Studies on tolerance level of advanced cotton strains to insects pest complex

By

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Abstract

An experiment was conducted to assess the relative resistance of different advance cotton strains viz. CRIS-129, CRIS-477, CRIS-486 along with a commercial check variety, CRIS-134 against sucking insect pests, i.e., thrips, jassids, whitefly and Bollworms under unsprayed condition during 2008 and 2009. The results revealed that maximum pest population of sucking insect pests and bollworm damage was found on advance strain CRIS-129 followed by CRIS-477, CRIS-486 and CRIS-134, whereas, lowest seed cotton yield 1734^{-ha} kg per hectare was obtained from CRIS-486 while highest (2332^{-ha}) from CRIS-134. However, advance strains CRIS-477, CRIS-486 and commercial variety CRIS-134 were remained moderate in degree of resistance against cotton insect pest complex during 2008. Similarly, during 2009 maximum pest population of sucking pests and bollworm damage was recorded on CRIS-129 followed by CRIS-486 and CRIS-134 and CRIS-477. The maximum seed cotton yield was also recorded in CRIS-134 (1944 kg^{-ha}) followed by CRIS-477 (1853 kg^{-ha}),CRIS-486 (1734 kg^{-ha}) and CRIS-129 (1614 kg^{-ha}).

Key words: Cotton strains, Insect pests, resistance, yield

Introduction

Cotton is an important cash crop and a lifeline of Pakistan's textile industry. It accounts for 8.2% of the value added in agriculture and 2.0% of Pakistan's GDP. Textiles account for about 55% of Pakistan's foreign exchange earnings. Millions of farmers are directly associated with the cultivation, harvest, and sale of cotton. Cotton production supports Pakistan's largest industrial sector, comprised of over 400 textile mills, 1,000 ginneries, and 300 oil expellers. Pakistan's cotton yield have been stagnant for the last several years. Factors responsible for this include: lack of availability of quality seeds, late wheat harvesting results in delayed cotton planting, excessive rains at the time of sowing, high temperatures at flowering stage, incidence of Cotton leaf curl virus, pest attack and

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improper use of biotech seeds by farmers in the major cotton growing areas of Punjab and Sindh (Bilal, 2011). The low yield per unit area could be due to the non-availability of qualitative seed, and unawareness about the latest cotton production technology among the farmers. However, the crop is handicapped to insect pests, which cause 15 to 20 % losses to seed cotton yield (Zahidullah, 1992). Plant protection plays a crucial role in the successful production of crops. In this regard, pesticides have contributed to dramatic increase in crops yield. However, increasing use of pesticides has contributed to number of major pesticides related disasters. The pesticides consumption has risen many folds during the last two decades. It is fact that about 80% of these pesticides are being used on cotton crop. In many areas, misuse of pesticides and their impact have been observed as pesticide residues in food chain, disappearance of wildlife, reappearance of secondary pests and pest resistance development are dreadful realities. Resistance develops when insects are constantly subjected to application of same insecticide (Mallah, 2007).

Cotton is attacked by a number of insect pests almost in all cotton producing countries and due to its economic importance much attention has been given on its pest control. At present the researchers and growers heavily depend on the pesticide use to get higher seed cotton yield and quality lint. Indiscriminate use of pesticides has brought many problems like resistance, resurgence and emergence of new pests as well as environmental pollution (Soomro *et al*, 2001). Damage due to insect pests has lead to decreased yield and profit (Diwakar, 2004). It is affected by increasing population of sucking and chewing insect pests. Among these pink bollworm, spotted bollworm, American bollworm, armyworm, whitefly, jassid, mealybug, thrips and aphid are very harmful pests. There are several characteristics both in wild and cultivated species of cotton, often collectively called "defence umbrella" that repel insects. These traits include hairiness of leaves, absence of nectars, reddish colour of the stem and leaf, okra type leaves and gossypol (Mursal, 1994). Different studies depicted that hairs on the surface of plant are not liked by insects (Alexander *et al.*, 2004).

The use of resistant varieties reduce the need for inspection of sucking pests. IRM aims to eradicate the application of early insecticide sprays in order to build a good ecosystem essential for bollworm control. The choice of insecticides used is based on their selectivity and use of alternative strategy. The aim is to eliminate farmers' dependence on experts by training them to be managers of pests, predators and parasitoids (Russell, *et al*. 2004).

Materials and Methods

The present study was conducted at Central Cotton Research Institute Sakrand, during 2008 and 2009 to determine relative resistance of different advance cotton strains against insect pests of cotton. Three promising newly developed cotton strains viz: CRIS-129, CRIS-477 and CRIS-486 along with a commercial variety CRIS-134 were sown on 1st May during each successive year. Layout of the experiment was Randomized Complete Block Design (RCBD) with three replications and 30 x 30 plot size. All agronomic practices

i.e., thinning, weeding, inter culturing, fertilizer and irrigation were applied according to the need of crop, as and when required during both years from sowing up to harvesting. The population of sucking insect pests i.e., thrips, jassid and whitefly per leaf was recorded in the morning during 7.00am to 9.00am at weekly intervals from June to September. Twenty leaves were randomly selected from 20 plants from each plot. For recording bollworm specially spotted bollworm damage, four stick samples (measuring (52, 52 each) taking 209// thus making 1/1000 of an acre were taken weekly from each treatment during August to October. A total healthy and damaged fruiting part i.e., square, buds, flowers and bolls were counted and damage percentage was calculated. The data obtained were analyzed statistically and means compared by using Duncan's New Multiple Range Test and LSD by COSTAT software.

Results and Discussion

Mean population of Cotton insect pests was recorded on weekly interval on four different strains of Cotton throughout the experimental period and results are displayed in Table-1 and 2. Among, sucking insect pests, jassid population remained above threshold level whereas thrips and whitefly were below economic threshold level during 2008. The data showed that all varieties were susceptible to jassid. The results showed that the maximum average population of jassid per leaf (1.17) recorded on CRIS-129, followed by CRIS-477 (1.05), CRIS-486 (1.02) and CRIS-134 (0.95). The results showed that all strains were tolerant to thrips and whitefly infestation. The highest per leaf thrips number were observed on CRIS-129 (3085) followed by others which were statistically non significant with each others. Whitefly population was also low on all the strains and differences between the treatments were non significant. However, its maximum average per leaf population (0.87) was recorded on CRIS-129, followed by CRIS-134 (0.30), CRIS-486 (0.28) and CRIS-477 (0.26).

Results obtained during 2009 showed that all varieties were tolerant to whitefly attack and differences between the treatments were non significant. The results showed that the maximum average per leaf population of whitefly (0.53) was recorded on CRIS-477 and CRIS-486 followed by CRIS-134 (0.52) CRIS-129 (0.27). The results indicated that all strains performed better against the attack of thrips. The maximum average population of thrip per leaf (3.08) was recorded on CRIS-129 followed by others which were statistically non significant with each other. The maximum average population per leaf of jassid (1.29) was recorded on CRIS-129, followed by CRIS-134 (0.8), CRIS-486 (0.80) and CRIS-477(0.73). The strains were partially tolerant against jassid. The results of 2008 showed that all the newly advanced strains were susceptible to bollworms (Table-1). The maximum bollworm damage (5.63%) was recorded on CRIS-129 followed by CRIS-477(5.11%), CRIS-134 (4.72%) and CRIS-486 (4.67%). Similarly, the data of 2009 indicate that all the newly advanced strains were susceptible to bollworms (Table 2). The maximum damage of bollworm (5.42%) was recorded on CRIS-129, followed by CRIS-486(3.65%), CRIS-477(3.60%) and CRIS-134(3.57%). The results were agreed with the Pathan *et al.* (2007)

who evaluated six varieties against sucking pests and bollworm complex and mentioned that CRIS-467 was highly susceptible against jassid and bollworm. Leghari, *et al.* (2001) reported that potentially on new CRIS varieties, different characters showed some tolerance against sucking as well as bollworm pest complex. The data (Table-1) revealed that all advance strains gave lower yield per hectare as compared to commercial variety CRIS-134. The maximum yield per hectare (2332) was obtained from CRIS-134, followed by CRIS-477 (1794 kg), CRIS-486 (1734 kg) and CRIS-129 (1750 kg). Similarly, the data (Table-2) showed that maximum yield per hectare was obtained from CRIS-134 (1944 kg), followed by CRIS-477 (1853 kg), CRIS-486 (1734 kg) and CRIS-129 (1614 kg). The Present study agrees with the Soomro, *et al.* (2001), who reported that jassid population was above economic injury level and highest seed cotton yield 4555 kg per hectare was recorded in CRIS-134.

Table -1 Mean population of sucking pests and bollworm damage percent on cotton strains in un-sprayed condition during 2008.

Strains/varieties	Average per leaf pest population/damage%				Seed Cotton
	Thrips	jassids	whitefly	Bollworm damage	yield/ kg^{-hac}\
CRIS-129	3.85	1.17	0.87	5.63	1750
CRIS-477	3.05	1.05	0.26	5.11	1794
CRIS-486	3.42	1.02	0.28	4.67	1734
CRIS-134 (standard)	3.06	0.95	0.30	4.72	2332
LSD	**0.53**	**NS**	**NS**	**NS**	**203.07**

Table -2 Mean population of sucking pests and bollworm damage percent on cotton strains in un-sprayed condition during 2009.

Strains/varieties	Average per leaf pest population/damage%				Seed Cotton
	Thrips	jassids	whitefly	Bollworm damage	yield/ kg^{-hac}\
CRIS-129	3.08	1.29	0.27	5.42	1614
CRIS-477	1.47	0.73	0.53	3.60	1853
CRIS-486	1.58	0.80	0.53	3.65	1734
CRIS-134 (standard)	1.59	0.81	0.52	3.57	1944
LSD	**0.40**	**0.08**	**NS**	**1.05**	**69.78**

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Particulars of Bt cotton varieties approved by "Punjab Seed Council" for cultivation in Punjab, Pakistan

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Sr.	Year of approval	Denomination	OPV* /Hybrid	Breeder (Institute/Station/Company)	Sector	Status of approval	Event (Gene)	Status of cultivation
1	2010	IR-NIBGE-3701	OPV	National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad.	Public	Approved	MON-531 (cry1Ac)	Under cultivation
2		Ali Akbar-703	OPV	M/s Ali Akbar Seeds, Multan	Private	Approved	MON-531 (cry1Ac)	Under cultivation
3		MG-6	OPV	M/s Nawab Gurmani Foundation, Kot Adu	Private	Approved	MON-531 (cry1Ac)	Under cultivation
4		Sitara-008	OPV	M/s Agri Farm Services, Multan	Private	Approved	MON-531 (cry1Ac)	Under cultivation
5		IR-NIBGE-1524	OPV	NIBGE, Faisalabad	Private	Approved	MON-531 (cry1Ac)	Under cultivation
6		Ali Akbar-802	OPV	M/s Ali Akbar Seeds, Multan	Private	Approved	MON-531 (cry1Ac)	Under cultivation
7		NS-121	OPV	M/s Neelum Seeds, Jahanian, Vehari	Private	Approved	MON-531 (cry1Ac)	Under cultivation
8		GN-2085	Hybrid	M/s Guard Agricultural Research Services, Lahore	Private	Two year Approval	Fusion gene (cry1Ac and cry1 Ab)/GFM event	

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** OPV (open pollinated Variety)*

9	2012	Tarzan-1	OPV	M/s Four Brothers, Multan	Private	Approved	MON-531 (cry1Ac)	Under cultivation
10		MNH-886	OPV	Cotton Research Station (CRS), Multan	Public		MON-531 (cry1Ac)	
11		NS-141	OPV	M/s Neelum Seeds, Jahanian, Vehari	Private		MON-531 (cry1Ac)	
12		IR-NIBGE-3	OPV	NIBGE, Faisalabad	Public		MON-531 (cry1Ac)	
13		FH-114	OPV	Cotton Research Institute (CRI), Faisalabad	Public		MON-531 (cry1Ac)	
14		Sitara-009	OPV	M/s Agri Farm Services, Multan	Private	Approved	MON-531 (cry1Ac)	Under cultivation
15		A-One	OPV	M/s Wheal Ag Corporation, Multan	Private		MON-531 (cry1Ac)	
16		CIM-598	OPV	Central Cotton Research Institute (CCRI), Multan	Public		MON-531 (cry1Ac)	
17		VH-259	OPV	Cotton Research Station (CRS), Vehari	Public	Approved	MON-531 (cry1Ac)	Under cultivation
18		BH-178	OPV	Cotton Research Station (CRS), Bahawalpur	Public		MON-531 (cry1Ac)	Under cultivation
19		CIM-599	OPV	Central Cotton Research Institute (CCRI), Multan	Public		MON-531 (cry1Ac)	Under cultivation
20		CIM-602	OPV	Central Cotton Research Institute (CCRI), Multan	Public		MON-531 (cry1Ac)	Under cultivation
21		FH-118	OPV	Cotton Research Institute (CRI), Faisalabad	Public		MON-531 (cry1Ac)	Under cultivation

22		FH-142	OPV	Cotton Research Institute (CRI), Faisalabad	Public		MON-531 (cry1Ac)	Under cultivation
23		IUB-222	OPV	Islamia University, Bahawalpur	Public		MON-531 (cry1Ac)	Under cultivation
24		CEMB-33	OPV	Center of Excellence in Molecular Biology (CEMB), University of Punjab, Lahore	Public		MON-531 (cry1Ac)	Under cultivation
25		Sayban-201	OPV	M/s Auriga Seed, Lahore	Private		MON-531 (cry1Ac)	Under cultivation
26		Sitara-11M	OPV	M/s Agri Farm Services, Multan	Private		MON-531 (cry1Ac)	Under cultivation
27		A-555	OPV	M/s Wheal AG, Multan	Private		MON-531 (cry1Ac)	Under cultivation
28		KZ-181	OPV	M/s Kanzo Seeds, Multan	Private		MON-531 (cry1Ac)	Under cultivation
29		Tarzan-II	OPV	M/s Four Brothers Seeds, Multan	Private		MON-531 (cry1Ac)	Under cultivation
30		CA-12	OPV	M/s Ali Akbar Seeds, Lahore	Private		MON-531 (cry1Ac)	Under cultivation
31		IR-NIAB-824	OPV	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad	Public		MON-531 (cry1Ac)	Under cultivation
32	2014	Various	OPVs=38 Private=2 Total=40	Various	Public=23 Private=17 Total=40		MON-531 (cry1Ac)	Under trial for apporval