VASANTDADA SUGAR INSTITUTE, PUNE, MAHARASHTRA

Annual report of AICRP (S) of Plant Pathology Discipline for the year 2016-17

Project No	**: AICRP- PP17-B**
Title of the experiment	**:** Evaluation of zonal varieties of sugarcane for resistance to smut disease under artificial disease condition.
Objectives	**:** To gather information on the relative resistance to smut of the entries in zonal varietal trials of the peninsular zone.
Year of commencement	**:** 1994-95
Year of report	**:** 2016-17
Location of the experiment	**:** VSI, Pune
Date of planting	**:** 07.01.2016
Date of Harvesting	: 08.02.2017
Type of soil	**:** Medium black
Plot No	**:** C-7 II, Vasantdada R & D Farm, VSI, Pune
No. of varieties	**:** 51 genotypes/ varieties (Including checks: Co740 & Co7219)
No. of replications	**:** 2
Design of the experiment	**:** Rod row trial
Inoculum	**:** *Sporisorium scitaminea* teliospores collected from commercially cultivated varieties of sugarcane in Maharashtra, which served as source of inoculum.
Method of inoculation	**:** The method of inoculation consists of dipping of 2 eye-budded setts for 30 to 45 minutes in a smut spore suspension of over 90 % viability and with the spore load of 1 million spores per milliliter.
Plot Size	**:** Two rows of 5 meter length. Spacing between 2 rows: 120 cm.
Observations	**:** I) Number of healthy and smut affected stools per row were recorded for disease incidence & reaction II) Smut incidence was recorded at fortnightly intervals up to the harvest

Table: 1. Evaluation of sugarcane genotypes under ZVT's for smut at VSI

Sr. No	Varietal Trial	Disease reaction with % smut disease incidence				
		Resistant (0% DI) (34 genotypes)	**Moderately Resistant , (0.1% to 10.00% DI) (2 genotypes)**	**Moderately susceptible (10.1% to 20.00% DI (7 genotypes)**	**Susceptible (20.01 to 30.00 DI) (5genotypes)**	**Highly Susceptible (DI More than 30 %) (3 genotypes)**
1	**Initial Varietal Trial – Early (12 genotypes)**	Co12001, Co12003, CoM 12081, CoM 12082, CoM 12083, CoT 12366, CoN12072, CoT12367	-	-	Co12007 (25.00%), Co 12008 (25.00%)	Co12006 (40.00%), CoN 12071 (33.33%)
2	**Advanced Varietal Trial – Early (8 gentypes)**	Co10004, Co10006, Co10024, Co10026, Co10027, CoT10367		Co10005 (14.28%), CoT10366 (18.18%)		
3	**Initial Varietal Trial – Early II Plant (3 genotypes)**	Co09004, Co09007		CoN09072 (18.18%)		
4	**Initial Varietal Trial – Midlate (15 genotypes)**	Co12012, Co12016, Co12017, Co12019, Co 12021, CoM 12084, CoM 12085, CoN 12073, CoT12368 VSI 12121.		Co12014 (14.28), CoM12086 (15.47%), CoN12074 (11.11%)	Co 12024 (25.00%)	Co12009 (75.00%)
5	**Advanced Varietal Trial - Midlate I Plant (11 genotypes)**	Co09009, Co10015, Co 10031, CoM 10083, CoT10368, CoT10369, PI 10131 PI 10132	Co10033 (10.00%)	CoVC10061 (11.11%)	Co10017 (25.00%)	
	Standard Check (2 genotypes)	-	Co740 (20.00%)	-	Co7219 (25.00%)	-

● *Figures in parenthesis shows per cent disease incidence*

Results:

Out of 51 genotypes including 2 standard checks (Co740 and Co7219), screened against smut disease under artificial disease condition to evaluate their resistance, 34 genotypes *viz.,* Co12001, Co12003, CoM12081, CoM12082, CoM12083, CoT12366, CoN12072, CoT12367, Co10004, Co10006, Co10024, Co10026, Co10027, CoT10367, Co09004, Co09007, Co12012, Co12016, Co12017, Co12019, Co12021, CoM12084, CoM12085, CoN12073, CoT12368, VSI12121, Co09009, Co10015, Co10031, CoM10083, CoT10368, CoT10369, PI10131 and PI10132 were found resistant, 2 were found moderately resistant, 7 were found moderately susceptible, 5 were found susceptible and remaining 3 were found highly susceptible.

Project No. **:** PP 1 - AICRP- PP 17 D.
Title of the Project **: Varietal Screening**
Title of the experiment **:** Screening of sugarcane varieties against yellow leaf disease (YLD).
Location **:** Vasantdada R & D Farm.
Date of Planting **:** 7.01.2016
Date of Harvesting **:** 09.02.2017
7. Soil type : Medium Black
8. No. of treatments : 14 genotypes / varieties
9. Design of the experiment **:** Rod Row trial
10. No. of replications : 2
11. Plot size : Two rows of 6 m length, spacing bet^{n} rows: 120 cm
12. Treatment Details **:** 14 genotypes (varieties) were screened against YLD in sugarcane.

13. Results and Discussion:

YLD disease incidence was noted 3 times i.e. 8th, 10th and 12thmonths age of crop. Each time, 25 canes (free from other biotic stresses) are observed. As per the color photographs of YLD symptoms displaying severity grades in technical programme of AICRP (S) , the observations were recorded.

YLD severity grades:

Disease grade	**Description**
0	No symptom of the disease
1	Mild yellowing of midrib in one or two leaves, no sign of typical bunching of leaves caused by YLD
2	Prominent yellowing of midrib on all the leaves in the crown. No bunching of leaves
3	Progress of midrib yellowing to laminar region in the whorl, yellowing on the upper leaf surface, and bunching of leaves
4	Drying of laminar region from leaf tip downwards along the midrib, typical bunching of leaves as a tuft
5	Stunted growth of the cane combined with drying of symptomatic leaves

Midrib yellowing was noticed in all the susceptible varieties; however leaf/ cane drying in affected varieties was absent. Purple or pinkish purple discoloration was not seen on the mid rib and lamina. No drying of canes noticed in affected stools.

Varieties are classified as per the severity scale

Score	Disease reaction
0.0 - 1.0	Resistant
>1.0 – 2.0	Moderately resistant
>2.0 – 3.0	Moderately susceptible
>3.0 – 4.0	Susceptible
>4.0 – 5.0	Highly susceptible

Results:

Table 2: Variety wise disease severity (Average of 25 canes and 3 observations)

Sr. No.	Name of the variety	Disease severity	Severity Scale	Sr. No.	Name of the variety	Disease severity	Severity Scale
1	CoVSI9805	0.0	R	8	Co85004	1.56	MR
2	VSI434	1.64	MR	9	CoVSI0309	1.60	MR
3	CoC671	1.60	MR	10	CoM0265	1.68	MR
4	Co86032	1.72	MR	11	CoVSI03102	1.52	MR
5	Co419	1.56	MR	12	CoVSI2000-01	1.68	MR
6	CoVSI0405	0.0	R	13	Co94012	1.48	MR
7	MS10001	0.0	R	14	VSI08005	1.52	MR

As per the data presented in Table 2, out of the 14 varieties, 3 *viz.,* CoVSI9805 , CoVSI0405 and MS10001 were observed free from the disease, while remaining 11 varieties *viz.*, CoC671, VSI434, Co86032, Co419, CoVSI0405, CoVSI0309, CoM0265, CoVSI2000-01, Co94012, CoVSI03102 and VSI08005 were found susceptible and reacted as moderately resistant.

Project No.	**: AICRP, PP 22**
Title of the experiment	**:** Survey of sugarcane diseases naturally occurring in the area on important sugarcane varieties in Maharashtra State.
Objective	**:** To gather the information on sugarcane diseases naturally occurring in the area on varieties for compiling an all India disease status report, yearly.
Location of the experiment:	Maharashtra, VSI (Peninsular zone), Pune
Year of start	**:** 1989-90
Year of report	**:** 2016-17

Observations:

During Survey, the major and minor diseases of sugarcane were recorded on different commercially cultivated varieties of sugarcane in Maharashtra State. The sugarcane disease situation in Maharashtra is given in Table 3**.**

New organism:

Isolated and identified new pathogen causing sett rotting in sugarcane (variety Co86032) as *Ceratocystis fimbriata* Ellis & Halst, family *Ceratocystidaceae.* The rotten and non germinated sugarcane setts were collected from Markal village in Shirur Tahsil of Pune district in Maharashtra. The isolated organism in pure form was sent on 17th February 2017 for the identification to Agharkar Research Institute (NFCCI-National Fungal Culture Collection of India) for identification and the sample submission code was 2615. The identification report from Agharkar Research Institute was received on 8th March 2017 by vide no. 3/426/2017/ fungi /559 dt.08.03.2017. The culture is maintained in our Plant Pathology Section for further study.

Table 3: Major and minor diseases recorded on different commercially cultivated varieties of sugarcane in Maharashtra State 2016-17

Sr. No.	Disease	Name of area surveyed	% Disease incidence	Varieties affected	Crop Stage when observed	Any other information
1	Whip Smut	Western Maharashtra, Dhule, Nandurbar, Wardha, and Nagpur Districts	up to 5 %	Co86032, Co419	All crop stages	The incidence of the disease in Khandesh and Vidarbha region is more.
2	Grassy Shoot	Throughout Maharashtra	Up to 15 %	CoC671, Co86032, CoM0265, Co419, CoVSI9805, Co92005	All crop stages	The incidence of GSD is increasing in Maharashtra.
3	Pineapple	Throughout Maharashtra	Up to 5 %	All the varieties	Germination	Observed in ill-drained soils.
4	Pokkah boeng	Throughout Maharashtra	Up to 10 % (Leaf basis)	CoC671, CoVSI 9805, CoM 0265 CoVSI434, Co86032, MS10001	Monsoon period, Disease incidence was severe in suru season planted crop.	Disease stages *viz.,* Chlorosis, top rot and knife cut stages are rare. Due to drought & low humidity for last 2 crop seasons, the incidence of the disease was low.
5	Rust	Throughout Maharashtra	Up to 15 % (Leaf basis)	CoC671, CoVSI 9805, VSI 434, Co92005 CoVSI 434, Co86032, CoM 0265	After the monsoon period- – Sept. onward.	**The disease is being observed throughout the year.** *The brown rust spore feeder insect i.e. Mycodiplosis coimbatorensis was observed in Pune, Ahmednagar, Kolhapur and Satara district on infected leaves of sugarcane .*
6	Eye spot	Throughout Maharashtra	Up to 7 % (Leaf basis)	CoC671, Co86032, CoM0265, Co92005	After monsoon period – Sept. onward	The incidence was noted in Southern Maharashtra on CoC671, Co92005 and Co86032 up to 7 %.
7	Mosaic	Throughout Maharashtra	-	CoC671,Co86032, CoM0265, VSI434	Throughout the year	The disease incidence was minor.
8	Brown spot	Throughout Maharashtra	Up to 5 %	CoM0265, Co86032	The incidence is being noticed throughout the year but the intensity is low during the year.	The incidence of this disease is decreasing and it was noted on CoM0265 and CoM0265 up to 5 %.
9	Yellow Leaf disease	Throughout Maharashtra	-	CoC671, CoM0265, Co86032, Co419, VSI434	The incidence was noted at the crop age of 7 months	The incidence of YLD is increasing.

Project No. **: AICRP PP 28 (b)**
Title of the Project **:** Methodology for screening sugarcane genotypes for resistance to brown rust (*Puccinia melanocephala*)
Objective **:** To standardize methodology for inoculation of urediniospores of brown rust and rating of resistance.
Year of start **:** 2013-14
Location : Vasantdada R & D Farm, VSI,Pune
Date of Planting : 07.02.2016
Date of Inoculation **:** 05.08.2016

Inoculation methodology:

a. **Clip inoculation in leaf whorl:** After brown rust appearance in field on CoVSI 9805, selected rust affected leaves and leaf bits measuring 8 cm were prepared. Inserted 3 clips in the leaf whorl of each shoot of ten rust-free plants of this variety.
b. **Leaf whorl inoculation:** After initiation of brown rust in field on CoVSI9805, collected rust affected leaves. Suspension of urediniopores in sterilized distilled water was prepared. Poured 1 ml freshly prepared urediniospore suspension in each leaf whorl of same variety. Inoculated 10 clumps (three shoots per clump) of same variety.

Observations: After one months period after inoculation, recorded the symptoms of brown rust on leaves by counting average number of rust pustules per square inch and number of leaves bearing rust pustules.

Table 4: Inoculation method wise rust pustules on inoculated leaves

Clip inoculation method		**Leaf whorl method**	
Shoot Number	**No.of rust pustules per sq.inch (Av.of 3 leaves)**	**Shoot Number**	**No. of rust pustules per sq.inch (Av. of 3 leaves)**
1	15	1	25
2	17	2	23
3	12	3	27
4	16	4	30
5	16	5	23
7	14	7	28
8	13	8	22
9	15	9	25
10	12	10	29
Total	**130**	**Total**	**232**
Average	**13.00**	**Average**	**23.20**

Results: Observations in Table No.3 indicates that, out of 2 methods, number of rust pustules on inoculated were higher (23.20/sq.inch^2) under leaf whorl method. In clip inoculation, the average numbers of rust pustules per square inch were 13.00. Therefore, leaf whorl inoculation method is far superior over clip inoculation method.

Project No. **: AICRP: PP31**
Title of the Project : Screening, epidemiology and management of pokkah boeng in sugarcane
Title of the experiment **: A. Varietal Screening:** Screening of promising genotypes of sugarcane against the pokkah boeng disease of sugarcane
Location : Vasantdada R & D Farm.
Date of Planting : 07.01.2016
Date of Harvesting : 09.02.2017
Soil type : Medium Black
No. of treatments : 14 genotypes/ varieties
Design of the experiment **:** Rod Row trial. **No. of replications** : 2 - Two rows of 6 m length, spacing bet^{n} rows:120 cm
Treatment Details **:** As per the AICRP (S) program, 14 genotypes were screened against pokkah boeng disease in sugarcane under natural condition.

Results:

The data regarding disease incidence (%) of genotypes, tested against pokkah boeng disease under natural condition presented in Table 5. Out of the 14 genotypes varieties / genotypes, 2 *viz.*, CoVSI03102 and Co85004 were observed free from the disease, while remaining 12 varieties/ genotypes *viz.*, CoVSI9805, CoC671, VSI434, Co86032, Co419, CoVSI0405, MS10001, CoVSI0309, CoM0265, CoVSI2000-01, Co94012 and VSI08005 were found susceptible (Table 5).

Table 5: Variety wise maximum incidence of pokkah boeng disease condition.

Sr. No.	Variety	Disease incidence	Sr. No.	Variety	Disease incidence
1	CoVSI9805	33.33%	8	Co85004	0.0
2	VSI434	35.71%	9	CoVSI0309	30%
3	CoC671	10.00 %	10	CoM0265	33.33%
4	Co86032	12.50 %	11	CoVSI03102	0.0
5	Co419	33.33 %	12	CoVSI2000-01	16.16%
6	CoVSI0405	28.57%	13	Co94012	16.66 %
7	MS10001	16.66%	14	VSI08005	25.00%

B. Epidemiology of disease

The pokkah disease was initiated in the last week of June 2015. Last year this area received pre-monsoon rains in 2nd fortnight of April 2016 (Meteorological week – 16th and 18th week). The minimum and maximum temperature of 24.20 ^{0}C and 33.03^{o}C respectively & humidity ranges from 53.40 % to 78.40 % during disease initiation period. Maximum pokkah boeng disease incidence was observed in the first fortnight of August 2016 while; the incidence of the disease was reduced after 36th meteorological week.

C. Management of pokkah boeng disease

Location : Vasantdada R & D Farm.
Date of Planting : 07.01.2016
Date of Harvesting : 09.02.2017
Soil type : Medium Black
No. of treatments : 5
Design of the experiment **:** Randomized Block Design (RBD)
No. of replications : 4
Plot size : 6 X 6 sq. Mt.
Treatment Details :

T 1: Sett treatment - Overnight soaking with Carbendazim @ 0.1% a.i.
T 2: Foliar spray - Carbendazim – 0.05% a.i. (3 sprays at 15 days interval from May15th)
T 3: Sett treatment (T1) + Foliar spray with carbendazim (T2)
T 4: Foliar spray – Mancozeb – 0.3 %
T 5: Control

Method of observations:

The observations regarding pokkah boeng disease incidence were recorded before each spray after 15th May, treatment wise. The percent disease incidence was worked on the basis of number of infected and disease free plants in 2 central rows. The other observations regarding the different parameters were recorded as per the pert chart starting from germination till harvest of the crop. The details of observations after statistical analysis are presented in Table 6.

Table 6: Effect of fungicides on growth parameters and incidence of rust disease of sugarcane

S.N.	Treatments	Germination (%)	Total height (cms)	Mill able height (cm)	Cane yield (t/ha)	CCS (t/ha)	Disease Control (%)
1.	Sett treatment - Overnight soaking with Carbendazim 0.1% a.i.	58.75	220.00	198.50	125.15	18.42	64.25 (53.44)
2.	Foliar spray – Carbendazim – 0.05% a.i. (3 sprays at 15 days interval from May15.)	59.50	222.50	201.50	133.98	20.16	62.63 (52.38)
3.	Sett treatment (T1) + Foliar spray with carbendazim (T2)	**61.00**	**235.00**	**211.75**	**134.44**	**20.13**	**66.2 (54.48)**
4.	Foliar spray- Mancozeb – 0.3% a.i. (3 sprays at 15 days interval from May15th)	**62.00**	**235.50**	**213.00**	**135.42**	**19.52**	**74.81 (60.06)**
5	T5: Control	57.00	219.25	195.00	124.00	18.14	0.0 (4.05)
	S.E. +	**3.39**	**8.90**	**9.09**	**1.32**	**0.86**	**1.83**
	CD at 5%	**10.47**	**27.44**	**28.20**	**4.08**	**1.87**	**5.66**
	CV	**11.39**	**7.86**	**8.91**	**2.03**	**6.31**	**8.19**
		NS	**S**	**S**	**S**	**NS**	**S**

Results:

- **Germination**

  The germination of sugarcane is influenced due to fungicides treatments before planting. Maximum germination (62 %) was recorded in T4 (Three foliar sprays of mancozeb @ 0.3% at an interval of 15days interval from 15th May.). The germination was also better in T3 (59.50%).

- **Total height of cane**

  The total height of cane was highly influenced by all the treatments under study. The results are significant. The total height of cane was maximum (i.e 235.50 cm) in T4 (Three foliar sprays of mancozeb @ 0.3% at an interval of 15days interval from 15th May.) followed by T3 (Sett treatment and Foliar spray with carbendazim.

- **Mill able height of cane:**

  There was significant difference in treated and untreated plots. The mill able cane height was maximum in T4 i.e. 213.00 cms.

- **Yield of cane:**

  The cane yield differed significantly due to various treatments under study. The cane yield was maximum in T4 i.e. 135.42 t/ha.

- **CCS (t/ha.):**

  There is difference in treated and untreated plots but results are non -significant. The CCS (t/ha.) was found maximum in T2 (sett treatment with three foliar sprays with carbendazim) i.e. 20.13 t/ha. It is followed by T3 (3 foliar sprays of Mancozeb @ 0.3% at an interval 15 days from 15th May) i.e. 19.52 t/ha.

- **Disease control:**

  The fungicides *viz.,* Carbendazim and mancozeb were tested along with control in 5 treatments. Both the fungicides are found effective to control pokkah boeng disease effectively, when these two fungicides are sprayed thrice at an interval of 15 days after 15th may onwards. However, mancozeb at 0.3 % found more effective than the carbendazim, which controls the disease up to 74.81 %.

Conclusion:

Both the fungicides viz., Carbendazim and mancozeb are found effective to control pokkah boeng disease effectively, when these two fungicides are sprayed thrice after 15th may onwards. However, mancozeb found more effective than the carbendazim.

PP 32 **: Management of brown spot disease of sugarcane**
Objective **:** To find out effective method of brown spot management through chemicals.
Year of Start **:** 2015-16
Location : Vasantdada R & D Farm.
Date of Planting : 07.01.2016
Date of Harvesting : 12.02.2017
Soil type : Medium Black
No. of treatments : 5
Design of the experiment **:** Randomized Block Design (RBD)
No. of replications : 3
Plot size : 6 X 7 sq. Mt.

Treatment :
I. Variety **:** CoM 0265
II. Fungicides

T.1	- Propiconazole (Tilt)	-	0.1 %
T.2	- Hexaconazole (Contaf)	-	0.1 %
T.3	- Triadimefon (Bayleton)	-	0.1 %
T.4	- Mancozeb (Ditahne M-45)	-	0.3 %
T.5	- Carbendazim (Bavistin)	-	0.1 %
T.6	- Control (Untreated)	-	-

III. Time of application of fungicides: To be applied just after appearance of brown spot lesions followed by two sprays at 15 days interval.

Observations:

1. Germination %
2. Disease incidence% (No. of clumps showing disease / total no. of clumps x 100)
3. Disease severity (% leaf area covered with brown spot lesions based on observations of 10 leaves per clump; total no. of clumps to be observed at least 10)
4. Cane yield per plot and per hectare
5. Brix, Pol %, Purity and CCS %
6. Cost-benefit ratio

**** The incidence of the disease was not observed throughout the year (crop period) and hence the treatments were not imposed so far. During 2017-18 crop, trial will be again conducted in the operational area of the Sarsenapati Santaji Ghorpade Sugars Ltd., Kagal, Dist. Kolhapur, where, the disease may be observed.***

VASANTDADA SUGAR INSTITUTE, PUNE

Meteorological Data: April 2016 to March 2017

Month	Air temperature (ºC)		Relative humidity (%)		Rainfall (mm)	No. of rainy days
	Min.	Max.	AM	PM		
April 2016	20.52	38.80	57.25	18.0	02.40	01
May 2016	23.57	38.57	54.75	25.25	06.50	01
June 2016	24.20	33.03	78.40	53.40	59.0	06
July 2016	22.40	27.57	90.50	77.25	151.10	11
August 2016	21.94	27.66	88.0	78.50	235..90	13
September 2016	21.15	28.47	88.75	71.25	56.60	09
October 2016	19.32	29.73	90.75	52.50	80.40	04
November 2016	11.94	30.58	93.40	31.0	00.00	00
December 2016	11.97	30.12	91.75	30.75	00.00	00
January 2017	11.27	29.60	91.50	29.50	00.00	00
February 2017	13.63	32.63	85.25	25.00	00.00	00
March 2017	16.34	35.54	72.20	15.80	00.00	00
TOTAL					**591.90**	