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

ANNUAL REPORT (Plant Pathology)

2013-2014

Sugarcane Pathology Section

PAU Regional Research Station

Kapurthala-144601

To

Dr O. K. Sinha
Project Coordinator of AICRP on sugarcane
Indian Institute of Sugarcane Research
Lucknow-226 002

Subject: Annual report of AICRP on Sugarcane (Pathology) for the year 2013-14 Kapurthala (PAU, Ludhiana)

Sir

Please find enclosed herewith two copies of Annual report of trials conducted on **Sugarcane Pathology** under AICRP at Punjab Agricultural University, Regional Research Station, Kapurthala during crop season of **2013-14.** This is for your kind information and further necessary action.

With regards

(Bipen Kumar) Sr. Plant Pathologist
(Ratinderbir Kaur) Asstt. Plant Pathologist
Sugarcane Pathology Section,
PAU Regional Research Station, Kapurthala

CC:

Dr R Viswanathan, Principal Investigator, (AICRP Sugarcane Pathology),
Head, Division of Crop Protection, Sugarcane Breeding Institute, Coimbatore-641 007
(Two copies of Report enclosed) for information please

TECHNICAL REPORT OF ALL INDIA CO-ORDINATED RESEARCH PROJECT ON SUGARCANE: PATHOLOGY SECTION (2013-14)

(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	: 29th (Year of start 1984-85)
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 26.08.2013 using conidial suspension separately from each of 9 red rot pathotypes / isolates (5 pathotypes and 4 new isolates) collected from Punjab state. The five pathotypes were CF 01 from Co 1148, CF 03 from CoJ 64, CF 07 from CoJ 64, CF 08 from CoJ 84 and CF 09 from CoS 767 and the newly collected 4 isolates were RI-291 from Co 89003 Ajnala sugar mill area, RI-292 from CoS 8436 Dhuri sugar mills area, RI-293 from CoJ 64 Budhewal mill area and RI-294 from CoJ 85 from Ajnala mill 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 isolates/ pathotypes were avirulent on BO 91, Baragua and SES 594 and virulent on Co 997, CoJ 64 and Khakai. Out of 9 tested pathotypes/isolates the new isolate namely RI-291 from Co 89003 and RI-293 from CoJ 64 respectively showed clear cut reactions i.e. Resistant, Intermediate and Susceptible on the tested differentials. RI-291 from Co 89003 isolate showed resistant (R) on

5 differentials (Co 7717, CoS 767, BO 91, Baragua and SES 594), Intermerdiate (X) on 3 (Co 419, Co 975 and Co 1148) and susceptible (S) on rest of the 6 differentials; whereas isolate RI-293 from CoJ 64 showed resistant (R) on 8 (Co 975, Co 1148, Co 7717, CoS 767, CoS 8436, BO 91, Baragua and SES 594) intermediate on 2 (Co 419 and Co 62399) and susceptible reaction on 4 (Co 997, CoC 671, CoJ 64 and Khakai). A new isolate RI-292 from CoS 8436 showed resistant reaction (R) on 5 and susceptible (S) on the remaining 9 differentials and isolate RI-294 from CoJ 85 showed susceptible reaction (S) on 9 differentials and resistant (R) on 5 differentials. An isolate RI- 291 from Co 89003 although resemble with pathotype CF 09 from CoS 767 but it showed resistant reaction to CoS 767, intermediate reaction to Co 1148 and susceptible to CoS 8436 and Co 62399. We can say it is somewhat different from pathotype CF 09 from CoS 767. Newly tested isolate RI-293 from CoJ 64 also resemble with pathotype CF 09 from CoS 767 and CF 07 from CoJ 64 as it showed resistant reaction on seven differentials. A new isolates RI-292 from CoS 8436 gave similar reaction on all the differentials as by the pathotype CF 08 from CoJ 84 except it showed susceptible reaction on CoS 8436 and resistant reaction on Co 1148. We can say it is quite virulent as pathotype CF 08. Similarly the new isolate RI-294 from CoJ 85 from Ajnala mill quite resemble with CF 08 and as virulent as pathotype CF 08. Further confirmation will be carried out this year.

Summary

Newly collected isolates RI-292 from CoS 8436 and RI-294 from CoJ 85 from Dhuri mill area are found as virulent as pathotype CF 08. RI-292 from CoS 8436 is susceptible on its host and it needs further confirmation for considering a new pathotype.

Project No	**: PP-17**
Location	: PAU Regional Research Station, Kapurthala
Title	Evaluation of pre-zonal /zonal varieties/genotypes 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 pre zonal/zonal varieties
Year of experiment	: 27th (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 26/08/2013 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

Five genotypes along with two checks CoJ 64 and Co Pant 84211 were evaluated against pathotype CF 08 and CF 09 separately. Two entries namely; CoH 09263 and CoS 09246 behaved as MR/ R by plug and cotton swab methods by both the pathotypes separately (Table PP 2). Three entries CoH 09262, CoLk 09202 and CoPb 09181 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method. The checks behaved as HS/S.

AVT (Early) Plant II

Three genotypes along with two checks CoJ 64 and Co Pant 84211 were evaluated against pathotype CF 08 and CF 09 separately. An entry CoPb 08212 behaved as MR/ R by plug and cotton swab methods by both the pathotypes separately (Table PP 2) while two entries CoPb

08211 and CoS 08233 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method. The two checks behaved as HS/ S.

AVT (Mid late) Plant I

Five entries along with 3 checks CoS 767, CoS 8436 and Co Pant 97222 were tested against pathotype CF 08 and CF 09 separately. An entry Co 09022 and a check CoS 8436 behaved as MR/R by plug and cotton swab methods by both the pathotypes separately (Table PP 2). Three genotypes namely; CoH 09264, CoPb 09214 and CoS 09232 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method. Genotype CoLk 09204 behaved MS/R by plug and cotton swab method. Check variety CoPant 97222 behaved as MS/ S whereas CoS 767 behaved as S/HS with CF 08/CF 09 respectively by plug method and susceptible (S) by cotton swab method.

AVT (Mid late) Plant II

Six genotypes along with three checks checks CoS 767, CoS 8436 and Co 1148 were evaluated against pathotype CF 08 and CF 09 separately. Three genotypes viz; CoH 08262, CoS 08234, CoS 08235 and a check CoS 8436 were found MR/R by plug and cotton swab method with both the pathotypes. Three genotype namely CoH 08263, CoH 08264 and CoPb 08217 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method. 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.

IVT (Early)

Three genotypes along with two checks CoJ 64 and Co Pant 84211 were evaluated against pathotype CF 08 and CF 09 separately. Two genotypes i.e., Co 10035 and CoS 10231 were found MR/R to both the pathotypes with plug and cotton swab methods. Genotype CoH 10261 was found MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method.

IVT (Mid late)

Ten genotypes along with three checks CoS 767, CoS 8436 and CoPant 97222 were evaluated against pathotypes CF 08 and CF 09 individually. Seven genotypes namely; Co 10039, CoH 10262, CoPant 10221, CoPb 10181, CoPb 10182, CoPb 10183 and CoPb 10211 and check CoS 8436 were found MR/R by plug and cotton swab method by both the pathotypes. A genotypes Co 10036 was found MR/R with CF 08 and MS/R with CF 09 by plug and cotton swab method while genotype Co 10037 was found MS/R with CF 08 and MR/R with CF 09 by both the methods. One genotype CoH 10263 showed HS/S with CF 08/CF 09 by plug method and susceptible (S) by cotton swab method. Check variety CoPant

97222 showed MS/S reaction on both the pathotypes while check CoS 767 showed S/HS with CF 08/ CF 09 respectively by plug and cotton swab method.

Summary

Thirty two genotypes 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 09263 and CoS 09246 behaved as MR/ R by plug and cotton swab methods by both the pathotypes separately. In AVT (Early) Plant II an entry CoPb 08212 behaved as MR/ R by plug and cotton swab methods by both the pathotypes separately. In AVT (Mid late) Plant I an entry Co 09022 and a check CoS 8436 behaved as MR/R by plug and cotton swab methods by both the pathotypes separately while three genotypes namely; CoH 09264, CoPb 09214 and CoS 09232 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method. In AVT (Mid late) Plant II three genotypes viz; CoH 08262, CoS 08234, CoS 08235 and a check CoS 8436 were found MR/R by plug and cotton swab method with both the pathotypes while three genotype namely CoH 08263, CoH 08264 and CoPb 08217 showed MS and MR with CF 08 and CF 09 respectively by plug method and R by cotton swab method. In IVT (Early) two genotypes namely; Co 10035 and CoS 10231 and in Midlate seven genotypes namely; Co 10039, CoH 10262, CoPant 10221, CoPb 10181, CoPb 10182, CoPb 10183 and CoPb 10211 and check CoS 8436 were found MR/R by plug and cotton swab method 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	: 18th (year of start 1995-96)
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:

Smut

Thirty two genotypes and 6 pathological standards (Co 740, Co 1158, Co 7915, Co 62175, NCO 310, Katha) 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 cummulative percent smut incidence.

Out of 32 genotypes, twelve genotypes namely CoH 09262, CoPb 08212, CoS 09232, CoH 10261, CoS 10231, Co 10036, Co 10037, Co 10039, CoH 10262, CoPant 10221, CoPb 10181 and CoPb 10183 were rated as moderately resistance (MR) (Table PP-3). Of the remaining 20 entries, 17 were rated as moderately susceptible (MS), 3 entries namely CoH 09263, Co 10035 and CoH 10263 were rated as susceptible (S). Among six pathological standards, five (740, Co 1158, Co 62175, NCO 310 and Katha) were found highly susceptible (HS) and Co 7915 as moderately resistant (MR).

Summary

Out of 32 genotypes, 12 genotypes namely CoH 09262, CoPb 08212, CoS 09232, CoH 10261, CoS 10231, Co 10036, Co 10037, Co 10039, CoH 10262, CoPant 10221, CoPb 10181 and CoPb 10183 behaved as MR, 17 as MS and 3 as S and out of 6 pathological standards, five genotypes (Co 740, Co 1158**,** Co 62175, NCO 310 and Katha) were highly susceptible and Co 7915 as moderately resistant.

Objectives	c) To gather information on the relative resistance to wilt of the entries in the pre zonal/zonal varieties
Year of experiment	: 13th (year of start 2000-01)
Technical Programme	Genotypes to be evaluated against wilt by planting under wilt sick soil
Technical programme for the next year	: To Continue with new entries

Technical Report:

Wilt

Thirty two entries with two standards Co 7717 and Co 89003 were evaluated for wilt at PAU Regional Research Station, Kaputhala. 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 32 genotypes 15 behaved as R (grade 0), 13 genotypes namely CoH 09262, CoH 09263, CoPb 9181, CoS 09246, CoPb 08211, CoH 08263, CoPb 08217, CoS 08234, Co 10035, Co 10036, Co 10037, Co 10039 and CoPb 10183 as MR (grade 1), 3 genotypes viz; CoH 08262, Co 767, CoPb 09211 and CoLk 09204 as MS (grade 2), 1 genotype CoH 08262 behaved as S (grade 3) and 2 standards viz; Co 07717 and Co 89003 as HS (grade 4) given in Table PP-4.

Summary

Out of 32 genotypes, 15 were resistant to wilt, 13 were moderately resistant, 3 were moderately susceptible and one CoH 08262 was susceptible. Check varieties namely Co 7717 and Co 89003 were found highly susceptible to wilt only.

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 : 24th (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 July, September and November. Recommended varieties CoJ 83, CoH-119 and CoJ 89 were found free from red rot disease in all mills areas. Red rot was observed on ratoon as well as plant crop CoS 8436 with an incidence (traces to 8.5 per cent) in Amloh, Morinda and Dhuri mills area and in traces on varieties CoJ 64, CoJ 85 and Co 89003 in Ajnala, ButtarSevian, Nawanshahr and Budhewal mills areas. Varieties Co 89003, CoJ 88 and Co 238 were found infected with smut in traces in Batala and Fazilka mills area. Light to mild incidence (traces to 8 per cent) of wilt was observed on Co 89003 in Dhuri, Amloh, ButtarSevian, Gurdaspur, Batala and Ajnala mills area. Pokkah Boeng disease was observed on variety Co 238 (traces to 3%) in Amloh, Dhuri, Gurdaspur, Budhewal, Bhogpur, Phagwara, Dasuya and Ajanala Sugarmill areas. Red

stripe/top rot disease in traces to 3 % was observed on CoJ 85 in Batala, Gurdaspur, ButtarSevian, Bhogpur and Mukerian sugar mills area (Table PP-5)

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

Technical Report:

Forty two ISH genotypes were inoculated by plug method on 28. 08. 2013 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 42 genotypes, none behaved as Resistant, fourteen genotypes namely ISH 01, 07, 108, 113, 118, 119, 135, 148, 203, 211, 264, 269, 277 and ISH 286 were found MR, one genotype ISH 115 was found MS, one ISH 31 was susceptible and 7 were HS to both the pathotypes by plug method of inoculation (Table PP-6). Four genotypes namely ISH 105, ISH 144, ISH 185 and ISH 313 were found MR to CF 08 and HS to CF 09 whereas two genotypes ISH 12 and ISH 284 were HS to CF 08 and MR to CF 09. Three genotypes ISH 49, ISH 191 and ISH 224 were found MS to CF 08 and MR to Cf 09 whereas ISH 260 was MR to CF 08 and MS to CF 09. Three ISH entries ISH 281, ISH 309 and ISH 314 were MS to CF 08 and HS to CF 09 where as genotype ISH 193 was MS/S to CF 08/ CF 09. Seven ISH entries ISH 88, ISH 114, ISH 187, ISH 265, ISH 267, ISH 273 and ISH 308 were HS to both CF 08 and CF 09 pathotypes.

Summary

Of the 42 genotypes, none behaved as Resistant, fourteen genotypes namely ISH 01, 07, 108, 113, 118, 119, 135, 148, 203, 211, 264, 269, 277 and ISH 286 were found MR, one genotype ISH 115 was found MS, one ISH 31 was S and 7 were HS to both the pathotypes by plug method of inoculation.

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- 03**	**CoJ 64**	**R**	**R**	**S**	**R**	**R**	**R**	**S**	**S**	**R**	**R**	**R**	**R**	**S**	**R**
3	**CF-08**	**CoJ 84**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**R**	**R**	**R**	**R**	**S**	**R**
4	**CF-09**	**CoS 767**	**X**	**X**	**S**	**S**	**R**	**R**	**S**	**S**	**S**	**R**	**R**	**R**	**S**	**R**
5	**CF-07**	**CoJ 64**	**X**	**R**	**S**	**S**	**R**	**R**	**X**	**S**	**R**	**R**	**R**	**R**	**S**	**R**
6	**RI- 291**	**Co 89003**	**X**	**X**	**S**	**X**	**R**	**S**	**S**	**S**	**R**	**S**	**R**	**R**	**S**	**R**
7	**RI- 292**	**CoS 8436**	**S**	**S**	**S**	**R**	**S**	**S**	**S**	**S**	**R**	**S**	**R**	**R**	**S**	**R**
8	**RI- 293**	**CoJ 64**	**X**	**R**	**S**	**R**	**R**	**X**	**S**	**S**	**R**	**R**	**R**	**R**	**S**	**R**
9	**RI-294**	**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: 26.08.2013

Date of observations: 26.10.2013

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 09262	4.1	MS	3.4	MR	R	R
2	CoH 09263	3.7	MR	3.5	MR	R	R
3	CoLk 09202	4.3	MS	3.7	MR	R	R
4	CoPb 09181	4.3	MS	3.5	MR	R	R
5	CoS 09246	3.4	MR	3.3	MR	R	R
6	CoJ 64	8.4	HS	8.2	HS	S	S
7	Co Pant 84211	6.2	S	8.1	HS	S	S
AVT (Early) Plant II							
1	CoPb 08211	4.8	MS	3.5	MR	R	R
2	CoPb 08212	3.9	MR	3.5	MR	R	R
3	CoS 08233	5.4	MS	3.7	MR	R	R
4	CoJ 64	8.4	HS	8.2	HS	S	S
5	CoPant 84211	6.2	S	8.1	HS	S	S
AVT (Mid Late) Plant I							
1	Co 09022	3.6	MR	3.3	MR	R	R
2	CoH 09264	4.8	MS	3.6	MR	R	R
3	CoLk 09204	5.7	MS	4.3	MS	R	R
4	CoPb 09214	5.3	MS	3.7	MR	R	R
5	CoS 09232	4.7	MS	3.5	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
AVT (Mid Late) Plant II							
1	CoH 08262	3.9	MR	3.4	MR	R	R
2	CoH 08263	5.7	MS	3.5	MR	R	R
3	CoH 08264	5.8	MS	4.2	MR	R	R
4	CoPb 08217	5.3	MS	3.8	MR	R	R
5	CoS 08234	3.8	MR	3.5	MR	R	R
6	CoS 08235	3.9	MR	3.3	MR	R	R
7	CoS 767	7.2	S	8.4	HS	S	S
8	CoS 8436	3.4	MR	3.1	MR	R	R
9	CoPant 97222	5.7	MS	5.4	MS	S	S
IVT (Early)							
1	Co 10035	3.9	MR	3.5	MR	R	R
2	CoH 10261	4.9	MS	3.4	MR	R	R
3	CoS 10231	3.6	MR	3.7	MR	R	R
4	CoJ 64	8.4	HS	8.2	HS	S	S

5	Co Pant 84211	6.2	S	8.1	HS	S	S
IVT (Midlate)							
1	Co 10036	3.8	MR	4.3	MS	R	R
2	Co 10037	4.6	MS	3.8	MR	R	R
3	Co 10039	3.8	MR	3.5	MR	R	R
4	CoH 10262	3.7	MR	3.4	MR	R	R
5	CoH 10263	8.3	HS	6.7	S	S	S
6	CoPant 10221	3.5	MR	3.3	MR	R	R
7	CoPb 10181	3.8	MR	3.3	MR	R	R
8	CoPb 10182	3.9	MR	3.6	MR	R	R
9	CoPb 10183	4.0	MR	3.5	MR	R	R
10	CoPb 10211	3.5	MR	3.3	MR	R	R
11	CoS 767	7.2	S	8.4	HS	S	S
12	CoS 8436	3.4	MR	3.1	MR	R	R
13	CoPant 97222	5.7	MS	5.4	MS	S	S

	***Score**	**** Reaction**
Date of inoculation : 26.08.2013	0-2	R (Resistant)
Date of Observation: 26.10.2013	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				**IVT (Early)**			
1	CoH 09262	8.0	MR	1	Co 10035	22.5	S
2	CoH 09263	23.5	S	2	CoH 10261	7.0	MR
3	CoLk 09202	13.5	MS	3	CoS 10231	8.5	MR
4	CoPb 9181	15.0	MS	4	CoJ 64	24.5	S
5	CoS 09246	14.0	MS	5	CoPant 84211	25.0	S
6	CoJ 64	24.5	S	**IVT (Midlate)**			
7	CoPant 84211	25.0	S	1	Co 10036	9.0	MR
AVT (Early) Plant II				2	Co 10037	8.5	MR
				3	Co 10039	8.0	MR
1	CoPb 08211	11.0	MS	4	CoH 10262	9.0	MR
2	CoPb 08212	8.5	MR	5	CoH 10263	24.0	S
3	CoS 08233	16.0	MS	6	CoPant 10221	8.0	MR
4	CoJ 64	24.5	S	7	CoPb 10181	9.5	MR
5	CoPant 84211	25.0	S	8	CoPb 10182	12.5	MS
AVT (Mid Late) Plant I				9	CoPb 10183	9.5	MR
1	Co 09022	13.0	MS	**10**	CoPb 10211	12.0	MS
2	CoH 09264	15.5	MS	11	CoS 767	22.0	S
3	CoLk 09204	17.0	MS	12	CoS 8436	12.5	MS
4	CoPb 09214	13.5	MS	13	CoPant 97222	14.0	MS
5	CoS 09232	12.0	MR	**Standards**			
6	CoS 767	22.0	S	1	Co 740	32.0	HS
7	CoS 8436	12.5	MS	2	Co 1158	35.0	HS
8	CoPant 97222	14.0	MS	3	Co 7915	8.5	MR
AVT (Mid Late) Plant II				4	Co 62175	34.0	HS
1	CoH 08262	13.0	MS	5	NCO 310	33.5	HS
2	CoH 08263	15.5	MS	6	Katha	36.5	HS
3	CoH 08264	13.5	MS	Disease incidence Nil	=	R (Resistant)	
4	CoPb 08217	15.5	MS	Disease incidence 0.1-10%	=	MR(Moderate Resistant)	
5	CoS 08234	14.0	MS	Disease incidence 10.1% - 20%	=	MS (Moderate Susceptible)	
6	CoS 08235	15.5	MS				
7	CoS 767	22.0	S	Disease incidence 20.1- 30%	=	S (Susceptible)	
8	CoS 8436	12.5	MS				
9	CoPant 97222	14.0	MS	Disease incidence > 30 %	=	HS (Highly susceptible)	

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

S.No.	Genotypes	Score	Reaction	S.No.	Genotypes	Score	Reaction
AVT (Early) Plant I				**IVT (Early)**			
1	CoH 09262	1.0	MR	1	Co 10035	1.0	MR
2	CoH 09263	1.0	MR	2	CoH 10261	0.0	R
3	CoLk 09202	0.0	R	3	CoS 10231	0.0	R
4	CoPb 9181	1.0	MR	4	CoJ 64	0.0	R
5	CoS 09246	1.0	MR	5	CoPant 84211	1.0	MR
6	CoJ 64	0.0	R	**IVT (Midlate)**			
7	CoPant 84211	1.0	MR	1	Co 10036	1.0	MR
AVT (Early) Plant II				2	Co 10037	1.0	MR
1	CoPb 08211	1.0	MR	3	Co 10039	1.0	MR
2	CoPb 08212	0.0	R	4	CoH 10262	0.0	R
3	CoS 08233	0.0	R	5	CoH 10263	0.0	R
4	CoJ 64	0.0	R	6	CoPant 10221	0.0	R
5	CoPant 84211	1.0	MR	7	CoPb 10181	0.0	R
AVT (Mid Late) Plant I				8	CoPb 10182	0.0	R
1	Co 09022	0.0	R	9	CoPb 10183	1.0	MR
2	CoH 09264	0.0	R	**10**	CoPb 10211	0.0	R
3	CoLk 09204	2.0	MS	11	CoS 767	2.0	MS
4	CoPb 09214	0.0	R	12	CoS 8436	0.0	R
5	CoS 09232	0.0	R	13	CoPant 97222	0.0	R
6	CoS 767	2.0	MS	**Standards**			
7	CoS 8436	0.0	R	1	Co 7717	4.0	HS
8	CoPant 97222	0.0	R	2	Co 89003	4.0	HS
AVT (Mid Late) Plant II				**Grade**		**Reaction**	
1	CoH 08262	3.0	S	**0**	**=**	**R**	
2	CoH 08263	1.0	MR	**1**	**=**	**MR**	
3	CoH 08264	2.0	MS	**2**	**=**	**MS**	
4	CoPb 08217	1.0	MR	**3**	**=**	**S**	
5	CoS 08234	1.0	MR	**4**	**=**	**HS**	
6	CoS 08235	2.0	MS				
7	CoS 767	2.0	MS				
8	CoS 8436	0.0	R				
9	CoPant 97222	0.0	R				

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	Dhuri, Ajanala, Amloh, ButtarSevian, Morinda, Nawanshahr, Budhewal	Traces to 8.5%	CoS 8436, CoJ 64, CoJ 85, Co 89003	5 Months (July)
Wilt	Dhuri, Amloh, Buttar Sevian, Gurdaspur, Batala, Ajanala	Traces to 8%	Co 89003	9 Months (November)
Smut	Batala, Fazilka	Traces	Co 89003 CoJ 88 Co 238	3 Months (May) 8 Months (October)
Bacterial red stripe disease/ top rot.	Batala, Gurdaspur, Buttar Sevian , Bhogpur, Mukerian	Traces to 3%	CoJ 85	5 Months (July)
Pokkah Boeng	Amloh, Dhuri, Gurdaspur, Budhewal, Bhogpur, Phagwara, Dasuya and Ajanala	Traces to 3%	Co 238	5 Months (July)

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 01	3.6	MR	3.3	MR
2.	ISH 07	3.7	MR	3.3	MR
3.	ISH 12	8.5	HS	3.4	MR
4.	ISH 31	7.3	S	7.6	S
5.	ISH 49	4.6	MS	3.7	MR
6.	ISH 88	9.0	HS	9.0	HS
7.	ISH 105	3.4	MR	8.2	HS
8.	ISH 108	3.3	MR	3.8	MR
9.	ISH 113	3.3	MR	3.2	MR
10.	ISH 114	9.0	HS	8.4	HS
11.	ISH 115	4.7	MS	4.5	MS
12.	ISH 117	3.5	MR	7.2	S
13.	ISH 118	3.3	MR	3.2	MR
14	ISH 119	3.4	MR	3.6	MR
15	ISH 135	3.6	MR	3.8	MR
16	ISH 137	7.5	S	3.8	MR
17.	ISH 144	3.8	MR	8.4	HS
18.	ISH 148	3.3	MR	3.5	MR
19	ISH 159	3.5	MR	7.5	S
20	ISH 185	3.4	MR	8.5	HS
21	ISH 187	8.5	HS	8.8	HS
22	ISH 191	4.4	MS	3.7	MR
23	ISH 193	5.5	MS	6.5	S
24	ISH 203	3.7	MR	3.2	MR
25	ISH 211	3.4	MR	3.6	MR
26	ISH 224	4.5	MS	3.4	MR
27	ISH 260	3.7	MR	3.4	MS
28	ISH 264	3.4	MR	3.3	MR
29	ISH 265	8.4	HS	8.7	HS
30	ISH 267	8.8	HS	8.5	HS
31	ISH 269	4.2	MR	3.5	MR
32	ISH 273	8.7	HS	8.6	HS
33	ISH 277	3.6	MR	3.4	MR
34	ISH 281	4.2	MS	8.4	HS
35	ISH 282	7.6	S	8.5	HS
36	ISH 284	8.5	HS	3.5	MR
37	ISH 286	3.6	MR	3.8	MR
38	ISH 287	8.5	HS	3.5	MR
39	ISH 308	8.7	HS	8.3	HS
40	ISH 309	5.8	MS	8.5	HS
41	ISH 313	3.8	MR	8.8	HS
42	ISH 314	5.2	MS	8.5	HS
Date of inoculation: 28/08/2013 Date of Observation: 28/10/2013			Pathotypes/ Isolates used CF-08 from CoJ 84, CF-09 from CoS 767		