

ECONOMIC YIELD, FIBER TRAIT AND SUCKING INSECT PEST INCIDENCE ON ADVANCED GENOTYPES OF COTTON IN PAKISTAN

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ABSTRACT. To evaluate resistance against sucking insect pest of cotton 16 cultivars were used along with their economic yield and fiber traits. Population of jassid, whitefly and thrips was recorded by using leaf turn method, yield of seed cotton was determined by hand harvesting method, while qualitative fiber properties were measured through high volume instrumentation (HVI) method. Best yield performance and staple length was of FH-158 (4000 kg/ha) (28.1 mm), respectively. Cotton cultivar FH-172 showed resistance toward jassid and thrips but FH-158 showed resistance against jassid. Thus these resistance cultivars along with other cultivars possessing resistance against insect pest should be explored. Additional research should identify the part of one pest species on the yield and fiber quality of cotton by managing other pest species to define better management strategies.

Key words: Productivity; Whitefly; Jassid; Thrips; HVI; Seed cotton; Textile industry.

INTRODUCTION

Cotton is an extensively studied crop and is the chief source of natural fiber worldwide (Riaz *et al.*, 2013). In Pakistan, it is main cash crop and lifeline of the textile industry. To meet increasing fiber demands the sufficient production of cotton for ever increasing world's population is now universally realized (Farooq *et al.*, 2013). Productivity as well as the quality of the agricultural commodities is affected by both biotic and abiotic stresses of the environment. Among biotic stresses insect pest are responsible for huge crop losses. Estimates on potential and actual losses due to insect pest for wheat and cotton varied from about 50% and 80%, respectively (Oerke, 2006). For the control of insect pests farmers rely on the use of chemical

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control (Arif *et al.*, 2007), leading to resistance in the insects, ecological contamination and imbalance between biotic fauna in agroecosystem (Ahmad and Khan, 1991; Hamburg and Guest 1997; Soerjani, 1998). Thus an integrated pest management program that uses biocontrol agents (Shahid *et al.*, 2007), cultural control especially host plant resistance, with judicious use of insecticides, is needed for sustainable management of arthropod pests (Hallett *et al.*, 2009).

Host plant resistance is an effective tool for controlling insect pest and is the key component of integrated pest management, because it enables plants to avoid tolerate or recover from the effects of insect pest attack (Painter, 1951; Tingey, 1986; Pedigo, 1996). The practical application of insect pest control via host plant resistance is increasing day by day especially due to food safety concerns of World Trade Organization (Al Chaabi, 2000). With the introduction of transgenic varieties of different crops, incidence of lepidopterous pests has been controlled now problem is of sucking insect pest attack on cotton (Kranthi *et al.*, 2005). Therefore the present studies were carried out to evaluate resistance in cotton varieties against sucking insect pest, yield potential and fiber properties of transgenic germplasm in Pakistan.

MATERIAL AND METHODS

In order to evaluate the comparative yield, fiber quality and insect pest incidence on transgenic cultivars of

cotton, 16 genotypes were cultivated as normal sowing date during the month of May at Cotton Research Institute Faisalabad. Tested genotypes consisted of FH-4243, FH-169, FH-200, FH-154, FH-158, FH-164, FH-153, FH-165, FH-197, FH-157, FH-191, FH-172, GN-31, FH-181, FH-114 and FH-184. All recommended cultural practices were adopted through out the cotton growing season. The plant inspection method for sampling was used and the populations of whitefly, jassid and thrips were recorded early in the morning at weekly interval from 20 leaves of 20 plants selected randomly. The sampling was done in such a way that the 1st leaf from upper portion of the 1st plant, the 2nd leaf from middle portion of the 2nd plant and the 3rd leaf from bottom portion of the 3rd plant and so on (Amjad and Aheer, 2007).

Determination of yield components

The yield of seed cotton from all the tested cultivars was determined by hand harvesting method for the total yield comparison of each cultivar. Seed cotton subsamples (200 g) from each cultivar were ginned with a 12-saw laboratory gin to determine the lint percentage and lint weight. Qualitative fiber properties were measured using the high volume instrumentation (HVI) method (Sasser, 1981). Analysis of variance was carried out using the methods described by Gomez and Gomez (1984).

RESULTS

Results revealed that seed cotton yield of the tested cultivars ranged from 2500 kg/ha to 4000 kg/ha. Best yield performance (4000 kg/ha) was of FH-158, followed by FH-184, whereas minimum yield was of FH-169. All the remaining cultivars

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showed intermediate behavior for seed cotton yield (Fig. 1).

Fiber quality results showed that staple length of tested cotton material was in the range of 26.8 to 28.1mm. Good staple length was of FH-157, FH-158 and FH-191 i.e. 28.1, but FH-

169 had the shortest staple size (26.8). Staple fineness of the cotton tested cultivars ranged from 3.5 to 4.5 $\mu\text{g}/\text{inch}$. FH-154 had good fineness i.e. 3.5 $\mu\text{g}/\text{inch}$, as compared with FH-191 with fineness (4.5 $\mu\text{g}/\text{inch}$) (Fig. 2).

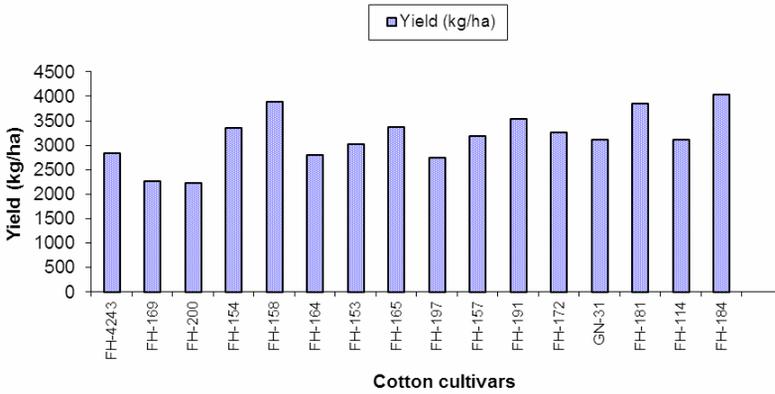


Figure 1 - Graphical presentation regarding yield of tested cotton cultivars

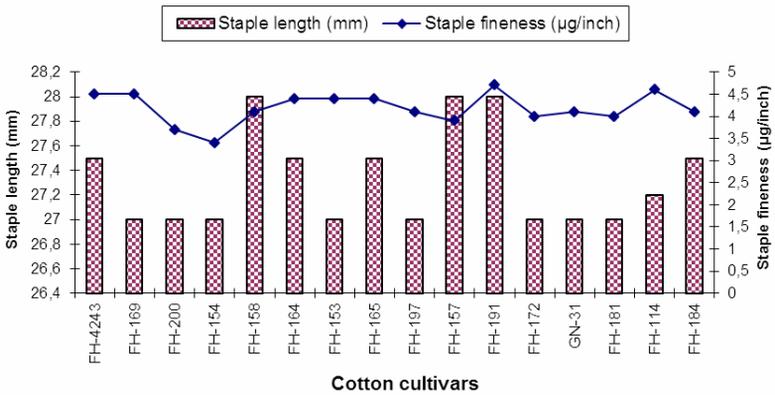


Figure 2 - Graphical presentation regarding fiber quality traits of tested cotton cultivars

Table - 1 Mean population of sucking insect pest on tested cultivars of cotton

Varieties	Whitefly	Thrips	Jassid
FH-4243	6.00	5.33	1.15
FH-169	5.23	3.43	1.55
FH-200	4.76	4.30	0.53
FH-154	5.33	6.40	1.26
FH-158	4.26	3.73	0.85
FH-164	6.63	4.93	0.63
FH-153	5.26	6.36	0.92
FH-165	5.33	4.83	0.73
FH-197	7.66	6.30	1.23
FH-157	6.56	6.20	1.45
FH-191	6.56	4.30	1.19
FH-172	4.66	2.96	0.40
GN-31	4.86	5.30	1.30
FH-181	5.56	5.96	1.53
FH-114	6.00	5.33	1.15
FH-184	6.13	4.43	1.48
LSD	3.25	2.54	0.47

Cotton cultivars played a significant role on the population of sucking insect pest of cotton. Maximum cotton whitefly (7.66/leaf) occurred on FH-197, but minimum population (4.26/leaf) on FH-158. White fly population 6.00 to 7.66 was recorded on FH-4243, FH-154, FH-164, FH-197, FH-157, FH-191, FH-114 and FH-184 thus showed susceptible response toward whitefly, whereas population range from 4.26 to 5.99/ leaf was recorded on FH-169, FH-200, FH-158, FH-153, FH-165, FH-172, GN-31 and FH-181, therefore showed resistance against whitefly. Seasonal mean population of jassid per leaf ranged from 0.4 to 1.53/leaf. Cotton cultivars FH-169

and FH-181 were most susceptible against jassid attack, but FH-172 exhibited resistance against jassid with minimum population (0.4/leaf). All the other tested cultivars showed intermediate response against jassid. Thrips population fluctuation among the tested cultivars ranged from 2.96 to 6.40/leaf. Cotton cultivar FH-172 showed maximum resistance against thrips (2.96/leaf), followed by FH-169, FH-158, as compared with FH-154 with (6.40 thrips/leaf) (*Table 1*).

DISCUSSION

Screening germplasm against insect pest complex and to identify good quality is crucial for increasing

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productivity and quality of the agricultural produce. This paper describes the yield, fiber quality and insect pest incidence on advanced transgenic Bt genotypes of cotton in Pakistan. From a practical standpoint it helps in understanding farmer complaints related to susceptibility of transgenic Bt cotton varieties toward the incidence of sucking insect pests. Cotton cultivar FH-172 showed resistance toward jassid and thrips but FH-158 showed resistance against jassid. Interestingly the economic yield of jassid resistant variety FH-158 surpassed all the other tested genotypes of cotton as compared with whitefly resistant variety FH-172 and thrips resistant variety FH-169. There were clear differences among the sixteen cultivars of transgenic cotton in terms of their fiber properties. Fiber strength results showed that staple length of tested cotton material was in the range of 26.8 to 28.1 mm. Good staple length was of FH-157, FH-158 and FH-191, i.e. 28.1 mm, possessing relative resistance against insect pests. Based on the results of present studies decline in seed cotton yield and staple length of insect pest susceptible than the resistant cultivars may be due these insect pests as reported by Jonathan *et al.* (2006), because sucking insect pests feed on the phloem, affect the photosynthetic activity of the affected plant as a result cause premature defoliation (Wells, 2001).

CONCLUSION

Although transgenic Bt cotton cultivars are resistant to lepidopterous insect pests of cotton, but limited information is available for sucking insect, economic yield and fiber quality parameters. This study was an attempt to better define integrated pest management rules through host plant resistance that is an important component of IPM. Significant decline in seed cotton yield and staple length of insect pest susceptible than the resistant cultivars was due to insect pests. Still there is need to evaluate the individual cotton pest affecting the yield and fiber quality of cotton in order to define better management strategies against that specific arthropod pest.

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