stem, green cotton seed, purple spot with purple petal were separately identified and marked for further studies.

Table 4.1.1 CROSS REFERENCE CHART OF SINGLE CROSSES IN GREEN HOUSE DURING DEC, 2014.

Cross No.	Female	Male	Cross No.	Female	Male
C-1	M-6	BTS-3	C-27	1044/13	FH-142
C-2	M-7	BTS-3	C-28	1017/13	FH-142
C-3	M-8	BTS-3	C-29	PCCT-1(NON BT/2013)	FH-142
C-4	M-9	FH-930	C-30	FH-LALAZAR	FH-142
C-5	VH-282	FH-930	C-31	VH-311	VH-327
C-6	VRS-BIG BOLL	VH-326	C-32	USDA-1140(2013)	(F2) NO.2
C-7	KZ-181	VH-326	C-33	USDA-1140(2013)	(F2) NO.6
C-8	GN-2085	VH-326	C-34	VRS-1	FH-930
C-9	VH-319	FH-LALAZAR	C-35	FH-LALAZAR	VH-252
C-10	VH-324	LALAZAR	C-36	VH-305	PCCT-1/13(NON BT)
C-11	MNH-886	LALAZAR	C-37	VH-303	PCCT-1/13(NON BT)
C-12	LALAZAR	1001/13	C-38	BT-370	(F2) NO.11
C-13	LALAZAR	1017/13	C-39	VH-319	PCCT-1/13(NON BT)
C-14	LALAZAR	1044/13	C-40	FH-142	PCCT-1/13(NON BT)
C-15	1035/13	LALAZAR	C-41	VH-311	VH-327
C-16	OKRA	LALAZAR	C-42	LALAZAR	(F4) 2088/11
C-17	1035/13	VH-319	C-43	4074/P3(F6)	PCCT-1/13(NON BT)
C-18	VH-260	VH-319	C-44	LALAZAR	PCCT-1/13(NON BT)
C-19	FH-114	VH-319	C-45	VH-319	OKRA/FR
C-20	1027/13	VH-319	C-46	VH-259	DS-1
C-21	VR-1	VH-311	C-47	4074/P3	VH-356
C-22	DS-1	FH-142	C-48	6028/13	M-9
C-23	FH-114	FH-142	C-49	USDA-1140/13	ST
C-24	1035/13	FH-142	C-50	USDA-1066	VH-319
C-25	VH-311	FH-142	C-51	(SSH×H7)	VH-319
C-26	LALAZAR	FH-142	C-52	VH-305	VH-319

- Crosses Attempted in pots: 52
- No. of F_1s sown: 40
- Detection of F_2s for Bt gene: 37

- Stem propagations of USDA Material: 23
- Confirmation of CLCuV Resistance by Grafting: 23

4.2 EFFECT OF FOLIAR APPLICATION OF PLANT HORMONES ON BOLL RETENTION, AV. BOLL WEIGHT, CLCUV INCIDENCE AND SEED COTTON YIELD

Two sprays were done at squaring and peak flowering at 30 days interval to study the impact of different plant hormones on the incidence of Cotton Leaf Curl Virus Disease, fruit retention and yield components in cotton.

Table 4.2 EFFECT OF FOLIAR APPLICATION OF PLANT HORMONES

So. No	Treatments	PGRs with dose	Av. yield (Kg/ha)	Av boll wt.	Boll retention %age	GOT	CLCuV %age
1	**T1**	**Cytokinin @10ml/a**	**3154**	**3.8 g**	**72**	**38.6**	**46**
2	**T2**	**Auxin @ 15ml/a**	**2586**	**3.4 g**	**64.5**	**38**	**56**
3	**T3**	**Cytokinin+Auxin @15ml/a**	**2168**	**3.3 g**	**55.7**	**38**	**67**
4	**T4**	**Control**	**1973**	**3.1 g**	**50.2**	**39.1**	**89**
		LSD (0.05)	**475.35**				

Cytokinins showed a significant effect in improving plant yield and quality traits.

4.3 Gene Pyramiding Block

To create genetic variability and get favorable variants double, crossing was done in F1 germplasm. These crosses contain some local and exotic germplasm (USDA-germplasm) with unique characters and phenotypic markers. The distinct markers found and utilized in double crossing are okra leaves, green seed, big boll size, naked seed, petal spot, profusely hairy, Red stem, green cotton seed, purple spot with purple petal. The 69 double crosses will be sown during June, 2015 to achieve succeeding generations. Some important double crosses with phenotypic markers are given in the table below.

Table 4.3 SOME IMPORTANT F1, F2 AND DOUBLE CROSSES MADE UNDER GREEN HOUSE CONDITIONS

Generation	Cross #	Total Plants	Avg. Bolls per Plant	CLCuV free plants (%)	Boll Wt (g)		
					Min	Max	AV
F_1	1035	10	41	27.2	1.40	6.00	2.85
	1038	9	53.6	71.4	1.14	2.46	1.71
F_2	2034	19	10.5	-	1.55	2.80	1.83
	2035	10	29.8	27.7	2.28	6.66	3.03
	2041	9	11	-	1.20	2.85	2.34
	2043	2	7	75	1.25	1.33	0.78
Double Crosses	DC-16	1	70	0	-	2.00	2.00
	DC-30	5	28.6	0	1.85	3.32	2.67
	DC-42	7	42	0	1.18	2.55	1.78
	DC-43	6	17.5	0	0.72	2.82	2.20
	DC-44	14	16.6	0	1.77	3.42	3.20
	DC-48	18	12.7	0	1.5	4	2.50
	DC-49	6	12.3	50	0.83	7	2.89
	DC-50	4	9	0	1.50	2.51	2.17
	DC-51	8	26.5	0	1.00	3.10	2.28
	DC-52	5	11	0	2.00	3.10	2.24
	DC-56	3	30.7	0	2.50	4.00	2.86
	DC-64	10	15.1	9	2.00	5.00	3.38
	DC-66	1	11	0	-	2	2.00

5. DEVELOPMENTAL PROJECTS

5.1 PARB PROJECT NO. 191

One project titled "Genetic Improvement of Cotton for Herbicide and Bollworms Tolerance" approved by PARB is being run in collaboration with Centre of Excellence in Molecular Biology (CEMB), Lahore. The total Project cost is Rs. 17.195 million for 5 years. Transgenic cotton tolerant to bollworms and glyphosate herbicide through incorporation of CEMB Bt (Cry1AC & Cry2A) and Gt gene in VH-281, VH-289, VH-290 and MNH-786 will be developed. Seed of above varieties have been supplied to CEMB for transformation. Field evaluation of these transgenic varieties containing CEMB Bt and Gt gene was done at Cotton Research Station, Vehari during coming year. CEMB supplied seed of transformed version of VH-281, VH-289, VH-290 and MNH-786 varieties to CRS Vehari for Evaluation against Glyphosat tolerance in coded form. The results are given below

Results after 1st Spray: Data was taken after 10 days.

- Dose: 1900 ml/acre
- Total transformed Entries = 75
- Totally damaged entries = 32
- Entries un-effected = 43 (Transformed and Non transformed)
- Effect on Control = No effect of weedicide
- In non-Transformed = 2-4 plants/12 plants per entry unaffected
- All the weeds in the field were killed.

Results after 2nd spray: Data was taken after 35 days.

- Dose: 2000 ml/acre
- Unaffected entries =22/43 (14 transgenic+ 08 Control)
- Entries damaged =21/43 (Transgenic+ Control

Table 5.1 PERCENTAGE OF PLANT SHOWING GLYPHOSATE TOLERANCE IN SELECTED 22 ENTRIES.

Sr. No.	Sample #	%age of tolerant plants	%age of tolerant plants
1	21/14	after 1st Spray	after 2nd Spray
2	Control	53.8	53.8
3	21/15	56.2	43.7
4	21/16	75.0	58.3
5	21/17	55.0	18.1
6	21/18	44.4	22.2
7	19/1	83.3	66.6
8	Control	80.0	60.0
9	19/2	62.5	62.5
10	Control	45.4	27.2
11	19/3	75.0	66.6
12	Control	42.9	42.9
13	19/4	100.0	90.0
14	Control	11.7	23.5
15	19/6	57.1	100
16	19/7	66.6	100
17	Control	66.6	26.6
18	19/8	92.3	84.6
19	Control	50.0	37.5
20	19/9	75.0	66.6
21	19/10	50.0	25.0
22	Control	50.0	15.0

5.2 ICARDA`s PAK-US COTTON PRODUCTIVITY ENHANCEMENT PROJECT

200 Ratoon and 600 new Tetrapoid and 50 Diploid entries were evaluated. None of the diploid entries showed CLCuV symptoms and 33 tetraploid entries showed CLCuV resistance but only 5 produced flowers but no boll formation.

Table 5.2Summary of plant mapping data of USDA Material 2014

S. No	PARAMETER	NO. OF OBS.	MAX	MIN	AV.
1	Seeds planted/hole	600 Set-N	7	02	4.218
2	No. of seeds germinated/hole	600	6	01	3.59
3	Germination %age	600	100	50	87
4	Plant Pop/plot	600	26	2	15
5	Plants in zero rating scale	1011	24	00	2
6	Plants in 1 rating scale	787	17	00	1.32
7	Plants in 2 rating scale	1090	19	00	1.82
8	Plants in 3 rating scale	2988	20	00	5.01
9	Plants in 4 rating scale	3362	26	00	5.653
10	Disease percentage	600	100	00	90
11	Av. Disease severity	600	4.00	00	2.89
12	Disease index	600	100	00	70.25
13	Resistant Entries	600	33	--	--
14	Resistant & Flowering	33	5	-	-
15	Highly Tolerant	600	74	--	--
16	Tolerant	600	192	--	--
17	Susceptible	600	198	-	-
18	Highly Susceptible	600	102		
19	Entries Missing	600	1		

6 ENTOMOLGICAL PHASE

6.1 EFFECT OF DUSKY COTTON BUG ON SEED COTTON YIELD, QUALITY TRAITS AND SEED GERMINATION %

Experiment was conducted to investigate the effect of Dusky Cotton Bug on yield and yield components, fiber quality, oil contents and seed germination in cotton.

Table 6.1EFFECT OF DUSKY COTTON BUG ON SEED COTTON YIELD, QUALITY TRAITS AND SEED GERMINATION %

Varieties	Yield per plant (g)		Seed Index		GOT %		Av No of Bolls		Avg Boll Wt (g)		Seed Germ %	
	Uncov	Cov	Uncov	Cov	Uncov	cov	uncov	cov	Uncov	Cov	Uncov	Cov
VH-305	72	34	7.7	9.43	42.27	38.07	28.27	10.33	2.56	3.02	64.67	86.67
VH-327	118.3	30.6	6.73	8.5	35.58	32.84	51.47	8.83	2.31	3.27	51.33	84.00
FH-142	83	33.3	7.75	8.6	40.57	38.26	31.53	11.83	2.64	3.08	56.67	86.00

There were significant differences in in the varieties regarding seed index, average boll weight and seed germination (%) of covered plant.