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# Evaluation of twelve genotypes against bacterial blight of cotton under field conditions

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**ABSTRACT**

The present experiment was performed to evaluate the cotton germplasm against bacterial blight of cotton under field conditions. For this purpose, nine Bt, (Bt Ali Akbar 802, Bt-FH 177, Bt-FH 182, Bt-NIBGE 2, Bt-CM 615, Bt-CRS 2007, Bt-CM 616, Bt-FH169, Bt-IUB 222,) and 3 non Bt, (Sindh 1, CRIS134 and CIM 573) varieties of cotton were used. The screening trial was conducted for two years under field conditions. six varieties showed moderately resistant response i.e. Bt-CM 615, Bt-CRS 2007, Bt-CM 616, Bt-IUB 222, Non Bt-Sindh 1 and Bt-FH 177 with disease rating 4. Three varieties (Bt-Ali Akbar 802, Non Bt-CIM 573 and Bt-NIBGI 2) expressed moderately susceptible response with rating 5. Two varieties (Bt-FH 182 and Bt-FH 169) showed susceptible response with disease rating 6 while Non Bt- CRIS 134 expressed highly susceptible response with disease rating 7.

**Key words:** cotton, bacterial blight

## Introduction

Bacterial blight of cotton is one of the most destructive diseases that causes considerable yield losses in rainy season (Delannoy *et al.,* 2005). *Xanthomonas axonopodis* pv *malvacearum* is a pathogen of bacterial blight of cotton which requires high humidity for proliferation and spread (Voloudakis *et al.,* 2006). This disease was generally present in subtropical and temperate region of the world. The extensive dissemination of pathogen and high variability made its control more difficult (Kamal and Naim, 1983). The bacterium could survive in the field on debris of previously harvested crops and its initial inoculum was seed borne (Mohan, 1983). The bacterium attaches to the cotton leaf surface, enters leaves through open stomata or wounds and develops symptoms in susceptible plants. It also stimulates a hypersensitive reaction (HR) in resistant plants in which necrosis, desiccation and tissues collapse occur within two days (Delannoy *et al*., 2005). It also caused defoliation, stem blighting, black arm, girdling, weakened stem breaking and boll shedding. It can reduce the quality of cotton from lint staining resulting in yield losses (Verma, 1986). Moreover, damage of stem and boll tissues occurred which gradually produce brown necrotic, angular, waxy and water-soaked lesions on the leaf surfaces and these lesions were named as seedling blight, angular leaf spot, vein blight; black arm lesion and boll rot (Hillocks, 1992). The first symptom appears as minute water soaked lesions (dull-green flaccid lesions) and then spread on the bottom of the young leaves (Verma, 1986). As the lesion size increase (about 4 mm in diameter in a susceptible cultivar), it turned into brown to black necrosis forming angular dead areas surrounded by chlorotic halos, or reddish or purplish ones (Innes, 1983). Bacterial blight of cotton causes 26- 30% yield losses in different cotton growing areas of the world (Chattannavar *et al*., 2006). It was assumed that yield losses generally reached from 10 to 30% in Asian countries. In African countries they were recorded up to 50% (Bayles & Verhalen, 2007). Search for source of resistance against bacterial blight disease of cotton was preliminary objective for management of this disease. As the development of resistant variety takes many years, so the screening of available germplasm of cotton to search out resistant cultivar of cotton was the short-term solution. Singh *et al.,* (2007) performed an experiment to find out the sources of resistance, 40 varieties were screened against *Xam* under natural conditions none of those were found free

from *Xam*. Six varieties were resistant, ten moderately susceptible and twenty-four were found to be susceptible. In view of above observations, the present project was planned with the following objectives:

- To identify the source of resistance against bacterial blight of cotton.

**Materials and methods**

Nine Bt varieties, (Bt Ali Akbar 802, Bt-FH 177, Bt-FH 182, Bt-NIBGE 2, Bt-CM 615, Bt-CRS 2007, Bt-CM 616, Bt-FH169, Bt-IUB 222,) and 3 Non Bt, (Sindh 1, CRIS134 and CIM 573) of cotton were collected (on the basis of their good agronomic traits) from Central Cotton Research Institute Multan (CCRI), Department of Plant Breeding and Genetics, University of Agriculture Faisalabad and Ayyub Agriculture Research Institute Faisalabad (AARI). Disease screening nursery was established in the experimental research Area 24.5×7 m, Department of Plant Pathology, University of Agriculture Faisalabad for two years 2017 and 2018 to find out source of resistance against bacterial blight disease of cotton. Seeds of above mentioned verities were neither treated with chemical nor given acid delinting to increase chances of primary infection of the disease. Sowing was done by using dibbler method (Islam *et al.,* 2001). Seeds of all varieties were sown with 30 cm plant to plant (P×P) and 75cm row to row (R×R) distance under randomized complete block design (RCBD) with three replications. No spreader was sown either around the field or between the lines. All the agronomic practices including recommended dose of fertilizers and irrigation schedule were followed to keep the crop in good condition. Data regarding disease incidence was collected on weekly basis by using (Brinkerhoff scale, 1977).

While disease incidence was calculated by using following formula.

$$\text{Disease incidence (\%)} = \frac{\text{No. of infected plants}}{\text{Total No. of plants}} \times 100$$

**Results**

**Evaluation of cotton germplasm against bacterial blight under field conditions in 2017**

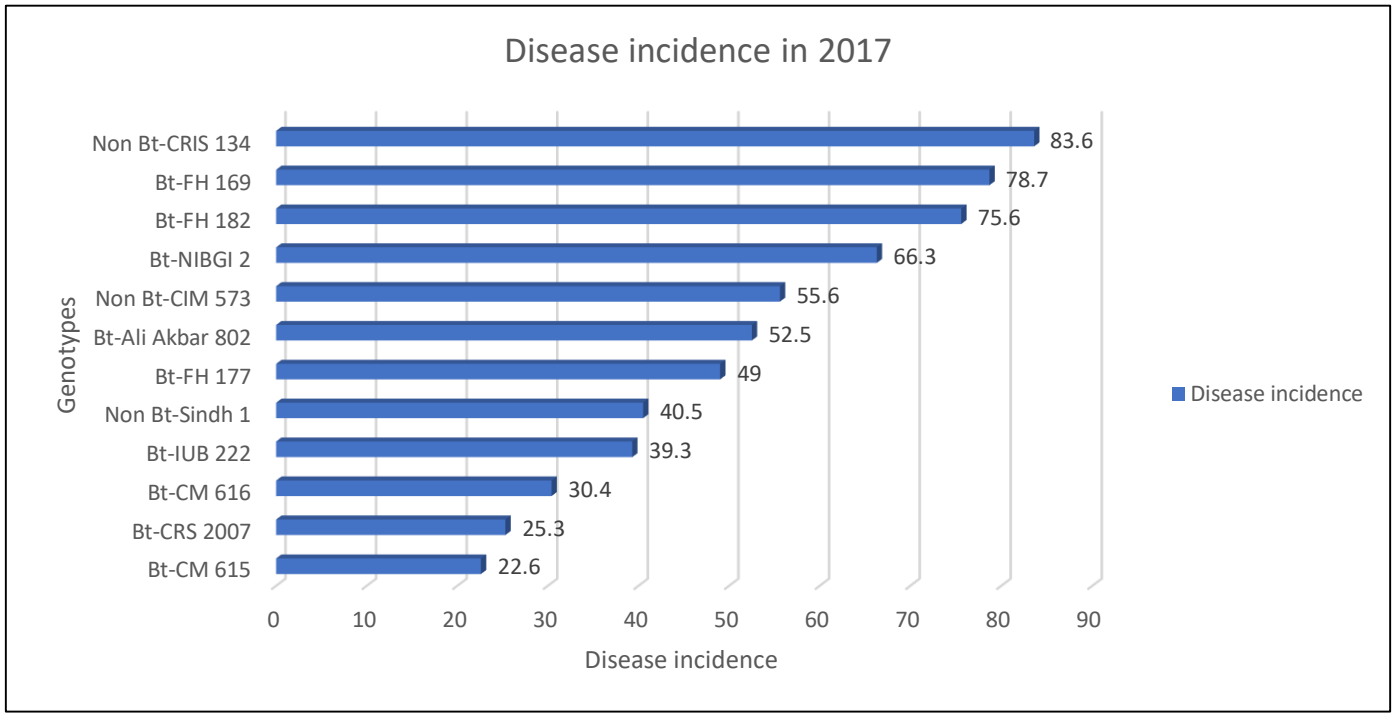
Twelve varieties were evaluated against bacterial blight of cotton for two years under field conditions. During, 2017 six varieties showed moderately resistant response i.e. Bt-CM 615(22.60), Bt-CRS 2007(25.30), Bt-CM 616(30.40), Bt-IUB 222 (39.30), Non Bt-Sindh 1(40.50) and Bt-FH 177 with 49% disease incidence (rating.4). Three varieties (Bt-Ali Akbar 802, Non Bt-CIM 573 and Bt-NIBGI 2) expressed moderately susceptible response with 52.50, 55.60 and 66.30% disease incidence with rating 5. Two varieties (Bt-FH 182 and Bt-FH 169) showed susceptible response with 75.60 and 78.70% disease incidence respectively (rating 6) while Non Bt- CRIS 134 expressed highly susceptible response with 83.60% disease incidence with rating 7 (Table.1 & fig.1).

**Table 1. Response of cotton varieties against bacterial blight under field conditions during 2017.**

| Sr.# | Varieties | Disease rating | Disease incidence (%) | Response |
|---|---|---|---|---|
| 1 | BT-CM 615 | 4 | 22.60L | MR |
| 2 | Bt-CRS 2007 | 4 | 25.30K | MR |
| 3 | Bt-CM 616 | 4 | 30.40J | MR |
| 4 | Bt-IUB 222 | 4 | 39.30I | MR |
| 5 | Non Bt-Sindh 1 | 4 | 40.50H | MR |
| 6 | Bt-FH 177 | 4 | 49.00G | MR |
| 7 | Bt-Ali Akbar 802 | 5 | 52.50F | MS |
| 8 | Non Bt-CIM 573 | 5 | 55.60E | MS |
| 9 | Bt-NIBGI 2 | 5 | 66.30D | MS |
| 10 | Bt-FH 182 | 6 | 75.60C | S |
| 11 | Bt-FH 169 | 6 | 78.70B | S |
| 12 | Non Bt-CRIS 134 | 7 | 83.60A | HS |

*Mean values in a column sharing similar letters do not differ significantly as determined by the LSD test ($P \leq 0.05$)

MR = Moderately resistant MS = Moderately susceptible
S = Susceptible HS = Highly susceptible




**Evaluation of cotton germplasm against bacterial blight under field conditions in 2018**

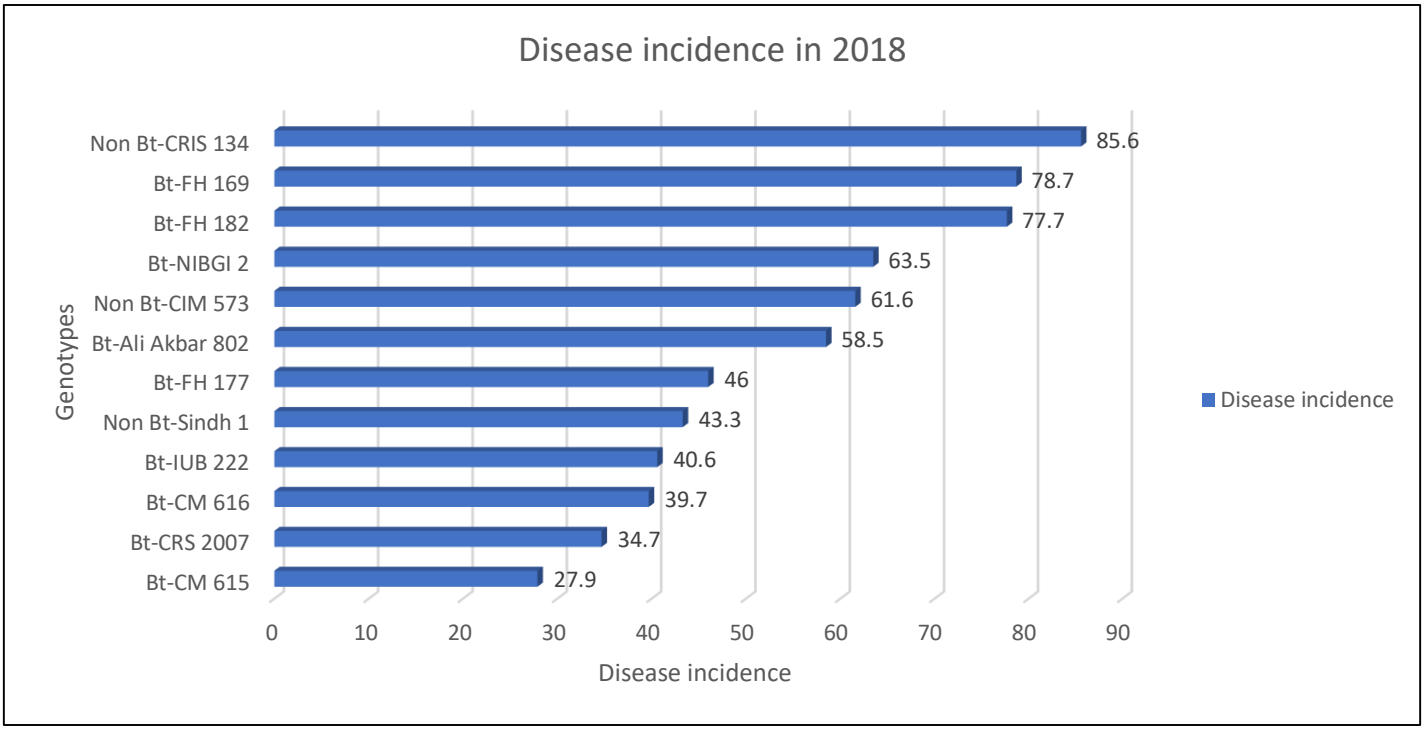
During 2018, two varieties (Bt-FH 169 and Bt-FH 182) showed susceptible response with 77.70 and 78.70 percent disease incidence (rating 6) while Bt-Ali Akbar 802 (58.50), Non Bt-CIM 573 (61.60) and Bt-NIBGI 2 (63.50) expressed moderately susceptible response with disease incidence (rating 5) and Non Bt-CRIS 134 showed highly susceptible response with 85.60 percent disease incidence (rating 7). Six varieties (Bt-CM 616, Bt-CRS 2007, Bt-CM 615, Bt-IUB 222 Non Bt-Sindh 1 and Bt-FH 177 expressed moderately resistant response with 39.70, 34.70, 27.90, 40.60, 43.30 and 46% disease incidence with rating 4. (Table 2 & fig.2).

**Table. 2 Response of cotton varieties against bacterial blight under field conditions during 2018.**

| Sr.# | Varieties/ Lines | Disease rating | Disease incidence (%) | Response |
|---|---|---|---|---|
| 1 | Bt-CM 615 | 4 | 27.90L | MR |
| 2 | Bt-CRS 2007 | 4 | 34.70K | MR |
| 3 | Bt-CM 616 | 4 | 39.70J | MR |
| 4 | Bt-IUB 222 | 4 | 40.60I | MR |
| 5 | Non Bt-Sindh 1 | 4 | 43.30H | MR |
| 6 | Bt-FH 177 | 4 | 46.00G | MR |
| 7 | Bt-Ali Akbar 802 | 5 | 58.50F | MS |
| 8 | Non Bt-CIM 573 | 5 | 61.60E | MS |
| 9 | Bt-NIBGI 2 | 5 | 63.50D | MS |
| 10 | Bt-FH 182 | 6 | 77.70C | S |
| 11 | Bt-FH 169 | 6 | 78.70B | S |
| 12 | Non Bt-CRIS 134 | 7 | 85.60A | HS |

*Mean values in a column sharing similar letters do not differ significantly as determined by the LSD test (P ≤ 0.05)

MR = Moderately resistant MS = Moderately susceptible
S = Susceptible HS = Highly susceptible




**Discussion**

In Pakistan the production of cotton crop is threatened by bacterial blight caused by the *Xam.* The early infection of the pathogen causes heavy losses in yield. It has been reported that the bacterial blight of cotton cause 40-50 percent losses depending upon the infection time and the genotype of the host (Bayles *et al.,* 2007). As the infection of pathogen affects the vegetative portion of plant and the components of yield, therefore *Xam* is responsible for low yield of cotton. Susceptible germplasm of cotton, conducive environmental conditions and presence of virulent pathogen play a major role in the development and spread of epidemics of the bacterial blight of cotton. Under such conditions the use of resistant varieties is only an effective and durable way to protect crop from *Xam.* The development of resistant variety by presenting resistant genes into cotton cultivars is only a single possible solution but it takes long time. So, the screening of available germplasm should be done as it short term and easy method to get resistant varieties. That is why in present study, a lot of twelve varieties was evaluated against bacterial blight of cotton under field conditions for two years (2017 and 2018). During both years 6 varieties expressed moderately resistant response with rating 4, while 3 varieties exhibited moderately susceptible response with rating 5. Two varieties showed susceptible while Non Bt- CRIS 134 expressed highly susceptible response. Similar work was also performed (Singh *et al.,* 2007) and concluded that no variety expressed immune response towards bacterial blight of cotton and the best management strategy to manage disease is use of resistant germplasm. Drishak *et al.,* (2014) screened cotton varieties against bacterial blight by using different inoculation techniques and found that no variety expressed highly resistant response. As the result of present screening, the selected resistant varieties can be further used in breeding program as source of resistance against bacterial blight. If these resistant varieties possess all desirable agronomic characteristics, then these can also be introduced at commercial level.

**Conclusion**

No variety expressed resistant to highly resistant response while few varieties exhibited moderately resistant response towards bacterial blight of cotton. So Moderately resistant cotton varieties should be recommended for farmers with exploitation of their high yielding potential and selection of planting dates is very important.

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