

# SCREENING OF SUGARCANE GENOTYPES AGAINST MAJOR DISEASES AND BORER PESTS

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## ABSTRACT

Genotypes of different maturity groups were evaluated against diseases and borer pests by artificially and natural field condition, respectively at Sugarcane Research Institute, Dr. R.P.C.A.U., Pusa. Inoculation plug method, during 2014-15. Genotypes CoSe 92423, CoSe 95422 and CoSe 11456 showed susceptible and moderately susceptible reaction and remaining genotypes showed resistant to moderately resistant reaction against both the test isolates. In cotton swab method, genotypes CoSe 11455, CoSe 95422 and CoSe 92423 showed susceptible reaction against both the isolates. Whereas, genotype CoSe 11453 and CoSe 11456 were graded as susceptible reaction against CF 07 and resistant reaction against CF 08 isolate. Remaining genotypes were graded as resistant reaction against both the test isolates. Nineteen genotypes showed resistant against smut disease and five genotypes showed resistant against wilt disease. As far as concerned of Shoot borer incidence, all genotypes showed less susceptible reaction. In case of top borer incidence, genotypes CoP 11438, BO 130, CoSe 8436, UP 09453, CoP 11440, BO 91, CoP 9301, CoSe 10452, BO 154 and CoSe 92423 were graded as less susceptible reaction based on 4th brood incidence. Remaining genotypes showed moderately susceptible reaction. However, screening of genotypes for their reaction is only way to overcome the incidence of diseases and borer pests.

## INTRODUCTION

Sugarcane is one of the most important commercial crop in India and it is cultivated in an area of 5.3 million ha, with total production of 346 million tons and it has productivity of 64.7 t/ha. In Bihar, sugarcane is cultivated in 0.3 million ha with total production of 14.9 million tons with an average productivity of 50 t/ha (ISMA, 2015). Cane yield is markedly influenced by several factors of which diseases and insect pests are known to inflict considerable losses in production as well as sugar recovery. Among these factors red rot, smut, wilt diseases, shoot borer and top borer pests are the most destructive factors for reducing the return to the crop. Alone red rot disease causes huge financial losses to farmers by deteriorating the juice quality and the overall production of sugarcane (Natrajan and Muthuswamy, 1981). Arade (2014) reported that red rot of sugarcane caused by *Colletotrichum falcatum* Went. is a serious problem which damaged the most of the important varieties. Many recently released superior varieties have succumbed to epidemics of red rot, and removed from cultivation in different states, (Vishwanathan, 2010). Red rot, wilt and smut diseases cause a loss of 10-25 per cent (Mohanraj et al. 2003) in sugarcane crop world wide amounting a loss of millions of dollars. While, the overall reduction of 36 to 56% due to attack of top borer was determined by Pandey et al. (1997) and the loss in yield due to attack of shoot borer was estimated to 22-33% by Alam et al., 2006. Red rot, wilt, smut diseases, shoot borer and top borer are the regular phenomenon in Bihar to create a problem to the crop. It is difficult to manage through pesticides

application because of the impervious nature of rind, fibrous nodes and their strong concealing habitat of shoot and top borer especially.

In this context, there is a need to continuous evaluation of sugarcane genotypes against red rot, wilt, smut, shoot borer and top borer to manage effectively without harming other biota present in ecosystem and it is most economic method and compatible with other methods of pests and diseases control.

## MATERIALS AND METHODS

The experiment was conducted at Pusa Farm during cropping season of 2014-15 under all India Coordinated Research Project at Sugarcane Research Institute, Dr. R. P. C. A. U., Pusa to assess the genotypes for their reaction against red rot, smut, wilt, shoot borer and top borer. Altogether 25 genotypes were evaluated in three replications. The plot size was of 6 meter row per genotype in each replication with recommended agronomical practices under Bihar condition. The plot was kept free from pesticide application. Twenty five canes of each genotype were artificially inoculated by adopting plug and nodal cotton swab methods of inoculation (Srinivasan and Bhat, 1961 and P. Padmanabhan, 2012).

In plug method, inoculation was done in the middle of the third exposed internode from the bottom, a borehole was punctured with the help of inoculator in seven month old cane and seven day old culture of CF 07 and CF 08 was injected separately into the hole and sealed immediately with

wax coated papers. After 60 days of inoculation, canes were splits opened longitudinally and scored as per the international scale (0-9) (Srinivasan and Bhat, 1961). The observations were made on the basis of condition tops, nodal transgression, lesion width and nature of white spots noted in case of each isolate.

The value of all the symptoms are added and the red rot score on 0-9 scale is arrived.

0-9 disease rating scale for red rot resistance

Score on the 0-9 scale	Reaction Category
0.0-2.0	Resistant (R)
2.1-4.0	Moderately resistant (MR)
4.1-6.0	Moderately susceptible (MS)
6.1-8.0	Susceptible (S)
Above 8.0	Highly susceptible (HS)

In case of nodal cotton swab method, five canes were inoculated by removing leaf sheath (top most green) and immediately placed cotton swab dipped in red rot suspension around of the exposed nodes. After inoculation of nodes with cotton swab it is tightly covered and wrapped with wax coated paper to maintain high humidity at inoculated nodes. After 60 days inoculated nodes are scrapped with knife, clones with reddish lesion appearing or spreading to other nodes are rated as susceptible and clones with no lesion development are rated a resistant.

In case of three smut, budded setts of each variety were inoculated by soaking in suspension of the smut pathogen for 30 minutes and planted. Smut incidence at fortnightly interval was recorded on clump basis with following grade.

Score	Reaction
0 %	: Resistant
0.1-10%	: Moderately resistant
10.1%-20%	: Moderately susceptible
20.1%-30%	: Susceptible
More than 30%	: Highly susceptible

While, in case of wilt, twenty five genotypes were planted in wilt sick plot to test their relative resistance to wilt disease. The observations were taken as appearance of wilt symptoms on the standing canes on clump basis. At the end of ten months, ten clumps were uprooted with root and all the canes from the clumps were split opened longitudinally and the wilt severity index was calculated by adopting the following formulae and the variety was assessed on 0-4 scale.

$$\text{Mean wilt severity index} = \frac{\text{Sum of wilt indices of individual stalks}}{\text{Number of stalks sampled}}$$

Whereas, in case of shoot borer, the observation was recorded on the basis of dead heart at 30, 60, 90 and 120 DAP and finally cumulative percent incidence was worked out. While, the observation of top borer was recorded in respect to per cent incidence of 3<sup>rd</sup> brood and 4<sup>th</sup> brood of top borer, it was quite prevalent during last week of June to 1<sup>st</sup> week of July and top borer infestation percentage was calculated by following formulae % incidence = total no. of infested cane/total no. of cane observed x100

The assessment of reaction of shoot borer and top borer based on cumulative % incidence and 4<sup>th</sup> brood incidence,

respectively were work out according to grading level as follows

Grade	Cumulative % incidence of shoot borer	% incidence of top borer
LS	Below 15	Below 10
MS	15.1-30	10.1-20
HS	Above 30	Above 20

## RESULTS AND DISCUSSION

Twenty five genotypes including one check of different maturity groups were tested artificially by using CF 07 and CF 08 isolates of red rot pathogen adopting plug and nodal cotton swab methods of inoculation. The data (Table 1) revealed that genotypes, CoSe 92423 and CoSe 95422 showed susceptible reaction against both the isolates, whereas, genotypes CoSe 11456 was graded as moderately susceptible reaction against CF 07 and CF 08. Six genotypes (CoP 11437, BO 153, BO 130, CoP 9301, CoSe 10453 and BO 154) and five genotypes (CoP 11437, CoSe 11451, BO 153, BO 130 and BO 155) showed resistant reaction against CF 07 and CF 08 isolates, respectively. The remaining genotypes showed moderately resistant reaction against both the test isolates.

In case of cotton swab method, genotypes CoSe 11455, CoSe 92423 and CoSe 95422 showed susceptible reaction against both the isolates, whereas, genotypes CoSe 11453 and CoSe 11456 were graded as susceptible reaction against CF 07 isolate and resistant reaction against isolate CF 08. Remaining genotypes showed resistant reaction against both the test isolates.

The data on the incidence of smut revealed that nineteen genotypes (Cop 11436, Cop 11437, Cop 11438, Cop 11439, Cop 11440, CoSe 11451, BO 153, CoSe 11455, BO 130, BO 91, CoP 9301, CoP 08436, CoSe 09452, BO 155, CoSe 10451, CoSe 10452, CoSe 10453, BO 154 and CoP 09437) showed resistant reaction while, remaining genotypes (CoSe 11453, CoSe 11454, CoSe 11456, CoSe 92423 and UP 09453) were graded as moderately resistant reaction. Twenty five genotypes screened against wilt in which five genotypes (Cop 11438, CoP 9301, BO 155, CoSe 10452 and BO 154) showed resistant reaction, fifteen genotypes showed moderately resistant while four genotypes showed moderately susceptible reaction against wilt disease. According to B. Kumar and S. Kumar (2004) four varieties viz. Co 97019, UP 9742, UP 9855 and BO 136 were graded as resistant while, eight varieties namely Co 97020, CoP 97181, BO 134, BO 135, CoP 97182, CoSe 98335 and BO 137 were found moderately resistance against red rot pathogen. Minnatullah *et. al.* (2010), made the observations that five entries were graded as resistant and thirteen entries were graded as moderately resistant reaction against red rot. Twenty entries showed resistance reaction while remaining genotypes were graded as moderately resistance reaction against smut disease whereas, two entries were found free from wilt disease and rest got infection ranging from 0.2 to 2.8 units in 0-4 scales. Similar findings were quoted by Ram Ji Lal *et al.* (1989) that the different isolates of *C. falcatum* Went gave various degree of resistance or susceptible reaction on different varieties of sugarcane.

The data pertaining to incidence of top borer in sugarcane

**Table 1: Screening of Sugarcane genotypes against major diseases and borer pests**

Sl.No	Genotypes	Plug Method		Cotton swab		Smut	Wilt	Per cent incidence of top borer		Reaction *	Cumulative % incidence of shoot borer	reaction
		CF 07	CF 08	CF 07	CF 08			3 <sup>rd</sup> brood	4 <sup>th</sup> brood			
1.	CoP 11436	MR	MR	R	R	R	MR	7.81	10.24	MS	8.73	LS
2.	CoP 11437	R	R	R	R	R	MR	7.31	10.14	MS	10.27	LS
3.	CoP 11438	MR	MR	R	R	R	R	5.12	8.28	LS	8.24	LS
4.	CoSe 11451	MR	R	R	R	R	MR	7.05	10.88	MS	11.22	LS
5.	BO 153	R	R	R	R	R	MR	7.47	10.17	MS	9.49	LS
6.	CoP 11439	MR	MR	R	R	R	MS	7.06	11.35	MS	8.28	LS
7.	CoP 11440	MR	MR	R	R	R	MR	6.27	9.11	LS	6.84	LS
8.	CoSe 11453	MR	MR	S	R	MR	MS	9.16	11.20	MS	9.65	LS
9.	CoSe 11454	MR	MR	R	R	MR	MS	7.25	13.24	MS	6.21	LS
10.	CoSe 11455	MR	MR	S	S	R	MR	7.79	11.65	MS	8.10	LS
11.	CoSe 11456	MS	MS	S	R	MR	MR	9.42	10.80	MS	5.98	LS
12.	BO 130	R	R	R	R	R	MR	6.40	8.58	LS	8.72	LS
13.	BO 91	MR	MR	R	R	R	MR	8.55	8.81	LS	9.47	LS
14.	CoP 9301	R	MR	R	R	R	R	10.69	9.79	LS	12.64	LS
15.	CoSe 92423	S	S	S	S	MR	MS	8.35	9.29	LS	8.25	LS
16.	CoP 08436	MR	MR	R	R	R	MR	5.94	9.92	LS	7.14	LS
17.	CoSe 09452	MR	MR	R	R	R	MR	6.63	10.22	MS	5.51	LS
18.	UP 09453	MR	MR	R	R	MR	MR	5.27	9.52	LS	8.14	LS
19.	BO 155	MR	R	R	R	R	R	7.62	10.41	MS	7.96	LS
20.	CoSe 10451	MR	MR	R	R	R	MR	8.84	11.55	MS	7.22	LS
21.	CoSe 10452	MR	MR	R	R	R	R	7.31	9.52	LS	6.28	LS
22.	CoSe 10453	R	MR	R	R	R	MR	8.44	11.81	MS	7.51	LS
23.	BO 154	R	MR	R	R	R	R	9.81	9.90	LS	8.06	LS
24.	CoP 09437	MR	MR	R	R	R	MR	8.18	10.75	MS	8.75	LS
25.	CoSe 95422 (Check)	S	S	S	S	MR	S	7.34	10.69	MS	6.02	LS
26.	Co 1158 (Check)	-	-	-	-	HS	-					LS

\*Reaction based on 4<sup>th</sup> brood incidence

was recorded and summarized in Table-I. It revealed from the data that ten genotypes (CoP 11438, BO 130, CoP 08436, UP 09453, CoP 11440, BO 91, CoP 9301, CoSe 10452, BO 154 and CoSe 95423) genotypes rated as less susceptible based on 4<sup>th</sup> brood incidence which was ranged from 8.28 to 9.92% and remaining 15 genotypes (CoP 11436, CoP 11437, CoSe 11451, BO 153, CoP 11439, CoSe 11453, CoSe 11454, CoSe 11455, CoSe 11456, CoSe 09452, BO 155, CoSe 10451, CoSe 10453, CoP 09437 and CoSe 95422) rated as moderately susceptible showing ranges from 10.14 to 13.24%. Similar observations were recorded by Kumar, et. al. (2010) reported that 8 genotypes were less susceptible, 34 as moderately susceptible and only two genotypes showed highly susceptible against top borer which was supported to the present investigation. Similar observation were recorded by earlier workers Sing and Madan reported that 12 genotype were graded as tolerant, 39 as moderately tolerant, 34 as susceptible and 8 as highly susceptible with top borer based on graded per cent incidence. In case of shoot borer incidence which was varied from 5.51 to 12.64% and on the basis of rating of shoot borer, all genotypes showed less susceptible reaction. Chand et.al. (2010) reported that the incidence of shoot borer ranged from 6.66 to 15.10%. Abdullah (2008) also reported that low infestation of shoot borer.

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