

## COMPERATIVE EVALUATION OF LOCAL BT AND NON BT COTTON AGAINST EXOTIC BT VARIETIES FOR COTTON LEAF CURL VIRUS DISEASE

<sup>1</sup>Inam-ul-Haq, <sup>1</sup>Mumtaz Hussain, <sup>2</sup>Noor-ul-Islam, and <sup>3</sup>S. Sarwar Alam

<sup>1</sup>Plant pathology Research Institute, Faisalabad

<sup>2</sup>Ayub Agricultural Research Institute, Faisalabad

<sup>3</sup>Nuclear Institute for Agriculture and Biology, Faisalabad.

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### ABSTRACT

Eight Elite advanced Non Bt(NBt) and six local Bt varieties planted at Faisalabad, Multan and Khanewal were evaluated for their response to cotton leaf curl virus (CLCuV) disease. SLH-284, BH-167 and GS-1, NBt cotton varieties showed resistance with 5%, 10% and 15% disease incidence respectively, whereas MG-6 and ARS-802 were tolerant with 20% and 25% disease infection. NBt, CRSM-38 and NIAB-777 and Bt hybrid FH-113 had disease range between 40% to 45%. Rest of the test entries were highly susceptible. Twenty four exotic Bt cotton hybrids of Monsanto were noticed with serious CLCuV disease infection ranging between 90-100% at Sahiwal, Khanewal and Vehari and 88% to 100% at Bahawalpur. The yield performance of exotic Bt hybrids was quite low showing stunting of plants with minimum numbers of bolls. Among all these hybrids CM-496 had maximum number of big bolls. It was obvious that local cotton varieties and Bt hybrid had highly significant edge over exotic hybrids with respect to intensity of disease and yield performance.

**Key words:** cotton, Cotton Leaf Curl Virus, disease incidence, seed cotton yield.

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### INTRODUCTION

Cotton is a main crop of subtropical and temperate regions of the world including Pakistan. It is the backbone of national economy as it accounts for major share of total foreign exchange earning. It furnishes raw material to 503 textile mills, 1135 ginneries and over 5000 oil expelling units and employment to millions of skilled and non skilled manpower. Moreover it has 85% share in total vegetable oil production in the country (Mehmood and Tahir, 2001). Cotton production of the country is low and stuck up at around 12-14 million bales whereas the consumption of the local textile industry is about 15 million bales (Mansoor, 2009).

There are several constrains involved in cotton production among which leaf curl virus is the major factor causing heavy losses to cotton crops. Yield losses found in tolerant varieties were about 50% and yield reduction were 85-90% in the susceptible varieties (Anonymous, 1993; Rehmat, 1995). The virus disease transmitted by whitefly is highly devastating and predominant on all cultivars in the cotton belt. Both the virus and whitefly vector have wide range of hosts posing serious threat to cotton productions.

A new strain of cotton leaf curl virus emerged in 2001-02 at Burewala District Vehari, Pakistan designated as CLCuD-Burewala complex. It is a destructive resistance breaking strain of CLCuV (Akhtar and Khan 2009). Several distinct variants, CLCuV-PakI, CLCuV-PakII, CLCuV-PakIII and CLCuV-PakIV were found in cotton areas of Pakistan (Zhou *et al*, 1998). There is no difference in symptoms of Burewala strain and the older strain of CLCuV disease. However Burewala strain can produce severe disease symptoms with shorter period of time against all previously available germplasm resistant to old strains. In recent years, a number of new cotton varieties/hybrids have been introduced and some of these are extremely susceptible to CLCuV that helps in rapidly built up of inoculums under commercial cultivation. There is a big room for search of better cultivars for cotton improvements in Pakistan (Pathan *et al*, 2009).

Breeding and screening for high yielding resistance cotton cultivars is the most appropriate and durable strategy to secure the crop from huge economic losses by CLCuD disease. Comparative studies of local cotton non Bt and Bt materials against exotic Bt hybrids for resistance/tolerance potential to CLCuV disease in hot spots of different agro ecological areas is therefore imperative and is under taken in the present paper.

### MATERIALS AND METHODS

Cotton advanced NBt elite lines: NIAB-824, NIAB-777, SLH-284, BH-167, GS-1, CIM-496, CRSM-38 and CIM-554 and five local Bt varieties: FH-113, MG-6, ASR-802, CEMB-1 and CEMB-II were planted on beds in May 2008 at Faisalabad, Khanewal and Multan. The data were recorded on visual observations of characteristic symptoms for CLCuV disease incidence during spot examination on 29-10-08 and 30-10-2009. Similarly, Twenty four Bt cotton hybrids of Monsanto (Boll Guard) were sown in June, 2008 at Sahiwal, Khanewal, Bahawalpur and

Vehari in three replications and data for disease incidence were recorded at dense fruiting stage on 15<sup>th</sup> and 16<sup>th</sup> of September, 2008 in the presence of scientists of Monsanto companies. The characteristic symptoms of small vein thickening to severe vein thickening, leaf curling, stunting and enation were kept under focus as described in disease scale (Akhtar and Khan, 2009). In the exotic Bt hybrids, severally infected plants were observed with reduced nodal length, curled leaf and flowers with spirally twisted leaf petioles and fruiting branches. The leaves from upper, middle and lower portion of the plants in each genotypes were deeply examined for assessment of disease incidence. A total number of leaves and disease leaves per plant were counted.

## RESULTS AND DISCUSSION

The cotton hybrid FH-113 had 60% and NIAB-777 exhibited 65% disease incidence on 3 grade intensity on new growth stage at Faisalabad, while NIAB-824 was found with 75% disease incidence at four grade stage. CRSM-38 and SLH-284 were noticed with lowest infection (5%) at Khanewal on first grade intensity followed by BH-167 with 10% and GS-1 15% disease incidence. Two local Bt varieties MG-6 and ASR-82 were having 20 and 25% disease incidence respectively. These results were in support to Pathan *et al.* (2009) who reported that local variety Bt 802 was tolerant. The local Bt hybrid FH-113 had abundant number of bolls with 40% disease incidence. The local Bt variety was found with higher yield potential on account of more number of open and closed bolls at this stage. The advance line CRSM-38 was observed with 50% infection at three grade intensity. The variety had more than six open bolls with early maturing habits. The findings were found in close agreement to Alam *et al.* (2009) who reported that some candidate varieties that were not resistant to disease produced very good yield even in the presence of the disease.

Bt hybrids CEMB-1 and CEMBII and CIM-55 were observed with highest disease incidence (90%) at Multan. CEMB-II and CIM-55 had enation and were rated under grade 5. However three local NBT cotton varieties (SLH-284, BH-167 and GS-1) showed resistance to CLCuD. The level of resistance in these varieties suggested that good efforts are under the programme to combat the threat of CLCuV disease. The approval of these varieties for commercial cultivation may increase substantial cotton yield in Pakistan.

**Table 1.** Cotton leaf curl virus disease incidence on local bt, nbt varieties and exotic hybrids at three locations.

Sr. No.	Location	Variety/hybrids	type	Date of sowing	Plant height	CLCuV disease (%)		Reaction
						incidence	intensity	
1	Faisalabad	FH-113	Bt	15-03-08	T	60(new growth)	3	S
2	"	NIAB-824	NBt	13-05-08	M	75	4	S
3	"	NIAB-777	NBt	15-05-08	M	65	3	S
4	Khanewal	MG-6	Bt	23-05-08	T	20	2	MR
5	"	ASR-802	Bt	23-05-08	T	25	2	MR
6	"	NIAB777	NBt	21-05-08	M	60	3	S
7	"	SLH-284	NBt	21-05-08	M	5	1	R
8	"	BH-167	NBt	21-05-08	M	10	1	MR
9	"	GS-1	NBt	22-05-08	M	15	1	MR
10	"	CIM-496	NBt	21-05-08	M	60	4	S
11	"	CRSM-38	NBt	22-05-08	M	5	1	R
12	"	FH-113	Bt	24-05-08	T	40	3	S
13	Multan	CEMB-1	Bt	27-05-08	V.P	90	5	HS
14	"	CEMB-II	Bt	27-05-08	V.P	90	5E	HS
15	"	CIM-554	NBt	17-05-08	M	90	5E	HS
16	"	CRSM-38	NBt	20-05-08	M	50	3	S

T: Tall; M: Medium; V.P: Variant Plants; E: Enation; S: Susceptible, MR: Moderate resistant; R: Resistant; HS: Highly susceptible

MG-6 hybrid and variety ARS-802 turned out to be tolerant followed by NBT variety SRS-38 and Bt hybrid FIH-113 and NBT NIAB-777. Rest of the test entries showed trend of susceptibility towards the disease, also reported by Akhtar *et al.* (2007) that substantial differences between genotypes are found for disease index under field conditions. Twenty four exotic hybrids at Sahiwal were found with intensive disease incidence ranging from

90-100%. Most of the hybrids were found with the least number of bolls per plant (1-5) The hybrid P07H0023 had 95% disease infection having more number of bolls per plants. None of the 24 hybrids at Khanewal exhibited resistance/tolerance with 91-100% infection. Only four hybrids (4, 8, 16 and 17) bore more than 7 bolls. While at Bahawalpur these hybrids were found to have serious disease incidence within the range of 88-100%. Only hybrid Hybrid No1 was at five grade of disease severity and rest were at 6 degree intensity. Only two hybrids No1 and No.23 had large number of bolls per plants. Seventeen hybrids at Vehari were found with 100% disease incidence indicating this side as hot spot for screening. Only three hybrids No.1, 4 and 23 had moderate number of bolls per plants. The higher disease infections in exotic hybrids may be due to their late sowing in these hot spots areas as chance of disease escape are meager in delayed plantings. All 24 hybrids in three replications showed similar higher magnitude of infection. These results are supported by the observation of Alam *et al.* (2009) who reported that most of the replicates were having relative disease score within their replicates and this prove that the pathogen had uniform chances of spread in the field.

**Table 2.** CLCuV disease incidence on bt cotton hybrids (monsanto) under four hot spot localities.

Genotypes	Sahiwal		Khanewal		Bahawalpur		Vehari	
	Incidence (%)	Grade	Incidence (%)	Grade	Incidence (%)	Grade	Incidence (%)	Grade
PO7H001	98	6	97	6E	80	5	90	5
PO7H002	96	6	100	6E	98	6	100	6
PO7H003	94	6	95	6E	95	6E	100	6E
PO7H004	92	6E	96	6	100	6	100	6
PO7H005	95	6	93	6	97	6	100	6
PO7H006	97	6E	100	6	95	6E	100	6
PO7H007	96	6	100	6E	94	6E	99	5
PO7H008	97	6	100	6E	96	6	98	6E
PO7H009	95	6	96	6E	100	6E	100	6
PO7H0010	94	6	100	6E	91	6	98	6
PO7H0011	96	6	100	6	94	6	98	6E
PO7H0012	93	6	91	6E	95	6	100	6
PO7H0013	100	6E	95	6	90	6	99	6
PO7H0014	95	6	93	6E	100	6	100	6E
PO7H0015	93	6	100	6	95	6	100	6
PO7H0016	100	6E	95	6	90	6	100	6
PO7H0017	100	6E	97	6	95	6E	100	6
PO7H0018	96	6	98	6	100	6E	100	6E
PO7H0019	94	6	96	6	94	6	100	6
PO7H0020	90	6E	100	6E	96	6E	100	6
PO7H0021	97	6	94	6	100	6	100	6E
PO7H0022	94	6	97	6E	97	6	100	6
PO7H0023	95	6	93	6	90	6	100	6
PO7H0024	100	6E	100	6E	95	6E	98	6E

The comparison of local varieties and hybrids with exotic cotton hybrids depicted the fact that local ones were superior to the exotic cotton hybrids on the basis of infection magnitude and yield performance. These findings were confirmed by those of Pathan *et al.* (2009) that the Chinese cultivar 149-1 was found with 90-95% susceptible against CLCuV disease.

It is plausible that the cotton cultivar should be sown repeatedly to let them acclimatize and proper time of sowing under the different agro-climatic conditions. These definitely exists sufficient scope for screening all the available cotton genotypes for resistance/tolerance and yield improvement in cotton.

Thus it is quite imperative that further multi aspect studies must be carried out to identify new sound sources of resistance from wild host and different cotton species operative against all strains of CLCuV disease.

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