

**ALL INDIA CO-ORDINATED RESEARCH
PROJECT ON SUGARCANE (ICAR)**



**ANNUAL REPORT (Plant Pathology)
2015-2016**

**Sugarcane Pathology Section
PAU Regional Research Station
Kapurthala-144601**

To .

The Incharge
Project Coordinator of AICRP on sugarcane
Indian Institute of Sugarcane Research
Lucknow-226 002

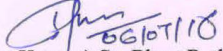
Memo No: 1625
Dated: 12/7/16

**Subject: Annual report of AICRP on Sugarcane (Pathology) for the year 2015-16
Kapurthala (PAU, Ludhiana)**

Sir

Please find enclosed herewith one copy of Annual report of trials conducted on **Sugarcane Pathology** under AICRP at Punjab Agricultural University, Regional Research Station, Kapurthala during crop season of **2015-16**. This is for your kind information and further necessary action.

With regards


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**TECHNICAL REPORT OF ALL INDIA CO-ORDINATED RESEARCH PROJECT
ON SUGARCANE: PATHOLOGY SECTION (2015-16)**

(Sugarcane Pathology Section, PAU Regional Research Station, Kapurthala)

Project No	: PP-14
Location	: PAU Regional Research Station, Kapurthala
Title	: Identification of pathotypes/races in red rot pathogen
Objectives	: To gather information on the major pathotypes of red rot
Year of experiment	: 32 (Year of start 1983-84)
Technical Programme	: A given set of differentials to be inoculated by plug method with different local isolates of red rot pathogen and observations to be recorded on disease development after sixty days.
Technical programme for the next year	: To continue with recently collected red rot isolates

Technical Report:

Fourteen differentials were inoculated by plug method on 22.08.2015 using conidial suspension separately from each of red rot pathotypes and isolates (7 pathotypes and 5 isolates) collected from Punjab state. The seven pathotypes were CF 01 from Co 1148, CF 02 from Co 7717, CF 03 from CoJ 64, CF 07 from CoJ 64, CF 08 from CoJ 84, CF 09 from CoS 767 and CF 11 from CoJ 64 and isolates were RI-295 from CoPb 91 and RI-298 from CoJ 88 Phagwara mills area, RI-299 from CoPb 13183 Kapurthala sugar mills area, RI-300 from CoPb 91 Bhogpur sugar mills area and RI-301 from CoJ 85 Batala sugar mills area. Observations on disease development as per technical programme were recorded 60 days after inoculations and host reaction was categorized into three groups viz., Resistant (R), Intermediate (X) and Susceptible (S).

The perusal of data contained in Table PP-I revealed that all the pathotypes and tested isolates were avirulent on CoS 8436 and SES 594 and virulent on Co 997 and Khakai only. All the pathotypes except CF-09 and CF-11 showed resistant reaction (R) on differential CoS 767, CoS 8436, BO 91 and SES 594 and susceptible reaction (S) on Co 997 and Khakai. Pathotype CF-11 showed intermediate reaction (X) on CoS 767, BO91 and Baragua whereas CF-09 showed susceptible reaction (S) on CoS 767 only and was avirulent on BO91 and

Baragua. However, all these pathotypes showed different reaction on Co 419, Co 975, Co 1148, Co 7717, Co 62399, CoC 671 and CoJ 64 differentials. Isolates prepared from varieties CoPb 91 and CoJ 88 namely RI-295 and RI-298 showed similar reaction on tested differentials. Both the isolates were resistant (R) on five, intermediate (X) on one and susceptible (S) on eight differentials. Isolates RI-299 from CoPb 13183 and RI-301 from CoJ 85 showed same reaction as pathotype CF-08. Isolates namely RI-299 from CoPb 13183 and RI 301 from CoJ 85 showed susceptible reaction (S) on 9 and resistant (R) on five differentials. Similar reaction was also reported with pathotype CF-08 from CoJ 84. RI-298 from CoJ 88 also showed similar reaction as RI-295 and RI-300 but it showed intermediate reaction on Co 419 where as RI 295 and RI 300 were intermediate on Co 1148.

Summary

Isolates RI-299 from CoPb 13183 Kapurthala and RI-301 from CoJ 85 Batala mills area are found as virulent as pathotype CF 08 from CoJ 84 whereas isolate RI-295 Phagwara mills area and RI-300 Bhogpur mills area from CoPb 91 are also found quite similar to CF-08 except their different reaction on one or two differentials. RI-298 from CoJ 88 Phagwara mills area still needs further confirmation.

Project No	: PP-17
Location	: PAU Regional Research Station, Kapurthala
Title	: Evaluation of zonal varieties for resistance to red rot, smut and wilt
Objectives	: a) To gather information on the relative resistance to red rot of the entries in the zonal varieties trial
Year of experiment	: 29th (year of start 1986-87)
Technical Programme	: Early and Mid-Late genotypes/varieties to be evaluated against red rot both by the plug and cotton swab with pathotypes CF 08 and CF 09 separately
Technical programme for the next year	: To Continue with new entries

Technical Report:

A: Red Rot

The material provided by Sugarcane Breeding Section was inoculated by plug and cotton swab methods on 22/08/2015 using a conidial suspension of two red rot pathotypes separately

viz., CF 08 from CoJ 84 and CF 09 from CoS 767. In cotton swab method two canes in each of the twenty clumps were inoculated by removing the lower most green leaf sheath and immediately placing the cotton swab (dipped in freshly prepared inoculum suspension) around the cane covering nodal region. The cotton swab was held in place by wrapping the parafilm over the swab. Observations on disease development were recorded up to 60 days of inoculations and varieties were categorized on 0-9 scale.

AVT (Early) plant 1

Four genotypes along with two checks CoJ 64 and Co 238 were evaluated against pathotypes CF 08 and CF 09 separately. Two entries namely CoH 11262 and CoLk 11202 behaved as moderately resistant (MR)/resistant (R) by plug and cotton swab methods by both the pathotypes separately (Table PP 2) and two entries CoLk 11201 and CoLk 11203 showed moderately susceptible (MS) and moderately resistant (MR) with CF 08 and CF 09 respectively by plug method and R by cotton swab method. Check variety Co 64 behaved as highly susceptible (HS)/susceptible (S) whereas Co 238 as MR/R with CF-08 and CF-09 by both the methods.

AVT (Early) Plant II

Three genotypes along with two checks CoJ 64 and Co 238 were evaluated against pathotype CF 08 and CF 09 separately. Genotype Co 10035 behaved as MR/ R by plug and cotton swab methods by both the pathotypes separately while entry CoH 10261 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method (Table PP 2). Genotype CoS 10231 behaved MR and MS with CF 08 and CF 09 pathotypes by plug and cotton swab method. Check variety Co 64 behaved as highly susceptible (HS)/susceptible (S) whereas Co 238 as MR/R with CF-08 and CF-09 by both the methods.

AVT (Mid late) Plant I

Six entries along with 3 checks CoS 767, CoS 8436 and Co Pant 97222 were tested against pathotype CF 08 and CF 09 separately. Five entries namely Co 11027, CoH 11263, CoLk 11204, CoLk 11206 and CoS 11232 and check variety CoS 8436 behaved as MR/R by plug and cotton swab methods by both the pathotypes separately (Table PP 2) while one genotype CoPb 11214 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method. Check variety CoS 767 behaved as S with CF 08 and HS/S with CF 09 by plug method whereas CoPant 97222 behaved as MS. Both the checks showed susceptible (S) reaction with the cotton swab method.

AVT (Mid late) Plant II

Five genotypes along with three checks checks CoS 767, CoS 8436 and Co 1148 were evaluated against pathotype CF 08 and CF 09 separately. Genotype Co 10036 behaved MS and MR by plug method and R by cotton swab method against both the pathotypes. Four entries namely CoH 10262, CoPant 10221, CoPb 10181 and CoPb 10182 and check variety CoS 8436 were found MR/R by plug and cotton swab method with both the pathotypes. Check variety CoPant 97222 behaved as MS/ S whereas CoS 767 behaved as S with CF 08 and HS/S with CF 09 by both the methods (Table PP-2).

IVT (Early)

Ten entries along with two checks CoJ 64 and Co 238 were evaluated against pathotype CF 08 and CF 09 separately. Five genotypes viz., Co 12026, Co 12027, CoPant 12221, CoPant 12222 and CoS 12231 were found MR/R with plug and cotton swab methods to both the pathotypes (Table PP-2). Genotype CoH 12261 showed MS with both the pathotypes by plug method and R by cotton swab method whereas CoLk 12204 behaved S by plug and R by cotton swab method respectively. Genotype CoLk 12201 showed HS by plug method and S by cotton swab method against both the pathotype while CoLk 12203 showed HS/ S with CF 08 and CF 09 pathotypes by plug method and S/ R by cotton swab method. Check variety CoJ 64 behaved as highly susceptible (HS)/susceptible (S) whereas Co 238 as MR/R with CF-08 and CF-09 by both the methods.

IVT (Mid late)

Fifteen genotypes along with three checks CoS 767, CoS 8436 and CoPant 97222 were evaluated against pathotypes CF 08 and CF 09 individually. Eleven genotypes namely Co 12028, Co 12029, CoH 12263, CoLk 12205, CoLk 12206, CoPant 12223, CoPant 12224, CoPant 12225, CoPb 12211, CoPb 12212 and CoS 12232 and check variety CoS 8436 were found MR/R by plug and cotton swab method against both the pathotypes (Table PP-2). Two genotypes viz., CoH 12262 and CoPB 12182 were found MS/R with CF-08 by both the methods whereas CoH 12262 was found MR/R and CoPb 12182 was MS/R with CF-09. Genotype CoPb 12181 showed S/R with CF 08 and MS/ R with CF 09 by plug method and cotton swab method while CoPant 12226 behaved HS/S by plug and cotton swab method against CF-08 and CF-09. Check variety CoPant 97222 showed MR/R for CF-08 and MS/R against CF-09 while check CoS 767 showed S and HS/S with CF 08 and CF 09 respectively by plug and cotton swab methods.

Summary

Forty-three genotypes were tested against red rot pathotypes CF 08 and CF 09 separately by plug and cotton swab methods. In AVT (Early) Plant I, two entries namely CoH 11262 and CoLk 11202 were behaved as MR/ R by plug and cotton swab methods against both the pathotypes separately. In AVT (Early) Plant II, only one genotype Co 10035 behaved as MR/ R by both the methods by two pathotypes separately. In AVT (Mid late) Plant I, five entries namely Co 11027, CoH 11263, CoLk 11204, CoLk 11206 and CoS 11232 behaved as MR/R by plug and cotton swab methods against both the pathotypes separately. In AVT (Mid late) Plant II, four genotypes viz; CoH 10262, CoPant 10221, CoPb 10181 and CoPb 10182 were found MR/R by plug and cotton swab method with both the pathotypes. In IVT (Early), five genotypes namely, Co 12026, Co 12027, CoPant 12221, CoPant 12222 and CoS 12231 were found MR/R to both the pathotypes with plug and cotton swab methods. In IVT (Mid late), eleven genotypes namely; Co 12028, Co 12029, CoH 12263, CoLk 12205, CoLk 12206, CoPant 12223, CoPant 12224, CoPant 12225, CoPb 12211, CoPb 12212 and CoS 12232 behaved as MR/R by plug and cotton swab method by both the pathotypes. Genotype CoPant 12226 was found HS/S by both the pathotypes.

Objectives : b) To gather information on the relative resistance to smut of the entries in the pre zonal/zonal varieties

Year of experiment : 21st (year of start 1994-95)

Technical Programme : Genotypes to be evaluated against smut (*Ustilago scitaminea*) by steeping of setts (3-budded) for 30 minutes in a mixed spore suspension . Observations to be recorded at weekly intervals and genotypes rated on cumulative percent disease incidence.

Technical programme for the next year : To continue with new entries

Technical Report:

B . Smut

Forty-three genotypes along with checks and six pathological standards (Co 740, Co 1158, Co 7915, Co 62175, NCO 310 and Katha) were evaluated against smut by steeping method. Observation on disease appearance was recorded at weekly intervals throughout the crop season and simultaneously rouging out of smutted clumps each time to avoid secondary

spread of the disease. The genotypes were categorized based on cumulative percent smut incidence.

Out of 43 genotypes, twenty genotypes namely CoH 11262, Co 10035, CoH 10261, CoH 11263, CoPb 11214, Co 10036, CoH 10262, CoPant 10221, CoPb 10181, Co 12026, CoLk 12201, CoPant 12221, CoPant 12222, Co 12028, CoH 12263, CoPant 12223, CoPant 12225, CoPant 12226, CoPb 12181, CoPb 12211 were rated as moderately resistance (MR) (Table PP-3). Of the remaining 23 entries, twenty two genotypes were rated as moderately susceptible (MS) and one entry CoH 12202 was rated as susceptible (S). Among six pathological standards, five (Co 740, Co 1158, Co 62175, NCO 310 and Katha) were found highly susceptible (HS) and Co 7915 as moderately resistant (MR).

Summary

Out of 43 genotypes, twenty genotypes namely CoH 11262, Co 10035, CoH 10261, CoH 11263, CoPb 11214, Co 10036, CoH 10262, CoPant 10221, CoPb 10181, Co 12026, CoLk 12201, CoPant 12221, CoPant 12222, Co 12028, CoH 12263, CoPant 12223, CoPant 12225, CoPant 12226, CoPb 12181, CoPb 12211 were rated as moderately resistance (MR), 22 were rated as moderately susceptible (MS), one entry CoH 12261 was rated as susceptible (S) and out of 6 pathological standards, five (Co 740, Co 1158, Co 62175, NCO 310 and Katha) were found highly susceptible (HS) and Co 7915 as moderately resistant (MR).

- Objectives** : c) To gather information on the relative resistance to wilt of the entries in the pre zonal/zonal varieties
- Year of experiment** : 15th (year of start 2000-01)
- Technical Programme** : Genotypes to be evaluated against wilt by planting in soil mass inoculated with *Fusarium sacchari* culture
- Technical programme for the next year** : To Continue with new entries

Technical Report:

C. Wilt

Forty-three entries with two standards Co 7717 and Co 89003 were evaluated for wilt at PAU Regional Research Station, Kaputhala. The inoculum mixture of *Fusarium sacchari* (@100 g/meter row) is applied over the setts uniformly in the furrows at the time of planting. Germination count was taken after 45 days. The symptoms on the standing canes were

recorded after 10 months of planting. The mean wilt severity index was worked out based on the number of canes sampled.

Out of 43 genotypes 33 behaved as R (grade 0), 7 genotypes namely CoLk 11203, Co 10035, CoH 11263, CoS 11232, CoLk 12206, CoPant 12226, CoPb 12182 as MR (grade 1), 3 genotypes viz; CoH 11262, CoLk 12203, CoLk 12204 as MS (grade 2) and 2 standards viz; Co 07717 and Co 89003 as HS (grade 4) given in Table PP-4.

Summary

Out of 43 genotypes, 33 were resistant to wilt, 7 were moderately resistant and 3 were moderately susceptible. Check varieties namely Co 7717 and Co 89003 were found highly susceptible to wilt only. Germination count recorded after 45 days of sowing showed no significant changes among the entries resistant and susceptible for wilt disease.

Project No : **PP-17D**
Location : PAU Regional Research Station, Kapurthala
Title : Yellow leaf disease (YLD)

No disease symptoms were observed during the year 2015-16.

Project No : **PP-22**
Location : PAU Regional Research Station, Kapurthala
Title : Survey of sugarcane diseases naturally occurring in the area on important sugarcane varieties
Objectives : To gather information on the diseases naturally occurring in the area on released varieties.
Year of experiment : 26th (year of start 1989-90)

The disease survey on sugarcane crop was conducted in 9 Cooperative sugar mills viz., Bhogpur, Budhewal, Batala, Gurdaspur, Nawan Shahar, Ajnala, Morinda, Nakodar and Fazilka and 7 private mill areas three times during June, September and November. Red rot was observed with an incidence from traces to 5.0 per cent on varieties CoS 8436, CoJ 64, CoJ 85 and Co 89003 in Amloh, Budhewal, Dhuri, Gurdaspur, Morinda, Nakodar, Nawashahr and Phagwara mills area. Wilt incidence of 7-8 per cent was observed on Co 89003 and CoS 8436 in Amloh, Batala, Dhuri, and Gurdaspur mills area. Varieties Co 89003 and Co 238 were found infected with smut (in traces) in Batala, Kiriafgana, Nakodar and

Phagwara mills area. Pokkah Boeng disease was observed on variety Co 238 (1-2%) in Batala, Budhewal, Bhogpur, Dasuya, Gurdaspur, Kiri afgana and Phagwara sugarmills area. Red stripe/top rot disease was observed (in traces) on CoJ 85 in Bhogpur, Dasuya, Gurdaspur, Mukerian and Phagwara sugar mills area. Grassy shoot disease (GSD) was observed with an incidence of 1-2% on Co 238 in ButtarSevian, Kidi afgana and Phagwara sugarmills area (Table PP-5).

- Project No** : **PP-23**
- Location** : PAU Regional Research Station, Kapurthala
- Title** : Assessment of elite and ISH genotypes for resistance to red rot
- Objectives** : To gather information on *Saccharum* sp. and elite genotypes for resistance to red rot, so that the resistant genotypes could be used in breeding programme as possible donor for resistance.

Technical Report:

Thirty three ISH genotypes were inoculated by plug method on 22. 08. 2015 using red rot pathotypes CF 08 from CoJ 84 and CF 09 from CoS 767. Observations on disease development were recorded after 60 days of inoculations and genotypes were rated on 0-9 scale.

Of the 33 genotypes, none behaved as resistant, seventeen genotypes were found MR against CF-08 and twenty-two against CF-09. Genotypes ISH 108, ISH 191 and ISH 269 were found MS to CF-08 whereas MR to CF 09 (Table PP-6). Genotypes ISH 137 and 282 were S to CF-08 but MR and HS to CF-09 respectively. Six genotypes were HS to both the pathotypes by plug method of inoculation whereas ISH 012, 148, 267 and 287 were HS to CF-08 and MR to CF-09. Genotype ISH 193 behaved HS against CF-08 and S against CF-09.

Summary

Of the 33 genotypes, none behaved as resistant (R), fourteen genotypes namely ISH 001, 007, 113, 118, 135, 144, 185, 203, 211, 224, 260, 264, 281 and ISH 286 were found MR to both of the pathotypes.

Project No : **PP-31**
Location : PAU Regional Research Station, Kapurthala
Title : Screening, epidemiology and management of pokkah boeng
in sugarcane
Objectives : To study the development of pokkah boeng in relation to
weather parameters and its management.

Technical Report

Forty-three entries along with two check varieties viz., Co 238 and CoJ 85 were screened for pokkah boeng at PAU Regional Research Station, Kapurthala under natural conditions. Out of 43 entries, 15 showed mild resistance (MS) and remaining were found resistant (R). Two check varieties Co 238 and Co 85 behaved as HS and MS (Table PP-7). The minimum and maximum temperature of 34.5 and 25.0°C, relative humidity 49.8 to 73.1 % and rainfall 19.0 mm were noted from May-September. The disease incidence was initiated during 1st fortnight of June and gradually increased till August-September. Maximum incidence was observed during the month of October. Rainfall and high humidity play an important role in incidence.

Table PP-1: Pathogenic behavior of isolates of *Colletotrichum falcatum* on host differentials- Kapurthala (PAU)

Sr No	Pathotypes/ Isolates	Source	Reaction* on host differentials													
			Co 419	Co 975	Co 997	Co 1148	Co 7717	Co 62399	CoC 671	CoJ 64	CoS 767	CoS 8436	BO 91	Baragua	Khakai	SES 594
1	CF- 01	Co 1148	R	S	S	S	R	S	S	S	R	R	R	R	S	R
2	CF-02	Co 7717	X	R	S	R	S	X	S	X	R	R	R	R	S	R
3	CF- 03	CoJ 64	R	R	S	R	R	R	S	S	R	R	R	R	S	R
4	CF-07	CoJ 64	X	R	S	S	R	R	X	S	R	R	R	R	S	R
5	CF-08	CoJ 84	S	S	S	S	S	S	S	S	R	R	R	R	S	R
6	CF-09	CoS 767	X	X	S	S	R	R	S	S	S	R	R	R	S	R
7	CF-11	CoJ 64	S	X	S	X	X	X	X	S	X	R	X	X	S	R
8	RI- 295	CoPb 91	S	S	S	X	S	S	S	S	R	R	R	R	S	R
9	RI-298	CoJ 88	X	S	S	S	S	S	S	S	R	R	R	R	S	R
10	RI-299	CoPb 13183	S	S	S	S	S	S	S	S	R	R	R	R	S	R
11	RI-300	CoPb 91	S	S	S	X	S	S	S	S	R	R	R	R	S	R
12	RI-301	CoJ 85	S	S	S	S	S	S	S	S	R	R	R	R	S	R

Reaction* R = Resistant; X = Intermediate; S = Susceptible

Date of inoculation: 22.08.2015

Date of observations: 23.10.2015

Table PP- 2: Evaluation of AVT/IVT sugarcane genotypes for red rot resistance- Kapurthala (PAU)

S. No.	Genotypes	Plug method				Cotton swab method	
		CF 08		CF 09		CF 08	CF 09
		S*	R**	S*	R**	R**	R**
AVT (Early) Plant I							
1	CoH 11262	3.5	MR	3.6	MR	R	R
2	CoLk 11201	4.5	MS	3.9	MR	R	R
3	CoLk 11202	3.7	MR	3.6	MR	R	R
4	CoLk 11203	4.5	MS	3.7	MR	R	R
5	CoJ 64	8.6	HS	8.2	HS	S	S
6	Co 238	3.6	MR	3.7	MR	R	R
AVT (Early) Plant II							
1	Co 10035	3.3	MR	3.2	MR	R	R
2	CoH 10261	4.8	MS	3.6	MR	R	R
3	CoS 10231	3.3	MR	4.4	MS	R	R
4	CoJ 64	8.6	HS	8.2	HS	S	S
5	Co 238	3.6	MR	3.7	MR	R	R
AVT (Mid Late) Plant I							
1	Co 11027	3.3	MR	3.5	MR	R	R
2	CoH 11263	3.6	MR	3.5	MR	R	R
3	CoLk 11204	3.5	MR	3.3	MR	R	R
4	CoLk 11206	3.6	MR	3.3	MR	R	R
5	CoPb 11214	4.3	MS	3.5	MR	R	R
6	CoS 11232	3.9	MR	3.4	MR	R	R
7	CoS 767	7.3	S	8.3	HS	S	S
8	CoS 8436	3.5	MR	3.2	MR	R	R
9	CoPant 97222	5.8	MS	5.5	MS	S	S
AVT (Mid Late) Plant II							
1	Co 10036	4.4	MS	3.4	MR	R	R
2	CoH 10262	3.7	MR	3.4	MR	R	R
3	CoPant 10221	3.2	MR	3.5	MR	R	R
4	CoPb 10181	3.7	MR	3.5	MR	R	R
5	CoPb 10182	3.6	MR	3.2	MR	R	R
6	CoS 767	7.2	S	8.4	HS	S	S
7	CoS 8436	3.4	MR	3.1	MR	R	R
8	CoPant 97222	5.7	MS	5.4	MS	S	S
IVT (Early)							
1	Co 12026	3.7	MR	3.6	MR	R	R
2	Co 12027	3.8	MR	3.6	MR	R	R
3	CoH 12261	4.7	MS	5.3	MS	R	R
4	Co Lk 12201	8.5	HS	8.4	HS	S	S
5	CoLk 12202	4.5	MS	4.0	MR	R	R
6	CoLk 12203	8.2	HS	6.3	S	S	R
7	CoLk 12204	6.5	S	6.2	S	R	R
8	CoPant 12221	3.8	MR	3.7	MR	R	R

9	CoPant 12222	3.6	MR	3.8	MR	R	R
10	CoS 12231	3.7	MR	3.5	MR	R	R
11	CoJ 64	8.5	HS	8.6	HS	S	S
12	Co 238	3.6	MR	3.7	MR	R	R
IVT (Midlate)							
1	Co 12028	3.5	MR	3.6	MR	R	R
2	Co 12029	3.9	MR	3.8	MR	R	R
3	CoH 12262	4.5	MS	3.7	MR	R	R
4	CoH 12263	3.8	MR	3.4	MR	R	R
5	CoLk 12205	3.5	MR	3.6	MR	R	R
6	CoLk 12206	3.7	MR	3.4	MR	R	R
7	CoPant 12223	3.8	MR	3.5	MR	R	R
8	CoPant 12224	3.9	MR	3.6	MR	R	R
9	CoPant 12225	3.8	MR	3.7	MR	R	R
10	CoPant 12226	9.0	HS	9.0	HS	S	S
11	CoPb 12181	6.5	S	5.6	MS	R	R
12	CoPb 12182	5.8	MS	5.3	MS	R	R
13	CoPb 12211	3.6	MR	3.8	MR	R	R
14	CoPb 12212	3.8	MR	3.6	MR	R	R
15	CoS 12232	3.8	MR	3.6	MR	R	R
16	CoS 767	7.6	S	8.2	HS	S	S
17	CoS 8436	3.4	MR	3.5	MR	R	R
18	CoPant 97222	6.0	MR	5.4	MS	R	R
					*Score	** Reaction	
Date of inoculation : 22.08.2015					0-2	R (Resistant)	
Date of Observation: 23.10.2015					2.1-4	MR (Moderately Resistant)	
Pathotypes/Isolates used:-					4.1-6	MS (Moderately Susceptible)	
CF-08 from CoJ 84					6.1-8	S (Susceptible)	
CF-09 from CoS 767					> 8	HS (Highly Susceptible)	

Table PP- 3: Evaluation of sugarcane genotypes for smut resistance- Kapurthala (PAU)

S.No.	Genotypes	Score	Reaction	S.No.	Genotypes	Score	Reaction
AVT (Early) Plant I				6	CoLk 12203	16.5	MS
1	CoH 11262	8.5	MR	7	CoLk 12204	14.5	MS
2	CoLk 11201	14.5	MS	8	CoPant 12221	8.5	MR
3	CoLk 11202	12.5	MS	9	CoPant 12222	9.0	MR
4	CoLk 11203	11.0	MS	10	CoS 12231	16.0	MS
5	CoJ 64	27.5	S	11	CoJ 64	27.5	S
6	Co Pant 84211	25.0	S	12	Co 238	29.0	S
AVT (Early) Plant II				IVT (Midlate)			
1	Co 10035	8.6	MR	1	Co 12028	7.5	MR
2	CoH 10261	9.5	MR	2	Co 12029	14.0	MS
3	CoS 10231	16.0	MS	3	CoH 12262	16.5	MS
4	CoJ 64	27.5	S	4	CoH 12263	8.0	MR
5	CoPant 84211	25.0	S	5	CoLk 12205	13.5	MS
AVT (Mid Late) Plant I				6	CoLk 12206	17.0	MS
1	Co 11027	13.0	MS	7	CoPant 12223	7.5	MR
2	CoH 11263	9.5	MR	8	CoPant 12224	16.0	MS
3	CoLk 11204	11.5	MS	9	CoPant 12225	8.5	MR
4	CoLk 11206	13.5	MS	10	CoPant 12226	8.5	MR
5	CoPb 11214	8.5	MR	11	CoPb 12181	8.0	MR
6	CoS 11232	15.0	MS	12	CoPb 12182	12.5	MS
7	CoS 767	26.5	S	13	CoPb 12211	9.0	MR
8	CoS 8436	14.5	MS	14	CoPb 12212	14.0	MS
9	CoPant 97222	17.0	MS	15	CoS 12232	14.5	MS
AVT (Mid Late) Plant II				17	CoS 767	26.5	S
1	Co 10036	8.5	MR	18	CoS 8436	14.5	MS
2	CoH 10262	8.0	MR	19	CoPant 9722	17.0	MS
3	CoPant 10221	9.0	MR	Standards			
4	CoPb 10181	10.0	MR	1	Co 740	31.0	HS
5	CoPb 10182	16.5	MS	2	Co 1158	35.0	HS
6	CoS 767	26.5	S	3	Co 7915	8.5	MR
7	CoS 8436	14.5	MS	4	Co 62175	35.0	HS
8	CoPant 97222	17.0	MS	5	NCO 310	32.5	HS
IVT (Early)				6	Katha	33.5	HS
1	Co 12026	8.0	MR	Disease incidence Nil =			R (Resistant)
2	Co 12027	13.5	MS	Disease incidence 0.1-10% =			MR(Moderate Resistant)
3	CoH 12261	22.0	S	Disease incidence 10.1- 20%=			MS (Moderate Susceptible)
4	Co Lk 12201	9.0	MR	Disease incidence 20.1- 30% =			S (Susceptible)
5	CoLk 12202	17.0	MS	Disease incidence > 30 % =			HS (Highly susceptible)

Table PP-4: Evaluation of sugarcane genotypes for wilt resistance- Kapurthala (PAU)

S.No.	Genotypes	Germination % at 45 days	Score	Reaction
1	CoH 11262	43	2.0	MS
2	CoLk 11201	39	0.0	R
3	CoLk 11202	42	0.0	R
4	CoLk 11203	45	1.0	MR
5	Co 10035	39	1.0	MR
6	CoH 10261	37	0.0	R
7	CoS 10231	40	0.0	R
8	Co 11027	41	0.0	R
9	CoH 11263	42	1.0	MR
10	CoLk 11204	46	0.0	R
11	CoLk 11206	49	0.0	R
12	CoPb 11214	36	0.0	R
13	CoS 11232	39	1.0	MR
14	Co 10036	38	0.0	R
15	CoH 10262	43	0.0	R
16	CoPant 10221	42	0.0	R
17	CoPb 10181	45	0.0	R
18	CoPb 10182	36	0.0	R
19	Co 12026	41	0.0	R
20	Co 12027	39	0.0	R
21	CoH 12261	38	0.0	R
22	Co Lk 12201	43	0.0	R
23	CoLk 12202	46	0.0	R
24	CoLk 12203	48	2.0	MS
25	CoLk 12204	40	2.0	MS
26	CoPant 12221	42	0.0	R
27	CoPant 12222	38	0.0	R
28	CoS 12231	46	0.0	R
29	Co 12028	48	0.0	R
30	Co 12029	39	0.0	R
31	CoH 12262	38	0.0	R
32	CoH 12263	37	0.0	R
33	CoLk 12205	42	0.0	R
34	CoLk 12206	45	1.0	MR
35	CoPant 12223	40	0.0	R
36	CoPant 12224	42	0.0	R
37	CoPant 12225	42	0.0	R
38	CoPant 12226	36	1.0	MR
39	CoPb 12181	39	0.0	R
40	CoPb 12182	40	1.0	MR
41	CoPb 12211	45	0.0	R

42	CoPb 12212	41	0.0	R
43	CoS 12232	43	0.0	R
Standards				
1	Co 7717	46	4.0	HS
2	Co 89003	44	4.0	HS
Evaluation: 0-4 Scale of wilt severity index				

Table PP-5: Survey of sugarcane diseases naturally occurring in the Punjab State on important sugarcane varieties.

Name of disease	Location	Disease incidence	Varieties affected	Crop stage when observed
Red rot	Amloh, Budhewal, Dhuri, Gurdaspur, Morinda, Nakodar, Nawanshahr and Phagwara	Traces to 5.0 %	CoS 8436, CoJ 64, CoJ 85, Co 89003	4 Months (June)
Wilt	Amloh, Batala, Dhuri and Gurdaspur	7-8 %	Co 89003, CoS 8436	8 Months (October)
Smut	Batala, Kiriafgana Nakodar and Phagwara,	Traces	Co 89003, Co 238	3 Months (May) 8 Months (October)
Bacterial red stripe disease/ top rot.	Bhogpur, Dasuya, Gurdaspur, Mukerian and Phagwara	Traces	CoJ 85	5 Months (July)
Pokkah Boeng	Batala, Budhewal, Bhogpur, Dasuya Gurdaspur, Kiriafgana, and Phagwara	1-2 %	Co 238	5 Months (June)
Grassy shoot disease	ButterSevian, Kiriafgana and Phagwara	1-2 %	Co 238	4 Months (June)

Table PP- 6: Assessment of elite and ISH genotypes for resistance to red rot by plug method.

Sr. No.	Variety / Treatment	CF 08		CF 09	
		Score	Reaction	Score	Reaction
1.	ISH 001	3.7	MR	3.4	MR
2.	ISH 007	3.4	MR	3.6	MR
3.	ISH 012	8.5	HS	3.4	MR
4.	ISH 105	3.4	MR	8.1	HS
5	ISH 108	4.3	MS	3.5	MR
6	ISH 113	3.5	MR	3.3	MR
7	ISH 114	8.5	HS	8.4	HS
8	ISH 117	3.4	MR	6.9	S
9	ISH 118	3.6	MR	3.7	MR
10	ISH 135	3.7	MR	3.5	MR
11	ISH 137	6.8	S	3.5	MR
12	ISH 144	3.7	MR	3.3	MR
13	ISH 148	8.4	HS	3.4	MR
14	ISH 159	3.7	MR	6.8	S
15	ISH 185	3.5	MR	3.8	MR
16	ISH 187	8.5	HS	8.3	HS
17	ISH 191	4.2	MS	3.6	MR
18	ISH 193	8.3	HS	6.1	S
19	ISH 203	3.7	MR	3.4	MR
20	ISH 211	3.6	MR	3.3	MR
21	ISH 224	4.3	MS	3.7	MR
22	ISH 260	3.5	MR	3.3	MR
23	ISH 264	3.4	MR	3.5	MR
24	ISH 265	8.5	HS	8.8	HS
25	ISH 267	8.4	HS	3.5	MR
26	ISH 269	4.2	MS	3.7	MR
27	ISH 273	8.5	HS	8.6	HS
28	ISH 281	3.3	MR	3.7	MR
29	ISH 282	7.3	S	8.3	HS
30	ISH 286	3.2	MR	3.6	MR
31	ISH 287	8.3	HS	3.6	MR
32	ISH 308	8.6	HS	8.1	HS
33	ISH 309	4.7	MS	8.3	HS
Date of inoculation: 22.08.2015 Date of Observation: 23.10.2015			Pathotypes/ Isolates used CF-08 from CoJ 84, CF-09 from CoS 767		

Table PP-7: Evaluation of sugarcane genotypes against Pokkah boeng.

S.No.	Genotypes	Per cent incidence	Disease reaction
1	CoH 11262	1.0	R
2	CoLk 11201	0.0	R
3	CoLk 11202	8.0	MS
4	CoLk 11203	0.0	R
5	Co 10035	0.0	R
6	CoH 10261	10.0	MS
7	CoS 10231	9.0	MS
8	Co 11027	0.0	R
9	CoH 11263	0.0	R
10	CoLk 11204	0.0	R
11	CoLk 11206	9.0	MS
12	CoPb 11214	10.0	MS
13	CoS 11232	3.0	R
14	Co 10036	0.0	R
15	CoH 10262	10.0	MS
16	CoPant 10221	0.0	R
17	CoPb 10181	0.0	R
18	CoPb 10182	0.0	MS
19	Co 12026	0.0	R
20	Co 12027	0.0	R
21	CoH 12261	0.0	R
22	Co Lk 12201	2.0	R
23	CoLk 12202	0.0	R
24	CoLk 12203	0.0	R
25	CoLk 12204	10.0	MS
26	CoPant 12221	9.0	MS
27	CoPant 12222	0.0	R
28	CoS 12231	0.0	R
29	Co 12028	0.0	R
30	Co 12029	1.0	R
31	CoH 12262	0.0	R
32	CoH 12263	6.0	MS
33	CoLk 12205	0.0	R
34	CoLk 12206	0.0	R
35	CoPant 12223	6.0	MS
36	CoPant 12224	0.0	R
37	CoPant 12225	6.0	MS
38	CoPant 12226	0.0	R
39	CoPb 12181	10.0	MS
40	CoPb 12182	9.0	MS
41	CoPb 12211	0.0	R
42	CoPb 12212	0.0	R
43	CoS 12232	7.0	MS
44	Co 238	22.0	HS
45	CoJ 85	16.0	S